The Political Economy of, and Modelling the Demand for, Australian Passenger Motor Vehicles.

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ABSTRACT

As with many other nations, the passenger motor vehicle industry has long been central to the economic health of Australia. In addition, the purchase of a motor vehicle is a commitment of considerable magnitude to most consumers. As a result, the passenger motor vehicle industry has attracted the attention and interest of a wide and diverse range of groups who have brought to bear a multitude of often-conflicting concerns and interests. Nowhere has this been more apparent that in the development and execution of industry policy.

This thesis examines the development and application of Australian passenger motor vehicle industry policy from the turn of the twentieth century until the mid-1990s. In the first instance, we focus on the development of the policy from the first embryonic stages of the industry to the mid-1980s. The second stage of specific policy analysis covers the period of the 'Button Plan", the last of a fairly long list of sector plans developed over the century. The central theme of this thesis is the identification of the consistent neglect of demand considerations in the development of policy and the analysis of the problems in the passenger motor vehicle industry. The thesis argues that policy formulation, application and modification were designed to aid and abet the interests and concerns of the producers whilst demand and consumer welfare considerations were consistently ignored. As such it is suggested that passenger motor vehicle industry policy was doomed to inevitably fall short as a set of effective guiding principles for the sector.

It is further suggested that this producer orientation may, in part, explain why there has been a lack of emphasis on modelling the demand for passenger motor vehicles in Australia. A major contribution of this thesis is to provide the very first demand analysis of Australian passenger motor vehicle demand using the standard tools of applied demand modelling emanating from the non-perishable goods literature. On the basis of the literature survey and experience of the United States and some European countries the Stock Adjustment model is deemed the most suitable methodology to undertake an applied demand analysis of passenger motor vehicles. This thesis therefore provides the first application of the Stock Adjustment model to the demand for passenger motor vehicles in Australia.

The thesis finds that the basic Stock Adjustment model does provide an empirically sound basis for the modelling of Australian passenger motor vehicle demand. This thesis finds that suggested modifications and alternative formulations do little to improve the basic stock adjustment formulation.

Finally, this thesis concludes by drawing out the policy implications for the development of Australian passenger motor vehicle industry policy that a proper consideration of demand, including demand modelling entails. An important outcome is the conclusion that demand considerations are of great significance when considering the formulation of effective passenger motor vehicle policy for Australia.

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1 Introduction

1.1 The Context of this study

Modelling of the demand for consumer durables has long been recognised one of the most difficult tasks in applied economics. Nevertheless it has been, and remains, an area of interest and importance to policy makers and producers as they strive to anticipate the complex factors that may determine the level of demand for a product. The passenger motor vehicle industry (hereafter the PMVI) has, from as early as the 1930s (Scorville, 1935; De Wolff, 1938; Roos and von Szeleski, 1939), recognised the importance of understanding both the process of demand formulation and the influence of particular factors on the demand for motor vehicles. The aim was then, and remains now, to better understand the complexity of the demand formulation process for motor vehicles so as to assist all interested parties secure their objectives for the industry.

Initially, these objectives were producer centric in that the intent was simply to secure the traditional producer objectives of viability and profit maximisation. However, the PMVI is a rather special case in point as compared to many other industries concerned with the provision of consumer durables and is, therefore, of great interest to those concerned with the formulation of appropriate industry policy for an economy. In the first instance, the motor vehicle is likely to be the second largest consumer durable purchase (after housing), for most consumers and therefore may exhibit unique demand characteristics. In the second instance, the industry has often held a central and commanding position in the aggregate or macroeconomic environment of many nations. This, in turn, has meant that the sector has long been central to the plans for industrial development in those economies. As a consequence, from the earliest stages of its evolution, the PMVI has been the subject of great interest and concern to governments of all political persuasions in almost all developed and developing nations of the world. Nowhere, as we shall see, has this been better demonstrated than in Australia.

In order to formulate an industry policy for the sector that will assist in the attainment of these goals there is a particular imperative to understand the totality of factors likely to influence the viability and health of the industry. We contend, however, that in the case of Australia, industry policy and strategic thinking at both the level of government and individual producer during the policy period considered in this thesis, was, in the main, limited to supply-side considerations. That is, motor vehicle policy was, to a very large extent, framed solely on the basis of the needs, wants and aspirations of the complex array of forces that sought to shape and influence the production and supply environment for the product. There is little evidence of any real effort to shape industry policy in such a way as to accommodate demand side and consumer welfare considerations.

We see this as a basic failure of industry policy and seek to offer an alternative strategy. In order to be best able to accommodate these vital demand side and welfare considerations, we contend that it is imperative to seek an understanding of these factors via a strong theoretical and empirical framework. As a consequence, we will provide the first analysis of the demand in Australia for PMVs under the setting of the Stock Adjustment (hereafter the

SA), method.

This thesis deals with the demand for Australian PMVs. That there has been no previous study of the demand in Australia for PMVs, of this sort, is surprising given the importance of this industry to the Australian economy during the twentieth century. However, the failure to undertake a study of this sort up to this point can best be understood by evaluating the policy context and process by which PMV industry policy developed and unfolded during this period. Therefore, an important contribution of this thesis, motivating the empirical demand study, is a detailed analysis of the political economy of PMV industry policy from the perspective of demand. Such an analysis provides an important necessary condition for the appreciation of the contribution of the empirical demand modelling that follows.

Accordingly, we first examine the formulation and application of PMV industry policy from the turn of the twentieth century until the middle to late 1990s. We demonstrate that the inherent inadequacy of the policy process was due to three main considerations. These included the failure by policy makers to recognise the dual sectoral nature of the industry and the additional failure to be clear and certain as to industry policy objectives. However, we contend that, overwhelmingly, the policy failed because the basis if its formulation did not even recognise, let alone consider, demand side and consumer welfare considerations.

Following a comprehensive discussion of the policy process, we then move to discuss the literature as it applies to the SA method. The seminal SA model is first discussed. An application of that model to the specific demand for PMVs is then considered. We note that previous studies using the SA method do not include the Australian industry but are limited to the United States and some European industries. We next turn our attention to criticisms of the basic SA model. These objections, in turn, generate a number of suggestions to improve the SA model as a mechanism to explain the demand for PMVs. The first area of concern relates to perceived inadequacies as to the composition of the desired stock and we, therefore, survey the contribution of a number of researchers who suggest the inclusion of a range of variables to better determine the level of the desired stock. We then move to consider a second criticism of the basic SA method that relates to concerns with the short-term adjustment mechanism implicit to the model and again consider the contribution of researchers who suggest the inclusion of further factors to elicit the improvement so desired.

We then progress to consider more strident and pervasive criticism of the SA formulation. These objections result, not in attempts to modify or augment the model, but in calls for its total abandonment and replacement with alternative formulations of PMV demand. In the first instance the User Cost method is promoted as an alternative to the SA approach because of its ability to differentiate between the market for new as against used cars and because, unlike the SA method, it incorporates a budgetary constraint component.
In turn, the User Cost model is itself subject to criticism from the supporters of the Structuralist approach because it does not accommodate the concept of a saturation level in its determination of PMV demand. We are not convinced as to the efficacy of either claim. We consider that the claimed

improvement for alternative formulations, either lack intellectual rigour, or do not apply to the peculiar realities of the Australian market. Where no clear theoretical case can be made *a priori*, we submit competing approaches to empirical testing and let the data determine the preferred specification.

We then turn to the empirical analysis of the demand for PMVs in Australia within the framework of the SA model. We determine that the most basic of formulations provides the best results and that attempts to augment or modify the model produce disappointing outcomes. We find that the User Cost method adds little to an understanding of the forces impacting on the demand for PMVs in Australia. The Structuralist model is not subjected to empirical analysis because of the concerns noted.

1.2 The Structure of the Thesis

This thesis is organised into six chapters including an introduction and conclusion. The following is a brief summary of Chapters 2 to 5. The main body of the thesis is contained in four relatively long chapters. Chapters 2 and 3 concentrate upon an analysis of the political economy of PMV industry policy up to and including the introduction of the "Button Plan". Chapters 4 and 5 contain the demand modelling.

1.2.1 The Australian Passenger Motor Vehicle Industry Policy and Structural Change 1900-1984

Chapter 2 provides an analysis of the policy process from the early part of the 20th century up until 1984. The years just prior to the close of the twentieth century saw, as per the observation of the Australasian Coachbuilder and Saddler (1896), the passenger motor vehicle well entrenched in Australia. This was an industry that Corden (1968) held to be important to the Australian economy. The history of government intervention into the operation of the PMVI, began at or near the turn of the century.

This is an industry and policy process that has attracted the interest of economists over the years. Stubbs (1972) provides an analysis of such intervention. In addition he provides a comprehensive and thorough examination of Australian PMVI development from the turn of the twentieth century until the 1970s. This includes the extent of external competition faced by the embryonic industry before the advent of World War One. Maxcy (1963) details some of the first protective devices installed to protect the manufacturing of Australian motor vehicle bodies from external competition. Forster (1965) examines the degree to which government policy influenced the North American producers, Ford and General Motors, to initially set up production facilities in Australia. Harnett (1981) insists that some twenty or so years later, GM would never have proceeded with the manufacture of an Australian produced motor vehicle without the determination of the Australian government for the project to succeed and the availability of both finance and other concessions. Warhurst (1982) on the other hand, examines the environment, which led overseas producers such as Leyland to close their Australian operation in 1974. However, an important contribution of the analysis of Chapter 2 is to reinterpret and reassess this policy process and its outcomes specifically from the demand perspective, often overlooked in previous studies.

Any assessment of this era, as with that of the Button Plan to follow, is to a considerable extent dependant upon officially sanctioned investigations into the industry. This literature shows that, in many instances, the political and social realities of the day took precedence over strictly economic criteria when decisions as to the future of the PMVI were made. The Tariff Board *Investigation into Vehicles and Parts* (1916) signalled the first of a multitude of such inquires over the century to the present time. Many Reports into the PMVI were to follow. These have included:

- The Tariff Board *Report on Motor Vehicles* (1938).
- The Tariff Board *Report* on the Automotive Industry (1957).
- The Tariff Board *Report on Motor Vehicles* (1965).
- The Industry Assistance Commission *Passenger Motor Vehicles* (1974).
- The Department of Industry, Technology and Commerce *The Automotive Component Manufacturing Industry in Australia* (1981).
- The Industry Assistance Commission *Passenger Motor Vehicles and Components-Post 1984 Assistance* (1981).
- The Industry Assistance Commission *Report on the Automotive Industry* (1985).

The first forty-five years of industry policy saw the government content to foster and develop assembly, body-building and component production. However, from the mid-1940s, Australian governments, irrespective of their political complexion, took an active and interventionist role in order to plan the promotion and development of the PMVI. From Chapter 2 we will learn that government policy was often muddled, counter-productive and subject to constant change, as attempts were made to secure the PMVI as the cornerstone of Australian post-WW II industrial development. But this policy intervention led to distorted outcomes because of the failure to acknowledge demand side considerations in any meaningful way during this period. After approximately eighty-five years of existence, the PMVI, by the time of the introduction of the Button Plan, remained:

- Inefficient although import competitive, (as a direct consequence of the very high levels of protection afforded it)
- Predicated on a disregard for consumer welfare and
- Unable to respond to the demands of intra-sectoral interests.

All these factors seriously threatened the viability of the industry and that of Australian manufacturing.

At the end of the analysis we are left with the clear impression that failure to focus attention in any serious way upon the demand side led successive governments, over a period of eight and a half decades, from one policy distortion to another. The period is a good case study in endogenous policy failure where second-best intervention leads to unintended outcomes that require subsequent policy intervention. All the time the welfare position of the consumer worsens.

1.2.2 The Button Car Plan 1984-1992

Chapter 3 examines in detail the Button Plan, another in a long line of inter-sectoral plans for the Australian PMVI, introduced as a reaction to the failure of past industry policy to secure long held objectives for the industry. Whereas Chapter 2 reveals a sorry tale of policy failure over eighty-five years as successive governments lurched from one policy response to another. Chapter 3 deals with a period characterised by a golden opportunity for a fresh approach to the formation and application of industry policy as it applied to the PMVI. Under the auspices of a concerned and involved Industry Minister, there was a real chance to rectify both the errors of past policy and to provide a framework to enable the industry to move confidently towards the new century. In specific terms there was a chance to address the three major errors of past policy. These were the failure to consider demand and consumer welfare considerations, the failure to recognise the dual sector realities of the industry and the failure to determine the basic objectives of the industry within the broad canvas of the general manufacturing sector itself. Therefore, the objective of Chapter 3 is to assess the extent to which the Button Plan actually achieved the reorientation of PMVI policy toward the rectification of these policy failures. In particular did the Plan sufficiently shift focus to accommodate demand and consumer welfare considerations as a key component of PMVI policy?

The Industry Commission (1990) (hereafter IC), provides an excellent summary of the main elements of the Plan. The literature available to chart the progression of the Plan is confined, in the main, to a factual determination of the results achieved in terms of the objectives set. During the operation of the Plan and for a period after its conclusion the Australian Automobile Industry Authority (hereafter the AAIA), published an annual report on the state of the industry. These Reports documented the progression of the industry toward the objectives determined by the Plan. Gregory (1988) indicates the size and complexity of the problem of industry restructuring at the beginning of the Plan in 1985. A mid-term review of the Plan led to the conclusion that there was a real risk that the objectives set for the Plan may not be attained. As Sampson and Woodbridge (1990: 59) observe "for the Plan to achieve its goals, the planned reduction in protection must come into fruition". A combination of circumstances had evolved to suggest that the planned reduction in protection would either not proceed or be rendered ineffectual due to changes in the macroeconomic environment. Therefore the IAC (1988) mid term review took on great importance. The total gamut of the Plan was subject to scrutiny with particular attention afforded the Export Facilitation Scheme.

The industry, as would be expected is the subject of a great deal of public scrutiny in the mass media. Innumerable articles and commentaries were to be found in the Press as the sector struggled to respond to the demands of the Plan and to those of a volatile and often difficult economic environment. The eventual results achieved by the Plan suggest that from the limited perspective of supply side considerations alone, quite a good deal was achieved. In addition, Owen (1995) notes that the AAIA acquired an intimate knowledge of the industry that may provide the basis for future policy making of a quality unusual in other industries.

From Chapter 3 we will learn that any attempt to evaluate realistically the consequences of the Plan, needs to reconcile its stated objectives with the outcomes achieved. The core requirement of the Plan was to both reduce the number of producers and the number of models produced. Judged on those criteria alone the Plan was modestly successful. It has brought about a paradigm shift in the structure, conduct and performance of the industry. It drove forth improvements in productivity, pushed the industry to lift its quality to world standards and to grasp the concept of global integration. However, it was less successful in the area of price and import penetration but may well improve in these areas as Australian manufacturers are forced to build better cars at relative value to meet the challenge of imports and to consolidate and expand exports.

However, whilst the Plan has led to reasonably impressive results across a fairly narrow range of criteria, it is of interest that the vast majority of critics and commentators have assessed the impact of the Plan from a very narrow dimension. In almost all instances the Plan is evaluated and rated in terms of its success or failure from the perspective of production, output and supply-side considerations. Although a major objective of the Plan was the need to attain lower real prices for Australian consumers, this objective was not met notwithstanding the maintenance of "affordability" over the last five years of the Plan. Yet in an assessment of the Plan, reference is rarely made to this factor and to the whole question of consumer welfare and demand side considerations. We suggest that this is a direct result of the fact that, from the inception of the PMVI, such deliberations ran a very poor second to the interests, welfare and protection of production and supply-side considerations in the framing of industry policy. Further, we contend that this failure to consider the demand-side factors as a key component of industry policy meant that the sector was ill-equipped to respond to volatile and fluid consumer preferences and demand.

1.2.3 Modelling PMV demand

Chapter 4 provides a survey of the relevant literature and introduces the SA model, which is the major analytical framework used to model empirically the determinants of PMV demand. What is perhaps surprising is that this is a mature literature that has stood the test of time, with the major theoretical and empirical contributions having been made up to two decades ago. Stone and Rowe (1957) develop the seminal SA model. Briscoe (1977) formulates a typical version of the SA model as applied to PMV demand. Rippe and Feldman (1976) apply the basic SA formulation to the demand for motor vehicles. Much of this contribution, as indeed for most of the analytical research of interest to the SA thesis, builds on the work of others. For example, Rippe and Feldman (1976) are much indebted to Chow (1957) who analyses the form of income and the rate of depreciation that may be included as variables. In the same manner they acknowledge the contribution of Evans (1969) who investigates the impact of unemployment and the appropriate depreciation rate and Hymans (1970) who contributes to the determination of an acceptable depreciation rate.

The contributions of a range of researchers who seek to improve the definition of desired stock by the incorporation of additional variables are canvassed. These include:

- Hamburger (1967): interest rates and residential construction.
- Juster and Watchel (1972): 'intentions' and transitory income.
- Smith (1975): consumer confidence
- Westin (1975): unemployment
- Mishkin (1976): interest rates.
- Rippe and Feldman (1977): residential construction.
- Briscoe (1977): attitudes and expectations in the context of hyperinflation.

We then consider the contribution of Wykoff (1973) who argues for the replacement of the SA model with the User Cost approach because the latter, unlike the former, enables a distinction to be drawn between the markets for new as opposed to used cars. Hess (1977) also calls for the replacement of the SA model with the User Cost approach on the grounds that the User Cost approach as, in contrast to the SA approach, it incorporates a budgetary constraint mechanism. de Palsmacker (1990) presents the case for the development of the Structuralist analysis to supersede both the SA and the User Cost model as the preferred approach to determine the demand for PMVs. However, Chapter 4 concludes by noting that there are no fundamental theoretical objections to the SA model that preclude its use in the modelling of PMV demand in Australia. Only empirical questions survive which will be addressed and resolved in Chapter 5.

1.2.4 The SA Model as Applied to Australia: 1975-1997

The application of the SA model to the Australian demand for PMVs over the period 1966 to 1977 is introduced in Chapter 5. This chapter begins with a discussion of the various previous attempts to analyse the demand for Australian PMVs. These previous studies often involved little more than elementary estimation procedures (such as the model of the Bureau of Transport and Communications Economics (BTCE), or broadly based macroeconomic models such as the NIEIR model and the Treasury NIF-10 model). The chapter also evaluates the aggregate type model developed by the IAC over the period from the mid-1970s to the early 1980s and discrete choice models developed by Professor David Hensher of the Macquarie University.

Following this discussion we then introduce our SA empirical analysis by detailing our data sources and referring to the possible estimation problems that may occur with the use of time-series data. We note the contribution of Charemza and Deadman (1992) in the illumination of the problem of dealing with the time-series data, particularly unit roots. We then sequentially evaluate the basic SA model, the suggested variations proposed and the alternative models (User Cost and Structuralist), suggested in Chapter 4. From Chapter 5 we learn that the SA approach is sufficiently robust and empirically sound to be a useful method by which the Australian demand for PMVs may be modelled.

The thesis concludes with some important observations as to the policy implications of this research in Chapter 6.

2 The Australian Car Industry: Industry Policy and Structural Change 1900-1984

This chapter will investigate the origins, rationale, methods and practices of almost eighty five years of active government intervention in the operation and conduct of the Australian PMVI. The period covered is from approximately the late 1890s until 1984, the year of introduction of the "Button Plan" (hereafter the Plan), another in a fairly long list of sectoral plans for the industry. In order to understand and appreciate why the modelling of the demand for Australian PMVs has been so neglected, it is important to evaluate the policy processes and context influencing industry policy outcomes and the neglect of demand side considerations, in particular, during this long period. Such intervention has, as we shall see, always been both difficult and contentious.

At the conclusion of the Plan in 1992, the Australian PMVI had been through seven distinct stages of development. Various Australian governments, whilst having significant input and influence on the first two stages, have been involved in the direct planning of these developments only since the third stage. The stages we have identified correspond to the years: 1902-1918, 1918-1944, 1944-64, 1964-1974, 1974-1975, 1975-1984, and 1984-1992. These periods cover our window of interest. We have chosen to segment the policy process into these seven distinct periods for convenience. Until the mid-1940s (stage two), the industry was largely confined to body building and assembly activities from imported engines and chassis. Therefore policy decisions, particularly in reference to the machinations of government assistance, were restricted to these areas. With the production, in 1949, of the first mass-produced Australian car (the General

Motors Holden), other considerations came to the fore. However, irrespective of the stage of development of the industry a number of recurring and fundamental problems have characterised industry policy. These have arisen from three sources. The first was the consequence of shaping policy solely from the perspective of supply-side considerations whilst effectively neglecting, even ignoring, demand-side factors. The second was a failure to recognise that the industry was not homogeneous. The third was a confusion as to basic objectives.

The first concern involved the lack of consideration of consumer welfare. In particular, aggregate determinants that impacted on consumer preference and welfare were of little or no consequence to those responsible for the formulation of PMV industry policy. By failing to consider these factors, particularly those associated with changing consumer preferences and the impact of industry policy on price, the Australian PMV has, at all stages of its development, faced the challenge of a high degree of import penetration into its market. In the second instance, industry policy has consistently failed to recognise that the PMVI consists of two separate but highly interrelated sectors with often competing and conflicting interests and objectives. On the one hand there is the production of fully assembled vehicles, and on the other, the area of component manufacturing. In order to gain the maximum possible aggregate economic impact from the industry, Australian governments have of necessity attempted to promote and support both areas. The problem has been that the form of assistance available to one sector was often at the expense of the other. This led to a continuous revamp of policy. This, in turn, promoted instability in an industry that valued stability as a fundamental prerequisite for long-term investment.

In the third instance, problems arose from the contradiction inherent in the need to consolidate and augment the industrial structure developed prior to, and during WW II, as the cornerstone for post-war reconstruction, as opposed to the development of a productive, import-competitive industry. Whilst the PMVI did initially achieve the goal of underpinning post World War Two industrial development, it did so at the expense of an economically efficient industry. By the late 1960s it was unable to meet the challenge of the import sector of the market without the assistance of a labyrinth of complex and cumbersome protective structures that ignored the interests and welfare of the consumer. Such an approach further highlights the general failure of policy to consider demand and consumer welfare considerations and was met with strong consumer resistance in the 1960s.

As a consequence of these three areas of policy failure (but particularly, in our view, the lack of concern as to demand side factors), the PMVI began to lose its pre-eminent place in the Australian manufacturing sector thereby endangering a fundamental tenet of aggregate post WW II industry policy. Subsequently, government industry measures were a mishmash of confused and confusing edicts and directives. Indeed as noted by Conlon and Perkins (1995:50) "the number of measures applied to the industry have only been exceeded by their complexity".

2.1 The First Phase: 1902-1918.

Whilst there is some evidence to suggest an interest in, and demand for, motor vehicles before Federation in 1901 (possibly due to the country's great distances and population dispersion), the first real phase of the industry was the period before and during the First World War. Nevertheless as early as the mid-

1890s, the London correspondent of the Australasian Coachbuilder and Saddler (1896: 135) observed, "the autocar, or motor car as it is now called, has come to stay".

While it is not possible to provide a detailed analysis of the structure of the PMVI before the 1914-18 war (hereafter WW I) (as accurate and reliable data is not available), there is evidence of a thriving motor body and assembly. These activities had begun substantial development very early in the century, and as a corollary, government assistance for the PMVI also began at about the same time. This took the form of tariff protection designed to secure body building and assembly activities. Before the advent of Australian Federation in 1901, the separate colonies had followed their own tariff regimes. The two most important colonies had diametrically opposing approaches to the question. New South Wales followed a 'free trade' regime whilst Victoria was fiercely 'protectionist'. Federation brought a uniform approach to the issue with immediate and direct consequences for the fledgling PMVI. The first Australian motor body is reputed to have been built in 1900. Maxcy (1963:104) observes that duties were imposed on imported bodies as early as 1902 to encourage this most infant of infant industries. These took the form of a uniform customs duty which enabled chassis from the United Kingdom to be imported free of excise but with a 5 percent levy on those coming from other countries. The duty on bodies was much higher: 30 percent on British bodies and 35 percent on others (Stubbs 1972:2).

Initially, some local producers were quite successful. For example, the Tarrant Company designed and built 10-11 cars (with a 90 percent local content), specifically for local conditions. However they could not withstand the economic strength of imported makes which could be offered for sale at relatively low prices. For example, in 1908 a two-cylinder Tarrant cost £375, while the four-cylinder Ford sold for £250 and the standard 'Model T' for £199 and 10 shillings (Stubbs 1972:3). In addition, imported chassis dominated the local market for much of the period before WW I. However, many local assemblers fitted their own bodies to imported chassis as some customers claimed the imported bodies were too flimsy for Australian conditions. By 1908 Australia operated a two-tier tariff with General and Preferential rates of duty.[1]

It is not possible to make an accurate assessment of the actual growth of the motor vehicle population (both local and imported), over the total period as in the very early years cars did not need to be registered.[2] Nevertheless, Table 2.4 shows the degree to which the number of motor vehicles grew in the two largest States. Despite the war, the vehicle population expanded rapidly. By 1921 there was one car for every 62.4 inhabitants of Victoria and one for every 65 in New South Wales.

An additional government initiative enacted during WW I proved to be critical to the development of the industry. The then Hughes government took the quite extreme step of replacing the tariff levy on car bodies with a complete ban on their importation. At the same time existing tariff levies on component parts were retained. These radical measures were justified on the grounds of the need to encourage local production, to conserve dwindling reserves of foreign currency

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[1]Built-up cars were subject to a 35 percent General and 30 percent Preferential duty as shown by Table 2.1 which details the pattern of protection operating up until just before WW I. Preferential tariffs applied to British imports which were subject to lower tariff rates.

[2]For example, Victoria first required registration in 1909.

for the war effort and to divert money from luxuries. At the end of the war this ban was relaxed to allow one car to be imported for every two chassis imported (with the exception of assembled chassis from North America). Whilst Table 2.4 shows that the restriction had little impact upon the growth of the number of cars registered, it's most significant effect was on the pattern of production rather than consumption. That is, during WW I local body producers were guaranteed one hundred percent of the market. Whilst the 1918 amendment guaranteed only 50 percent of the market for bodies to local producers, this was a substantial increase on the 29 percent share gained prior to the war.

2.1.1 A Summary of Policy Developments: 1900-1918

This period saw the emergence of a vigorous and sophisticated Australian PMVI that was, however, unable to withstand the economic challenge of foreign producers. The outbreak of WW I saw increased tariffs imposed on component parts and the quite drastic step of a ban on car body importation. The period after the war saw local body manufacturers effectively guaranteed 50 percent of the market.

2.1.2 Winners and Losers: 1900-1918

The big losers of the period were the local manufacturers of completely built-up vehicles (hereafter CBUs),(such as the Tarrant Company), who were initially quite successful but received little protection from the imports. Local body-builders were the clear winners from government policy over the interval. In addition, this period was perhaps the only one where consumer welfare (in the form of reduced prices for CBUs), also improved.

2.2 The Second Phase: 1918-1944.

After the conclusion of WW I, the Federal government launched additional measures to expand the industry as they were still not satisfied with the degree of protection that guaranteed local body builders fifty percent of the market. In 1920 the actual rate of tariff protection on car bodies was lifted to double that of the pre-war era. Table 2.5 details the composite structure of flat rate and *ad valorem* duties that remained in force over the 1920s and thereby provided a very high rate of effective protection for the local bodybuilding industry.

At the same time the Government also introduced rates of duties that differentiated between assembled and unassembled chassis imports. Assembled chassis were subject to higher import duties so as to encourage the assembly of these items in Australia. In addition, as shown by Table 2.6, although the rates of duty payable on both assembled and unassembled chassis then fell between 1920 and 1925, the rates discriminated heavily in favour of Britain.

The protective structure then in place had the desired effect and led to a rapid increase in the number of local body producers. It may have also influenced the North American producers, Ford and General Motors (hereafter GM), to assemble their chassis in Australia. However, this claim was refuted by a GM executive of the time who argued that GM had made the decision to manufacture in Australia before such tariff decisions were taken (Stubbs 1972:9). Other factors beyond the level of tariff protection available to local producers may have also influenced the decision of foreign producers to set up operations in Australia. An assembled chassis required much more open shipping space to transport and thus was much more expensive to ship than its component assemblies. In addition, the

Australian government promised Ford and GM tariff assistance of their own if they established operations in Australia (Forster 1964:38). Whatever their actual motivation, Ford set up a plant in Geelong, Victoria to build bodies and assemble vehicles using imported chassis in 1925. By mid-1926 it was employing about 1000 people. GM set up an assembly operation in Melbourne in 1926 but purchased their bodies from a local producer, Holden Motor Body Builders, which produced a not insignificant 36,000 bodies in that year. With the establishment of a local chassis assembly capacity, the value of imports of unassembled chassis as a percentage of total imported chassis increased from 25 percent in 1923-24 to 68.7 percent in 1926-7 (Tariff Board *Report* 1938:16).

Tariff protection was also vital to the growth of the component industry. Over the 1920s, Australian component producers, unsatisfied with their market share, sought and gained further protection from external competition. Initially these producers had limited their attention to the replacement component parts market. However, with the increase in local assembly over the period, domestic component producers increasingly began to bid for original equipment contracts even though they faced a strong impediment in their efforts to compete for such a market. The problem was that an imported vehicle chassis was subject to lower duties than was an imported vehicle body. Therefore the parts incorporated into the chassis entered Australia quite cheaply and were difficult for local manufacturers to compete against. The government was successfully lobbied over the 1920s to exclude several parts such as tyres, batteries, bumper bars, shock-absorbers, spark plugs and springs from the definition of a chassis. These items were given much higher effective rates of protection and helped secure the market for the local producer. In addition, the advent of the Great Depression saw a serious deterioration in Australia's foreign exchange position particularly in 1929 and 1930. In order to slow the speed of depletion of foreign reserves, the government imposed substantial increases in import duties on a variety of commodities including components for PMVs. These combined actions, together with the prohibition of certain imports, greatly stimulated the use of locally manufactured parts in the assembly of PMV chassis and bodies. The success of the measures, even in the face of a severe and prolonged depression, is illustrated by Table 2.7 which shows the growth of the local component sector over the 1930s.

Despite the relative success of the component sector, the Australian PMVI suffered a severe downturn during the Great Depression. For example, between 1928-29 and 1934-35 (the years of the greatest severity of the depression), there was an absolute fall in the total number of passenger cars registered in Australia. As Table 2.8 shows registrations of PMVs did not surpass the level for 1928-29 until 1935-36. From that year the industry made a strong recovery and registered an annual 16 percent growth rate until the advent of WW II.

By 1936 general economic recovery was clearly apparent. Further, the PMVI had developed to a point where the majority of vehicles on the market were assembled locally from imported chassis. The Tariff Board *Report* (1938: 11) estimated the local content of complete cars manufactured in Australia to be between 43 percent and 50 percent. Despite such success, the then Lyons (Conservative) federal government saw the need to generate more value-added production within the industry and, in particular, to encourage the establishment of motor engine and chassis manufacture in Australia. Subsequently, the government introduced a wide range of measures to attain this end. These included increased duties on imported engines and chassis and quotas on the importation of chassis from North America[3]

However, more importantly, the government pressed ahead with a much more radical strategy that involved plans to develop an Australian produced motor vehicle. This was despite Tariff Board reservations as to the economic viability of the policy. In 1938 the Board concluded, "it would be unwise at present to encourage or enforce the manufacture of the complete motor vehicle in Australia". (Parliamentary Papers, Vol 11 (1937-40): 1818). The first decision taken was that there should be only one company involved in the manufacture of such a vehicle and, further, that the company should be Australian owned. Subsequently, in 1940, a deal was negotiated with Australian Consolidated Industries (ACI). This gave ACI the sole right to build, with government assistance, an Australian PMV. The plan was quite ambitious in scope envisaging the manufacture of 20,000 motor vehicle engines and chassis annually. However, due to the impact of WW II the plan did not proceed. At the same time the existing, predominantly foreign owned companies, expanded in response to war munitions demand. In 1943, the 1940 proposals for the motor vehicle industry were reviewed. As the war neared its end, the then Curtin (Labour) federal government were as committed as had been the pre-war Conservative government to the expanded development of an Australian motor vehicle industry.

[3] Crawford (1979) comments on the extreme disquiet of the Americans who retaliated by revoking Australia's most favoured nation trading status

2.2.1 Summary of Policy Developments: 1918-1944.

Whilst effective tariff protection was increased for local body-builders over the 1920s, rates of duties were also imposed that differentiated between assembled and unassembled chassis. These factors led to an increase in the number of local body producers and may have influenced Ford and GM to begin Australian operations. The 1920s and 1930s also saw the expansion of the local component industry. The industry was adversely affected by the Great Depression. However, by 1936 economic recovery was assured and, despite Tariff Board reservations, the government began to initiate moves to establish motor vehicle and chassis manufacture in Australia. The onset of WW II effectively put such plans on hold.

2.2.2 Winners and Losers: 1918-1944.

In the first instance, local body-builders and component producers enjoyed increased support and protection and performed strongly over the 1920s. As with all sectors of industry, both were hard hit by the impact of the Great Depression. However, it is possible to argue that each did, in fact, perform much better than would otherwise have been the case if the substantial protective devices outlined were not in place. Each sector was well placed to take advantage of the economic recovery in the mid-1930s. It is during this phase that the expression of an industry policy predicated on the need to support, assistance and protect the producer of PMVs and component parts came clearly to the fore. At no time, over the whole phase, is there any reference to the need to consider demand factors or considerations of consumer welfare during the formation and expression of industry policy. Therefore the apparent loser over the period was the consumer who bore the welfare losses of an industry policy predicated on a disregard for their interests.

2.3 The Third Phase: 1944-64.

As WW II drew to a close the plan to produce an Australian PMV was revived but with the 1940 proviso as to Australian ownership effectively abandoned. On October 5 1944, likely motor vehicle manufacturers were invited to submit plans for the manufacture of such a vehicle. The rationale of the policy was to consolidate and augment the industrial structure developed during the war and thereby provide the cornerstone for post-war reconstruction. The Minister for Post-War Reconstruction summed up the intention of the government in a speech on March 22 1945.

> It is the policy of the Government to encourage the local manufacture of motor vehicles. That policy is in response to the over-riding importance of motor transportation to the future prosperity and development of Australia. The Government looks to a developing and expanding automotive industry as the keystone that will consolidate the industrial structure built up during the war (Commonwealth Hansard, May 22, 1945: 1145)

Such expectations for the industry necessitated much more than the mere assembly of imported component parts and some body building activity. In order to attract the interest of foreign PMV producers, enhanced tariff protection for domestically produced PMVs was promised. The inducements proved successful and a number of proposals were received. Subsequently, the government accepted GM-Holden's submission to build a vehicle with 90 percent Australian content in return for this increased tariff protection and a range of further government assistance. In addition, the Australian subsidiaries of Chrysler, Ford, and International Harvester agreed to substantially increase the Australian content of their vehicles in repayment for duty-free importation of a range of component parts. The first Holden rolled off the production line in 1949.

A severe balance of payments crisis in the early 1950s prompted the then Menzies (Conservative) government to take additional measures which were of great benefit to the development of the embryonic vehicle manufacturing sector. Due to a shortage of foreign currency reserves (especially U.S. dollars), a range of non-tariff import restrictions were applied to the industry. The main constraint involved a system of import licensing to exclude goods imported from outside the dollar area. (In effect, a ban on the importation of a range of imports from these areas was imposed). The outcome of these restrictions on motor vehicle imports can be seen by reference to Table 2.9 which shows that the impact of import licensing was little short of spectacular. In the three-year period from 1951/52 to 1954/55, the value of imported car bodies (assembled) fell by 50 percent and the value of imported assembled chassis by 61 percent. These outcomes secured the market for the local producer.

In March 1952 import licensing was extended to include goods imported from outside the dollar area. This gave British manufacturers an incentive (which they previously did not have given the preferential tariff treatment received), to expand local manufacture. Some British producers, such as Austin (1948) and

Morris (1950) had established assembly plants in Australia prior to 1952. However, in an attempt to retain their market share, which had fallen from 40.4 percent in 1952 to 32.2 percent in 1955, British owned manufacturers were forced to increase the Australian content of their vehicles (Tariff Board *Report* 1957:9). Austin and Morris merged to form the British Motor Corporation (Australia), and began plans to manufacture locally. An influx of foreign manufacturers soon followed including Standard, Rootes, Rover and Volkswagon. Clearly, government policy had been successful in attracting leading United States, German and British manufacturers to Australia.

The objective of securing the industry as a basis for post-WW II manufacturing consolidation and expansion seemed assured. In 1955 new registrations of PMVs were 168,914 and at the end of 1956 there was one motor vehicle to every 4.1 persons in the country (Tariff Board *Report* 1957:10). This placed Australia fourth on the list of most motorised countries in the world. During the financial year 1954-55 the manufacturing, assembly and accessory industry employed 48,388 persons, whilst direct employment in the motor industry was estimated to be 125,000. During 1956, the value of the sale of motor vehicles and parts was estimated to be between £450 million and £500 million, a high proportion of which went to the relatively concentrated motor vehicle production industry. Of all vehicles registered in 1955, GMH accounted for 34.3 percent, Ford 18 percent, and British Motor Corporation 19.6 percent (Tariff Board *Report* 1957:11). The 1950 and 1952 import licensing restrictions also greatly stimulated the Australian component manufacturing industry. Existing producers expanded their operations whilst both British and West German companies were attracted to the market. By 1957/58 the Australian content of locally-made vehicles had reached 77 percent (Department of Industry, Technology and Commerce 1981:7).

The development of the component sector was further influenced by the Tariff Board *Report* of 1957. The Tariff Board had been instructed to advise on procedures to simplify the tariff and to develop a tariff schedule that would be sufficient to sustain and consolidate the automotive industry and the manufacture of components and spare parts. The *Report* recommended an approach that would facilitate the consolidation of earlier gains made by industry.

The *Report* divided components into three groups; X, Y and Z. Group X included components that were then considered capable of efficient and economic manufacture in Australia in sufficient quantities to supply the bulk of original equipment requirements. Group Y included components made for motor vehicles in Australia but without there being a sufficiently large market to make production competitively economic. Group Z included components which, in 1957, were imported at non-protective rates of duty and for which production in Australia to meet demand was not then economic. The Board recommended that Group Y items bear a protective tariff of 37.5 percent MFN (Most Favoured Nation), and 27.5 BPT (British Preferential Tariff), Group X items be more heavily protected at 42.5/35 percent and Group Z items be admitted at the non-protective rates of 7.5 percent/nil. (Tariff Board *Report* 1957: 34). Of interest to the later development of the industry was a proposal for a 'local content' scheme contained in a submission to the Inquiry by the Department of Trade and Customs. The Department suggested an arrangement whereby a system of duty concessions dependent on increasing local content would be introduced. The Department submitted that a new tariff item should be instituted covering components "for use as original equipment in motor vehicle manufacture in accordance with plans approved by the Minister as prescribed by Department by-laws" (Tariff Board *Report* 1957: 62). Items in this category would be admitted at concessional rates. This proposal was not accepted at the time but was, in fact, introduced in 1964.

In 1960 quantitative import restrictions on components were lifted. The abolition of the licensing system heralded a rapid rise in the volume and value of imported components from a level of £54 million in 1958-59 (including £40 million under by-law), to a value of £97.6 million in 1964-65 of which £76 million was under by-law (Tariff Board *Report* 1957: 62). However, the growth in the importation of components was not solely due to the impact of trade restrictions. To some extent this rise in imports was due to the growth of the industry. Total vehicle registrations nearly doubled from 213,795 units in 1957 to 408,555 units in 1964. Funds employed in the motor vehicles manufacturing and assembly industry and the value of production (£282 million in 1963-64) more than doubled over the same period (Tariff Board *Report* 1965:8-15). Notwithstanding, there was considerable disquiet in the component sector as increased import penetration began to bite into the market share of local producers.

This period also saw the beginning of an even more monumental influence on the development, structure and performance of the Australian PMVI than that of trade and import restriction. This was the arrival of the Japanese. Whilst British firms dominated the market in the late 1940s, a decade later the US firm GMH held over 50 percent. However, the nature of the market was undergoing a significant change that had been completely unforseen by the 1957 Tariff Board

Report. In what fast became a composite market for vehicles, strong competitive pressures began to emerge in the medium to small-sized cars sector. It was here, in particular, that the growth of Japanese motor imports began in earnest. In 1960 Japanese cars held a thousandth of the Australian market. By 1964 they held a tenth (Stubbs 1972:28)

As Australian manufacturers began to rapidly lose market share to the Japanese, the cost of framing industry policy without consideration as to consumer preferences or consumer welfare became abundantly clear. Japanese imports added a new dimension to the industry by offering both a reliable and acceptable small car and, as standard equipment, a range of features that would normally have been considered optional extras by Australian manufacturers and assemblers. The degree of consumer acceptance of the Japanese product clearly illustrated the extent to which Australian industry policy and manufacturing strategy had not focused on the consumer. As a consequence, both the proliferation of the model range and the standard equipment now demanded, saw a rise in both the imported content of locally manufactured vehicles (for example, Ford imported the automatic transmissions for the early Falcons) and the number of cars imported fully assembled. The abolition of import licensing controls in early 1960 also made it easier to import components from overseas. As seen from Table 2.10 import costs relative to total costs began to rise. In addition there was a sharp rise in CBU imports as from 1962-63 which continued over the next two years. (See Table 2.11.) These developments challenged the predominant position of the local PMVI as the pivot around which the totality of Australian secondary industry revolved.

2.3.1 Summary of Policy Developments: 1944-1964.

The advent of WW II had seen the decision to develop an Australian-made motor vehicle put on hold. However, the immediate post-war phase revived such intentions, which were predicated on high levels of tariff protection and the duty free importation of component parts. Balance of Payments problems saw import licensing introduced in the early 1950s. By the end of the period, despite the significant impact of the pattern and degree of local protection of both sectors, the industry was unable to meet the growing challenge of Japanese imports.

2.3.2 Winners and Losers over the Period: 1944-1964.

Given that in all circumstances industry policy had been formulated from solely the perspective and interests of supply-side and production considerations, the aggregate industry was the big loser. Whilst the machinations of industry policy seemed to favour the interests of the manufacturing sector over those of the component sector, the triumph was short-lived. Increased tariff protection and import licensing had appeared to secure the market for local CBU producers whilst by-law importation of a range of component parts enabled CBU producers to increasingly by-pass the more expensive local component industry. (Notwithstanding, import licensing had secured 77 percent of the market for local component producers by 1958). However, the challenge of by-law concessional imports of components and the proliferation of models in the CBU sector saw the component industry under serious threat by 1964. On a more serious and broader front, the failure of industry policy to accommodate demand and consumer welfare considerations ensured that the PMVI, *in toto,* was unable to anticipate, let alone meet, the challenge of Japanese imports. Indeed, because of such failures, industry policy was in danger of losing relevance to the future evelopment of the sector.

2.4 The 1964-1984 Era.

At the conclusion of the third period a chronological examination of the industry becomes a little more complicated in that it is possible to identify the fourth, fifth and sixth phases of the PMVI as occupying a single era enacted over the 1964-1984 period. In the first instance, the era can be broken up into three distinct periods: 1964-74, 1974-75, and 1976-84 on the basis of the government in power and the subsequent modifications and amendments to policy designed to secure basic strategic objectives. However, it is also true that there are a number of general themes that transcend any single phase and thereby hold for the total period.

2.4.1 Common Objectives over the 1964-1984 Period.

In the first instance, the detailed and highly intrusive government involvement in the PMVI that began in the immediate post-WW II period continued over the entire two decades of this era. However, in the face of the emerging challenge of imports, the focus of attention shifted as the government continued to pursue the original intention of securing the industry as the cornerstone of post-WW II industrial development. Government policy now aimed at the establishment of an import competitive industry. This would, it was thought, secure the viability of the industry and thereby safeguard the future of Australian manufacturing in general. An import competitive industry was to be made possible by the provision of whatever level and form of protection that was necessary for the local PMVI (both manufacturing, assembly and component parts), to effectively compete with imports (Sexton 1992: 2). In all instances the welfare of the consumer was effectively ignored. A second theme common to the total interval and to governments of all political complexions then emerged that highlighted a particular and somewhat unique dilemma for the industry. That is the PMVI was, and is, composed of two sectors with often competing and conflicting interests where attempts to assist one sector were often at the expense of the other. In the rush to develop the much desired import competitive PMVI, this factor was effectively ignored. This in turn led to short-term, *ad hoc* and highly complex intervention as the adverse consequence of government strategy on one sector or the other of the industry emerged. Such realities promoted instability and made long-term investment strategies very difficult for the Australian manufacturers of both CBUs and component parts. Consequently, the total industry was made more vulnerable to external competition. Notwithstanding, the second general theme shows that intervention over the period extended the existing pattern of assistance. This can be seen by reference to both tariff levels and local content policy.

2.4.1.1 Tariff Policy

Enhanced tariff protection involved adjustments to the existing tariff provisions as they applied to both sectors of the industry and modifications to the long held policy of duty-free importation of necessary inputs not locally available. The dilemma associated with interventionist policy and mutually exclusive sectoral interests within the industry soon became clear. This can be demonstrated by reference to the nominal and effective rates of tariff protection afforded the industry as denoted in Table 2.12.

The effective rate of protection for the PMVI, as shown in Table 2.12, had ballooned over this period to twice its original rate. By 1981-82 local PMV producers had, whilst remaining price competitive, a 158 percent price differential available to them, while local component producers enjoyed a price differential well above 105 percent.[4] These rates of protection came at a high cost. The obvious loser was the Australian consumer who suffered a considerable and visible welfare loss. In addition, the intra industry impact of the high rates of effective protection for the component sector on the CBU proved extremely detrimental to the manufacturing/assembly sector. Theoretically, a tariff on component parts or intermediate products should encourage the development of a local import-competing facility. On the other hand, given a requirement to use local components (and the fact that local component parts were considerably more expensive than those produced overseas), such a tariff imposes cost burdens on the local manufacturing/assembly industry. In effect it is a tax on one division of the PMVI (the manufacturing/assembly sector), in order to facilitate the development of another division (the component parts and/or intermediate products sector). The net consequence would thus be to make the locally produced PMV increasingly non-price competitive with external competitors. This, in turn, necessitated increased protection for this sector. Moreover, it also encouraged the importation of fully assembled vehicles, which was in direct conflict with the objectives of government policy as it applied to the manufacture of motor vehicles and put at some risk the viability of the sector. This in turn was contrary to the objective of

[4] For details on the effective rate of assistance that had operated in the PMVI see Stubbs (1972) and more recently the IC Report (1990).

securing the PMVI as the pivot of Australian manufacturing.

2.4.1.2 Local Content Policy

It is of interest that the origin of Australian local content plans is obscure. Most industry analysts see them as a direct outcome of the dramatic increase in component imports that followed the abolition of import licensing in 1960. However, Stubbs (1972:79) felt that they were developed in response to a proposal from an American multinational, probably GM International, to incorporate its Australian operations into a system of worldwide sourcing. Regardless of this debate, manufacturers and assemblers had, since the 1940s, been able to import duty free inputs for which no suitable local substitutes were available. Given the price differentials between Australian and foreign produced component parts it was not surprising that the manufacturing sector had enthusiastically utilised such provisions to reduce the cost of component parts. During the early 1960s, particularly with the abolition of import licensing, the government had become concerned with import competition and the subsequent slow pace of development of the local component industry. It therefore sought ways to offset the provisions of the policy that enabled the duty-free import of selected component parts in order to encourage local component production. Consequently, the essential policy impasse became clear. On the one hand, one aspect of assistance policy to the component sector (tariff policy and the subsequent rate of effective protection), adversely impacted on the manufacturing and assembly sector. On the other, there remained a strong commitment to foster the development and growth of the component sector through alternative assistance packages. The apparently contradictory nature of policy goals necessitated the continuous adjustment and revision of policy over the entire period and led to a climate of instability within the total industry. This dilemma had been raised, although not addressed, by the 1957 Tariff Board *Report* that noted:

> The Australian automotive industry is one of great variety; it consists of many interests with conflicting views on tariff matters even in cases where complete harmony would at first glance appear to be assured. For example, in the manufacture of a complete motor vehicle the Australian content in different makes varies and, whilst one might expect that the maker of the vehicle with the greatest Australian content would seek the highest protection, this is not so. Some manufacturers of vehicles with high Australian content are also importers of other vehicles and a high duty for protection of one part of their operations would increase the cost of the other part (Tariff Board *Report* 1957:37).

Such volatility did little to encourage the degree of long-term planning and investment necessary to meet the emerging challenge of imports particularly those from Japan.

2.4.2 Summary of the Common Features of Policy over the 1964-1984 Era.

The period began with the continuation of detailed and highly intrusive government intervention based on the determination to provide whatever level of assistance was necessary to secure the industry against the threat of imports. Such an approach ignored the fact of a two-sector industry with often competing and conflicting interests. The era concluded with tariff policy subject to constant revision and change as a balance was sought between the demands of the manufacturing sector and the desire to develop a strong and viable component industry. Instability and uncertainty reigned. Once again this period was characterised by policy intervention motivated by supply-side considerations and the failure to pay any heed to demand-side factors. We now turn to look at the policy process during this twenty year period in more detail.

