CENTRE of POLICY STUDIES and the IMPACT PROJECT

Eleventh Floor
Menzies Building
Monash University Wellington Road
CLAYTON Vic 3168 AUSTRALIA

Telephone:
(03) 9905 2398, (03) 9905 5112 from overseas: 61 3 990 52398 or 61 3 9905 5112

Fax: (03) 9905 2426 from overseas: 61 3 9905 2426

e-mail impact@vaxc.cc.monash.edu.au

Report prepared for the Senate Select Committee on a New Tax System
January 25, 1999

The Government's Tax Package: Further Analysis based on the MONASH Model

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Peter B. Dixon and Maureen T. Rimmer

Centre of Policy Studies

Monash University

General Paper No. G-131 April 1999

ISSN 1 031 9034 ISBN 0 7326 1511 9

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Background

This report builds on an earlier paper[1] discussed by Peter Dixon with the Senate Select Committee on December 18. The December paper is part of an ongoing research project with the Queensland Treasury. The views expressed here and in the December paper do not necessarily reflect those of the Queensland Treasury.

The current report has been prepared for the Senate Select Committee under a consultancy contract. The tasks to be completed for the contract are given in appendix 1. In accordance with the contract, we extend the December paper by producing a range of estimates of the effects of the Government's proposed tax package, focusing on sensitivities to variations in key assumptions.

The December paper describes a single simulation, with the MONASH model, of the effects of the tax package. A revised version of this simulation is presented in the current report as the central case. The description of the central case repeats, in slightly revised form, much of the material from the December paper. This ensures that the present report is self-contained. Readers who have already seen the December paper will be able to skip through sections 2 and 3 of this report.

Summary

The Government plans: to reduce taxes on inputs to business; to reduce income taxes; and to increase taxes on consumption by the introduction of a 10 per cent GST. The details of the Government's proposal are contained in a Treasury Paper (ANTS) published in August 1998.

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* We thank Brian Parmenter for valuable suggestions made during the preparation of this report.

1 See Dixon, P.B. and M.T. Rimmer, "The Government's tax package: analysis based on the MONASH Model", paper presented to the Forum for Modelling Australian Taxation, held in Sydney on December 10, 1998.

In our central simulation with the MONASH model, we find, as in the December paper, that:

- the long-run resource allocation gains flowing from the proposed tax changes will be negligible;
- the package will harm Tourism and benefit most traditional exporters, e.g. Iron ore;
- the effects on consumer-good industries will be mixed;
- employment will be stimulated in the short-run by about 30,000 jobs;
- investment will be increased, especially in the short run; and
- the package will produce a long-run increase in capital stock in Australia, but little change in economic welfare.

A welfare-reducing aspect of the tax package is terms-of-trade reduction. In the central simulation there is a long-run negative effect on Australia's terms of trade associated with the positive effect on overall exports. The negative effect on the terms of trade is exacerbated by a shift in the composition of exports away from services and towards goods. In our basecase forecasts, world prices of services increase relative to those for goods. The negative terms-of-trade effect of the package slightly outweighs the long-run welfare gains associated with other aspects of the package including increases in the capital stock.

Our finding of a small negative long-run welfare effect should not be interpreted as inconsistent with Econtech's result obtained using the MM303 model. Econtech found a small long-run welfare gain[2]. The main point is that both models agree that the economic welfare effects of the proposed tax changes will be small.

In addition to the central simulation, we conducted six sensitivity simulations. The first is concerned with the labour market. In the central simulation we adopted the favourable assumption that workers make their wage bargains in real after-tax terms. This means that workers accept the income tax cuts in the Government's tax package as compensation for the increase in the CPI associated with the imposition of the GST. In the sensitivity simulation we make the alternative assumption that workers bargain in real before-tax terms. Under this assumption, the GST-induced jump in the CPI produces a corresponding jump in wage demands. We find a significant short-run negative effect on employment, a loss of 100,000 jobs. If the tax

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[2] See Chris Murphy, "The Long-term Economic Effects of the Government's Tax Plan, modelled using MM303", Econtech, ACT, September 1998. The accuracy with which long-run welfare gains from tax changes can be calculated in a CGE model depends on: (1) the level of commodity disaggregation in the model; (2) the specification of substitution possibilities; and (3) the representation of taxes. In all three aspects, MM303 is impressive. Consequently we consider the MM303 long-run welfare result to be strong confirming evidence that the tax package will produce only a small long-run change in economic welfare.

package is to be implemented smoothly, it is vital that Australian workers allow their before-tax wages to decline relative to the CPI.

The second sensitivity simulation is concerned with exports of tourism and education services. It is clear that the tax package will increase foreign currency prices of Australia's service exports. However it is not clear what elasticity value should be used in translating foreign-currency price increases into resulting reductions in tourist and student numbers. In the central simulation we assumed that foreign elasticities of demand for these services are -3. With this value we found in our central simulation that the tax package will reduce tourism exports by between 9 and 13 per cent, and education exports by between 7 and 12 per cent. Some well-informed commentators think that these estimates exaggerate the damage to Australia's service exports that will flow from the tax package. They think that -3 is too large for the export demand elasticities for services. In the sensitivity simulation we set the export demand elasticities for services at -2. With these lower elasticities, we still find significant damage to service exports. Tourist exports decline by between 6 and 10 per cent, and education exports decline by between 5 and 10 per cent. In the low elasticity simulation the long-run terms-of-trade outcome is more favourable than in the central simulation. This converts the small long-run welfare loss in the central simulation into a small long-run welfare gain in the low-elasticity simulation.

In the third sensitivity simulation we take the GST off packaged holidays to Australia paid for by foreigners in their own countries. These packaged holidays are taken by about two thirds of holiday visitors to Australia and holiday visitors are about half of all tourists[3]. Thus for about one third of tourists, the removal of GST on packaged holidays would lower the costs of hotels, entertainment and other expenditures attracting a GST in the Government's current plans. These expenditures are typically about half the cost of a visit to Australia. The removal of GST on packaged tours therefore affects only about one sixth of tourist expenditures. Nevertheless, freeing packaged holidays of GST would have a useful damage-reducing impact on tourism exports. Rather than tourism exports being reduced by between 9 and 13 per cent as in the central simulation, when packaged holidays are GST-free these exports are reduced by between 6 and 10 per cent. That is, the removal of GST on packaged holidays stimulates tourist exports by about 3 per cent. On the other hand, failure to charge GST on packaged holidays reduces annual revenue by about $300 million. We assume that this is recovered by giving a smaller reduction in income taxes. Overall, the removal of GST on packaged holidays has a negligible, but slightly positive, net impact on the change in economic welfare flowing from the tax package.

In the fourth and fifth sensitivity simulations we remove the GST from food and make a corresponding reduction in the income-tax cut offered as part of the Government's package. The fourth sensitivity simulation adopts the labour market assumption used in the central simulation (after-tax wage bargaining) while the fifth adopts the assumption used in the first sensitivity simulation (before-tax wage

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[3] Throughout this report, tourism is defined broadly. It includes not only holiday makers but also business visitors and people visiting relatives or attending conventions.

bargaining). With after-tax wage bargaining, higher income taxes stimulate wage demands. However, this effect is slightly outweighed in the fourth sensitivity simulation by the lowering of food prices. The net result is a small favourable effect in the short run on employment. Instead of employment increasing in the short run by 30,000 jobs as in the central simulation, in the fourth sensitivity simulation there is a gain in jobs of 38,000. In the fifth sensitivity simulation, the lowering of food prices continues to damp wage demands but, with before-tax wage bargaining, the increase in income taxes has no effect. Thus, the short-run stimulatory effect on employment of exempting food from the GST is much greater with before-tax wage bargaining than with after-tax bargaining. Instead of employment decreasing in the short run by 100,000 jobs as in the first sensitivity simulation, in the fifth sensitivity simulation short-run job losses are restricted to 68,000. In the long run, exempting food has a negligible, but negative, impact on economic welfare under either labour market assumption.

Our food-exempt simulations bring two issues to mind. The first concerns the costs of implementation, compliance, administration and rent-seeking. These costs are likely to be increased if the GST is implemented with substantial exemptions, but in all of our simulations they have been ignored. These ignored costs should be set against any benefits that we show in our simulations for the tax package, especially in assessing the benefits of exempting food.

The second issue concerns the source of employment gains in the central simulation. We can think of the move from the central simulation to the fourth sensitivity simulation as combining a reduction in consumption taxes with a compensating increase in income taxes. According to the fourth sensitivity simulation this leads to an increase in employment. The question arises therefore as to how the imposition of consumption taxes combined with a reduction in income taxes generates a short-run gain in employment in the central simulation. The answer is that the tax changes in the central simulation are not balanced. Employment is stimulated in the cental simulation (after–tax wage bargaining) only because the Government's tax package involves a net movement towards deficit, allowing large reductions in income taxes. More generally, in an environment of after-tax wage bargaining, the Government could achieve short-run employment gains simply by cuts in income taxes without changing indirect taxes.

In the sixth sensitivity simulation we introduce different pass through rates for increases and decreases in indirect taxes[4]. In the central simulation we assumed that all changes in indirect taxes are passed on immediately. In the sensitivity simulation we continue to assume immediate passing on of increases in consumption taxes but we assume that it will take two years to complete the passing on of reductions in taxes on inputs. The long-run effects of delayed pass through are negligible. However, the short-run effects could be quite severe. In the sensitivity simulation, a short-run effect of the package is to reduce employment by 15,000 jobs whereas in the central

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[4] We thank Colin Hargreaves for drawing our attention to this possibility in his presentation to the Forum for Modelling Australian Taxation, held in Sydney on December 10, 1998.

simulation employment in the short run increased by 30,000 jobs. As recognised by the Government, it will be important to ensure that tax reductions pass through quickly to reduced input prices.

Overall, the six sensitivity simulations strengthen the finding in our December paper that the Government's proposed tax changes will have little effect on Australia's long-run macro-economic performance. They add a new dimension by illustrating two short-run down-side risks: the package will cause job losses in the short run if wage earners refuse to allow before-tax wage rates to fall relative to the CPI or if increases in indirect taxes are passed on more quickly than reductions.

In motivating the tax package, particularly the introduction of the GST, the Treasury has asserted that a major change in the tax mix is necessary because the present array of indirect taxes will raise insufficient revenue to met Australia's future needs. Using a MONASH forecast simulation, we find no support for this proposition.

1. Introduction

The aim of this report is to present simulations of the Government's planned tax changes. We use the MONASH model. Readers are not expected to be acquainted with the details of MONASH. Consequently we spend considerable effort in explaining the MONASH results in terms of economic mechanisms which will be known to professional economists.

The present report has been written under contract as part of the Senate Select Committee's project on macro-economic modelling. In preparing the report we have revised our calculations presented in December to the Forum for Modelling Australian Taxation[5]. The revisions were made in response to helpful comments by Chris Murphy and John Rooney[6]. Despite the revisions, the central results remain close to those in our December paper.

In accordance with the Committee's requirements we have extended the December paper to include analyses of the macro-economic effects of the Government's proposed tax package under alternative assumptions and the effects of variations in the tax package. In particular we have looked at the effects:

(a) of different wage responses;

(b) of different levels of sensitivity of tourism and education exports to variations in the costs of these services to foreign consumers;

(c) of excluding inbound-tourism packages from the GST;

(d) of excluding food, under different wage assumptions, from the GST; and

(e) of different rates of pass through of the proposed reductions in input taxes relative to the proposed increases in consumption taxes.

All of these extensions have required new simulations with the MONASH model. In addition to these new simulation results we provide comments on two other areas of interest to the Committee: the inflationary effects of the proposed tax changes; and the likely path of tax revenues in the absence of tax changes.

The paper is organised as follows. In section 2 we review the Commonwealth Treasury's analysis of the Government's tax package. Section 3 reports our central simulation. In sections 4 to 9 we discuss the sensitivity simulations directed to (a) - (e) above. In section 10 we present a forecast of the path of indirect tax revenue assuming no GST and no changes in tax rates. Concluding remarks, including comments on inflationary effects, are in section 11. Appendix 1 lists the terms of reference for this report. The details of our wage assumptions are in appendix 2 and

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5 See footnote 1.

6 In response to comments by Chris Murphy of Econtech we revised our treatment of taxation of inputs to capital creation. Our original calculations underestimated the likely reduction in the cost of business capital which would flow from the Government's tax package. In response to comments by John Rooney of the Office of National Tourism we revised down the assumed value in MONASH for the export demand elasticity for tourism. This is discussed in detail in section 5.

the numbers underlying most of the charts are in appendix 3. The charts are grouped at the end of the report.

2. The Treasury's analysis

In August 1998 the Australian Treasurer published "Tax Reform: not a new tax, a new tax system", hereafter referred to as (ANTS). This is a comprehensive description of the government's tax proposals.

A central part of ANTS is the application of a detailed input-output price model called PRISMOD. This is used to estimate the effects of the proposed tax changes on producer, consumer and investment prices. In essence, PRISMOD takes the form:

$$p_g = p_g*A + t_g + w*L \quad (2.1)$$

$$p_c = p_g + t_c \quad (2.2)$$

and

$$p_i = p_g + t_i \quad (2.3)$$

In these equations:

P_g is the row vector of basic prices or costs of commodities;

A is the input-output coefficient matrix showing the use of each good i per unit of output of each good j (i can be used up directly in j's production or it may be embedded in capital used up in j's production);

t_g is the row vector of taxes collected on the inputs to each industry per unit of output;

L is the row vector of labour input to each industry per unit of output;

w is the wage rate;

p_c is the row vector of prices of commodities to consumers;

t_c is the row vector of taxes collected per unit of sales of each commodity to consumers;

p_i is the row vector of prices of private investment goods used by business; and

t_i is the row vector of taxes collected per unit of sales of each commodity to private business capital creators.

In applying PRISMOD, the Treasury introduced changes in t_g, t_i and t_c to reflect the proposed reductions in taxes on producers and investors and the proposed increases in taxes on consumers. They then used (2.1) to (2.3) to compute the resulting impacts on p_g, p_c and p_i.

From these computations, the Treasury concluded that the proposed tax changes will, on average, reduce basic prices (p_g) by 3.2 per cent, increase consumer

prices (p_c) by 1.9 per cent[7] and reduce the cost of private investment goods used by business by 7 per cent.

The first of these results can be understood as follows. For a typical Australian industry, intermediate inputs (including used up capital) represent about 75 per cent of costs. Taxes on these inputs are about 2 per cent of costs and labour is about 23 per cent of costs. In the Treasury's calculations, the nominal wage (w) is held constant and intermediate-input taxes are reduced by about 40 per cent, from 2 per cent of costs to 1.2 per cent[8]. Assuming that prices are initially unity, a one-industry version of the Treasury's equation (2.1) gives

$$\Delta p_g = \Delta p_g * 0.75 - 0.008 \quad , \tag{2.4}$$

generating

$$\Delta p_g = -0.032 \quad . \tag{2.5}$$

In obtaining the second result, it is apparent that the Treasury is assuming that the proposed changes in the tax mix will increase rates of consumer tax by, on average, about 5.2 percentage points. This gives

$$\Delta p_c = \Delta p_g + \Delta t_c \tag{2.6}$$

$$= -0.032 + 0.052$$

$$= 0.020 \quad . \tag{2.7}$$

The current rate of consumer taxes is about 7 per cent (i.e., $T_c = 0.07$). With basic prices on unity, (2.7) implies an increase in consumer prices of 1.9 per cent (= 2.0/1.07).

In obtaining the third result the Treasury is assuming that the proposed changes in the tax mix will reduce rates of tax on private investment goods used by business by, on average, about 4 percentage points. This gives

$$\Delta p_i = \Delta p_g + \Delta t_i \tag{2.8}$$

$$= -0.032 - 0.04$$

$$= -0.072 \quad , \tag{2.9}$$

that is a reduction in the price of investment goods of about 7 per cent.

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7 This excludes the prices of new houses and of tobacco.

8 In the package, wholesale taxes on intermediate inputs are removed but existing taxes on energy products are substantially retained. The government has judged that it would be difficult to impose the GST on financial services and the services of housing. Instead the government intends to tax inputs to financial services and to home construction.

The Treasury and the Government are inclined to portray the 3.2 per cent reduction in business costs (p_g) as a major advantage to business arising from the proposed tax changes (see, for example, ANTS, p.24). To us, this advantage seems an illusion. It comes about because business is assumed to reduce its selling prices by an average of 3.2 per cent. Thus there is a general deflation of 3.2 per cent in the costs of business inputs and the value of business outputs. General changes in the price level are not normally an important determinant of business prosperity. At some points in ANTS it is argued that cost reductions will give Australian producers a competitive advantage in international markets. This also seems an illusion. We would expect that general changes in the business cost/price level would be offset by exchange rate movements. In fact, in their PRISMOD calculations, Treasury assumes an offsetting loss in competitiveness via a 3.5 per cent appreciation of the Australian dollar.

What is important to individual industries is the movement in their costs *relative* to the movements in the costs of other industries. For example, an export-oriented industry gaining a 5.2 per cent cost reduction benefits in a situation of an economy-wide cost reduction of 3.2 per cent. This is because currency appreciation offsets only the economy-wide cost reduction leaving the individual industry with a 2 per cent competitive advantage in international markets. Thus, on the basis of the PRISMOD results in ANTS (p.167) we would expect the Iron ore industry to gain from the tax changes (their costs are projected to decline by 5.8 per cent) whereas we expect the Sheep industry to lose (their costs are projected to decline by only 2.6 per cent). Similarly, an import-competing industry experiencing less than a 3.2 per cent cost reduction loses in a situation of an economy-wide cost reduction of 3.2 per cent. This is because the appreciation causes only a 3.2 per cent reduction in the prices of competing imported products. Thus, on the basis of the PRISMOD results (p.167) we would expect the clothing and footwear industries to be adversely affected by the proposed changes in the tax mix. Both are projected to have unit cost reductions of only 2.9 per cent.

For consumer products there is an additional complication. The affect of the tax package on industries producing such products depends not only on relative cost reductions but also on relative changes in consumer taxes. If tax changes in combination with cost reductions lead to an increase in the price to households of commodity i relative to the price to households of commodities in general (the CPI), then we can expect producers of commodity i to suffer from a shift in consumer purchases away from their product. Thus, for example we would expect the beer industry to lose from the proposed tax changes. According to the PRISMOD calculations (p. 170), the consumer price of beer products will increase by 3.3 per cent, compared with an overall increase in consumer prices of only 1.9 per cent.

Similar complications could apply to producers of investment goods. However, in MONASH we assume that there is little price-induced substitution between different investment goods. This is a point of contrast with Econtech's MM303 model. In that model, it is assumed that it is possible to substitute between cars, buildings and other investment goods in the creation of units of capital. To the extent that substitution is possible, MONASH understates the benefits of the tax package to industries producing investment goods (e.g. vehicles) on which tax rates

will be reduced relative to the tax rates on other investment goods. Similarly MONASH overstates the benefits to industries producing investment goods on which there will be relative increases in tax rates.

From the point of view of the macro economy, the most important relative price change emerging from the PRISMOD calculations is for labour compared with consumer goods. As already mentioned, the Treasury assumes no change in the nominal wage rate (w) in a situation in which the CPI rises by 1.9 per cent. Treasury relies on workers accepting the income tax cuts offered in the tax package as compensation for price rises. The assumption that workers will accept reductions in real before-tax wage rates in return for income tax cuts is also made in the central MONASH simulation, reported in section 3. In section 4 we use the MONASH model to work out the macro-economic implications of the Government's tax proposal under the alternative labour market assumption that workers resist declines in w relative to the CPI.

At the micro (commodity) level, economic theory suggests that the tax changes should be designed to increase the consumer prices of commodities which are currently lightly taxed relative to the prices of commodities which are currently heavily taxed. This requires reducing high tax rates and increasing low tax rates. A glance at the PRISMOD results for consumer prices (ANTS, pp. 170-172) shows mixed outcomes on this issue. In accordance with theory, the tax changes are projected to increase the prices of some commodities (e.g., electricity) which are currently lightly taxed and to reduce the prices of some (e.g., cars) which are currently heavily taxed. On the other hand, there are some lightly taxed items (e.g., health services and education) for which the tax changes are likely to reduce consumer prices and some heavily taxed commodities (e.g., beer and tobacco[9]) for which prices are likely to rise.

A useful formula for making a preliminary back-of-the-envelope assessment of whether the proposed tax changes will alter relative consumer prices in a welfare enhancing manner is[10]:

$$\Delta\text{Welfare} = \Sigma_i \, W_i*(R - R_i)*(\Delta R_i - \Delta R), \qquad (2.10)$$

where

R is the average tax rate currently applying to consumer goods;

R_i is the rate currently applying to good i;

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[9] Higher taxes for these commodities may be justified by externality arguments. In MM303, Chris Murphy has allowed for this possibility. Among other things, he can assume that existing vice taxes are optimal from the point of view of restricting consumption of commodities producing negative externalities. Under this assumption, increases in vice taxes, in line with increases in other consumer taxes, are justified.

[10] This formula is valid under the assumptions that consumer taxes are the only distortions in the economy and that consumer preferences are Cobb-Douglas.

ΔR is the proposed change in the average rate;

ΔR_i is the proposed change in the rate applying to good i; and

W_i is the percentage of consumer spending currently devoted to good i.

This formula projects:

gains from increases in the relative taxation ($\Delta R_i > \Delta R$) of lightly taxed items ($R - R_i > 0$); [This is the electricity example.]

gains from reductions in the relative taxation ($\Delta R_i < \Delta R$) of heavily taxed items ($R - R_i < 0$); [This is the car example.]

losses from reductions in the relative taxation ($\Delta R_i < \Delta R$) of lightly taxed items ($R - R_i > 0$); [This is the health and education example.]

and

losses from increases in the relative taxation ($\Delta R_i > \Delta R$) of heavily taxed items ($R - R_i < 0$). [This is the beer and tobacco example.]

In Table 2.1, we have applied (2.10) with data from the MONASH model on W_i, R_i and R and data deduced from ANTS on ΔR_i. We obtained

$$\Delta\text{Welfare} = -0.039 \quad , \tag{2.11}$$

i.e., we calculated that the proposed tax changes will alter the pattern of consumer spending in a manner which reduces consumer welfare by 0.039 per cent. In 1998 prices, this is equivalent to an annual loss to consumers of about $100 million. Because (2.10) captures the effects of only part of the proposed tax changes (it ignores the effects of changes in relative producer taxes) and because it involves some crude assumptions (e.g., Cobb-Douglas preferences and no externalities), not much quantitative significance should be attached to result (2.11). Nevertheless, it contains a message:

- a detailed investigation using a comprehensive model such as MONASH or MM303 is likely to show that the proposed tax changes will lead to a negligible change in the economic efficiency with which households allocate their budgets across commodities.

Table 2.1: Back-of-the-envelope Welfare Calculation

Commodity	W_i	$R - R_i$	$\Delta R_i - \Delta R$	$W_i*(R - R_i)*(\Delta R_i - \Delta R)$
Motor Vehicles	2.6	-0.159	-0.085	0.035

Electricity	0.7	0.181	0.064	0.008
Tobacco	0.7	-0.711	0.136	-0.068
Health	3.7	0.065	-0.032	-0.008
All other	92.3			-0.006
Total	100.0			-0.039

3. The effects of the proposed change in the tax mix: the central MONASH simulation

This section describes our central MONASH simulation of the effects of changing Australia's tax system as proposed in ANTS. The central simulation acts as a point of comparison in the description of subsequent simulations.

The section is organised as follows. Subsection 3.1 describes how we ensured that the tax changes assumed in the MONASH simulation are in line with those assumed in ANTS. Subsection 3.2 sets out the key assumptions underlying the central simulation. Subsection 3.3 presents the results and explains them by the use of back-of-the-envelope algebra.

3.1. Deducing the tax changes

ANTS contains comprehensive qualitative information on the Government's tax plan but does not provide detailed quantitative information on the proposed changes in the indirect tax rates [t_g, t_c and t_i see equations (2.1) to (2.3)]. Fortunately, it is possible to deduce these changes quite accurately from the published PRISMOD results for Δp_g, Δp_c and Δp_i.

To deduce the Treasury assumptions concerning changes in consumer taxes (Δt_c) and changes in taxes on investment (Δt_i), we used versions of (2.6) and (2.8).[11] Deducing the changes in taxes applying to business inputs (Δt_g) was more complicated. We started by configuring MONASH as an input-output model in the style of PRISMOD. We then conducted a simulation imposing our best guess of Δt_g, based on the qualitative information in ANTS. In this simulation, we adopted Treasury assumptions: no change in wage rates; exchange rate appreciation of 3.5 per cent; and no change in rental prices of capital relative to asset prices. Next, we compared the results from this simulation for changes in basic prices (Δp_g) with those published by the Treasury. In the few cases in which there were significant discrepancies, we fine tuned our guesses for Δt_g.

In this way, we arrived at a set of tax changes (Δt_c, Δt_i, and Δt_g) which we think accurately reflect those used by the Treasury. It is these tax changes that are used in the MONASH simulations described below.

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[11] We modified these equations to allow for wholesale, retail, transport and other margins.

3.2. Key assumptions

3.2(a) Labour market

In the central MONASH simulation (reported in this section), we assume that workers are concerned with the real after-tax wage rate, that is, the wage rate less income taxes, deflated by the CPI. If the labour market tightens, then we assume that the real after-tax wage rate increases in response to increased worker demands. More technically, we assume that the deviation in the after-tax real wage rate from its basecase forecast level increases in proportion to the deviation in employment from its basecase forecast level. The coefficient of proportionality is chosen so that the employment effects of a shock to the economy are largely eliminated after 5 years. In other words, after about 5 years, the benefits or costs of a shock, such as tax reform, are realised almost entirely as an increase or decrease in real after-tax wage rates. This labour market assumption is consistent with conventional macro-economic modelling in which the NAIRU is exogenous. Further explanation of our labour market assumption is given in appendix 2.