2.5 The Fourth Phase: 1964-1974.

Notwithstanding such general observations, the 1964-84 era can be further broken into three distinct phases. The first covered the period 1964-74 and was the fourth stage in the general evolution of the PMVI. This period saw a policy response to the increase in import penetration of the CBU sector and the fall in local content of new vehicles registered.

2.5.1 The Manufacturing Sector: 1964-74.

As noted, the policies of protection in place prior to the mid-1960s, had not prevented more cost efficient producers (particularly the Japanese), from seizing a substantial portion of the Australian market via import penetration. In response, repeated decisions were taken to reaffirm, and if necessary, escalate tariff protection particularly as it applied to CBU production. Not surprisingly, this form of assistance did substantially accelerate over the period. The Menzies government increased the tariff on CBUs from 35 percent in 1964 to 45 percent in 1966 (which continued until the end of the phase in 1974). This gave Australia the second highest tariff rate in the world after New Zealand.

Notwithstanding this increase in protection, the four Australian producers, GMH, Ford, Chrysler and Leyland saw their combined market share decrease from 84 percent in 1966 to 58 percent in 1974. In particular, Chrysler and Leyland were experiencing substantial losses by 1972. In 1974, Leyland closed its Australian manufacturing operation. Late in the phase local manufacturing industry also faced further pressure. In December 1972 and early 1973 respectively, Toyota and Nissan, which had been assembling vehicles under the low-volume plan, sought permission to manufacture in Australia under the high-volume plan that required 95 percent local content. Both companies were concerned that they may have otherwise been excluded from the Australian market.

2.5.2 The Component Sector and Local Content Policy: 1964-1974.

By 1963 the government was seriously concerned as to the viability of the component industry and feared a domino effect on employment from the collapse of the domestic component industry. (The Menzies Government had almost lost power in the 1961 election as the electorate reacted to rising unemployment). Consequently, the coalition government established, in May 1964, a local content plan. Supporters of a high local content requirement for the PMVI had, paradoxically, been given a major boost by the abolition of import licensing requirements on component parts in the early 1960s. The abolition of such controls saw a dramatic rise in the import of component parts and the local industry under some threat. In response, domestic component producers (principally Repco), proposed what was then a novel form of protection: a local content requirement that was felt would ensure the future viability and prosperity of the local component industry. In a belated recognition of the fact that the PMVI was composed of two separate sectors with often-conflicting interests, the scheme was adopted with three different sections designed to accommodate the concerns of both the manufacturers and assemblers.

From January 1, 1965 by-law concessions on components for use in PMVs were granted only for vehicles entered under specified manufacturing programs designed to increase Australian content. These plans were called Plan A, Plan B1 and Plan B2. Plan A guaranteed by-law concessions (ie duty-free importation of component parts that were usually subject to a 35 percent tariff rate), to high-volume producers such as Ford and GMH who undertook to increase the local content of specific models to 95 percent over five years. A definition was also given to local content. This was to be the lowest wholesale price (including service charges), to the most favoured metropolitan distributor or dealer minus the into-factory costs of imported components (excluding re-exports), expressed as a percentage of the lowest wholesale price. During the time provided for reaching this level of local content (up to December 3 1974), vehicle builders were permitted to enter *all* their import requirements (other than certain 'excepted' components), for the vehicles concerned free of duty or at non-protective rates.

Plan B1 granted by-law concessions to low volume producers who undertook to manufacture with 50 percent local content at the end of the first year and 55 percent by the end of year two. The duty concession was granted only on non-protected components. Plan B2 offered the least assistance. Models entered under B2 were required to be assembled from completely knocked down (CKD) components in Australia. If a commitment was given by the manufacturer that the local content for the entered model would increase, by-law admission would be granted on these components for which firm orders had been placed with Australian component manufacturers until the contract was honoured or for eighteen months, whichever was less.[5] A summary of the recommendations is given in Table 2.13.

The Tariff Board did recognise that the proposals contained an inherent weakness; that manufacturers might restrict the volume of production in order to secure the advantage of a larger proportion of by-law imported components for a given vehicle. However, the Tariff Board considered that sufficient incentives existed to guard against this possible eventuality. Unfortunately, they were proven incorrect on that score. This miscalculation did much to place the industry in a position that threatened its very viability. As noted in Table 2.13 the original scheme permitted companies to produce with very low levels of local content as long as the volume of vehicles was limited. That is 45 percent local content up to 2,500 vehicles, 50 percent up to 5,000 vehicles and 60 percent up to 7,000 vehicles. This provided extremely high levels of assistance to this form of production. For example, if a manufacturer produced less than 2,500 vehicles per annum they were required as noted, to use only 45 per cent local content. They were then free to source up to 55 percent of requirements with much cheaper components from overseas. A low-volume production run would thereby earn substantially greater profit per unit of output for the manufacturer, than would a high volume production run that required the much more expensive 95 percent

[5] For details of each plan see McEwan *et al.* (1964).

local content. This led to further fragmentation of both the vehicle and component markets.[6] In addition, such production was extremely vulnerable to import competition. The complete absence of economies of scale meant severe cost disadvantage and price differentials that could only be overcome by additional protective devices being put in place. And, as per usual, the interests of the consumer were, once again, not considered

At the same time as the local content plans were made public, the Minister for Trade referred to the Tariff Board the matter of tariffs on CBU imports. The major reason for the reference was the growing value and number of cars being imported fully assembled into Australia (see Table 2.11). The Board was asked to advise on two issues. The first was the question of protection for the Australian PMVI from CBU imports. The second issue concerned the merit of cancelling the by-laws governing the importation to Australia of components at non-protective rates of interest.

2.5.2.1 Protection from CBU Imports.

Most of the CBU imports had an engine capacity of 1500cc or less and were sourced from Japan where producers had a price advantage over similar cars assembled in Australia, principally by the British Motor Corporation. As to the issue of protection from CBU imports, the Board recommended an increase in tariffs such that PMVs were to be dutiable at 35 percent BPT (up from the existing 25 percent BPT), and 45 percent MFN (up from the existing 35 percent MFN), *ad valorem*. However, it was also determined that a means should be available to

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[6] Variations in local content obligations greatly affect the determination of effective rates of protection available to producers of CBUs. This had a tremendous impact on the development of the CBU sector when such diversity in local content requirements was possible.

provide for the demand for some specialist vehicles, and to allow companies not yet involved in the Australian market to test their products. Thus a by-law was advocated that would allow the rate of duty to remain at 25 percent BPT and 35 percent MFN provided that over a 24 month period the importation of PMVs did not exceed 7.5 percent of new registrations averaged over the same period (Tariff Board 1965:18).

2.5.2.2 The Cancellation of By-Law Provisions on Imported Components.

As to local content, the Board found that the cancellation of the component by-law would substantially increase the duty paid and thereby place too great a burden on domestic vehicle producers. Therefore, although cancellation was not recommended it proposed measures by which by-law admission would be tied to the volume of production of a given vehicle for which the component was destined to be used.

The local content schemes were subject to continual revision and amendment over the period 1964-74. For example, in 1966 alone there were two amendments to the scheme. In February of that year the Government modified the Board's 1965 proposals. Plan A was left almost intact with the exception of those small producers who were able to qualify for the standing by-law on components if the minimum content level shown in Table 2.13 was achieved. This reduced by 2500 units the level of protection recommended by the Board commensurate with a 60 percent local content and provided a substantial gap between the manufacturer and the assembler. Therefore, it could be expected to protect the five local manufacturers of the ten models then entered in the Plan A local content scheme from import competition, especially from the Japanese. In 1965 the Japanese supplied 78 percent of all imported CBU PMVs. They thus sought a reduction of 20 percent in local content requirements and deferment of the tariff increases until local assembly could be established. In response to these Japanese representations the Government did effectively reduce the local content requirement by 5 percent (through a redefinition of local content), without actually changing Plan A, and granted some extensions of time before the tariff increases became effective. In November 1966 a second change was made following pleas by three of the major local manufacturers. There had been a continued fall in new car sales for the second year running. The small car sector had been hardest hit. Subsequently, Plan A was modified so that the criteria for entry was:

- model production less than 25,000 per annum
- no reversion to imports currently sourced in Australia
- components under program at October 31, 1966 would be sourced within the original five year period.

If these conditions were met the government agreed to extend by two years the period allowed to reach 95 percent local content (McEwan *et al.*, 1966).

Notwithstanding, the Japanese were still able to surmount this augmented protective apparatus. In addition, local manufacturers, faced with increased capital costs in order to meet local content requirements had less opportunity to make frequent model changes. This was a severe handicap in a highly competitive market. Thus, in 1968, further amendments were made to Plan A. These saw an optional 85 percent local content plan introduced for vehicles selling less than 25,000 units per year. In addition, manufacturers with more than one car under Plan A could retain duty concessions by securing a weighted average 95 percent

Australian content for all their cars, provided one car had reached 95 percent local content and others did not fall below 85 percent Australian content (McEwan, 1968).

In 1971 further major amendments to Plan A were introduced. The main reason for these changes was the simple fact that the 1966 and 1968 amendments failed to achieve the desired results. Tables 2.14 and 2.15 show, over the period June 1969–June 1970, that as the same time that CBU imports were increasing the market share of producers assembling vehicles in Australia also increased.

The main element of the 1971 amendment was the decision to phase out the Assembly Plans by the end of 1974 so that low content assemblers ceased to receive by-law concessions after 1974. This decision was taken because the Assembly Plans tended to encourage the proliferation of small car models and discourage high content manufacture. This was because duty concessions for the Assembly Plans (on average slightly over 20 percent of the vehicles' value), were more favourable than those under the Manufacturing Plans. Vehicles under the Assembly Plan were thus receiving much higher rates of effective protection than vehicles under the Manufacturing Plan. Therefore, the local content plan, with its impact on the effective rate of protection, slanted CBU output towards low-volume production. This, in turn, meant a proliferation of low-volume models, which were completely unable to access economies of scale. Thus, the manufacturing of CBUs was both fragmented and made even more inefficient. This again placed at risk the viability of the industry and in turn, Australian manufacturing in total. Other decisions taken included an extension of the assured life of the 85 percent and 95 percent Manufacturing Plans until the end of 1979, and the introduction of a 'local content-export credit' scheme. A summary of the changes in the local content plans introduced in 1971 is given in Table 2.16.

The consequence of government policy as it applied to the local component industry over the decade 1964-1974 was little short of disastrous. The rationale of the first local content scheme introduced in May 1964 was, as we have seen, to protect local producers of components against import competition. However, it is clear that 1964 local content plan did not achieve this end and further, undermined the operation of the manufacturing sector of the industry. The problem for the local component industry was that of external price competition. Notwithstanding the protective buffer in place, local component production remained, in many instances, more expensive than externally produced components. CBU production runs were therefore biased towards low-volume manufacturing that allowed the use of a greater percentage of cheaper imported components. However, such production permitted no economies of scale and left the CBU sector unable to meet the challenge of imports. A similar situation applied to the local component suppliers themselves. The expansion in available models meant, in turn, a demand for a diverse range of low-volume components. As with the manufacturers of CBUs, local component producers were thereby denied access to economies of scale. This in turn promoted inefficient production and accentuated the non-competitive price position of local component suppliers. In addition, in an effort to promote local price competition, vehicle manufacturers encouraged the development of a multitude of component producers. Major component requirements had a minimum of two producers, whilst for more minor components there were often three or more competing suppliers. This development further compounded the problems associated with the local component producer's lack of economies of scale. Given these factors, the government either continually amended the local content plans and/or introduced new ones as in 1966, 1968 and 1971. The situation with regard to local content had become so confused and illogical that by 1971, any vehicle manufactured or assembled in Australia could be subjected to one of five local content plans ranging from 45 to 95 percent local content. The variations in local content requirements were eventually abandoned and a general 95 per cent provision operated for all producers until 1974, with provision for an 85 percent level thereafter. For those producers who operated under these conditions, some duty-free importation of component parts, for which no local substitute existed, was still possible. If assemblers chose to stay outside the plan, a full 25 percent tariff on all imported component parts applied. The policy was designed to ensure that the large manufacturers, in particular, were forced to operate under the plan. However it was also becoming increasingly clear that local content plans were not in general achieving their expressed objectives. As a result the government decided to phase them out completely.

2.5.3 Summary of Policy Developments: 1964-74

This period began with the clear intention to develop, at whatever cost, an import competitive PMVI. Protection was to be further developed and if necessary, escalated for both sectors of the industry. The tariff on CBUs was increased from 35 percent in 1964 to 45 percent in 1966, which at the time gave Australia the second highest tariff rate in the world after New Zealand. Notwithstanding, the four Australian producers, GMH, Ford, Chrysler and

Leyland saw their combined market share plummet from 84 percent in 1966 to 65 percent in 1973. In 1974, Leyland closed its Australian manufacturing operation. Pressure on the sector increased when Toyota and Nissan sought permission to manufacture in Australia under the high-volume plan that required 95 percent local content. May 1964 saw the introduction of the first local content scheme which sought to protect local producers of components against import competition. It failed to do so and, in addition, undermined the operation of the manufacturing sector of the industry. Further, the protectionist policies in place promoted inefficient production and accentuated the non-competitive price position of local component suppliers. Consequently, the government either continually amended the local content plans or introduced new ones as in 1966, 1968 and 1971. Total confusion resulted. As at 1971, any vehicle manufactured or assembled in Australia could be subjected to one of five local content plans ranging from 45 to 95 percent local content. A general 95 per cent provision was therefore introduced to cover all producers until 1974, with an 85 percent level to operate thereafter.

2.5.4 Winners and Losers

During this period the CBU manufacturing sector was a clear loser as it was undermined by the application of a local content policy. The dynamics of the scheme generated low-volume CBU production in Australia and an increasing challenge from imports for market share. In addition, the fact those local component suppliers were not price competitive with external producers further frustrated the local CBU producer in their attempt to compete against imports. The component industry did benefit from the local content policy although continuous modifications to the schemes promoted instability. The sector also suffered as CBU manufacturers sought to promote internal price competition amongst component suppliers, leading to multiple, small and inefficient suppliers. In essence, no sector of the industry emerged from the period as a winner, particularly not consumers.

2.6 The Fifth Phase: 1974-1975

Many of the economic decisions taken over this phase reflected the ideological position of and/or, divisions within, the new Whitlam Labor government elected to power in 1972 as the first non-Conservative government in Australia for twenty-three years. Such political realities applied as much, if not more, to the PMVI as to other areas of manufacturing. As a case in point, the controversy generated by the application of Nissan and Toyota in late 1972 and early 1973 respectively, for entry into the PMV manufacturing sector under the high-volume, 95 percent local content scheme illustrates the contention. These applications raised important questions associated with the newly elected government's objectives for the industry, particularly the question of plans and government policy towards new entrants. At the time, as shown by Table 2.18, the four domestic producers, operating under the existing scheme, were facing major challenges from imported vehicles that had steadily gained an increased market share.

Local producers expressed great concern as to the ability of the Australian PMVI market, operating under the then current pattern of protection, to sustain two additional manufacturers.[7] Consequently, all producers, with the exception of GMH, began to lobby extensively for additional support. Specifically, for quantitative import restrictions. In August 1973, the Government referred the question of assistance for the Australian PMVI to the Industries Assistance Commission.[8] An interdepartmental committee had been set up to examine and report on options for the PMVI. However, division as to appropriate policy beset this committee.

Eventually a compromise was reached that saw the IAC instructed to conduct an inquiry into the PMVI in order to both "improve the efficiency with which the community's productive resources are used..... and consider a broad range of social, employment and environmental issues" (IAC 1974:125).

The IAC, as with its predecessor the Tariff Board, was a staunch critic of the protection policies afforded the PMVI and therefore produced a not unexpected condemnatory report on the industry. The principal conclusion found that the costs of production in the Australian PMVI were significantly higher than those in Japan, North America and most European countries. As with past investigations the Inquiry determined that the most important factor contributing to these cost disadvantages was the inability of the Australian industry to exploit the benefits of high volume production. This, in turn, was directly related to the structure of the industry. Further that the assistance policies of the previous decade (a high tariff and local content plans), had contributed significantly to the unsatisfactory structure of the industry. The main recommendations of the 1972 IAC Inquiry were:

- to discontinue the phasing-out of the local content schemes and abolish

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[7] The Whitlam government did not in fact take a decision on the entry of Nissan and Toyota.

[8] The Industries Assistance Commission (hereafter IAC), replaced the Tariff Board in 1973 as the body to advise

them completely.

- to instigate immediate phased-in tariff reductions on CBUs to 25 percent by 1981.

The IAC estimated that this policy would result in:

- the domination of the small vehicle sector by the Japanese;
- a rationalisation of the manufacturing sector of the industry to three producers;
- a rationalisation of the component sector with a number of the smaller, inefficient producers closing down.

The *Report* also estimated that the complete adoption of its recommendations would result in a total of 2000 job losses out of an aggregate workforce of 80,000 (IAC 1974: 158-72).

An extremely hostile reaction to the *Report* from manufacturers, unions, the South Australian government, elements of the federal bureaucracy (the Department of Secondary Industry), and the federal Labour caucus resulted. These disparate elements combined in a powerful alliance to defeat the IAC recommendations. As a result the Standing Interdepartmental Committee on Assistance to Industry (hereafter SIDCAI), produced an alternative to the IAC *Report*. This argued for retention of the local content schemes, albeit in a simplified form, and, in complete contrast to IAC recommendations, for an *increase*, not a decrease, in tariff protection for CBUs. The acceptance of the SIDCAI position and the subsequent rejection of the IAC recommendations represented a significant victory for those advocating a continuation of substantial

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government on all aspects of industry protection including tariffs.

protection for the PMVI. (The oil price shocks of 1973-74 added further weight to the argument for protection of the sector in the volatile and uncertain economic environment of the time).

The resultant sectoral plan had two main features aimed at either the CUB division or the component sector. It proposed an assured 80 percent market share for the manufacture of a reduced model range of CBUs and the retention of a local content scheme that would see increased specialisation of component parts production. The plan was to operate for ten years from January 1 1975. This period was seen as the minimum necessary to provide a stable environment for investment and the anticipated restructuring process. Irrespective of the complex political compromises that had underpinned much of the plan, the economic rationale of the plan was simply stated. Once again, the aim was to achieve increased efficiency for the PMVI and thereby increased international competitiveness. This would be gained through the economies of scale that would result from its key provisions.

2.6.1 CBU Sector

The objectives for this sector over the period were two-fold. Firstly, via a revamp of the local content policy, to reduce the range of models so as to better secure economies of scale in order to make the sector more competitive with imports. Secondly, to secure and enhance the market share of Australian CBUs through much more direct means. The Whitlam Government had, in July 1973, introduced a 25 percent across-the-board tariff cut that reduced tariff protection for CBUs from 45 percent to 33.75 percent. Under the new scheme, a tariff trigger was put in place that would immediately return the CBU tariff to a level of 45 percent if imports exceeded 20 percent of the local market. This came into effect. straightway. There were however, no provisions put in place to protect the consumer from the price aspects of the policy. In addition, an even more assured protective device was reinstated. Quotas on imported vehicles were reintroduced should tariff barriers fail to secure the designated 80 percent of the market for local producers.[9]

2.6.2 Local Content

The objective of securing a 'reduced model range' of locally produced CBUs was supposed to result from the abolition of the complex array of local content requirements that had encouraged the proliferation of low-volume production runs for CBUs. In its place, a single 85 percent local content requirement was established. However, unlike other local content schemes, this 85 percent requirement could be averaged over the manufacturer's total operation. This, it was believed, would assist in achieving greater flexibility for the CBU producer and thereby achieve substantial cost and price advantage for the local manufacturing sector. These factors would lead to the desired economies of scale for both sectors of the industry and, in turn, promote the much-coveted escalation in efficiency and thereby increased international competitiveness.

2.6.3 Summary of Policy Developments 1974-1975

Protection of CBUs had initially been reduced from 45 percent to 33.75 percent following the July 1973, 25 percent across-the-board tariff cut. Protection was subsequently increased to 45 percent if, and when, CBU imports gained 20

[9] Introduced as a 'temporary' measure in January 1975 to combat unemployment in the industry, successive governments increased the competitive advantage of the local manufacturing and assembly industry by maintaining quantitative restrictions on imports.

percent of the market. This meant, in reality, an immediate increase to the new 45 percent level of protection. The policy aimed to ensure 80 percent of the Australian CBU market to local producers. The phasing-out process for the complex array of local content schemes for the component sector was abolished. A single 85 percent local content requirement, averaged over the manufacturer's total operation, was established.

2.6.4 Winners and Losers: 1974-1975.

The period was really too short to see any clear winners or losers although the CBU gained an assured 80 percent of the market. However, the component sector also stood to gain with a single 85 percent local content requirement. Although there was a shift in policy focus to consider "international competitiveness", there was no real consideration of what this might mean for consumer welfare, rather the focus was upon making the supply side more internationally competitive; again the demand side was neglected during this period.

2.7 The Sixth Phase: 1976-84.

The election of the Frazer Conservative government in late 1975, ensured that the Whitlam plan had little chance of achieving any of its objectives. The predominant aims of the new government as they applied to the industry were to:

- confront the issues of structure, performance and protection afforded the PMVI, and
- address the specific problems they saw as having been generated by the previous government.

This had to be attempted in the light of the then current internal and external economic conditions and in the context of the Conservative political philosophy and real politic.

The attempted restructuring process of the Whitlam period was quickly undermined by a combination of local and external factors. As noted, Nissan and Toyota had been lobbying since late 1972 to gain permission to convert from assemblers to manufacturers. In terms of value-added production, the development of workforce skills and balance of payments considerations (which loomed large at this time), manufacturing was clearly preferable to the assembly process. It seemed absurd to policy makers to totally import or assemble the cars when the Japanese producers were willing to set up manufacturing operations in Australia for a much-desired range of products. By 1976, the rationale for the conversion from assembly to manufacturing was irresistible. Permission was duly granted to both Nissan and Toyota-AMI to begin production in Australia. This decision was taken even though, as made clear by the Crawford *Report* (1979:18), the industry could not support five manufacturers at the 85 percent local content level and still generate an acceptable return on investment. Therefore, the reform of the industry was dealt a severe blow as instead of the sought-after economies of scale of the Whitlam plan, there was escalation in low-volume production runs and increased market fragmentation. Further, the Australian PMVI, as with much of the world industry, was undergoing significant change at this time. Australian consumers were continuing to shift their preferences from the largely Australian produced big, basic, fuel inefficient six-cylinder vehicles to fuel-efficient, four-cylinder, predominantly Japanese, cars. They were less expensive to both purchase and to operate, were held to be more reliable, and provided as standard equipment a range of accoutrements that were expensive "extras" in Australian produced vehicles. As with the US car industry, the Australian PMVI had failed to either anticipate or react quickly, to the shift in consumer preferences. Such a failure was not surprising given that post-WW II industry policy had consistently ignored the consideration of demand.

The response of the Frazer government to the subsequent decline in market share for the Australian industry was not atypical in terms of previous industry policy. That is, the response to demand-induced challenges to the Australian industry was to attempt to manipulate and influence the conditions of supply. Instead of “listening” to the market and considering the demand and consumer welfare considerations that were obviously emerging as key factors, the government sought to repeat the failed remedial action of the past. As such the tariff on CBU imports was increased from 45 percent to 57.5 percent by 1978. Despite this escalation in protection, the market share of the local industry continued to decline, plunging to 74.8 percent by early 1980 (Lynch 1980:1049). Some inevitable rationalisation did occur at this time. In 1980, Mitsubishi bought out Chrysler and GMH closed its Pagewood plant in Sydney. One year later Renault closed its assembly operations.

The objective of CBU tariff policy from 1974 had been, as noted, to ensure 80 percent of the market to local producers. However, even with the level of protection at 57.5 percent this objective was not achieved. Since tariff protection alone was failing to achieve the stated objective the Frazer government took further decisive action. It entrenched quantitative restrictions on imports that had first been applied by the Whitlam government as a temporary expedient to avoid job losses.[10] In addition, in March 1979, the government instructed the IAC to report on the level of assistance to the PMVI post-1984. As with the 1974 IAC *Report*, vested interest groups mobilised to influence IAC deliberations and to contest or support its 1981 published results. This Report was little changed from that of 1974. The IAC found that the manufacturing of cars in Australia remained an extremely high cost activity for the same reasons as noted in the 1974 and 1964 Reports. That is, too many producers, too many models and the complete absence of standardisation of component parts in a market far too small to allow any real economies of scale. This can be illustrated by reference to Table 2.18.

The *Report* lambasted the fact that the PMVI received three to four times the assistance available to the manufacturing sector as a whole, at an estimated rate of $1,000 million per year, or between $2,000 and $3,000 per vehicle (IAC 1981:6) and called for radical action. It urged that the policy of maintaining the car industry at all costs be abandoned and, as such, recommended the dismantling of all forms of non-tariff protection. That is, the 85 percent local content requirement, the 80:20 market share policy between locally produced vehicles and imports, and the quantitative restrictions on imports were to be abolished. Further, tariff protection was to be granted only in the long term if, and when, the PMVI responded positively to the removal of the non-tariff protective measures.

As could be expected, the drastic recommendations of the *Report* caused a storm of controversy. The Frazer government, although unwilling to pay the

[10] It is of interest that by the perpetuation of the restriction of imports to 20 percent of the market, the Frazer government took a strategic decision that was at odds with its own stated industry policy.

perceived political cost of a return to tariff-only protection for the PMVI, was convinced of the need to reform the assistance program. Moreover, the government was split between two quite radically different reactions to the IAC *Report*. The first was the so-called 'GMH' option that proposed the maintenance of the local content plan and the quota system. These provisions were to be offset however, by an expansion in the credits available under an Export Facilitation Scheme (hereafter EFS), to a ceiling of 15 percent.[11]

The EFS had arisen out of the 1979 Crawford Study Group on Structural Adjustment. This *Report* had identified the high cost of Australian produced components as a key variable in the cost structure of the CBU sector that rendered it internationally non-competitive. An EFS was designed to offset this debilitating factor. At the time, GM International was lobbying hard for a local content scheme. The Crawford *Report* (1979:20) urged the government to accept the GM strategy. The essence of the GM proposal was to allow manufacturers to import component parts duty-free equivalent to the value of their exports. That is, to obtain local content credits in exchange for exports. (Final acceptance of the Scheme saw a 7.5 percent ceiling imposed). This was to be in addition to the imports allowed duty-free under the local content plan. The rationale of the EFS was to encourage local manufacturers to become more export-orientated and thereby improve their international competitiveness. The Scheme would have, at least in theory, allowed manufacturers less expensive access to high technology-

[11] An EFS had been put in place in March 1980 for CBUs and March 1982 for the components sector. This was designed to help offset the adverse impact of the local content scheme on the efficiency of the PMVI. Although the EFS was introduced too late to really impact on industry performance during the period it was expanded and promoted during the period of the Button Plan. As such the rationale and development of the Scheme is of interest.

specialist components and therefore assist in developing economies of scale in both the CBU and component sectors of the industry. The Scheme also contained a further strong inducement. GMH guaranteed that if their proposal was accepted it would build an engine-plant in Australia capable of producing 300,000 four-cylinder engines a year with at least 50 percent of production to be exported. It subsequently did so at Broadmeadows, Victoria.

The second alternative was known as the 'Mitsubishi' option and more closely reflected the IAC position. This proposal supported market-driven reform for the industry through a reduction in local content requirements and a loosening of import quotas. The GMH position finally attained support when the impact of the Mitsubishi option on Australia's defence capacity was invoked.

However, vested interests continued to attack the GMH proposal, especially as it related to the EFS. The Federation of Automotive Parts Manufacturers (FAPM), claimed that if the ceiling on the scheme was raised from the then 7.5 percent to 15 percent, it would cost the local component industry 50 percent of their sales and many thousands of jobs. Alternatively, GMH claimed that it was not viable to continue as an Australian manufacturer if the ceiling remained at 7.5 percent. It is of interest that while the union movement, Mitsubishi and Toyota supported the FAPM position, Ford declared it could live with the 15 percent scheme.

2.7.1 The Lynch Plan

The final policy recommendations became known as the Lynch Plan, after the then Minister for Industry and Commerce and Industry, Sir Phillip Lynch. This plan reflected a troubled compromise between the 'wets' (who saw a role for government intervention in the determination of the structure and conduct of the market), and 'dries' (who argued for a reliance on market forces freed of the constraints of such intervention). The outcome also represented an uneasy balance between political considerations and IAC recommendations. As such, few were satisfied and, more importantly, the adopted policy was very unlikely to meet its stated objectives. The main planks of the policy:

- Retained the 57.5 percent tariff on CBU imports but abolished quantitative import restrictions and replaced them with tariff quotas.
- Progressively expanded the quotas on imports, with imports beyond the quota to be subjected to a 150 percent tariff, which was, over time, to be reduced to 125 percent.
- Retained the 85 percent local content requirement, but gradually raised the ceiling on local credits under the Export Facilitation Scheme from 7.5 percent to the GMH desired level of 15 percent.

The objectives of the Lynch plan were muddled to say the least. On the one hand, the retention of tariff protection and quota levels at a much higher tier than had been available in 1974 would do little to encourage rationalisation. On the other hand, industry restructuring and rationalisation was to be encouraged by policies that would suppress model growth. In particular, the abolition of quantitative CBU import controls were to be abolished and replaced with a progressively expanded quota system allied to tariff penalties. The object was to encourage the importation, rather than the local production, of low-volume models. Therefore, the local PMVI would, hopefully, concentrate on the, much-craved high-volume production. Implicit in the plan was the assumption that, by

1992, the industry would operate under a system of tariff protection alone.

2.5.6 A Summary of Policy Options: 1976-1984

The addition of two further domestic producers led to increased low-volume production runs and increased market fragmentation. Declining market share for Australian producers resulted in increased tariff protection offset by an abolition of quantitative restrictions on CBU imports, offset in turn by an increase in local credits under the EFT scheme. Reaction to yet another IAC *Report* on the future protection to be afforded the industry saw further divisions within the government and the industry between the Mitsubishi and GM options. The Lynch Plan was muddled and confused.

2.5.7 Winners and Losers: 1976-1984

Increased tariff protection for CBU imports were offset in part by the lifting of quantitative import restrictions. However, the sector continued to suffer a direct consequence of the attempt to ensure the viability of the component sector. Consumer welfare was at no time taken into consideration.

2.6 An Overview of Industry Policy 1944-1984

At the conclusion of WW II, government policy as to the PMVI underwent a radical change. From that period, intrusive and activist intervention in the planning and operation of the industry reflected a determination to establish an Australian produced PMV as the cornerstone of post-WW II reconstruction. As such, comprehensive and complex patterns of assistance were developed for the sector that, in turn, generated high cost, inefficient production devoid of a concern for the consumer. Subsequently, the industry was unable to meet the growing challenge of imports. However, it was the 1964-1984 era that most graphically illustrated the confusion of objectives and the inconsistency of policy that has beset the sector. This period was characterised by a determination to provide the PMVI with whatever form and level of protective assistance necessary to maintain the viability of the industry and make it import competitive.

The aggregate impact of tariff protection, local content schemes and the quota system can be summarised to show that the combined consequence of such assistance was to produce, paradoxically, an import competitive and highly inefficient industry at one and the same time. Although the aggregate level of tariff assistance did increase during the period, tariff protection for the industry was not unique to this era. Thus, it was the *form* of additional assistance that was critical. That is, quantitative restrictions of local content and quota, in conjunction with the general level of tariff protection were critical in determining the objectives and consequences noted. For example, throughout the entire period there were mandatory requirements on the proportion of local components that had to be included in the production and, or, assembly of locally produced vehicles. Consequently, irrespective of considerations such as price, quality, and delivery performance, the policy required local vehicle producers, to place themselves at an often-great competitive disadvantage.

In theory, and in a limited number of cases at the margin in practice, assemblers could be forced to incorporate local components, which were more than ten times the price equivalent of imported product. Furthermore, assemblers were often forced to accept less than satisfactory quality and delivery performance from component suppliers (Sexton 1992:7). The local content scheme, therefore, distorted the component and vehicle production market in three specific ways. In the first instance, the local component industry suffered from the fact that limited resources were spread over a very wide range of products with little real opportunity to foster excellence through specialisation. This was because local vehicle producers, who required the very high and mandatory local content of components, forced the local component suppliers to produce a much wider range of products than they would have under other circumstances. Secondly, because the local vehicle producers were denied access to externally produced components, they sought, successfully, to operate under a multi-sourcing arrangement within Australia. This was to try and engender a degree of price competition within the component industry. The result for the local component suppliers was further dilution of any available economies of scale. Finally, the local content schemes also encouraged low volume output runs for CBUs by providing very high levels of effective protection to this form of production. This encouraged further fragmentation of the market and a loss of scale economy opportunities.

Quotas also played a key role in shaping the PMVI over the last ten years of the period. From 1974, the local production of CBUs was made competitive with imports by restricting the import of vehicles to 20 percent of the market. Beyond the distortion to the market caused by this lack of external competition, quotas distorted the Australian PMVI market in other ways. The first was in the drive for increased market share. To gain and/or increase their share of the market, manufacturers were forced to produce in Australia. This lead to an increase in producer numbers (five by 1977, up from four in 1973), of models, of components, and of production facilities. The net result was the totally uneconomic fragmentation of what was, in any circumstances, a very diminutive market. Under the limitations imposed by quotas, the market for CBUs did not expand. This further exacerbated the problems created by a small market. The import market for cars was also directly distorted by the quota system. In order to maximise returns from the limited quota, dealers concentrated on the importation of expensive luxury cars. These cars were often subjected to long waiting lists. Consequently, customer service fell away. This, in turn, meant that Australian producers did not have to be concerned as to one more area of potential competition.

2.9 Conclusions as to Industry Policy: 1900-1984.

The first forty-five years of industry policy saw the government content to foster and develop assembly, body-building and component production. However, from the mid-1940s, Australian governments, irrespective of their political complexion, took an active and interventionist role in order to plan the promotion and development of the PMVI. This involvement was often muddled, counter-productive and subject to constant change, as attempts were made to secure the PMVI as the cornerstone of Australian post-WW II industrial development. After approximately eighty-five years of existence, the PMVI, by the time of the introduction of the Button Plan, remained:

- Inefficient although import competitive (as a direct consequence of the very high levels of protection afforded to it).
- Predicated on a disregard for consumer welfare and
- Unable to respond to the demands of intra-sectoral interests.

All these factors seriously threatened the viability of the industry and that of Australian manufacturing.

At the end of this analysis we are left with the clear impression that the failure to focus attention in any serious way upon the demand side led successive governments, over a period of eight and a half decades, from one policy distortion to another. The period is a good case study in endogenous policy failure where second-best intervention leads to unintended outcomes that require subsequent policy intervention. All the time the welfare position of consumers worsens.

Table 2.1: Duties on Imported Bodies: 1908 to 1913.

	Preferential £	General £
Single-Seat Bodies	15.0	17.0
Double-Seat Bodies	21.0	24.5
Bodies with Fixed or Moveable canopy tops, eg laundaulette limousine, taxi-cabs	36.0	42.0

Source: *Tariff Board ' Investigation Report on Vehicles and Parts', May 9, 1916, p.22.*

Table 2.2: Value of Imports of Motor Vehicles: 1909-1913

Year	Motor bodies £	Motor chassis £	Vehicle parts NEI* £
1909	62,000	435,000	66,000
1910	96,000	694,000	125,000
1911	160,000	1,018,000	147,000
1912	220,000	1,451,000	248,000
1913	216,000	1,335,000	222,000

Source: *Tariff Board 'Investigation Report on Vehicles and Parts', May 9, 1916, Appendix pp 19-21.*

* *NEI* :The average value of the imported bodies was £44 so that the flat rate tariff gave average *ad valorem* rates of about 52 percent

Table 2.3: The Country of Origin of Imports of Motor Vehicles: 1909-1913

Country	Motor bodies £	Motor chassis £	Vehicles and Parts NEI £
United Kingdom	70,000	486,000	91,000
United States of America	93,000	337,000	95,000
Canada	37,700	158,000	14,400
France	7,700	151,000	5,400
Germany	4,300	69,000	11,400
Italy	NA	75,000	1,400
Other	3,300	57,000	3,400
TOTAL	216,000	1,333,000	222,000

Source: *Tariff Board 'Investigation on Vehicles and Parts', May 9, 1916 pp. 19-21.*

Table 2.4: Registration: Cars/Vehicles NSW and Victoria 1910-21.

Year	NSW	Victoria		Year	NSW	Victoria
1910	2,351	NA		1917	18,884	12,614
1911	3,975	3,944		1918	21,387	15,158
1912	5,944	6,735		1919	25,197	17,991
1913	8,072	6,735		1920	29,100	21,772
1914	10,590	7,977		1921	32,189	24,485
1915	12,095	9,175				
1916	15,020	10,713				

Source: *Official Victorian Year Book 1910-11 to 1921-22; Official Year Book of NSW 1912-22.*

Table 2.5: Tariff Duties on Bodies 1920-1929.

Type	British Preferential Tariff £s.	Intermediate £s.	General £s.
Single-seat Bodies	50	35	40
Double-Seat Bodies	50	55	60
Bodies with Fixed or Moveable Canopy Tops ie landautettte, limousine or taxi; or *ad valorem*; which rate returned the higher duty	65	70	75
	40 percent	50 percent	60 percent

Source:: *Stubbs. (1972), p.10.*

Table 2.6: Prevailing Tariff Rates on Chassis, 1920-27: Item 359(D)(4):

Year	Type of Chassis	British Preferential %	Intermediate %	General %
1920	Unassembled	7.5	12.5	17.5
	Assembled	10.0	15.0	20.0
1921	Unassembled	5.0	7.5	10.0
	Assembled	7.5	10.0	12.5
1925	Unassembled	Free	7.5	12.5
	Assembled	5.0	20.0	20.0
1927	Unassembled	Free	12.5	17.5
	Assembled	5.0	20.0	25.0

Source: *Stubbs, (1972) p.12.*

Table 2.7 Production of Motor Accessories: 1930-31 to 1939-40.

Year	Number of Factories	Employment	Value of Output £
1930-31	18	204	97,000
1931-32	18	215	115,000
1932-33	27	322	184,000
1933-34	28	360	230,000
1934-35	36	566	360,000
1935-36	37	643	440,000
1936-37	61	1,154	662,000
1937-38	66	1,926	1,096,000
1938-39	72	1,919	1,068,000
1939-40	76	1,964	1,094,000

Source: *Commonwealth Bureau of Census and Statistics: 1930-31 to 1939-40 Monthly Bulletins of Production.*

Table 2.8: Registrations in Australia: 1928-29 to 1938-39.

Year	Cars		Year	Cars
1928-29	474,359		1933-34	455,199
1929-30	466,930		1934-35	457,684
1930-31	429,206		1935-36	484,832
1931-32	419,970		1936-37	499,289
1932-33	438,499		1937-38	534,963
1933-34	455,199		1938-39	562,271

Source: *Official Year Book of the Commonwealth of Australia: No 23-33*

Table 2.9 Vehicle Imports 1951-55.

	Assembled Chassis £	Assembled Bodies £
1951-52	20,000,000	17,000,000
1954-55	7,750,000	8,850,000

Source: *Tariff Board' Report on the Automotive Industry', June 1957, p.59.*

Table 2.10: Imports of Vehicle Components 1961-1965.

Year	Vehicle Component Imports : £	Year	**Vehicle Component Imports** £
1961	95,000,000	1964	122,200,000
1962	55,400,000	1965	143,500,000
1963	110,200,000		

Source: *ABS Catalogue Number 9304.0.*

Table 2.11: Value of CBU Imports 1958-59 to 1964-65.

Year	Value: FOB £s.	CBU Imports (units)
1958-59	3,700,000	4,866
1959-60	4,000,000	5,351
1960-61	5,900,000	7,150
1961-62	3,000,000	3,664
1962-63	8,800,000	11,999
1963-64	10,200,000	15,115
1964-65	15,800,000	28,930

Source: *ABS Catalogue Numbers 9304.0.*

Table 2.12: Tariff Indices 1968-1982.

TARIFF		1968-69	1973-74	1977-78	1981-82
Average Nominal Rates (Percent)	Motor Vehicles	36	27	47	59
	Motor Vehicle Instruments	40	30	40	49
	Motor Vehicle Parts n.e.c.	30	22	43	53
	Manufacturing Total	24	17	15	16
Average Effective Rate (Percent)	Motor Vehicles	52	41	108	158
	Motor Vehicle Instruments	51	39	84	106
	Motor Vehicle Parts n.e.c.	40	29	88	119
	Manufacturing Total	36	27	26	26

Source: *IAC (1982-83:16)' Nominal and Effective Assistance to Manufacturing'.*

Table 2.13 Recommended Tariff Board Incentives 1965 *Report*.

Volume of Production Units (p.a.)	Minimum Local Content for By-Law Concession (percentage)
1-2500	45
2501-5000	50
5001-10,000	60
10,001-20,000	70
20,001-30,000	80
30,001-40,000	90

Source: *Tariff Board' Report on the Automotive Industry', September 1965, p.16.*

Table 2.14: Imports of CBU Vehicles Per Quarter: June 1969-June 1970.

	Source: Japan	Source: Italy	Total: All Sources	Percentage of Total Registrations
June 1969	7303	819	9,283	9.3
Sept.1969	6,867	1,965	10,486	10.1
Dec.1969	6,589	1,531	9,436	9.1
March 1970	4,939	1,689	8,400	8.6
June 1970	6,098	3,195	11,123	10.0

Source: *ABS Catologue Number 9304.0*

Table 2.15: Assembly Sector: March 1969-June 1970.

	45% Plan	50%Plan	60%Plan	Total	Total as a percentage of Plan vehicles
March 1969	1,445	2,046	10,913	14,404	17.1
June 1969	1,728	2,381	11,328	15,437	16.7
Sept.1969	1,480	3,771	11,607	16,858	17.5
Dec. 1969	1,868	3,597	12,155	17,620	18.5
March 1970	1,626	3,264	11,944	16,834	18.8
June 1970	1,742	4,012	12,553	18,307	19.1

Source: *Department of Trade and Industry, Departmental Paper, November 2, 1970, p.13.*

Table 2.16 Local Content Plans as per the 1971 Amendments.

	Local Content	Volume Limits	By-Law Duty Free Concessions
Manufacturing Plans	95%	No Limit	All residual components
	85%	25,000 p.a.	All residual components
Assembly Plans	60%	7,500 p.a.	20% in 1972
			15% in 1973
			10% in1974
			Nil in 1975
	50%	5,000 p.a.	As per 60% content.
	45%	2,500	As per 60% content.

Source: *McEwan , J., (1971) Press Statement: 'Motor Vehicle Industry', December 16.*

Table 2.17: Market Concentration by Mode of Origin Percentage Registrations of PMVs.

Year	Locally Manufactured	Locally Assembled	Imported CBUs	Total
1968	76.9	9.7	13.4	100
1969	75.7	14.8	9.5	100
1970	71.2	18.5	10.3	100
1971	70.0	17.6	12.4	100
1972	71.0	20.5	8.5	100
1973	64.9	20.8	14.3	100
1974	58.1	17.6	24.3	100

Source: *IAC 'Report on the Automotive Industry', (1974) .p 17.*

Table 2.18: The Range of Locally Produced Motor Vehicles, 1964, 1973, 1977, and 1980.

	Number of Producers	Number of Models	Number of Body Styles	Average Registrations per Model ('000s)	Range of Registrations per Model ('000s)	Average Registrations per Body Style ('000s)
1964	5	8	13	32.1	1.7-130.1	19.7
1973	4	12	23	24.8	4.6-95.3	13.0
1977	5	17	31	19.5	2.2-53.8	0.7
1980	5	14	24	22.8	1.3-68.2	13.3

Source: *Gregory (1988:189)*

3 The Button Car Plan

The previous chapter revealed a sorry tale of policy failure over eighty five years as successive governments lurched from one policy response to another. However, in 1983 the new Hawke Labour government was elected to power. This government brought with it a determination to instigate change over a wide range of political, social and economic considerations. Thus there appeared to be a golden opportunity for a fresh approach to the formation and application of industry policy as it applied to the PMVI. It seemed that under the auspices of a concerned and involved Industry Minister, there was a real chance to rectify both the errors of past policy and to provide a framework to enable the industry to move confidently towards the new century. In specific terms, as we have continually stated, there was a chance to address the three major errors of past policy. These were the failure to consider demand and consumer welfare considerations, the failure to recognise the dual sector realities of the industry and the failure to determine the basic objectives of the industry within the broad canvas of the general manufacturing sector itself.

In this chapter we will review and evaluate the impact of the 1985-92 Plan for the Australian PMVI. The 1985-92 strategy became known as the 'Button' car plan (hereafter the Plan), named for the Industry Minister responsible for its development and operation, Senator John Button. In this chapter, therefore, we will evaluate the degree to which the Button Plan was an example of a fundamental policy shift to embrace demand side considerations in the development of PMV policy, or whether, the Plan represents an example of missed opportunity. To what extent did demand and consumer welfare considerations permeate the

the strategic thinking behind the Plan?

The Plan operated, with modification, over a turbulent and difficult period, particularly given the recessed nature of both the Australian and world economies over the latter stages of its existence.[1] The Plan was of utmost relevance to an $8 billion-a-year industry. At its conclusion in 1992, the PMVI employed almost 45,000 people nationwide (nearly 6 per cent of employment in the manufacturing sector), accounted for 20 per cent of all complex manufacturing (which represents about 5 per cent of value added and about 1 per cent of Australia's total Gross Domestic Product), and exported $1.247 billion in value-added manufactured goods (AAIA 1993:1)

In this chapter we will place the Plan in its contemporary and historical context, detail its major elements and evaluate its known consequences in the light of the need to address the failure of past industry policy. However, any evaluation of the Plan needs to move beyond the rather narrow parameters of PMV industry policy alone and incorporate the context of previous aggregate industry policy that had, of course, extended well beyond the PMVI.

Both aggregate and individual industry manufacturing performance are fields that have received much attention in Australia from groups that include government, government policy-makers and advisory bodies, employers, the trade union movement and academic writers alike. Manufacturing performance has either been the central focus, or at the very least, a major factor influencing numerous Inquires, Reports and Panels since the turn of the twentieth century and

[1] The Plan was replaced with a post-1992 strategy designed to take the PMVI into the twenty-first century. This new scheme has been operational since January 1, 1993. As this chapter is concerned with an evaluation of the Plan, only the broad thrust of the replacement scheme will be detailed.

indeed, generated spirited argument before Federation itself. In more recent times, the economic realities of the 1980s and the early 1990s have added a greater sense of urgency to the need to address the performance of the aggregate and/or individual components of the manufacturing sector. This is particularly as Australia struggles to adjust to a rapidly changing external and internal economic environment in an increasingly globalised world. The question of industry efficiency has often taken centre stage in such deliberations.

It has long been recognised that Australia lacks a competitive edge both in the aggregate manufacturing sector and in specific industries such as the PMVI. This has been partly due to factors such as population size and geographic isolation that are outside the direct and immediate control of policy makers. However, other influences that are capable of manipulation, such as the degree of protection afforded industry in general and specific industries, in particular, have also contributed to a failure to achieve both macroeconomic and microeconomic efficiency. Irrespective of the cause, over many years there has been insistent calls for both the aggregate Australian economy and for particular industries to become more efficient and thereby more internationally competitive. In particular, bodies such as the Industry Commission (IC), its predecessor, the Industry Assistance Commission (IAC) and its predecessor, the Tariff Board undertook, repeated examinations of the levels of assistance provided to individual industries. These scrutinies invariably result in reference to the lack of efficiency of Australian industry.

As the 1980s unfolded and, in the face of Australia's major and apparently intractable current unemployment and Balance of Payments problems, there was a sense of urgency in the need to address this perennial question of the lack Australian industry efficiency. This was particularly so for areas of value-added manufacturing such as the PMVI. With the election of the Federal Labor government in 1983, a range of policy initiatives including structural reform, changes in work-practices and reform in such areas as transport, the waterfront, finance and telecommunications were canvassed and, in some instances, put into place. The Plan was predicated on this push for reform continuing.

The closely interrelated question of protection and assistance as applied to the PMVI is, as we have seen, a highly vexed issue involving particular areas of difficulty. In the first instance, the interests of the consumer had been largely ignored in any determination of industry policy particularly in the context of the application of protective measures such as tariffs. An industry policy that concentrates almost exclusively on the conditions and factors influencing supply considerations is, as we have stressed, unable to anticipate or react quickly to changing conditions of demand, which is, itself, often the product of import competition. The subsequent successful challenge of imports means that supply-side objectives are either irrelevant or unattainable without recourse to increased protectionism. The cost to both individual consumers and the aggregate economy of such a limited policy is very high. The net welfare loss associated with a decreased consumer surplus that arises from higher prices and reduced output in an industry that is protected from external competition is clearly demonstrable in both a theoretical and practical sense.