3.2(b) Public expenditure

In the central simulation and all subsequent sensitivity simulations, we assume that the change in the tax mix makes no difference to the path of real public consumption.

3.2(c) Consumption, investment, ownership of capital and measurement of welfare

In each year of our tax-mix simulations, we assume that Australians save sufficient to finance the same quantity of investment as in the basecase forecasts. Together with our assumption of no change in the path of real public consumption, this means that aggregate real consumption diverges from its basecase forecast level by an amount reflecting the divergence in real income available to Australians. In other words, we assume that the benefit or cost in year t from the change in the tax mix is absorbed in that year entirely as a change in real household consumption. This is consistent with a zero marginal rate of real national saving. Marginal rates of saving in the Australian economy are low but not zero. Consequently, our household consumption assumption leads to a small over-estimation of the immediate consumption effects of income changes. Against this, our assumption has two important simplifying advantages. First, it means in our model that it is easy to keep track of foreign/domestic ownership of units of capital. Extra units created as a result of tax changes are entirely foreign owned. Similarly, if the tax changes lead to a reduction in the capital stock, then there is a corresponding reduction in the quantity of foreign-owned capital. Consequently, in our policy simulation, all of the variation in after-tax capital income associated with variations in the capital stock is excluded in the calculation of the change in income available to Australians. The second simplifying advantage is that compensating variation calculations based on the divergences in the paths of the volumes of consumption of each commodity provide a valid indicator of the welfare effects of the tax changes under consideration. This is because in our policy simulations the domestic population undertakes no extra

investment, owns no extra capital and incurs no extra debt.

3.2(d) Rates of return on capital

In simulations of the effects of changes in policy (e.g. tax) variables, MONASH allows for short-run divergences in after-tax rates of return on industry capital stocks from their levels in the basecase forecasts. Short-run increases/decreases in rates of return cause increases/decreases in investment and capital stocks, thereby gradually eroding the initial divergences in after-tax rates of return.

3.2(e) Production technologies

MONASH contains many types of technical change including: primary-factor and intermediate-input-saving technical change in current production; input-saving technical change in capital creation; and input-saving technical change in the provision of margin services. In the policy (tax-mix) simulations in this report, we assumed that all technology variables have the same values as in the basecase forecasts, that is, we assume that the change in the tax mix has no effect on technology.

3.3. Results

Charts 3.1 to 3.10 show for our central simulation the macro and industry effects of the assumed change in the tax mix.

3.3(a) Back-of-the-envelope model

The Government's tax package involves changes to five types of taxes: taxes on labour income; taxes on capital income; taxes on intermediate inputs; taxes on inputs to capital creation; and taxes on consumption. In explaining the MONASH results, we use a back-of-the-envelope (bote) model which includes these five types of taxes but sharply simplifies MONASH by assuming that the economy produces one good (grain) and imports one good (vehicles).

Grain production is via a constant-returns-to-scale production function of capital and labour inputs. Grain and vehicles are both consumption and investment goods. Units of consumption and investment are formed as Cobb-Douglas functions of grain and vehicles leading to Cobb-Douglas unit-cost functions. Finally, we assume that the costs per unit of employing capital and labour equal the values to the employer of their marginal products. Under these assumptions we have:

$$P_c = P_g^{\alpha_{gc}} * P_v^{\alpha_{vc}} * T_c \quad , \tag{3.1}$$

$$P_i = P_g^{\alpha_{gi}} * P_v^{\alpha_{vi}} * T_i \quad , \tag{3.2}$$

$$W * T_w = (P_g / T_g) * M_l \quad , \tag{3.3}$$

$$Q * T_q = (P_g / T_g) * M_k \quad , \tag{3.4}$$

$$W_{realA} = W / P_c \quad , \tag{3.5}$$

$$W_{realB} = W * T_w / P_c \quad , \tag{3.6}$$

and

$$R = Q / P_i \tag{3.7}$$

where:

P_g and P_v are the basic price of grain and the c.i.f. price of vehicles;

P_c and P_i are the purchasers' prices of a unit of consumption and a unit of investment;

T_c, T_i and T_g are the powers (one plus rates) of the taxes applying to consumption, investment and production;

Q and W are after tax factor payments, the rental rate and the wage rate;

T_w and T_q are the powers (one plus rates) of the income taxes applying to labour and capital income;

M_l and M_k are the marginal products of labour and capital;

W_{realA} and W_{realB} are the *after*-tax real wage rate and the *before*-tax real wage rate;

R is the rate of return on capital calculated as the after-tax rental or after-tax user price of capital divided by the cost or asset price of a unit of capital; and

the αs are positive parameters reflecting the shares of grains and vehicles in consumption and investment, such that $\alpha_{gc} + \alpha_{vc} = 1$ and $\alpha_{gi} + \alpha_{vi} = 1$.

From these equations we find that

$$M_l\left(\frac{K}{L}\right) = W_{realA} * T_w * T_g * T_c * \left(\frac{P_v}{P_g}\right)^{\alpha_{vc}} \quad , \qquad (3.8)$$

or equivalently

$$M_l\left(\frac{K}{L}\right) = W_{realB} * T_g * T_c * \left(\frac{P_v}{P_g}\right)^{\alpha_{vc}} \quad , \qquad (3.9)$$

and

$$M_k\left(\frac{K}{L}\right) = R * T_q * T_g * T_i * \left(\frac{P_v}{P_g}\right)^{\alpha_{vi}} \quad . \qquad (3.10)$$

In (3.8) to (3.10), we emphasise that marginal products are functions of K/L. M_l is a positive function of K/L and M_k is a negative function of K/L.

In terms of the bote model we can think of the tax package as:

- reducing T_g from 1.036 to 1.022;

  (Taxes on intermediate inputs to production currently are about 2 per cent of production costs for most industries. This translates to about 3.6 per cent of capital and labour costs. Consequently in our bote model, which has no intermediate inputs, we represent existing taxes on these inputs as a 3.6 per cent tax on output. The tax package involves the removal of about 40 per cent of the taxes on intermediate inputs. We represent this as a movement in T_g from 1.036 to 1.022.)

- reducing T_i from 1.037 to 1.013;

  (Taxes on inputs to capital creation are about 3.7 per cent of investment costs for most industries[12]. The tax package involves the removal of most of the existing taxes but the imposition of new taxes on housing construction. We calculate that after the changes to the tax mix have been implemented, the average rate of tax on sales of goods and services to capital creation will be 1.3 per cent. Thus in the bote model we assume that T_i moves from 1.037 to 1.013.)

- reducing T_w from 1.250 to 1.215;

  (Taxes on wage income are about 25 per cent of after-tax wage income. The tax package involves a 14 per cent reduction in this rate. We represent this as a movement in T_w from 1.250 to 1.215.)

- reducing T_q from 1.250 to 1.233; and

  (Taxes on capital income are about 25 per cent of after-tax capital income. The tax package involves a 14 per cent reduction in this rate. However, we estimate that about half of the reduction in the rate of tax on capital income will be offset by dividend imputation. Thus, we represent the movement in the capital tax rate by a shift in T_q from 1.250 to 1.233.)

- increasing T_c from 1.070 to 1.105.

  (Taxes on consumption currently average about 7.0 per cent. After the imposition of the GST, our MONASH calculations indicate that this will become about 10.5 per cent. Thus in the bote model we assume that T_c moves from 1.070 to 1.105.)

3.3(b) The MONASH results for the central simulation explained by the bote model

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[12] Here we are referring to all industries. In section 2, where we mentioned a 7 per cent reduction in the cost of investment goods, we were referring to private investment goods used by business, that is we excluded housing and investment by government.

With the change in the tax mix $T_W * T_g * T_c$ declines by 1.0 per cent (from 1.250*1.036*1.070 to 1.215*1.022*1.105). Under our labour market assumption, W_{realA} is sticky in the short run (see subsection 3.2(a)). In the absence of a change in the terms of trade (a movement in P_v / P_g), the bote model (see equation (3.8)) indicates that the change in the tax mix will cause a short-run reduction in the marginal product of labour. Consequently K/L will decrease. Because K moves slowly, there must be a short-run increase in L. This is confirmed in Chart 3.1 where we see that employment moves above the basecase forecast.

In implementing the tax package, the government plans to make a net reduction in tax revenue of $6 billion. This accounts for about half of the planned reduction in income taxes. Without the reduction in tax revenue, T_W would decline from 1.250 to 1.233 rather than to 1.215, and $T_W * T_g * T_c$ would increase by about 0.5 per cent. This would generate a short-term decline in L. Thus we conclude that the short-term employment gain associated with the package is entirely the result of fiscal stimulation.

Looking now at (3.10), we ask what is the short-run impact of the change in the tax mix on the rate of return (R)? With a decrease in K/L, M_k rises. $T_q * T_g * T_i$ falls by 4.9 per cent (from 1.250*1.036*1.037 to 1.233*1.022*1.013). Again, ignoring changes in P_v / P_g, we see that R must rise. Thus in our MONASH simulation we expect to see a short-run increase in investment followed by an upward movement in capital. This is confirmed in Chart 3.2.

The short-run increase in employment leads to increased demands for after-tax real wages, generating increases in W_{realA} (Chart 3.3). Thus, after initially moving below its forecast path, M_l moves up towards this path (see (3.8)). This means that after its initial fall, K/L must rise (see Chart 3.1). This forces M_k to fall back towards forecast generating a reduction in R, thereby slowing the rise in K. With growth in K being choked off, further rises in W_{realA} (necessitating increases in K/L) must be achieved by reductions in L. Thus, as can be seen in Chart 3.1, L falls back towards forecast.

In the very long run, the deviation in R is zero. In the absence of terms of trade effects, the reduction in $T_q * T_g * T_i$ leaves the K/L ratio permanently increased (Chart 3.1). Thus M_l is permanently raised. This together with the reduction in $T_w * T_g * T_c$ leaves W_{realA} permanently increased with L approximately on its forecast path.

The terms of trade

Throughout the explanation so far we have ignored movements in the terms of trade. As can be seen in Chart 3.4, the terms of trade initially moves above forecast and then moves below forecast. In the context of the bote model this reinforces the short run decrease in M_l (an increase in the terms of trade lowers P_v / P_g). Similarly, it reinforces the short run increase in R and the consequent increases in I and K. In the

long run, the decline in the terms of trade reinforces the upward movement in M_l. This accelerates: the return of L to its forecast path; the increase in M_k; the decline in R; and the choking off of the upward movement in K.

What explains the movements in the terms of trade in Chart 3.4? In MONASH we treat Australia as a small country on the import side, that is we treat c.i.f. import prices in foreign currency as exogenous. On the other hand, we recognise that Australia has considerable shares of world markets for several relatively homogeneous agricultural and mineral products, and that Australia exports distinctive varieties of manufactured goods and tourist and education services. Thus we assume that expansions of any of Australia's exports reduce their world prices and generate a decline in Australia's terms of trade. Consequently the deviation path of the terms of trade is closely connected with the deviation path in aggregate exports. As can be seen from Chart 3.4 and will be explained shortly, the change in the tax mix initially reduces exports but eventually leads to an increase in exports. This is consistent with the initial upward movement in the terms of trade and the eventual downward movement.

A reinforcing long run negative effect on the terms of trade is changes in the composition of exports. As is apparent from Chart 3.5, the change in the tax mix favours exports of primary and manufactured goods relative to exports of services. This is discussed below. In our basecase we are forecasting decreases in the world prices of primary and manufactured goods relative to the world prices of services. This is consistent with historical trends. An implication is that a change in the composition of Australia's exports away from services will be terms-of-trade reducing.

Imports, exports and the composition of exports

The first step in understanding the results for the trade quantities is to look at investment. In the short run, investment jumps strongly to facilitate the upward movement in K. In the longer term the deviation in K stops growing, allowing investment to fall back towards its forecast path (Chart 3.2). When investment is strong, the balance of trade moves towards deficit with an associated strengthening of the real exchange rate (Chart 3.6) and consequent export contraction. As the investment deviation declines, the balance of trade moves towards surplus, with an associated weakening of the real exchange rate and consequent export expansion.

A surprising result is the occurrence of a positive long-run deviation in aggregate exports in combination with a positive long-run deviation in the real exchange rate (Charts 3.4 and 3.6). The change in the tax mix is cost reducing for major export industries such as coal, iron ore and non-ferrous metal ores relative to major import-competing industries such as motor vehicles, aircraft, electronic equipment and other machinery. This allows long-run export expansion despite long-run real appreciation. It also explains the long-run increase in import volumes (Chart 3.4).

The change in the composition of exports (Chart 3.5) referred to above reflects the planned GST treatment of exports of goods compared with the planned treatment for the main service exports, tourism and Australian-based education. Goods exports will not be subject to GST. For these exports there will be a reduction in $A costs

largely but not completely offset by exchange rate appreciation. On the other hand, foreign tourists[13] and students will find that most of their purchases in Australia are subject to GST. For tourists, we estimate that the foreign currency price of their Australian visit will rise by about 3.6 per cent[14]. (This takes account of: the appreciation of the Australian dollar; increases in the GST-inclusive $A prices of hotels and other tourist services; and of the fact that in-Australia costs are only about 60 per cent of tourist expenditures.) For foreign students we estimate that the foreign-currency price of their Australian studies will rise by about 3 per cent. (This takes account of: the appreciation of the Australian dollar; increases in the GST-inclusive $A prices of accommodation, food and other student requirements; and of the fact that education fees will be GST free.)

Real GDP, real consumption and welfare

Chart 3.7 compares the deviation results for capital and labour with that for real GDP. At first glance, the GDP path seems too low, especially in the long run, relative to the deviation paths for the factor inputs. With capital and labour shares in GDP being about 0.3 and 0.7, we might expect the GDP deviation in 2008 to be about 0.31 per cent (= 0.3*0.90+0.7*0.05). Instead it is only 0.15 per cent.

In earlier applications of the MONASH model[15] we have provided a detailed decomposition of GDP results. This work shows that deviations in real GDP depend not only on deviations in quantity variables (such as capital, labour and tax-carrying commodity flows) but also on differences between forecast and policy simulations in the composition of GDP. If the policy under consideration increases the shares in GDP of slow-growing quantity variables relative to the shares of fast-growing quantity variables then on this account real GDP growth is reduced in policy relative to forecast. In our tax mix simulations, the tax shares in GDP of various slow-growing consumption items (e.g. beer and tobacco) are increased in policy relative to forecast. On the other hand, the tax shares of various fast-growing consumption items (e.g. motor vehicles) are reduced in policy relative to forecast. This has the effect of reducing GDP growth in policy relative to forecast, generating an ever expanding negative effect on the policy level of GDP relative to the forecast level.

A similar phenomenon affects the measurement of real consumption (CR). The path of real consumption in policy deviates from the forecast path not only because of deviations in the quantities consumed of each commodity but also because

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13 We define tourism broadly, see footnote 3.

14 In ANTS, Treasury assumed an appreciation of 3.5 per cent. MONASH implies a smaller appreciation, between 1 and 2 per cent for most of the simulation period. Consequently we project a smaller increase in the foreign-currency price of visits to Australia than would be obtained on the basis of Treasury calculations. The difference between the MONASH and Treasury exchange rate projections arises because the Treasury ignores terms-of-trade deterioration.

15 See particularly P. B. Dixon and M.T Rimmer, "Forecasting and Policy Analysis with a Dynamic CGE Model of Australia", paper presented at The First Annual Conference on Global Economic Analysis, Denmark, June 1998.

of deviations in budget shares. By increasing their prices relative to those other consumption goods, the change in the tax mix increases the budget shares of alcohol and tobacco. (Price elasticities of demand for these commodities are low.) Simultaneously, by lowering their relative prices the change in the tax mix decreases the budget shares of vehicles and appliances. Overall the budget shares of slow-growing consumption items are increased by the tax changes while those of fast-growing items are reduced. This produces the ever-expanding negative long-run consumption deviation shown in Chart 3.8.

From the point of view of economic welfare, movements in real GDP and real consumption associated with share effects are of little significance. Consequently, in measuring the welfare effects of the changes in the tax mix, we rely on calculations of compensating variations. These are computed according to

$$cv_T = \sum_i BSH^p_{Ti} * dev_T(consr_i) \qquad (3.11)$$

where

BSH^p_{Ti} is the share in year T of the household budget accounted for by good i in the policy simulation; and

$dev_T(consr_i)$ is the percentage deviation in year T in real household consumption of good i.

Under the assumptions in subsection 3.2(c), the path of cv is a legitimate indicator of the overall welfare effect of the changes in the tax mix. As can be seen in Chart 3.8, the cv path moves away from the path for CR. Thus, in the current application of MONASH, real consumption is misleading as a welfare indicator.

The cv path in Chart 3.8 indicates a small long-run welfare loss from the tax package. This is a result of offsetting factors. On the one hand, welfare is reduced by the decline in the terms of trade. At the end of the forecast period, exports and consumption are 27 and 60 per cent of GDP. This suggests that the long run decline in the terms of trade of 0.5 per cent (Chart 3.4) would reduce real consumption by about 0.22 per cent (= 0.5*0.27/0.60). On the other hand, the expansion in the capital stock carries a welfare gain. As explained in section 3.2(c) we assume that the extra capital generated as a result of changing the tax mix is owned by foreigners. Nevertheless there are benefits to Australians. These arise from extra tax collections on foreign-owned capital. The extra collections are worth about 0.11 per cent of consumption, calculated as the percentage deviation in capital (0.9) times the capital share in GDP (0.3) times the tax rate on capital income (0.25) divided by the share of consumption in GDP (0.6). Together the terms-of-trade and the capital-tax effects suggest a long-run welfare loss of about 0.11 per cent of consumption. Chart 3.8 indicates a smaller loss (0.01 per cent of consumption). We suspect that welfare is affected to only a minor extent by changes in the composition of exports favouring commodities with relatively slow rates of growth in their world prices. Thus, while we do not have a complete explanation for the reduction in welfare of 0.01 per cent, we are not surprised that this is less than the reduction (0.11 per cent) suggested by the simple calculations made here.

Industry results

Chart 3.9 shows the deviations in the output paths of the industries which are the main winners from the change in the tax mix. These are industries for which the output deviation in 2008 is more than 3 per cent. They fall into three groups. The first contains traditional export industries and related industries (Iron ore, Non-ferrous ores, Non-ferrous products, Wool processing, Water transport and Mining services). Output in these industries is stimulated by tax-related cost reductions which are only partially offset by currency appreciation. The second group are export-oriented manufacturing industries (Electronic equipment and Basic chemicals). The relatively strong stimulation of these industries reflects relatively strong growth in non-traditional exports as a whole. The third group consists of one industry, Motor vehicles. Under the change in the tax mix, this industry will benefit strongly from reductions in sales taxes.

Chart 3.10 shows the deviations in the output paths of the industries which are the main losers from the change in the tax mix. These are industries for which the output deviation in 2008 is below -1.40 per cent. Hotels, Air transport, Personal services, Entertainment and Aircraft appear among the losers because of their connection with both domestic and foreign tourism. As explained, the change in the tax mix will increase the costs to foreign tourists of their Australian visits. MONASH also recognises that the change in the tax mix will reduce the costs to Australians of holidaying overseas relative to holidaying in Australia. Residential building is a loser because of the proposed GST treatment of the sale of new houses. Beer and Footwear lose because the government proposes a sharp increase in the tax rate on these products causing their consumer prices to rise relative to the CPI.

4. The effects of the proposed change in the tax mix with before-tax wage bargaining

In the simulation discussed in section 3.3, we assumed that workers are concerned with the real after-tax (AT) wage rate. An alternative assumption is that workers are concerned with the real before-tax (BT) wage rate. Under this assumption, the deviation in the BT real wage rate from its basecase forecast level increases in proportion to the deviation in employment from its basecase forecast level. Results generated by MONASH for the effects of the Government's proposed tax changes under the BT assumption are shown in Charts 4.1 to 4.10.

Under the AT assumption, wage demands by workers can be damped by reductions in income taxes. This is not the case under the BT assumption. Consequently, the short run macro effects of the proposed change in the tax mix (which involves cuts in income taxes) are more favourable with the AT assumption than the BT assumption.

The adverse short-run macro repercussions of the change in the tax mix under the BT assumption can be understood in terms of equation (3.9). Under the tax package $1_g * 1_c$ will rise by about 2 per cent (from 1.036*1.070 to 1.022*1.105). With sticky before-tax real wages (W_{realB}), there will be a tendency for M_1 to rise, necessitating a short-run fall in L. As can be seen in Chart 4.1 the short-run fall in

employment reaches 1.3 per cent, about 100,000 jobs.

The long-run effects under either assumption are quite similar. This is because under both assumptions, employment in the long run is driven close to its basecase forecast level. Relative to the AT results, the BT results show a delayed movement to the long run. Under the BT assumption, the short-run increases in K and I are strongly damped, reflecting negative initial movements in output and employment. Thus, under the BT assumption the capital stock takes longer to achieve its final deviation from the basecase forecasts than it takes under the AT assumption. Notice in Chart 4.1 that K is still rising in 2008 whereas in Chart 3.1 it has stabilised.

5. The effects of the proposed change in the tax mix with low export demand elasticities for tourism and education services

In the central simulation (reported in section 3.3), we assumed that the foreign elasticity of demand for tourism in Australia is -3. This means that international tourist arrivals in Australia are reduced by 3 per cent if there is a 1 per cent increase in the foreign currency cost to tourists of their visit to Australia, holding constant other relevant variables such as the costs of holidays in other countries. In the cost of a visit to Australia, we include not only tourism costs incurred in Australia (e.g. hotel bills and travel within Australia) but also the costs of transport in and out of Australia.

After reviewing our December paper, officials from the Department of Tourism, Transport and Business Development have suggested that a much lower elasticity for tourism is realistic. They have shown us results from fitting regression equations broadly of the form:

$$Q_j(t) = A_j(t) * \left(\frac{P_{tourA}(t) * \Phi_j(t)}{P_j(t)} \right)^{E_j} \qquad (5.1)$$

where

$Q_j(t)$ is the number of tourists coming to Australia in year t from country j;

$A_j(t)$ is an activity variable in country j, for example real GDP;

$P_{tourA}(t)$ is an index of the $A prices of accommodation and transport in Australia;

$\Phi_j(t)$ is an exchange rate, the number of units of country j's currency per $A;

$P_j(t)$ is the consumer price index in country j; and

E_j is a negative parameter to be estimated on the basis of time-series data for the variables listed above.

Via (5.1) the Departmental officials obtained low values (often smaller in absolute value than 1) for the E_js. They appear willing to interpret this as evidence in favour of their low-elasticity hypothesis.

However, for two reasons, the values of E_j should not be interpreted as foreign elasticities of demand for tourism. First, (5.1) does not include the prices to foreign tourists of visits to countries apart from Australia. It is likely that the prices of these visits were positively correlated with the prices of Australian visits over the period for which (5.1) was estimated. This is because movements in country j's exchange rate relative to the Australian exchange rate will be positively correlated with movements in country j's exchange rate relative to the exchange rates of countries offering tourism services in competition to Australia. Thus, at points in the time series data at which there were increases (decreases) in the price to tourists from country j of an Australian visit, there are likely to have been increases (decreases) in the prices to these tourists of visits to alternative countries. In these circumstances, E_j estimated in (5.1) will under estimate the effect on tourist arrivals in Australia from country j of an increase in the price of an Australian visit holding constant the prices of alternative visit, that is E_j will underestimate j's elasticity of demand for visits to Australia.

The second reason that the E_j's are invalid estimates of foreign elasticities of demand is that the composite price variable enclosed in curly brackets on the RHS of (5.1) is not the foreign-currency price to international tourists of their Australian visit. It leaves out the costs of travel in and out of Australia. As with our first argument, this suggests that E_j will tend to underestimate the elasticity of demand by tourists from country j for Australian visits. If E_j were -1 and the in-Australia costs were 50 per cent of the total costs of an Australian visit, then under some conditions (not met in the present case because of the first argument) it would be reasonable to conclude that country j's elasticity of demand for Australian visits is -2. This is because a value of -1 for E_j would imply a 1 per cent reduction in the number of tourists from country j in response to an increase in the cost of their Australian visit of 0.5 per cent, that is a 1 per cent increase in 50 per cent of the cost of their visit.

Officials from the Department of Tourism, Transport and Business Development have told us that an average of tourism elasticity estimates over a large number of studies is -1.0. This implies that at least some of the studies that they have surveyed give elasticity estimates with an even smaller absolute value than 1. By including such studies in their averaging process, they are giving credibility to numbers which imply that Australia could impose large tourist taxes and thereby increase its foreign currency receipts from foreign tourism. We think that this is implausible. Certainly if the officials were convinced by very low elasticity numbers, then they should be recommending tourism taxes quite independently of the Government's current tax proposals, that is, low elasticities provide an argument for a tourism tax, not for a more general reform of the tax system.

If on the other hand the officials are not convinced by the low elasticity numbers, then they should exclude them from the averaging process. As is apparent from our analysis of (5.1) it is easy to make mistakes in estimating export demand elasticities. Estimates that have been made by faulty methods should be given no weight in deciding the appropriate elasticity value for use in the MONASH model.

Over many applications of the MONASH model and its predecessor ORANI, we have found that low export demand elasticities (smaller in absolute value than 3)

lead to unrealistic results for the terms of trade. With low elasticities, Australia is shown as suffering terms-of-trade losses from cost-reducing micro-economic reforms (such as increased competition in internal air travel) which significantly offset the benefits of saving resources. Similarly, the costs to Australia of micro-economic distortions (e.g. union-induced over-manning of coal mines) are shown to be considerably reduced by terms-of-trade gains.

Although we think that the Department of Tourism, Transport and Business Development has made no case for a low foreign elasticity of demand for tourism, we acknowledge that there is considerable doubt concerning the appropriate number. Consequently we have rerun the MONASH simulation reported in section 3.3 with the foreign elasticity of demand for tourism set at -2 rather than -3. The results are presented in Charts 5.1 to 5.10.

In this simulation we have also adjusted down the export demand elasticity for education services. In the central simulation (section 3.3), we assumed that the this elasticity is the same as that for tourism, -3. This means that foreign student arrivals in Australia are reduced by 3 per cent if there is a 1 per cent increase in the foreign currency cost to students of their Australian education, holding constant other relevant variables such as the costs of education in other countries (e.g. USA). As with the tourism elasticity, there is considerable doubt concerning the student elasticity. In the simulation presented in Charts 5.1 to 5.10 the student elasticity has been set at -2, the same as the tourism elasticity.

With the low elasticities, the long-run declines in tourism and education exports are about 6.5 and 5.5 per cent (Chart 5.5) compared with 9.0 and 6.8 per cent in the high elasticity case (with the tourism/education elasticities at -3, Chart 3.5). Reducing the elasticities by a third does not quite reduce the damage to tourism and education exports by a third because of exchange rate effects. In the low elasticity case, the real exchange rate appreciates more than in the high elasticity case (compare Charts 5.6 and 3.6). The greater appreciation of the exchange rate also explains the weaker performance in the low elasticity case of other categories of exports compared with their performance in the high elasticity case (Charts 5.5 and 3.5).

The difference in the exchange rate results in the two cases is associated with the differences in the terms of trade. In the low elasticity case, the long-run reduction in the terms of trade is very small relative to that in the high elasticity case (Charts 5.4 and 3.4). Thus Australia's requirements for export revenue can be met in the low elasticity case with a smaller volume of exports and consequently a lower level of international competitiveness (i.e. a higher real exchange rate) than in the high elasticity case.

The terms of trade are stronger in the low elasticity case than in the high elasticity case for two reasons. First, in the low case we have lowered the export demand elasticities for the components of exports adversely affected by the GST (the services) while leaving the export demand elasticities unchanged for the components of exports favourably affected by the GST (the goods). Second, compared with the high elasticity case, the low case involves less contraction in tourism and education exports and less expansion in other exports. As pointed out in section 3.3(b), contraction of service exports relative to other exports harms Australia's terms of trade. This is

based on our forecast that service prices will increase relative to the prices of these other exports.

Stronger terms-of-trade performance explains the more favourable welfare result in the low-elasticity case relative to the high-elasticity case (Charts 5.8 and 3.8). Rather than a long-run welfare loss (0.01 per cent of consumption) as in the high-elasticity case, the low-elasticity case shows a welfare gain (0.22 per cent of consumption). Nevertheless, the most important conclusion is that the long-run welfare effect of the change in the tax mix is negligible under either value for the export demand elasticities for services.

6. The effects of the proposed change in the tax mix with no GST on inbound tourist packages

To mitigate the damage to Australia's tourist industry caused by the GST, one proposal is to exempt payments made outside Australia by foreigners for Australian packaged tours. About two thirds of foreign holiday makers come to Australia on these tours. With holiday makers representing about half of tourists (broadly defined, see footnote 3), this proposal would remove the GST from about one third of hotel, entertainment and other in-Australia tourist expenditures. We estimate that this would reduce GST collections by about $A300 million a year.

To investigate the effects of the proposal, we have run a MONASH simulation adopting the same assumptions as in the central simulation (section 3.3) except that we have freed packaged tours from GST and have reduced the cut in income tax to take account of the $A300 million loss in revenue. The results are in Charts 6.1 to 6.10.

Comparing Chart 6.5 and 3.5 we see that exempting packaged tours from GST improves tourism exports by about 3 per cent. In Chart 3.5 the percentage deviations for tourism exports are between -13 and -9 whereas in Chart 6.5 these deviations are between -10 and -6. With tourism doing better in the package-exempt case than in the central case, other exports do worse. This is because the better performance of tourism strengthens the real exchange rate (compare Charts 6.6 and 3.6).

Apart from the change in the composition of exports, there is little difference between the results in the central case and the package-exempt case.

7. The effects of the proposed change in the tax mix with no GST on food

Charts 7.1 to 7.10 show MONASH results for a simulation conducted under the assumptions of the central simulation except that the GST is not applied to food and the cut in income taxes is correspondingly reduced. We interpret food to mean Meat, Diary products, Fruit and vegetables, Oils and fats, Flour and Bakery (MONASH commodities 20 to 25). Annual consumer expenditure on these commodities is currently about $27 billion. The revenue cost of exempting them from GST will be about $2.5 billion. We estimate that with this loss in GST revenue the cut in income tax must be reduced from 14 per cent to 11.4 per cent.

With the exemption of food the short-run employment effects of the tax

package are slightly more favourable than in the central simulation. This can be seen by comparing Chart 7.1, where the peak deviation in employment is 0.48 per cent, with Chart 3.1 where it is 0.38 per cent. In the longer term, the exemption of food makes the economy slightly smaller than it otherwise would have been. In Chart 7.7 the percentage deviations in capital and GDP in 2008 are 0.84 and 0.14 whereas in Chart 3.7 they are 0.89 and 0.15.

These results can be explained with reference to equations (3.8) and (3.10). We start with the short-run employment result.

In the central simulation, T_c increases from 1.070 to 1.105 and T_w falls from 1.250 to 1.215. With food exempt, we estimate that the post-GST values of T_c and T_w are 1.097 and 1.220. T_g is the same in both cases. Hence rather than falling by 1.0 per cent as in the central simulation, with food exempt $T_w * T_g * T_c$ falls by 1.3 per cent. Thus, via (3.8), the exemption of food has a small positive short-run effect on employment.

More generally, we can think of the change from the central simulation to the food-exempt simulation as a reduction in consumption taxes combined with a revenue-compensating increase in income taxes. Assume, realistically, that aggregate consumption expenditure and the aggregate wage bill happen to be equal, say \$100. Assume that the reduction in consumption taxes is \$1. This reduces short-run wage demands by 1 per cent. When the \$1 loss of revenue is replaced by an increase in income taxes, only about two thirds of this increase applies labour income. The rest is borne by capital income. Thus wage earners find themselves paying an extra \$0.66 in income taxes. This increases their short-run wage demands by 0.66 per cent. In total wage demands have been reduced by 0.34 per cent allowing a short-run increase in employment.

We turn now to the long-run effect on the size of the economy. With the exemption of food T_q is increased, reflecting the revenue-replacing increase in income taxes. T_i and T_g remain unchanged from their values in the central simulation. Consequently, as we move from the central simulation to the food exempt simulation, $T_q * T_g * T_i$ increases. The exemption of food makes little difference to the terms of trade or to the long-run required rate of return. Thus, via (3.10) we see that the exemption of food must, in the long run, increase the marginal product of capital. With L returning close to its forecast value in the long run, the increase in the marginal product of capital implies that the exemption of food must reduce K. This in turn reduces GDP.

Reduction in K leads to a slightly less favourable long-run welfare result in the food-exempt case than in the central case (compare Charts 7.8 and 3.8). This is explained by the loss of tax revenue on foreign-capital income.

8. The effects of the proposed change in the tax mix with no GST on food and before-tax wage bargaining

Charts 8.1 to 8.10 show MONASH results for an alternative food-exempt

simulation. In the previous section we adopted the wage assumption used in the central simulation, that is we assumed that workers bargain in real after-tax terms. Here we adopt the wage assumption used in section 4, that is we assume that workers bargain in real before-tax terms.

With before-tax wage bargaining, the exempting of food plays a more useful short-run role than it does when wage bargaining is in after-tax terms. By comparing Chart 8.1 with Chart 4.1, we see that food exemption reduces the peak employment loss associated with the tax package from 1.31 per cent to 0.90 per cent. That is, when we assume before-tax wage bargaining, food exemption generates a short-term increase in employment of 0.41 per cent. When we assumed after-tax wage bargaining, food exemption generated a short-term increase in employment of only 0.10 per cent (a short-term gain of 0.48 per cent in Chart 7.1 compared with 0.38 in Chart 3.1). In terms of equations (3.8) and (3.9), the increase in T_w associated with food exemption generates an increase in the marginal product of labour when W_{realA} is sticky [equation (3.8)] but not when W_{realB} is sticky [equation (3.9)].

In the long run, there is little difference between the results in Charts 8.1 to 8.10 and Charts 4.1 to 4.10. That is, with before-tax wage bargaining, exempting food makes little long-run difference to the outcome of the tax package.

9. The effects of the proposed change in the tax mix with different rates of tax pass through

Our final set of simulations (Charts 9.1 to 9.10) were conducted under the same assumptions as the central simulation (section 3.3) except that we allowed for different rates of tax pass through. In particular, we assumed that consumer prices are fully adjusted for increases in consumer taxes as soon as these taxes are imposed, but that most input prices are reduced only with a lag in response to reductions in input taxes. In imposing the lag we assumed 50 per cent pass through in the first year and 50 per cent in the second year. That is, if a 10 per cent tax on a material input were eliminated, we assumed that the price would be reduced by 5 per cent in the first year and 5 per cent in the second year. In effect we assumed that producers of most intermediate inputs are able to increase their profits temporarily by retaining half of tax decreases in the year in which they are introduced. In the case of intermediate usage of petrol, where the tax changes are readily identifiable, we assumed immediate pass through. Similarly, we assumed immediate pass through for new taxes which will be imposed on inputs to the finance, homebuilding and home-ownership sectors.

As could be expected, lagged pass through has very little long-run effect. The results for 2008 in Charts 9.1 to 9.10 are similar to the corresponding results in Charts 3.1 to 3.10. In the short run, lagged pass through has quite severe negative effects. With lagged pass through, employment falls in the first year of the simulation by 0.2 per cent rather than rising by 0.4 per cent as in the central simulation (compare Charts 9.1 and 3.1). In terms of (3.8), lagged pass through can be viewed as a delay in the

reduction in T_g . With the reduction in T_g largely[16] eliminated, T_w *T_g *T_c increases in the first year leading to a short-run reduction in employment.

10. Revenue in the absence of the GST

ANTS (e.g. p.8) implies that a major change in indirect taxation is necessary because, without increases in tax rates, the present array of indirect taxes will raise insufficient revenue in relation to Australia's future public sector requirements. However ANTS includes no explicit revenue forecasts. We find no evidence to support the ANTS proposition. As shown in Chart 10.1, in our basecase forecasts[17], indirect taxes collected by the whole of the public sector grow slightly faster than GDP. These forecasts were made with no changes in ad valorem tax rates.

The bulk of indirect taxes are collected on consumption and intermediate usage of goods and services. In our basecase forecasts, collection of consumption taxes is projected to grow at about the same rate as GDP. Among the main contributors to these taxes are some fast-growing consumption items (e.g. Electronic equipment, Scientific equipment, Cars, and Entertainment) and some slow-growing items (e.g. Tobacco, Beer and Other Alcoholic drinks). Collection of taxes on intermediate inputs is projected to grow faster than GDP. The main contributors are intermediate sales of Petrol, Oil and gas, Commercial printing, Banking services, Insurance, Electronic equipment and Motor vehicles. Intermediate sales of all these commodities and associated tax collections are projected to grow faster than GDP over the next eight years.

Underlying our forecasts of tax collections are forecasts of GDP growth averaging 6 per cent a year (3 per cent real and 3 per cent in prices). Different growth rates for real GDP and the price level would generate correspondingly different projected rates of growth for collections of indirect taxes. However, the present spread of indirect taxes across goods and services is sufficiently broad that we would expect growth in tax collections to keep approximately in line with growth in nominal GDP even if our macro and structural forecasts prove to be inaccurate.

11. Concluding remarks

In the preceding sections we have, with one exception, considered all of the items in the terms of reference (tor) given in appendix 1. We have dealt with: lagged pass through (tor 1) in section 9; revenue forecasts (tor 2) in section 10; tourism (tor 3) in sections 5 and 6; wages (tor 4) in sections 3 and 4; and exempting of food (tor 5) in sections 7 and 8. Tor 6 mentions sensitivities to variations in other assumptions. In section 3.3(a) we set out a back-of-the-envelope (bote) model which was used

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[16] The reduction in T_g in the first year is less than half the eventual reduction because we assume only 50 per cent pass through of input-tax reductions and 100 per cent pass through of input-tax increases.

[17] Our forecasting method using the MONASH model is described in various publications, e.g. Adams, P.D. and G.A. Meagher, "The outlook for employment by occupation", *Australian Bulletin of Labour*, 23(4), December 1997, pp. 229 – 254.

extensively in explaining the central simulation and the six sensitivity simulations. Consistent with tor 6, readers will be able to use the bote model to work out other sensitivities not considered in this report.

The tor not so far considered explicitly is tor 7, concerning inflation in the first year. In the central simulation we assumed that the change in the tax mix will cause a jump in the CPI of 2.19 per cent. If we had assumed a different jump in the CPI, e.g. 2.5 per cent or 3.1 per cent, then our results for real variables would have been unaffected. For example, we still would have found a short-run increase in employment of 0.4 per cent (Chart 3.1). With a larger CPI jump we would have obtained a larger jump in all domestic prices including nominal wage rates. With more inflation, the nominal exchange rate would have appreciated by less, leaving the change in Australia's international competitiveness the same as in the central simulation.

In all of the sensitivity simulations we continued to assume a 2.19 per cent jump in the CPI in the first year. Just as in the central case, variations in this CPI assumption would have changed only the results for nominal variables, not real variables. For example, with before-tax wage bargaining we would have continued to find a 1.3 per cent reduction in employment in the first year (Chart 4.1), irrespective of our inflation assumption.

While we think that small variations in the inflation assumption of the type envisaged in tor 7 are unlikely to have noticeable implications for real macro variables, they might have significant distributional effects. People with non-inflation-proofed incomes would be worse off with higher rates of inflation. However, analysis of distributional effects is beyond the scope of this report.

Our detailed conclusions are summarised at the beginning of the report. We find, as in our December paper, that the Government's proposed tax changes will have little effect on Australia's long-run macro-economic performance. With after-tax wage bargaining, the package will stimulate employment in the short run. This results from the net reduction in taxes implied by the package. The employment gain could be generated simply by cutting income taxes without the GST or other changes in indirect tax rates. If wage earners refuse to allow before-tax wage rates to fall relative to the CPI, then the package will cause job losses in the short-run, despite the net reduction in taxation. Another short-run risk to employment is that increases in indirect taxes may be passed on more quickly than reductions. Finally we should emphasise that no consideration has been given in this report to the costs of implementation, compliance, administration and rent-seeking. These should be set against any benefits claimed for the package.

Appendix 1. Terms of Reference for the Consultancy Task

The Select Committee on a New Tax System wishes to commission a project involving macro-economic modelling of the effects of the proposed new tax package.

The macro-economic modelling should aim to produce "range estimates" focusing on the sensitivity of the key assumptions that might underpin the short-term effects of the tax package.

Key issues that should be modelled include:

1. 100% pass through of indirect taxes. Further work is needed with differing quanta and timeframes on the pass through. The assumptions should be based on assessments of how quickly particular taxes can be washed through (e.g., distinguishing between WST and stamp duties, allowing 80, 90, 100% flow through over the first three years, or some other realistic option). This is to include both short-term and long-term outcomes.
2. Revenue forecasts. The committee needs a comparison of what revenue could be gained from the existing indirect tax system (as a % of GDP) and the proposed new one over the next five to ten years. Attached to that should be a sensitivity based on "low, medium and high growth" scenarios.
3. Tourism. The key sector identified in evidence as problematic is tourism. The full effect depends on the elasticity of demand, and further work is needed on different scenarios here. Also, the Committee would like to see what the effect would be if inbound tourism packages were zero-rated.
4. Wages. If wages are linked fully or partly to CPI, how does this affect macroeconomic outcomes in the short and long term?
5. Food. If food (excluding restaurants and takeaways) is excluded, offset by income tax cuts being reduced, what effect does this have on the CPI, and on the "pessimistic" wages assumption and macro-economic variables in the short and long terms?
6. Other assumptions. Key sensitivities which are identified for other key assumption should also be tested, after consultation with the Chair of the Committee.
7. Inflation. Assuming CPI effects of (i) 2.5 per cent, and (ii) 3.1 per cent, in the first year, what would be the short-term and long-term effects on macroeconomic variables?

Appendix 2. Labour market specification

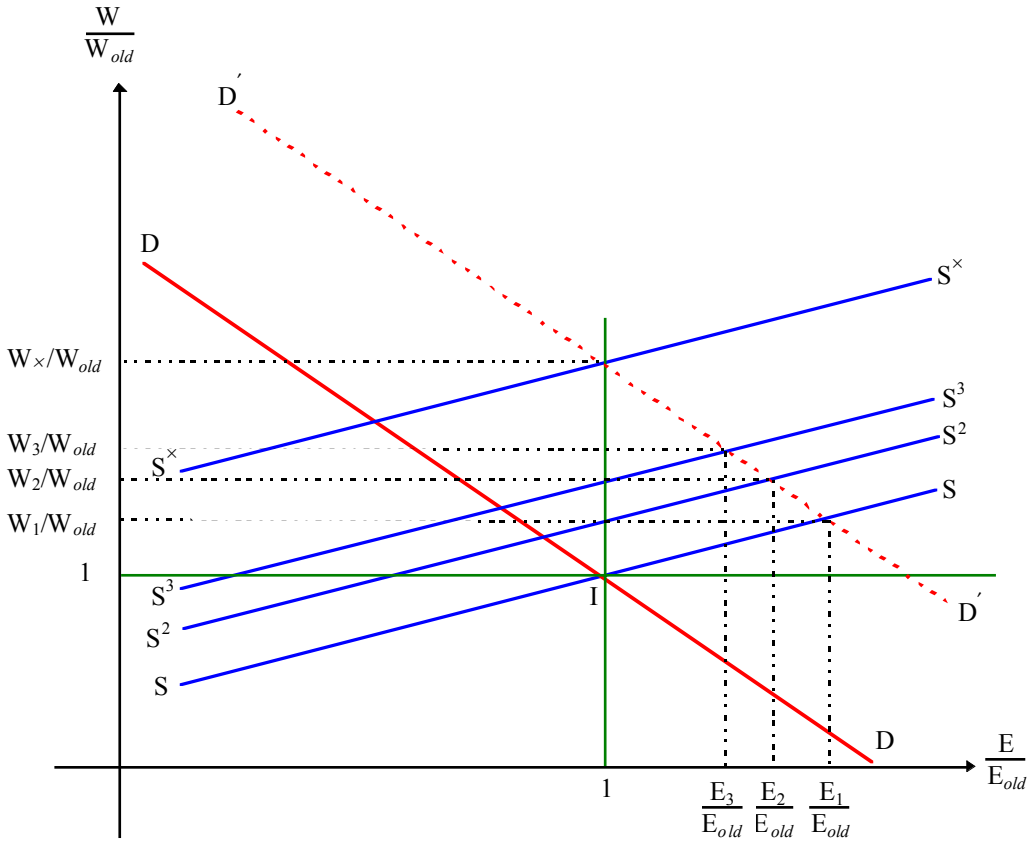
We assume that real wages are sticky in the short run and flexible in the long run. Thus policy shocks generate short-run changes in aggregate employment and long-run changes in real wages. In the simulation reported in section 3.3, the real wage variable is *after*-tax wages deflated by the CPI. In section 4 we discuss a simulation in which the real wage variable is the *before*-tax wage rate deflated by the CPI. In either simulation, where W refers to the relevant real wage concept, our algebraic specification is:

$$\left\{\frac{W_t}{W_{t,old}} - 1\right\} = \left\{\frac{W_{t-1}}{W_{t-1,old}} - 1\right\} + \alpha\left\{\frac{E_t}{E_{t,old}} - 1\right\}. \qquad \text{(A2.1)}$$

In this equation, *old* indicates a basecase forecast value. $W_{t,old}$ and $E_{t,old}$ are the real wage rate and the level of employment in year t in the basecase forecasts. W_t and E_t are the real wage rate and the level of employment in year t in the policy simulations, and α is a positive parameter. Under (A2.1), the real wage rate in the policy simulations will continue to move further above the real wage rate in the basecase forecasts whenever employment in the policy simulations is above that in the forecasts. We set the value of α so that the effect on aggregate employment of a policy change in year t will be largely eliminated by year t+5. That is, we assume that employment gains/losses from policy changes are a short-run phenomenon with the economy tending in the long run to an exogenously given natural rate of unemployment.

The operation of the employment-wage specification is illustrated in Figure A2.1 for a steady-state case in which technology, consumer tastes, foreign prices and capital availability are unchanged from year to year. In this steady state, the demand curve for labour in each year t is DD and the supply curve is SS. In each year employment is E_{old} and the real wage rate is W_{old}, that is, the employment-wage combination is at point I in Figure A2.1. Now assume that there is a policy change in year 1 which causes the demand curve for labour to shift up to D′D′, where it remains for all future years. The supply curve for year 1 is the initial supply curve SS. The policy-simulation levels for employment and the real wage rate in year 1 are E_1 and W_1. In year 2 there is a vertical upward shift in the supply curve reflecting the gap between W_1 and W_{old}. In our diagram employment and the real wage rate in year 2 are E_2 and W_2. Eventually the supply curve for labour stops moving when W reaches W_∞. At this stage employment has returned to E_{old}.