In 1990 the IC spelt out the extent to which higher prices were imposed on consumers of PMVs by the 1988 level of assistance available to the industry.

They did so by an analysis of the two measures used to place a dollar value on the assistance provided by the arrangements. The first is the gross subsidy equivalent (GSE) and the second is the consumer tax equivalent (CTE). The GSE is the notional amount of money, or subsidy, necessary to provide the same amount of assistance as is provided by an industry's nominal rate of assistance. In 1988 the GSE for the PMVI was put at approximately $1.3 billion (IC 1990: 25). The CTE is an estimate of the additional payments made by purchasers of domestically produced and imported goods as a result of assistance, excluding the additional sales tax paid by consumers as a result of the inflated wholesale value of the vehicles due to assistance. In 1988 the CTE was approximately $1.6 billion. This was about $4000 per car at ex-factory prices (IC 1990: 25).

Protectionism and assistance to the industry also generates the need to balance the often mutually exclusive interests of the two distinct sectors within the industry. Given the reality of a dual-sector industry, the problem for the policy-makers is that tariff protection for the industry is often a two-edged sword. That is, the PMVI consists of two distinct entities, the production/assembly sector and the component sector. Both areas often have mutually exclusive interests. The imposition of tariff protection can, as demonstrated in the previous chapter, have beneficial consequences for one sector and adverse effects on the other. It was into just such an environment that the Plan was born.

3.1 Basic Details of the Plan

Notwithstanding such generalised industry policy failure, the 1985 launch of the Plan saw many of the specific problems that had consistently bedevilled the Australian PMVI persist almost intact. That is, the industry remained inefficient and highly protected, surrounded and supported by a vociferous array of powerful and vocal vested interest groups and plagued by a small demand for a very wide range of either component parts and/or models. In the 1960s the problem was components, in the 1980s, the number of models. Both considerations reflected the inability of the Australian PMVI to secure any real economies of scale whether in components or models. For example, as shown by Table 3.1, even at the mid-point of the plan in 1988, production runs for the thirteen CBUs then produced averaged 40,000 units with no run exceeding 100,000. This was in stark contrast to US producers such as GM whose top-selling models of that year averaged more than 300,000 units. The top Japanese producer Toyota produced more than 700,000 Corollas and 350,000 Camrys over the same period (IC 1990: 34).

Whilst in Opposition, the Hawke government had been highly critical of the so-called Lynch plan for the industry and had made clear its intention to replace the Lynch agenda with its own strategy for the restructure of the PMVI. The perilous state of the industry, illustrated by the August 1983 GMH sacking hundreds of workers at its plants in South Australia and Victoria, gave added impetus to this objective. In October 1983, the new Industry Minister, Senator Button, formed the tripartite Car Industry Council (CIC).[2] Chaired by Senator Button, the CIC was to report on the long-term future of the industry in a mere two months. The CICs brief was to develop and recommend joint action to be taken by all those with a stake in the industry (including the Federal government), in order to restructure the industry to become efficient and competitive within Australia and abroad. At the same time production and design capabilities were

[2]A tripartite body reflected the highly consensual approach to decision-making in vogue at the time.

to be retained in Australia whilst opportunities for long-term employment were to be maximised (Commonwealth Record 1983: 107).

The CIC, as with other bodies before it that had investigated the PMVI, had to contend with the fundamental incongruity of the industry. That is the attempt to position the industry as the cornerstone of the Australian manufacturing sector whilst at the same time develop an industry:

- responsive to the demands of the consumer;
- able to accommodate the diverse interests operating within the industry itself; and
- able to contend with the challenge of imports.

As we saw in Chapter 2, from the turn of the twentieth century there has been a concerted effort by governments of various political persuasions to develop and sustain the Australian PMVI as a foundation for industrial development. The industry had for a long time (and remained so in 1983), pivotal to the manufacturing sector in terms of employment and value-added manufacturing. For example, the centrality of the industry to manufacturing employment in South Australia and Victoria was of the utmost significance. In a submission to the IAC the South Australia Government argued that "The automotive industry is critical for broader manufacturing development in South Australia in terms of its direct and indirect (invisible) linkages to other manufacturing activity" (IAC 1982-83: 61). In addition, the PMVI was deemed vital to Australia's defence capabilities. In 1981, the Minister for Industry and Commerce, Sir Phillip Lynch estimated that the industry provided 20 percent of all engineering capacity for defence preparedness and 50 percent of the existing capacity for large-scale defence production (Commonwealth Record 1981: 457). These realities assured that the CIC had to be mindful of the very severe economic, social and political repercussions that would arise should the protection afforded the industry be diminished. In the final analysis the CIC was unable to agree on the nature of the appropriate solutions to the industry's problems. However it did recommend that the Government announce an industry goal incorporating both a target for the industry to reach and a strategy to reach it. The CIC (1983:36) stated:

> The purpose of such a goal would be to give notice to the industry of the direction in which the Government wishes to see it go. Individual participants in the industry would then be able to make forward plans in consultation with Government, which they knew to be in harmony with the Government's long term aims for the industry.

Up to this period the industry policy decisions of previous governments had generally ignored or overridden the recommendations of bodies charged with investigating and recommending options for the PMVI. In particular, the advice of the IAC had consistently been ignored. For example, there had been two IAC investigations into the PMVI industry during the period 1964-84. Both examinations recognised the costs associated with the degree of effective protection afforded the industry, both argued for reductions in such assistance and both were rejected by the Governments of the day. In fact, existing levels of assistance were not only maintained but also often pushed higher. However, this time the environment had changed. In response to the CIC recommendations the Plan was borne. Unlike past efforts at change, the Plan did represent a determination to implement fundamental reform within the PMVI. One reality however did not change. As with past attempts at PMVI reform, the Plan ultimately centred its attention on the conditions of supply even though it was predicated in part on consumer welfare considerations. However, as always, any consumer welfare gains were to be generated from supply-side considerations with no real reference to demand-side factors.

3.2 General Objectives of the Plan.

The broad goals of the Plan were to accelerate the restructuring of the industry and to gain additional time for modernisation. The Plan was based on two requirements. The first was to increase the total efficiency of the industry so as to generate effective competition with imports at substantially lower levels of protection. The second was to generate lower real vehicle prices to the Australian consumer. Senator Button (Motor Vehicle Policy Statement, 1984), announced the strategies by which these objectives were to be pursued as comprising:

- an increase in import competition through a gradual reduction in the tariff rate;
- the pursuit of scale economies and better capacity utilisation through rationalisation, encouraged by minimum volume provisions and Export Facilitation; and
- productivity and quality improvements through investment in new manufacturing technology including automation and investment in new management practices, skills training and work organisation.

The aggregate aim of the Plan was to reduce the number of producers from five manufactures producing thirteen models to a target of three manufactures producing five models. It was felt that this would ensure larger production runs, increased efficiency and thus cheaper cars. The key to the development of increased efficiency (and thus the corner stone of the Plan) was to increase the scale at which car models were produced in Australia. This should generate increased profitability that was itself dependant upon high levels of local content associated with increased volumes of production. The task was little short of daunting. As at 1984 the Australian PMVI was dominated by five manufacturers, Ford, GMH, Nissan, Australian Motor Industries Ltd. (Toyota/Australian ownership), and Mitsubishi producing thirteen models. These producers shared "a market of about one-twentieth the size of the United States .... in an industry so inefficient by world standards that (even after imports had satisfied 20% of domestic market) motor vehicle buyers, at the margin, were prepared to pay a tariff of just over 90% for the right to import an additional vehicle" (Gregory, 1988: 174).

The Plan contained specific measures to reduce the very high level of assistance afforded the PMVI and thereby, hopefully, generate the desired increased efficiency within the industry. A combination of direct penalties (aimed at discouraging low volume production), and market forces were to be applied to achieve the objective. The direct penalties were contained under "minimum production volume" provisions that were to be current until 1996. These provisions required the production of a minimum 30,000 units of a model per year in order to receive the full 15 percent entitlement to duty-free entry of component parts. This factor was predicated on an 85 percent local content requirement. That is, producers were entitled to import 15 percent of their inputs duty-free only if they attained an 85 percent local content over a minimum of 30,000 units. Exemptions to the volume requirements were available if a producer agreed to rationalise production facilities or to withdraw the model from production. The market factors used to promote efficiency primarily involved significant reductions in tariff protection. (Table 3.2 shows the nominal rate of tariff protection over the life of the Plan and the future projected rate of tariff assistance to the year 2000).

The original Plan (1985) had included significant changes to the pattern of border protection offered prior to its inception. These included a phased reduction in penalty duty on imports beyond quota, the phased introduction of tendering for import quota and expanded export facility provisions. Quota protection and the local content scheme were subject to continuous scrutiny in the early years of the Plan. Quota protection was ultimately abandoned in April 1988.

3.3 Key Provisions of the Plan

The principal features of the Plan can be divided into a number of key elements. (For a very detailed description of the main elements of the Plan see IAC (1988b), whilst an excellent summary of these features is provided by the IAC(1987a). The IAC determines the main properties of the Plan as:

3.3.1 Output Protection

Prior to the Plan, the PMVI enjoyed extensive protection due to quantitative import restrictions that ensured the industry a massive 80 per cent of the domestic market. Under the Plan tariff quotas replaced these quantitative import restrictions. A total quota was set at approximately 22 per cent of the anticipated market in each year of the Plan. Any importation beyond the import quota was to attract penalty rates of duty. This level was set at 100 per cent for 1985 but was to be almost halved to 57.5 per cent by 1992 (the same rate as was to apply to imports within the quota).

3.3.2 The Local Content Plan

At the inception of the Plan, Australian producers of assembled vehicles remained locked into a local content policy that required 85 per cent of the wholesale value of the vehicle to be sourced in Australia. This obligation sought to insulate local component producers from external competition. The compensation for the PMVI producers faced with the higher cost of local as against imported components was the privilege of importing components and/or vehicles duty free to a value of 15 per cent of the wholesale value of their production. Prohibitive penalties in the form of escalating duties forced compliance with the requirements of the local content plan.

3.3.3 The Export Facilitation Scheme

The Plan sought to expand existing provisions designed to facilitate exports. These provisions had enabled producers to import, duty free, additional components and vehicles beyond the limits imposed by the 85 per cent local content requirement in return for automotive exports. This was set at a limit of 15 percent of the value of the export. Thus, the subsidy was set at a level equal to the duty that would apply to imports when local content requirements were not met. Producers could therefore choose to reduce the level of their local content in domestically produced vehicles without incurring additional import component penalties. Consequently domestic vehicle production costs were reduced but at the cost of a large subsidy to automotive exporters.

3.3.4 The Australian Automotive Industry Authority

The Plan provided for the establishment of the Australian Automotive Industry Authority (hereafter the AAIA), to monitor the operation of the Plan. The AAIA was required to report annually to the Minister for Industry on the 'state of the automotive industry'. The AAIA was to also provide a mechanism for consultation with the industry as to the progress of the Plan.

3.4 Changing Macro-economic Parameters and the Plan: The Mid-Term Review

During 1988 a scheduled mid-term review of the Plan led to subsequent changes in the assistance arrangements provided. The objective of the review was to lower the cost of PMVI assistance to the consumer and to take account of the consequence of the then depreciation of the Australian dollar. The most important change in the macroeconomic parameters under which the Plan operated did involve the exchange rate of the Australian dollar. The Plan was certainly not predicated on the assumption of a significant devaluation of the Australian dollar in 1985. Nor had it foreseen an almost continuous subsequent fall in the value of the Australian dollar over the period 1985 to 1988 in relation to the currencies of major external players in the PMV market. Both situations posed a threat to the effective operation of the Plan. Table 3.3 provides data on the extent to which the $A devalued against the four most relevant currencies. Devaluation had the potential to greatly reduce the impact of reduced import restrictions as a means of forcing local PMVI producers to restructure operations. That is, to eliminate the production of a large range of low volume output models. This did prove to be the case.

Given the escalating prices of imports under the impact of devaluation, Australian producers found themselves more than price competitive under existing structures and arrangements. Table 3.4 details the market share of imports (1983-88) and demonstrates that the cost and difficulty associated with restructuring could be, and was, delayed as a result of the devaluation of the Australian dollar over the period. The decline in market share of the Imported Sector across all relevant sectors was very apparent.

In addition to either maintaining or improving their market share against imports as a result of the devaluation, Australian producers also took advantage of the reduced competitive pressure of imports to pass on the increased cost of imported component parts to the consumer. Whilst this was to be expected, local producers took further benefit by substantially increasing the price of the local product. Table 3.5 details the growth in prices of vehicles over the 1985-1988 period. It demonstrates that as the price of imported vehicles increased by approximately 70 percent over the period of the December quarter 1984 to the December quarter 1987, the price index of locally manufactured cars rose 48 percent. This compared to an increase in the Consumer Price Index and Average Weekly Earnings of 27 percent and 20 percent respectively (AAIA 1988: 28)[3].

Therefore substantial change to the macroeconomic environment between the 1985 inception of the Plan and its 1988 mid-term review in 1988 effectively scuttled two of its key planks. The drive for restructuring was ignored and the

[3] There were some extenuating circumstances. The increase in sales tax on luxury vehicles from 20 to 30 percent in August 1986 and the introduction of Australian Design Rule 37 which required all vehicles manufactured from February 1 1986 to be fuelled with unleaded petrol, also contributed to the rise in prices.

objective of enforcing lower real prices to the consumer was not attained. The scheduled mid-term review therefore saw the Plan in some disarray.

3.5 The Mid-Term Review of the Plan

The change in the macroeconomic parameters under which the Plan operated did ensure that mid-term review ushered in broad and controversial alterations that impacted on every segment of the industry.

3.5.1 Output Protection

Despite the initial howls of anguish from a range of disaffected groups, the 1988 review introduced significant reductions in the degree of output protection afforded the local industry. Perhaps the most controversial was that quantitative import restrictions were to be completely abolished by April 1988. In addition, parallel reductions on the tariff applied to imported vehicles (from 57.5 per cent to 45 per cent), were immediately implemented and were to be further reduced to 35.5 per cent by 1992. From 1992 the tariff was to be progressively reduced by an annual rate of 2.5 percentage points to reach 15 per cent by the year 2000. (See Table 3.2.)

3.5.2 Local Content

As of January 1 1989 penalty provisions for the failure to reach required levels of local content in the production of PMVs were to be abolished. From that time the failure to meet local content obligations saw the imposition of a fixed duty on components equal to the tariff on vehicle imports. This effectively gave local producers a choice. They could choose to obtain component parts through imports if these costs (including the tariff penalty), did not exceed the cost of locally produced components or source from local suppliers. In other words, local producers could choose to ignore the 85 per cent local content requirement and pay duty on any shortfall rather than look to Australian producers for their component requirements. Therefore from January 1989, local component producers were supported by tariff protection alone.

3.5.3 The Export Facilitation Scheme

In contrast to the two previous provisions the export facilitation scheme was strengthened as a result of the mid-term review. The duty-free entitlement available through the export facilitation provisions increased from 15 to 20 per cent of the value of a vehicle's production. Export credits available to manufacturers of component parts were also increased. Export facilitation provisions for vehicle imports were extended until the end of 1994 (IAC 1988b:75).

3.6 The Results of the PMVI Plan

Any effective evaluation of the Plan requires an assessment of the stated goals and objectives of the Plan itself.[4] Such an appraisal must therefore consider:

- the number of manufacturers/models produced
- volume performance
- export promotion
- price
- efficiency gains: as measured by productivity.

3.6.1 The Number of Manufacturers/ Models Produced

Of all the stated objectives, success or failure for the Plan hinged on the attempt to reduce the number of producers, and thereby models offered, to a

[4] As the Plan concluded at the end of 1992 most emphasis will be placed on the results achieved in the latter stages ie 1991 and 1992. Further, some detail will be given as to fluctuations in price, sales, stocks imports and exports over these concluding phases. This will be to emphasise the volatile nature of the industry's performance as it struggled to respond to the directives of the Plan in the light of the internal and external constraints imposed by the recessed economic environment.

predetermined and strategic level. If this objective was not achieved the Plan had clearly failed. The objective was to reduce both the number of producers to three local manufacturers (instead of five), and the range of models offered (from thirteen to five). This would enable local manufacturers to obtain production and productivity improvement through greater utilisation of the considerable economies of scale available to the PMVI. By mid-1990 and some eighteen months from completion, the Plan was in some trouble. The thirteen models had been reduced to eight rather than the five required and five rather that the requisite three manufacturers remained. However, a combination of the severely depressed Australian economy and a significant gain in market share by imports did ensure that this major platform of the Plan would be partially realised within the projected time frame. Notwithstanding, this success was for reasons more associated with recession and import competition rather than the specific impetus of the Plan itself. This can be seen by reference to the following factors over the period 1990 to 1992:

- total PMV sales (incorporating sector share).
- movements in PMV stocks.
- the market share of imports.
- producer viability

3.6.1.1 Total PMV Sales

Tables 3.6 and 3.7 indicate the volatile nature of the market as the Plan drew to a close. In 1990, sales rose to their second highest level since the mid-1970s (AAIA 1991:34). However, 1991 graphically illustrates the impact of the recession on PMVI sales. In a clear reflection of the recessed state of the

Australian economy, sales of passenger motor vehicles fell 15.9 per cent from 1990 levels to 391,529 units in 1991 (Table 3.6). This figure was the second lowest level in twenty years. With the exception of the fully imported micro car and the imported small car, 1991 sales in all other areas of the PMVI suffered a considerable decline (Table 3.7).[5] This aggregate trend initially showed signs that it would continue unabated in 1992. As a probable response to the February reduction of sales tax from 20 per cent to 15 per cent, a seventeen-month high of 50,240 new vehicles was sold in March. However, sales then dropped to 41,172 in April, a 13 percent drop on the previous month and a substantial 6.3 per cent below the level of April 1991. These results fuelled fears that the recession had not bottomed. The trend continued unabated in May. New car registrations fell a further 4.8 per cent on the depressed April figure to a low of 41,63 (VFACTS, 1992). In early June 1992 (before the release of the actual June results), Senator Button observed that the government had expected the sales tax cut to provide a much stronger and more continuous stimulation to the industry. He also noted that both the government and the PMVI had: " not entirely foreseen the inroads into the market by smaller imported cars" (Button, 1992). Nevertheless, the Minister stressed that there would be no change to the speed and pattern of tariff reduction.

The PMV market however remained extremely volatile at this time as demonstrated by the results for June 1992. Sales figures for this month, at 51,575 units, were a very surprising and quite significant 24 per cent improvement on the May outcome (VFACTS: 1992). This result (although unforseen), was the best

[5]The extent of the decline of sales in 1991 was second only to the substantial fall that occurred in 1986. The latter was, as we have seen, a result of the price rises caused by the depreciation of the Australian dollar at that time.

recorded for the previous twenty months. The results for the latter part of 1992 continued the July trend and ensured an encouraging aggregate result for 1992. This was particularly so in the face of the continued recessed Australian economy. In aggregate, total new passenger vehicle sales for the year increased by 3.6 percent. That is, from 391,529 in 1991 to 406,427 in 1992. However, as always, these figures needed to be split between sales of locally produced and imported cars to determine the real consequence of the result. Whilst the overall increase in sales of passenger vehicles of 3.6 percent is in itself an indication of a reasonably strong market recovery for the year, the fact remained that sales of locally produced vehicles fell 8.8 percent from 269,588 units in 1991 to 245,758 in 1992 (AAIA1992: 45).

3.6.1.2 Movements in PMV Stocks: 1988 to1992.

As the Plan neared completion, the stock levels of locally produced PMVs are important for two reasons. In the first instance they provide a strong indication as to the state of the PMV industry in the light of the then current economic environment. Secondly, stock levels provided a broader assessment of the impact of the Plan on aggregate industry performance as they illuminate the increased success of import penetration into the Australian market. Table 3.8 illustrates the movement in stock levels from the mid-point of the Plan to its completion in 1992.

Given that locally produced vehicle stock levels are derived from the difference between local production and sales including exports, the results as per the above table need to be interpreted with some caution. For example, the depressed state of the market over 1991 is actually evidenced by the *downward* movement in locally produced car stocks. That is, Table 3.8 indicates that a comparison of production and sales figures of locally produced vehicles for the year show that stocks decreased by 15,723 units in 1991 and appears to indicate a quite optimistic result. This is in contrast to 1990 where stocks increased by 211 units (reflecting the discounting process involved), after rising by 17,730 units in 1989. On the surface, a decrease in stock level for 1991 may appear to indicate increasing demand. However a closer examination shows that the real reason was the 20 percent fall in production levels for the year. As producers slashed output, much of the very flat demand for the year was met from existing stocks. The 1992 fall in stock levels gave greater reason for optimism. Whilst stock levels fell by an almost identical amount, viz 15,740 units for 1992 compared to the 15,723 units for 1991, production figures fell by a much reduced 3.5 percent for the year. Notwithstanding the demise of Nissan as a manufacturer, this fall in stock levels does indicate a modest demand recovery especially, as noted, in the second half of 1992. However, the figures also must be interpreted in the light of import competition.

3.6.1.3 The Market Share of Imports

The aggregate change in the relative sales performance of imported vehicles over the life of the Plan can be illustrated by reference to Table 3.9. This shows that in the initial period of the Plan (1982-85), the import penetration of CBUs remained fairly constant at between 22 to 24 percent reflecting the quantitative restrictions on imports imposed until 1988. From 1986 until 1988 the market share of imports declined quite sharply, ie 19.2 percent in 1986 to 15.5 percent in 1987 and mirrors the price advantage to the domestic producer that resulted from the 1987 devaluation of the Australian dollar to around 70 cents U.S.[6]. From that time however, the market share of imports dramatically escalated to the point where imports held 40.2 percent of the market by 1992. The increased market share of imports over the latter stages of the Plan reflected two areas of price failure for local industry. The first was the inability to exploit the competitive price advantage generated by the devaluation of the Australian dollar. The second was the incapacity of the local industry to simply remain price competitive with imports over the latter stages of the Plan. In the twelve quarters between 1990 and 1992, there were only three instances where the increase in the recommended retail price for locally produced cars was below that of imports (AAIA 1992:35).[7]

Other factors beyond price considerations then began to determine the degree of import penetration into the Australian market over the period. A major influence, as we have seen, was the abolition of import quotas in 1988. The third consideration was the surging popularity of the fully imported Micro car.[8] The effect of all three forces can be illustrated by a comparison between 1987 (the mid-term review), and the conclusion of the Plan in 1992. In 1987 the influence of the devaluation and the retention of the quota system combined to limit the sale of imported cars to 58,584 or 19.2 percent of the total market. This compared to import sales of 143,889 in 1992 that represents a 41 percent increase in aggregate

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[6] However, with the gradual revaluation of the Australian dollar to a point where it hovered around the 75-76 US cent mark over the period 1988-92, the price advantage was lost.

7It is of interest that in the post-Plan period, the 1992 devaluation of the Australian dollar (especially against the Japanese yen), did give local producers a further opportunity to exploit price differentials and thereby increase market share but again the opportunity was not taken.

ιThe 'Micro' car is a classification for a vehicle smaller than those categorised under the 'Small' car section. It includes models such as the Diahatsu Charade, Suzuki Swift, Ford Festiva, Mazda 121 and the Holden Barina.

sales over the 1987 figure and 40.2 percent of the total market (AAIA 1992:58).

The explanation for increased import penetration into the Australian market is, however, quite complex and moves beyond a failure on the part of the domestic producers or a change in the parameters of import controls. From one perspective increased PMV imports were neither totally unexpected nor unwelcomed as such import success was a logical and predictable response to the impetus of the Plan itself. As we have seen, a principal strategy of the Plan had been to subject the PMVI to increased external competition. Thus, if strong import competition had not eventuated by 1992, it would have signalled a *failure* of the Plan. Further, as the industry was pushed to rationalise their local production they increasingly fleshed out their range with imports. In the most extreme example, in 1992 Nissan moved from being a local producer to solely an importer of vehicles into the Australian market.

On the other hand increased import penetration did reflect the failure of industry policy to consider demand side factors and the failure of the Australian industry to meet changing consumer expectations. In particular, domestic producers did not anticipate changing patterns and trends in demand. The industry and indeed the government had, once again, directed the bulk of their attention to questions and considerations of production and supply and thereby were unable to foresee the very fluid patterns of demand that began to emerge over the latter stages of the Plan. In particular, the change in consumer preference towards the micro car had been entirely unforeseen. This vacuum was readily filled by imports.

Notwithstanding such considerations, the gain in market share for imports needs to be interpreted with some caution. In the first instance, local PMV producers themselves increased their sales of imported vehicles by 20.6 percent over the year 1991-1992 to 32 percent of all PMV sales (AAIA 1992:59). Such importations are part of the aggregate strategy of the company's involved and did not pose a threat to medium to long term local production decisions. An example of such a policy decision was when Ford chose to import the cheaper Festiva in direct competition with its locally produced Laser.

In the second instance, as noted, the growing market share of imports was due to the strong and continued popularity of the micro car. The fastest growth in the market, over the latter period of the Plan, was in the sale of the Diahatsu Charade, Suzuki Swift and Mazda 121 micro-cars, none of which were made in Australia. This type of vehicle increased its sales to 9 percent of total market sales by Plan completion (AAIA 1992: 45). The popularity of the micro car was probably due to the price differential of this sector in comparison to other areas of the market. That is, it was possible to get a new micro car on the road for about \$15000 or less at the end of 1992. This compared most favourably to approximately \$18000 for a small car, \$23,000-25,000 for a medium car and up to \$30,000 for a large car. In a climate of subdued sales, the strong growth in market share of the totally imported micro-car effectively boosted the share of imports to 40 percent by 1992. That level of sales performance did much to produce the aggregate decline in market share of the locally produced vehicle. This can be illustrated by reference to the medium car market. In 1992, imports had 26.1 percent of this market up from 22.0 percent in 1990. However, whilst the sales of imported medium cars remained essentially static, the total sales of locally produced medium cars fell 22 percent between 1990 and 1992 (AAIA 1992:46). This indicates that, at least in part, the imported micro car has replaced some of the market share previously taken by locally produced medium cars.

In the third instance, the increased market share of imports was due to the machinations of the small car market. Whilst imported small cars expanded to the point where their share of the small car market increased to 40.2 percent, up from 32.7 percent in 1991 (AAIA1992: 45) the reason for such sales success is complicated. Some of the expansion was no doubt due to buyer substitution of locally produced cars for imported models. However, some of this increase in demand for imported vehicles is in line with the objectives of the Plan. For example, the closure of the Nissan manufacturing capacity in 1992 and the inevitable phasing-out of the locally produced Pulsar and Pintara/Corsair resulted in a not unexpected leakage to imports. As noted, market decisions, as per the Ford Festiva/Laser, also contributed to the increase in market share for imports in this sector of the market.

3.6.1.4 Local Producer Viability

In an economic climate heavily influenced by economic recession and the increased competition of imports it was impossible for all the manufacturers to survive as, indeed, was the intention of the Plan. By 1992 one of the key Plan objectives was realised with the number of producers reduced to the requisite three. The mechanics of the reduction saw the complete demise of one producer and a merger between two others. Nissan proved to be the most vulnerable. The company had been importing vehicles into Australia since 1965 and had gained permission to manufacture cars in Australia as from 1976. Nissan had consistently been fourth or fifth in market share over much of its production life. By February 1992 it had run up cumulative losses of greater than $500 million. It subsequently ceased to manufacture vehicles in Australia from late 1992, although it remained as a manufacturer and exporter of component parts[9]

The announcement, on March 17,1992, by Toyota and General Motors Holden that they had completed an agreement to merge their passenger car operations under an equally owned joint venture called the United Australian Automotive Group heralded the birth of Australia's largest automotive group. Under the impetus of the Plan, Toyota and GMH were already fully sharing ("rebadging"), their three main passenger models, Lexon/Commodore, Corolla/Nova and Apollo/Camry.[10] This form of cooperation would provide further impetus for full integration as rebadging is, at best, a short-term option to facilitate a reduction in the number of models available to the consumer. The architects of the Plan did see formal integration of the two operations as concrete

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[9] It is with some interest and no little irony that some two years later, the wisdom of the Nissan decision to shut down its production capacity in Australia was being questioned by the then chairman of Nissan Australia, Mr M.A.Nakamura. A disastrous sales performance in June 1994 saw Nissan win just 2.7 percent of the Australian passenger car market. This result left Nissan with just 4.2 percent of the total market against the 5 percent it had planned in its move from 11 percent as a maker to an importer. Mr Nakamura stated that it was too early to determine whether shutting down Nissan's high-technology plant in Clayton, Victoria, had been a mistake. Notwithstanding other factors, the decision to close the plant incurred a debt of A$400 million. (The irony is that at the time of the wrong production decisions that led to Nissan Australia's demise, Mr Makamura was the powerful deputy-general manager of manufacturing for Asia-Oceania with special responsibilities for Australia). The former head of Nissan Australia at the time of the decision to shut the plant, Mr I Deveson, has argued that it was a big mistake to allow Japan to overrule Australia with respect to decisions as to production. Nissan Australia wanted to continue the production of the popular six-cylinder Skyline and did not want to continue with the outdated four-cylinder Pintara. The Japanese head office overruled both scenarios. The decision eventually sealed the fate of the Australian production facility because the appreciation of the yen and the cost of refitting the Clayton plant coincided with a Pintara that was being exported to Japan after it had ended its model life there.

[10] The practice of rebadging a vehicle is an interesting tactic as it is clear the practice does not meet with Australian buyer approval. It may be the same car, but the builder of the car normally outsells the seller of the rebadged version at least 2:1 Nissan Patrol outsold the rebadged Ford Maverick 3:1. However the GMH Commodore outsold the rebadged Toyota Lexen 10:1.(Paxus figures for PMV registrations).

evidence of the success of a critical feature of the plan. Not surprisingly, Senator Button seized upon the merger. He welcomed the move as a "historic decision" and an "important step" in the restructuring of the PMVI as Australia now had a three car manufacturing group which was the number envisaged under the Plan (Smithers 1992). With a more detached view, it is difficult to be certain as to whether the attainment of this objective was due to the impact of the Plan or the fact of the recession and the impact of renewed and uncontested import competition. There is little doubt that local producers had been operating to the long-term timetable of the Plan and therefore had plans for integration well in hand. There is also little doubt that up until early 1992 all existing manufacturers were making loud and strong pronouncements about their long-term commitment to a continued Australian manufacturing presence.[11]

In July 1993 the position of Ford Australia was clouded by the outbreak of what, in the first instance, appeared to be little more than an attempt at political point scoring in an election year. The shadow Australian federal treasurer (Mr. Downer), stated that at a meeting in New York with the head of Ford's international manufacturing operations he had been informed that there was a real chance that Ford was considering closing its Broadmeadows plant. Downer claimed that Ford believed that the Australian market was too small to manufacture cars for that market alone. Moreover Ford would only continue to manufacture in Australia, if Australia could be used as a manufacturing base for markets in Asia. This could only be achieved if Ford Australia was cost efficient. Downer

[11] The union of the two producers was, in fact, quite short-lived as it was dissolved in 1995 due to the sales success of the GMH Holden Commodore. GMH were facing a level of demand beyond their existing capacity for the vehicle and thus were loath to rebadge the car as the Toyota Lexen. In addition, further competitive pressures in other areas of the market such as the small and micro car sector put further strain on the alliance.

asserted that the necessary cost efficiencies were unlikely to be achieved due to poor productivity, restrictive work practices and labour market inflexibility. Of interest is the Downer contention (perhaps because his Party proposed reducing the tariff to zero post 2000), that the program to reduce the car tariff to 15 percent by the year 2000 was not an over-riding consideration for Ford in the context of its long-term viability in Australia. Company spokespersons were quick to deny the Downer assertion. It was noted that Ford Australia had made significant steps to ensure the viability of its Australian production facility. It had reduced its workforce from 14,000 to 7,700 through peaceful negotiations with unions and workers (without an hour being lost in disputes), abolished restrictive work practices, dramatically increased productivity and saw the EB model Falcon become Australia's top-selling car (Colebatch 1993).

Even though the stated intention of the Plan was to reduce the number of manufacturers to three, the long-term commitment of Ford to Australia had not, until that time, been seriously questioned. This is not to suggest that Ford, did not have real concerns as to its future Australian operation. The company had long been voicing concern as to the future conditions of operation for the PMVI in Australia. In particular, Ford questioned the viability of the Australian PMVI once tariffs fell below 25 percent as of January 1, 1997. The company had, therefore, even graver concerns as to the impact of a 15 percent tariff regime as proposed for the year 2000. Not surprisingly therefore, it was both appalled and very publicly critical of the Federal Opposition's proposal for a zero tariff regime post-2000 during the federal election campaign of 1993 (Gratten 1992). In addition, as early as 1992 the future of the much-heralded Ford Capri was in doubt and the forecast for the locally assembled Ford Laser was precarious. Both these vehicles were assembled in Australia from largely imported components. By 1993, tariff cuts had assisted both Japanese and Korean imports to slash Laser sales by 50 percent and also cost Capri sales in Australia. As at July 1993, Capri had sold only 5000 units in Australia. On February 9, 1994 Ford Australia announced the closure of its Homebush plant in Sydney and the end of production of the Laser. The Capri, which was manufactured in Broadmeadows in Victoria, was also to cease production (Colebatch [2] 1993). The final factor in the demise of both the Laser and the Capri was the continued appreciation of the Japanese yen. The Laser and the Capri were based on Mazda componentry and parts had to be imported from Japan. Thus, the appreciation of the yen had led to subsequent substantial increases in costs. However, the position of the Falcon had seemed to assure the future of Ford in Australia. By the conclusion of the Plan the Falcon was the most quintessential of all Australian cars. It was totally designed in Australia, was manufactured with an 85 percent Australian content and had been the top selling car for most of the past decade. If the Falcon were to be replaced by an import it would seem to foretell the death of the Australian PMVI.

3.6.2 Industry Volume Performance By Model and Plant

The number of producers alone is, of course, not the only consideration to be taken into account when considering the objective of production rationalisation. A major objective of the Plan was to increase industry efficiency by the achievement of substantial increases in plant volume as greater production volumes should produce better capacity utilisation and lower unit costs. Increased efficiency is therefore directly related to the number of producers in the market and the number and volume of models produced. The objective, as we have seen, was to reduce the number of producers to three and to ensure a minimum of 30,000 units per vehicle model per annum, or average 30,000 units over a four-year period ending in the year in question. Only if the latter volume were achieved would producers be able to earn their full entitlement to duty-free entry of PMVs and PMV components. In 1991 the five manufacturers produced eight separate car models down from thirteen in 1985. Of these eight, three were by the Holden/Toyota joint venture, two by Ford, and two by Nissan and one by Mitsubishi. Further, of the eight models under production in 1991 four failed to achieve the required volume of 30,000 units and thereby did not qualify the producers to duty-free entry of vehicles or component parts (AAIA 1992:51-52). The first six months of 1992 saw no change from 1991 in terms of models produced. However, the Nissan closure of its manufacturing operations in July and October of 1992 saw two models, the Pintara and the Pulsar, no longer manufactured. Therefore, the number of models produced in Australia at the conclusion of the Plan was six. This is one more than the stated objective which had called for a reduction from thirteen models in 1985 to five models at the beginning of 1993. Table 3.10 shows the volume performance by model line one year after the official conclusion of the Plan [12]

Of the six cars still being produced in Australia at the end of 1992, only the Laser/Capri and Corolla/Nova failed to achieve the critical production level of 30,000 units per year.[13] The remaining four models: the Camry/Apollo; the

[12] Please note that this table is a little confusing as to model numbers. However, the Commodore/Lexen and the Statesman/Caprice were regarded as variations upon the one basic model. Therefore the number of models produced was six.

[13] The Corolla/Nova was the only vehicle that failed to meet the minimum volume requirements in 1993. It was

Magna/Verada; the Commodore/Lexen/Statesman/Caprice; and the Falcon/Fairlane/ LTD achieved volumes in excess of 40,000 with the Commodore and Falcon range recording volumes in excess of 60,000. Average production volume per model improved by 41 percent from 34,700 to 49,000 (AAIA 1994: 47). The success of the Plan in boosting output volume can be seen by Table 3.11 which compares the volume performance by model line over the period 1989 to 1993 with that of 1985.

3.6.2.1 Production Runs per Plant Facility

At the conclusion of the Plan seven car assembly plants were operational in Australia. As the recession bit in 1991, the average plant volume decreased by almost 20 percent from 52,600 units in 1990 to 41,197 in 1991. At first glance the position appeared to worsen in 1992 as average plant volume at the seven plants further declined to 39,675 units. However, if Nissan's production capacity is excluded, average volume performance actually increased by about 4 percent on the 1991 result to 42,834 units in 1992. The 1992 average production run of almost 49,000 units was of course, not achieved in all the six facilities. Output ranged from an extremely low minimum of 16,164 units to a maximum of 77,054 units. (This compared to a minimum of 25,794 units and a maximum of 77,000 units in 1991). As in 1991, only two plants achieved output volumes above the industry average in 1992 (AAIA 1992: 53). However 1993 saw the scenario begin to quickly change. The closure of the Nissan facility saw the number of assembly plants reduced to six. The average plant volume increased to 49,012, which represented a 23.5 percent increase on 1992 (AAIA 1993: 47). In September 1994

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however, granted an exemption from the volume requirements in 1993. The Laser/Capri satisfied the four-year test.

Ford closed its Homebush (NSW) plant which produced the Laser and in early 1995 Toyota completed the transfer of its Corolla and Camry production facilities from two Victorian plants in Dandenong and Port Melbourne respectively, to a single new production facility at Altona (Victoria). As a result the number of assembly plants fell to four. As total production in 1995 exceeded 300,000 (VFACTS, 1995), average plant volume increased to more than 75,000, which represented an increase of over 50 percent on the 1993 level. This generated a significant boost to efficiency and was seen as a firm indication of Plan success.

Irrespective of this commendable result, the challenge remained to achieve a production run level capable of securing the necessary economies of scale to make the local industry truly internationally competitive. The IC Report (1990) highlighted the importance of scale economies to the efficient production of motor vehicles. The Report expressed the relationship between costs and scale in terms of a 'minimum efficient scale' (MES). The MES represents the scale at which virtually all the available scale economies are exhausted. That scale is generally held to be between 200,000 and 250,000 units, although there is a suggestion that the scale may decrease, over the 1990s, to around 150,000 units with technological and product mix (more upmarket), improvement. (The IC noted that, internationally, new plants were not commissioned for operation at less than 200,000 vehicles per annum). By the conclusion of the Plan no Australian plant had achieved more than about 51 percent of even this much reduced MES with the average levels of output at about 29 percent of that MES.

The cost penalties of a failure to achieve scale economies in the production of motor vehicles are significant but difficult to quantify. In addition, there is general agreement that the cost penalties associated with low volume production were lower in this industry than in other manufacturing operations. This is due to the fact that the cost of assembly only accounted for about 20 percent of the total vehicle cost. Materials and components account for the remaining 80 percent. Therefore the drive for economies of scale needs to extend beyond considerations of total CBU production runs into that of component parts. It is clear that substantial gains could be made if scale economies could be realised in the manufacturing of components given the high proportion of component costs in the unit price of car manufacture. Citing a 1988 study undertaken by the Bureau of Industry Economics, the IC (1990: 42) noted:

> Data on scale economies prevailing in Australia in the mid 1980s in the production of engines, body panels and plastic components suggest that a doubling of output of engines for medium size cars could reduce unit costs by 11 percent and, for larger cars, by 12.5 percent. For a 'representative' plastic component, a doubling of output would reduce unit costs by 5.5 percent for small cars, 8 percent for medium cars and 12.5 percent for large cars. In the case of body panels, a doubling of output would provide a unit cost reduction of 20 percent for small cars, 21 percent for medium cars and 8 percent for large cars.

In the same Report, the IC acknowledged that there was a potential to reduce the negative impact of low volume production runs through what it termed 'flexible manufacturing' (such as the abolition of penalty wage rates). Nevertheless, it still held the view that the low volume of production in Australian plants was a major factor contributing to the high costs of the domestic industry.

Notwithstanding such concerns as to component parts, it is fair to suggest that the Plan did, did at the very least, provide an environment that made significant increases in the volume of CBU production per plant possible. However, there were still strong external realities to take into consideration when determining the success or failure of the Plan in this regard. Despite the quite drastic model rationalisation arising from the Plan, Australian production volumes per plant were still much below Japanese, European and US levels, at the conclusion of the Plan in 1992. Even if there were further significant improvement in production runs to a level of 80,000 CBUs per unit (which is a level considered possible by the AAIA (AAIA 1994: 48), output levels would remain at approximately 65 percent of Japanese volumes and 40 percent of European and American volumes (AAIA 1994: 48). The local industry would still struggle under the cost disadvantage imposed by low volume output per plant.

3.6.2.2 Aggregate Volume and the International Arena

Even if the problem of low production runs per plant is put aside, the local industry still needed to face other salient international realities when considering current and future scenarios pertaining to the volume performance of the Australian PMVI. The simple reality was (and is), that Australia would continue to remain an extremely small player in the international automotive industry. For example, world car production in 1991 (excluding utilities and panel vans), totalled 35.6 million units of which Australia produced less than 1 percent (AAIA 1992: 53). When attempting to determine the implication of these figures it is worth noting that, over the period 1985 to 1992, total world industry capacity increased by over 10 percent whereas demand increased by only about 4 percent. In 1991, Japan (perhaps ominously for the longer-term viability of the Australian PMVI), produced 27.5 percent of total world production with 9.5 million units. The disquieting aspect of this result is that over 50 percent of Japanese output was exported (AAIA 1992: 54). This had, and has, major implications for the Australian industry in terms of both the internal market and future export considerations. Japan was both the largest source of imported cars into Australia and an established, vigorous and ruthless competitor for external markets.

The Republic of Korea, the second largest source of imported cars into Australia, had increased its output capacity from 158,000 units in 1984 to 1.2 million units in 1991 to capture 3.3 percent of the world output. This represents about a 760 percent increase in production over the period (AAIA 1992: 54). As with Japan, Korea exported over 50 percent of output and saw Australia as an emerging and valuable market. In the USA, Europe and many newly emerging industrialised countries such as Brazil, Taiwan, Malaysia and Mexico, the picture was the same. Output had increased and the drive to find export markets had accelerated. The failure of world demand to match increased world capacity to produce means small producers such as Australia, will face increasing domestic pressure from imports and greatly escalated competitive pressure to secure export markets.

3.6.3 Export Promotion

Of all objectives of the Plan, it was export encouragement and promotion that looked set to produce, at least initially, successful results. Increasing PMV exports provided the PMVI with an opportunity to secure the production and sales volume so critical to the attainment of the Plan's basic objectives. Indeed, without such export success the other tenets of the Plan would have been virtually unattainable. This export success did appear to be significant as the Plan drew to a close. For example, exports of CBU passenger motor vehicles increased from 22,478 units in 1990 to 27,604 in 1991. Table 3.12 shows the accomplishments achieved in this area by the end of 1991. This was mainly due to the fact that 1991 was the first full year of export of the Ford Capri to the United States. However, the trend continued into 1992 when Mitsubishi exported 6000 Magna station wagons to the US in February (Thomas 1992: 5). Indeed, exports of vehicles and component parts increased 14.2 percent over the year to $1,157 million (AAIA 1992: 55). These result further built on the sustained export growth achieved since the inception of the Plan. Continued export success was claimed by Plan advocates to be a direct result of the fact that car manufacturers have focused on the rewards available under the Plan's Export Facilitation Scheme. This scheme, as noted, gave export credits to producers achieving external sales of high value-added Australian automotive goods and allowed then to import niche market cars or parts into Australia duty free.

In April 1992, The Federal Chamber of Automotive Industries released figures for the 1991 calendar year that trumpeted the fact that Australian motor-industry's overseas sales accelerated to the record $A1.57 billion noted. The

Chamber stressed that this was up from $A383.4 million in 1984 and represents a massive 201.9 per cent increase over the life of the Plan. The Chamber also asserted (rather too optimistically as things panned out), that there were good indications that the trend would continue. It noted that Australia still accounted for less than 1 percent of the world automotive trade and that Asia's car market was growing at 2.2 per cent per annum. Both factors were seen as affording Australia strong additional export opportunities (McKenzie 1992). On the other hand, as noted, an expanding market such as Asia was (and will be), of continued interest to Australia's very large export competitors. These very much bigger and stronger exporters are seeking to secure additional export opportunities as their capacity to produce expands with the 'tiger' economies of Asia of obvious interest.

Nevertheless, as the Plan drew to a close, the PMVI had much to be pleased with in terms of its export orientation. Quality improvements, price factors and niche marketing had seen the industry breaking new ground in CBU markets such as the United States that had long been considered closed to Australian producers. By the conclusion of the Plan, there did appear to be strong evidence that, despite the recession, the PMVI had developed a clear export orientation. Some industry spokespersons argued that the PMVI has responded positively and with great success to those provisions of the Plan that were designed to facilitate and promote export potential. Mr Ian Grigg (1991:30-31), chief executive of the Federal Chamber of Automotive Industries noted "what we are seeing now is the pay-off from the Button plan. We have managed to convince our industry to be export aware".

However, by mid 1993 there were signs that such initial optimism with respect to the impact of the Plan on exports may have been premature. An analysis of the export performance and stated export intentions of each of the Australian manufacturers operating in the period following the conclusion of the Plan attested to this conclusion.

3.6.3.1 Ford Australia

The much heralded export success of the Ford Capri proved to be only very short-term in nature. By as early as June 1993 (only a little over two years from its initial export successes), Ford Australia suggested that the long-term future of the car was in doubt due to cost of re-engineering the car to meet US safety standards that would come into vogue in 1995. As if to temper this bad news, Ford Australia declared that it still saw a robust future for the export of Australian component parts rather than niche products like the Capri (Colebatch, 1993). These considerations cast doubt on one of the much-trumpeted successes of the Plan, as its supporters had embraced the increased export of CBUs (not just components), as a clear vindication of its main tenets. However, despite the reservations of Ford, the export projections of other Australian-based manufacturers meant that the picture with respect to the future export potential of CBU's around the time of a the conclusion of the Plan, were far from clear.

3.6.3.2 Toyota Australia

For example, as at mid-1992, Toyota Australia had a medium term export plan that would see the export of 6000 Camrys per year to Thailand (worth $50 million over 1993-94 and $160 million by 1998). This was to be only the first step in an export program that would underpin the new plant being developed at

Altona. The wider scenario planned for the export of 30,000 Camrys a year by the year 2000 (Australia's largest export intention of CBU's), and the linkage of the Altona plant into Toyota's world manufacturing program. Toyota Australia claimed that its future export program would generate $600 million per annum in export earnings by 2000. In addition, it declared that it had firm contracts to send 6000 Camry engines a year in components to South Africa and 2000 complete cars, per year, to New Zealand (Lynch 1992). The optimism of 1992 seemed vindicated when, in October 1994, Toyota Headquarters in Japan nominated its Australian division to export more than 25,000 Camrys a year from its Altona plant. The objective would be to supply Saudi Arabia and the Gulf States from 1996. This contract was estimated to be worth $500 million per year and would be, by a large margin, the biggest export deal ever negotiated for an Australian produced vehicle. The contract would almost double car exports out of Victoria and increase Australian car exports by one third from their then $1.5 billion (de Fraga 1993). If proven to be correct the deal would provide a startling vindication of the Plan. A key element of Plan strategy had been to encourage exports by allowing manufacturers to import $1 of automotive goods free for every $1 of goods exported and thereby encourage transnational manufacturers to integrate their local plants with world markets. This would lead to higher volume production of fewer cars in Australia. This objective would most certainly be achieved under Toyota's proposals for its Altona plant. The plant has a capacity of 100,000 cars per year, but even with both the Corolla and the Camry being produced there the Australian market would only be expected to absorb about 70,000 units. The Middle East contract, in association with existing export markets in Thailand, New Zealand, and other countries in South-East Asia and the Pacific (about 5,000 units per year), would allow the plant to run at full capacity and significantly reduce the cost of producing each car.

3.6.3.3 Mitsubishi Australia

Some twelve months after the conclusion of the Plan, Mitsubishi Australia signed contracts that saw the Magna wagon exported to a total of eleven nations that included the United States, Germany, Great Britain and Japan. In January 1995 the Japanese head office announced that Australia was to become a global supplier for Magna sedans as well as wagons. However, while this was a most welcome development the principal explanation for the decision lay more in the vagaries of the international foreign exchange market than as a direct consequence of the impetus of the Plan. It was clear that by 1995 the rising value of the Japanese yen had finally overcome the ingenuity of Japanese car manufacturers. By that time approximately 25 percent of the output of Japanese vehicle manufacturers was produced outside of Japan. The fate of Mitsubishi's Adelaide plant was a clear illustration of this trend. The Adelaide plant had, since 1993, been producing Magna *wagons* for export to the US, Europe and Japan, whilst the accompanying *sedans* were made in Japan. Although export sales for both vehicles were strong in 1993, they crashed in 1994 due to the rising value of the yen which made both the sedan and the wagon (which was dependant to a large degree on costly Japanese parts), uncompetitive. Thus, the decision was taken to produce the next model Magna sedans as well as the wagons in Australia. In addition, Mitsubishi scrapped the four-cylinder engines it imported from Japan and started producing a six-cylinder, three-litre engine in Australia. These outcomes were a vindication of the Plan but were hardly due to the impact of the Plan itself.