Figure A2.1: Operation of employment-wage specification in steady-state



Appendix 3. Numbers underlying the charts

Central: data for Charts 3.1 to 3.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 3.1									
L	0.00	0.38	0.30	0.21	0.15	0.11	0.08	0.06	0.05
K	0.00	-0.01	0.45	0.68	0.79	0.85	0.88	0.89	0.89
K/L	0.00	-0.39	0.15	0.47	0.65	0.75	0.80	0.83	0.84
Chart 3.2									
I	0.00	4.24	2.93	2.28	1.89	1.67	1.54	1.46	1.42
K	0.00	-0.01	0.45	0.68	0.79	0.85	0.88	0.89	0.89
Chart 3.3									
L	0.00	0.38	0.30	0.21	0.15	0.11	0.08	0.06	0.05
real after-tax wage	0.00	0.32	0.56	0.72	0.83	0.90	0.95	0.99	1.02
real before-tax wage	0.00	-2.82	-2.59	-2.43	-2.33	-2.26	-2.21	-2.17	-2.15
Chart 3.4									
export volume	0.00	-3.58	-1.48	-0.49	0.10	0.47	0.70	0.86	0.98
terms of trade	0.00	0.93	0.32	0.02	-0.16	-0.29	-0.39	-0.46	-0.52
import volume	0.00	1.64	1.25	1.04	0.92	0.85	0.81	0.80	0.79
Chart 3.5									
non-traditional export vol.	0.00	-3.46	-0.66	0.71	1.53	2.02	2.32	2.51	2.62
traditional export vol.	0.00	-0.39	1.45	2.31	2.85	3.22	3.50	3.73	3.92
tourism exports	0.00	-12.78	-11.18	-10.42	-9.95	-9.64	-9.40	-9.20	-9.01
f'gn student numbers	0.00	-12.08	-9.40	-8.17	-7.51	-7.16	-6.96	-6.85	-6.78
total export vol.	0.00	-3.58	-1.48	-0.49	0.10	0.47	0.70	0.86	0.98
Chart 3.6									
real exchange rate	0.00	2.93	1.70	1.17	0.90	0.77	0.71	0.70	0.70
I	0.00	4.24	2.93	2.28	1.89	1.67	1.54	1.46	1.42
Chart 3.7									
real GDP	0.00	0.32	0.36	0.33	0.30	0.26	0.22	0.19	0.15
L	0.00	0.38	0.30	0.21	0.15	0.11	0.08	0.06	0.05
K	0.00	-0.01	0.45	0.68	0.79	0.85	0.88	0.89	0.89
Chart 3.8									
real consumption	0.00	1.03	0.65	0.37	0.17	0.01	-0.12	-0.23	-0.32
welfare	0.00	1.00	0.67	0.44	0.28	0.17	0.09	0.03	-0.01

Before-tax: data for Charts 4.1 to 4.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 4.1									
L	0.00	-1.31	-0.77	-0.42	-0.21	-0.08	-0.02	0.02	0.03
K	0.00	0.00	0.09	0.20	0.30	0.39	0.47	0.53	0.58
K/L	0.00	1.33	0.87	0.62	0.51	0.48	0.49	0.52	0.55
Chart 4.2									
I	0.00	0.68	1.19	1.58	1.79	1.87	1.88	1.85	1.81
K	0.00	0.00	0.09	0.20	0.30	0.39	0.47	0.53	0.58
Chart 4.3									
L	0.00	-1.31	-0.77	-0.42	-0.21	-0.08	-0.02	0.02	0.03
real after-tax wage	0.00	2.07	1.40	1.04	0.86	0.79	0.78	0.79	0.83
real before-tax wage	0.00	-1.11	-1.76	-2.11	-2.29	-2.35	-2.37	-2.35	-2.32
Chart 4.4									
export volume	0.00	-1.46	-1.16	-0.90	-0.61	-0.32	-0.05	0.19	0.40
terms of trade	0.00	0.35	0.23	0.13	0.02	-0.09	-0.19	-0.28	-0.36
import volume	0.00	-0.44	0.08	0.44	0.64	0.75	0.81	0.84	0.85
Chart 4.5									
non-traditional export vol.	0.00	-0.81	-0.28	0.16	0.60	1.01	1.37	1.67	1.91
traditional export vol.	0.00	1.43	1.75	2.01	2.31	2.62	2.91	3.19	3.43
tourism exports	0.00	-10.49	-10.63	-10.62	-10.47	-10.25	-9.99	-9.72	-9.46
f'gn student numbers	0.00	-7.76	-8.22	-8.45	-8.42	-8.26	-8.05	-7.82	-7.60
total export vol.	0.00	-1.46	-1.16	-0.90	-0.61	-0.32	-0.05	0.19	0.40
Chart 4.6									
real exchange rate	0.00	1.07	1.26	1.35	1.35	1.29	1.22	1.15	1.09
I	0.00	0.68	1.19	1.58	1.79	1.87	1.88	1.85	1.81
Chart 4.7									
real GDP	0.00	-0.95	-0.54	-0.27	-0.10	-0.01	0.04	0.06	0.06
L	0.00	-1.31	-0.77	-0.42	-0.21	-0.08	-0.02	0.02	0.03
K	0.00	0.00	0.09	0.20	0.30	0.39	0.47	0.53	0.58
Chart 4.8									
real consumption	0.00	-1.37	-0.78	-0.42	-0.24	-0.18	-0.19	-0.24	-0.31
welfare	0.00	-1.41	-0.75	-0.34	-0.11	0.00	0.04	0.04	0.04

Tourism/education sensitivity: data for Charts 5.1 to 5.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 5.1									
L	0.00	0.46	0.35	0.23	0.16	0.12	0.09	0.07	0.06
K	0.00	-0.01	0.50	0.75	0.89	0.96	0.99	1.01	1.02
K/L	0.00	-0.46	0.16	0.52	0.72	0.84	0.90	0.94	0.96
Chart 5.2									
I	0.00	4.73	3.24	2.51	2.09	1.84	1.70	1.62	1.58
K	0.00	-0.01	0.50	0.75	0.89	0.96	0.99	1.01	1.02
Chart 5.3									
L	0.00	0.46	0.35	0.23	0.16	0.12	0.09	0.07	0.06
real after-tax wage	0.00	0.39	0.66	0.84	0.97	1.05	1.11	1.16	1.19
real before-tax wage	0.00	-2.76	-2.49	-2.31	-2.20	-2.11	-2.06	-2.01	-1.98
Chart 5.4									
export volume	0.00	-4.21	-1.88	-0.82	-0.20	0.18	0.41	0.57	0.68
terms of trade	0.00	1.42	0.72	0.40	0.20	0.08	-0.01	-0.07	-0.11
import volume	0.00	2.01	1.51	1.23	1.09	1.01	0.96	0.94	0.92
Chart 5.5									
non-traditional export vol.	0.00	-4.94	-1.80	-0.31	0.57	1.09	1.39	1.57	1.68
traditional export vol.	0.00	-1.68	0.46	1.41	1.98	2.35	2.62	2.83	2.99
tourism exports	0.00	-9.81	-8.39	-7.74	-7.34	-7.08	-6.89	-6.73	-6.58
f'gn student numbers	0.00	-9.84	-7.55	-6.54	-6.00	-5.72	-5.57	-5.49	-5.45
total export vol.	0.00	-4.21	-1.88	-0.82	-0.20	0.18	0.41	0.57	0.68
Chart 5.6									
real exchange rate	0.00	3.95	2.41	1.77	1.45	1.29	1.22	1.20	1.21
I	0.00	4.73	3.24	2.51	2.09	1.84	1.70	1.62	1.58
Chart 5.7									
real GDP	0.00	0.40	0.43	0.39	0.35	0.31	0.28	0.25	0.21
L	0.00	0.46	0.35	0.23	0.16	0.12	0.09	0.07	0.06
K	0.00	-0.01	0.50	0.75	0.89	0.96	0.99	1.01	1.02
Chart 5.8									
real consumption	0.00	1.38	0.91	0.60	0.38	0.22	0.10	0.00	-0.09
welfare	0.00	1.34	0.93	0.66	0.50	0.39	0.31	0.26	0.22

GST-free tourism packages: data for Charts 6.1 to 6.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 6.1									
L	0.00	0.39	0.31	0.21	0.15	0.11	0.08	0.06	0.05
K	0.00	-0.01	0.47	0.70	0.83	0.89	0.93	0.94	0.94
K/L	0.00	-0.39	0.16	0.49	0.67	0.78	0.84	0.88	0.89
Chart 6.2									
I	0.00	4.35	3.02	2.35	1.97	1.74	1.61	1.53	1.48
K	0.00	-0.01	0.47	0.70	0.83	0.89	0.93	0.94	0.94
Chart 6.3									
L	0.00	0.39	0.31	0.21	0.15	0.11	0.08	0.06	0.05
real after-tax wage	0.00	0.33	0.58	0.74	0.86	0.93	0.99	1.03	1.06
real before-tax wage	0.00	-2.75	-2.51	-2.35	-2.24	-2.17	-2.11	-2.08	-2.05
Chart 6.4									
export volume	0.00	-3.54	-1.41	-0.43	0.16	0.52	0.76	0.91	1.02
terms of trade	0.00	0.88	0.27	-0.02	-0.20	-0.32	-0.41	-0.47	-0.52
import volume	0.00	1.75	1.35	1.12	1.00	0.92	0.88	0.86	0.85
Chart 6.5									
non-traditional export vol.	0.00	-3.79	-0.98	0.38	1.20	1.70	2.00	2.18	2.30
traditional export vol.	0.00	-0.81	1.04	1.89	2.42	2.79	3.06	3.28	3.46
tourism exports	0.00	-10.09	-8.46	-7.71	-7.26	-6.98	-6.78	-6.62	-6.47
f'gn student numbers	0.00	-12.77	-10.05	-8.81	-8.14	-7.78	-7.57	-7.46	-7.39
total export vol.	0.00	-3.54	-1.41	-0.43	0.16	0.52	0.76	0.91	1.02
Chart 6.6									
real exchange rate	0.00	3.24	1.97	1.43	1.16	1.02	0.96	0.94	0.94
I	0.00	4.35	3.02	2.35	1.97	1.74	1.61	1.53	1.48
Chart 6.7									
real GDP	0.00	0.34	0.38	0.34	0.30	0.26	0.23	0.19	0.15
L	0.00	0.39	0.31	0.21	0.15	0.11	0.08	0.06	0.05
K	0.00	-0.01	0.47	0.70	0.83	0.89	0.93	0.94	0.94
Chart 6.8									
real consumption	0.00	1.04	0.66	0.37	0.17	0.01	-0.12	-0.23	-0.33
welfare	0.00	1.01	0.68	0.44	0.29	0.18	0.10	0.03	0.00

Food GST-free, after-tax: data for Charts 7.1 to 7.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 7.1									
L	0.00	0.48	0.37	0.24	0.16	0.11	0.08	0.05	0.04
K	0.00	-0.01	0.44	0.65	0.76	0.82	0.84	0.84	0.84
K/L	0.00	-0.48	0.08	0.41	0.60	0.71	0.76	0.79	0.80
Chart 7.2									
I	0.00	4.05	2.79	2.16	1.78	1.57	1.44	1.38	1.35
K	0.00	-0.01	0.44	0.65	0.76	0.82	0.84	0.84	0.84
Chart 7.3									
L	0.00	0.48	0.37	0.24	0.16	0.11	0.08	0.05	0.04
real after-tax wage	0.00	0.41	0.71	0.90	1.03	1.12	1.17	1.21	1.24
real before-tax wage	0.00	-2.17	-1.87	-1.68	-1.56	-1.47	-1.42	-1.38	-1.36
Chart 7.4									
export volume	0.00	-3.28	-1.28	-0.36	0.18	0.51	0.72	0.85	0.94
terms of trade	0.00	0.88	0.30	0.03	-0.15	-0.27	-0.35	-0.41	-0.46
import volume	0.00	1.62	1.24	1.02	0.89	0.82	0.78	0.76	0.76
Chart 7.5									
non-traditional export vol.	0.00	-3.14	-0.49	0.79	1.55	1.99	2.25	2.40	2.48
traditional export vol.	0.00	-0.28	1.47	2.27	2.78	3.13	3.39	3.60	3.77
tourism exports	0.00	-12.12	-10.62	-9.92	-9.50	-9.23	-9.02	-8.85	-8.70
f'gn student numbers	0.00	-10.36	-7.83	-6.69	-6.11	-5.82	-5.68	-5.63	-5.62
total export vol.	0.00	-3.28	-1.28	-0.36	0.18	0.51	0.72	0.85	0.94
Chart 7.6									
real exchange rate	0.00	2.76	1.60	1.12	0.88	0.77	0.73	0.73	0.76
I	0.00	4.05	2.79	2.16	1.78	1.57	1.44	1.38	1.35
Chart 7.7									
real GDP	0.00	0.39	0.40	0.35	0.30	0.25	0.21	0.17	0.14
L	0.00	0.48	0.37	0.24	0.16	0.11	0.08	0.05	0.04
K	0.00	-0.01	0.44	0.65	0.76	0.82	0.84	0.84	0.84
Chart 7.8									
real consumption	0.00	1.08	0.68	0.38	0.16	0.00	-0.13	-0.23	-0.32
welfare	0.00	1.05	0.69	0.44	0.27	0.16	0.07	0.01	-0.03

Food GST-free, before-tax: data for Charts 8.1 to 8.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 8.1									
L	0.00	-0.90	-0.51	-0.27	-0.12	-0.04	0.00	0.02	0.03
K	0.00	0.00	0.15	0.27	0.36	0.44	0.51	0.55	0.59
K/L	0.00	0.91	0.66	0.53	0.49	0.48	0.50	0.53	0.56
Chart 8.2									
I	0.00	1.15	1.39	1.60	1.70	1.73	1.72	1.70	1.67
K	0.00	0.00	0.15	0.27	0.36	0.44	0.51	0.55	0.59
Chart 8.3									
L	0.00	-0.90	-0.51	-0.27	-0.12	-0.04	0.00	0.02	0.03
real after-tax wage	0.00	1.84	1.40	1.17	1.06	1.03	1.03	1.05	1.08
real before-tax wage	0.00	-0.76	-1.19	-1.42	-1.52	-1.55	-1.55	-1.53	-1.50
Chart 8.4									
export volume	0.00	-1.56	-1.04	-0.71	-0.41	-0.13	0.10	0.30	0.47
terms of trade	0.00	0.41	0.24	0.11	0.00	-0.10	-0.19	-0.27	-0.34
import volume	0.00	-0.07	0.29	0.53	0.67	0.74	0.78	0.80	0.81
Chart 8.5									
non-traditional export vol.	0.00	-1.01	-0.20	0.33	0.78	1.16	1.46	1.70	1.89
traditional export vol.	0.00	1.20	1.70	2.02	2.33	2.63	2.91	3.15	3.37
tourism exports	0.00	-10.26	-10.19	-10.10	-9.94	-9.73	-9.51	-9.29	-9.06
f'gn student numbers	0.00	-6.83	-6.90	-6.96	-6.89	-6.76	-6.61	-6.45	-6.31
total export vol.	0.00	-1.56	-1.04	-0.71	-0.41	-0.13	0.10	0.30	0.47
Chart 8.6									
real exchange rate	0.00	1.26	1.26	1.28	1.25	1.20	1.15	1.11	1.08
I	0.00	1.15	1.39	1.60	1.70	1.73	1.72	1.70	1.67
Chart 8.7									
real GDP	0.00	-0.65	-0.33	-0.14	-0.02	0.04	0.07	0.08	0.07
L	0.00	-0.90	-0.51	-0.27	-0.12	-0.04	0.00	0.02	0.03
K	0.00	0.00	0.15	0.27	0.36	0.44	0.51	0.55	0.59
Chart 8.8									
real consumption	0.00	-0.87	-0.48	-0.26	-0.16	-0.14	-0.17	-0.23	-0.29
welfare	0.00	-0.90	-0.46	-0.19	-0.04	0.02	0.04	0.03	0.00

Lagged pass through: data for Charts 9.1 to 9.8

(% deviation from basecase forecasts)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Chart 9.1									
L	0.00	-0.23	0.42	0.31	0.22	0.15	0.11	0.08	0.06
K	0.00	0.00	0.12	0.43	0.59	0.68	0.72	0.74	0.74
K/L	0.00	0.23	-0.29	0.12	0.37	0.53	0.61	0.66	0.68
Chart 9.2									
I	0.00	1.23	3.26	2.49	2.01	1.72	1.55	1.44	1.38
K	0.00	0.00	0.12	0.43	0.59	0.68	0.72	0.74	0.74
Chart 9.3									
L	0.00	-0.23	0.42	0.31	0.22	0.15	0.11	0.08	0.06
real after-tax wage	0.00	-0.20	0.14	0.38	0.54	0.65	0.72	0.77	0.79
real before-tax wage	0.00	-3.33	-3.01	-2.77	-2.61	-2.51	-2.44	-2.40	-2.37
Chart 9.4									
export volume	0.00	-1.25	-2.02	-0.79	-0.07	0.36	0.64	0.82	0.95
terms of trade	0.00	0.25	0.46	0.10	-0.12	-0.27	-0.38	-0.45	-0.52
import volume	0.00	0.23	1.42	1.18	1.02	0.92	0.87	0.84	0.82
Chart 9.5									
non-traditional export vol.	0.00	-0.36	-1.37	0.31	1.30	1.90	2.26	2.48	2.61
traditional export vol.	0.00	1.39	1.02	2.07	2.72	3.14	3.45	3.69	3.89
tourism exports	0.00	-10.53	-11.61	-10.66	-10.09	-9.72	-9.45	-9.23	-9.04
f'gn student numbers	0.00	-7.61	-10.05	-8.50	-7.66	-7.19	-6.94	-6.80	-6.72
total export vol.	0.00	-1.25	-2.02	-0.79	-0.07	0.36	0.64	0.82	0.95
Chart 9.6									
real exchange rate	0.00	0.48	2.00	1.31	0.95	0.76	0.68	0.64	0.64
I	0.00	1.23	3.26	2.49	2.01	1.72	1.55	1.44	1.38
Chart 9.7									
real GDP	0.00	-0.17	0.36	0.34	0.30	0.25	0.20	0.16	0.13
L	0.00	-0.23	0.42	0.31	0.22	0.15	0.11	0.08	0.06
K	0.00	0.00	0.12	0.43	0.59	0.68	0.72	0.74	0.74
Chart 9.8									
real consumption	0.00	-0.11	0.80	0.49	0.24	0.05	-0.10	-0.22	-0.33
welfare	0.00	-0.13	0.83	0.57	0.37	0.23	0.12	0.05	-0.01

Charts

Chart 3.1. Central: Capital and labour inputs
(% deviation from basecase forecasts)

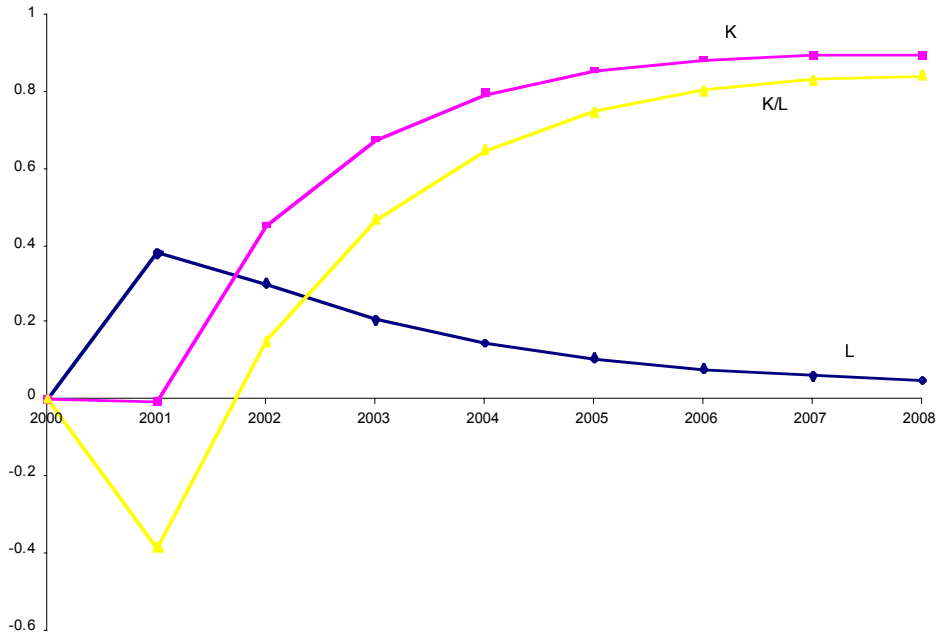


Chart 3.2. Central: Investment and capital
(% deviation from basecase forecasts)

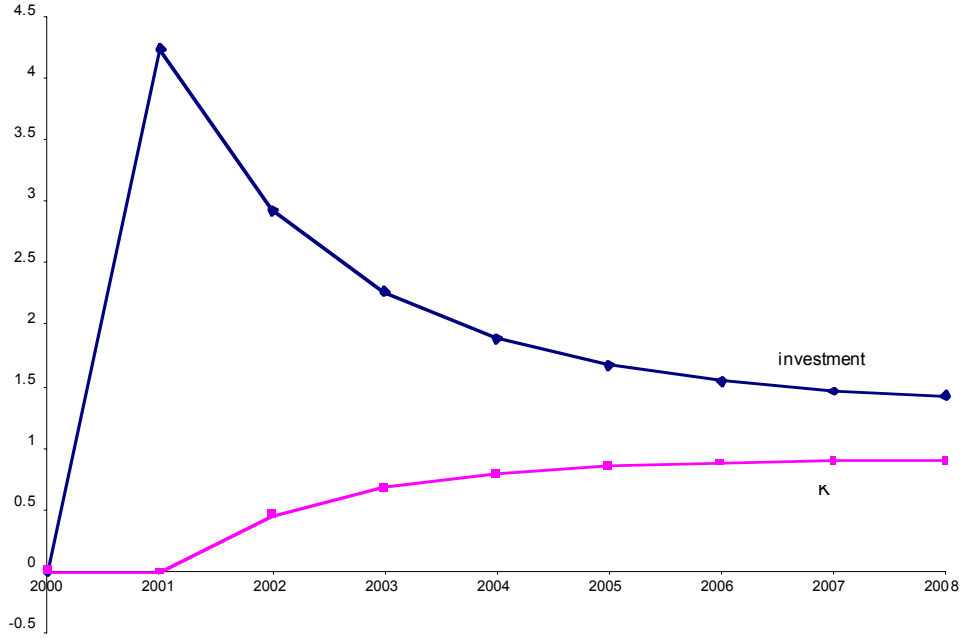


Chart 3.3. Central: Employment and real wage rates (% deviation from basecase forecasts)

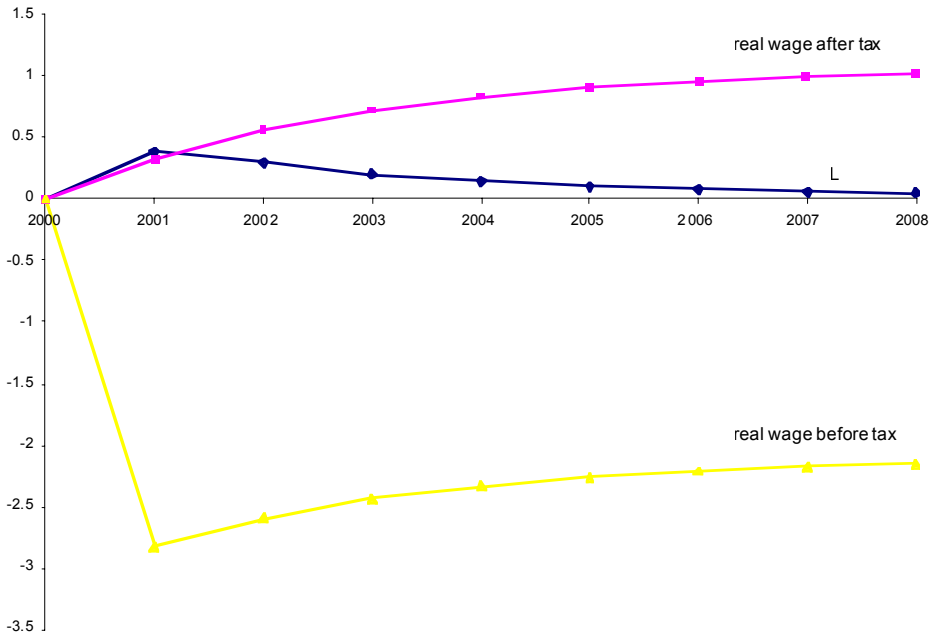


Chart 3.4. Central: Exports, imports and the terms of trade (% deviation from basecase forecasts)

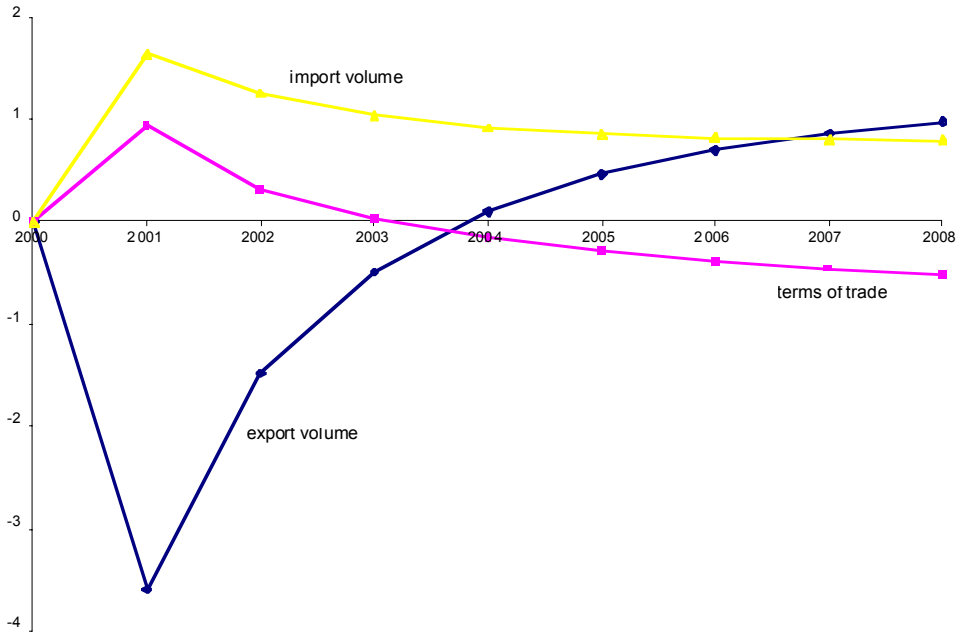


Chart 3.5. Central: Export volumes
(% deviation from basecase forecasts)

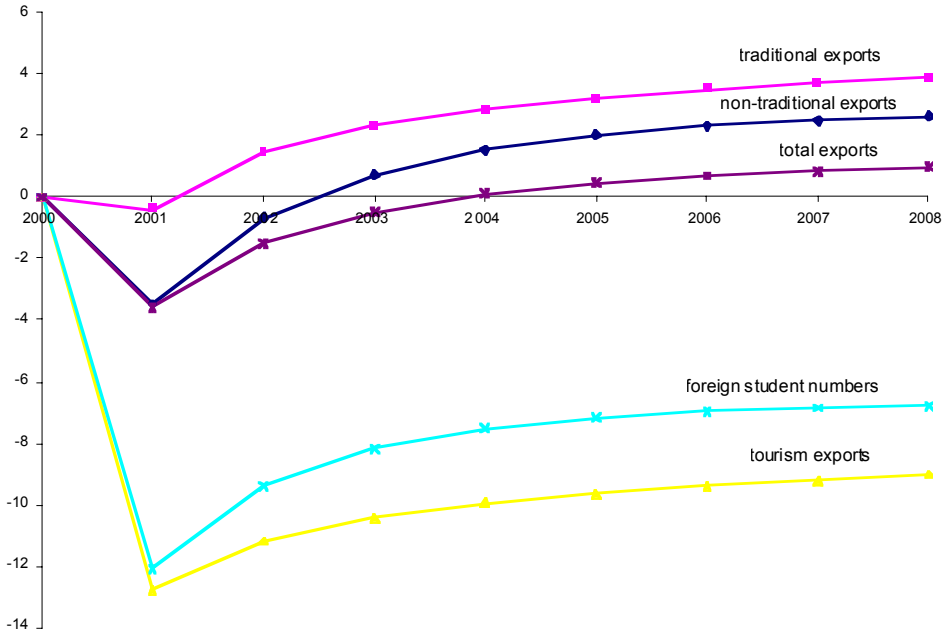


Chart 3.6. Central: The real exchange rate and investment
(% deviation from basecase forecasts)