3.6.3.4 General Motors Holden

The transient nature of the Australian PMV industry was well demonstrated when, in August 1993, confidence within the sector was dramatically boosted by speculation that the giant GM Corporation was about to launch the Australian produced Commodore on the international market and that the Australian-made V6 engine was to be used in any export-model Commodore. If exported, production of the Commodore could be expected to increase by about 33 percent to approximately 100,000 units per year. At 1993 prices, the export of 30,000 Commodores would have been worth about $600 million annually. This figure would have eclipsed, at that time, the export efforts of both Ford and Toyota (McKenzie, 1993). Eighteen months later these hopes were dashed when General Motors rejected the plans of its Australian subsidiary to export the next generation Commodore to the US. Without access to the giant US market there was little real chance that the Commodore would achieve international status and emerge as a major boost to the export market for Australian-produced vehicles.

3.6.3.5 General Conclusions as to the Impact of the Plan and Exports of PMVs.

A few years down the track from the conclusion of the Plan, the position of the industry with respect to the export sector remained both volatile and obscure. Pushing, prodding, enticing and threatening, the Plan had overseen a dramatic internationalisation of the industry. From $463 million in 1986, export earning exceeded the $1 billion level by 1990 and peaked in 1991 at 27,906 vehicles when the Ford Capri was selling at its prime. Aggregate export sales totalled an impressive $1.5 billion in 1991 (AAIA 1991: 53).

However by 1994, the failure of the Capri and the slump in the fortunes of Australia's other major PMV export, the Mitsubishi Magna station wagon, saw a marked slow down, if not reversal, of this trend. In addition, exports still lag far behind imports. For example, over the year June 1993 to June 1994 Australia earned about $1 billion on vehicle exports but spent about $7 billion on vehicle imports (AAIA 1994: 35). In spite of the encouraging export intentions of Toyota, the demise of the Magna, the failure of the Capri and the rejection of the Commodore in terms of the US market, all raised questions as to Australia's future as a car exporter. In a world with both a massive global glut of vehicle-making capacity and more countries such as Malaysia and Spain emerging as exporters, the PMV export market was, in the mid-1990s, as one of the most competitive and volatile in the world. However Australia did have two things in its favour. It was both a relatively low-cost producer by Western standards and the quality and efficiency of production of the local product had improved dramatically. Coupled with the Plans provisions which enable producers $1 of duty-free imports for every $1 of value-added exports, the future of the industry did appear to be relatively secure in the immediate post Plan period. Nevertheless, the continued uncertainty that surrounded the export future of the Australian PMVI was (and remains as), further proof of the fact that, to a large extent, the industry is beyond the direct control and influence of Australian decision-makers. Given its size and its impact on the world market, the future of the Australian PMVI was, and is at the discretion of foreign transnationals which, of course, follow their own agendas for the future. The success or failure of the Australian PMV export sector will ultimately be determined by the aggregate world strategy of such companies.

Indeed it may be argued in terms of exports and export potential that, at best, the Plan precipitate the development of a manufacturing environment that may enable the Australian produced vehicle to claim a role in the future manufacturing and distribution plans of international producers.

3.6.4 Prices

The impact of the Plan on the pricing structure of the industry was somewhat equivocal. On the one hand, it appears to have failed to deliver in the area of real price reductions. Over the duration of the Plan, the prices of locally produced and imported vehicles increased by 82 percent and 96 percent respectively, whilst over the same period the Consumer Price Index recorded an increase of 60 percent (AAIA 1993: 25). As noted, much of the increase in imported vehicle prices was due to the very sharp devaluation of the Australian dollar (especially against the Japanese yen), over the period 1985-86. The failure of Australian producers to initiate price competition as a result of the competitive advantage afforded by the devaluation has also been noted. On the other hand, since the relative stabilisation of the Australian dollar from 1987, the Plan appeared to deliver in the key area of price moderation. There was an almost constant reduction in the rate of price increase for locally produced cars since that time. As can be seen from Table 3.13 recommended retail prices of locally produced cars increased by 11.7 percent in 1987, 5.9 percent in 1988, 6.0 percent in 1989, 5.2 percent in 1990, 4.5 percent in 1991, and 1.9 percent in 1992. These results were to a large extent the result of two key Plan initiatives, the abolition of import quotas and the cut in tariff protection from 57.5 percent to 45 percent in 1988.

In point of fact, the results achieved in the area would have been even more impressive but for the very poor outcome in 1991 which altered the complexion of the aggregate price performance of the industry under the Plan. For the first time since 1987, the recommended retail prices of locally produced cars rose faster than the aggregate CPI. In addition, the rate of price increase in 1991 ensured that the total price increase of locally produced cars (35.3 per cent), exceeded the total increase in the general level of prices (30.8 per cent as measured by the CPI), for the period 1987 to 1992. Concern as to price level movements was not, however, limited to 1991.

Price level movements over 1992 underlined a serious problem within the Australian PMVI. The last year of the Plan saw sales tax reduced from 20 percent to 15 percent on Australian produced PMVs. If fully implemented this reduction could have resulted in falls in the recommended retail price of approximately $620 for a small car, $750 for a medium car and $800 for a large car. However, it would appear that the Australian industry was not interested in using price differentials as a means of securing increased market share for the local product. That is, if adjustments are made for the impact of the February 1992 sales tax reduction, the average price for locally produced vehicles increased at 5.3 percent with imported cars averaging 5.8 percent over the same period. This compares with a CPI increase of 0.3 percent over the same period. There was little doubt that the cut in sales tax in February 1992 did provide a real opportunity for the industry to both increase sales and to cut real prices. To the chagrin of those responsible for the development and the overseeing of the Plan, this opportunity was lost "the tax break has been more than eaten up by subsequent price rises"

(Wynn-Hughes, 1993:4).

However, there is a further factor to take into consideration when an evaluation is made of the price performance of local producers over the life of the Plan. That is the dependency of the local industry on imported components. Imported componetry and equipment is estimated to account for between 20 percent to 25 percent of a finished vehicle's cost (McKenzie[2] 1993). Therefore, the ability of the local producer to control and contain costs was, as with many aspects of the industry, to a large extent dependent on factors outside their direct control. Hence, their capacity to control and contain price was similarly constrained. This factor may then, at least in part, explain why over the year to March 1993, local car makers followed the lead of importers who increased prices over the period as a consequence of the almost 25 percent devaluation of the Australian dollar against the Japanese yen. (Importers increased their recommended retail price by 11.3 percent over 1993 whilst the price of locally produced vehicles increased 8.6 percent over the same period)[14].

However, even when discounting and changes to vehicle specifications were taken into consideration vehicle prices rose, on average, 3.3 percent over the period (McKenzie [3] 1993). This was almost three times the rate of inflation. Such trends posed significant problems for the attainment of lower real prices for consumers and thereby jeopardised a major objective of the Plan.

This objective was put under further pressure in 1993 when car prices

[14] An interesting feature of the pricing structure of the industry is examined by Menon (1992) who measures the amount of exchange rate pass-through for imported PMVs into Australia over the period 1981- 1990. Exchange rate pass- through measures the degree to which exchange rate changes are reflected in the domestic currency prices of traded goods. Menon reports a pass-through of 80 percent in the long run and 70 percent in the short run with symmetry in the pass-through of changes in exchange rate and foreign cost. He suggested the effects of quantitative restrictions and the pricing practices of foreign transnational producers may explain the incomplete pass-through finding.

continued to increase more rapidly than general inflation and earnings growth. Further, local producers continued to fail to take market share advantage of the currency-induced increase in imported vehicle prices and, indeed, the recommended retail prices of locally produced vehicles actually exceeded that of imports for nine of the twelve quarters between 1990 and 1992 (AAIA 1992: 32). These factors point to a failure of the Plan to force local producers to become price competitive and would suggest that the Plan has failed in its aggregate pricing objective.

The performance of relative prices under the Plan is, however, further clouded by the additional fact that the 'affordability' of locally produced vehicles remained relatively constant over the last five years to 1992. That is, by and large, the price of locally produced vehicles had risen in line with average weekly earnings over the period. In 1992, as in 1987, some 40 weeks of full-time work was needed to purchase a typical Australian six-cylinder vehicle and just less than 30 weeks to purchase a small, manual, Australian car (AAIA 1992 :34). The period 1987 to 1992 (not 1985 to 1992), is the relevant interval for consideration of this indicator. That is, while 'affordability' for Australian produced cars was less than it was at the commencement of the Plan in 1985, all local cars that were produced in 1992 were introduced from 1987. All these vehicles offered quite superior levels of performance, quality and safety as compared to the cars they replaced. Further, with the exception of the small cars in the US market, the pre-tax prices charged by local producers were not as far out of alignment with world prices as is often asserted (AAIA 1992 :34).

3.6.5 Efficiency Gains: Productivity

As noted many times the rationale of the Plan was a simple one. That is, to force the Australian PMVI to become both import and export competitive by becoming more efficient via improved productivity. Productivity is a difficult concept to define. At best, productivity estimates do little more than indicate the size of any variation in efficiency. However, the aggregate impact of the Plan on productivity rates can be well illustrated by reference to the results of an international study of productivity rates (the International Motor Vehicle Program [IMVP]), of the PMV assembly sector of a number of world producers in 1988 and 1993.[15] These surveys showed that, as at late 1988 and early 1989, the average time taken to assemble a standardised car in Australian plants was over 40 hours. This compared to only 17 hours for Japanese plants, with smaller but still significant gaps between Australian plants and those operating in North America and Europe (AAIA 1992:35). Whilst exposing the productivity gap facing the Australian producers, the IMVP also identified the strategies that would raise their productivity. The most significant of which was the development and application of "lean manufacturing". (The objective of lean manufacturing is to eliminate waste so as to make more efficient use of all human and material resources through a process of continuous improvement. Lean manufacturing also uniquely institutionalises methods of eliminating waste within the production system). It can be contended that the Plan did provide part of the necessary impetus for local manufacturers to embrace this concept. Therefore, the degree to which the PMVI developed and applied lean manufacturing is, in itself, an indication of the impact of the Plan.

3.6.5.1 Lean Manufacturing

The implementation of lean manufacturing requires major changes in the way that companies operate. This is especially pertinent in the relationship established between management and the workforce. The traditional dichotomy between these two sectors of a company, which has frequently manifested itself into an often hostile "them" and "us" scenario, is completely rejected under lean manufacturing. In its place is envisaged an approach that entails sharing both the task of achieving company goals and the benefits which resulted from the achievement of the goals. Over the life of the Plan, the progress of the PMVI in this area can be ascertained by reference to the four key areas of:

- motivation.
- the development of targets.
- the use of a "pull" system of production and
- improved work systems.

3.6.5.2 Motivating Employees

In order to implement lean manufacturing it is essential that the goals and objectives of the organisation are communicated to, understood by, and shared by all employees. It was apparent that by the conclusion of the Plan the Australian PMVI have taken much of this strategy to heart. In particular, companies have strongly embraced the need for employee training to facilitate staff development in a manner consistent with the achievement of organisational goals. For example, by the end of 1992, companies were providing in excess of 200 hours training to their newly hired employees, compared to 96 hours in 1991 and only 49 in 1988 (AAIA 1992: 35). The companies also indicated a commitment to increased

[15] The AAIA first became formally involved in the study in 1988.

motivation via improvements to the physical workplace, policies to better enhance security of employment and strategies to enable the sharing of benefits achieved from improvements in performance.

3.6.5.3 Development of Targets

Once employee motivation has been enhanced it is necessary to have specific targets in place so that an objective measure of progress is available to all. Changes to the Australian industrial relations system, via the October 1991 national wage case, facilitated the introduction of enterprise bargaining. These enabled organisations to develop enterprise agreements where wage increases could be based on the implementation of efficiency measures. These agreements, in turn, resulted in quite substantial productivity gains across the industry. In this sense the enterprise bargaining process complimented the introduction of lean manufacturing. By the end of the Plan in 1992, all PMV producers and a majority of specialist component manufacturers had enterprise agreements with their employees. In some instances wage increases were directly linked to measured improvements in productivity. However, in the majority of agreements, wage increases were based on the acceptance and implementation of less direct measures aimed at the achievement of productivity improvement.

3.6.5.4 The "Pull" System of Manufacturing

A "pull" system of production provides the framework within which lean manufacturers must operate. The "pull" system helps to eliminate waste because products are only produced when, and as, they are required. In a true lean manufacturing environment the "pull" system should operate between production processes within the organisation and between the organisation and its suppliers

(Shingo, 1988; Lubben, 1988, and Mondon, 1992). The benefit of a well implemented "pull" production system is a significant reduction in inventories which in turn leads to a reduction in the cost of working capital and an increase in factory floor space. More floor space provides the opportunity to improve plant layout. Smaller inventories enable early identification of defective products and enables effective countermeasures to be put in place. In the last year of the Plan, there was a substantial reduction of inventory as one of the first benefits of the introduction of lean manufacturing (AAIA 1992: 36).

3.6.5.5 Improved Work Systems and Factory Organisation

A motivated, cooperative workforce operating under a "pull" system of production will not in itself eliminate all waste.[16] A workforce that seeks improvement in all activities integrated into the production process and a factory that is efficient and open to visual control is also required. The latter two objectives can be facilitated under a system of self-management teams. These teams are empowered to design standardised procedures, manage the flow of work, parts and materials so as to eliminate waste, undertake simple maintenance, control quality inspection, job rotate, and undergo training to upgrade skills in all facets of their work area. Such an approach increases flexibility and productivity across the whole team. Other activities aim to improve work processes by revising the work methods employed in order to better re-organise and redistribute work and, where necessary, change plant layouts in order to eliminate waste. Empowering employees to use their own ideas to improve production flow often achieves substantial gains in productivity. Improved visual controls can also be important.

By the conclusion of the Plan, the majority of companies within both the PMV producer sector and the component sector did appear genuinely committed to the introduction of lean manufacturing (AAIA 1992:38). The experience of Ford is a salient case in point of this commitment and the resultant productivity gains generated. At the launch of the new model Falcon in August 1993, Ford announced that in the past two years it had lifted its manufacturing efficiency for the vehicle by a quite astonishing 35 percent. That is, at its plant in Broadmeadows, Victoria, it had decreased from 40 to 25 the hours required to manufacture a Falcon and reduced the break-even volume by 51 percent. At the same time its plant workforce had decreased by 49 percent. At an investment cost of $176 million over 1990 to 1993, the Broadmeadows plant was then only about 10 to 15 percent behind Ford's most efficient plant worldwide located in Atlanta, Georgia in the US. (McKenzie[4], 1993).

Table 3.14. gives more general indication of the impact of efficiency and productivity gains within the industry, especially following the mid-term review of the Plan. It shows that the number of labour hours required to carry out a standardised set of assembly operations on a standard size car had fallen by almost 15 percent over the period 1988-1993.[17]

3.7 The Post-1992 PMV Plan

The post-1992 scheme for the industry operated until the year 2000 and was put in place to continue the reform and rationalisation process initiated by the Plan. In many respects it was a progression of the Plan itself. As such the opportunity to instigate a major change in strategic thinking was again ignored.

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[16]Waste is anything that increases the cost of production without adding value to production.

[17] Under IMVP methodology, the standard assembly operations involve the welding together of steel panels to

The chief provisions of the post Plan policy continued to be directed at production and supply criteria with, as per past policy initiatives, demand factors and consumer welfare considerations ignored. The AAIA Report (1993: 1) detail the provisions of the post Pan strategy as:

- the continued progressive reduction in tariff protection afforded to CBU production. As per the 'Button' plan, tariff protection will be reduced from the 1993 level of 32.5 percent at an annual rate of 2.5 percent. This will culminate in a 15 percent level of tariff protection in the year 2000.
- the retention of the main elements of the export facilitation scheme apropos of the 'Button' plan with one quite important exception. Export credits are now only available on the 'value added' component of exports. This is to encourage the export of more elaborately transformed manufactured goods.
- the retention of the main elements of the local content provisions of the 'Button' plan. That is, an automatic duty-free entitlement for the attainment of 85 percent local content. This enables producers of CBU's to import components and\or vehicles duty free. However, as with the export facilitation scheme, the post 1992 arrangements for local content do have one difference to those of the previous plan. The 'Button' plan had enabled duty-free importation of component parts, beyond the requirements of the 85 percent local content, in return for the export of vehicles. However, there was a 20 percent ceiling

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form the shell, the painting of the shell and the assembly of all components into the shell to finish the car imposed. That is, producers could import such components duty-free but to a maximum level of 20 percent of the value of their automotive exports. This ceiling has been abolished and replaced with a provision whereby such credits could be earned on a dollar-for-dollar basis.

- the modification of the minimum volume provisions of the 'Button' plan. Under the local content requirements of that Plan, some exceptions to the provision of a minimum 30,000 production run in order to qualify for the 15 percent duty-free importation of component parts, (phasing down to zero for a production run less than 20.000) were possible. These exceptions no longer operate.

3.8 Conclusions as to the Impact of the Plan

Any attempt to realistically evaluate the consequence of the Plan needs to reconcile its stated objectives with the outcomes achieved. The core requirement was to both reduce the number of producers and the number of models produced. Judged on those criteria alone the Plan was modestly successful. Over a ten-year period from just prior to the inception of the Plan until some two years after it concluded (as at February 11, 1994), the number of producers in the PMVI has been reduced from five to four. Those left were Ford, Mitsubishi, GMH and Toyota (with the latter two briefly merging their productive activities before again separating into independent production entities). The number of models produced reduced to five with nine cars having ceased production in Australia. Tables 3.15 and 3.16 show the number of models that had ceased production over the decade to 1994 and the five models still in production as at February 1994.

Ultimately it is envisaged that the Australian PMVI will eventually produce five models in four major plants in two states with significantly increased and growing export volumes as compared to the pre-Plan era. If so achieved, the Plan will have been a qualified success. It has brought about a paradigm shift in the structure, conduct and performance of the industry. It drove forth improvements in productivity, pushed the industry to lift its quality to world standards and to grasp the concept of global integration. It was not as successful in the area of price and import penetration but may well improve in these areas as Australian manufacturers are forced to build better cars at relative value to meet the challenge of imports and to consolidate and expand exports.

However, whilst the Plan has led to reasonably impressive results across a fairly narrow range of criteria, it is of interest that the vast majority of critics and commentators have assessed the impact of the Plan from very narrow dimension. In almost all instances the Plan is evaluated and rated in terms of its success or failure from the perspective of production, output and supply-side considerations. Although a major objective of the Plan was the need to attain lower real prices for Australian consumers, this objective was not met notwithstanding the maintenance of "affordability" over the last five years of the Plan. Yet in an assessment of the Plan, reference is rarely made to this factor and to the whole question of consumer welfare and demand side considerations. We suggest that this is a direct result of the fact that, from the inception of the industry, such deliberations ran a very poor second to the interests, welfare and protection of production and supply-side considerations in the framing of industry policy. Further, we contend that this failure to consider the demand-side factors as a key component of industry policy meant that the sector was ill-equipped to respond to volatile and fluid consumer preferences and demand. It is our contention that in order for the Australian PMVI to have any real chance to succeed in the extremely competitive world of the global motor vehicle industry, it is imperative to understand and respond to the pressures of a consumer demand and the need to enhance consumer welfare. The first and most basis requirement to achieve these objectives is to determine a sound theoretical and empirical base to model the demand for PMVs. It is to this area that we therefore turn our attention.

Table 3.1: Australian Volume Performance by Passenger Motor Vehicle Line: 1988.

Sales Volume	Model Lines	Plan Producer
0-14,999	Camira*	GMH
	Colt	Mitsubishi
15,000-29,999	Corolla	AMI/Toyota
	Laser	Ford
	Pintara/Skyline	Nissan
	Pulsar/Astra	Nissan/GMH
30,000-39,999	Camry	AMI/Toyota
40,000+	Commodore	GMH
	Falcon/Fairlane	Ford
	Magna	Mitsubishi

Notes: * Production of this model was discontinued in 1988.

Sources: Paxus Australia Pty Ltd: *Bulletin-New Motor Vehicle Registrations,* Various Issues-1988.
AAIA *Report on The State of the Automotive Industry, (1988), p.53.*

Table 3.2 Tariff Percentage Rates for PMVs 1985 to 2000

1985	1986	1987	1988	1989	1990	1991	1992
57.5	57.5	57.5	45	42.5	40	37.5	35
1993	1994	1995	1996	1997	1998	1999	2000
32.5	30	27.5	25	22.5	20	17.5	15

Source: AAIA, *State of the Automotive Industry Report (1994), p.30.*

Table 3.3: Value of the Australian Dollar Relative to Various Currencies, 1985 to 1988 (Units of Foreign Currency Per $A): Average Exchange Rates.

Currency	Quarter	1985	1986	1987	1988	Currency	Quarter	1985	1986	1987	1988
Yen	1	191.2	130.5	101.4	92.0	Won	1	633.9	583.7	567.6	553.2
	2	164.9	119.8	100.3	97.7		2	572.8	590.3	582.9	571.4
	3	164.5	95.5	103.4	105.2		3	621.1	540.4	569.0	577.2
	4	140.9	102.3	95.1	104.1		4	564.1	556.0	560.1	572.3
Mark	1	2.414	1.629	1.219	1.204	US$	1	0.747	0.697	0.666	0.720
	2	2.028	1.582	1.271	1.329		2	0.661	0.709	0.709	0.778
	3	1.964	1.279	1.293	1.469		3	0.695	0.616	0.709	0.799
	4	1.765	1.278	1.196	1.472		4	0.683	0.644	0.703	0.839

Source: AAIA, *State of the Automotive Industry Report (1988), p.81.*

Table 3.4: Market Share of Locally Produced and Imported Passenger Motor Vehicles by Vehicle Size, 1983 to 1988.

Vehicle Size		1983 (%)	1984 (%)	1985 (%)	1986 (%)	1987 (%)	1988 (%)
SMALL	Local	22.5	21.6	20.5	21.9	19.8	20.3
	Imported	7.5	5.2	9.7	8.8	6.4	6.4
MEDIUM	Local	29.6	27.3	25.4	24.0	24.7	33.1
	Imported	5.7	6.6	5.7	3.0	2.8	5.1
LARGE	Local	24.1	28.1	28.0	32.0	37.0	33.1
	Imported	0.0	0.0	0.0	0.0	0.0	0.0
LUXURY	Local	3.7	3.3	2.9	2.8	2.9	3.3
	Imported	6.8	7.9	7.8	7.5	6.4	7.8

Notes: The classification of vehicle size used by the Authority is similar to the 1986 IDAPS, now PAXUS, grouping of vehicles. The concordance between the two classifications is given as follows. AIA: small, medium, large, and luxury; Paxus Bulletin: small and lower medium, medium, upper medium, and medium and upper luxury.
Source: AAIA, *State of the Automotive Industry Report (1988), p.79.*

Table 3.5: Annual Rate of Growth in Prices of Passenger Motor Vehicles by Market Segment, 1985 to 1988.

Class of Car		1985 (%)	1986 (%)	1987 (%)	1988 (%)	1985 to 1988: Total Growth (%)	1985 to 1988 Annual Average Growth (%)
Locally Produced	Small	12.9	25.1	11.2	6.2	66.8	13.6
	Medium	10.4	20.6	10.7	5.7	55.8	11.7
	Large	9.1	17.9	11.0	8.0	54.2	11.4
	Total	10.3	20.5	11.2	6.4	57.2	12.0
Imported	Small	21.5	26.1	11.3	8.2	84.5	16.5
	Medium	19.7	34.1	15.9	7.2	99.4	18.8
	Large	13.8	26.3	12.9	5.8	71.7	14.5
	Total	17.3	27.0	13.8	7.1	86.6	16.1

Source: AAIA *State of the Automotive Industry Report* (1988), p.28.

Table 3.6: New Vehicle Sales Volume, 1990-1992

PMVs	1990	1991	1992
	464,630	391,529	406,427

Source: AAIA *State of the Automotive Industry Report (1993), P.38*

Table 3.7: Passenger Motor Vehicle Sales by Market Sector, 1990 -1992

SECTOR	MODEL LINES	1990 SHARE		1991 SHARE		1992 SHARE	
		Number	Percentage	Number	Percentage	Number	Percentage
MICRO CAR	Locally Produced	Zero	Zero	Zero	Zero	Zero	Zero
	Imports	23,782	100	28,636	100	36,283	100
	SHARE OF TOTAL PMVs		5.1		7.3		8.9
SMALL CAR	Corolla/Nova	35,557	26.7	29,350	25.4	27,074	26.4
	Laser/ Capri	37,162	28.0	28,110	24.4	18,792	18.3
	Pulsar/Astra*	27,688	20.8	20,161	17	15,358	14.9
	Colt**	3,517	2.6				
	IMPORTS	29.103	21.9	37,800	32.7	41,606	40.5
	TOTAL SMALL CARS	133,027	100	115,421	100	102,876	100
	SHARE OF TOTAL PMVs		28.4		29.3		25.3
MEDIUM CAR	Magna/Verada	31,808	26.6	28,963	28.7	34,315	34.8
	Camry/Apollo	40,381	33.6	33,335	33.1	31,063	31.5
	Pintara/Corsair***	21,320	17.8	15,381	15.3	7,460	7.6
	IMPORTS	26,403	22.0	23,086	22.9	25,751	26.1
	TOTAL	119,912	100.0	102,350	100.0	100,025	100.0
	SHARE OF TOTAL PMVs		30.5		27.9		30.1
LARGE CAR	Commodore/Lexen	73,230	51.3	56,999	52.0	62,826	51.2
	Falcon	61,830	43.3	51,016	46.6	59,851	48.8
	Skyline****	7,701	5.4	1,585	1.4		
	IMPORTS						
	SHARE OF TOTAL PMVs		30.5		27.9		30.1
LUXURY CAR	Fairlane/LTD	6,522	13.6	4,195	10.8	4,475	9.5
	Statesman/Caprice	3,244	6.8	2,125	5.5	2,313	4.9
	IMPORTS	38,245	79.6	32,419	83.7	40,131	85.6
	TOTAL	48,011	100	38,739	100	46,919	100
	SHARE OF TOTAL PMVs		10.3		9.9		11.5

Notes: *Pulsar ceased production in October 1992 but was still on sale at the end of the year. Astra ceased production in 1989 but was still on sale in 1991.** Colt ceased production in1989 but was still on sale in 1991. *** Pintara/ Corsair ceased production in 1992.**** Skyline ceased production in October 1990 but was still on sale in 1991.

Source: AAIA, *State of the Automotive Industry Report (1992), Appendix 1, p.85.*

Table 3.8: Production, Sales and Changes in Stocks of Locally Produced Motor Vehicles and their Derivatives, 1988 to 1992

Year	Local Production*	Local Sales	Export Sales	Total Sales	**Implied Change in Stocks**
1988	331,245	338,866	2,352	341,218	-9,973
1989	373,339	349,594	6,015	355,609	17,730
1990	377,461	354,040	23,210	377,250	211
1991	288,380	276,197	27,906	304,103	-15,723
1992	277,725	267,680	25,785	293,465	-15,740

Notes: Includes production for export

Sources: AAIA, *State of the Automotive Industry Report* (1993) ; EconData Dx Database

Table 3.9: Import Share of Passenger Motor Vehicle Market: 1982-1992.

Year	Import Share of PMV Market (%)	Year	Import Share of PMV Market (%)
1982	22.1	1988	19.5
1983	24.3	1989	24.6
1984	24.1	1990	31.0
1985	23.4	1991	31.0
1986	19.2	1992	40.2
1987	15.5		

Source: PAXUS Corporation Limited; *Bulletin New Motor Vehicle Registrations-Various Issues.*

Table 3.10: Volume Performance by Passenger Vehicle Model Line : 1993

Volume	Model Line	Sold By	Produced By
0-19,999	NA	NA	NA
20,000-29,999	Laser/Capri	Ford	Ford
	Corolla/Nova	Toyota/GMH	Toyota
30,000-39,000	NA	NA	NA
40,000-59,999	Camry/Apollo	Toyota/GMH	Toyota
	Magna/Verada	Mitsubishi	Mitsubishi
60,000+	Commodore/Statesman	Toyota/GMH	GMH
	Caprice/Lexen	Toyota/GMH	GMH
	Falcon/Fairlane/LTD	Ford	Ford

Notes: NA is "Not Applicable".
Source: *AAIA State of the Automotive Industry Report (1994), p.47*

Table 3.11: Volume Performance by Passenger Motor Vehicle Model Line 1985 and 1989 to 1993.

Number of Model Lines						
Volumes*	1985	1989	1990	1991	1992	1993
0-19,999	4	4	0	1	2	0
20,000-19,999	6	2	2	2	1	2
30,000-39,999	1	3	2	2	3	0
40,000-59,999	0	0	2	2	0	2
60,000+	2	2	2	1	2	2
Models manufactured in the year.	13	9	9	9	8	6
Models remaining at end of year.	13	8	8	8	6	6

Notes: Volumes includes exports.
Sources: Paxus Corporation Limited, *New Motor Vehicle Registrations*, 1985 and 1989-1991. VFACTS, Vehicle Retail Sales, 1992-1993. AAIA Industry Surveys.

Table 3.12: Value of Automotive Exports, 1984 to 1991

Year	Exports ($m)	Annual Growth (%)	Growth since 1984 (%)	Average Annual Growth Since 1984
1984	383.4			
1985	442.3	15.4	15.4	15.4
1986	463.3	4.7	20.8	9.9
1987	754.9	62.9	96.9	25.3
1988	613.4	-18.7	60.0	12.5
1989	649.1	5.8	69.3	11.1
1990	1,013.8	56.2	164.4	17.6
1991	1,157.3	14.2	201.9	17.1

Sources: AAIA *State of the Automotive Industry Report*, (1991);
EconData Dx.

Table 3.13: Annual Price Increases for Locally Produced and Imported Cars compared to the Consumer Price Index 1987 to 1993.

Year	Local Cars(%)	Imported Cars (%)	CPI (%)
1987	11.7	13.8	7.1
1988	5.9	7.0	6.9
1989	6.0	2.5	8.1
1990	5.2	2.2	6.5
1991	4.5	2.3	1.7
1992	2.0	2.2	0.5
1993	8.3	11.3	1.8

Source: AAIA *State of the Automotive Industry Reports, 1991 and 1993.*

Table 3.14: Australian Assembly Plant Productivity: 1988 to 1993.

	1988	1989	1990	1991	1992	1993
Hours Per Standardised Vehicle	40.4	41.4	52.5	44.1	39.0	34.5

Notes: Includes data from all five Assembly plants. The sharp deterioration in productivity that occurred in 1990 was probably attributable to a drop in sales and production towards the end of the year when the survey was conducted but before the companies were able to adjust their workforces in line with the drop in output.
Source: AAIA, *State of Automotive Industry Report (1993) p.12.*

Table 3.15: Vehicles that Ceased Production: 1984-1994

Year	Make	Year	Make
1984	GMH Statesman/Caprice	1989	Mitsubishi Colt Nissan Pintara/ Ford Corsair
1987	GMH Gemini	1992	Nissan Pulsar
1988	GMH Camira	1994	Ford Laser Ford Capri

Source *AAIA, State of Automotive Industry Report (1994) p 13*

Table 3.16: The Five Models Produced in Australia as at February 1994.

Ford Falcon	Toyota Camry/ GMH Apollo
GMH Commodore	Toyota Corolla/GMH Nova
Mitsubishi Magna	

Notes: Following the breakdown of the short-live amalgamation of GMH and Toyota in Australia , the Apollo and the Nova were no longer produced
Source: AAIA, *State of Automotive Industry Report, (1994) p 13.*

4 Modelling The Demand for PMVs: The Stock Adjustment Method.

Chapters Two and Three have canvassed the issues of industry policy and the conditions under which the production and output of Australian motor vehicles and components was fostered and promoted over the period 1900-1992. They show that government intervention into the operation of the industry was muddled and often counter productive. Further, in many instances production and policy decisions were taken without reference to consumer preference and/or the factors determining the demand for motor vehicles. Indeed the one consistent theme running through the entire period has been the neglect of demand considerations. This failure to focus on the demand side in the policy development process may help to explain why to date there has been limited interest by Australian researchers to model the demand for PMVs. Attention to demand modeling may have helped inform the policy development process. We now turn our attention to the latter concern.

We will therefore examine the factors that may influence the demand for PMVs in Australia for the period under review. We will do so by reference to three important approaches that have been developed to model the demand for consumer durables in general. These are the Stock Adjustment method (hereafter the SA method), the User Cost approach and the Structuralist approach. These broad consumer demand models have often been applied to the specific demand for PMVs, but mainly with respect to European and US studies. Our objective is to apply these methods to the Australian PMV market and to provide the first comprehensive attempt to model the demand for Australian PMVs. Our period of reference is 1966 to 1997, which encompasses both the Plan and the post-Plan period prior to the year 2000. The aim will be to determine both the key variables that impacted on the Australian demand for PMVs over that interval and to determine if any single method provides significant insight into the factors influencing consumer demand for PMVs in Australia.

We will begin with an examination of the SA method. In the first instance, the seminal SA model itself will be introduced. The SA archetype will then be applied directly to the demand for PMVs. A range of suggested modifications to the basic SA model that have been developed in response to a variety of criticisms of the traditional SA model will then be assessed. There are two major areas of concern as to the SA model of demand analysis. The first involves the proposition that the 'desired stock' equation may be improved with the addition of previously omitted variables. That is, a number of theorists have questioned the variables that constitute the determination of the 'desired stock' and argue for the inclusion of a particular factor within that component of the SA model. Whilst there is some uniformity in approach, differences of variable selection characterise the literature applying to the SA model. The second field of criticism with the SA model suggests that the short-term adjustment mechanism implicit to the original model may be refined by the incorporation of some measure of consumer confidence.

We will investigate a number of modifications proposed to the established SA model which are claimed to improve the explanatory power of the SA model as applied to the demand for motor vehicles. In the first instance, we will canvass a number of models that have incorporated a range of additional variables into the 'desired stock' equation. Secondly, the suggested expanded adjustment mechanism will be reviewed. Both variations will then be tested in the Australian context.

4.1 The Basic Stock Adjustment Model.

Modelling the demand for consumer durables is one of the more challenging topics in applied demand economics.[1] Yet, much of the most creative work in the field of consumer durable demand modelling was done in the United Kingdom during the 1950's. The classic paper by Farrell (1954),[2] was the first systematic application of discrete choice theory to the problem. Cramer (1957) first put forward a neoclassical model integrating the demand for durable and non-durable goods with the life cycle theory of Ramsey (1928), Fisher (1930), Tintner (1938) and Modigliani and Brumberg (1955). The pivotal feature of the model is that of a well-recognised linear budget constraint and the assumption that, in efficiency-corrected units, new and used durables were perfect substitutes. Indeed, the consumer durable demand literature may be described as a mature literature, with the major theoretical contributions completed by the 1970s. Stone and Rowe (1957), simultaneously with Chow (1957), first applied the SA model to the demand for consumer durables. This approach became the principal tool of analysis for investigating the demand for consumer durables over time and was thought to be most suitable for use with time-series data. Concerns as to the possible non-stationarity of the data did not emerge for another twenty or so years.

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[1] The literature views a consumer durable as an asset which yields a return of consumption services; the consumer derives benefit from the services of the stock, not from the flow of durable purchases. For further development of this concept see Stone and Rowe (1957), Chow(1957), Harberger(1960), Juster and Watchel (1972).

[2] Farrell also made a notable contribution to the analysis of the interaction of the markets for new and used motor vehicles.

In the most basic of its formulations the SA model can be defined as:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

where :

D_t = aggregate demand for the durable in period t.

S_{t-1} = stock of the durable in the public's hand at the end of period t-1.

S_t^* = desired stock at the end of period t.

g = adjustment coefficient.

r = depreciation rate.

As S_{t-1} is a known factor, the challenge with the application and use of the model is to determine what constitutes S_t^*, which is not a constant but can and does change in accord with changes in the economic environment. The essential difference between the SA models that will be examined below turns on just how S_t^* is determined. There are, of course, a number of regressors incorporated into S_t^* (such as income and price), that are common to most models although differences emerge as to the actual form of these common factors. However, variation between the models lay in the choice of variables that are claimed to best determine S_t^*. We will examine each of the suggested modifications in order to determine whether they do indeed improve the operation of the basic SA model and thereby lead to a better understanding of the factors influencing the demand for PMVs in Australia for the period under review. That is, we will use Equation (4.1) as the essential theoretical framework for the SA model. We then operationalise that basic structure as per the contributions of a number of researchers, examine the empirical methodology employed in each case, determine the expected *a priori* results and compare such results to the actual generated outcomes.

4.2 A General Interpretation of the SA Model.

Before we begin, however, there is merit in interpreting and expanding equation (4.1), in order to better understand the need to isolate the factors that constitute S_t^*. There have been many interpretations of the model. A typical approach is that of Briscoe (1977). This exposition began with the proposition that the basic SA model typically views households as having a desired level of durable stocks ('target ownership'), to which they gradually adjust through time. This desired or equilibrium stock of the durable (S_t^*) is made to depend on a set of economic variables *(V)*, which usually contains terms measuring disposable income *(Y)*, relative price *(P)* and the cost of credit *(CR)*. Therefore, the desired level of stock (S_t^*) at any one time is not a constant. Changes in the economic environment will, in turn, cause shifts in the desired level of stock of the durable. Thus, the desired level of stock is defined as the equilibrium level of ownership, which constantly changes as a consequence of change in the economic environment. In addition to this planned component of demand, net purchases of the durable are also held to contain a transitory component *(T)* which depends on unforeseen economic occurrences that can be assumed to be proxied by general business cycle variables, such as unemployment *(U)* and capacity underutilisation *(M)*. Finally, in order to formulate the demand equation in terms of the gross purchase of the durable *(G)* there is a requirement to add a third component to take account of any replacement demand which occurs in each time period. The relationship hypothesised may be formally written as:

$$G = \Delta S^P + \Delta S^T + dS_{t-1} \tag{4.2}$$

where:

d = the rate of depreciation made proportional to the level of stock of the durable at the end of the preceding time period.

The planned change in stocks (S^P) is determined by:

$$\Delta S^P = b(S_t^* - S_{t-1}), \tag{4.3}$$

$$S_t^* = V, \tag{4.4}$$

$$V = f_1(Y_{t-n}, P_{t-n}, CR) \tag{4.5}$$

where:

b = the speed of adjustment of actual to desired stock levels.

In specifying (4.5), the lag structure on either income or relative prices has not been made explicit. The simplest assumption would involve proxying expected values of both variables by their current actual values, so that $n = 0$. However, in the case of income, in particular, this analysis argues that it may be more realistic to invoke a permanent income hypothesis and measure this variable by a weighted average of present and past levels of income. The transitory change in stock (ΔS^T) is obtained from

$$\Delta S^T = T, \tag{4.6}$$

$$T = f_2(U,M) \tag{4.7}$$

If we now substitute equation (4.4) through (4.7) into (4.1) we produce the general specification:

$$G = bf_1(Y_{t-n}, P_{t-n}, CR) + f_2(U,M) + (d-b)\, S_{t-1} \tag{4.8}$$

When the relationship between the terms *V* and *T*, respectively, are specified to be linearly additive, a form of the traditional consumer demand model is thereby produced.

4.3 The Stock Adjustment Model as Applied to the Demand for Motor Vehicles.

Since the pioneering work of Stone and Rowe there have been many attempts to analyse the demand for motor vehicles within the framework of the SA model. These include Chow (1957, 1960), Suits and Sparks (1965), Houthakker and Taylor (1966), Hamburger (1967), Evans (1969), Hymans (1970). However, to date there have been no attempts to apply the framework to the Australian PMV case.

A typical formulation is that of Rippe and Feldman (1976), who argue that people purchase motor vehicles when the desired stock of motor vehicles changes and when existing vehicles wear out. Furthermore, when the desired stock changes, the adjustment does not necessarily take place immediately but may rather be spread out over time. Their basic model emulates Equation (4.1)[3] and thereby proposes that the general form of the SA model as applied to the demand for PMVs may be written as per Equation (4.1):

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

By rearranging the terms we obtain,

$$D_t = g\,S_t^* + (r\text{-}g)\,S_{t-1} \tag{4.9}$$

which is the form used in the estimation.

To complete the model, a specification of the determinants of S_t^* is

[3] Note that Rippe and Feldman did not use the same symbols as Equation (4.1) to represent the variables. We

needed. For most consumer goods, the typical variables to be included are income and prices:

$$S_t^* = f(Y, P_1, P_2, \ldots, P_n), \tag{4.10}$$

where:

Y = income.

$P_2, \ldots P_n$ = is the price of D and all other goods and services available in the economy.

In practice, the specification of the prices included is usually limited to a few substitutes and complements.

To apply the SA model formulation to the demand for motor vehicles, data on D_t and the included variables is needed, as is the exact specification of S_t^*. The specification for S_t must be estimated. Rippe and Feldman use quarterly data for consumption expenditure on automobiles in 1958 dollars to estimate D_t with the series seasonally adjusted at quarterly rates. In the first instance, their analysis uses income, price, and unemployment as the three main determinants of S_t^*. Each of current and permanent income is tested for the income variable. The results are found to be uniformly better with current income. (In another test of current versus expected (ie. permanent), income Chow (1957) found, within the SA framework described above, that the disposable income variable accounted for considerably more of the variation than the expected-income variable. To further test this conclusion Chow separated disposable income into expected income and unexpected income. That is, disposable income less expected income. His estimates show virtually the same responsiveness of motor vehicle purchases to

have, however used the symbols applicable to Equation (4.1) to examine their contribution.

expected and unexpected income. It can also be noted that in regressions that use the stock of cars as the dependent variable (S_t in the Rippe and Feldman notation), Chow found that expected income performed better than disposable income.

Consequently, Rippe and Feldman employ current disposable income less transfer payments (in 1958 dollars), seasonally adjusted at quarterly rates. Transfer payments were included in some of their testing but their final results were slightly better with the transfers excluded. Transfer payments were hypothesised to generate inferior results due to the fact that most recipients did not purchase new cars.[4] The implicit price deflator for motor vehicles as a ratio to the implicit price deflator for all consumption expenditures, is employed as the price variable. Thus, the price variable is the price of new motor vehicles relative to all consumer goods and services.

Following Evans (1969), Rippe and Feldman then include the level of unemployment as a further variable in the model of PMV demand. Evans argues that a function explaining the demand for cars incorporating income, relative prices, stocks, and appropriate credit variables is still missing one important determinant that is required to accommodate the fact that the purchase of any consumer durable, including PMVs, is postponable. People who already own a particular durable and who may be considering re-entering the market for a replacement could do so immediately, or may postpone such re-entry by continuing to use their existing commodity for an extra year or two. For example, in the pre-WW11 era Roos and von Szeliski (1939) show that during a recession consumers do not purchase as many consumer durables as in a non-recessionary

[4] It was concluded however that transfer payments may have a significant impact on the demand for used cars.

period and that the ratio of consumer durables purchases to personal disposable income will fall substantially. Whilst accepting this premise, Evans does however reject, for the post WW11 period, Roos and von Szeliski's further contention that the demand for cars is a function of "supernumerary" income. This form of income is defined as the income left after paying for basic necessities such as food and rent.

Notwithstanding this rejection of the role of 'supernumerary' income, Evans proposes that when businesses turn down, many people will reduce their purchases of consumer durables even if their own income is not reduced. The explanation for this behaviour is to be found in exogenous attitudinal indexes that seek to measure attitudes rather than buying plans. That is, if consumers think that times are bad they will not purchases durables even if they are not directly affected. Evans further notes that even if consumption is held to be related to income alone, attitudes will make a significant addition to an explanation of consumer durable purchases. However, it is stressed that it is crucial to judge the importance of attitudes on the basis of a function that contains variables beyond a simple $C= f(Y)$ relationship. It is proposed that a variable capable of representing general cyclical movements is likely to be important and that one such variable is the unemployment rate. Evans argues that the then (1969), available empirical evidence suggests an index of attitudes towards the purchase of consumer durables can be explained by general cyclical variables such as unemployment.

Given this justification for the inclusion of the unemployment variable, Rippe and Feldman then estimate the existing stock of motor vehicles. In equations

(4.1) and (4.9) it is hypothesised that depreciation is proportional to the existing stock employed; hence stock at any time t is given by:

$$S_t = D_t + (1 - r)S_{t-1}, \tag{4.11}$$

or equivalently by

$$S_t = \sum_{i=0}^{\infty} (1-r)^i D_{t-1} \tag{4.12}$$

To use (4.11), estimates of r (depreciation rate), and of S_{t-1} (stock estimate), at some initial period are needed. It is proposed that in the case of the stock estimate, the problem of obtaining an initial value for S can be avoided by the assumption that after a suitable lag, the D_{t-1} terms do not enter S_{t-1}. For example, both Evans (1969), and Hymans (1970), assume that after 40 quarters D was no longer in the capital stock, and thus change the upper limit to the summation in (4.12) to be 40 rather than ∞. In the case of the depreciation rate, Chow (1957), used $r = 0.063$ for the quarterly depreciation rate obtained from price data on used motor vehicles. Alternatively, Evans (1969) and Hymans (1970) estimate $d = 0.0712$ and $d = 0.078$ respectively, for the quarterly depreciation rate. Rippe and Feldman follow both Evans (1969) and Hymans (1970) and estimate the stock using (4.12) with an upper saturation limit of summation of 40 instead of ∞· They then use the middle value of the above three estimates of the quarterly rate of depreciation (that is $d = 0.0712$) to arrive at a figure for the quarterly rate of depreciation. In addition to the variables described above, two dummy variables are included in the model. DB is employed as a dummy for the quarters of strikes and DA as a dummy for the quarters after strikes. The period of estimation is 1958:2 - 1873:3 with 1959:4 omitted due to a steel strike.

4.3.1 Empirical Estimation

It will be recalled that the basic SA model as applied to the demand for PMVs formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

Given (4.1), the challenge is to determine S_t^* (the level of desired stock) in order to determine D_t. The factors considered of relevance by Rippe and Feldman led to a model determined for estimation as follows:

$$D_t = f(Y_t, PA_t/PC_t, U_t, DB, DA, S_{t-1}) \tag{4.13}$$

where:

D_t = expenditures for motor vehicles in 1958 dollars,

Y_t = disposable income less transfer payments in 1958 dollars,

PA_t = implicit price deflator for motor vehicles,

PC_t = implicit price deflator for all consumption,

U_t = the rate of employment,

DB = dummy variable for quarter of the General Motors strikes in 1964 and 1970,

DA = dummy variable for quarter after General Motors strikes in 1964 and 1970, and

S_{t-1} = stock of motor vehicles in previous quarter.

Function (4.13) may be expressed in the following empirical form:

$$\hat{D}_t = a_0 + a_1 Y_t + a_2 (PA/PC)_t + a_3 U_t + a_4 DB_t + a_5 DA_t + a_6 S_{t-1} + \varepsilon \tag{4.14}$$

A priori, the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_1 > 0$, *and* $\alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 < 0$.

Given (4.1) Rippe and Feldman were able to generate the following regression results:

$$D_t = 1.85 + 0.13Y - 2.99PA_t/PC_t - 0.14U_t - 1.36DB_t - 0.17DA_t - 0.10S_{t-1}$$
$$(5.90) \quad (-0.70) \quad (-2.52) \quad (4.88) \quad (0.58) \quad (-3.52) \qquad (4.15)$$

Notes: t-statistics in parentheses beneath the coefficients; $R^2 = .930$; *S.E.* of the regression = 0.37 (billion 1958 dollars); $DW = 0.68$.

4.3.2 Conclusions as to the Rippe and Feldman SA Model.

The general conclusions drawn for the model are mixed. Some aspects are reasonably satisfactory in that all the coefficients have the signs that are expected a priori and most are significantly different from zero at acceptable levels. The R^2 show that the model can explain 93 percent of the variance in D. However, the model is dogged by the presence of severe autocorrelation as indicated by a DW of only 0.63. Further, relative price is not significant. Both economic theory and intuition would dispute this finding. It is of some interest that both the results and the problem of autocorrelation, are similar to the findings obtained by other investigators of motor vehicle demand undertaken at roughly the same period. Table 4.1 contains several of the regression statistics for these equations.[5] All of the models make use of the SA framework and test income and price as explanatory variables. In most cases several other independent variables, such as consumer loan repayments, credit availability, supply restriction dummies, household wealth, and consumer expectations are used. As the statistics demonstrate, 85-94 percent of the variance in the dependent variable is explained.

[5] All the regression results were generated during a period when there was no testing for the time series properties of the data.

However, all the models exhibit autocorrelation as shown by the low *DW* statistics or use of first differences.[6]

4.4 Modifications to the Stock Adjustment Model.

The SA model, whilst empirically straightforward, does pose a range of econometric and conceptual concerns. By way of example, it is clear that not all the parameters of the model are fully defined. For instance, Rippe and Feldman (1976), Chow (1960), Hymans (1970) and Evans (1969) determine the rate of depreciation externally to their models and before the actual demand estimations are attempted. However, it is problems generated by the scope and application of the SA model that are of greatest concern to many who attempt to model the demand for consumer durables generally and the demand for motor vehicles in particular. That is, Equation (4.1) is held to be circumscribed in range and utilisation by the parameters prescribed for the model. Consequently, a large body of work has been undertaken that sought to expand the boundaries of the SA model in an effort to present what was held to be a more authentic picture of the behaviour of the aggregate demand for consumer durables.

Broadly speaking, there have been attempts to come to terms with what we have nominated as the conceptual problems inherent to the SA model. That dilemma, as noted, is to define S_t^* the original 'desired stock' equation. One such attempt at definition has involved expanding the range of variables incorporated in S_t^*. Other efforts have concentrated on accommodating concerns as to the short-term adjustment mechanism implicit to the model. That is, there have been

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[6] The *DW* statistic for Chow (1957) is fairly close to the range typically used for acceptance of the hypothesis of zero autocorrelation. Hymans (1970) adjusts his model for autocorrelation by assuming a first-order autoregressive error.

a number of efforts to expand the boundaries of the traditional SA model by the incorporation of an additional variable(s) with an acceptance of the implied adjustment mechanism proposed for the traditional model. Other approaches have sought to address problems associated with the short-term adjustment mechanism whilst ignoring concerns as to the veracity of the desired stock equation. We will investigate each of the areas in turn. We will begin with the suggested modifications to the desired stock equation.

4.5 The Incorporation of Additional Variables into the 'Desired Stock' Equation.

This section will canvass the contributions of a range of researchers who suggest the inclusion of additional variables to help improve the desired stock equation. These include:

- Rippe and Feldman (1976): building activity.
- Hamburger (1967): the availability and the cost of consumer credit, building activity.
- Mishkin (1976): the availability and cost of consumer credit.
- Smith (1975): attitudes and expectations
- Briscoe (1977): attitudes and expectations; the availability and cost of consumer credit.

The major area of contribution of each researcher is listed first. Hamburger, for example, whilst primarily concerned with the impact of the availability and cost of consumer credit on consumer durable demand in general and PMVs in particular, also made reference to the impact of building activity as it applied to the demand for motor vehicles.

4.5.1 The Impact of Residential Construction on the Demand for Automobiles An Omitted Variable.

As we have noted, Rippe and Feldman (1976) utilise a typical SA prototype to model the demand for PMVs. The determinants employed in their study were those used in standard SA demand studies: own price, price index of other goods, income and unemployment. The overall results were, however, quite disappointing. Notwithstanding, they propose that such demand models might be improved by the explicit consideration of substitute and complementary goods. Intuitive analysis suggests that a SA model of PMV demand might be enhanced by the incorporation of information about household expenditures on new residential construction which, while an important variable in its own right, may also be seen as a proxy for the state of the economy.

To incorporate such a variable into the SA model, the analysis first turns to microeconomic theory. This holds that utility maximisation subject to a budget constraint, will lead to a specification of demand functions incorporating income, the price of the good in question and the price of all other goods. Therefore the standard approach to test for the impact of residential construction on PMV demand would be to include the price of residential construction in the variables which determined the desired stock of PMVs. However, Rippe and Feldman identify two problems with the use of price as an explanator. The first is the possibility of market disequilibrium. This may mean that price will not provide the consumer with appropriate information as to the terms under which transactions may have taken place. The second problem involves the mechanics of collection of the relevant price in their study. Both factors led to inclusion of the quantity of new housing constructed rather than the price of new housing as the additional variable utilised in the SA equation.

4.5.1.1 *Empirical Estimation and Estimation*

The basic SA mode formulated by Rippe and Feldman as applied to the demand for PMVs is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

where:

$$D_t = f(Y_t\,,\ PA_t/PC_t\,,\ U_t\,,\ DB,\ \ DA,\ S_{t-1}) \tag{4.13}$$

Equation (4.13), was then modified to incorporate residential construction, which is lagged one period to reflect the delay between construction and the potential impact on consumer behavior.

$$D_t = \ \ f(Y_t\,,\ PA_t/PC_t\,,\ U_t\,,\ DB_t,\ \ DA_t,\ S_{t-1,}\ H_{t-1}) \tag{4.16}$$

where:

H_{t-1} = investment in residential construction in 1958 dollars in period $t\text{-}1$ seasonally adjusted at quarterly rates.

Function (4.16) may be rewritten as:

$$\hat{D}_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 (PA/PC)_t + \alpha_3 U_t + \alpha_4 DB_t + \alpha_5 DA_t + \alpha_6 S_{t-1} + \alpha_7 H_{t-1} + \varepsilon_t \tag{4.17}$$

A priori, the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_{1\,,}\alpha_7 \ > 0$, *and* $\alpha_2,\ \alpha_3,\ \alpha_{4,}\ \alpha_{5,}\ \alpha_6 < 0.$

Rippe and Feldman expect that residential construction will have a positive impact on PMV sales give their assertion that most new housing is located outside of the central cities. Because of their location, it is felt that suburban and rural households will be more likely to own motor vehicles than will central city residents (see Table 4.2) Using (4.17) Rippe and Feldman are able to generate the following results:

$$
\begin{aligned}
D_t = &\ 8.100 + 0.07Y - 7.00PA_t/PC_t - 0.38U_t - 0.956DB_t - 0.66DA_t - 0.06S_{t-1} \\
&\ (2.47) \quad (4.62) \quad (-2.73) \qquad (-8.87) \quad (-5.54) \quad (-3.60) \quad (-3.46) \\
&\ + 0.404H_{t-1} \\
&\ \quad (9.92)
\end{aligned}
\tag{4.18}
$$

Notes: The *t*-statistics are in parentheses. The estimation period was 1958:2 - 1973:3 with 1959:4 removed due to a steel strike. $R^2 = .975$; *S.E.* of the regression = 0.22 (billion 1958 dollars); $DW = 1.64$.

Rippe and Feldman claim a marked improvement for this model (4.18), over the results achieved for equation (4.15). All the coefficients enter with the correct signs and all are significant at the five- percent level with a very high R^2. In addition, the *DW* statistic is much higher at 1.64, which indicates that autocorrelation is much less of a problem, if at all. The standard error of the regression has been reduced from 0.37 billion 1958 dollars in equation (4.15), to 0.22 billion 1958 dollars in equation (4.18). Importantly, relative price is, now, significant. The inclusion of the housing construction variable has improved the explanatory power of the model and caused the previously non-significant relative price variable to be significant. Clearly, housing construction is an important omitted variable in the context of the Rippe and Feldman study. In addition to the consideration of variables such as prices, income and unemployment impacting on the demand for PMVs, the work suggests that it is also necessary to assess the prospects for new residential construction. Certainly for the period under review in the United States, continued cyclical swings in housing construction appear to affect the demand for PMVs.

We now turn our attention to contributions that sought to improve the definition of S_t^*, by including two additional explanators not included in the standard SA model.

4.5.2 Hamburger (1967): Interest Rates and the Demand for Consumer Durable Goods

It will be recalled that the Rippe and Feldman model which explicitly cast the generic SA model in terms of PMV, is expressed as:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

Hamburger examines the impact of two additional variables into S_t^* beyond those incorporated into equation (4.1). These are measures for the availability and cost of credit and to a lesser extent the impact of building activity on the demand for consumer durables, including motor vehicles. The prime concern of the analysis is to examine the effect of monetary variables on the demand for consumer durable goods. Hamburger begins by challenging a proposition, generally accepted since the publication of Keynes' 'General Theory', that concerns the impact of money variables on the level of demand for consumer durables. This orthodox view states that as consumption is insensitive to interest rates, money variables are of no real consequence in determining the level of demand for consumer durables. Thus the only money variable included in the consumption function with any regularity up to that time (1967) were liquid assets.

In contrast to this prevailing orthodoxy, Hamburger propose that monetary variables do have a significant effect on consumer purchases of durable goods, that the most appropriate measures of these variables are interest rates and that the level of consumption demand is indeed sensitive to interest rates. This thesis is examined via a model that seeks to explain the quarterly movements in two major components of demand: automobiles and parts, and all others (with furniture and household equipment being the most important items in the latter).

Hamburger's model of the demand for consumer durables is expressed as follows.[7] Firstly, let the desired aggregate stock of any given physical asset S_t^*, be a linear function of aggregate income *(Y)*, valued in constant prices, *v*, a vector of yields on financial assets and liabilities, and the price of the asset *(P)*, relative to all other goods and services purchased by consumers. That is:

$$S_t^* = a + bY + cv + dP \qquad (4.19)$$

where :

the parameters *b*, *c* and *d* denote the long-run effects of the independent variables on the desired stock[8]

Secondly, purchases of the asset (which we will assume is a PMV) during period *t* (D_t), are defined as the sum of the consumption (or depreciation, r_t) and net investment (ΔS_t):

$$D_t \equiv r_t + \Delta S_t \qquad (4.20)$$

where it is assumed that :

$$\Delta S_t = \theta(S_t^* - S_{t-1}); 0 \le \theta \le 1, \qquad (4.21)$$

and

---

[7] Obviously Hamburger did not use the same symbols as Equation (4.1) to represent the variables as his paper was published in 1967 and Rippe and Feldman did not publish until 1976. However, in order to both ensure consistency of approach and to aid the reader, we use the symbols applicable to Equation (4.1) to examine his contribution.

[8] Except for the inclusion of *v*, this formulation of the demand function for consumer durables is similar to those that have been used elsewhere.See, for example, Stone and Rowe (1957) and Chow (1961).

$r_t = e_1D_t + e_2S_{t-1}$ (4.22)

S_t denotes the existing stock of the asset at the end of the t^{th} period.

Equation (4.21) is a standard SA relationship where θ is the reaction coefficient. It measures the percentage of the adjustment that consumers make towards equating their actual and desired asset balances during any time period. It is assumed that:

- the response patterns associated with each of the explanatory variables may be described by a simple decay function; and
- the parameters associated with these functions are identical.

Hamburger then slightly modifies the model. That is, the adjustment process is allowed to begin at different time periods for the various independent variables. This is done by the introduction of lagged values for the variables on the right-hand side of equation (4.19) such that:

$S_t = a + bY_{t-n1} + cv_{t-n2} + dP_{t-n3}$

or alternatively,

$S_t = a + bY_{t1*} + cv_{t2*} + dP_{t3*}$ (4.19)*

where

the n's indicate the lags associated with the independent variables and t^* is used as a shorthand device for $(t-n_1)$, $(t-n_2)$, and $(t-n_3)$.

The values of t^* are generally found to be dissimilar. For non-zero values of n, equations (4.19)* and (4.21) imply that the adjustment of expenditures to changes in the explanatory variables is negligible for some initial time period, then rises abruptly to their maximum, and declines geometrically thereafter.[9] Hence,

[9] In reality, actual expenditures, even if lagged, will probably not start off at their peak response but are more

Hamburger feels that the adjustment process determined may be overly restrictive. However, in view of the primary objective to assess the effects of monetary variables on the demand for consumer durables, this pattern is thought to provide a reasonable first approximation.[10]

Equation (4.20) suggests that depreciation is a constant percentage, e_2, of the existing stock plus some percentage, e_1, of current purchases. As at 1967 there were are at least two views as to the relative values of e_1 and e_2. For example, Stone and Rowe (1957) assume that:

- the rate of depreciation for any particular asset is constant throughout its life; and
- current purchases are divided evenly during the period of observation.

As such, they derive the equation:

$$e_1^{SR} = 1 + e_2 / I_n(1 - e_2) \tag{4.23}$$

Equation (4.23) implies, for aggregate analysis, that the rate of depreciation on current purchases is approximately one-half the rate on the existing stock.[11] However, there are objections to this approach, particularly the first of Stone's and Rowe's assumptions. Real experience points to the fact that some durable goods, particularly motor vehicles, depreciate much faster during the quarter in which they were purchased than they do during subsequent periods. Thus, Hamburger claims that one of the more desirable features of his approach is that many of the important parameters of the model can be estimated without

---

likely to build up gradually to the peak and then taper off.

[10] For more general treatments of the distributed lag model, see Almon (1965), Hamburger (1966), Jorgenson (1964) and Solow (1960).

[11] See Stone and Rowe (1957), for the derived equation which led to their conclusions as to the rate of depreciation on current purchases.

making any assumptions about the absolute or relative values of e_1 and e_2.

The model that is subsequently developed represents only a slightly modified version of the standard SA model. However, there are two important specificational differences between Hamburger's model and the regulation SA equation for durable goods. The first involves the explicit recognition of the rate of depreciation on current purchases. This is a factor that had been often ignored in other studies to that time, Chow (1961), Evans (1966). The annual rate of depreciation for PMVs used by Hamburger is 28 percent which is claimed to be well within the range implied by the behaviour of prices in the used car market. The second is the use of weighted differences of the explanatory variables as opposed to the levels of the variables. This approach tends to reduce any multicollinearity that might otherwise have been present.[12]

4.5.2.1 *Empirical Generalisation and Estimation*

It will be recalled that the basic SA model as applied to the demand for PMVs formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

The model determined by Hamburger is formulated as:

$$D_t = f(\,Y,\ P_A\,,\ vAaa,) \tag{4.24}$$

where:

D_t = personal consumption expenditure on motor vehicles and parts seasonally adjusted.[13]

Y = the lagged expenditures and weighted differences of real disposable

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[12] In addition, Hamburger notes that although the empirical result find the yield on savings account has the proper sign, it is not statistically significant at the five percent level. It is therefore not reported.

[13] e_2^A ,the annual percentage rate of depreciation on existing stock is equal to 28%.

personal income, seasonally adjusted at annual rates deflated by either all the components of the CPI or the implicit price deflator for all consumption expenditures seasonally adjusted at annual rates.

$vAaa$ = the yield on long-term corporate bonds. That is, the percentage rate (Moody's) on long-term corporate bonds,

P_A = the relative price of motor vehicles measured as the implicit price deflator for personal consumption expenditures on motor vehicles divided by the implicit deflator for all consumption expenditures, 1958=100.

Function (4.23) may be, rewritten as:

$$\hat{D}_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 PA_t + \alpha_3 vAaa + \varepsilon_t \qquad (4.25)$$

A priori the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_1 > 0$ *and* $\alpha_2 , \alpha_3 < 0$

Hamburger generates the following regression results with e_2^A, the estimated annual rate of depreciation of existing stock, set at 28%:

$$D_t = + .257Y - .235P_A - 4.44vAaa \qquad (4.26)$$

$$\begin{array}{ccc} (.047) & (.104) & (1.27) \\ [1.0] & [0.0] & [4.5] \end{array}$$

Notes: The numbers in brackets are t statistics whilst the numbers in the square brackets are lags associated with the independent variables. R^2= .9170; DW = 1.25; SE = .9249.

Hamburger claims the empirical results to be generally satisfactory. The statistical fit of the model is quite good. All the regression coefficients have the proper sign and are at least twice their standard error. (However, in our view the relatively poor *DW* of 1.25 is evidence of some serial correlation). The quite long lags associated with the yield on bonds are of interest to Hamburger in that they show it takes over four quarters for changes in the bond yields to have their maximum effect on consumer expenditure on PMVs. He suggests that the length of the lags associated with the other independent variables show that *vAaa* is acting primarily as a proxy for the rates charged on consumer credit, rather than as a measure of the yields available on marketable financial assets. In summary, the results suggest that expenditure on PMVs can be explained as a relatively simple function of income, relative price and interest rates. Hamburger claims that the importance of the study is that it is able to isolate a significant relationship between expenditure on PMVs and interest rates.

4.5.3 Residential Construction and Expenditure on PMVs.

In addition to the impact of interest rates, Hamburger (1967) tests the proposal that variations in residential construction expenditure, H_{t-1}, play a role in explaining the association between market rates of interest and the purchase of PMVs. It is suggested that the relationship between open-market rates and the purchase of PMVs can be attributed to the combined effects of:

- the negative association between interest rates and residential construction and
- the positive correlation between housing expenditures, on the one hand, and expenditures on PMVs on the other.

4.5.3.1 *Empirical Generalisation and Estimation*

It will be recalled that Hamburger's model tested as Equation (4.24) included interest rates as, a then new variable, and is formulated as:

$$D_t = f(\,Y\,,\; P_A\,,\; vAaa) \qquad (4.24)$$

When H_{t-1} is added to Equation (4.24) we get:

$$D_t = f(\,Y\,,\; P_A\,,\; vAaa,\; H_{t-1}) \qquad (4.24)^*$$

which may be represented as:

$$\hat{D}_t = \alpha_0 + \alpha_1\, Y_t + \alpha_2 PA_t + \alpha_3 vAaa_t + \alpha_4 H_{t-1} + \varepsilon_t \qquad (4.25)^*$$

A priori, the following pattern of signs for the independent variable parameter estimates are expected:

$\alpha_1,\ \alpha_4 > 0,\ \alpha_2,\ \alpha_3 < 0.$

Hamburger generates the following regression results, again with e_2^A, the estimated annual rate of depreciation of existing stock set at 28%.

$$D_t = +\ 0.186Y - 0.204P_A - 3.80vAaa + 0.489\,H_{t-1} \qquad (4.26)^*$$

(5.63)	(1.98)	(3.14)	(2.56)
[1.0]	[0.0]	[4.5]	[2.0]

[Notes: the t -statistics are in parentheses beneath the coefficients. The numbers in the square brackets are lags associated with the independent variables. R^2= .9234; *Adjusted SE* = .9249; *DW* =1.25].

The inclusion of H_{t-1} yields reasonably satisfactory results. H_{t-1} has the anticipated sign and is significantly different from zero at the one percent level. In addition, the interest rate coefficient remains statistically significant when the H_{t-1} variable is included in the analysis. Hamburger therefore suggests that the finding provides some support for the view that consumers treat houses and PMVs as complements.

4.5.4 Illiquidity, Consumer Durable Expenditure, and Monetary Policy.

A second researcher to examine the impact of interest rates on expenditure on PMVs is Mishkin (1976). This study seeks to determine the cost and availability of credit on consumer durable expenditure by incorporating a 'liquidity' model into the traditional SA model of consumer durable demand. Mishkin observes that the literature sees monetary policy as having a major impact on consumer durable expenditure. This is either through interest rates, or liquid assets (real balance) effects.[14] At the time (1976), whilst the theoretical justification for the inclusion of liquid assets as an important determinant of consumer durable expenditure was not particularly strong, the work of Zeller, Huang and Chau (1965) did vindicate the incorporation of the variable. The acceptance of the theoretical basis for the inclusion of monetary policy effects via the interest rates on the level of demand for consumer durables did not however, detract from the fact that empirical econometric work had, at that time (1976), rarely found the effect to be substantial. The major exception is Hamburger (1967) who, as we note above, does find reasonably strong effects, but only when interest rates enter his equations with quite long lags. Therefore, Mishkin surmises that either monetary policy has only a marginal effect on consumer durable expenditure or that a critical channel of such policy has been ignored. The work examines the second scenario via a model that seeks to determine the effects of consumer durable illiquidity on the desirability of an asset (including that of PMVs and parts).

[14] The effects of interest rates are classified with the effects of installment credit.

4.5.4.1 Illiquidity of the Consumer Durable Asset

The analysis begins by observing that consumer durable assets have far less liquidity than financial assets. Well-developed capital markets exist for most financial assets. Cash can be generated with a minimum of cost in time, money, and effort by selling in these near perfect markets. Capital markets for consumer durables are, on the other hand, highly imperfect. Durable goods are very heterogeneous, and much costly information is needed to determine their value. For example, how well had the owner treated the durable, had it been damaged, how frequently had it been used, etc.[15] In addition, the bulk and difficulty of handling durables leads to high transaction costs in their purchase and sale. This transaction and information problem, in turn, generates a wide spread between the price the consumer receives from selling the consumer durable and its value in use. The value-in use is the present discounted value of the durable's flow of services. Further, costly information may lead to a spread between selling price and in-use value. In an extreme case no organised market might exist as a result of information problems. The absence of organised markets for many types of used consumer durable goods is quite common.

Mishkin develops a two-period 'liquidity' model to determine the effect of consumer durable illiquidity on the desirability of the asset. The model finds that the nature of the markets for consumer durables does force the consumer to take account of their balance sheet position. That is, consumers do make reference to their debt and financial asset position, as well as the riskiness of their income stream, in determining the desired level of their consumer durable stock. The

[15] This well known asymmetric information problem is eloquently described by Akerlof (1970) in his famous "market for lemons" article.

model begins with the assumption that consumers buy a unit of durables with price equal to unity at the beginning of period one. The durable's in-use value at the end of the period will be $1-d$ where d is the depreciation rate. (In the case of a durable where there is a planned trade-in, the expected costs incurred in the trade-in-transactions would be included in depreciation. The value of the durable at the end of the period would reflect these costs). However, if the consumer suffers a shortfall in income so that a durable good has to be sold in a distressed manner, it will, in most instances, not be possible to realise the full value of the good. This illiquidity stems from the imperfect nature of the used consumer durable capital market.

The degree of this illiquidity is described by the variable q $(q < 1)$, which is the fraction of the in-use value that will be realised from a distress sale. This quite general formulation is not dependent on any specific type of illiquidity loss. That is, the formulation includes the loss from a low sales price as well as from transaction costs. If, as a result of an income shortfall, a distress sale of the durable is required to raise cash, the realised value of the durable at the end of the period will be $q\ (1-d)$, where q is less than one. If there is no distress sale, the one-period opportunity cost, C_o, of holding a durable rather than a financial asset is formulated as:

$$C_o = 1 - (1 - d) + r = r + d \tag{4.27}$$

where

r = one-period return on a financial assets (which was assumed certain).

But if there is a distress sale as the result of an income shortfall then:

$$Co = 1 - q\ (1 - d\ ) + r \tag{4.28}$$

$$\Rightarrow C_o = r + d + (1-q)(1-d)$$

where

C_o = one-period opportunity cost of holding a durable good.

The opportunity cost in equation (4.28) assumes that a consumer can not borrow to cover an income shortfall or that the cost of borrowing over and above the yield on financial assets will be more than $(1-q)(1-d)$. Mishkin claims that it is well known that financial intermediaries are more than happy to make loans to customers when they least need them and are extremely reluctant to make loans to customers when they are in financial trouble. If a financial intermediary does make a loan at all to consumers with an income shortfall, it charges a very substantial premium to compensate for the increased risk. Thus the assumption inherent in equation (4.28) is held to be quite reasonable. If the difference between the borrowing costs and the yield on financial assets is less than $(1-q)(1-d)$, the consumer will borrow instead of selling the consumer durable. This can be incorporated into the model by replacing $(1-q)(1-d)$ with the spread between the distress borrowing yield and the yield on financial assets. This procedure in fact, leads to the same results as is found in the original model.

Mishkin suggests that the reluctance of financial intermediaries to lend to consumers who are in financial trouble explains why most consumers hold debt and financial assets at the same time, even if borrowing costs were somewhat higher than the yield on financial assets. When a consumer suffers a drop in income, financial assets are a buffer that helps to prevent them from bearing a loss either by selling the durables or by borrowing at inflated rates to raise cash. Therefore, the consumer will not try to minimise borrowings by holding no financial assets as would occur in a world of absolute certainty and perfect capital market.

Thus, Mishkin can now view the opportunity cost of holding durable goods in an uncertain world with a Tobin-Markowitz mean-variance framework. If the probability of holding a distress sale is p and not holding a distress sale is $1\text{-}p$, then

$$E(C_o) = p[r + d + (1 - q)(1 - d)] + (1 - p)(r + d)$$

$$= r + d + p(1 - q)(1 - d)$$

$$Var(C_o) = p(1 - p)[(1 - q)(1 - d)]^2 \qquad (4.29)$$

where

E and Var are the expectation and variance operators respectively. A distress sale occurs whenever consumption plus debt service (interest plus amortisation), is larger than income, plus readily available financial assets. That is, when

$$DS + CON - Y - FIN > 0 \qquad (4.30)$$

where:

DS = debt service

CON = consumption

Y = disposable income

FIN = holdings of financial assets.

The permanent income hypothesis implies that: $CON = k\bar{Y}$

where:

k = the propensity to consume out of permanent income

$\bar{Y}$ = expected average (permanent) income.

Given that income is a normally distributed random variable, the use of the standard normal distribution formulae makes it possible to write:

$$p = f[(DS - FIN - (1 - k)\ \bar{Y})/\sigma_y] \tag{4.32}$$

where

σ_y = the square root of the income variance, with

$\partial p/\partial DS > 0,\ \partial p/\partial FIN < 0$

$\partial p\ /\ \partial \sigma_y > 0\ ,\ \partial p/\partial_{\bar{Y}}$ and

since k is assumed to be less than one. In a Tobin-Markowitz mean-variance model, both a lower opportunity cost and a lower variance are expected. Therefore, a consumer durable is a more desirable asset, the lower the debt holding, the higher the financial asset holdings, the lower the variance in income, and the higher the expected income in that period.

4.5.4.2 Empirical Generalisation and Estimation

A SA model is then developed that incorporates this 'liquidity' model. It is tested on quarterly aggregate time-series data for consumer durable expenditure and its two component parts: motor vehicles and parts expenditures, and non-motor vehicle consumer durables expenditure (we will concern ourselves only with the former). The models are estimated over the period 1954(1) through to 1972(4), with the exclusion of quarters in which there were motor vehicle strikes. All quantities are in real per capita terms (thousands of 1958 dollars per capita) with flows as seasonally adjusted annual rates.

It will be recalled that the basis SA model as applied to the demand for

PMVs is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

and that the objective is to better determine the composition of S_t^*.

Mishkin's empirical investigation takes as its starting point the concept of 'User Cost' which assumes that a consumer durable is an asset in a portfolio that yields a return on consumption services. As such, the consumer derives benefit from the services of the stock of consumer durables and not from the flow of durable purchases as per Harberger (1960), Chow (1957), Stone and Rowe (1957), Juster and Watchel (1972). The consumer would, therefore, desire a certain stock of durables, S_t^*, which has been traditionally seen as a function of permanent income and the user rental cost of capital. However, the liquidity model also determines that, in addition, S_t^*, is a function of the value of the consumer's debt and their financial asset holdings at the beginning of the period. Therefore:

$$S_t^* = f(Yp,\ CAPC,\ DEBT,\ FIN) \tag{4.32}$$

where:

S_t^* = real per capita desired stock of durables (PMVs).

Y_p = real per capita expected average (permanent) income.

$CAPC$ = user rental of consumer durable capital $= (vAaa + r)$ $(PCD/PCON)$.

$vAaa$ = Moody's AAA corporate bond rate

r = annual depreciation rate of 0.25% per annum.

PCD = consumer durables implicit price deflator.

$PCON$ = consumption implicit price deflator.

DEBT = real per capita debt holdings of households: beginning of quarter

FIN = real per capita gross financial assets holdings of households (including demand deposits plus currency), time and savings deposits, bonds, corporate equity, life insurance and pension funds, and other miscellaneous assets): beginning of quarter.

In the derivation of *CAPC*, the nominal and not real interest rate is used. Thus the effects of inflation on consumer durable expenditure is not incorporated into the model.[16]

When both expected income and the desired durables stocks are high, a change in the user cost of capital should cause a larger dollar change in the desired stock of durables. Thus Mishkin linearised (4.32) with the coefficient of permanent income a linear function of the user rental capital cost, ie.,

$$S_t^* = a + (b + c\,CAPC)Y_P + d\,DEBT + e\,FIN + \varepsilon_t \qquad (4.33)$$

Mishkin then modelled consumer durable expenditure via the SA process. Therefore, the change in the stock, i.e., net investment, is seen as only as a fraction, λ, of the gap between the desired and actual stock at the beginning of the period. Net investment is also viewed as a function of transitory income because:

- some proportion of transitory income and hence savings should be reflected in consumer durable purchases; and
- transitory income is a proxy to some extent for perceptions of income

[16] Mishkin did attempt to estimate the effects on consumer durable expenditure but found that the use of varied distribution lags of past inflation rates is of little value; no significant effects could be found. It is argued that this is to be expected, as the impact of inflation is not clear. On the one hand, with constant nominal interest rates, inflation lowered the user rental cost of capital and encouraged durable expenditures Yet evidence from consumer surveys indicate that inflation increase consumers' perception of uncertainty

variance, which the liquidity model indicates affects the desired stock of durables and thereby net investment.

Transitory income is viewed as a cyclical variable that is related to the probability of a worker losing their job and suffering an interruption to their normal income stream. When transitory income is low, workers have a high probability of being laid off and therefore have a larger income variance, and when it is high, workers have a low probability of being laid off and have a correspondingly lower income variance.[17] If transitory income is excluded from the expenditure model and the unemployment rate is used as a proxy for income variance in its place, it enters with the appropriate negative sign which indicates that higher income variance depresses consumer durable demand. It is found to be statistically significant at the 5 percent level or higher. Therefore:

$$(S - S_{t-1}) = \lambda\,(S_t^* - S_{t-1}) + Y_t + \varepsilon \qquad (4.34)$$

where:

S = real per capita stock of durables (PMVs) at the end of the quarter,

λ = the quarterly adjustment rate,

Y_t = real transitory income per capita,

ε = additive error term,

Consumer expenditures, or equivalently, gross investment in consumer durables (D_t), equals the sum of net investment and replacement. Assuming quarterly replacement rate of δ:

(Juster and Watchel, 1972b), and thereby has a depressing effect on consumer durable expenditures.

[17] Mishkin sees the unemployment rate as a cyclical variable that reflects the probability of losing one's job and is therefore related to income variance.

$$D_t/4 = \delta S_{t-1} + (S_t - S_{t-1}) \tag{4.35}$$

where:

D_t = real per capita consumer durable expenditures (PMVs) at an annual rate.

When equations (4.32) through to (4.35) are combined, Mishkin derives the following testable empirical generalisation:

$$\hat{D}_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{P_t} + \alpha_3 (CAPC^*Y_P)_t + \alpha_4 S_{t-1} + \alpha_5 DEBT_t + \alpha_6 FIN_t + \alpha_7 NSFIN_t + \alpha_8 K_t + \sum_{t=0}^{4} \beta_t K_{t-1} + \varepsilon_t \tag{4.36}$$

where:

$NSFIN$ = real per capita non-stock market financial asset holdings of households beginning of quarter = $FIN - KT$.

KT = real per capita value of households stock market assets holdings—beginning of quarter.

ε_t = additive error term.

A priori the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_1, \alpha_2, \alpha_6, \alpha_7, \alpha_8, \beta_t, > 0$, *and* $\alpha_3, \alpha_4, \alpha_5 < 0$.

4.5.4.3 *Empirical Results*

The consumer durables demand model so presented only allows for lags in the adjustment of actual to desired consumer durable stocks. That is, no decision lags are allowed in the consumer's determination of their desired stock. Mishkin sees this as a naive assumption given that the consumer may acquire information on their user rental cost of durables only quite slowly. Therefore decisions on the desired stock of durables are likely to be influenced by past as well as present user rental costs. Capital gains or losses may not be fully considered part of the consumer's financial assets until they are realised. Movements in common stock prices, which may lead to unrealised capital gains or losses in the short run, should not have their full impact immediately; instead the valuation of common stock will affect the desired consumer durables stock with a distributed lag. The analysis tests for the possibility of such lags, by experimentation with polynominal distributed lags of the user rental cost variable and stock market financial assets. No improvement in the standard error of the regression or asymptotic t-statistics from a lag on the capital cost variable is, however, found. Notwithstanding, a substantial improvement in fit is obtained when the value of stock market assets affects the desired stock of durables with a distributed lag.

In addition, Mishkin experiments with endpoint constrained polynominial distributed lags. The best fit is obtained with a four-quarter endpoint constrained, polynominial distributed lag on stock market assets. The constraint that the sum of the *KT* coefficients should equal the coefficient of *NSFIN* is imposed.[18]

The empirical results are presented as Table 4.3. Mishkin claims the results as excellent. The parameter estimates of the debt and financial asset variables are of the right sign and are significant in all cases at acceptable decision levels. The parameter values of the lagged stock market assets also look sensible in that more recent movements in the value of stock market asset holdings have a greater impact on expenditure on PMVs than do more distant movements. The user cost of capital parameter has a significant negative impact in two of the regressions and only just fails a 10% test in the first equation. The lagged version of the estimated model

[18]The null hypothesis that this constraint is valid cannot be rejected at the 5 percent level. The asymptotic *t*-

(column 2), has a superior fit to the unlagged version (column 1). The quarterly speed of adjustment implied by the lagged model is over 12 percent; at annual rates almost 50 percent. The estimated debt and financial asset coefficients are quite large indicating that the consumer's financial position has a marked impact on the decision to purchase a PMV. As a control test Mishkin excluded debt and financial assets variables. The results, reported in column 3, are inferior to the liquidity model. The latter has a better fit, a lower standard error and a smaller autocorrelation coefficient.

4.5.4.4 Conclusions as to the Mishkin Model

Mishkin's major claim is that it is the composition of the consumer balance sheet, not the actual level of net wealth, that is critical to spending decisions. Therefore, changes in the composition of the household balance sheet, which leave net wealth unchanged can still affect the expenditure behaviour of households. For example, an increase in indebtedness, matched by an increase in holdings of nonfinancial assets that leaves net wealth constant, can still lead to a future decline in consumer durable expenditure, including that of PMVs. Alternatively, a decrease in the value of financial asset holdings, matched by an increase in nonfinancial asset holdings that leaves net wealth constant, will also lead to a decline in consumer durable demand.

We now leave the question of interest rates and consider further contributions that seek to improve the SA method by reference to additional variables impacting on the level of S_t^*. The next is a measure of a 'confidence variable' proposed by the work of Smith (1975).

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statistic is .4293. The critical t at the 5 percent level is approximately 2.

4.5.5 Consumer Demand for Cars in the USA

Smith (1975) seeks to determine the impact of consumer confidence on the determination of demand for motor vehicles. He does so by augmenting S_t^* with an additional variable that attempts to take into account the impact of expectations on the level of demand of consumer for PMVs via a discrete choice model based on car holding per household. Smith justifies examination of this factor by asserting that much of the history of the post-war US PMV market has emphasised the role of psychological and behavioural influences on the level of car demand.[19] Further, a major industry leader of the period is on record as observing that short run fluctuations in PMV sales appear to reflect variations in consumer confidence. Smith quotes Frederic G. Donner, Chairman of GM, who in 1965 made the following comment in Fortune: "I have always felt that two things make a good market for automobiles. One is the desire of people to buy a car; and the other is adequate confidence in their earning power in the future to pay for the car." (Smith: 247).

Confidence is seen as important for two reasons. Firstly, because most new motor vehicles are bought on credit. The consumer buys at a particular time with the expectation of the capacity to pay at a later date. Secondly, because the consumer has to have faith in their ability to afford the new car relative to future income and consumption as transaction costs make subsequent adjustment expensive. In order to investigate this "state of confidence" Smith considers three factors:

- what influence expectations is likely to have on car demand.

[19] Two attempts to quantify these influences are the Index of Consumer Sentiment published by the University

- how such expectations can be measured, and
- the significance of wealth expectations for the rich, given that the rich are more likely to purchase a PMV.

4.5.5.1 The Influence of Confidence on New Car Demand

Smith begins with the observation that the analysis of the influence of expectations of consumer demand typically starts with the assumption that consumption is a stable function of normal or long run average income. The marginal propensity to consume therefore reflects the relationship between current and normal income[20] Consequently, if there is, for example, an exogenous change in confidence that increases the amount of income expected in the future, the desired marginal propensity to consume out of current income will increase. However, Smith does draw a distinction between consumer responses to the likely future demand for durable as opposed to non-durable goods in this situation. He asserts that an exogenous increase in confidence about future income is more likely to lead to a subsequent continued increase in consumer expenditure on durables such as PMVs, rather than in non-durable spending. The contention therefore is that car purchases reflect the ability to make both the immediate capital outlay and the belief in future prosperity that justifies it.

4.5.5.2 Measurement of the State of Confidence

While the state of confidence is, in itself, unobservable, some attempt has to be made to measure it in order to obtain some quantitative estimate of its effect on car purchase. This can be done on the basis of theory as it applied to expected income or on the basis of the direct interrogation of consumers. Smith employs

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of Michigan and The Buyers of New Automobiles issued by US News.

[20] See Farrall (1959) who points out that an individual's marginal propensity to consume out of current income

both approaches. The theoretical exposition suggests that expected income is a weighted average of the past values of actual income (Friedman 1957). This estimate of expected income is designated as 'permanent income', in order to distinguish it from other estimates. Friedman suggests current income will have the largest influence on permanent income and earlier incomes successively declining weights. (In practice, geometrically declining weights which sum up to unity were used). Hence, if Y^* is permanent and Y actual income:

$$Y_t^* = \beta \sum_{j=0}^{\infty} (1-\beta)^j Y_{t-j} \tag{4.37}$$

Smith finds this formulation appealing for a number of reasons. Firstly, only a single coefficient β needs to be supplied or estimated. Secondly, the formulation can be derived from a simple and plausible model of expectations adapted to unforeseen developments. That is, expected income in the next period can be adjusted proportionally to the difference between actual and expected income in the current period, ie.

$$Y_{t+1}^* - Y_t^* = \beta(Yt - Yt^*) \tag{4.38}$$

Thirdly, it has been shown by Mincer (1969), that such forecasts are optimal linear predictions, in the sense of minimising the mean square error of forecast for certain types of time series. Therefore, permanent income is seen as merely a distributed lag of past actual income. The difference between actual and permanent income is referred to as transitory income.

Under this permanent income definition, expectations are stabilising, since β is a constant and the weighted average of past incomes is likely to be more stable

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will be dominated by the elasticity of expectations which relates estimated normal income to current income.

than current income. However, Smith surmises that this is an implausible conclusion given that expectations are clearly subjective and a substantial amount of variation will be expected to result from psychological and social influences on confidence. That is, waves of optimism or pessimism sway that most marginal of decisions, whether to replace a not very old car. These waves of optimism or pessimism need not be a response to changes in the estimate of the mean of the distribution of expected earnings, for even if that does not change, movements in the perceived distribution of possibilities about it could be important. For example, the variance of the distribution of expected earnings could increase, and people will be less sure about what income they will receive. Alternatively, the distribution may become more skewed, and it may be felt that very good things are unlikely but that all sorts of horrible things may turn up. Both these factors will influence the confidence with which people consider a future decision that would commit them well into the future.

Further, Smith contends that it is implausible to suppose that the estimate of mean income are derived solely from a simple extrapolation, for a further, perhaps more important reason. This is, the consumer always have more information available to them than simply the past value of income. They have information as to the stage of the business cycle, government policy, feelings of business confidence, and the general state of the economy, all of which come together as a generic 'state of the news'. As a consequence, consumer confidence is more likely to be influenced by the prosperity of the whole economy (as measured by some aggregate variable like unemployment), than by possibly arbitrary fluctuations in individual economic circumstance.[21]

Smith thereby concludes that increased demand for consumer durables not only responds to news of government action, but also precedes the increase in income that results from the tax cut. That is, the increase in demand is primarily a response to an improvement in confidence. This 'state of the news' will determine whether the consumer treats a particular unexpected receipt (overtime pay, bonus, stock market gain), as being merely transitory income (the difference between current and permanent income), or as an income flow that is likely to continue and thus as part of normal income. This causality is in direct contradiction to that indicated by the traditional extrapolation models. Estimates of future income based on aggregate variables were then nominated as 'confidence measures'.

The second method of determination of consumer attitude is via the direct interrogation of consumers. Smith suggests that "Anticipation Surveys" (where consumers are asked a series of questions that related to their expectations), is an additional proxy for expected income. Pickering *et al.* (1973) utilises such an approach to investigate the measurement of consumer confidence in the UK and suggests that there are at least two dimensions to that state of confidence:

- a personal judgement of economic conditions and their impact on the economic status of the respondent and
- durable buying intentions and the financial implications of purchase.

There is a considerable literature on the advantages and disadvantages of

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[21] Following the announcement of the foreshadowed February 1965 tax cut in the USA, Katona and Mueller (1968) show that expenditures on durable goods and the incurrence of installment debt increased in the winter of 1963-64 due to anticipation of the tax cut which was seen as ensuring an improvement in business confidence.

this type of data. A typical conclusion is that of Juster and Watchel (1972), based on an analysis of aggregate quarterly data for motor vehicles and other durables. Juster and Watchel find that survey measures of purchase expenditures combined with systematic changes in consumer sentiment seem able to replace the influence of income and all adjustment lags in a complex objective model. However, it does not appear that anticipatory variables reflect the influence, on purchases of movements in the relative prices of durables. This is possibly because they are largely unforseen.

4.5.5.3 The Significance of Wealth Expectations for the Rich

Smith then moves the analysis to an area that has intuitive appeal. That is, to determine the influence of factors such as expectations and attitudes on the PMV expenditure patterns of consumers who are differentiated on the basis of income. Households are ranked into quintiles by pre-tax money income. The quintiles are numbered 1 (the poorest), to 5 (the richest). The empirical investigation consists of a number of equations which seek to isolate the impact of consumer confidence (with particular reference to impact of a range of macroeconomic variables and the 'state of the news'), on the PMV expenditure patterns of each quintile. However, as the rich are seen as the group most likely to purchase PMVS, the inquiry concentrates on the behaviour of the top quintile

4.5.5.4 Empirical Generalisation and Estimation

Recalling the basic SA model as applied to the demand for PMVs formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

Smith seeks to make a contribution toward a better understanding of the variables implicit to S_t^* through the impact of an additional 'attitude' variable. The model is formulated as:

$$D_t = f(Y_t\ ,\ Y_p,\ Y_{Tt}, Y_{dt}\ A_t,\ GNP_t,\ U_t,\ D_t) \tag{4.39}$$

where for some time period *t:*

D_t = average new car purchase frequency of households in a particular quintile.

Y_t = the average pre-tax income of a household in that quintile, deflated by the consumer price index.

Y_{pt} = permanent income for a particular quintile, assuming $\beta = 0.4$

Y_{Tt} = transitory income for a quintile, (Y*-y)

A_t = the Michigan SRC index of consumer 'attitudes' for all households

Y_{Dt} = aggregate personal disposable income at constant prices

GNP_t = gross national product at constant prices

U_t = the average unemployment for the whole economy

ΔP_t = the change in the new car price index.

Function (4.39) may be rewritten as:

$$\hat{D}_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 Y_{Pt} + \alpha_3 Y_{Tt} + \alpha_4 A_t + \alpha_5 Y_{Dt} + \alpha_6 GNP_t + \alpha_7 U_t + \alpha_8 \Delta P_t + \varepsilon_t \tag{4.40}$$

A priori the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6 > 0$, and $\alpha_7, \alpha_8 < 0$.

Smith performs a wide range of regression tests. The results are quite varied. The best outcome is achieved by equations that incorporate "confidence" variables as explanators. These are pre-tax income (Y_D), attitudes (A) and unemployment *(U)*. Such regressions are run on five separate income quintile groups. In addition, the consistent performance of A, U, and Y_d, leads Smith to interact some of these terms to test hypotheses about whether they may multiplicatively provide a better explanation. The best performing of the interaction terms is a regression that interacts A with U. This combination emphasises the importance of attitude to the rich as the effect of income decreases and attitudes increase, as an individual moves up the quintile. Smith feels however that, generally, the results are a little disappointing. The R^2 levels across all quintiles (except possible quintile 3), are discouraging.

From the multitude of results generated by Smith, Table 4.4 reports a sample for five separate quintile regressions using the parsimonious selection of the regressors. In the poorest quintile regression the confidence variable, A, enters with the wrong sign but is not statistically significant. The diagnostic statistics also indicate some difficulty with this set of regression results and it may be that this modelling framework is less relevant to individuals at the lowest end of the income distribution.

4.5.5.5 Conclusions as to the Smith Model

Smith finds that car purchases will be sensitive to variations in the state of consumer confidence, especially for the wealthy. Further, he suggests that indicators of consumer sentiment and some macro-economic variables are likely to provide some evidence of consumer confidence. Consumers influenced by such considerations are unlikely to base their expectations on extrapolations of past income. As a consequence, Smith determines that there are no stable short run demand functions for motor vehicles. Short run demand is dependent on the consumer's timing of acquisition and replacement, which in turn will vary in response to the state of confidence or expectations. These expectations are not based on a fixed extrapolation of past income, but on a subjective evaluation of the 'state of the news'. Hence, they are subject to all sorts of social and psychological influences. The state of confidence is also very volatile and subject to sudden and violent change. The rich, with their greater economic freedom to manoeuvre, can easily respond to changes in their expectations, whilst the poor, constrained by their income, can not. Because new motor vehicles are largely the prerogative of the rich variations in expectations are rapidly transformed into fluctuations in new car sales.

We now expand the analysis by reference to a further contribution that seeks to expand the determination of factors influencing the demand for PMVs to incorporate psychological influences beyond that of consumer attitudes.

4.5.6 Anticipatory and Objective Models of Consumer Demand.

This contribution also seeks to augment S_t^* by reference to psychological factors that may influence consumer demand patterns for PMVs. However, unlike the Smith analysis that considers the impact of 'attitude', Juster and Watchel (1972) consider a subtle variation on the theme. This involves the impact of consumer 'anticipations' on the propensity of households to acquire consumer durables such as motor vehicles. In the first instance, a nonanticipatory (Objective) model of consumer durable demand is developed. The performance of this Objective Model is then contrasted with one based largely on the use of survey measures of consumer anticipations (Anticipatory model). In the final section, an examination of an optimal model that combines both types of information is undertaken.

The Anticipatory model is held to consist of both purchase intentions and attitudes. Purchase intention is viewed as the direct measure of the difference between beginning of period stocks and planned end of period stocks. It is suggested that, in principle, purchase intentions can substitute fully for the planned investment of the objective model. However, the role of the attitude variable is not as clear. Nevertheless, it is suggested that intentions are an imperfect measure of the difference between planned and actual stocks and that attitudes serve to modify or correct that measure. Juster (1969) finds that attitudes and lagged intentions are the best predictor of purchase rates of households classed as nonintenders. Hence both intentions and attitudes make significant contributions to an explanation of aggregate purchase rates; intentions reflect variations in intender purchase rates, while attitudes picked up variations in purchase rate of nonintenders.

4.5.6.1 Empirical Generalisation and Estimation

Recalling the basic SA model as applied to the demand for PMVs formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

Juster and Watchel seek to make a contribution toward a better understanding of the variables implicit to S_t^* through the impact of consumer 'anticipations' which incorporates a purchase 'intention' and 'attitude' variable. The Anticipatory model, with unemployment incorporated as a transitory component is formulated as:

$$X = a_0 + a_1 p + a_2 A + a_3 U \tag{4.41}$$

where:

X = the purchase rate

p = intentions

A = attitudes

U = unemployed man-hours

A priori the following patterns of signs for the independent variable parameter estimates are expected:

$a_1, a_2, > 0, a_3 < 0$[22]

The work therefore modifies the traditional SA model in that a specific adaptive process for the formulation of household's expectations is incorporated into a model to yield a second-order distributed lag equation. This contains in addition to the variables, a change in the lagged stock term. (Survey measures of consumer purchase expectations are interpreted as a subjective estimate of the difference between actual and desired stock. Reported purchase expectations are therefore a reflection of the speed of the adjustment process as well as of the underlying determinants of desired stock. Survey measures of consumer attitudes (optimism, pessimism), are interpreted as one of the factors of influence in the desired stock function).

Although this approach has merit and may provide an interesting insight into PMV expenditure patterns, there is an insurmountable problem with regard to emulating the study for Australia. That is, data on purchase intention as distinct from attitude is simply not available in Australia. A very limited pool of information that relates purchase intention in terms of expenditure on a limited

[22] Juster and Watchel's results will not be reported as the authors presented them in a form whereby the coefficients of each regressor are not detailed . Only the individual t ratios of each regressor and the standard error for the whole equation are documented. Therefore, it is not possible to calculate the individual coefficients

range of household expenditure is available. However, this has been collated only since 1995 and does not, in any case, cover expenditure on PMVs. A further interesting analysis is one that incorporates both the impact of attitudes and expectations and the availability of credit. This is the contribution of Briscoe (1977).

4.5.7 On the Prediction of Consumer Durable Demand.

The point of particular interest in this analysis is that Briscoe undertakes an analysis of these factors in times associated with a great deal of uncertainty caused by hyper-inflation. As Australia did not experience excessive inflation during the period under review, it may be contended that this study is of limited value to an exposition of PMV demand in Australia over that time frame. In addition, reference has already been made to the lack of suitable expectational data for Australia. However, we contend that the exposition is of some value to our study. It provides evidence of the need to treat attitudinal factors cautiously when determining the factors influencing consumer demand for durables including that of PMVs.

4.5.7.1 Empirical Estimation and Generalisation

Recalling the basic SA model as applied to the demand for PMV's formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \qquad (4.1)$$

Briscoe seeks to make a contribution toward a better understanding of the variables implicit to S_t^* through determining, in times of hyper-inflation, the impact of attitudes and expectations on the demand for consumer durables

of each regressor.

including PMVs.[23] This expectational model is formulated as:

$$New\ Car\ Registrations,\ NCR = f(\Delta D_1,\ B_t) \tag{4.42}$$

where:

ΔD_1 = Changes in hire purchase debt outstanding.