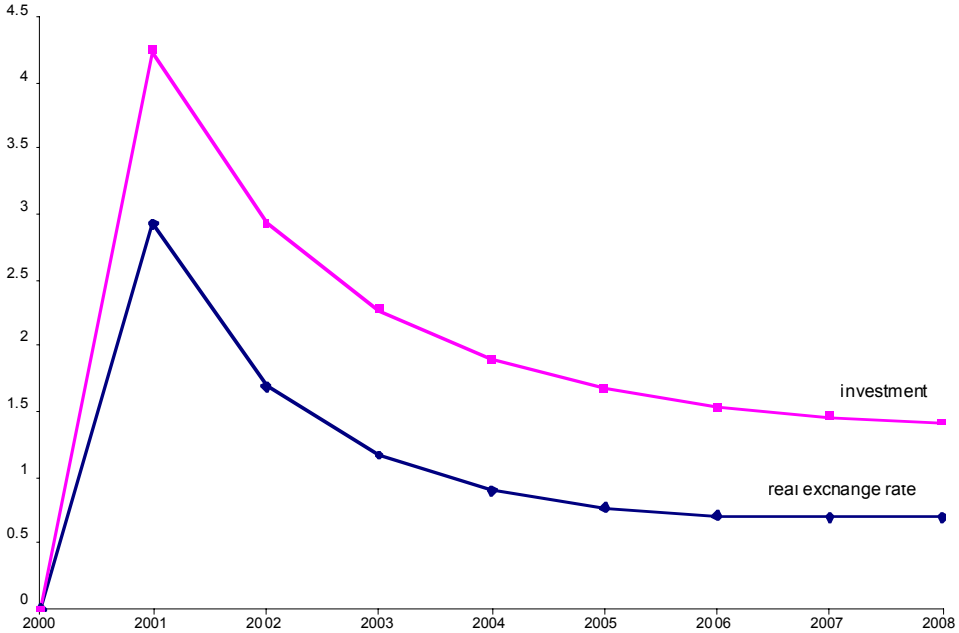


Chart 3.7. Central: Real GDP and factor inputs
(% deviation from basecase forecasts)

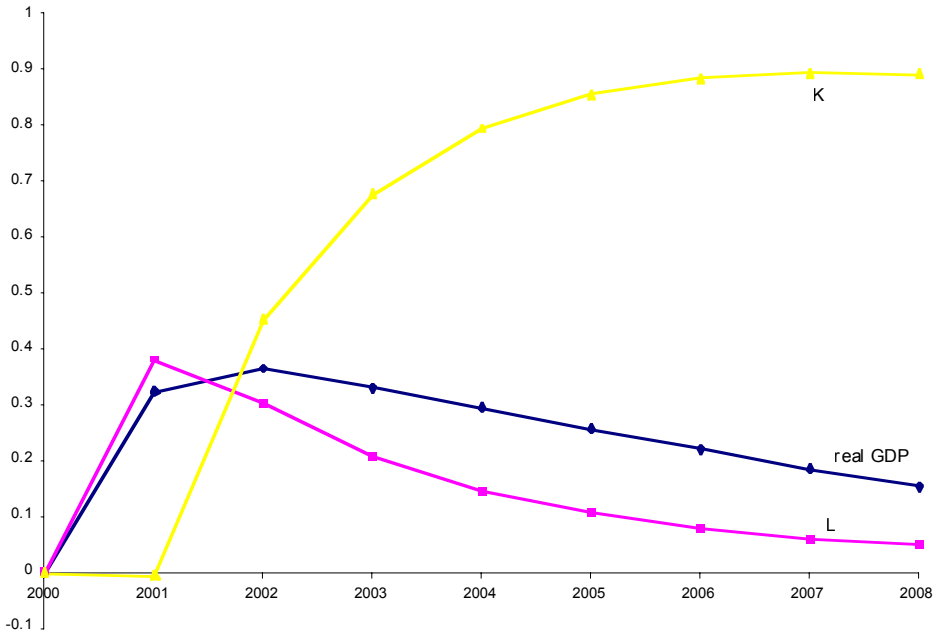


Chart 3.8. Central: Real consumption and welfare
(% deviation from basecase forecasts)

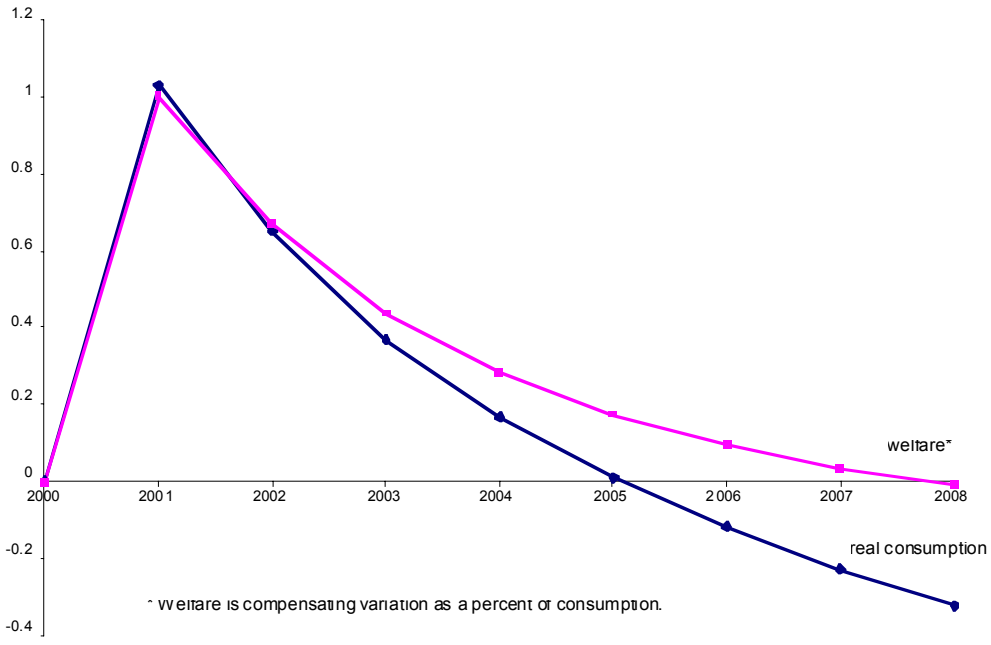


Chart 3.9. Central: Output of main winners
(% deviation from basecase forecasts)

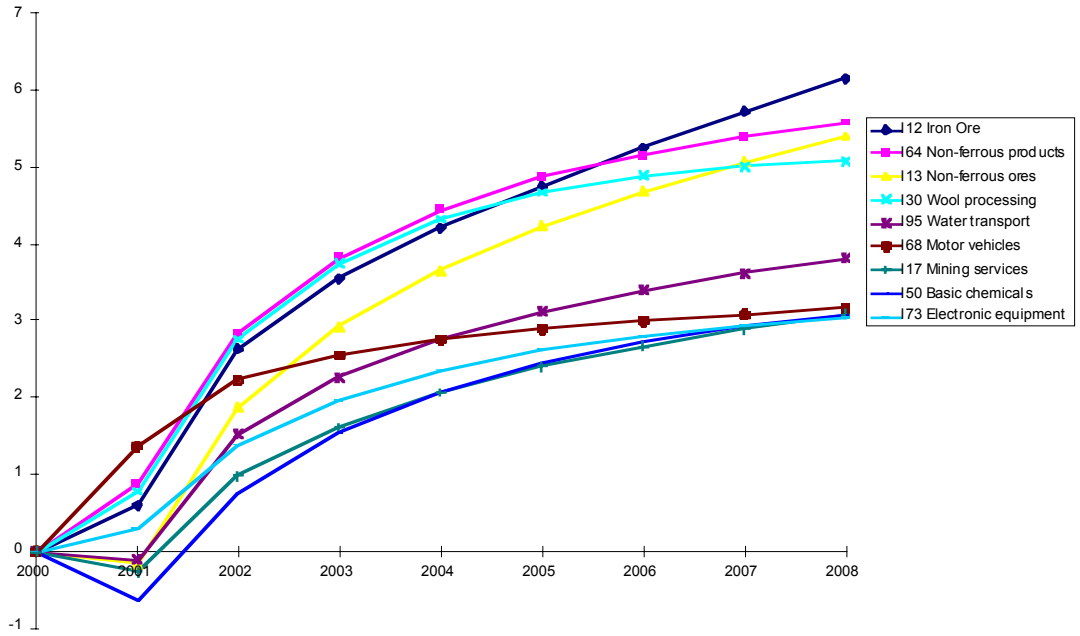


Chart 3.10 Central: Output of main losers
(% deviation from basecase forecasts)

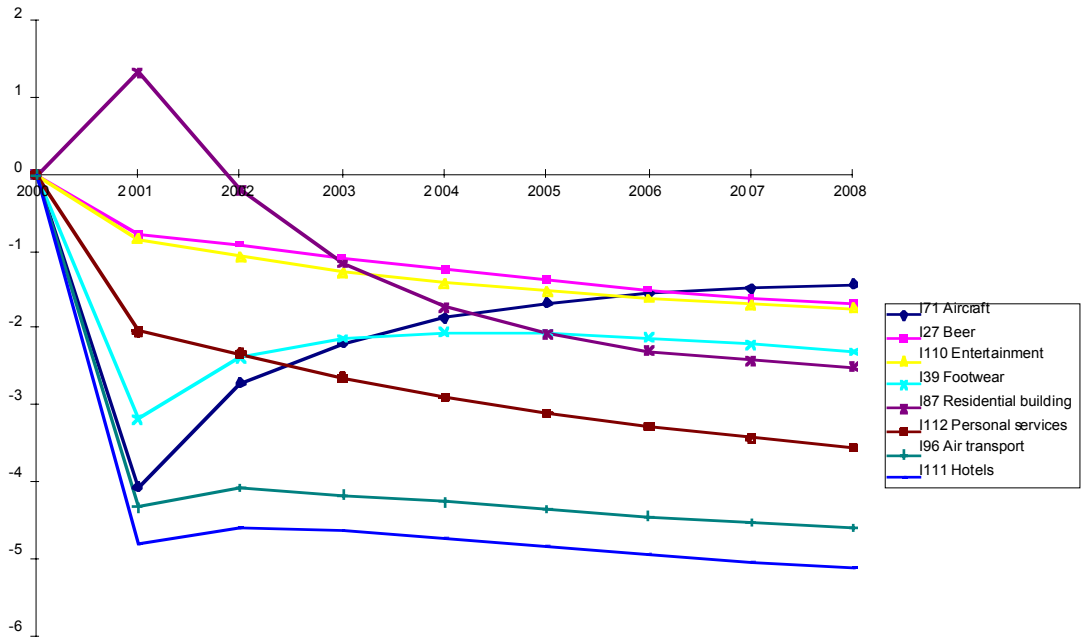


Chart 4.1. Before-tax: Capital and labour inputs

(% deviation from basecase forecasts)

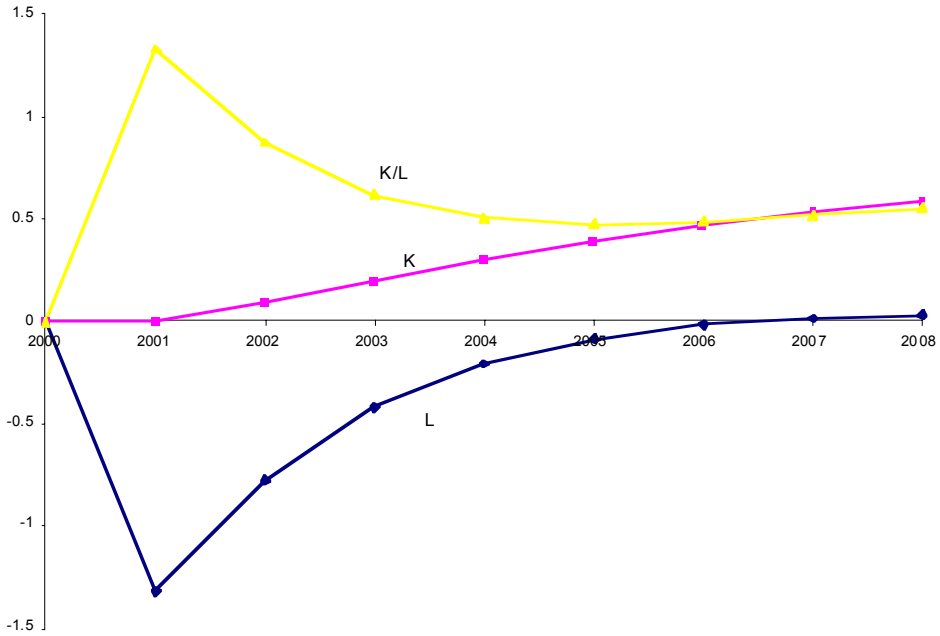


Chart 4.2. Before-tax: Investment and capital
(% deviation from basecase forecasts)

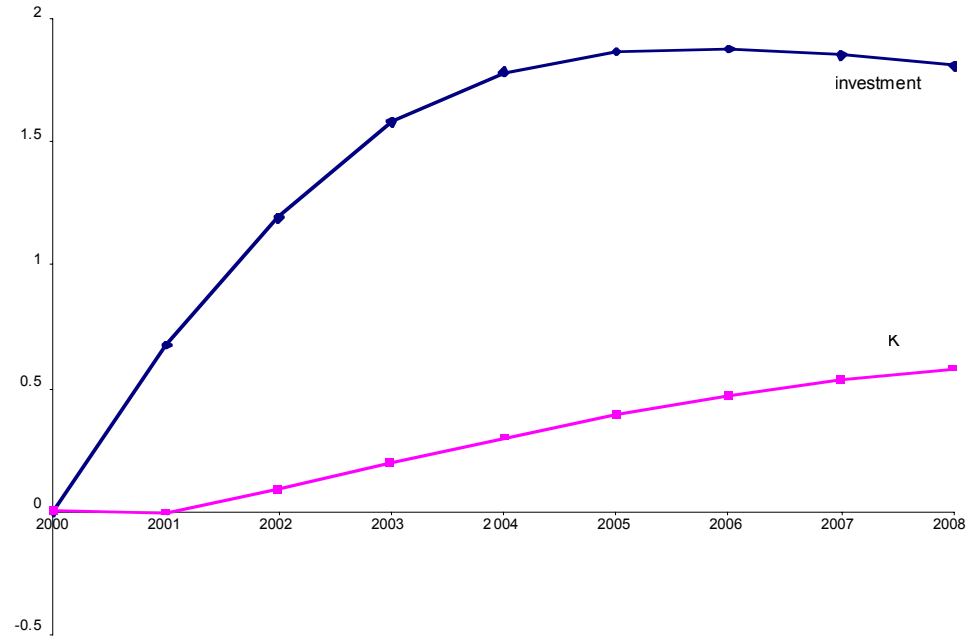


Chart 4.3. Before-tax: Employment and real wage rates

(% deviation from basecase forecasts)

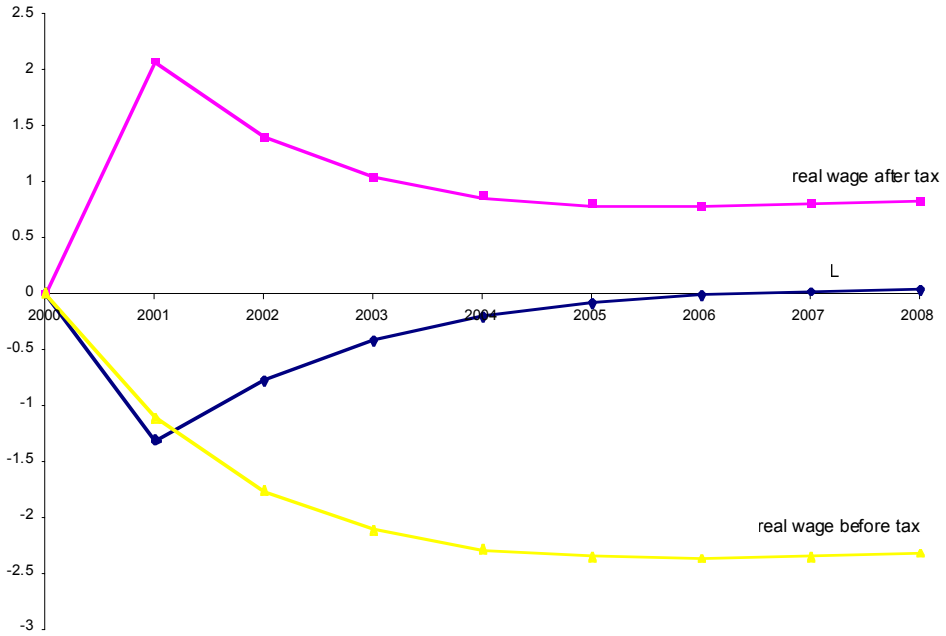


Chart 4.4. Before-tax: Exports, imports and the terms of trade
(% deviation from basecase forecasts)

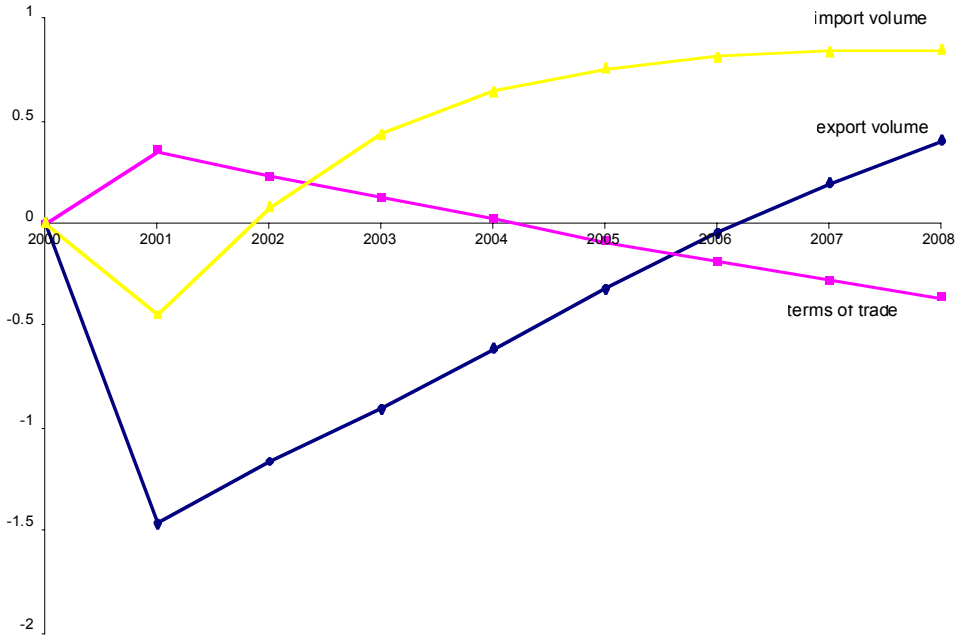


Chart 4.5. Before-tax: Export volumes
(% deviation from basecase forecasts)

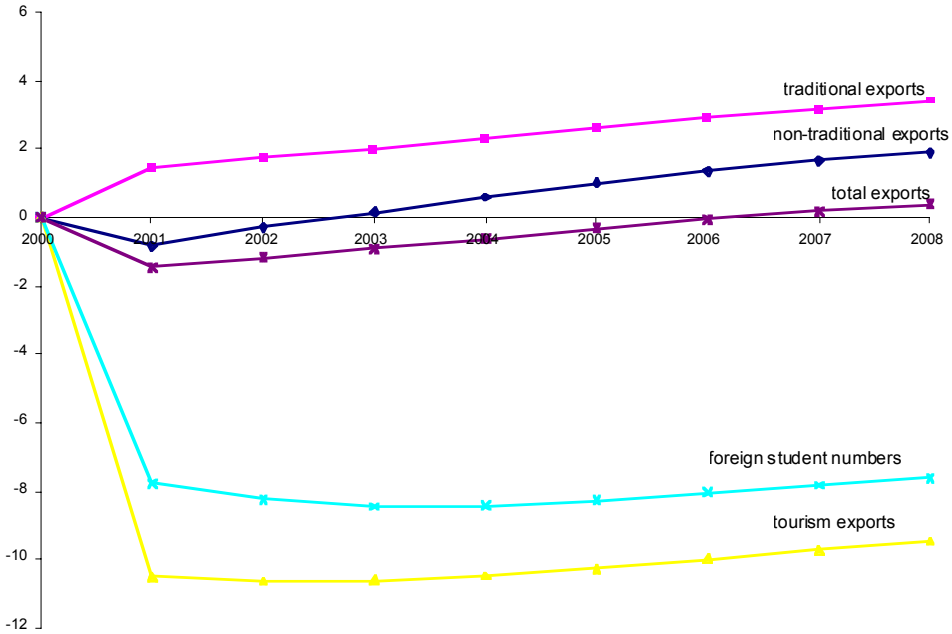


Chart 4.6. Before-tax: The real exchange rate and investment
(% deviation from basecase forecasts)

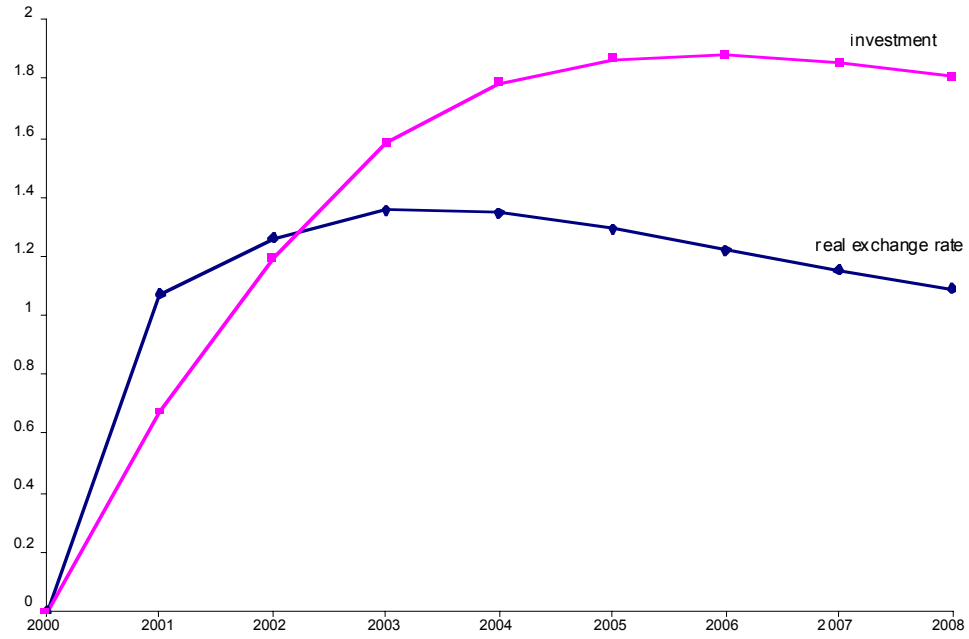


Chart 4.7. Before-tax: Real GDP and factor inputs (% deviation from basecase forecasts)

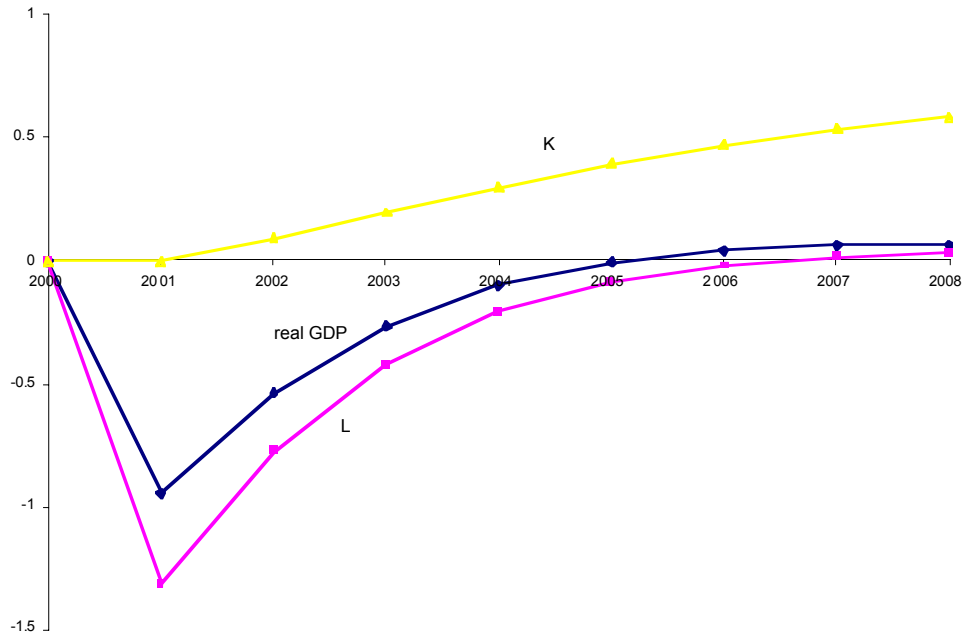


Chart 4.8. Before-tax: Real consumption and welfare (% deviation from basecase forecasts)