B_t = Measured time-to-buy expectations at time period t.

and estimated using Cochrane -Orcutt method.

This model can be represented empirically as:

$$NCR_t = \alpha_0 + \alpha_1 H_t + \alpha_2 B_0 + \alpha_3 B_1 + \alpha_4 B_2 + \varepsilon_t \tag{4.43}$$

where:

H = Dummy variable for hire purchase restrictions

A priori the following patterns of signs for the independent variable parameter estimates are expected:

$\alpha_1 < 0$, α_2, α_3, $\alpha_4 > 0$ for Equation (4.43)

4.5.7.2 Empirical Results

Dependent Variable	Independent Variables	Estimation Technique	R^2	F	DW
New Car Registrations	ΔD_1 , B_2	OLS	0.73	14.44	2.19
New Car Registrations	H, B_0, B_1, B_2	COI	0.99	14.5	2.20

Note: F is the generalised F statistic.

Briscoe finds, in accord with earlier studies of Juster and Watchel (1972) and Smith (1975), that a simple expectational model formulated in terms of a few variables will produce good results if consumer expectations can be measured with reasonable precision. These results are on a par with those obtained from a

[23] Briscoe also incorporated the cost and availability of credit as factors of influence in determining the demand

complex model that is fully specified in terms of traditional economic determinants. Briscoe's expectational model compares well (but is not superior), to a standard SA approach both in terms of its historical explanatory power and predictive efficiency. Therefore he does sound a note of caution. That is, his results are obtained in a period of recent high consumer uncertainty. In this situation it may well be supposed that traditional economic models will perform particularly badly. Thus, Briscoe's findings do indicate that expectational models do not do significantly better than there more conventional counterparts even in periods where intuition would suppose a degree of superiority for the former over the latter. Such a finding therefore suggests, at best, a very circumspect acceptance of models based solely on anticipatory data

4.6 Efforts to Improve the Short term Adjustment Mechanism Implicit to the SA Model.

We now turn our attention to the second area of concern as to the SA method. This involves the short-term adjustment mechanism implied by the formulation. Efforts to reshape the traditional expression of the SA short-term adjustment mechanism were prompted by concerns as to its accuracy. Attempts to improve the precision of the adjustment mechanism often involve the explicit definition of a variable that may be expected to fashion short-term demand. Two such examples are the rate of transitory income, Juster and Watchel (1972), and the level of unemployment, Westin (1975). These variables have an extensive history of use in automobile demand studies as per Chow (1960), Houthakker and Haldi (1960), Friend and Adams (1964), and Wu (1965).

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for consumer durables. This will be examined later.

4.6.1 Transitory Income

The Juster and Watchel (1972) analysis is of further interest because, although primarily concerned with the impact of consumer sentiment and purchasing intention on the demand for consumer durables, it also considers the role of transitory income as a catalyst to shifts in the short-term adjustment process of consumers. Transitory income can be defined as the difference between current and permanent income. Transitory income is therefore a cyclical variable that is related to the probability of a worker losing their job and suffering an interruption to their normal income stream. When transitory income is low, workers have a high probability of being laid off and therefore have a larger income variance. When transitory income is high, workers have a low probability of being laid off and therefore have a correspondingly lower income variance. It is of general interest that there was some debate as to the necessity to divide income into its permanent or transitory components. Chow (1960), Houthakker and Haldi (1960) and Wu (1965), argue that since the regression coefficient of current transitory income is not significantly different from the regression coefficient of permanent income in their studies, the division of disposable income into permanent and transitory components is irrelevant[24]

Juster and Watchel find that the results for transitory income proper are unsatisfactory in that, although correctly signed, they do not satisfy the magnitude tests. In general the results indicate a lagged rather than an immediate influence on stock change. Therefore, transitory income is held to not greatly improve an understanding of the factors likely to shape short-term demand.

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[24] It is of interest that subsequent to the Juster and Watchel (1972) paper, Westin (1975) assert that such a conclusion misses the essential point of Friedman's argument. That is, transitory income affects purchase

As compared to transitory income a more relevant and influential determinant impacting on the short-term adjustment mechanism of PMV consumers may be the level of unemployment. This variable is the subject of analysis by Westin (1975).

4.6.2 Empirical Implications of Infrequent Purchase Behaviour in a Stock Adjustment Model

Westin (1975) develops a 'discretionary replacement' model (hereafter the DR model), in the specific context of the demand for PMVs, which is advanced as an alternative to the SA construction. The DR model nominates the level of unemployment as a critical variable in determining shifts in short-term adjustment rates. The analysis rejects the basic premise of the SA model that replacement demand is proportional to net stock holdings. Rather Westin argues that many holders of durables have no intention of entering the market. Consequently, they do not translate the loss of service on the present stock of durables into effective demand for new stock. Accordingly, the composition of the purchasing public is held to frequently change from one period to the next. As a consequence, a DR that allows for the possibility of short-run variations in the normal timing of replacement is developed. In addition, in order to determine total demand, Westin contends that there is also the need to account for 'non-replacement' demand in addition to replacement demand.[25] This non-replacement demand is determined by economic variables such as income, relative prices and the existing stock of PMVs. The model is formulated as:

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timing, while permanent income affects gross investment.

[25] Non -replacement demand may arise from new entrants into the market, multiple car ownership and buyers who "trade up" and become new car buyers.

$$D_t = D_t^* + \sum_{i-1}^{T} (\alpha_i - \gamma_i) V_{t-1} + \beta (B_t - B_{t-1}) \tag{4.44}$$

where:

D_t = the number of new motor vehicles purchased in time t

D_t^* = non-replacement demand

γ_t = the saturation effect of the existing stock on non-replacement demand.

V_{t-1} = the number of cars of vintage $t-1$ existing in period t.

B_{t-1} = a vector of discretionary variables.

Aside from minor differences in the dependent variables and the interpretations of the coefficients, the SA and DR models are equivalent except for the addition of the term $\beta\ (B_t - B_{t-1})$ to equation (4.44). As current discretionary variables are included in the traditional SA models of new car demand, the unique feature of the DR model is the inclusion of lagged discretionary variables. If the DR model is superior to the traditional SA model, the coefficients of the lagged discretionary variables should be opposite in sign and roughly equal in magnitude to the coefficients of current discretionary variables. In addition the coefficients of the existing stock variables should be positive or close to zero.

4.6.2.1 Empirical Generalisations and Estimation

Recalling the basic SA model as applied to the demand for PMVs formulated by Rippe and Feldman is:

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

Westin seeks to make a contribution by improving the accuracy of the short-term adjustment mechanism implicit to the model. The model specified by equation (4.44) is estimated by Westin using data from the period 1953-72 with data from 1951 and 1952 used to give starting values of the lagged discretionary variables. The DR model has, as its dependent variable, total new passenger retail sales. The discretionary variables are the unemployment rate, an index of consumer sentiment and transitory income. These variables have an extensive history of use in automobile demand studies.[26] The variables used to explain non-replacement demand are disposable and permanent income and the relative price of new automobiles. A dummy variable representing strikes is added to all equations

where:

$$\hat{D}_t = \alpha_0 + \alpha_1 Y_{dt} + \alpha_2 Y_{Pt} + \alpha_3 PCR_t + \alpha_4 U_t + \alpha_5 ATT_t + \alpha_6 Y_{Tt} + \sum_{t=0}^{T} \beta_i Z_{t-1} + \alpha_7 U_{t-1}$$

$$+ \alpha_8 ATT_{t-1} + \alpha_9 Y_{t-1} + \alpha_{10} \Delta U_t + \alpha_{11} \Delta ATT + \alpha_{12} \Delta Y_t + \varepsilon_t \qquad (4.46)$$

where

Y_d = Disposable income (1958 dollars).

Y_p = Permanent income (1958 dollars).

PCR = Relative price of new cars

U = Current unemployment rate

ATT = Current index of consumer sentiment

Y_t = Current transitory income

Z_I = Number of cars in use on January 1 of vintage i years old

Δ = the change operator

A priori, the following patterns of signs for the independent variable parameter estimates are expected:

[26] See for example, Friend and Adams (1964), Juster and Wachtel (1972), Smith (1974).

$\alpha_1, \alpha_2, \alpha_5, \alpha_6, \alpha_7, \alpha_{11}, \alpha_{12} > 0, \alpha_3, \alpha_4, \alpha_8, \alpha_9, \alpha_{10} < 0.$

$\beta_i > 0$ for small i and < 0 for large i.

In order to judge the contribution of the lagged stock variables to the estimation equations, the F-statistic is used to test the joint hypothesis that the coefficient of the lagged variable should be opposite in sign and equal in magnitude to the coefficient of the current value of the discretionary variable.

Comparisons with the SA model show that Westin's DR approach, in fact, adds little additional input to an understanding of the factors influencing the demand for PMVs. It is true that when entered as first differences, the discretionary variables give coefficients of the lagged stock variables that are small and positive for the newest stock. This factor is held to be the most important contribution of the DR model in that it achieves as good a fit as the traditional SA model while implying that the powerful inventory effect postulated by the SA model is insignificant. However this factor aside,[27] an examination of the goodness of fit statistics, R^2, and the standard error of the equation, shows the DR model has only a slightly better fit to the data than the SA model. Therefore, as stated, the DR model provides little new to the debate as to the forces influencing the demand for new motor vehicles.

4.6.2.2 Conclusions as to the Westin DR Model

The Westin thesis suggests that the appropriate theoretical specification for aggregate demand models should be a discrete purchase model rather than a continuous adjustment model. The key issue is seen as the concept of substitution in use between new and old durables. The assumption that very new stock

[27] Such results for the DR model were not able to be reproduced in the Australian context.

depresses new purchases because it was a good substitute in use requires the strong supposition that the distribution of stock amongst individuals is irrelevant. As an alternative to this assumption, Westin stresses that recent purchasers are not the same people as those who are currently entering a market and that the stock holdings of recent purchasers are thereby may be irrelevant for the prediction of current demand.

Whilst this approach has theoretical intuitive appeal, in point of fact the results achieved were not significantly different from those of the SA model. In particular, the use of unemployment and consumer sentiment variables in the DR model is well covered by the SA approach. A further consideration of particular interest is that we were not able reproduce the role for stock as per the Westin DR model when considering the Australian demand for PMVs over our window of interest.

4.7 A Summation of the Contribution of Selected Researcher's to the Development and Application of the SA model to the Demand for PMVs

Each of the contributions noted has sought to model the demand for PMVs under the general umbrella of the SA model. The SA model was first developed as a means to estimate the demand for consumer durables by Stone and Rowe (1957). The approach was soon adapted to the demand for PMVS . We have noted a typical formulation as that of Rippe and Feldman (1976). However perceived problems as to the scope and application of the model to the demand for PMVs led to many efforts to refine and augment the approach. In particular, concerns as to the determination of the level of desired stock led a number of researchers to expand the parameters of the desired stock equation. Others were concerned as to the short-run adjustment mechanism implicit to the theory. Whilst each researcher lays claim to a significant improvement upon the basic SA model it remains an empirical question as to whether such claims will hold in the Australian context. This will be determined in the next chapter.

Notwithstanding such efforts to improve the application and scope of the SA model in the context of the demand for PMVs, there are areas of more trenchant criticism of the SA approach. These culminate in a rejection of the SA method itself and the advocacy of alternative approaches to the modelling of the demand for PMVs. It is to these areas that we now turn our attention.

4.8 Criticisms of the Stock Adjustment Model and the Development of Alternative Approaches to Modelling PMV Demand

The SA approach is not the only approach that has been used to model PMV demand. For example two alternative approaches have been developed because of specific criticisms levelled at the SA approach. Some researchers consider that the SA model is inadequate for one or more of the following reasons:

- the failure of the SA approach to draw a distinction between the market for new PMVs against that for used PMVs.
- the lack of consideration in the model for the effects of budget constraints on the total demand for consumer durables.
- the fact that the approach gives no consideration to 'market saturation'.

The User Cost model seeks to accommodate the first criticism by the incorporation of an explicit distinction between new PMVs (seen as superior goods), and used PMVs (seen as inferior goods). The User Cost model also responds to the second criticism via an approach that accepts the neo-classical assumption that the consumer will strive to allocate their budget amongst a number of possible alternatives in order to achieve optimisation of utility. The third criticism has led to the development of a Structuralist model to incorporate the concept of market saturation.

In the following sections we will introduce the alternative models that have been suggested as superior alternatives to the SA model and discuss the essence of these criticisms.

4.8.1 The User Cost Approach

As we have seen, the User Cost approach posits that consumers derive utility from the services provided by durables and that it is the price of the services, rather than the purchase price of the durables, that determines the flow they will consume. The User Cost model is, therefore, a standard neoclassical maximisation model than can be applied to the determination of the demand for durable goods such as PMVs. In that context, the user cost of a PMV is also termed the implicit rental price of a car and is seen as the opportunity cost of holding the car plus the loss value of the car over the year. In a competitive market with relatively small transaction costs and competitive capital markets, imputed rental prices, derived from current market prices, represent the marginal utilities of the vehicles' current flow of services to the utility maximiser. The User Cost approach has been seen by a small group of authors as providing a more relevant definition of the price and cost variable, as they apply in the modelling of PMV demand, than has the more general SA model. We will return to whether this is a theoretical or empirical criticism below.

A perceived weakness of the SA model is its failure to deal with the distinction between the market for new products as against that of the used-product market. The seminal User Cost model is that of Wykoff (1973) who built upon the earlier contribution of Suits (1958). Suits contended that the market for PMV demanded could be segmented as follows:

- the demand for new cars by the public.
- the supply of new cars by retail dealers.
- the supply of used cars by retail dealers
- the demand for used cars by the public.

4.8.1.1 The Theory Behind the User Cost Model

Wykoff (1973) begins by noting that the SA model assumes, in the case of motor vehicles, that new car purchases are simply acquisitions to the existing stock. The rate of acquisition is therefore the difference between the existing stock retained and the desired level. As such, the SA model is dependent on the assumptions that all motor vehicles provide essentially the same service (simply that of private transportation), and that therefore all motor vehicles are perfect weighted substitutes for each other. These assumptions in turn imply that the prices of perfect substitutes move together, and that consumers are indifferent between them. Wykoff challenges this view.

In contrast to the hypothesis that all motor vehicles are perfect weighted substitutes, Wykoff contends that the services of new motor vehicles are considered by consumers to be qualitatively superior to those of used motor vehicles. Therefore, new car purchases should not be seen merely as additions to the existing stock. Rather, they reflect the demand for a unique commodity, new car services, measured independently of the existing stock of used motor vehicles. This view led Wykoff to construct a 'superior goods' model.

A further feature of the User Cost approach is the assumption, that in general, rental markets for durables are undeveloped, so consumers must own the durables in order to consume the desired services. However, if resale markets are extensive and sufficiently competitive, owners can act as if they were renting to themselves, since they always have the option of selling. Given a competitive resale market for cars, Wykoff assumes car owners can act as if they were renting to themselves as they do have the option of selling. Further, since many owners are paying off their motor vehicles they will be very aware of the current cost of ownership.

Under these conditions the implicit user cost, or rental price, of an *s*-year-old car in year *t*, *c(s, t)*, can be shown to have the following relationship to market purchase price and interest rates:

$$c(s,t) = r(t) \cdot p(s,t) + p(s,t) - p(s+1,t+1) \tag{4.46}$$

where:

p(s, t) = the purchase price of an *s* year-old car in period *t*.

r (t) = the market interest rate

The User Cost, or implicit rental price, of a car over a year therefore, is the opportunity cost of holding the car plus the loss value of the car over the year.

A key feature of Wykoff's User Cost model is the use of the 'superior goods' hypothesis developed in an earlier work (Wykoff 1970). Given that the following specifications of the superior goods model are taken as given:

- new car services are superior goods relative to used car services and
- private transportation is a necessity,

Wykoff uses a survey of depreciation patterns to support the view that new motor vehicles are qualitatively superior to used motor vehicles. The analysis therefore contends that, as incomes increase, the demand for new car service demand will increase faster than used car service demand, Thus, the former's value will rise relative to the latter. If no significant differences in substitution occurs within the homogeneous stock of used motor vehicles between services from vehicles of different vintages, then, as incomes increase, depreciation rates after the first year will remain unchanged (including scrappage rates), while new car depreciation rates will increase. These are observable trends in the post-WWII US market to 1973 and are used by Wykoff to support the contention that new motor vehicles are superior to used motor vehicles.

Used motor vehicles will, however, influence the demand for new motor vehicles through their implicit rental price as inferior substitutes. Therefore, if the number of new motor vehicles held is proportional to the flow of services consumed, the demand for new car services A is:

$$A = A(Y, C, U, Q,) \tag{4.47}$$

where[28]:

Y = the consumer's income constraint

C = the User Cost of a new car

U = the User Cost of a used car

Q = a price index for all other good.

Whilst used motor vehicles are not perfect substitutes for new ones, it is assumed that they are perfect substitutes for each other. The constancy of used car depreciation is consistent with this assumption and is maintained throughout the

[28] The analysis, for the moment, ignores problems of heterogeneity of cars because of differences of make and

analysis. This assumption is almost universal in automobile demand studies with the exception of Farrell (1954). Furthermore, it is argued the depreciation patterns imply that used motor vehicles are homogeneous in that they depreciate at a constant fixed rate. Therefore, there is no reason to believe that motor vehicles of different vintages would be treated differently by consumers.

It is acknowledged, in the superior goods model, that the used car stock can not be explained merely as a residual of new car purchase decisions of the past, since new and used motor vehicles are not perfect substitutes. However, the number of used motor vehicles is seen as essentially a residual of previous decisions, even though the market value of the used stock depends on current conditions. Therefore, the rental price of used motor vehicles, not the stock, is determined endogenously from income, new car rentals, the existing stock of motor vehicles, and the prices of other goods.[29]

$$U = U\,(Y,\ C,\ Q,\ S) \qquad (4.48)$$

Equations (4.47) and (4.48) represent the superior goods model.

Wykoff then constructs an approach to determine the level of new and used car stocks. The simplest method of aggregation for used motor vehicles is to count them. But the analysis claims that this is no better than totalling apples to oranges, as a car's ability to provide consumer services depends on its age. Therefore, each used car is translated into a one-year old equivalent and aggregated. The resultant sum gives a well defined commodity; the stock of one-year old equivalents. The weights used in the homogenising process are derived from User Cost theory.

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model. Furthermore, one price, U, represents the price of all used cars.

[29] Since used motor vehicles are assumed to be perfect substitutes, a single price index, U, adequately represents the price of used motor vehicles.

Since $c(s, t)$ is the in-use value of an s-year-old car in period t, $c(s, t) / c(1, t)$ is the value of that car relative to a one-year old car in that period. The ratio thereby measures the fraction of the market value of a one-year-old car that this given car was still worth. That is, $c(s, t) / c(1, t)$ is the ratio of the marginal utilities of the two commodities. Thus, the actual weight for a model-m, s-year-old car is the ratio of its rental price $c(m,s,t)$ to that of say a one-year-old Ford, $c(f,1,t)$, choosing Ford arbitrarily as numeraire.

The used car stock, measured in one-year-old Ford equivalents, in year t, $S(t)$ is:

$$S(t) = \sum_{m} \sum_{s=1} S(m,s,t) \cdot c(m,s,t) / c(f,1,t) \tag{4.49}$$

where

$S(m,s,t)$ = the stock of model-m s-year-old motor vehicles in year t.

The analogue for new car purchases $A(t)$ is:

$$A(t) = \sum_{m} A(m,t) \cdot c(m,t) / c(f,t) \tag{4.50}$$

where :

$a(m, t)$ = the quantity of new motor vehicles purchased in year t

$c(m,t)$ = their rental price

$c(f, t)$ = the rental price of a standard Ford in year t

The SA model is held to differ from the superior goods model (4.47) and (4.48) only in the assumptions made as to the relation between new and used motor vehicles. The SA model, as we have seen, does not distinguish between the two markets. The user cost model devised by Wykoff gives the desired demand for motor vehicle services and therefore measures the market for new cars, $A(t)$, as distinct from the market for used cars, *S(t)*. As such, Wykoff lays claim to a preferred model.

4.8.1.2 The Empirical Generalisation of the User Cost Model.

The empirical generalisation of the User Cost Model is represented in two parts: the 'superior goods' model and the used car model. The superior goods model is represented by the two equations:

$$A = A\ (Y,\ C,\ U) \tag{4.51}$$

$$U = U\ (Y,\ C,\ S) \tag{4.52}$$

Equation (4.51) is the demand for new car purchases measured in homogeneous units: new Ford equivalents; with equation (4.52) as the demand for used cars. The rental price of used cars *(U)*, is the endogenous variable since the number of used cars, *S*, measured in one-year-old Ford equivalents, is predetermined. The market, therefore, determines the value of the stock or its price. Equations (4.51) and (4.52) are derived from equations (4.47) and (4.48) respectively, by assuming homogeneity in money income and prices. Therefore *Q*, the consumer price index, divides *Y*, *C* and *U* in (4.51) and (4.52). Equations (4.51) and (4.52) are studied in a variety of functional forms. However, Wykoff details only the log-linear or constant elasticities equation.

$$\textit{Rental Prices: } InA = F(InY,\ InC,\ InU) \tag{4.53}$$

where:

lnA = log of new car purchases;

lnY = log of income;

lnC = log of new car rental price

InU = log of used car rental prices.

Purchase Prices: InA =f(InY, InP, InUP) (4.54)

where:

lnP = log of new car purchase price

$lnUP$ = log of used car purchase price

The empirical generalisations of the two equations are:

$$Ln\hat{A} = \alpha_0 + \alpha_1 lnY + \alpha_2 lnC + \alpha_2 lnU + \varepsilon_t \quad (4.55)$$

$$Ln\hat{A} = \beta_0 + \beta_1 lnY + \beta_2 lnP + \beta_2 lnUP + \varepsilon_t \quad (4.56)$$

A priori, the following patterns of signs for the independent variable parameter estimates are expected:

(1) Rental Prices: α_1, $\alpha_3 > 0$, $\alpha_2 < 0$,

(2) Purchase Prices: β_1, $\beta_3 > 0$, $\beta_2 < 0$,

To test the User Cost model the rental price coefficients *(α)* in equation (4.55) are compared to the purchase price coefficients *(β)* in equation (4.56). Wykoff reports that unambiguous conclusions can not be drawn from his results. However, rental prices do compare favourably to purchase prices. The rental price coefficients are smaller than those of the purchase prices and also have much smaller standard errors. Rental price elasticities are smaller and the estimates more precise than those of the purchase prices.

Wykoff draws a number of general conclusions about new car demand based on his regression tests of (4.55) and (4.56). These include that:

- point estimates of new car income elasticities are about unity. They ranged from 0.9 to 1.1.
- new car rental elasticities are consistently smaller than purchase price elasticities. The former are inelastic (-0.41 to -0.43) and the latter are

elastic (-1.6 to -1.7).

- cross-elasticities display a pattern similar to own price elasticitities. New demand is rental price inelastic (0.45 to 0.47) and purchase price elastic (2.1 to 2.3).

Wykoff concedes that the exploration of used car demand is considerably less satisfactory than that of new car demand. However, in our view there is a much more salient criticism of the Wykoff method than the failure to adequately determine the demand for used cars. Central to the Wykoff criticism of the SA approach is the need to distinguish between the demand for new cars as against the demand for used cars. The failure of the SA model to incorporate such delineation is held by Wykoff to seriously comprise the approach. Unfortunately, Wykoff himself fares badly in this regard. His results suggest that the null hypothesis that new and used cars have the same income elasticities can not be rejected. This theme will now be further developed.

4.8.1.3 The Relationship Between New and Used Motor Vehicles.

The implicit thesis of the SA model treats new and used motor vehicles as perfect substitutes. Therefore, purchases of new motor vehicles can be treated simply as additions to the existing stocks of motor vehicles. Wykoff challenges this assertion via the User Cost model, on theoretical and empirical grounds.

As noted, the User Cost approach assumes that consumers view new motor vehicles as superior to used motor vehicles and that private transportation is a necessity. A number of suppositions to support the contention that new motor vehicles are superior to used motor vehicles are presented. It is argued that 'newness' in PMVs is important to the consumer for at least two reasons. The first is aesthetic, the feeling of freshness, the enjoyment of having the latest gadgets and safety features, the pride of driving the latest model etc. The second is that consumers who bought new motor vehicles avoid the problems often associated with the purchase of a used car. These could include finding a trustworthy used car dealer, the lack of knowledge as to how the car was treated by its previous owner or whether the odometer had been reset, the 'fine-print' of the guarantee etc. In short, buying a new car requires less expertise and involved fewer risks than buying a used car.

It is of interest that this latter explanation for new car preference suggests an engaging test of the User Cost formulation. If new car prices contain a risk premium, then it would need to be properly amortised over the entire period during which the buyer holds the car. Since many car owners hold their vehicles longer than a year, the one-year-old market price understates the true present value to these owners of their one-year old motor vehicles. Consequently, the User Cost, calculated from market prices, in turn overstates the true implicit rental price of new motor vehicles to these owners. The leasing of new motor vehicles by private individuals suggests that the avoidance of the risks of market transactions is worthwhile. Notwithstanding, even though the User Cost figures may be inflated by their failure to correctly amortise the risk premium, the larger new car elasticities with respect to rentals relates to the variability of the rental price, not their levels. A third reason as to the difference between new and used car demand may be that people who buy new motor vehicles are different from those who buy used motor vehicles. Perhaps based on age group or occupation or types of family or ethnic group etc. This would need to be tested by cross section study.

However, much of the Wykoff criticism of the SA model may, indeed, be turned back on the User Cost approach itself. Wykoff suggests that the market for PMVs should be dichotomised between new and used vehicles as if these were the only PMV market segments. But how realistic is this? Market segmentation occurs from both the supply side and the demand side and consumers do not simply compare a single homogeneous new car purchase decision with a single homogeneous used car purchase decision. For example, some potential consumers may consider a one or two year old used prestige vehicle to be a superior good as compared to a brand- new less prestigious vehicle. Moreover, the assymetric information problems associated with used cars in Wykoff's day (1973), are not present to anywhere near the same degree today the same for all used vehicles. In addition, information problems are not the same for all used vehicles. Therefore, we reject the Wykoff assertion that there is a clear separation of the new and used car markets. It is our contention that due to consumer protection legislation and manufacturer warranties, many potential buyers treat used vehicles, particularly those less than three years old and/or those that have travelled less than 100,000 km as a very good substitute for a new car.

Therefore, the simple dichotomisation of the PMV market into new and used segments as suggested by Wykoff is a far too simplistic an approach. In the real world it is much more likely that there exists a spectrum of market segments with substitution possibilities between some segments but not others. Therefore Wykoff's criticisms of SA model are less well founded on theoretical grounds than Wykoff supposes. In the end it remains an empirical matter whether the approach suggested by Wykoff is superior to the SA approach since it cannot be resolved *a priori*. The User Cost model provides a plausible alternative approach, however, it is not theoretically superior to the SA model. Effectively, it remains an empirical question as to which approach performs better in modelling Australian PMV demand. This will be resolved in the next chapter.

4.8.2 The Budget Constraint Criticism

The second area of criticism of the SA model is its failure to incorporate a budget constraint mechanism into the determination of the demand for PMVs. As such Hess (1977) utilises a method based on User Cost to overcome this perceived deficiency of the SA approach. Hess claims there are two aspects of economic theory that have not been fully reflected in previous empirical studies prior to his analysis. These are the implications of a multi-period horizon and the possibility of substitution between assets. Theoretical models that do assume a multi-period horizon imply that the relevant asset prices are User Costs and that the appropriate constraint is wealth. In contrast, most empirical studies use purchase prices rather than User Costs and income rather than wealth. Further, while some theoretical models did permit substitution over a variety of assets, most empirical studies restrict substitution to cars and consumption goods

Hess analyses the length of the time horizon, the range of substitutes, and the relative importance of substitution and wealth effects by estimating, over the same set of data, a variety of equations which reflect different assumptions about the horizon and the range of substitutes. Specifically, Hess compares demand equations derived under multi-period, single asset; single-period, single asset; and single-period, multi-asset assumptions, with the broadest multi-period, multi-asset equation. He concludes that:

- a multi-period, multi-asset equation best describes motor vehicle stock demand;
- estimates of substitution and wealth effects are quite sensitive to specification bias; and
- substitution effects are seven times more important than wealth effects in the dominant equation.

4.8.2.1 A Model of Household Motor Vehicle Demand

The analysis aims to provide a unifying theoretical framework for the derivation and comparison of alternative lists of arguments that influence household motor vehicle demand. It is assumed that the consumer hold a changing portfolio of durables on the basis of two factors; their relative 'User Cost' or 'rental price' and the reality that most consumers are subject to a lifetime constraint which is defined as a discounted income stream. The derivation of the model begins with the basic assumption that the goal of the household is to maximise the value of a lifetime utility function. This is the sum of each period's utility discounted by a time preference parameter γ. The single-period utility function has as arguments the flow of consumption goods *C*, the stock of physical assets *K*, and real money balances *M/P*. The function to be maximised is:

$$V_0 = \sum_{t=0}^{T} V(C_{t,} K_{t,} M_t / P_t)(1+\gamma)^{-t} \tag{4.57}$$

Assuming that households can borrow and lend and that beginning and ending financial assets are zero, lifetime utility is maximised subject to the constraint that the present value of nominal income *Y* is equal to the present value of nominal purchases. Purchases consist of consumption goods and additions to the stocks of capital and money balances. Given the assumption that physical depreciation is proportional to the asset stock, the gross investment identity

$$I_t \equiv K_t - (1-\delta)K_{t-1} \tag{4.58}$$

links the asset stock K, rate of depreciation δ, and gross investment I. Making use of (4.58) the lifetime budget constraint is

$$\sum_{t=0}^{T}[Y_t - P_t C_t - P_{k,t}(K_t - (1-\delta)K_{t-1}) - (M_t - M_{t-1})](1+i)^{-t} = 0 \tag{4.59}$$

where

the P's = purchase prices, and

i = the nominal rate of interest.

After invoking several standard assumptions concerning the derivation of wealth, Hess determines his PMV demand equation. Breaking physical assets K into the component A for motor vehicles gives:

$$A_t^d = \phi\left(\frac{u_{a,t}}{P_t}, \frac{u_{d,t}}{P_t}, \frac{u_{h,t}}{P_t}, u_{m,t}, W_{h,t}, W_{n,t}\right). \tag{4.60}$$

This is the list of variables which enters the PMV stock demand equation.

Hess analyses the length of the time horizon over the same set of data with a variety of equations that reflect different assumptions about the horizon. Specifically, the PMV demand equation is tested over a range of scenarios ranging from a:

- a single-period; single–asset model,
- a single-period; multi-asset model and finally,
- a multi-period; multi-asset model

The latter is found to best represent the household's stock demand for motor vehicles.

4.8.2.2 Empirical Generalisation and Estimation

As Hess concludes that the multiperiod, multiasset model best represents the households stock demand for cars we will concentrate our attention on this variation.

The Demand for PMV Stock (multiperiod, multiasset) A is

$$A = f(\, P_a/P,\ P_d/P,\ P_h/P,\ i/1+I,\ \dot{P}^a/P(1+i),\ \dot{P}^d/P(1+i),\ \dot{P}^h/P(1+i),$$

$$\dot{\rho}/1+i, Y, W_n \qquad (4.61)$$

where:

P_a = the implicit price deflator for gross PMV product.

P_d = an implicit price deflator for durable goods other than PMVs.

P_h = the implicit price deflator for nonfarm residential structures

$\dot{\rho}$ = the anticipated rates of inflation in the above price indices[30]

i = the rate of interest on long term U.S.bonds

Y = personal disposable income

W_n = an estimate of wealth from flow-of-funds data.

P =implicit price deflator for personal consumption expenditure

$$\hat{A} = \alpha_0 + \alpha_1 (P_a/P)_t + \alpha_2(Pd/P)_t + \alpha_3 (P_h/P)_t + \alpha_4 (i/1+I)_t + \alpha_5 (\dot{P}^a/P(1+i))_t$$

$$+ \alpha_6 (\dot{P}^d/P(1+I))_t + \alpha_7 (\dot{P}^h/P(1+i))_t + \alpha_8(\dot{\rho}/1+I)_t + \alpha_9 Y + \alpha_{10} W_{nt} + \varepsilon$$

(4.62)

A priori the following pattern of signs for the independent variable parameter estimates are expected:

$\alpha_1, \alpha_3, \alpha_5, \alpha_8, \alpha_9, \alpha_{10} > 0,\ \alpha_2, \alpha_4, \alpha_6, \alpha_7 < 0$

[30] Calculated using the adaptive expectations model described in the text.

The question to be considered is to what extent does the addition of the budget constraint improve the underlying theoretical framework associated with the demand for PMVs? Does, in fact, a User Cost model that incorporates a complicated multi-period, multiasset model generate significant improvement over the more empirically straightforward SA model? We feel the results obtained by Hess are, at best, only marginally important to the debate as to the appropriate methodology to employ in determining the demand for PMVs. In truth, the analysis adds a great degree of complexity to the modelling framework without attaining any superiority over the more straightforward SA model. However, it remains an empirical question as to the extent to which the Hess model is superior to the SA method. This matter will be resolved in the next chapter.

4.8.3 The 'Saturated Market' Criticism

A third criticism of the SA model is that it fails to consider the extent to which the market for PMVs may be 'saturated'. Essentially this criticism argues that an implied assumption of no quantity constraints to the use of motor vehicles is unrealistic. The most recent advocate of this view is de Pelsmacker (1990) who studies the demand for new cars in Belgium.

de Pelsmacker develops a Structuralist model of PMV demand. Structural models are held to begin from the idea of a 'state effect', a complicated determination of the effect of stock or past purchases on demand. The Structuralist approach then combines this 'state effect' with the SA approach of dividing demand into two components. Each component is then studied separately in order to isolate the underlying structural mechanisms of car demand evolution. It is argued that the two structural components that determine demand in the long run are:

- the car ownership growth component, which can be defined as the result of a new product diffusion process (growth of motorisation) towards saturation.[31]
- the remaining short-run demand shifts (the deviations from structural demand), that are explained by changes in the economic environment.

A major requirement of modelling car ownership growth in any market involves the definition of the saturation level of ownership. A saturation level may be seen as a final stage where every person who chooses to, or can own a car, in fact does. Car ownership growth, or 'motorisation' (the number of motor vehicles per head or per family in a given society), can be defined as a growth process to saturation. The shape of this growth curve is generally based upon the widely accepted theory of diffusion of a new product into the market. That is, after a period introduction characterised by a slow growth of ownership, a phase of rapid motorisation follows. This, in turn, is followed by a gradually decreasing growth of ownership until saturation is achieved. But what is the saturation level? Button *et al.* (1980) suggest two possibilities.

- the saturation level may merely be a statistical parameter for a sigmoid growth curve never intended to approach its upper asymptote during the period under review.
- saturation may be regarded as a 'ceiling' level of a car ownership variable that is not possible for a group of people to exceed.

Notwithstanding either definition the saturation level is assumed to be a

[31] Structural replacement demand can therefore be defined as the 'echo'-effect of past purchases. See De Wolff

binding constraint on the maximum per capita level of ownership. In addition, it is independent of the level of income, motoring costs and other such economic variables.

One method chosen to define saturation is to directly estimate its level as a parameter of a growth function. The philosophical rationale that underpins the approach is to accept that the nature of the diffusion process (that is, the definition of the growth curve) is given. Therefore the saturation process is an inevitable result of the growth curve definition. As early as 1938, De Wolff (1938) had attempted to define the saturation level of PMVs in the United States over the period 1921-34, in these terms. A second approach suggests that the saturation level as function of a growth parameter. Bos (1970) determines that the saturation level is best resolved through a linkage to a logistic growth curve. Based on an exposition of the demand for PMVs in the Netherlands over the period 1950-1970, Bos surmises that the growth process has an exponential character. However, an exponential growth pattern also means that the number of passenger cars will increase infinitely and therefore is inconsistent with the notion of saturation and a quantity constraint.

Notwithstanding the method utilised to define a saturation level we contend, particularly in the context of the demand for PMVs in Australia, that there is a more important consideration than definitional concerns. The real question is to determine the value of the saturation concept to the Australian debate, as there is little convincing evidence of market saturation being achieved in this market. However, before answering this criticism let us consider some of

(1938), for a simple explanation of the echo effect.

the difficulties associated with measuring saturation.

Can saturation be reduced to a single all-embracing statistical parameter? Button *et al.* (1982) argue that the saturation level for PMVs is a different problem altogether to that of other consumer durables and should not be considered as merely a statistical parameter of a sigmoid growth function. Notwithstanding this debate there are problems with the use of such a growth function. In many instances the relevant growth function is often simply estimated given an exogenously defined saturation level. But just what value should this saturation level take? There have been relatively unsophisticated 'rule-of thumb' approaches applied to the definition of an exogenously determined saturation level. For example, Paelinck (1960), uses one car per family, Mogridge (1967) and Smith (1975) use two motor vehicles per family, Tanner (1978) uses 'per member of the car driving population' and Altschuler *et al.* (1984), one car per person.

de Palsmacker sees the need for a more sophisticated approach to the determination of a saturation level and thereby develops a growth-size relationship. Central to this approach is the contention there is a negative relationship between the relative growth of motorisation (G) and its size (C). The saturation level is attained when the growth of motorisation is equal to zero. de Palsmacker develops both a linear $(G = a + bc)$, and convex $(G = a + lnC)$, function in order to generate a functional G-C relationship for Belgium over a thirty-year period (1956-1986).

An additional problem associated with the saturation level is the recognition that there has been a long-term growth in motorisation. Therefore the concept of saturation can only be understood if there exists an accurate measure of the growth of motorisation. When consideration turns to the actual growth of motorisation there are two areas of contention. The first involves the shape of the growth curve whilst the second concerns the variables that should included in its specification. The basis of the first consideration is the assumption that motor vehicle markets conform well to the theory of market penetration and the corresponding concept of saturation. That is, motor vehicle markets move, over time, toward a respective level of saturation.

A large number of models have been used to describe the diffusion process of new products, de Palma *et al.* (1986) provide an excellent review. One of the most popular functional forms used in car ownership analysis is the logistic function as per De Wolff (1938), Bos (1970) and Fowkes and Button (1977).

Another aspect necessary for the accurate measurement of saturation is the need for accurate measures of scrappage rates and replacement demand. Two quite distinct elements influence a country's scrappage rate. The first is the stage of motorisation reached. In the early stages, recently purchased motor vehicles form a relatively large proportion of the vehicle stock and, as a result, the demand for vehicles to replace scrappings is low. With the gradual ageing of the vehicle stock and as market saturation is neared, replacement demand and the scrappage rate, increases. The final stage involves complete saturation where replacement accounts for all sales (except for a small amount of new demand that arises from population growth). At this stage, scrappage rates should be roughly equal in line with the average life of vehicles in the park. For example, if the average life is 12 years, the annual scrappage rate should in theory be equal to its reciprocal, namely 8.3 percent. The essential problem is to know where, on the vehicle density curve a country's market will be at a particular future date. The market saturation level is the major determining factor in this regard, along with the approach path followed by the market.

The second and more important determinant of scrapping rates is the average lifetime of motor vehicles. Evidence from Sweden, the USA and Japan suggests that (as of 1982), there has been a consistent increase in the average lifetimes of motor vehicles since the mid-1960's[32]. Since replacement demand is a direct function of the "longevity" of cars, future increases or decreases in motor vehicle lifetimes will fundamentally influence aggregate demand estimates. Clearly, therefore, in order to obtain an accurate measure of scrappage, a good deal of attention needs to be given to the likely future trend in the average lifetimes of motor vehicles[33].

In summary, the Stucturalist approach of de Pelsmacker and others proposes the need to recognise and include explicitly the extent of market saturation in any demand modelling exercise. However, we are not convinced that this approach offers a superior alternative to the SA model particularly in the Australian market. Indeed the Structuralist method has major weaknesses that may be summarised as follows. Firstly, there are significant measurement problems associated with accurately measuring the key component parts of saturation. These include the growth rate of motorisation, replacement demand and scrappage rates. The measurement of all these vital considerations is dependent, in the final

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[32] For example, 1980 model Swedish cars were estimated to have a 65% longer life than those of 1965. Although the data for the USA is presented as the average age of vehicle stock, the increase over time was indicative of a lengthening vehicle lifetime since 1970. Over the decade to 1990 the average lifetime of cars in Japan increased from 8.4 to 10.6 years

[33] Hind (1983) details a study published in 1984 by the German Motor Vehicle Manufacturer' Association

analysis, upon some arbitrary limit or contrived statistical measure. Secondly, unlike some European countries there is little evidence that congestion and quantity constraints are imposing a saturation constraint in the Australian market. Hence we believe the approach of using contrived measures of market saturation is in no way superior to the SA model and is an approach that itself is subject to major weaknesses. As such the Structuralist approach will not be subject to empirical testing in the Australian market.

4.9 A Summary of the Modelling of the Demand for PMVs: The Stock Adjustment Approach.

This chapter analyses the literature relevant to the methodology employed by the SA approach to model demand for PMVs. We begin by tracing the development of the seminal SA model as it applies to the demand for consumer durables in general and then consider its application to the demand for PMVs in particular. We are able to show that the seminal model does result in acceptable empirical outcomes but not withstanding, attracts a range of criticisms associated with the empirical procedures inherent to the method. These include the debate as to the need to:

- expand the range of variables included in any determination of the level of desired stock and,
- the need to incorporate adjustments to the short-term adjustment mechanism implicit to the model.

We consider each of these criticisms in turn and find, not surprisingly, that all the involved researchers claim an improvement to the basic SA model by their

(VDA) which considers, on balance, that a continuous increase in the average lifetime of PMVs is likely to occur.

contribution related to the above factors.

We then turn our attention to a more serious assertion. This is the claim that the SA method is so flawed it should be abandoned in favour of either the User Cost or Structuralist approaches when modeling the demand for PMVs. These more dramatic claims are based on the perceived failure of the SA method to either:

- account for a difference between the demand for new as opposed to used cars
- consider the impact of a budgetary constraint on the level of PMV demand and
- incorporate the concept of a saturation level in the demand for PMVs.

We consider each of these criticisms in turn through the use and application of the User Cost and Structuralist models. We conclude that much of the debate can be resolved only through empirical analysis. In the context of the demand for Australian PMVs we are not, however, convinced of the efficacy of the saturation level debate.

Table 4.1: Regression Results: Various Studies

Study	Type of Data	R^2	DW
Chow (1957)	Annual	.858	1.43
Suits (1958)	Annual	.854	First Difference used to avoid autocorrelation
Evans (1969)	Quarterly	.916	1.13
Hymans (1970)	Quarterly	.937	0.80

Table 4.2: Households Owing One, Two, or Three or More Cars: July 1972 (Percent within each group)

Income by Residence ($)	One or More	Two or More	Three or More
Under $5000			
Metropolitan Areas	46.9	6.8	0.9
Central Cities	37.8	4.7	0.3
Suburban Rings	60.5	10.0	1.3
Outside Metropolitan Areas	63.5	11.5	1.3
$5000-$9,999			
Metropolitan Areas	83.6	24.5	3.2
Central Cities	75.8	18.3	2.1
Suburban Rings	91.2	30.4	4.3
Outside Metropolitan Areas	93.8	32.1	4.6
$10,000-$14,999			
Metropolitan Areas	93.8	44.6	6.9
Central Cities	89.5	35.4	4.0
Suburban Rings	96.5	50.2	8.7
Outside Metropolitan Areas	97.4	47.8	9.4
$15,000 and over			
Metropolitan Areas	95.2	60.2	16.1
Central Cities	91.5	53.8	15.4
Suburban Rings	97.1	63.4	16.5
Outside Metropolitan Areas	97.5	60.4	16.4

Source: U.S. Department of Commerce, Bureau of the Census, Current Population Reports: Consumer Buying Indicators, Series P-65 No.44. Washington, D.C. Government Printing Office, February 1973.

Table 4.3 Dependent Variable: D_t = expenditure on PMV and parts

Coefficient of	Equation A (Unlagged)	Equation B (Lagged)	Equation C (Excludes debt and financial assets)
Constant Term	-.1920 (-2.89)	-.2591 (-3.33)	-.1570 (-2.14)
Y_t	.1002 (1.42)	.0777 (1.08)	.0306 (.34)
Y_p	.2142 (2.74)	.3133 (3.42)	.3432 (3.25)
$CAPC^{\cdot}Y_p$	-.1834 (-1.610	-.2458 (-2.09)	-.4578 (-2.82)
S_{-1}	-.0194 (-.08)	-.2819 (-1.100	-.4453 (-1.40)
DEBT	-.1731 (-4.24)	-.2149 (-3.63)	
FIN	.0398 (4.09)		
NSFIN		.0468	
KT		.0209 (3.53)	
KT_{-1}		.0139 (4.05)	
KT_{-2}		.0083 (2.09)	
KT_{-3}		.0041 (.97)	
KT_{-4}		.0014 (.45)	
$\sum_{L=0}^{4} KT_{-L}$		.0486 (3.44)	
ρ	.5163	.6045	.7630
R^2	.9703	.9738	.9661
DW	1.84	1.91	1.63
S.E.	.0071	.0068	.0075

Table 4.4:Explanatory Variables: Personal Disposable Income; Attitudes; Unemployment.

	Income Quintile 1 (poorest)	Income Quintile 2	Income Quintile 3	Income Quintile 4	Income Quintile 5 (richest)
	0.6380 (0.1)	-14.89 (2.1)	-22.30 (3.9)	- 21.48 (1.7)	-38.95 (2.5)
Y_d	+0.003088 (1.5)	+0.002547 (2.8)	+0.002889 (8.8)	+0.001636 (3.4)	+0.000488 (1.8)
A	-0.0401 (0.9)	+0. 1282 (2.0)	+0.1506 (2.8)	+0.2465 (2.0)	+0.5965 (3.9)
U	-0.01861 (1.1)	0.07152 (3.2)	-0.05141 (2.7)	- 0.09341 (2.2)	-0.8603 (1.6)
ΔP	0.0269 (3.1)	0.6151 (2.0)	0.8753 (2.2)	0.5818 (2.0)	0.5877 (2.5)

$R^2 = .9986$: $DW = .73$

5 Stock Adjustment Models of Demand for Australian PMVs

As we have seen in Chapter 4, the SA method has a long but somewhat chequered history of application to the modelling of the demand for PMVs. Many researchers, whilst accepting the basic premise of the model that links demand for PMVs to the level of existing stocks, have expressed some doubt as to its veracity given perceived inadequacies of the method. The principal concerns involve the need to refine the concept of the desired stock and to improve the short-term adjustment mechanism implicit in the model. Irrespective of these misgivings, which can be controlled for, in this chapter we provide the first application of the SA method to the modelling of the demand for PMVs in Australia. However, before undertaking such modelling we need to consider other attempts that have been made to model the demand for Australian PMVs.

5.1 Early Models of the Demand for Australian PMVs

The Australian PMV industry was, as noted in Chapter 2, a strong and vigorous sector by the first decade of the twentieth century. Nevertheless it was not until the 1980s that attempts to model the demand for Australian PMVs moved beyond relatively simple estimation procedures that incorporated PMV expenditure into a broad macroeconomic model. However, as we will argue, these efforts neglected both the basic SA method and efforts to improve and augment the approach as detailed in Chapter 4. The impetus for the development of more sophisticated PMV modelling for the sector is explained by the volatility of the environment at that time. The 1980s proved to be a particularly difficult decade for the Australian PMVI. In the first instance, as we have seen, under the provisions of the Plan the industry was forced to accommodate change to the scope and size of government assistance. Further, it had to face the challenge of both new product and process technologies and the competition of escalating import penetration into the market. In addition, the demand for new cars had, since 1984, diverged significantly from established trends. These difficulties highlighted the need for more reliable information about many of the industry's aspects including that of the future demand pattern for PMV in Australia.

In the light of this volatile environment the Automotive Industry Council (AIC) established a Working Party in 1988 to examine the validity of current forecasting methods.[1] The Working Party, in turn, requested the Bureau of Industry Economics (BIE) to undertake research on the basis of two main objectives. The first was to identify and quantify factors responsible for the downturn in demand for PMVs from 1986. The second objective, which is of more interest to this research, was to predict the level of demand until 1995. The completion of this latter objective was predicated on the development of an econometric model that would be able to explain the movements, or at least the long -term trend, in PMV demand over the previous fifteen to twenty years. It is the specification of such an econometric model that interests us.