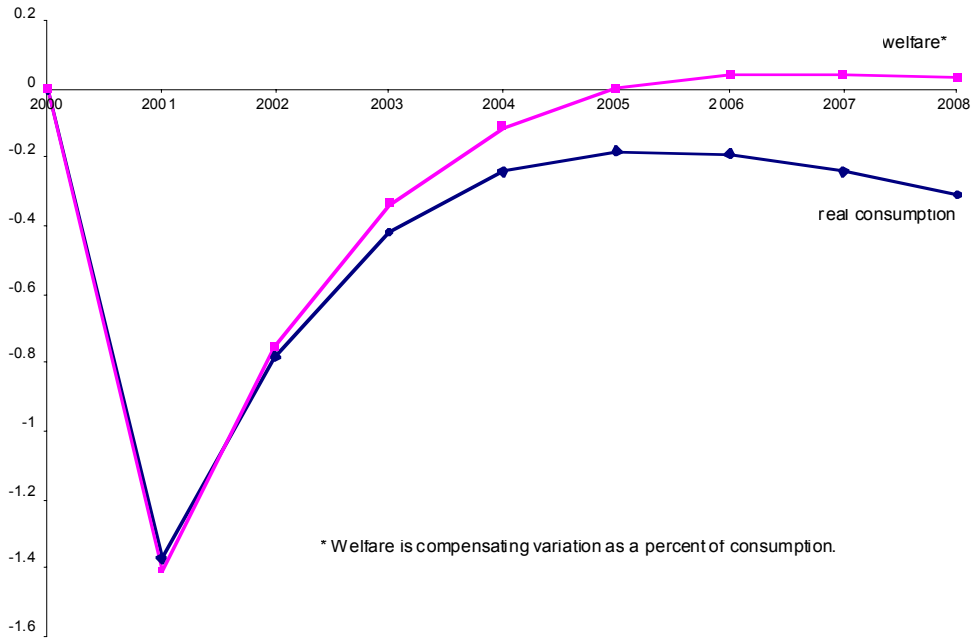


Chart 4.9. Before-tax: Output of main winners (% deviation from basecase forecasts)

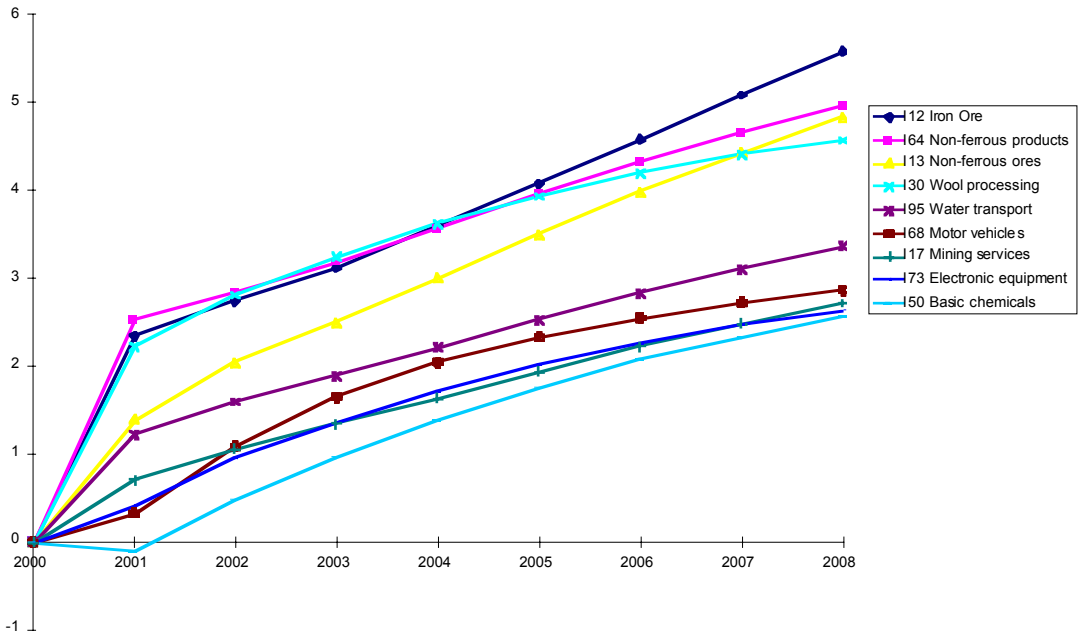


Chart 4.10. Before-tax: Output of main losers (% deviation from basecase forecasts)

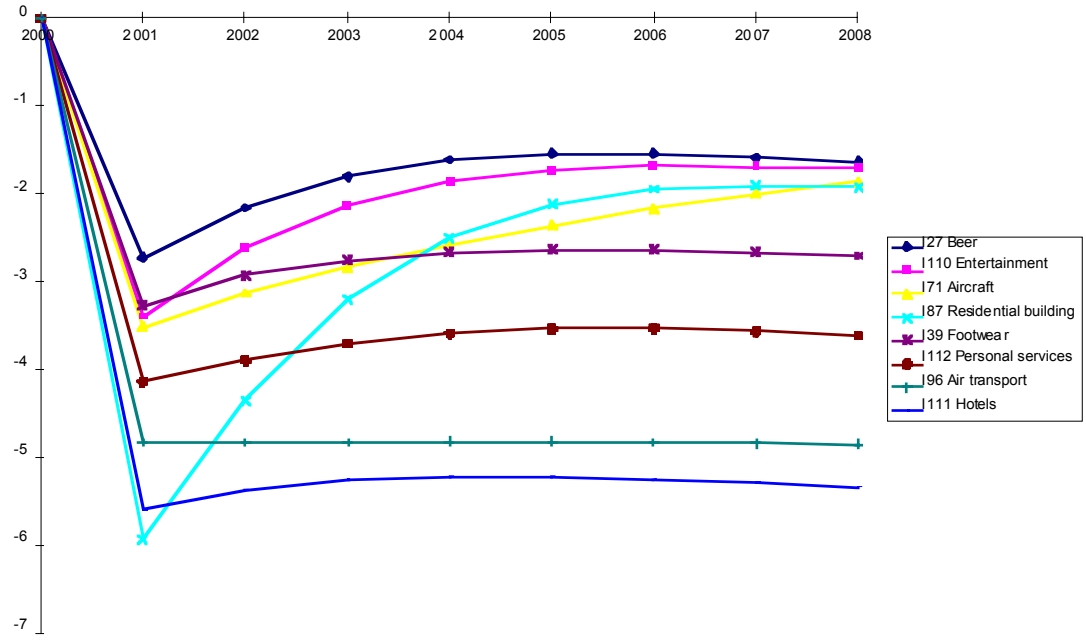


Chart 5.1. Tourism/education sensitivity: Capital and labour inputs (% deviation from basecase forecasts)

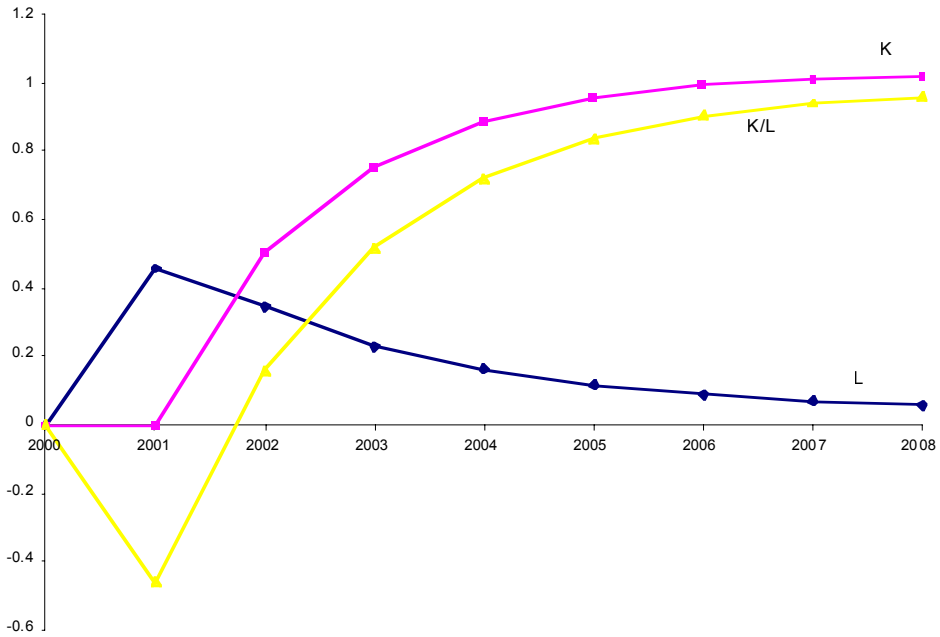


Chart 5.2. Tourism/education sensitivity: Investment and capital (% deviation from basecase forecasts)

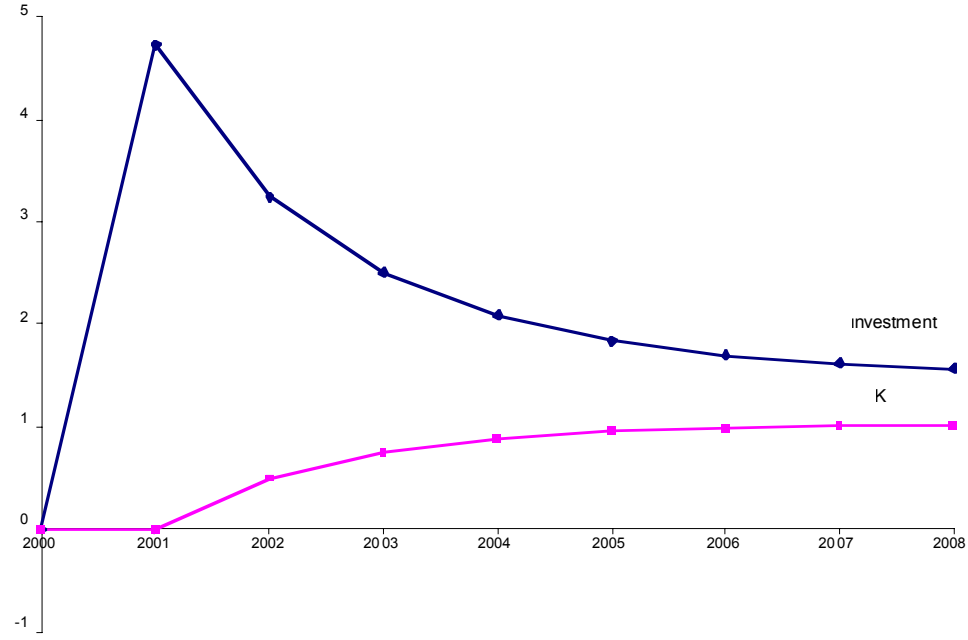


Chart 5.3. Tourism/education sensitivity: Employment and real wage rates (% deviation from basecase forecasts)

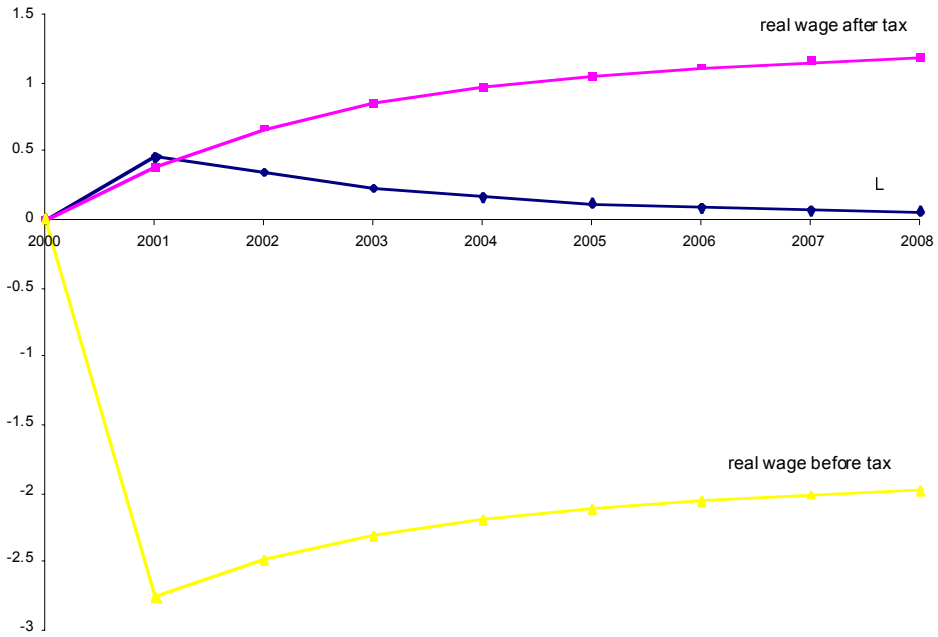


Chart 5.4. Tourism/education sensitivity: Exports, imports and the terms of trade (% deviation from basecase forecasts)

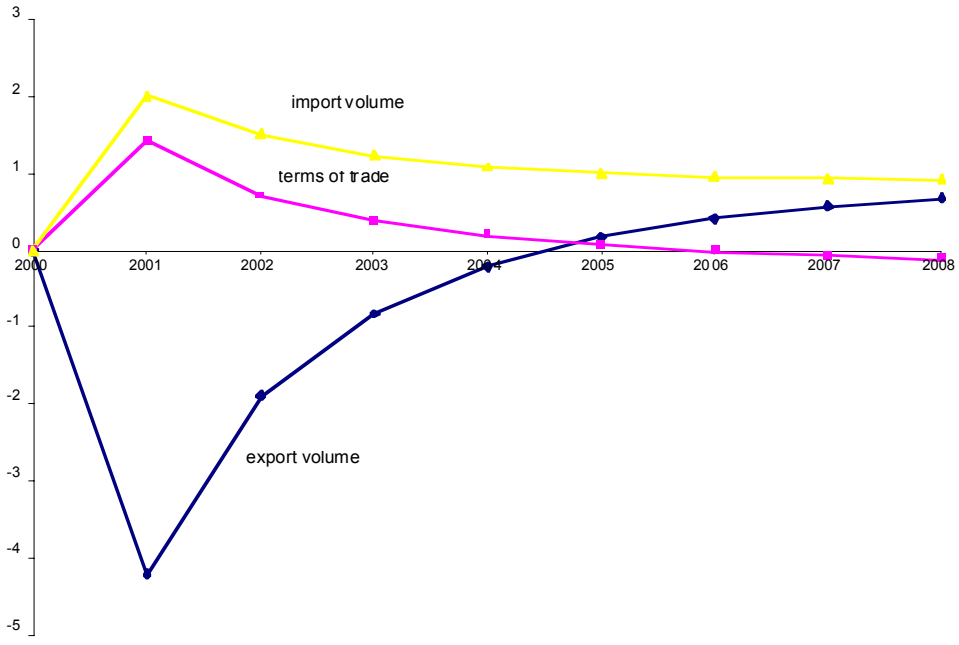


Chart 5.5. Tourism/education sensitivity: Export volumes (% deviation from basecase forecasts)

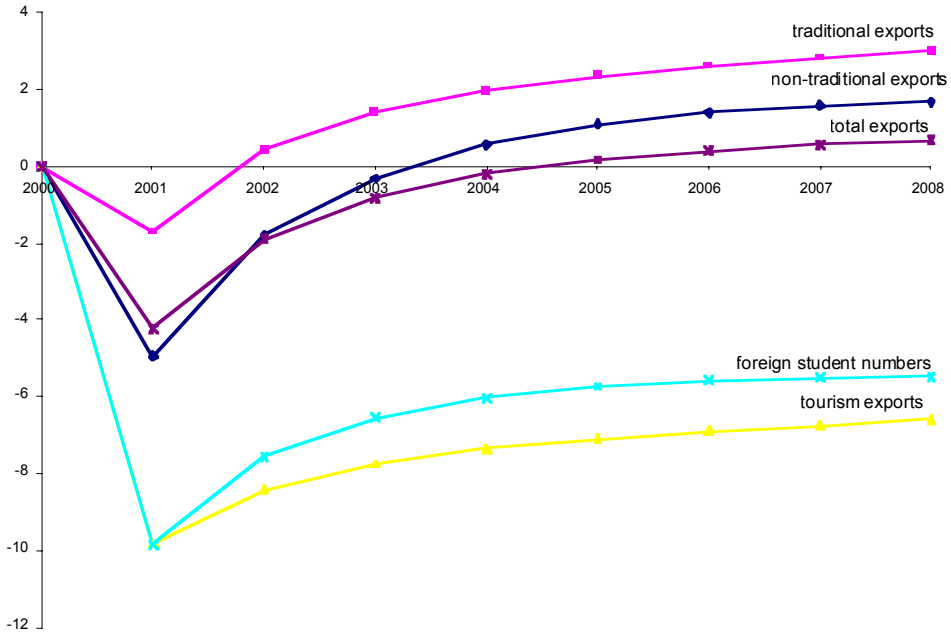


Chart 5.6. Tourism/education sensitivity: The real exchange rate and investment (% deviation from basecase forecasts)

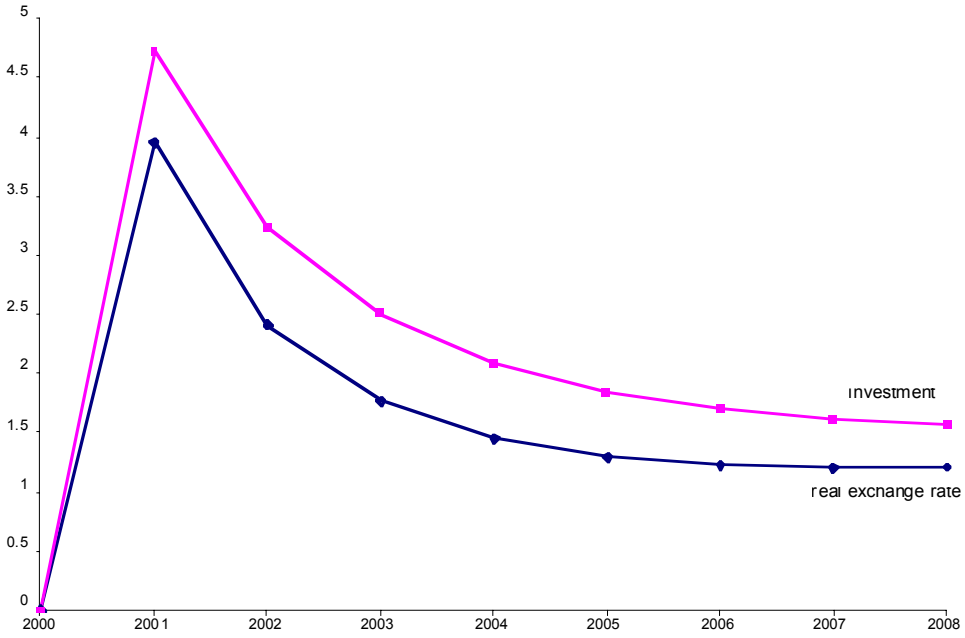


Chart 5.7. Tourism/education sensitivity: Real GDP and factor inputs (% deviation from basecase forecasts)

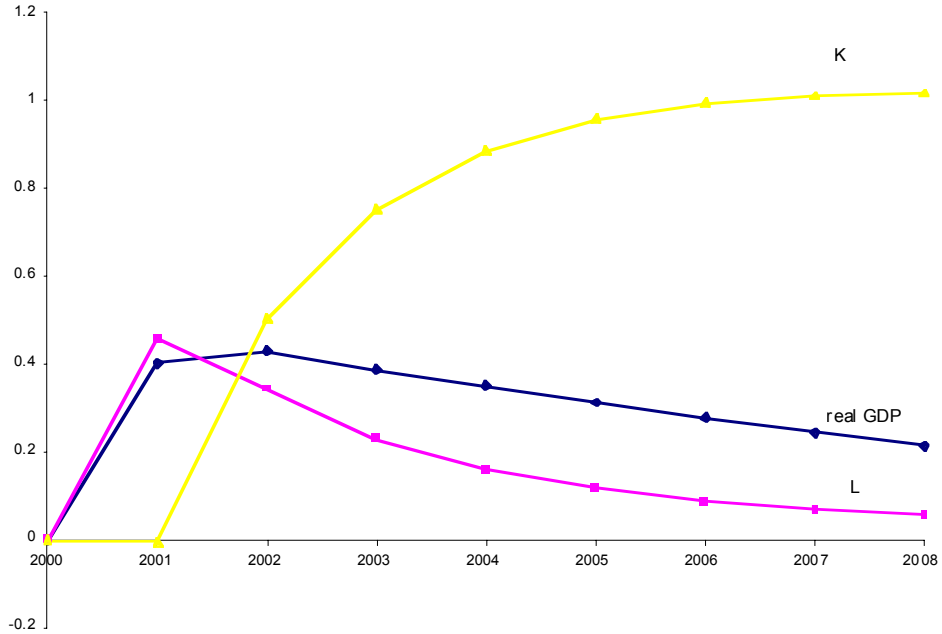


Chart 5.8. Tourism/education sensitivity: Real consumption and welfare (% deviation from basecase forecasts)

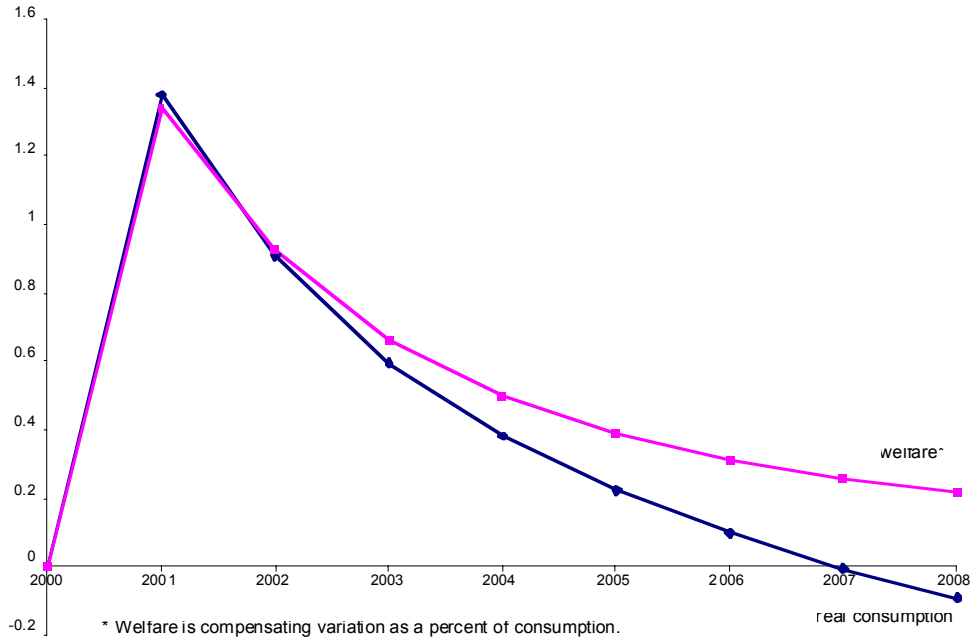


Chart 5.9. Tourism/education sensitivity: Output of main winners (% deviation from basecase forecasts)

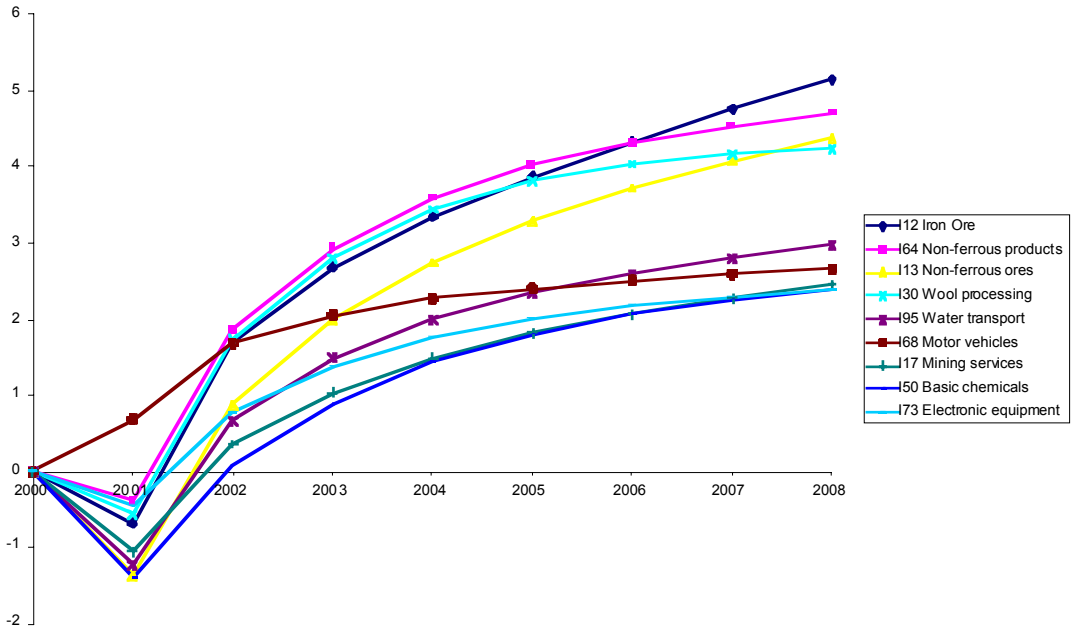


Chart 5.10. Tourism/education sensitivity: Output of main losers (% deviation from basecase forecasts)

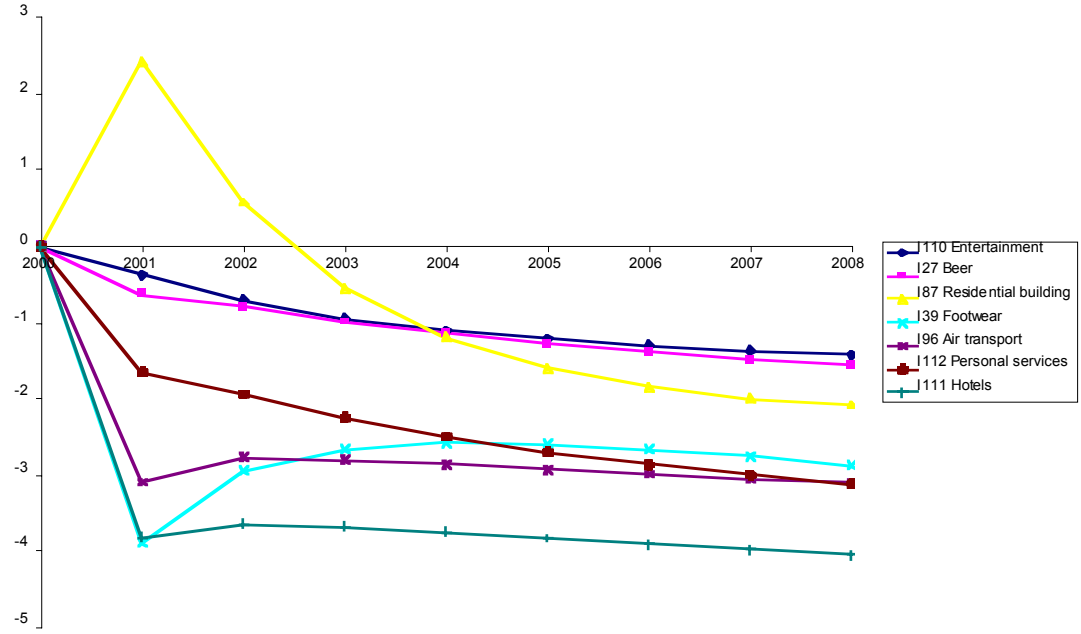


Chart 6.1. GST-free tourism packages: Capital and labour inputs (% deviation from basecase forecasts)