In the first instance the BIE examined approaches to motor vehicle demand modelling and forecasting that had been employed to that period in Australia. It found that, as at 1988, there were a few rather rudimentary models of PMV demand utilised by both government and industry. These included relatively simple estimation procedures used by the then Federal Department of Transport

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[1] The AIC was one of six industry councils established under the umbrella of the Australian Manufacturing Council to provide advice to Government on the manufacturing sector. The council consisted of senior industry, union and government representatives and provided a forum for consultation on industry issues.

to predict long-run road usage and the Federal Department of Resources and Energy to predict fuel efficiency. Other examples included broad macroeconomic models such as the NIEIR model and the Treasury NIF-10 model. Both the NIEIR and the NIF-10 models explicitly recognised motor vehicle expenditure.[2] However, these models were thought to be of little value to the terms of reference of the BIE research. An existing model of more interest to the BIE was the short-term forecasting model developed over the mid-1980s by the Bureau of Transport and Communications Economics (BTCE). This model concluded that the major influences on demand for PMVs were price and income factors. Details as to this model were made available to the working party.

5.2 The BTCE Model of Automobile Registrations

The BTCE formulated a demand equation for PMVs predicated on two assumptions. These held that:

- the period after 1976 was one of stability in the trend of registrations and could be idealised as a period where there had been an absence of major structural change in demand.
- deviations from the stable trend could be explained by variations in price and income.

5.2.1 Empirical Estimation

The BTCE model may be represented as follows:

$$ln\ REGS_t = f\ (RPRICE_t,\ RGNE_t,\ DEND_t,\ DUM85_t,\ D1_t,\ D2_t,\ D3_t) \qquad (5.1)$$

where:

$REGS_t$ = quarterly registrations of cars, station wagons, panel vans

[2] For details of these models see the Automotive Industry Council (1988) which cites the NEIR model, whilst the NIF-10 Model is detailed in *The NIF-10 Model and the Australian Economy* (1981).

and utilities, from 1977:1 to 1987:4.

$RPRICE_t$ = the real year-end price of "intermediate" motor vehicles, extrapolated quarterly.

$RGNE_t$ = quarterly real seasonally adjusted gross national product

$DEND_t$ = a dummy variable set to -1 in June 1987 and +1 in December 1987 to catch the effects of apparent demand shifts between these two quarters.

$DUM85_t$ = a dummy variable equal to 1 for each quarter of 1985 to capture the effects of unusually heavy buying of motor vehicles in that year.[3]

D_{it} = seasonal dummy variables.

Equation (5.1) may be rewritten as:

$$\ln REGS_t = \alpha_0 + \alpha_1 GNE_t + \alpha_2 RPRICE_t + \alpha_3 DEND_t + \alpha_4 DUM85_t + \alpha_5 D1_t + \alpha_6 D2_t + \alpha_7 D3_t + \varepsilon_t \quad (5.2)$$

A priori, we expect the following pattern of signs for the independent variable parameter estimates:

$\alpha_1, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7 > 0; \alpha_2 < 0.$

The BTCE concluded that the major advantage of this simple demand equation was that it identified the two main variables that determine PMV registrations. Accordingly, a large range and diversity of interested parties could put their own forecasts of these two variables into the equation and very easily generate their own forecasts. Further, the simplicity of the model also enabled modification in the light of changing circumstances within the industry. However,

[3] Due to the anticipation by buyers of a significant rise in price due to the introduction of unleaded petrol engines and the devaluation of early 1985.

it was conceded that the demand equation had some negative features. In the first instance, it was a preliminary model and would be subject to revision. Secondly, it was a short-term demand model and would thus need to be re-estimated at regular intervals to maintain predictive ability in the face of structural change in the industry. In addition, we conclude that its most obvious weakness is its failure to include a stock adjustment variable.

5.3 Other Early Models

In addition to the BTCE model, the working party found, as at 1988, there were only two further Australian demand models of any real sophistication applicable to PMVs. These were the aggregate model developed by the Industries Assistance Commission (hereafter the IAC), over the period from the mid-1970s to the early 1980s and a discrete choice model developed by Professor Hensher of Macquarie University.[4]

5.3.1 The IAC Model

The IAC developed and utilised a model to predict motor vehicle demand but determined that their model had a number of problems that made it unsuitable for the particular tasks they had envisaged for it. These problems included concerns as to both data definition and the theoretical structure employed. The latter consideration meant that, in particular, the model had proved to be unsuitable in tracking demand at times of strong transient influence. Subsequently, the IAC decided against further modifications of their model themselves but provided the BIE with all their data and working papers. The BIE then developed a modified version of the original IAC model that was initially

[4] There was, however, an international model incorporating a market saturation technique that had been developed by the OECD in order to forecast demand for motor vehicles in many countries of the world

quite satisfactory. However, the model showed a substantial decline in econometric performance when the period covered was extended from 1965-1980 to 1965-1986. Because of the decline in performance of the model as then structured, the BIE considered its forecasting power to be inadequate for reliable projections. The BIE then turned its attention toward the development of a completely new model rather than continue with further attempts to modify the IAC model.

5.3.2 The BIE Model

The BIE chose to base their approach on a method favoured by the Organisation for Economic Cooperation and Development (hereafter the OECD), in that organisation's study of the long-term outlook for the world motor vehicle industry published in 1983.[5] This procedure involved the use of a technique to forecast long-term demand that was based on the extrapolation of historical relationships toward a long-term level of market saturation. The approach generates trend-line estimates and ignores short-term transient influences.

Under saturation modelling the market for new cars is divided between

- new demand (which is calculated from vehicle density in the population) and
- replacement demand (which is a function of the rate at which cars are scrapped from the vehicle stock).

During the late 1970s to the late 1980s there was a significant and unexpected fall in scrapping rates in Australia over the period under review, which directly fed into replacement demand. The implication was that Australian

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including Australia.

[5] See OECD (1983)

consumers were holding on to their cars for longer periods of time. This is contrary to the usual behaviour of mature car markets that tend toward higher scrapping rates and higher turnover of vehicles over time. While some structural influences may have contributed to this trend in the new car market, (such as longer vehicle life, and changes in vehicle distribution and buying patterns, the working party concluded that it was economic factors that had the most significant impact on deferring replacement decisions over the 1980s.[6]

5.3.2.1 Key Economic Variables: Influences on PMV Demand

(i) Prices:

The importance of this factor is demonstrated by the sudden downturn in vehicle sales in 1986. The sharp increase in vehicle prices over the year were closely linked to the decline in PMV sales. Significant price rises commenced in 1985 and, (as is argued in Chapter 3), were closely related to the almost 50 percent depreciation of the Australian dollar against the Japanese yen and the West German mark, the currencies of the then major suppliers of imported vehicles. The depreciation led to increased prices and therefore costs for imported passenger motor vehicles as well as increased costs for imported components, raw materials, tooling and machinery for locally produced PMVs and components.

The 1987 AAIA Report (AAIA 1987:26) noted Australian vehicle prices increased much more quickly than both the Consumer Price Index (CPI) and average weekly earnings (AWE). Price increases were most marked in 1986, with imported PMV prices increasing by 27 percent and domestically produced PMV

[6] We again note that, as with the BTCE model, a fundamental weakness of this BIE model is the failure to consider the impact of the desired level of stock on the demand for PMVs).

prices rising by 21 percent. Some price moderation was experienced over 1987 with imported PMV prices increasing by 13.7 percent compared to 12.6 percent for domestically produced PMVs (AAIA 1988: 27). These substantial price increases, relative to wage increases, inevitably affected consumer's purchasing power. In December 1983, an adult on average weekly full-time earnings required twenty-seven weeks gross pay to purchase an "average" Australian produced four door, six cylinder, four speed manual, family sedan, costing around $12,000. In December 1987, a similar vehicle would have cost around $18,500 (AIC 1988:26).

However, there had been substantial product improvement by 1987 compared to 1983. In contrast to the earlier period, the 1987 vehicle would have typically included a cassette player, five- speed manual transmission, electronic fuel injection and power steering as standard equipment. In December 1987, an adult on average weekly full-time earnings would have required 33 weeks gross pay to purchase this vehicle. This represented a real increase of 18 percent or an additional 6 weeks pay over that required in December 1983 (AAIA, 1987: 16).

(ii) Income

The Australian economy experienced a strong and persistent slowdown during 1986. This exacerbated the fall in vehicle demand that had been initially caused by price increases. Real GDP growth virtually ceased in 1986 and actually declined in the first half of 1987 as the Government introduced policies designed to combat persistent inflation, a large budgetary deficit, and a serious structural deficit on the external account. The effects of these measures on wage levels and disposable income can be seen in Table 5.1 which shows average weekly earnings and disposable income from 1983-1986.

At the same time, the Government adopted a policy of restraint that meant that future expectations were likely to be negative. The working party concluded that a double disincentive of rising prices and low expectations as to increased future income emerged. This would dissuade many potential new entrants who may have been considering purchasing an expensive item such as a new car over that period.

(iii) Interest Rates

Given the application of a tight monetary policy by the Government over the few years before 1988, the working party concluded that interest rates exerted a considerable influence over motor vehicle sales in the relevant period. Interest charges were seen to impact on the purchase of motor vehicles in three main ways:

- the direct cost to the buyer of financing the purchase of the motor vehicle;
- the reduction in discretionary income as housing mortgage repayments increase; and
- the additional cost of supply to the producers.

A significant proportion of motor vehicles sold at the time were financed (ABS CAT.5642.0) and thus were influenced by interest rate variation. There may also be an opportunity cost factor involved. As the rate of interest increases, the opportunity cost of buying a new vehicle also increases. A potential new purchaser may choose to forego the purchase of a new vehicle and hold their wealth in other ways in order to earn additional income from higher interest rates.

Table 5.2 shows the significance of interest in the total operating cost of a selection of vehicles.

Interest rates also impact on the market for motor vehicles through supply-side considerations, particularly as they relate to costs of production. Manufacturers require funding for inventory and new model investment, including tooling, facilities and research and development. The interest cost of these factors ultimately brings pressure on retail prices.[7] In a similar fashion, dealers' inventory costs and the provision of sales and services are also influenced by interest rates.

Over the period 1984 -1987 the cost of financing both a locally produced and imported PMV increased sharply, (AIC 1988: Appendix 4A & 4B: 70-71) although the proportionate increase was much greater for imported vehicles. In addition, Table 5.3 indicates that as both retail prices and interest rates increased rapidly over the period, car repayments, as a proportion of average weekly earnings, increased substantially. Further, the effects of interest charges on housing mortgage repayments are of great importance to the private vehicle buyer. Table 5.4 shows changes in the proportion of car and mortgage repayments and income tax of average weekly earnings over the period 1980 to 1987 and gives an indication of the significant burden to private buyers of interest and total loan payments over the period 1980-1987. It highlights that, from 1985, the burden substantially rose as interest rates increased sharply. Total payments and income tax were a quite stable percentage of AWE until 1985 when payments began to increase rapidly. Over the period 1986-87, total interest comprised 26.4 percent of AWE compared to 16.3 percent in 1984. The increase was largely the result

[7] This factor was particularly significant over the 1986-1988 period.

of increased mortgage interest rates. Variations in home mortgage rates of this magnitude had a significant impact on the discretionary income of private vehicle buyers. In addition, the example used by the Working Party related to a single taxpayer, earning average weekly income, who has financed a Toyota Corolla sedan, and had a mortgage over 25 years at the savings bank new loan mortgage rate. This example would however be fairly atypical. It is not likely that a person on average weekly earnings in 1987 would have been able to afford a $43,000 mortgage, as well as a $14,000 car on credit.

It was obvious that, by the mid 1980's, escalating prices and interest rates coupled with stagnant or falling real incomes, were of great significance in determining the fall in demand for PMVs. As we see from Table 5.4 although interest rates applicable to car finance had been high in 1981 and 1982, repayments as a proportion of AWE were not affected significantly until 1985. From that time they began to escalate. National income indicators also show 1979-80, 1982-83 and 1986-87 as very depressed years in terms of income growth. These factors added to an escalating pattern of prices set the parameters for a substantial fall in PMV culminating in a massive decline of 22 percent between 1985 and 1986 (AAIA 1987:11).

5.3.3 Empirical Generalisations and Estimations

Whilst a number of elementary regression models can be specified to demonstrate the significance of these economic factors the Working Party present only one such example. Household disposable income and interest rates are combined to explain the variation in total new motor vehicle registrations in the period 1970 to 1985. The impact of the price variable is not considered. The model is:

$$IDAPS_t = f\,(HDI_t, RIR_t) \tag{5.4}$$

where:

$IDAPS_t$ = Total motor vehicle registrations in 1000 units

HDI_t = Household disposable income

RIR_t = Real Interest Rate

Equation (5.4) may be rewritten as:

$$IDAPS_t = \alpha_0 + \alpha_1\, HDI_t + \alpha_2\, RIR_t + \varepsilon_t \tag{5.5}$$

A priori, we expect the following pattern of signs for the independent variable parameter estimates:

$\alpha_1, > 0$, *and* $\alpha_2 < 0$.

The estimated model is:

$$IDAPS_t = 444.858 + 7.1439\ HDI_t - 3.8952\ RIR_t \tag{5.6}$$

In this simple model, household disposable income and real interest rates combine to explain 84 percent of the variance in total new motor vehicle registrations in the period 1970 to 1985.[8]

The Working Party then moved to consider additional factors that may have influenced the demand for PMVs in the period to the late 1980's. The first was the influence of demographic considerations.

5.4 The Impact of Demographic Factors on the Australian Vehicle Market

One of the primary determinants of the future level of new PMV sales is the level and structure of the population. As at 1988, Australia's population characteristics followed the profile of a developed, mature country with a comparatively low proportion of children and a higher number of persons in the older age cohorts. The Working Party surmised that the trends in Australia's demography indicated that, in the face of a decline in the growth of the population, there would be several significant changes to the structure of Australian society over the period to the year 2000. These trends included the supposition that the population would age, there would be a higher participation rate in the workforce and there would be a greater diversity in living arrangements. These factors would directly impact on the market for PMVs. The elements that were seen as likely to add PMV sales included:

- less dependence on a single family income structure; and
- an increasing proportion of households without dependent children.

The factors that were seen as likely to retard PMV sales included:

- small and slowing population growth.
- an increasing proportion of aged persons in the population that would be less inclined to use and replace cars.

It was concluded that it was impossible to predict with any degree of certainty the combined impact of these counter-balancing forces. However, it was again stressed that discretionary income would remain the major constraining influence on the aggregate demand for PMVs.

5.5 Other Factors Affecting the Market for PMVs

The Working Party also suggested that there were a range of factors beyond economic variables and demographic influences that may prove to be of influence in determining the then future market for PMVs. These included the impact of public levies, fuel considerations and product factors.

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[8] Adj $R^2 = 0.8424$.

5.5.1 Public Levies

The sale and operation of motor vehicles clearly provided a major source of revenue to both the Commonwealth and State Governments. Taxes were levied on the manufacturing process and were built into the cost of vehicles. Taxes were levied on the sale of the vehicle and raise the price to consumers. The cost of motor vehicle operation was increased through fuel taxes and fees for vehicle registration and driver licensing. Notwithstanding these considerations, the Working Party concluded that although governments continued to derive a large proportion of their revenue from taxing the sale of motor vehicles and their use, it was doubtful that such revenue raising activities had a major influence on the downturn in the vehicle market in 1986 and 1987. However, this was not to suggest that a change in some of these taxes and charges on the industry would not have a substantial impact on future vehicle demand.

5.5.2 Technological Adjustments and Product Factors

As at 1988, three product hardware factors were identified that might impact on the future market for PMVs. These were:

- technical innovation such as front-wheel drive and engine technology.
- new usage capability such as the "4 x 4" recreation market and new "people movers"
- variety/personalisation such as the increase in the range of choice to satisfy the market.

The Working Party concluded that in aggregate, product hardware factors were unlikely to stimulate significant growth of the market. However, product change and innovation were likely to affect the shape of the market and the market share of individual manufacturers. In addition, a major change in product might provide the opportunity for growth in the industry.

In concluding this discussion of the BIE contribution, it is worth noting that the authors had demonstrated a full understanding of the important underlying economic, and non-economic factors that may influence the demand for PMVs in Australia. Surprisingly however, they had not moved to consider the importance of stocks and the SA approach to such a determination.

5.6 Hensher's Discrete Choice Model

In addition to the BTCE model, the second model of interest to the Working Party was a sophisticated and complex study on the dimensions of PMV demand developed by Hensher (1984) in his article "Economics of the Motor Vehicle and the Future of the Car". This approach employed a policy sensitive, panel-data based econometric model of the household sector's demand for PMVs by number, composition and level of utilisation. The emphasis was on the identification of the major influences on vehicle choice and usage levels. These were seen as, in varying degrees, under the control of the government sector (such as fuel prices, indirect taxes), the corporate sector (vehicle design, provision of company vehicles to the household sector), and the household sector itself (family income, lifestyle).

The main elements of the analysis involve the development of a theoretical framework centred on an economic theoretic perspective of joint utility maximisation of a discrete choice (that is, vehicle choice), and a continuous choice (that is, vehicle utilisation). The individual consumer was assumed to behave as if they were utility maximisers. The choice of vehicle technology (the choice of

PMV), and its level of utilisation are in theory determined simultaneously as the solution to a single utility problem. The consumer is faced with a finite set of mutually exclusive vehicles and selects one alternative in conjunction with a choice of the level of vehicle utilisation.

Unlike traditional aggregate SA models, which assumed that the stock of durables might be changed continuously, the discrete choice approach assumed that the difference between desired and actual stocks is not instantaneously or adaptively actualised. The use of depreciation was replaced with repair and/or replacement decisions on a discontinuous basis. The inherently dynamic choice of a durable stock and the use of it over its lifetime required maximisation of an intertemporal utility function:

$$U = U(U_1, U_2 \dots. U_T) \tag{5.7}$$

subject to the sum of the present discounted value of the minimum expenditure necessary to achieve utility level U_t and price P_t (i.e. $\sum_{t=1}^{T} E_t(U_t, P_t)$) being no greater than wealth (W).

In terms of the allocation of income towards motor vehicles Hensher takes the demand for PMVs to be a function of the prices of car services and the budget allotment to that expenditure area. This is not to imply that the demand for vehicles is independent of the prices of other commodities or of total expenditures, rather that the total income and price of other goods enter the demand for vehicle use, only through their effect on the budget allotment to cars. When this allotment is known, the prices of other goods can be ignored.

To achieve demand separability it is necessary to either solve a broad group allocation problem, which determines total expenditure in each period, or assume that budget constraints between expenditure groups are set exogenously. Hensher followed Hausman (1979) and Dubin (1982) and assumes that expenditure levels are predetermined. The data provides details only on expenditure on motor vehicles and the household's income. There is no information on savings or on wealth. Hence the demand function is conditional. Given the temporal expenditure on motor vehicles (defined as equal to the product of quantities purchased at prices $P_t(p_t)$ where $P_t(.)$ is the price of the index of the category of goods (see Philips 1983) the second-stage commodity demand satisfies:

$$\max U_t (X_t) \text{ subject to } I_t \geq P_t X_t \qquad (5.8)$$

where

I_t = temporal expenditure and

X_t = input commodities for production of end-use service j, $j=1, .., n$.

Hensher rewrites (5.8) as, (after Dubin 1982) a weakly separable utility function between end-use service commodities VKM_j, (such as kilometres travelled) and all other goods x_{n+1} (dropping the t subscripts for convenience).

$$U(x) = U[f_1^{i^1}(x_1;\bar{a}), f_2^{i^2}(x_2;\bar{a}),\ldots,f_n^{i^n}(x_n;\bar{a}), x_{n+1}] \quad (5.9)$$

where

$f_j^{i^j}(x_j;\bar{a})$ = production of end-use service VKM_j by technology type j, $j=1,\ldots, n$

i_j = particular technology type (e.g. type of vehicle for production of end-service VKM_j (e.g. annual kilometres travelled).

x_j = vector of input commodities, (e.g.fuel) for production of end service j

$\bar{a}$ = vector of parameters

x_{n+1} = vector of non-produced commodities.

The function was maximised subject to the budget constraint:

$$\sum_{j=1}^{n} p_j x_j + p_{n+1} x_{n+1} \leq 1 \quad (5.10)$$

Conditional on the choice of motor vehicle(s), households allocate resources to maximise (5.9) subject to (5.10).

Hensher then developed a body of intricate and complex work that was primarily directed toward the prediction of levels of fuel consumed by the household sector and not the determinants of PMV demand *per se*. However, as we note earlier, Hensher took the demand for PMVs to be a function of the prices of car services and the budget allocation to that expenditure area. We will assess the impact of these two variables on the demand for Australian PMVs in the following sections.

Although Hensher made an important contribution to the modelling of the demand for fuel consumption, his approach to modelling PMV demand, as with the BIE, did not take into consideration the role of stocks as suggested by the SA methodology.

5.7 Modelling the Australian Demand for PMVs

We will now turn our attention to modelling the Australian demand for PMVs over a thirty two year period (1966 to 1997), which of course covers the period of the Plan. Well before the Plan began in 1985 there had been, as we noted in Chapter 4, a large number of international econometric studies formulated to estimate a demand function for PMVs. The main body of work applied, however, to either the USA or Europe. This section will apply these approaches framed over the late 1960s to the mid-1980s to the Australian market for PMVs although, as we have just seen, some attempts had been made in the mid to late 1980s to develop and apply a PMV demand model to Australia.

Our purpose now is to determine if the SA approach is able to shed light on the key determinants of Australian PMV demand. While there are many examples of each model, we will nominate the seminal models of each type. Each of these established models will then be tested, and the validity of the assumptions checked. We will then consider variations suggested for the seminal models and apply similar checking and testing procedures.

5.7.1 Data

The data window that we use is 1966:3 to 1997:4. Appendix 5.1 provides details on the variables and the data sources used to construct the data set. In assembling this data set, careful consideration was given to finding proxy variables that are close as possible to the theoretical constructs contained in the SA model in its various manifestations. Indeed, because there are often several alternatives that may be chosen to reflect an important theoretical variable, considerable care was taken to choose the most appropriate. The bulk of the data come from three main sources. The first is the ABS via the NIF10-S data set. The second is provided by the Institute of Applied Economic and Social Research based at the University of Melbourne. The third is Glasses Guide, an internationally recognised specialist in the provision of data for the motor vehicle industry.

5.7.2 *Time-series Analysis and the Problem of Non-Stationarity*

Before we begin the analysis, reference needs to be made to the potential problems associated with estimating procedures that involve time-series data. The use of econometric modelling to forecast demand has the considerable advantage of providing an analytical basis for testing the basic foundations or causes of such demand. Hence the approach enables conditional forecasting. Conditional forecasting, in turn, permits the consequence of possible changes in the causal factors to be assessed. In line with the trend of recent years, this study will be concerned with the time-series properties of the dependent and explanatory variables that are critical to the selection of valid estimation procedures. None of the studies reviewed in Chapter 4 use estimation procedures which post-date important changes in standard practice that have been developed in time-series analysis. Thus they may or may not satisfy the scrutiny of modern tests.

The so-called unit root issue arises in the context of the standard regression model, for example the regression equation:

$$y_t = a_0 + a_1 z_t + \varepsilon_t \qquad (5.11)$$

The assumptions of the classical regression model necessitate that both y_t and z_t be stationary, (stationarity of a time-series Y_t requires that $E(Y_t)=\mu$ and $VAR(Y_t)= \sigma^2$, or, in other words, $E(Y_t)$ and $VAR(Y_t)$ are time invariant). In the presence of non-stationary variables, there may be what Granger and Newbold (1974) called a *spurious regression*. A spurious regression has no economic meaning but nevertheless has a high R^2 and t statistics that appear to be significant. The regression output "looks good" because the least-squares estimates are not consistent and the customary tests of statistical inference do not hold. If the time-series in a regression model is not stationary, the F and t tests normally used to examine the significance of various aspects of the model are not valid.

The Augmented Dickey-Fuller procedure, which accommodates possible drift and trend, is commonly used in applied empirical analysis. It tests for the presence of a unit root in a time-series Z_t, uses OLS to estimate:

$$\Delta Z_t = \mu + \lambda t + \xi Z_{t-1} + \psi_1 \Delta Z_{t-1} + \psi_2 \Delta Z_{t-2} \ldots + \psi_m \Delta Z_{t-m} + \eta_t. \quad (5.12)$$

The null hypothesis of the presence of a unit root may be rejected if ξ is sufficiently large and negative. The t statistic does *not* have a standard Student t distribution, and critical values based on simulations have been produced by simulation methods.[9]

As we review and apply the alternative approaches used to determine the forces impacting on the demand for PMVs in Australia over the period 1985-1992, we will, in addition, administer the ADF tests to the Australian series suggested by the Stock Adjustment and User Cost models of PMV demand.[10]

5.1.1 Co-integration and Error Correction Models

Since the *Oxford Bulletin Symposium* (1986), unit roots tests have become an important part of time-series analysis. If the variables in the model

$$Y_t = f\,(X_{1t}, X_{2t}, \ldots\ldots. X_{kt}) \quad (5.13)$$

are not stationary, the t and F statistics produced in OLS regressions are invalid. Whilst this problem may often be solved by using first differences of the variables instead of levels, it is argued that this process loses useful information.

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9 See Charemza and Deadman (1992).

10 Because all series used are seasonally adjusted, we do not test for unit roots at seasonal frequencies.

To overcome both problems, we may attempt to estimate a co-integrating vector

$\alpha = \{-1, \alpha_1, \alpha_2, \ldots\ldots \alpha_k\}$ such that the residuals, ε_t, from:

$$Y_t = \alpha_1 X_{1t} + \alpha_2 X_{2t} \ldots\ldots + \alpha_k X_{kt} \tag{5.14}$$

are integrated of order zero. This is the so-called long-run relationship between the dependent variable and the regressors. Although there are several procedures for estimating a co-integrating vector, the simplest and intuitively most appealing is the Engle-Granger procedure. This uses OLS to estimate the equation:

$$Y_t = \alpha_0 + \alpha_1 X_{1t} + \alpha_2 X_{2t} \ldots\ldots + \alpha_k X_{kt} + \varepsilon \tag{5.15}$$

A co-integrating relationship exists if the residuals, ε_t, are integrated of order zero. The error correction or short-run relationship is found by using OLS to estimate:

$$\Delta Y_t = \beta_0 + \sum_{j=1}^{k} \sum_{i=0}^{1} \beta_{ji} \Delta X_{j,t-1} + \sum_{i=1}^{n} \omega_i \Delta Y_{t-1} + \xi \hat{\varepsilon}_{t-1} + \gamma_t \tag{5.16}$$

5.8 The Stock Adjustment Model

The Australian econometric studies of PMV demand developed up to the mid-1980s had either neglected the impact of a stock variable (i.e. the BTCE and BIE models), or had rejected it in favour of a discrete choice approach (Hensher 1984). As we have seen in Chapter 4 the basic form of the SA model has the distinct advantage of empirical simplicity in that the approach is both direct and straightforward. However, as we have also noted, econometric and conceptual concerns as to the parameters of the model led to many attempts to both incorporate additional variables into a "desired stock" equation and to improve the short-term adjustment mechanism. Such attempts have the potential to create significant analytical problems particularly when comparing the variations suggested. All researchers canvassed used Ordinary Least Squares, (OLS) as the estimation technique. In itself, the use of OLS poses no concern. There are, however, potential problems with emulating the exact qualities of the additional variables suggested by each researcher for incorporation into the basic SA model. These problems are due to the considerable differences between these various researchers in their use of proxies. This causes two difficulties. In the first instance, some of the series are not available for Australia. However, we feel that although an exact replica of the data used is not always possible, acceptable proxies are available. On occasion a proxy is arguably superior to the original. The second area of complication is the variation in proxies used. This makes comparisons between this research and the results of previous overseas studies more difficult. We feel, however, that this problem can be overcome by the approach we will adopt.

In Chapter 4 we built up a sequential survey of the literature that led to a number of preferred specification beyond that of the seminal SA model itself. We shall emulate the approach by modelling the SA incrementally. This will enable an evaluation of each suggested modification to SA model in the context of the Australian demand for PMVs. That is, we first restate the basic SA model of Stone and Rowe. We will then reiterate the SA model of Rippe and Feldman (hereafter the RF model). Next the RF version of the SR model as applied to the demand for PMVs in Australia, will be estimated. We will then add, one at a time, the additional variables and or the variations proposed for the short-term adjustment mechanism, as suggested by the other authors. In each instance the proposed model will be restated and then applied in the Australian context to determine whether the Australian experience confirms their econometric work on the one hand and to see how well the SA model performs as a demand model for Australian PMVs, on the other.

5.8.1 Stone and Rowe

As we have seen the SA model is formulated by Stone and Rowe (1957) as

$$D_t = g(S_t^* - S_{t-1}) + rS_{t-1} \tag{4.1}$$

5.8.2 The Stone and Rowe Model Applied to Australia.

We will now apply the RF SA formulation to Australia over the period 3:1966 to 4:1997 which therefore includes the duration of the Plan. Our stating point is the equation:

$$LREXP_t = \alpha_0 + \alpha_1 LRGDP_t + \alpha_2 LPMRP_t + \alpha_3 LSTOCKS_{t-1} + \alpha_4 LURATE_t + \varepsilon_t \tag{5.18}$$

where:

$LREXP_t$	= Real Expenditure
$LRGDP_t$	= Real Disposable Income
$LPMRP_t$	= Relative Price of Passenger Motor Vehicles
$LSTOCKS_t$	= Stocks of PMVs
$LURATE_t$	= Unemployment Rate.[12]

A priori, we expect the following patterns of signs for independent variable parameter estimates of:

$\alpha_1 > 0$, and $\alpha_2, \alpha_3, \alpha_4 < 0$.

[12] L denotes a logarithmic transformation.

The coefficients of Equation (5.18) may be interpreted as constant elasticities in the usual way. As we have noted a potential area of concern when attempting to emulate a model developed for another country lies in the ability to reproduce the data utilised. This immediately becomes apparent in that there is an important difference between the stock variables employed between RF's American model constructed in 1979 and the Australian model constructed in 1999 and applied to 1966-97. RF assemble their stock variable from real expenditure data and a depreciation rate because they did not have a direct measure of the stock variable available at the time of their analysis (1976). However, we are fortunate to have a direct measure available as a stock variable in the NIF10-S database. We feel that this is a superior measure to the one used by RF and that our model offers a superior test of the SA approach. Nevertheless, we believe there is one area of concern with the ABS data. This is that the ABS depreciation rates used for PMVs are higher than the depreciation rates used by Glasses Guide which is, as we note, the premier industry source providing advice to PMV retailers. Therefore, to test the appropriateness or otherwise of the ABS measure, we will use a stock series generated by both approaches.

As RF employ OLS for time-series data (as indeed do all previous studies using the SA approach), concerns as to the stationarity of the series arise. In accord with modern time-series analysis we therefore investigate whether the variables in the model have unit roots which would render OLS estimation invalid. For this purpose we adopt the commonly utilised Augmented Dickey-Fuller (ADF) test. Table 5.5 shows that the null hypothesis of the presence of a unit root cannot be rejected for all variables in the RF model for PMVs over the period under review. Since all the variables are integrated of order 1 we are unable to use OLS in the manner of the theorists listed and instead use the Engle-Granger procedure to estimate a co-integrating vector that describes the long run relationship between the variables. This approach uses OLS to estimate the equation where the equation only contains 1(1). Any 1(0) variables appear in the error correction equations that appear below.

To begin with we use two alternative measures of real income in our regression modelling. For some of the variables included in the SA model, several alternative proxy measures present themselves. Income is an obvious example. Since we can not unequivocally choose one income measure over another, we begin by considering real gross domestic product and real household disposable income.

We begin with the results generated using RDI_t (real disposable household income). The estimated co-integrating vector or long-run relationship is as follows:

$$\underset{}{LREXP_t} = 4.5804 + \underset{(8.60)}{1.3469LRDI_t} \underset{(-7.78)}{-1.2746LPMVRP_t} - \underset{(-3.88)}{0.6046LSTOCKS_{t-1}} \underset{(-0.11)}{-0.069LURATE_t} \quad (5.19)$$

$Adj\ R^2 = 0.89$. The residual, $RESID_t$, is integrated of order 0 (ADF_0t =-4.53).

We now report results generated from using $RDGP_t$ (Real Gross Domestic Product). The estimated co-integrating vector or long-run relationship is as follows:

$$LREXP_t = 6.7738 + \underset{(6.80)}{1.0244LRGDP_t} \underset{(-6.86)}{-1.3815LPMVRP_t} - \underset{(-2.53)}{0.4353LSTOCKS_{t-1}} \underset{(-0.91)}{-0.069LURATE_t} \quad (5.20)$$

$Adj\ R^2 = 0.87$. The residual, $RESID_t$, is integrated of order 0 (ADF_0t =-3.42).

For the testing of the short-run relationship we deal only with the model using $RGDP_t$ as the income proxy.[12] The preferred error correction or short-run relationship using $RGDP_t$ is:

$$\Delta LREXP_t = 0.0009 + 0.8779\Delta LRGDP_t - 1.7173\Delta LPMVRP_t - 0.2956\Delta RESID_{t-1}$$
$$(2.18) \qquad (-6.66) \qquad (-4.84) \qquad (5.21)$$

$Adj\ R^2 = 0.33$ and $RESID_{t-1}$ is the residual from the long-run relationship.

In the first instance it should be noted that the stock variable is not significant at acceptable decision levels in the short-run model. This result indicates that there is no evidence of a short-run relationship between the level of stocks and the demand for PMV. This finding will be discussed later. Despite this failure of the stock variable to be associated with short-run variations in the demand for PMV in Australia we suggest that, over the period under review, the Australian SA model for PMVs is, in the main, in accord with the predictions of the theoretical model. In the first instance the signs of the coefficients are the same as those suggested by the theory of the SA approach for both the long-run and short-run relationships. In the second instance, Equation 5.20 using $RGDP_t$ generates a long-run income elasticity of 1.02 and Equation 5.21 a short-run income elasticity of 0.88, which again conforms to expectations that the short-run elasticity of income is lower than the long-run elasticity of income. In the third instance the results generated for price elasticity again concur with SA theory. That is, long-run price elasticity for PMVs is determined as lower than that of short-run price elasticity. When $RGDP_t$ is used to denote income, Equation 5.20

[12] The decision to use $RGDP_t$ is based on the marginal superiority of the performance of the model using *RGDP* on the basis of the Ramsey Reset test $\chi^2_1 = 4.81[0.028]$ for the RDI model compared to $\chi^2_1 = 2.72[0.099]$ for the RGDP model. In addition, the *RGDP* income measure captures business income, an important source of passenger motor vehicle demand.

suggests a long-run price elasticity of -1.38 as compared to Equation 5.21 that generates a short-run price elasticity of only -1.72. It can be argued that these price elasticity results are somewhat inconsistent with what is often expected, *ceteris paribus*, for a given price change in the short-run. Nevertheless, we contend that this short-run price elasticity result is explicable in the particular context of the PMV market. That is, the short-run results for price elasticity reflect the particular nature and characteristics of the PMV market as compared to the market for other consumer durables. These unique elements include the likelihood that in the market for PMVs:

- short-run price decreases are usually not expected by consumers to be permanent and may therefore generate large short-run responses, and
- the marketing of PMVs is characterised by model changes and discounting of new car during model "run-outs" which again is likely to generate strong short-term price elasticity.

Taken together, these particular features of the PMV market can explain the empirical results that determines short-run price elasticity to be greater than long-run price elasticity. In the fourth and final instance, whilst the coefficient of the unemployment variable in the long-run model is negative, it is also small and insignificantly different from zero at acceptable decision levels. In addition, and again in accord with SA theory, the unemployment variable is not significant at acceptable decision levels in the short-run model.

We now consider the impact of the key explanator of the SA model. This, of course, is the impact of the stock variable in determining PMV demand. Equation 5.20 suggests that the level of stocks one period prior is an important determinant of long-run real expenditure on PMVs. This result lends credence to the SA approach which, as noted, holds that households typically have a desired level of durable stocks ("target ownership"), to which they gradually adjust through time. Equation 5.20 shows that a one percent decrease in stocks is associated, in the long-run, with a 0.44 percent increase in real expenditure on PMVs in the following quarter. On the other hand, Equation 5.21 shows that the stock variable is not significant at acceptable decision levels in the short-run model. This result indicates that there is no evidence of a short-run relationship between the level of stocks and the demand for PMV. However, we again contend that this result is not surprising and does not detract from the validity of the SA model. This result is perfectly explicable since the stock adjustment process is a long-run mechanism whereby consumers adjust to their desired holdings of PMVs. By way of contrast, short-term responses to changes in stocks appear to be swamped by price and income effects.

5.8.2.1 Alternative Measurements of the Stock Variable

Given the pivotal role of the stock variable to the validity of the SA method, we now move to test whether the method and process of determination of the quantitative stock variable itself will impact on the empirical results generated. There are two legitimate sources of data as to the level of Australian PMV stocks. The first is from the ABS and the second from the authoritative Dealer's Guide publisher, Glasses Guide. The point of interest is that there is a significant difference as to the calculation of the depreciation rates implicit to determination of the stock level.

The stock series used in the regressions above is calculated by the ABS and reported in the NIF-10S database. This series is calculated on the basis that new purchases depreciate by 3.25 percent immediately and at 6.25 percent in all subsequent quarters. This generates a stock value close to 6 percent of its original worth after 10 years. By contrast Glasses Guide, using actual data on current new and used car prices, effectively estimate new cars to depreciate at 5 percent per quarter for the first year and 2.5 percent per quarter for subsequent quarters. This generates a stock value close to 32 percent of its original worth after 10 years. Quite obviously there is a substantial variation between the two series in their estimation of the value of the stock estimate. As we are confident that the values provided by Glass are indicative of actual market values, we believe that it is well worth considering the stock estimate suggested by Glass as an alternative stock series in a test of an Australian SA model applied to PMVs. Therefore, we will construct our own stock series using the indicative depreciation rates provided by Glass.

Figure 5.1: Stock Series Compared

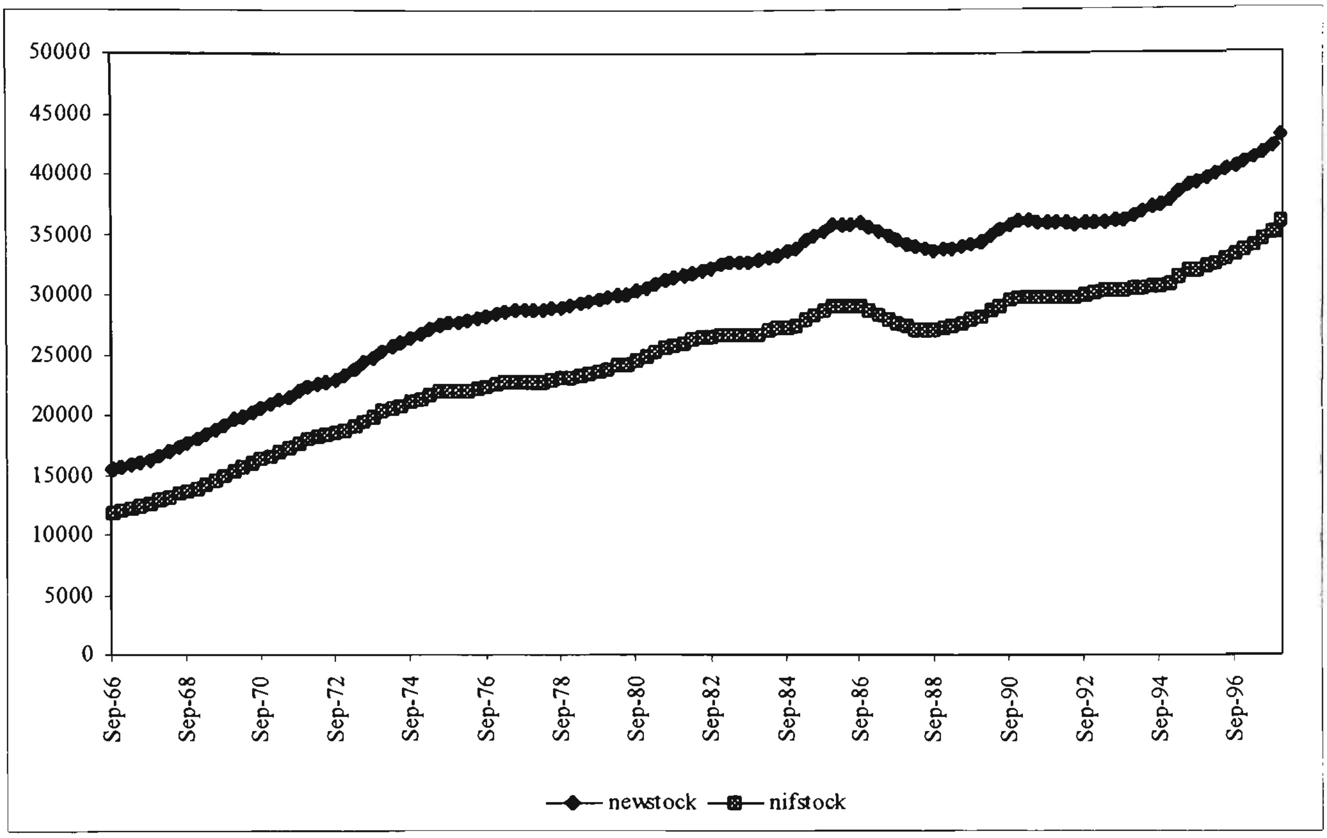

Fig 5.1 plots the two series from 3:1966 to 4:1997 for purposes of comparison. As expected the series constructed using the approach suggested by Glass lies above the ABS stock series. However, both series follow a very similar path over time as indicated by the Pearson correlation coefficient of 0.997 and, importantly, both experience a significant dip after 1:1986. We now report results using the alternative stock variable, (NSTOCK) calculated from data supplied by Glasses Guide.

The estimated co-integrating vector or long-run relationship using NSTOCK is as follows:

$$LREXP_t = 7.7023 + 1.1298LRGDP_t - 1.4602LPMVRP_t - 0.5962NLSTOCKS_{t-1}$$
$$(6.80) \qquad (-6.86) \qquad (-2.53)$$
$$-0.0449LURATE_t$$
$$(-0.76) \qquad (5.22)$$

$Adj\ R^2$ = 0.87. The residual $RESID_t$ is integrated of order 0 ($ADF_0\ t$ = -3.63).

We now turn to the short-run model. The preferred error correction or short-run relationship using $RGDP_t$ is:

$$\Delta LREXP_t = -0.0016 + \underset{(2.42)}{0.9860\Delta LRGDP_t} - \underset{(-6.75)}{1.7291\Delta LPMVRP_t} - \underset{(-510)}{0.3216RESID_{t-1}} \quad (5.23)$$

$Adj\ R^2$ = 0.34 and $RESID_{t-1}$ is the residual from the long-run relationship.

In the first instance it can be seen that, as with the stock series generated by the ABS, the signs of the coefficients for both the long-run and short-run relationships applicable to the Glasses stock estimate, are the same as those suggested by the SA theory. Notwithstanding, the results obtained when our alternative stock variable is substituted for the ABS series are marginally better than those results reported above. These can be seen when a comparison is made between the income and price elasticity outcomes.

The income elasticity results applicable to the Glasses stock estimate as compared to the ABS stock estimates are similar. As with the ABS results, the Glasses stock variable is associated with a short-run income elasticity below that of the long-run income elasticity. Both income elasticity outcomes are therefore consistent with the expectations of the traditional SA model and with prior beliefs. However, Equation 5.22 which uses Glasses stock estimate generates a long-run income elasticity of 1.13, very slightly below the long-run income elasticity of 1.38 recorded for Equation 5.20 (ABS stock estimate). On the other hand, Equation 5.23 (Glasses stock estimate), reports a short-run income elasticity of 0.99 that is slightly above the short-run income elasticity of 0.88 recorded in Equation 5.21 (ABS stock estimate).

In a like vein, the price elasticity results applicable to the Glasses stock estimate are very similar to those recorded with the ABS stock variable. In both instances the results concur with SA theory. Equation 5.22, (Glasses stock estimate), suggests there is a long-run relationship between real expenditure on PMV and stock in the previous quarter. A one percent increase in stock is associated with a long-run price elasticity of –1.46 as compared to Equation 5.20, (ABS stock estimate), of –1.38. Equation 5.23, (Glasses stock estimate), is associated with a short-run price elasticity of -1.73, as compared to Equation 5.21, (ABS stock estimate), that is associated with an almost identical short-run price elasticity of –1.72.

We will now consider the stock adjustment variable itself as per the Glasses Guide estimate. Equation 5.22 suggests that a one- percent decrease in stocks is associated with a 0.60 percent increase in real expenditure on PMVs in the following quarter. On the other hand, again we find that the stock variable is not significant at acceptable decision levels in the short-run model, Equation 5.23, which indicates that there is no evidence of a short-run relationship.

The substitution of the alternative stock variable for the stock series calculated by the ABS has slightly improved the regression results. The individual *t* scores are marginally higher for most of the significant variables as is the *Adj* R^2. In addition, the Ramsey Reset statistic is slightly improved.[13] Thus the use of the Glasses Guide stock series is as well justified as that of the ABS stock series.

5.9 The Use of Additional Variables in the Desired Stock Equation

We now turn our attention to various efforts made to improve the SA model as brought to bear on the demand for PMVs. The first such attempts to be canvassed will be those that sought to better the "desired stock" equation

[13] $\chi^2_1 = 2.37[0.124]$.

through the incorporation of a range of additional variables. The first additional variable to be examined is real expenditure on housing. RF suggested augmenting the SA model with a real housing expenditure variable. The rationale, as noted in Chapter 4, was that, in some instances, demand models may be improved by the explicit consideration of substitute and complementary goods.

Economic logic suggests one such complementary relationship may exist between the demand for PMVs and residential construction. The hypothesis is that residential construction will have a positive impact on PMV sales given the assertion that most new housing is located in areas outside of the central cities. Because of location, intuition suggests that suburban and rural home owners would be more likely to own motor vehicles than would central city residents. This argument may have considerable merit in the case of Australia where the majority of the Australian population is located in six major cities and the post war period has been characterised by urban sprawl about these cities. In addition, the outer suburban areas are often poorly served by public transport thereby increasing the imperative for car ownership. Thus a model of PMV demand for Australia may well be enhanced by the incorporation of information about household expenditures on new residential construction.

5.9.1 New Residential Construction

The expanded SA equation that includes a real housing expenditure variable, $HOUSE_t$, as suggested by Rippe and Feldman (1976) and Hamburger (1967), will now be applied to the Australian market for PMVs for the period 1966:3 to 1997:4. To begin with the model is tested with the following independent variables: $RGDP_t$, $PMVRP_t$, $NSTOCK_t$, $HOUSE_t$, and $URATE_t$.

However, the $URATE_t$ variable entered with a wrong sign significant at the five percent level and so was dropped from the preferred specification. We therefore report results generated from a model without the $URATE_t$ variable. The estimated long-run relationship using $RGDP_t$, $PMVRP_t$ and $NSTOCK_t$, and including the lagged real residential housing construction variable is as follows:

$$LREXP_t = 7.0416 + 0.8853LRGP_t - 1.3648PMVRP_t - 0.6227LNSTOCKS_{t-1}$$
$$\qquad\qquad (7.70) \qquad\qquad (-8.85) \qquad\qquad (-4.89)$$
$$+0.3908LHOUSE_{t-}$$
$$(-5.74) \qquad\qquad (5.24)$$

$Adj\ R^2 = 0.90$. The residual $RESID_t$ is intergrated of order 0 ($ADF_0\ t$=-3.71)

The coefficient on the housing expenditure variable, which enters with the correct sign and significance at the one percent level, may be interpreted as follows. A one-percent increase in housing expenditures this period is associated with a 0.39 percent increase in PMV expenditure next period.

The preferred short-run relation relationship is as follows:

$$\Delta LREXP_t = 0.0028 + 0.8422\Delta LRGDP_t - 1.6295\Delta LPMVRP_t + 0.3452\Delta LHOUSE_{t-1}$$
$$\qquad (2.10) \qquad\qquad (-6.68) \qquad\qquad (2.94)$$
$$-0.3587RESID_{t-1} \qquad\qquad (5.25)$$
$$(5.24)$$

$Adj\ R^2 = 0.34$ and $RESID_{t-1}$ is the residual from the long-run relationship.

The short-run relationship finds that the housing variable lagged one period has a coefficient with a positive sign and is significant on a one sided test at the 0.01 level. The coefficient of $\Delta LHOUSE_{t-1}$ may be interpreted as follows. For a given period, a one percent increase in real housing expenditure is associated with a 0.35 percent increase in short-run expenditure on PMVs in the next quarter.

A comparison of the short-run and long-run results conforms to the expected outcomes. In the first instance, housing expenditure elasticity is positive over both time frames. We also find, as expected, that the long-run elasticity of 0.39, (Equation 5.24) is slightly higher than the short-run elasticity of 0.35, (Equation 5.25). The inclusion of the housing variable has slightly reduced both the long run and short run income elasticities, but both are still significant at the one percent level. Also we note that both the long run and short run price elasticities fall slightly, but both are still significant at acceptable decision levels.

Both the long-term and short-term Australian results conform to the US outcomes achieved by Rippe and Feldman and Hamburger. We therefore suggest that the Australia experience for the period under review, as in the US for the period canvassed by Rippe and Feldman and Hamburger, determines that at least in the short-run, real expenditure on housing and the demand for PMVs are complementary.