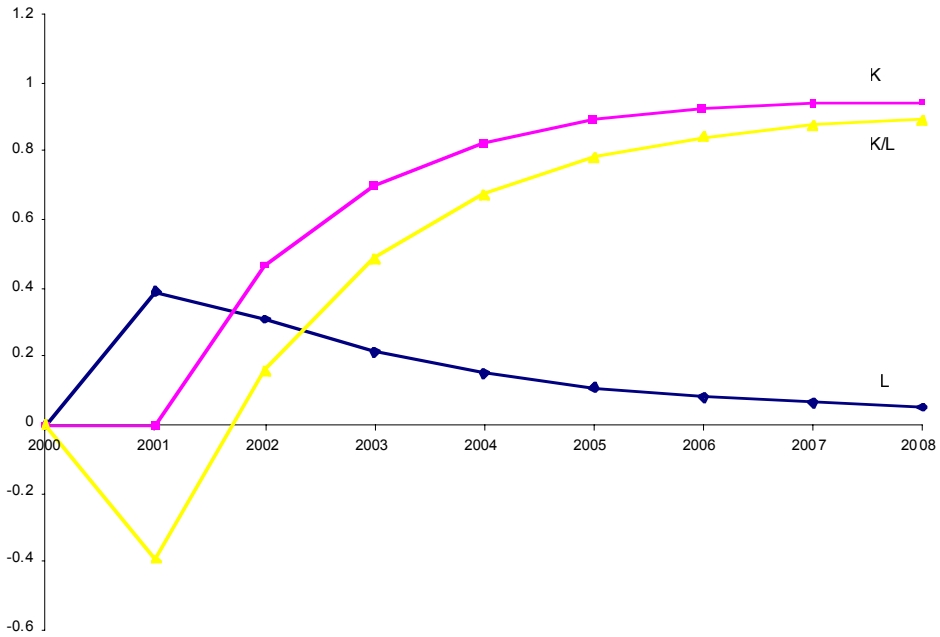


Chart 6.2. GST-free tourism packages: Investment and capital (% deviation from basecase forecasts)

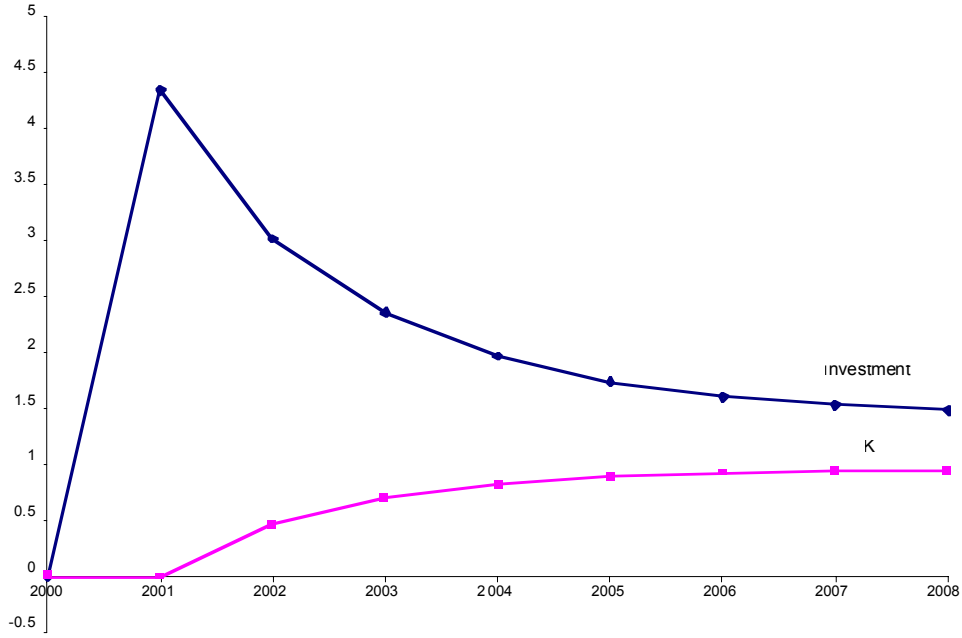


Chart 6.3. GST-free tourism packages: Employment and real wage rates (% deviation from basecase forecasts)

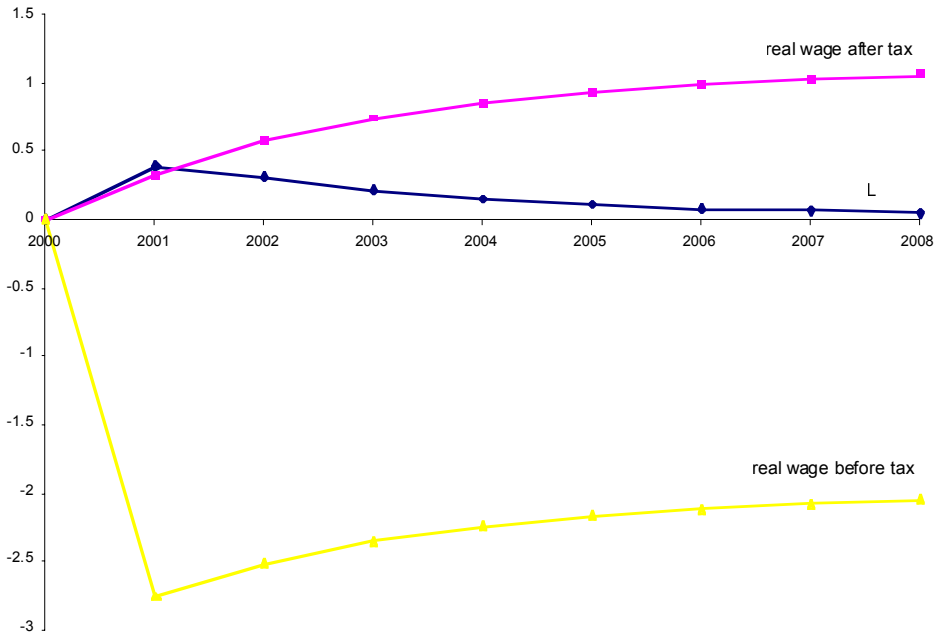


Chart 6.4. GST-free tourism packages: Exports, imports and the terms of trade (% deviation from basecase forecasts)

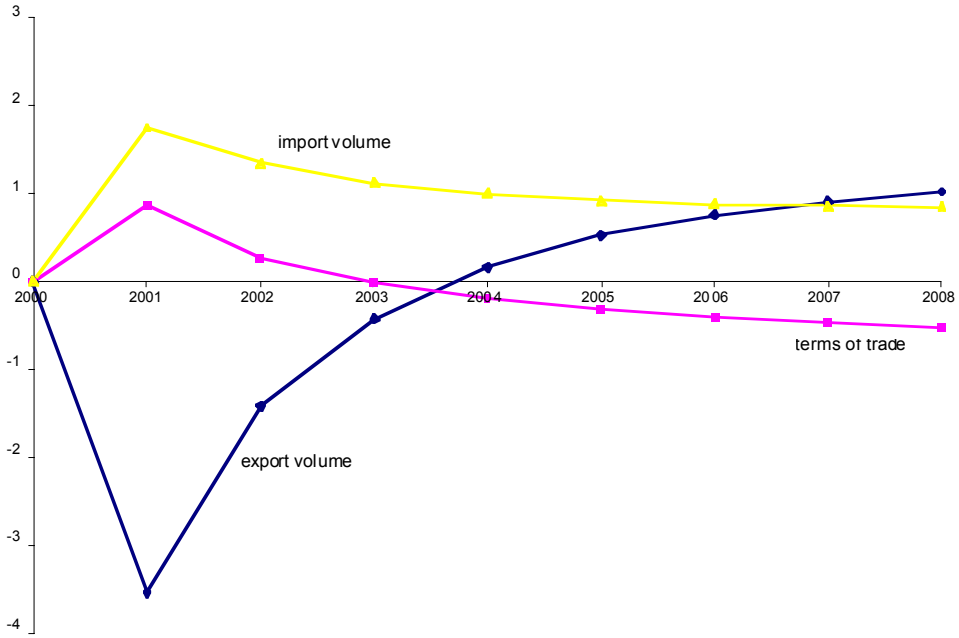


Chart 6.5. GST-free tourism packages: Export volumes (% deviation from basecase forecasts)

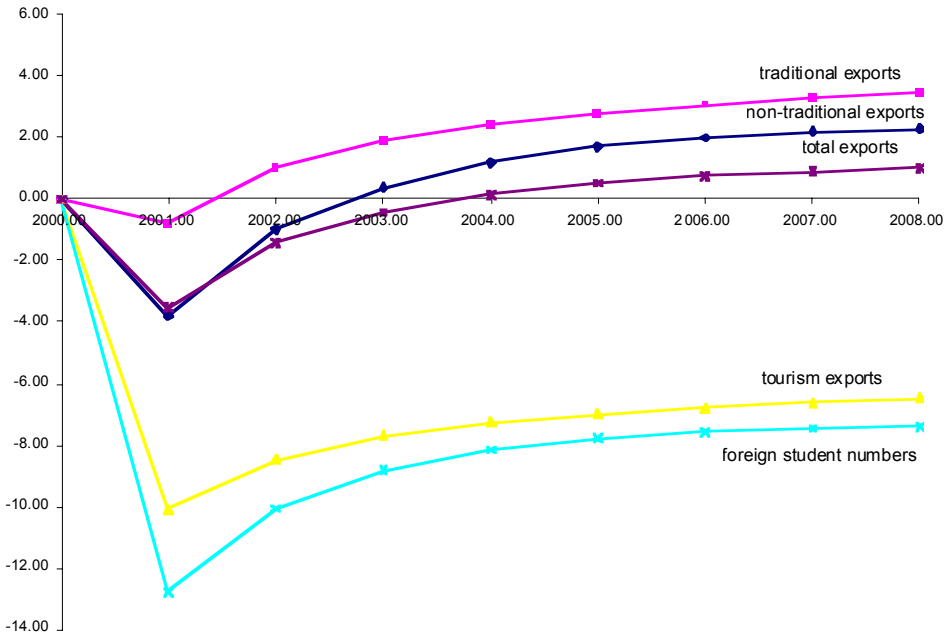


Chart 6.6. GST-free tourism packages: The real exchange rate and investment (% deviation from basecase forecasts)

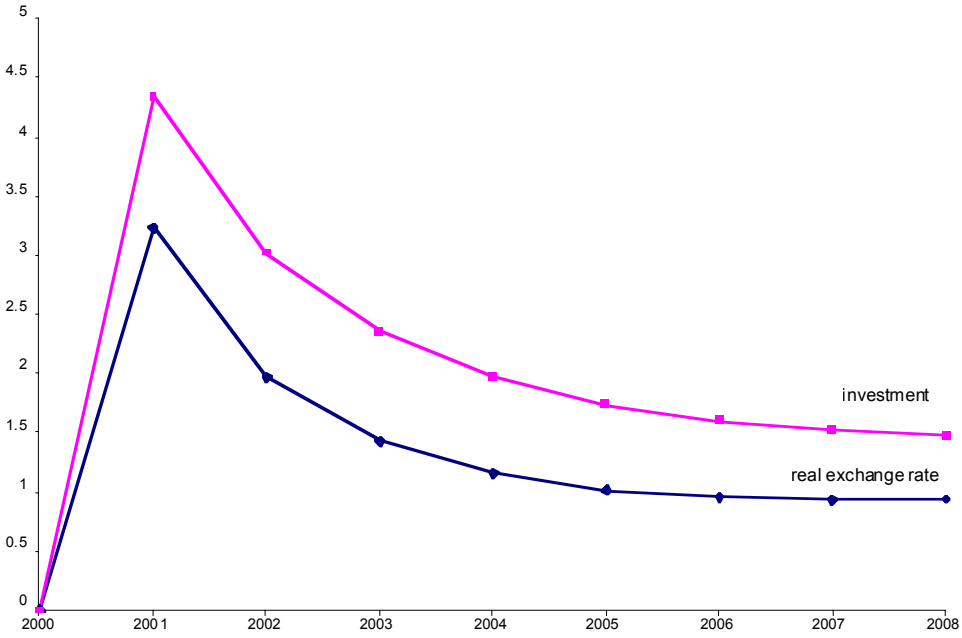


Chart 6.7. GST-free tourism packages: Real GDP and factor inputs (% deviation from basecase forecasts)

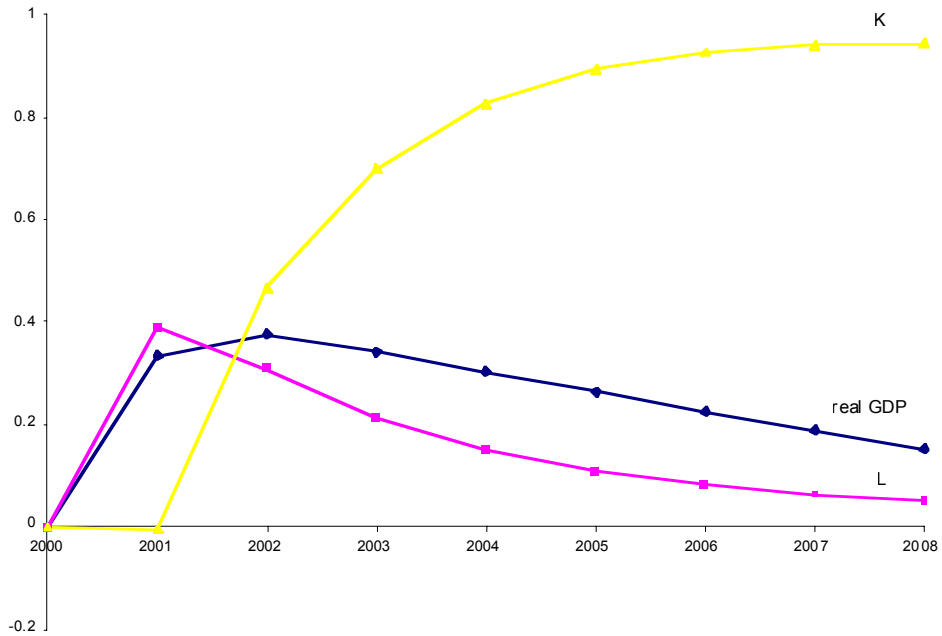


Chart 6.8. GST-free tourism packages: Real consumption and welfare (% deviation from basecase forecasts)

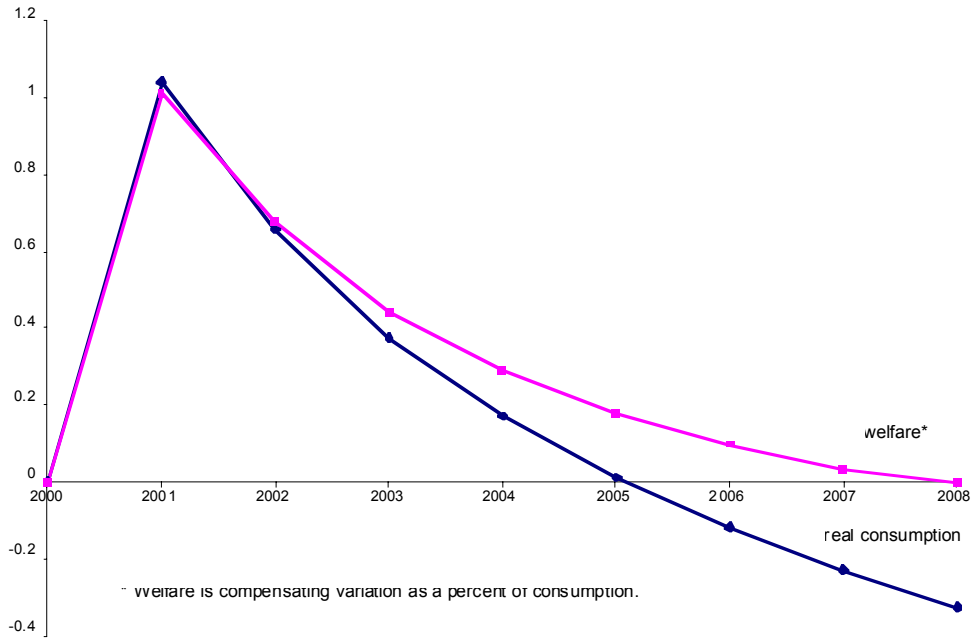


Chart 6.9. GST-free tourism packages: Output of main winners (% deviation from basecase forecasts)

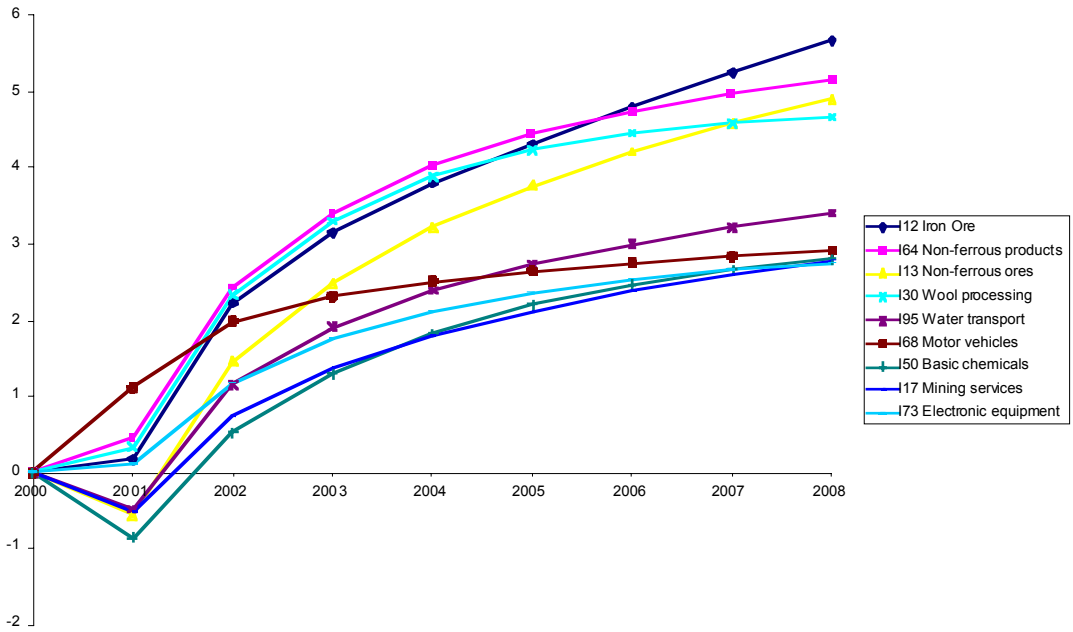


Chart 6.10. GST-free tourism packages: Output of main losers (% deviation from basecase forecasts)

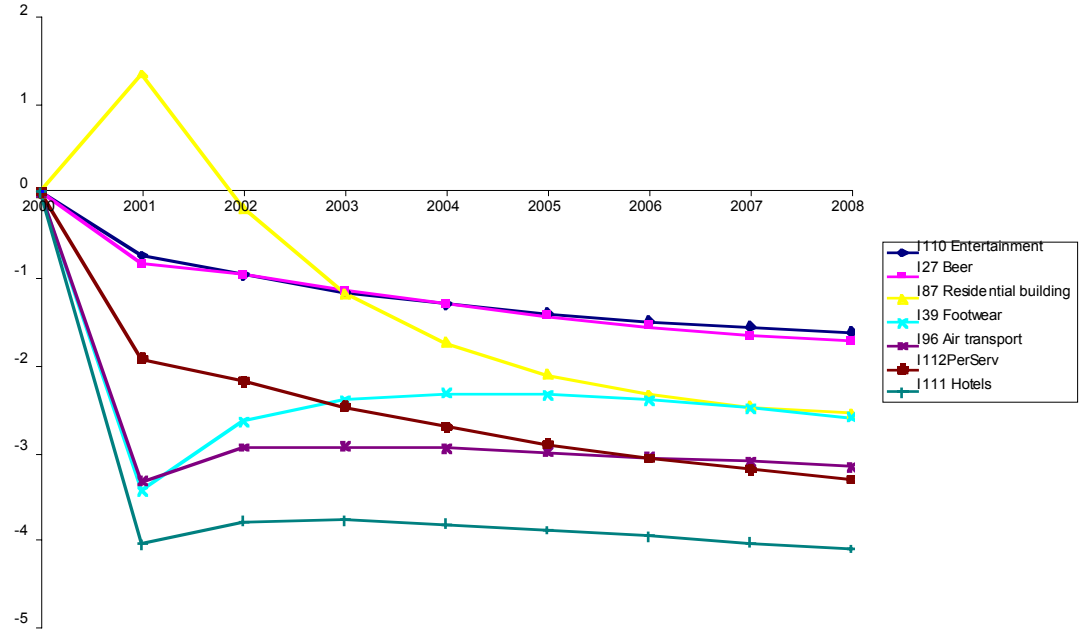


Chart 7.1. Food GST-free, after-tax: Capital and labour inputs (% deviation from basecase forecasts)

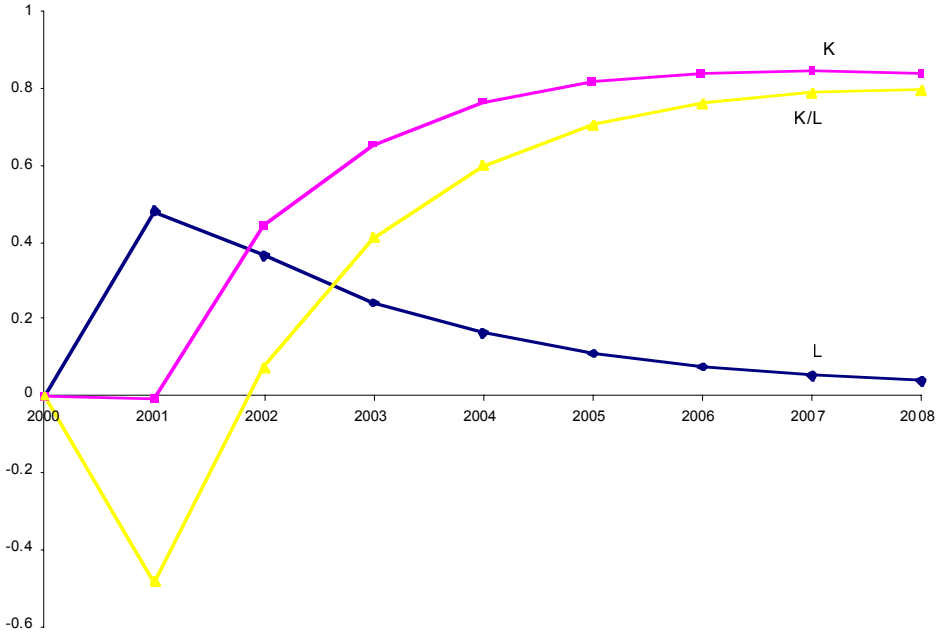


Chart 7.2. Food GST-free, after-tax: Investment and capital (% deviation from basecase forecasts)

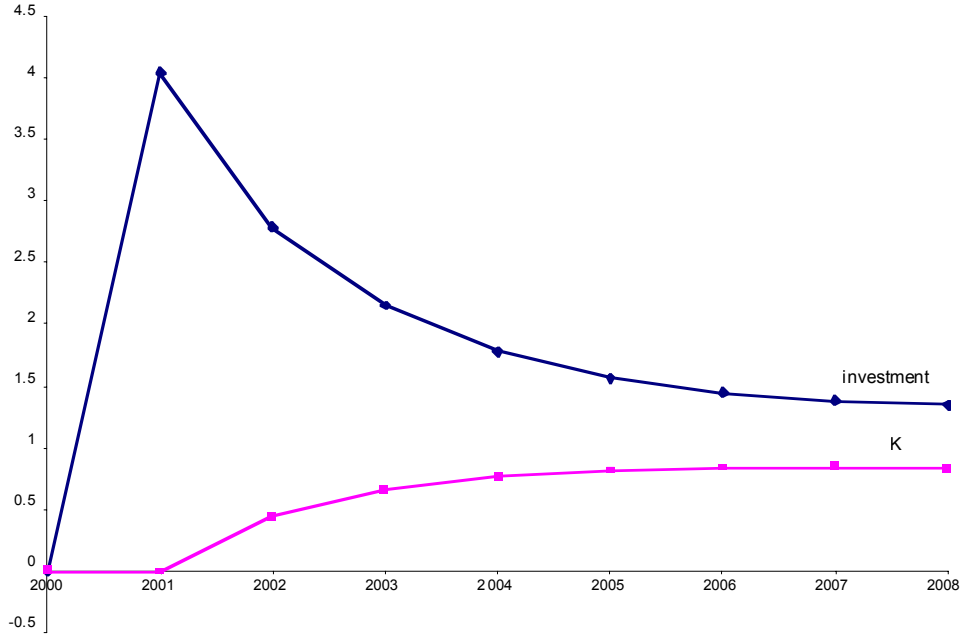


Chart 7.3. Food GST-free, after-tax: Employment and real wage rates (% deviation from basecase forecasts)