5.9.2 Interest Rates

We now turn our attention to a further additional variable that has been suggested for incorporation into the "desired stock" equation, namely the availability and the cost of consumer credit. A number of researchers have suggested this factor for consideration including Hamburger (1967), Juster and Watchel (1972), Mishkin (1976) and Briscoe (1977). These authors use a range of interest rates as explanators and, in some cases, distinguish between real and nominal interest rates in their attempts to model the demand for PMVs. The arguments in favour of using real interest rates are obvious since it is the real user cost of capital that matters. However, on occasion, nominal interest rates have been used as an alternative to that of real interest rates for reasons associated with money illusion.

In the case of Australia there are several real and nominal interest rates to choose from. In choosing an interest rate it is important that the rate reflect, as accurately as possible, the user cost of capital and the opportunity cost of borrowing. In our initial modelling we used a real interest rate derived from the nominal bank interest rate $BINT_t$ published by the RBA and deflated by the CPI. This variable proved to be disappointing because it entered the long-run regression with a counter-intuitive positive sign, insignificantly different from zero. Such a result suggests that real interest rates are not associated with variation in the level of Australian PMV demand in the long-run. This is a somewhat surprising result as intuition and indeed, economic theory would suggest a strong and sustained linkage between the two considerations.

We then tried including the nominal bank interest rate, $BINT_t$. Initially we simply added $BINT_t$ to a standard SA regression model. However, the poor performance of the unemployment variable led us to drop $URATE_t$ from our preferred long-run model.

Consequently, the estimated long-run relationship is:

$$\underset{}{LREXP_t} = 6.9982 + \underset{(7.39)}{0.8488LRGDP_t} - \underset{(-9.16)}{1.4090LPMVRP_t} + \underset{(-5.46)}{0.3705LHOUSE_{t-1}}$$

$$\underset{(-3.94)}{-0.5277LNSTOCK_{t-1}} \ \underset{(-2.05)}{-0.0643LBINT_t} \qquad (5.26)$$

$Adj\ R^2 = 0.87$. The residual $RESID_t$ is integrated of order 0 ($ADF_0\ t = -5.04$).

Our results do suggest that changes in the nominal bank interest rate are associated with a long-run variation in demand for PMVs.[15] In the first instance, the coefficient is correctly signed. Secondly, the elasticity of the demand for PMVs with respect to the nominal bank interest rate is -0.064, (Equation 5.26). This suggests that, in the long-run, a one-percent increase in the nominal bank interest rate is associated with a 0.064 percent decrease in the demand for PMVs.[16]

In aggregate, the empirical results associated with interest rates and the demand for PMVs in Australia are somewhat surprising. Given that many PMVs are bought with borrowed funds, it is intuitively suspected that variations in real interest rates would have a powerful association with variations in the demand for PMVs. However, the expected linkage between real interest rates and the demand for PMVs can not be sustained. Increases in nominal interest rates are associated with a decline in the demand for PMVs. However, concerns as to the efficacy of the regressor remain because, as noted, real and not nominal interest rates reflect the real user cost of capital. Importantly, substitution of $BINT_t$ for the unemployment rate variable has only marginally changed the coefficient estimates of the other explanatory variables. A comparison of equation 5.24 to equation 5.26 shows very little difference in the long run elasticities.

5.9.3 Consumer Sentiment

We now consider a third additional variable, consumer expectations or consumer sentiment, that has been suggested for incorporation into the "desired stock" equation. A number of researchers including Smith (1975), Juster and Watchel (1972) and Briscoe (1977), suggest that the SA model will be much

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[15] The nominal bank interest rate variable is not significant at an acceptable decision level in the short-run and therefore could not be included in a preferred short-run model.

[16] For example, if the bank interest rate increased from, say, 5 percent points to 6 percent points, an effective 20 percent increase, then demand for PMVs would fall by 1.3 percent.

improved by the inclusion of this additional regressor.

An index of consumer sentiment seems a promising variable for a model that seeks to explain expenditure on PMVs. The concept can be empirically tested in the Australian context as, fortunately, the Melbourne Institute of Applied Economic and Social research has been collecting data on consumer sentiments since 3:1974. Two indexes are considered relevant for this exercise, the index of current sentiments of consumers, $CSIC_t$, and the index of sentiments of consumers regarding the future, $CSIE_t$. However, we find that both $CSIC_t$ (current consumer sentiment), and $CSIE_t$ (consumer sentiment as to the future), are integrated of order 0 and, therefore, are not included in the long-run relationship. We therefore reproduce the parsimonious long-run results for the period 1974-1997 as follows:[16]

$$\begin{aligned} LREXP_t = 11.5181 + &\underset{(6.85)}{1.4318LRGDP_t} - \underset{(-9.79)}{1.6332LPMVRP_t} + \underset{(-2.74)}{0.2193LHOUSE_{t-1}} - \\ &\underset{(-4.48)}{-0.1.3778LNSTOCK_{t-1}} \underset{(-1.68)}{-0.0539LBINT_t} \end{aligned} \tag{5.27}$$

$Adj\ R^2 = 0.83$. The residual $RESID_t$ is integrated of order 0 ($ADF_0\ t = -3.21$).

Importantly, these results are similar to those reported above with the larger data window.

We now report the parsimonious short-run model results using only the current consumer sentiment index.[17] The preferred short-run model is as follows:

$$\begin{aligned} \Delta LREXP_t = 0.3581 &- \underset{(-6.92)}{1.75725\Delta LPMVRP_t} + \underset{(-2.53)}{0.3376\Delta LHOUSE_{t-1}} + \underset{(2.01)}{0.0798LCSIC_{t-1}} \\ &\underset{(4.85)}{-0.3794RESID_{t-1}} \end{aligned} \tag{5.28}$$

[16] The shorter sample causes the coefficients of Equations (5.25) and (5.26) to differ but only to a slight extent.

[17] The results were very similar whether *CSIC* or *CSIE* is used. For convenience we report only those results generated using CSIC.

$Adj\ R^2 = 0.83$. The residual $RESID_t$ is integrated of order 0 ($ADF_0\ t = -3.21$).

Although the consumer sentiment variable is significant and correctly signed, the adjusted R^2 statistic is little higher than that of Equation 5.25, suggesting that this variable plays, at best, a moderate role in explaining short-run demand for PMVs in Australia. A one percent increase in $LCSIC_t$ is associated with a 0.0798 percent increase in expenditure on PMVs in the following quarter. Thus, in the Australian context, variations in short-run consumer sentiment have a much more marginal association with variation in PMV demand than is the case for the US studies of Smith, Juster and Watchel and Briscoe.

5.10 An Appraisal of Australian SA Models

We find that, over the period 1966 to 1997, the best empirical result for the determination of Australian demand for PMVs is generated by the most basic form of the SA models, $D_t = g(S_t^* - S_{t-1}) + rS_{t-1}$. This model does not seek either to embellish the level of desired stock through the incorporation of a range of additional variables, or to improve the implicit short-term adjustment mechanism. The results are generally satisfactory over both the short and long-run and suggest that the level of stocks one period prior is an important determinant of the demand for PMVs in Australia. In addition, the coefficients of the model are in accord with those expected *a priori* and are significant at satisfactory levels. Further, we are satisfied that the use of the Engle-Granger cointegration methodology has avoided some of the pitfalls of OLS time-series modelling so that the test statistics can be regarded as "reliable".

Equation 5.23 (incorporating a stock estimate based on Glasses Guide), indicates that the long-run and the short-run income coefficients are correctly signed. In addition, the long-run income elasticity exceeds the short-run elasticity. The magnitudes of both (1.13 and 0.99 respectively), appear credible and are broadly in accord with those found by other authors in overseas studies. In the cases of the price elasticities, the short-run elasticity (-1.73) exceeds the long-run elasticity (-1.46), absolutely. We suggest this result may be explained by the importance of bargain hunting during stock run-outs that are common in Australia. As with the income elasticities, both price elasticities seem to be of credible magnitudes and, again, are broadly in accord with those found by other authors. The model suggests that the stock of PMVs plays an important role in explaining new PMV purchases and this conclusion is not greatly affected by the depreciation rate used. Our preference for our own stocks variable following Glass was principally because the NIF-10 depreciation rate seemed at odds with that suggested by Glass which is widely regarded in the industry as reliable.

Attempts to improve the SA model through the use of additional variables in the desired stock equation were generally disappointing. Although residential construction did have some impact in the short-run, the long-run relationship is not found to be altered by the addition of a housing variable. Real interest rates are found to have little impact on PMV demand (and in addition, generate a counter-intuitive sign that suggests an increase in real interest rates will in fact generate an increase in PMV demand). Short-run real interest rates have at best a very marginal influence on PMV demand. Nominal interest rates in fact perform slightly better than do real interest rates although, as indicated, do not indicate the real cost of credit to the consumer. We find that the index of consumer sentiment is integrated of order 0 and is therefore not included in a long-run relationship. In the short-run the index of consumer sentiment is significant but its coefficient is comparatively small.

5.11 Testing Criticisms of the SA Method

Chapter 4 concludes by identifying three sets of criticisms of the SA model. Two of these criticisms will be empirically tested over the Australian window of interest. We will first examine the User Cost critique of the so-called failure of the SA model to distinguish between the market for new as against used cars. We will then move to test the second User Cost objection to the SA model which involves the failure of the SA approach to incorporate a budget constraint variable. As noted, we will not empirically analyse the third area of censure of the SA model. This involved the Structuralist claim that there was a need to incorporate a saturation level into any model seeking to explain PMV demand. As noted in Chapter 4, we reject this claim on two grounds. The first is the need to employ arbitrary or contrived measurements to determine a saturation level. The second is the fact that we are not convinced, in any case, of the need to apply such measures to the Australian market for PMVs.

We now move to test, in the Australian context, the first of the User Cost objections to the SA model, the failure to distinguish between the market for new PMVs as against that of used PMVs. In the previous chapter we traced the development and application of the User Cost approach to the demand for PMVs via the contribution of a number of researchers. The approach was validated on the grounds that the SA model is inadequate in two main areas. The first is the failure of the approach to draw a distinction between the market for new PMVs against that for used PMVs. The User Cost model proposes that new PMVs are perceived as a 'superior' goods whilst used cars are regarded as necessities. The second is the lack of consideration in the SA model for the effects of budget constraints on the total demand for consumer durables. The first of these concerns is tested on the demand for Australian PMVs and follows the contribution of Wykoff (1973). The budget constraint consideration will be analysed in the Australian context following Hess (1977).

5.11.1 The User Cost Approach: The Wykoff Model

As we saw in Chapter 4 Wykoff developed an empirical model that compared the aggregate demand for new cars (assuming constant elasticities and homogeneity in money income and prices), on the basis of rental prices (user cost), as compared to purchase prices. According to Wykoff the key feature of this model is its capacity to delineate between the separate influences of new and used car demand.

The empirical User Cost equation is:

$$In\, A = a_0 + a_1 + In\, Y + a_2 In\, C + a_3 In\, U \qquad (4.54)$$

where

In = the natural log;

A = new car purchases;

Y = income;

C= new car rental

U = used car rental price

It will be recalled that the implicit user cost, or rental price, of an s-year-old car in year t, $c(s, t)$ can be shown to have the following relationship to market purchase price and interest rates:

$$c(s,t) = r(t) \cdot p(s,t) + p(s,t) - p(s+1,t+1) \tag{4.47}$$

where:

p(s, t) = the purchase price of an *s* year-old car in period *t*.

r (t) = the market interest rate

The user cost or implicit rental price of a car over a year therefore, is the opportunity cost of holding the car plus the loss value of the car over the year.

As seen in Chapter 4, although clear conclusions could not be drawn from the empirical results generated Wykoff did assert that the rental price model compared favourably to that of purchase price. The use of purchase price elasticities as yardsticks to test the User Cost model enabled Wykoff to conclude that the use of rental prices in the model generate superior goodness-of-fit characteristics than models which use new PMV relative prices. This suggests that factors beyond the initial purchase price, such as interest rates (on loans taken out to finance the purchase), and depreciation rates (which in part determine resale values), are of importance in determining the demand for new cars.

5.11.2 An Australian Application of the Wykoff Model

In order to construct a model that incorporates new and used car stocks and thereby calculate the user cost of new PMVs, we follow Wykoff's approach and determine the User Cost of new PMVs through the use of a numeraire which is taken to be a standard Ford Falcon sedan. It is arguable that, as a market leader, the price of Falcons is a good indicator of the price levels for both new and used PMVs of other models and manufacturers.[19] The User Cost or implicit rental price

[19] In addition practical realities made the use of a numeraire necessary. The data on the price of Australian used cars over the period of the data window was obtained from the authoritative Glasses Guide. These statistics are

of a new car is thus taken as the difference between the average prices of new and one-year old Falcons. Data is less reliable on the prices of PMVs older than one year. Based on data obtained from Glasses Guide we, nevertheless, believe that a 10 percent annual rate of depreciation after the first year is a reasonable estimate.

Wykoff proposes that, in principle, used cars are necessities. This implies they have no opportunity cost. We, however, consider the "cost" of using a used PMV within the bounds of the Wykoff empirical model. The user cost of a new PMV is assumed to be first year depreciation plus interest on the new PMV price. The user cost of a used PMV is assumed to be the depreciation over the second year (deemed to be 10 percent), plus interest on the value of a one- year old used PMV price. The model is couched in terms of an individual facing two choices:

- purchase a new PMV or have no PMV, or
- purchase or retain a one year old PMV or have no PMV.
- Our estimating model is:

$$LREXP_t = \beta_0 + \beta_1 LRGDP_t + \beta_2 LNEWUC_t + \beta_3 LOLDUC_t + \varepsilon_t \qquad (5.29)$$

where:

$LREXPt$ = Log of real expenditure on new PMVs

$LRGDP_t$ = Log of real disposable Income

$LNEWUC_t$ = Log of real user cost of new PMVs

$LOLDUC_t$ = Log of real user cost of used PMVs

We use the Engle-Granger (1987) error correction approach. The estimated co-integrating vector or long-run relationship is as follows:

used by the industry to determine the relative prices of used cars. However they are very expensive to obtain. The database used in this calculation cost A$2,500. Information on other models would cost a similar amount.

$$LREXP_t = -0.5463 + 0.6266LRGDP_t - 0.001LNEWUC_t + 0.0082LOLDUC_t$$

$$\qquad\qquad (10.18) \qquad\qquad (-0.27) \qquad\qquad (0.04) \qquad\qquad (5.30)$$

Adj $R^2 = 0.65$ and the residual $RESID_t$ is integrated of order 0 ($ADF_0\, t = -2.98$). $DW = 2.01$)

In the first instance the variable enter the model with the correct signs. However, whilst the explanatory power of the long-run model is reasonable, it is clear that neither of the user cost variables contribute anything of substance to it. That is, we find that a one percent increase in user cost of new cars will be associated with a 0.001 percent decline in expenditure on new cars, while a one percent increase in the user cost of a used car is associated with a 0.008 increase in expenditure on new cars. However, neither of these elasticities is insignificantly different from zero. In addition, we find that the error correction or short-run relation relationship is even less satisfactory and is, therefore, not reported here.

These results suggest that the Australian experience of PMV sales during our sample is not adequately explained by a User Cost model that sought to distinguish between the demand for new and used PMV's. Thus a major advantage claimed for this approach over that of the basic SA model is not of great assistance in explaining the demand for Australian PMV's over the period of 1966 to 1997.

5.12 Testing the Budget Constraint Criticism

As we have seen, researchers such as Hess (1977) claim that the lack of consideration in the SA model for the effects of budget constraint on the total demand for consumer durables, including PMVs, is a major weakness of the approach. Consequently, as this factor can be accommodated within a User Cost model, Hess sees that method as a preferred option when analysing the factors determining the demand for PMV's. As noted, Hess (1977) accepts the neo-classical assumption that the consumer will strive to allocate their budget amongst a number of possible alternatives on the basis of relative price differences and subject to a budget restriction in order to achieve optimisation of utility. Hess develops a 'multi-period, multi-asset, ownership allocative model' to test this contention in his study of the demand for automobiles, in the United States, over the period 1952 to 1972.

Hess's User Cost equation is:

$$\text{Demand for PMVs} = f(\,P_a/P,\ P_d/P,\ P_h/P,\ i/1+I,\ P_a^*/P(1+i),\ P_d^*/P(1+i),\ P_h^*/P(1+i),\ \rho^*/1+i,\ Y,\ W_n\,) \quad (4.60)$$

P_a = the implicit price deflator for gross PMV product.

P_d = an implicit price deflator for durable goods other than PMV's.

P_h = the implicit price deflator for non-farm residential structures

ρ^* = the anticipated rates of inflation in the above price indices[20]

i = the rate of interest on long term U.S. bonds

Y = personal disposable income

W_n = an estimate of wealth from flow-of-funds data.

P = implicit price deflator for personal consumption expenditure

The theoretical and empirical analysis employed is claimed to show that the demand for PMV's is best examined within a constrained utility maximisation model. The high explanatory power, statistical significance and correct signs of the

[20] Calculated using the adaptive expectations model described in the text.

theoretically implied regressors are seen to point to the value of the approach and its perceived superiority to that of the SA model.

5.12.1 The Australian Experience

In order to test the budget constraint criticism made by Hess, we have attempted to identify an empirical specification that includes variables similar to those suggested by Hess. However, it has not been possible to directly replicate Hess's empirical generalisations. Our estimating model is:

$$\begin{aligned} LREXP_t &= \beta_0 + \beta_1 LPMVRP_t + \beta_2 LRPDUR_t + \beta_3 LRPHOUSE_t \\ &\quad + \beta_4 LPMVRP^*_t + \beta_5 LRPDUR^*_t + \beta_6 LRPHOUSE^*_t \\ &\quad + \beta_7 LRTNOTE_t + \beta_8 LRGDP_t + \beta_9 LRASSETS_t + \varepsilon_t \end{aligned} \qquad (5.31)$$

where:

$LPMVRP_t$ = Log relative price of PMVs

$LRPDUR_t$ = Log of the relative price of household durables

$LRPHOUSE_t$ = Log of the relative price of housing

$LPMVRP^*_t$ = Log of expected relative price of PMVs

$LRPDUR^*_t$ = Log of expected relative price of household durables

$LRPHOUSE^*_t$ = Log of expected relative price of housing

$LRTNOTE_t$ = Log of real Treasury Note interest[21]

$LRGDP_t$ = Log real disposable income

$LRASSETS_t$ = Log of real non-financial assets of businesses and households

The estimated co-integrating vector or long-run relationship is as follows.

$$\underset{}{LREXP_t = 16.035} \; \underset{(-14.07)}{-1.4612LRGDP_t} \; \underset{(-3.17)}{-0.6021LRDUR_t} \; \underset{(8.39)}{+1.6268LRPHOUSE_t}$$

[21] We replace Hess's 10-year bond rate with the Treasury Note rate. This more closely proxies underlying contemporary Australian interest rates.

$$+2.4352LRGDP_t \; -2.2030LRASSETS_t$$
$$(13.45) \qquad\qquad (-10.63) \qquad\qquad (5.32)$$

$Adj\ R^2 = 0.93$ and the residual $RESID_t$ is integrated of order 0 ($ADF_0\ t = -7.14$, $DW = 2.12$).

The preferred error correction or short-run relation relationship is as follows

$$\Delta LREXP_t = 0.0037 - 1.5485\Delta PMVRP_t + 1.2437\Delta LRGDP_t - 0.5278RESID_{t-1}$$
$$Adj\ R^2 = 0.43. \qquad (5.33)$$

The interest rate variable was deleted because its coefficient, whilst significant, is positive suggesting that an increase in interest rates is associated with an increase in demand for new PMVs. Both intuition and economic theory does, of course, reject this relationship. The expected price variables did not perform well at acceptable levels of significance and they, too, were removed from the equation. Having deleted these variables, those remaining in the specification do not appear to capture the notion of a budget constraint.

Both the long-run and short-run models are disappointing, although the long-run results are superior to the short-run results. In the long-run model, the log of the relative price of household durables and the log of the relative price of housing are both significant at acceptable decision levels. Importantly the log of real non-financial assets of business and households enters with a negative and significant sign. A one percent increase the relative prices of houses is associated with a 1.62 percent increase in the demand for PMVs. This suggests that in the long run consumers see houses and PMVs as substitutes. Similarly, a one percent increase in real non-financial assets of businesses and households leads to a 2.23 percent decrease in the demand for PMVs indicating a long run substitutability between PMVs and household assets. Further, a one percent increase in the real price of consumer durables is associated with a 0.60 percent fall in the demand for PMVs. As a consequence, consumers see PMVs and consumer durables as complementary in the long run. Thus, both the relative prices of housing and consumer durables are long run predictors of real expenditure on PMVs.

Turning to the short-run model we see that none of the asset variables survived. As a consequence, the preferred short- term model contains only price and income variables. The Australian experience, particularly for the short run, does not support the strong and positive assertions claimed for the User Cost model by Hess (1977). Whilst Hess pronounces strong validation of the need to incorporate a consideration of budgetary constraint concerns into any model of PMV demand, such claims are not borne out by the Australian experience over our window of interest.

5.13 A Summary of the SA Model as Applied to the Demand for PMVs in Australia.

This chapter has both reviewed efforts to model PMV demand in Australia up until the mid-1980s and undertaken an empirical analysis of such demand within the framework of the SA model. We find that early attempts to model Australian PMV demand either lacked theoretical credibility or focused their attention on other issues such the estimation of fuel usage. In any case, all suffered from a failure to include a stock variable as a key factor in the determination of PMV demand. We therefore develop and test the SA model in the context of the Australian demand for PMVs over the period 1966-1997. In accord with modern statistical practice we test for the presence of unit roots in the variables employed. We are subsequently obliged to apply the Engle-Granger procedure to estimate a co-integrating vector to describe the long-run relationship between variables.

We find that the classic SA model, free of attempts to broaden the notion of desired stock or modify the short-run adjustment mechanism, generates the best results. We are not able to emulate the findings claimed by a number of researchers who seek improvement in the estimation procedures by either modifying or augmenting the standard SA framework. We then broaden the analysis to incorporate the contention that the SA model should, in fact, be abandoned in favour of the User Cost and /or the Structuralist methodology.

However, we reject the Structuralist model on two grounds. The first is the arbitrary and contrived methods that are necessary to develop the key requirement of a saturation level for PMV demand. The second is that the Australian PMV market differs from those of some European countries where a saturation concept may have greater validity. As a result we do not subject the Structuralist model to empirical analysis within the context of the Australian demand for PMVs.

The User Cost model is, however, subjected to rigorous empirical investigation. We test the contention as, the User Cost model is able to distinguish between the market for new as against used PMVs and incorporate a budget constraint factor in its determinations, it is inherently superior to that of the SA method. We conclude, on the basis this empirical analysis, that such claims are not sustained in the Australian context. As a consequence we find that the replacement of the SA model by the User Cost approach is not justified as a means of best determining the factors influencing the demand for PMVs in Australia.

In summary it is found in the long run the demand for PMVs is well explained by the basic SA model. The level of stocks one period prior is an important determinant of long run real expenditure on PMVs. In addition, real expenditure on PMVs is both income and price elastic, with greater price responsiveness in the short run as compared to the long run. By contrast there is greater income responsiveness in the long run as compared to the short run.

We are now in a position to consider what this knowledge of the determinants of the demand for Australian PMVs means for Australian PMV industry policy.

Table 5.1: Average Weekly Earnings and Disposable Income, 1983-1986

	Dec.1983 $	Dec.1984 $	Dec.1985 $	Dec.1986 $
AWE(a)	365.10	398.10	423.10	456.10
Est. Income Tax (b)	77.55	91.80	1032.86	117.45
Net Disposable	287.55	306.30	320.25	338.65
Net Disposable (1983 dollars)	287.55	298.64	288.46	277.84

Source: (a) *AIC (1988): 'Factors Determining Future Demand for Motor Vehicles', p.27.*

Notes:

(b) All persons normal average weekly earnings-plus additions (overtime, penalties, etc)

(c) No dependents with general tax rebate. All tax figures from tax scales issued 1 December 1986.

Table 5.2: Interest cost as a Percentage of Running Costs

	Private Use	Private Use	Business Use	Business Use
Annual kms.	15,000	30,000	15,000	30,000
Colt Hatch (small car)	20.0%	6.1%	23.4%	20.0%
Corona Sedan (medium car)	20.4%	16.5%	22.9%	20.6%
Fairmont Sedan (large car)	21.7%	17.8%	23.4%	21.4%

Source: *Motoring Cost Schedule NRMA June, 1987.*

(a) Statistics based on New South Wales Royal Motoring Association (NRMA) data.

(b) The difference between private and business interest was due to NRMA assumed finance arrangements.

(c) Private: 75 percent of purchase cost financed by NRMA personal loan.

(d) Business: 100 percent internal finance but opportunity cost calculated at Government bond rate.

Table 5.3. Car Payments as a Percentage of Average Weekly Earnings

Year	percent	Year	percent
1980	17.4	1984	16.0
1981	16.4	1985	16.9
1982	16.9	1986	17.4
1983	15.7	1987	19.8

Source: *AIC[1] (1988) 'Factors Determining Future Demand for Motor Vehicles' p.30.*

Note: The example used is based on the retail price of a Toyota Corona sedan, assuming 25 percent deposit, with an interest rate of 15.5percent. For details of the estimation procedure see AIC (1988) Appendix 4B.

Table 5.4: Mortgage, Car and Income Tax as a Percentage of AWE

		Car Payments		Mortgage Payments			
Year	AWE $	Interest Percent	Total Percent	Interest Percent	Total Percent	Total percent	Income Tax percent
1980	230	3.2	17.4	13.1	20.9	38.3	22.3
1981	262	3.4	16.4	14.9	22.1	38.5	22.5
1982	296	4.0	16.9	16.9	23.6	40.5	23.3
1983	338	2.8	15.7	14.8	21.3	37.0	22.9
1984	362	2.8	16.0	13.5	20.2	36.2	22.7
1985	390	3.6	16.9	15.9	23.1	40.0	22.5
1986	414	3.4	17.4	21.5	29.0	46.4	23.2
1987	445	4.2	19.8	22.2	29.7	49.5	23.9

Source: *AIC[1] (1988) 'Factors Determining Future Demand for Motor Vehicles' p.31.*

Table 5.5: Augmented Dickey-Fuller Unit Root Tests

Variable	Description	Test	DW	t	Trend	I(1)
$REXP_t$	Real Expenditure on PMVs	ADF_0	1.97	-3.17	Yes	Yes
RDI_t	Real disposable income	ADF_1	1.94	-2.80	Yes	Yes
$RGDP_t$	Real GDP				Yes	Yes
$PMVRP_t$	Relative price of PMVs	ADF_3	1.74	-1.78	No	Yes
$STOCKS_t$	Stocks of PMVs (NIF-10)	ADF_1	2.09	-2.64	Yes	Yes
$NSTOCKS_t$	Stocks of PMVs (New)				Yes	Yes
$URATE_t$	Unemployment rate	ADF_2	2.06	-1.89	No	Yes
$HOUSE_t$	Real housing expenditure	ADF_3	1.90	-5.28	Yes	Yes
$RBINT_t$	Real bank interest	ADF_0	1.75	-1.47	No	Yes
$BINT_t$	Bank interest	ADF_1	2.01	-1.51	No	Yes
$CSIC_t$	Current consumer sentiment	ADF_1	2.04	-3.25	No	No
$CSIE_t$	Expected consumer sentiment	ADF_0	1.99	-4.89	No	No

Notes:

(a) Variables were tested as logarithms.

(b) At $\alpha = 0.05$, without trend $t_{critical} = -2.87$, with trend $t_{critical} = -3.46$.

Appendix 5.1: Sources of Data

5.1.1 The Data Set

In order to undertake the econometric modelling of the Australian SA method and suggested alternatives, a comprehensive data set had to be assembled. The creation of this data set provided two sets of challenges. The first was the need to identify suitable proxy variables that represent and capture the variables suggested by the theoretical literature and, in some cases, are used by other researchers who had undertaken similar modelling in a non-Australian context. Once such key proxy variables were identified, the second challenge was to find suitable and available sources from which to construct a reasonably long data set. It is important in time series modelling, particularly when using quarterly data, that we have a data set of adequate length to provide sufficient degrees of freedom for regression analysis. Therefore, the data set used in this analysis was collected from a variety of sources.

The selection and collection of such data was, in itself, a non-trivial task. Although the majority of the time series came from the ABS and were extracted from EconData DX, several data series came from a range of less accessible sources. Table A5.1 provides details for each variable of the exact source of the data used.

Appendix 1 : Source of Data

Variable	Definition	Source
REXP	Real Expenditure	Private Final Consumption Expenditure: Motor Vehicles. ($ 1989/90 sa) Private Final Consumption Expenditure: ABS CAT: 1342:1.3
RDI	Real Disposable Income	Real Household Disposable Income ($m 1989/90 sa) ABS CAT: 5204.0
RMVRP	Relative Price of PMVs	Two Sources: (1) CPI: Weighted Average 8 Capital Cities (sa) (2) Private Final Consumption Expenditure: PMVs (sa) ABS Price Indices: CAT: 1342:5.1
STOCKS	Stocks of PMVs	Stock of Physical and Financial Assets: Motor Vehicles.($ 1989/90 sa) Stock of Physical and Financial Assets: ABS CAT: 1342: 4.1
NSTOCK	New Stock	Glasses Guide
HOUSE	Real Housing Expenditure	Original Expenditure in GDP: Current Prices. Private Dwellings: New and Used Dwellings. ABS CAT: 5206: 4.6
RBINT	Real Bank Interest Rate	Interest Rates: Major Trading Banks % p.a. 1959.2: 1997.4 ABS CAT. 1342-6.1
BINT	Bank Interest Rate	Interest Rates: Major Trading Banks % p.a. 1959.2: 1997.4 . ABS CAT. 1342-6.1
CSIC	Consumer Sentiment-(Current)	Index of Consumer Sentiment: (Current): 1974: 1998. Institute of Applied Economic and Social Research: Melbourne University.
CSIE	Consumer Sentiment (Expected)	Index of Consumer Sentiment: (Expected): 1974: 1998. Institute of Applied Economic and Social Research: Melbourne University.
URATE	Unemployment Rate	Australian Labour Unemployment (Total): 1964.1:1999.2. OECD Main Economic Indicators Table: AUS.07.
LRTNOTE	Log Treasury Note Interest Rate	Finance Markets: From RBA Table F 01: Interest Rates and Yields: Money Market Treasury Notes: Market Yields: 13 weeks.

6 Conclusion

This thesis sets for itself two objectives. Firstly to evaluate the political economy of the PMV industry particularly from the point of view of demand. That is, an analysis of the major policy processes and shifts was undertaken. Such an analysis provides an important justification and motivation for the demand modelling that follows.

In the first instance a historical perspective is given as to the machinations of Australian PMV industry policy from the turn of the twentieth century until the conclusion of the Button Car Plan in 1992. We establish that although such industry policy has a basic dichotomy centred on WW11, there is a theme central to all periods. This is that policy was designed in all instances to protect and enhance the interests of the Australian producers. This dictum applies equally to body builders and assemblers prior to WW11 and to manufacturers of completely built up vehicles and component part producers post WW11. In almost every instance, industry policy made little or no effort to accommodate the influence of factors determining demand or to incorporate considerations as to consumer welfare. Although there have been other analyses of PMV industry policy over the decades since the birth of the industry at the turn of the twentieth century, an important original contribution of this analysis is to emphasise the key role played by consumer demand considerations in PMV policy and process and to show how neglect of such considerations contributed to endogeneous policy failure.

We hold that this failure of industry policy has severely limited the ability of the Australian PMVI to respond to the dynamics of industry change.

Such a reality has occurred over the total time frame of the industry but has accelerated in the last two decades of the century. As a consequence, the industry has been unable to respond to changing consumer pressures, the challenge of import competition and the modern-day reality of international globilisation within the sector. We therefore contend that there is a major imperative to develop and apply a modelling process within a rigorous and acceptable empirical framework, to determine the major factors likely to influence the demand for PMVs in Australia.

As such, the second stage of the investigation provides the first attempt to model the demand for Australian PMVs within the setting of the SA model. Any attempt to model the demand for PMVs should not occur in a policy or theory vacuum. The detailed analysis of the political economy of PMVI policy that identified the failure to pay due attention to consumer demand and welfare considerations provides a helpful starting point for motivating interest in demand modelling. A detailed review of the literature of the SA model as it has been applied to the demand for PMVs in the United States and some European countries is first undertaken. We consider the seminal SA model as it applies to the demand for consumer durables, the application of the model to the specific demand for PMVs and a range of suggested modifications held by selected researchers to improve the basic SA approach as an approach to determining PMV demand. We then, provide the first application of the SA model to the demand for PMVs in Australia. We next undertake both a sequential examination of the suggested modifications to the seminal SA model and canvass even more drastic recommendations that argue for the abandonment of the SA model in favour of alternative demand modelling strategies. In both instances the objective is to determine whether modifications to, or abandonment of, the seminal SA model improves our understanding of the main factors impacting on the demand for PMVs in Australia.

6.1 Major Findings

We began our investigation into the Australian PMVI by reference to the development of industry policy. We find that from the earliest period (around the turn of the twentieth century), successive Australian governments of all political persuasions, have sought to use industry policy as a mechanism to actively protect the interests of the Australian producer. However, we show that three areas of omission consistently thwarted such efforts. The first, and most fundamental, is the failure to incorporate demand-side and consumer welfare considerations into the framing and application of industry policy. The second is the failure to recognise that the industry is composed of two sectors (CBU production and component parts manufacture), and that in many instances, policy initiatives designed to protect the interests of one sector impose severe costs on the other. This, in turn, leads to the need for a constant revamp of policy and thereby promotes a great deal of instability in an industry that demands stability as a prerequisite for investment. The third is the failure to establish consistent aggregate objectives for the industry.

We establish an analytical framework to emphasis the endongeous policy failure endemic to PMVI policy via the division of such policy into seven distinct phases by the conclusion of the Button Plan in 1985. The first stage is from approximately the turn of the century to the conclusion of the WW1 in

1918. We find that an initially vigorous and sophisticated production of Australian PMVs is unable to withstand the challenge of external competition. The Australian industry, by 1918, is therefore concentrated on local body-building, the assembly of vehicles from imported components and on component production itself. Substantial protective devices are already in place to ensure industry viability. The second period from 1918 until 1942 sees addition to, and refinement of, these protective barriers. We trace the development of industry policy over the period to show the evolution of the component sector and the impetus behind the decisions of foreign producers such as Ford and GM to begin operations in Australia. We demonstrate that the industry survived the Great Depression and emerged strongly into sustained growth by 1936. However the fact that the sector was limited to body building, assembly and component parts manufacture began to be of concern. By the late 1930's plans are well developed to mass-produce an Australian PMV.

We establish WW11 as the pivotal turning point in the development of the PMVI and the subsequent application of industry policy. The third stage of historical development of the industry is between 1944-64. During this period the PMVI is designated as the cornerstone to post-war reconstruction and as central to the future development of Australian manufacturing industry. Thus, industry policy is designed both to attract foreign producers to set up CBU production in Australia and to ensure the domination of the Australian product. However, we see that, despite a range of measures including import licensing, the industry comes under threat from the Japanese by the conclusion of the stage.

The fourth stage in the evolution of Australian PMVI policy corresponds to the period 1964-1974. This is the first constituent of a three-stage period that covers a twenty-year interval from 1964-1984. Whilst we show that those twenty years of policy can be divided on the basis of the government in power and the vagaries of policy application, we are able to establish a number of themes common to all three stages. These are:

- the continuation of the intrusive and detailed government involvement in PMVI conduct and operation initially to establish the industry as the pivotal sector upon which to base post WW11 reconstruction and the development and expansion of Australian manufacturing industry generally.
- the shift in focus from these objectives to the determination, regardless of the cost, to make the industry import competitive particularly as a result of the challenge of the Japanese.
- the propensity to use traditional protective measures such as tariffs and quantitative import controls, allied to a willingness to embrace new protective measures such as local content policy to secure an import competitive industry.
- the continued and, indeed, escalated indifference to demand-side factors and consumer welfare considerations in the formation of industry policy.
- a failure to grasp the policy implications arising from the dual sector nature of the industry which promoted volatility, complexity and instability in the sector.

The fourth stage, 1964-74, is characterised by the intention to develop an import competitive industry. As such we see the escalation of tariff protection to a level exceeded only by New Zealand. The consequence is shown in the adverse impact on consumer welfare and the continued rise of imports into the market. We detail the introduction of a chaotic and volatile local content scheme that did little other than to effectively undermine the domestic PMV producer.

The fifth stage, 1974-75, relates to the period of office of the Whitlam Labour government, the first non-conservative government for twenty-three years. This is an important political reality as we show that the industry policy designed over that period reflects the complex and disparate array of forces competing for political and economic dominance. Notwithstanding the very short time span of the government and the fact that their objectives for the industry were quickly superseded by the re-election of a Conservative government in 1975, we show that the period is important in the development of industry policy over the next decade. This is because the period sees domestic PMV producers guaranteed eighty percent of the market. This guarantee did much to shape policy options in the next period. In addition, we see the recognition of the complexity and inconsistency of the local content scheme and attempts to simplify the policy.

Over the period 1976–1984, the final stage of industry policy before the introduction of the Plan, we show that the emergence of two new PMV producers in Australia accentuates problems associated with a lack of economies of scale in the market. We demonstrate that industry policy continues to respond to declining market share for domestic producers by the continuous revamping of supply-side policies. We see tariff levels adjusted, quantitative restrictions lifted, local content schemes adjusted and an Export Facilitation Scheme introduced. The aggregate result is to produce an industry policy that, because of its muddled and confused nature, generates a great deal of general industry disquiet.

We establish, as shown by this summation of industry policy to the period of the Plan, the fundamental problem inherent in the development and application of strategic industry policy. We show that, in almost every instance, little or no consideration is given to demand-side factors or to consumer welfare. By ignoring this critical aspect industry policy, already severely hampered by a failure to recognise the basic dichotomy of the industry between CBU and component parts production and allied to confusion as to fundamental objectives for the sector, achieved little of its stated objectives. In addition, these successes were often obtained at great cost.

In Chapter 3 we introduce the Plan as a new and fresh opportunity for industry policy to learn from the errors of the past and thereby develop operational parameters that may better equip the sector to face the continued challenge of imports and an increasingly globalised PMV market. We establish that the inherent objective of the Plan is to increase domestic production efficiency at substantially lower rates of protection and to generate lower real prices for Australian consumers. These objectives are to be achieved by a strategy that aims to:

- reduce the number of domestic PMV producers from five to three and

• reduce the production of domestic models from thirteen to five

We show that a combination of adverse macroeconomic factors, principally related to the devaluation of the Australian dollar, forces the scheduled mid-term review of the Plan to take fairly drastic action. This involves:

• an abandonment of quantitative import restrictions.

• a revamp of local content policy that sees domestic producers supported only by tariff protection.

• a strengthening of the Export Facilitation Scheme.

We determine that the Plan achieved a modest degree of success. The numbers of producers fell to four (not to three as envisaged by the Plan), and the number of models fell from thirteen to five whilst pricing outcomes remain more obscure. However, we show that the real success of the Plan is not a simple factor of quantitative considerations alone. Rather that the accomplishments of the Plan reflect the degree to which the Australian PMVI has undergone a shift in conduct and performance which led to increased efficiency, productivity and quality and the recognition of the need to embrace global integration.

Nevertheless, we show that the basic errors of past industry policy remain intrinsic to the Plan. In particular, the failure to incorporate demand-side or consumer welfare considerations in the formation, execution and evaluation of the Plan itself.

In Chapter 4 we contend that to effectively contest the extremely competitive world of the global motor vehicle industry it is imperative to understand and respond to the pressures of a consumer demand and the need to enhance consumer welfare. This requires, in the first instance, a sound theoretical and empirical base to model the demand for PMVs. We determine that the SA method, first developed as a tool of demand analysis for consumer durables in the 1950's, fulfills these criteria. As such, this chapter analyses the literature pertaining to the SA model. The methodology employs an analysis of the theoretical contribution of a number of researchers, an assessment of the empirical estimations and generalisations appropriate to their individual model, and finally a brief examination of their results.

We first present the basic SA model applicable to the determination of demand for consumer durables. This broad model is then refined as an instrument for the specific determination of the demand for PMVs. Although we find that the seminal SA model to be empirically valid we show that the application of the basic SA method to the demand for PMVs is subject to a range of criticisms. The first broad area of concern involves perceived errors of omission in the primary model as to what should constitute S_t^* the level of desired stock. A number of contributions that incorporate additional variables such as residential construction, the availability and cost of consumer credit and consumer confidence measures are then analysed. The second area of concern involves the short-term adjustment mechanism inherent to the basic SA model. We detail efforts to improve the adjustment mechanism through the incorporation of a measure of consumer confidence, an explicit definition of a transitory income and the incorporation of the level of unemployment as three variables that may be expected to fashion short-term demand. As a result of their contribution we find that researchers in both broad areas of concern, not unnaturally, claim a significant improvement upon the basic SA method of determining PMV demand.

We then turn our attention to a range of criticisms that move beyond efforts to improve the SA model. Some researchers contend the method is so flawed it should be abandoned altogether and replaced with an alternative method of PMV demand assessment. This is because of the inherent failure of the SA model to consider three perceived major areas of concern:

- the failure to account for a difference between the demand for new, as opposed to used cars;
- the failure to consider the impact of a budgetary constraint mechanism on the level of PMV demand;
- the failure to incorporate the concept of a saturation level in the demand for PMVs.

We investigate each claim as per the methodology employed for efforts to improve the SA method. We find little convincing theoretical motivation to abandon the SA model and conclude that questions as to the validity of the SA model's exclusion of a distinction between new and used cars and the impact of a budgetary constraint mechanism may only be resolved through empirical analysis. We further contend that the lack of incorporation of a saturation level does not distract from the validity of the SA model. This is due to the questionable statistical techniques that must be employed in order to determine a saturation level and because of the unique circumstances that pertain to the Australian market for PMVs.

In Chapter 5 we begin by reviewing efforts to model PMV demand in Australia up until the mid-1980's which did not use the SA framework. We then undertake an empirical analysis of PMV demand within the framework of the SA model. We find that early attempts to model Australian PMV demand either lack credibility or focus their attention on other issues, such as the estimation of fuel usage. In any case, all suffer from a failure to include a stock variable as a key factor in the determination of PMV demand. We therefore develop and test the SA model in the context of the Australian demand for PMVs over the period 1966-1997. In accord with modern statistical practice we test for the presence of unit roots in the variables employed. We are subsequently obliged to apply the Engle-Granger procedure to estimate a co-intergrating vector to describe the long-run relationship between variables.

We find that the classic SA model, free of attempts to broaden the notion of desired stock or modify the short-run adjustment mechanism, generates the best results. We are not able to emulate the findings claimed by a number of researchers who claim improvement in the estimation procedures by either modifying or augmenting the standard SA framework. We then broaden the analysis to incorporate the contention that the SA model should, in fact, be abandoned in favour of the User Cost and /or the Structuralist methodology.

We reject the Structuralist model on two grounds. The first is the arbitrary and contrived methods that are necessary to develop the key requirement of a saturation level for PMV demand. The second is that the Australian PMV market differs from those of some European countries where a saturation concept may have greater validity. As a result we do not subject the

Structuralist model to empirical analysis within the context of the Australian demand for PMVs.

The User Cost model is, however, subjected to rigorous empirical investigation. We test the contention as, the User Cost model is able to distinguish between the market for new as against used PMVs and incorporates a budget constraint factor in its determinations, it is inherently superior to that of the SA method. We conclude, on the basis this empirical analysis, that such claims are not sustained in the Australian context. As a consequence we find that the replacement of the SA model by the User Cost approach is not justified as a means of best determining the factors influencing the demand for PMVs in Australia.

We therefore determine that the SA model does provide a sound and empirically sustainable framework for the estimation of the demand for PMVs in Australia over the period of our window of interest 1966-1997. In summary we learn that in the long run real expenditure on PMVs is negatively price elastic and positively income elastic. We also observe that an increase in stocks of PMVs leads to a decrease in real expenditure in the following period. In the short run there is absolutely greater price elasticity and lower income elasticity as compared to the long run. Notably, the demand for PMVs is determined and explained by the important economic variables of price, income and stocks.

6.2 Policy Implications

There are two areas of policy implication that flow from our study. In the first instance we have, through our intensive exposition of past industry policy as applied to the Australian PMV, demonstrated the adverse consequences that flow from the formation of a policy based on:

- a single-sided market perspective. That is, a policy that is supply-side driven to the extent that demand-side considerations are either totally ignored or receive minimal attention.
- a failure to recognise the consequence of a dual sector industry. This consideration relates to the instability generated by the application of an industry policy such that benefits achieved for one sector, impose substantial cost penalties on the other.
- a failure to clarify ultimate aggregate objectives. Is the industry to be the centre of Australian post WW11 manufacturing? Is it to be import competitive? Is it to be efficient? Are these considerations to be complimentary or mutually exclusive?

We therefore demonstrate that in order for industry policy to succeed these considerations and questions must be accommodated and incorporated into the formation and application of Australian PMVI policy. However, there is an even more important implication that flows from the study. Beyond these specific factors we demonstrate that there is a need for a change in the mind-set of policy makers. That it is vital for those responsible for the determination of future PMV industry policy recognise the mistakes of the past. To acknowledge that there is an imperative to move beyond the creation and implementation of an industry policy based solely on producer and supply-side considerations and to incorporate demand and welfare considerations in any future policy formulation.

The second policy implication that flows from our study is that the SA method provides a satisfactory theoretical and empirical framework for the determination of Australian PMV demand. The model is shown to have a long and successful history of application to external PMV markets and to have been the subject of intensive analysis by researchers seeking to modify and improve the seminal framework implicit to the method. We show that Australian PMV industry policy will, in the light of modern statistical techniques, be able to confidently utilise the empirical methodology of the seminal SA model in any determination of PMV demand. This will much better equip any such policy to provide realistic parameters to better ensure the development and future viability of the industry.

The findings of the demand analysis should be used to influence PMV industry policy. The results from the SA modelling confirm theoretically important ideas concerning price and income elasticity of demand for PMVs. As such, any industry policy that leads to an increase in costs and prices will inevitably lead to a fall in demand for PMVs. In a policy sense, the move to lower tariffs and reduce trade barriers, an inevitable feature of globilisation associated with several rounds of the General Agreement on Tariffs and Trade and the World Trade Organisation over recent decades, has led to lower costs and prices having a positive impact on the demand for PMVs. The knowledge gained from the study as to the negative price elasticity of demand, particularly that of long run price elasticity, is also useful when considering the other identified policy deficiency, namely the failure of policy makers to successfully grapple with the dichotomous nature of the PMV industry. Given that consumers demand the final product and its characteristics, namely the PMVs themselves, increasing the demand for PMVs by lowering prices may only be achieved by improved efficiency and lower priced inputs. Therefore, the knowledge of the importance of the negative price elasticity effect may prove useful in handling the policy challenges of the component sector of the industry. Policy support for the component sector can only be justified to the extent that it reduces prices of inputs to the PMV manufacturing sector.

Knowledge of the long run income elasticity of demand for PMVs is also directly linked to the potential success or failure of industry policy. Our study has shown that increases in real income will lead to a long run increase in the demand for PMVs. Given that real income per capita has increased by 2.1 percent per annum over the last forty years (ABS Cat. 5204.0), it is clear that much of the aggregate growth of the industry has been directly linked to such increases in real income. However, industry policy, whilst recognising the nexus between the demand for PMV and income, should not presuppose that continued real income growth of this magnitude is axiomatic. One lesson of the thesis is that decreased real income will, in turn, led to decreased demand for PMVs. Thus PMV industry policy must always be framed with due regard to the macroeconomic realities facing the Australian economy.

Finally, knowledge of a confirmed negative stock elasticity for PMVs means that in Australia, as with any mature economy, the demand for PMVs is directly influenced by the level of desired stock. As such, Australians are influenced to purchase PMVs when the desired stock levels falls or where the existing stock level wears out. Furthermore, the adjustment may not be immediate but rather be spread out over time. Therefore our study shows that the formulation of PMV industry policy needs to be predicated, in part, on a knowledge of the existing stock of PMVS and the likely long run adjustment to variation in the level of desired stock.

6.3 Directions For Future Research

This thesis has provided important insights into the role of demand and its significance to policy formation in the area of PMVI policy. However, although important questions have been answered, further questions readily suggest themselves. As a consequence, this study suggests a range of possible future directions for research into the Australian PMVI. These include developing:

- a disaggregated analysis by model which, of necessity, would be subject to data availability.
- an analysis of the impact of technology on changing tastes and the demand for PMVs. That is, the issue of endogenous tastes formation (does technical change lead or lag tastes and preferences and what does it mean for the manufacturing process?).
- a study of the impact of globilisation upon policy formation and industry structure.
- A determination of the extent to which public transport and PMVs are substitutes and complements.

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