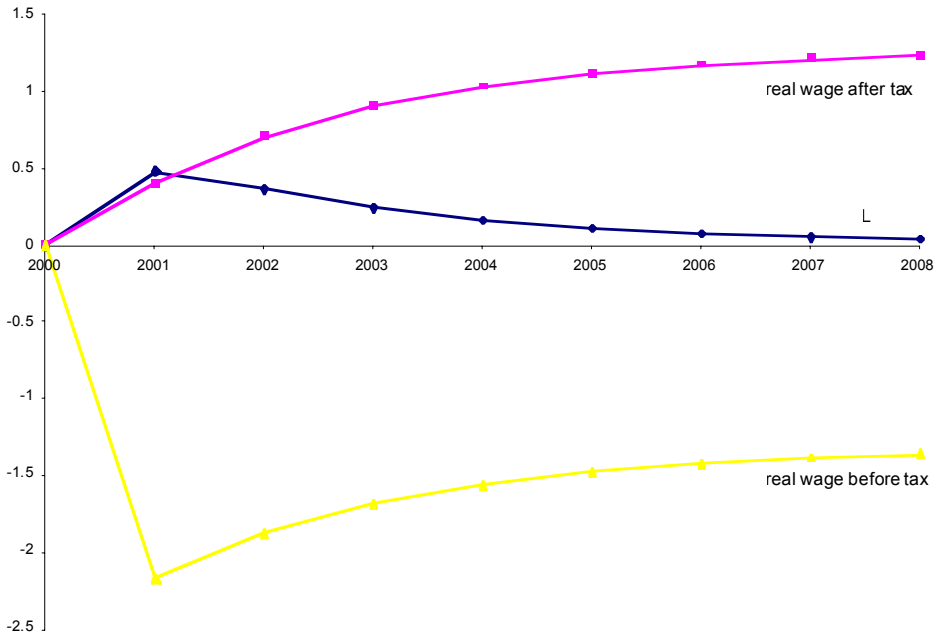


Chart 7.4. Food GST-free, after-tax: Exports, imports and the terms of trade (% deviation from basecase forecasts)

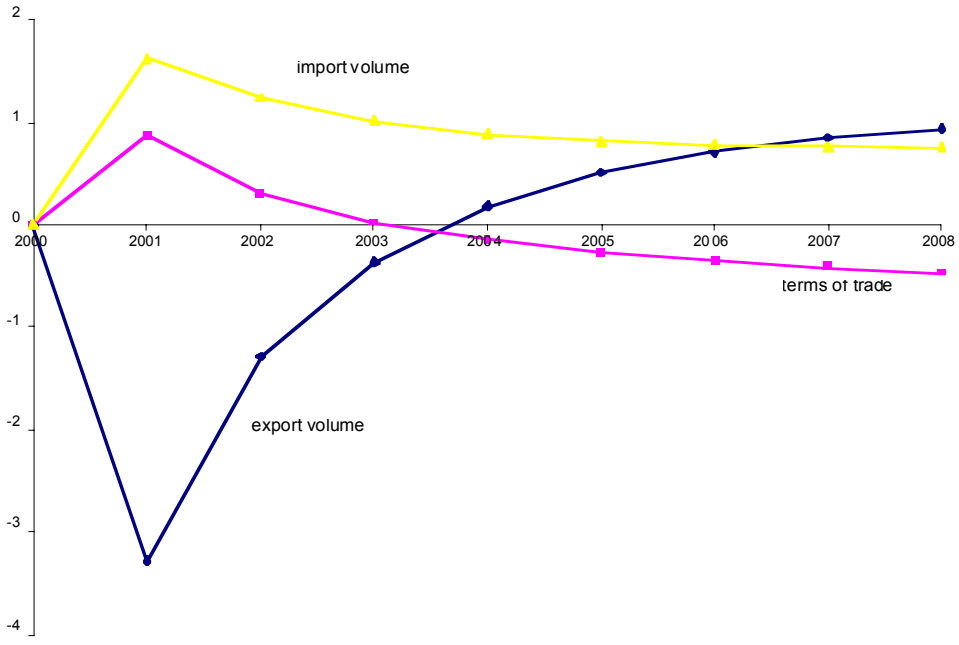


Chart 7.5. Food GST-free, after-tax: Export volumes (% deviation from basecase forecasts)

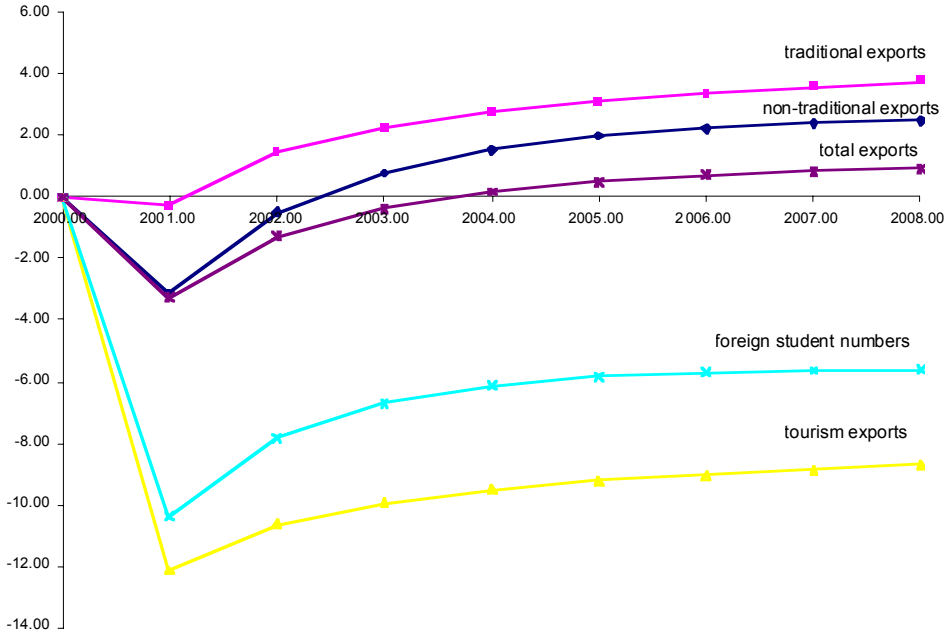


Chart 7.6. Food GST-free, after-tax: The real exchange rate and investment (% deviation from basecase forecasts)

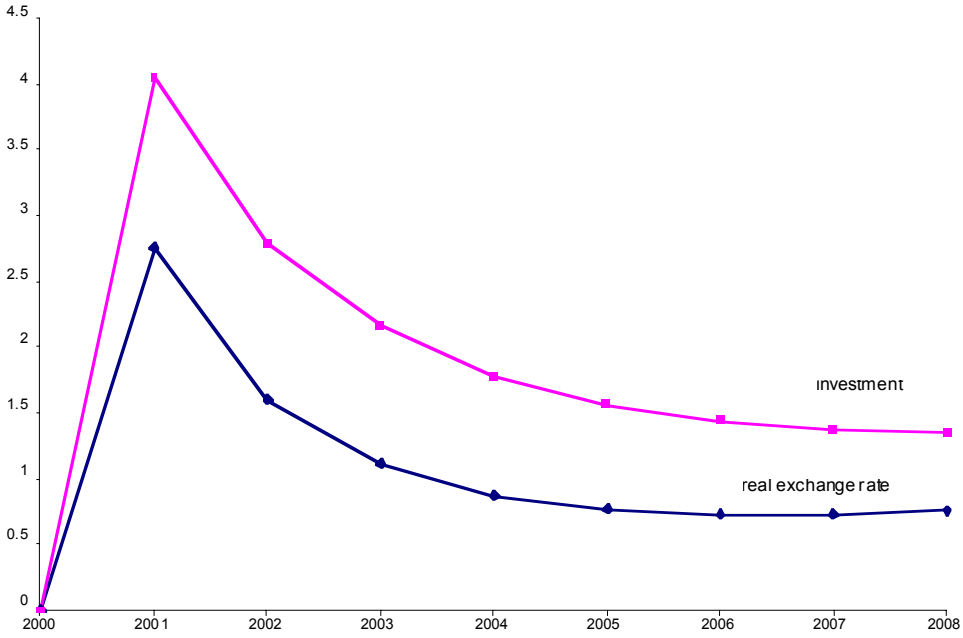


Chart 7.7. Food GST-free, after-tax: Real GDP and factor inputs (% deviation from basecase forecasts)

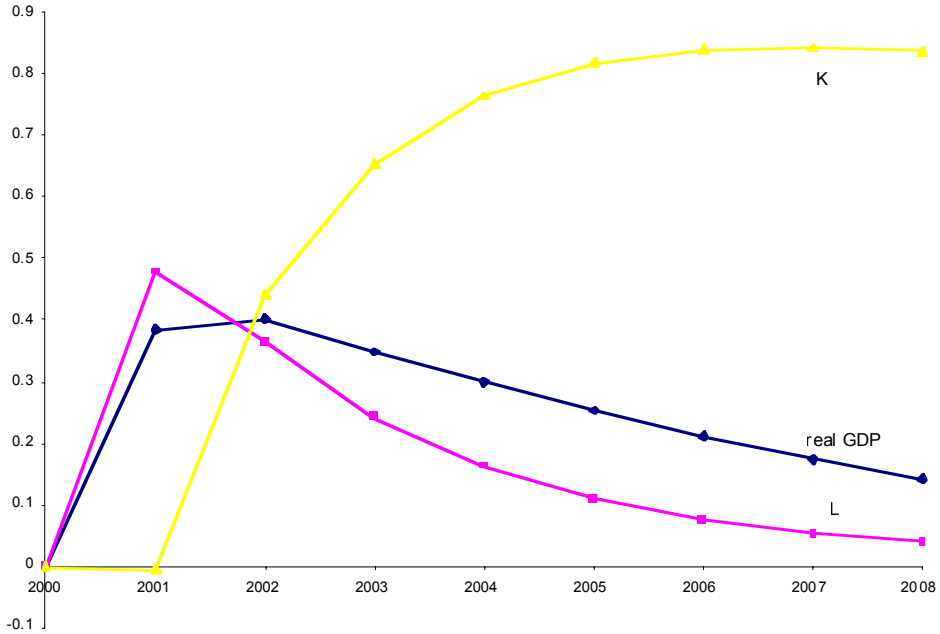


Chart 7.8. Food GST-free, after-tax: Real consumption and welfare (% deviation from basecase forecasts)

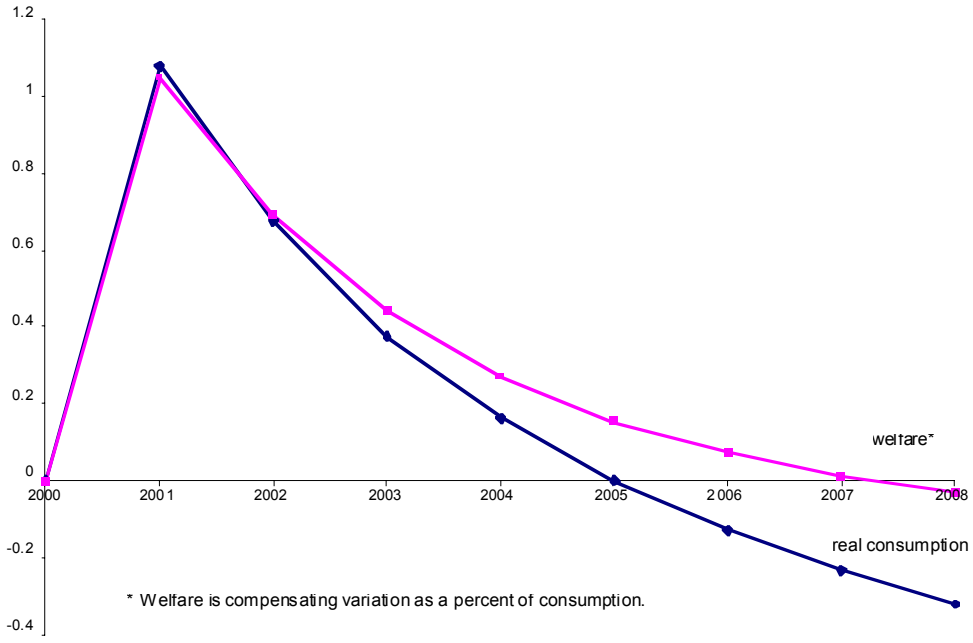


Chart 7.9. Food GST-free, after-tax: Output of main winners

(% deviation from basecase forecasts)

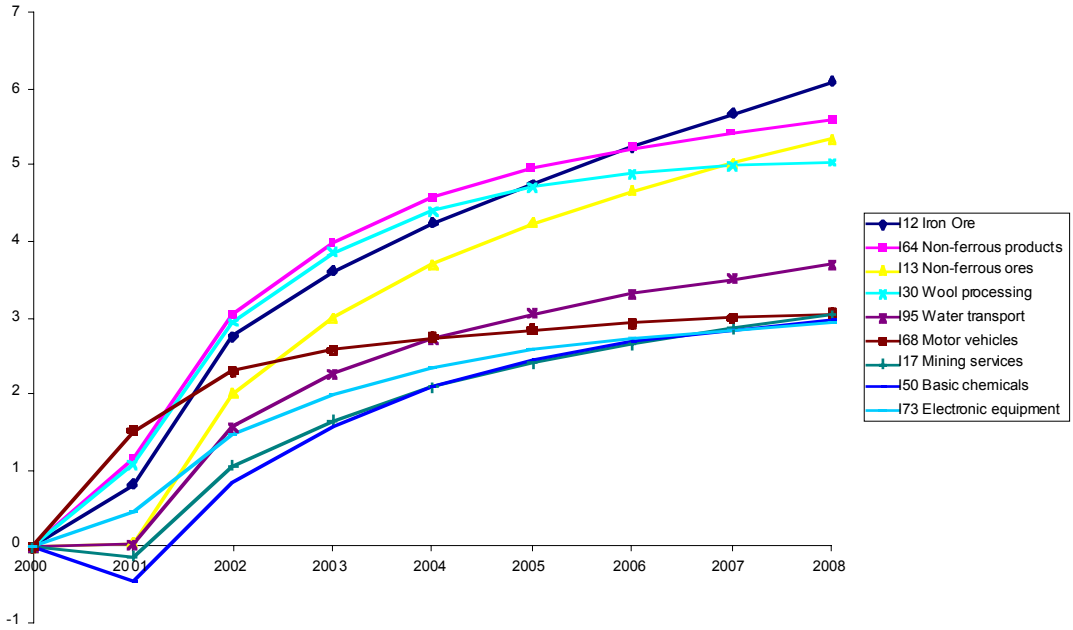


Chart 7.10. Food GST-free, after-tax: Output of main losers
(% deviation from basecase forecasts)

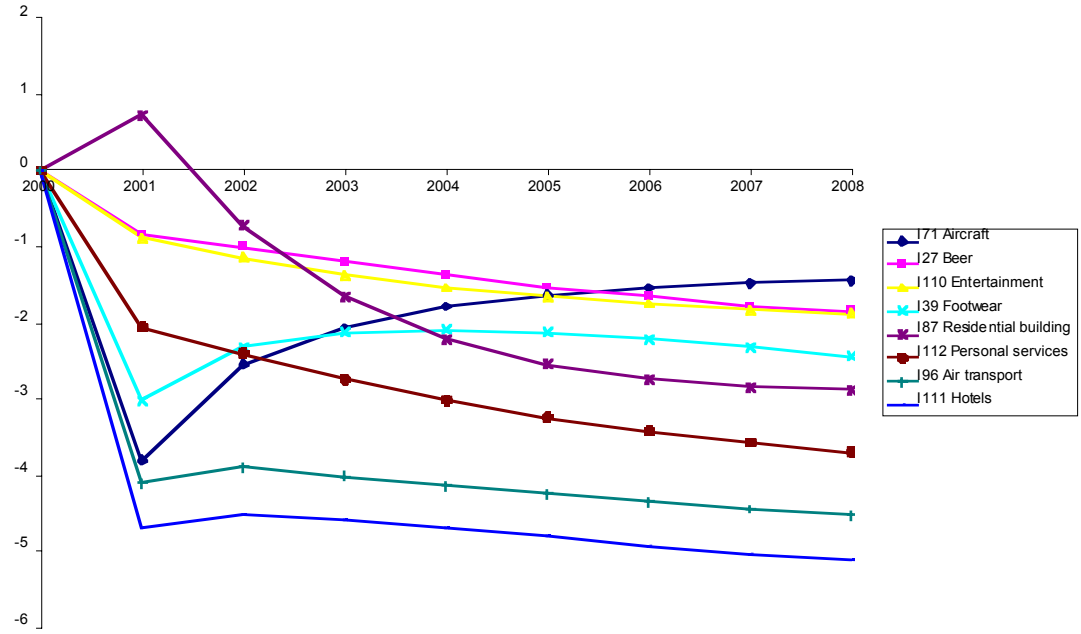


Chart 8.1. Food GST-free, before-tax: Capital and labour inputs

(% deviation from basecase forecasts)

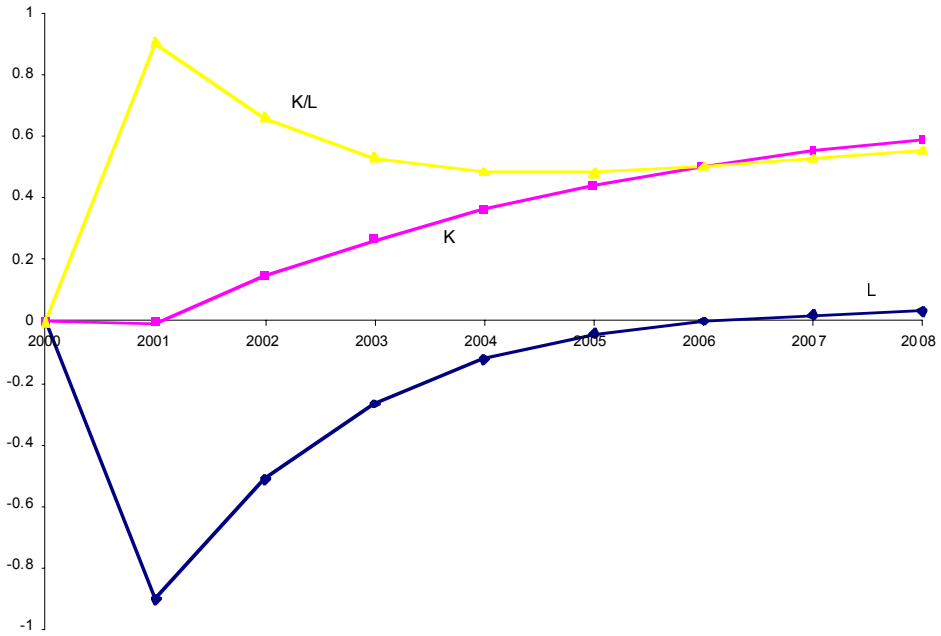


Chart 8.2. Food GST-free, before-tax: Investment and capital
(% deviation from basecase forecasts)

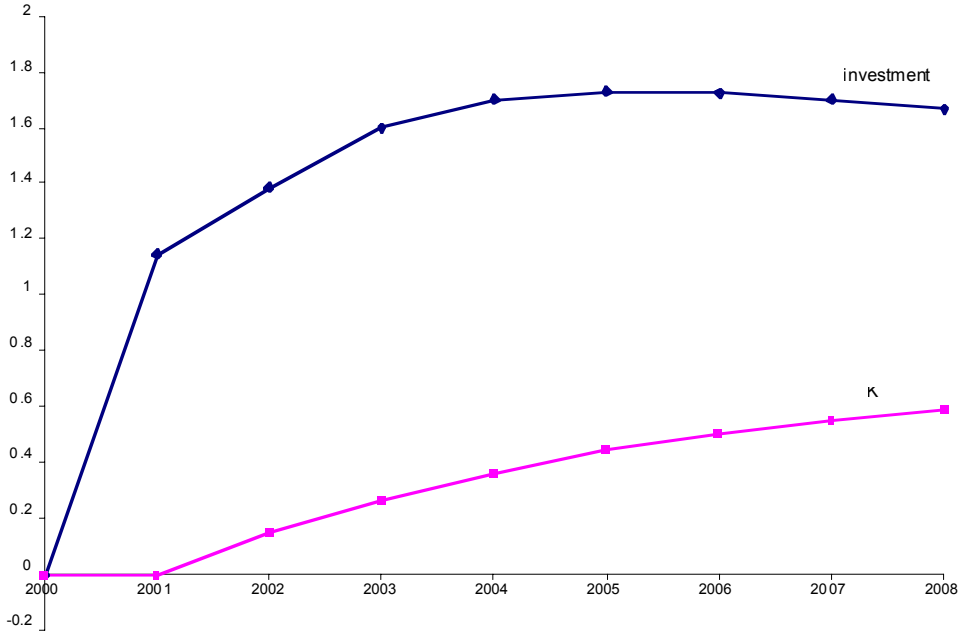


Chart 8.3. Food GST-free, before-tax: Employment and real wage

rates (% deviation from basecase forecasts)

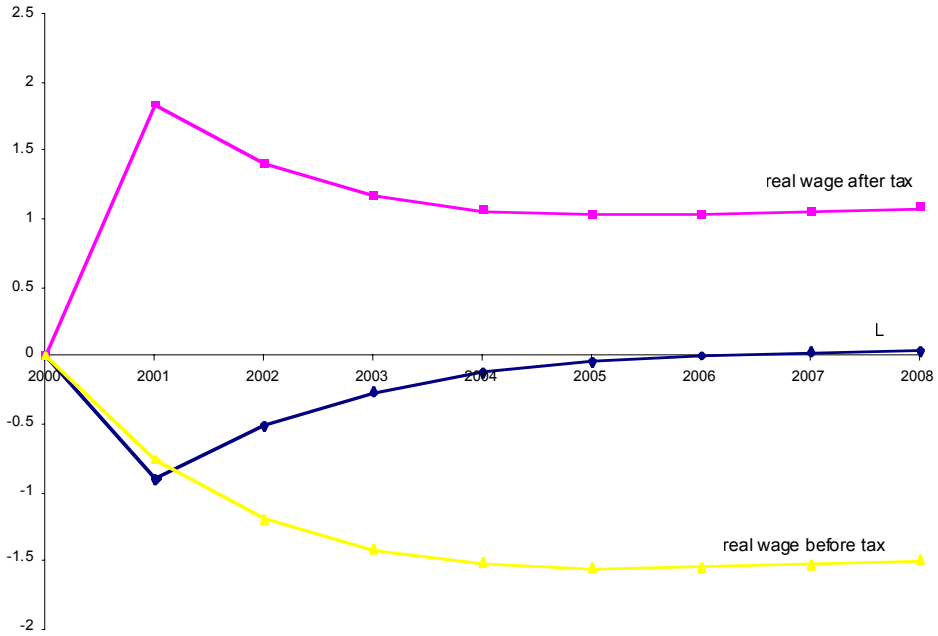


Chart 8.4. Food GST-free, before-tax: Exports, imports and the terms of trade (% deviation from basecase forecasts)

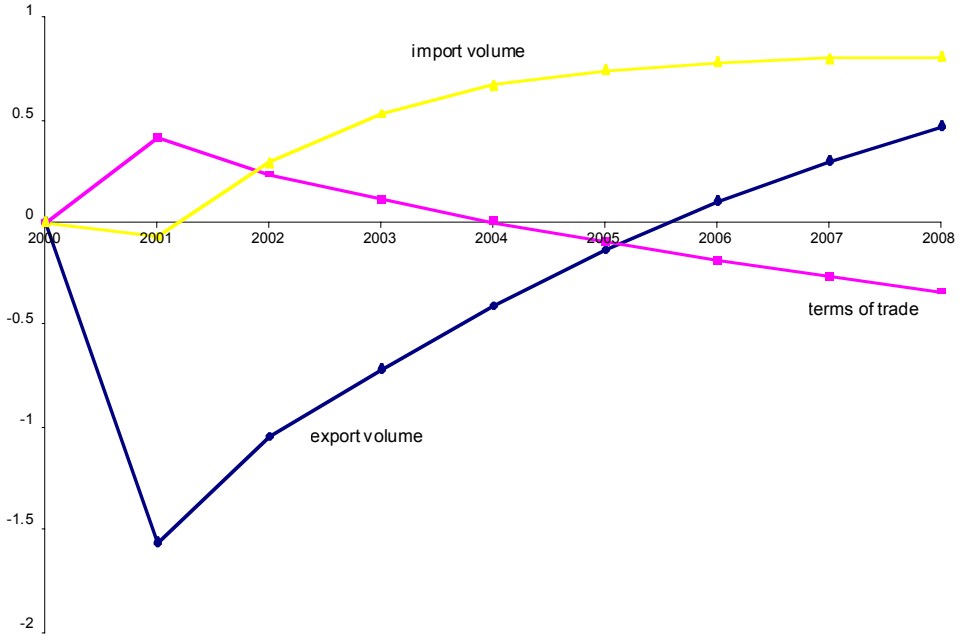


Chart 8.5. Food GST-free, before-tax: Export volumes (% deviation from basecase forecasts)

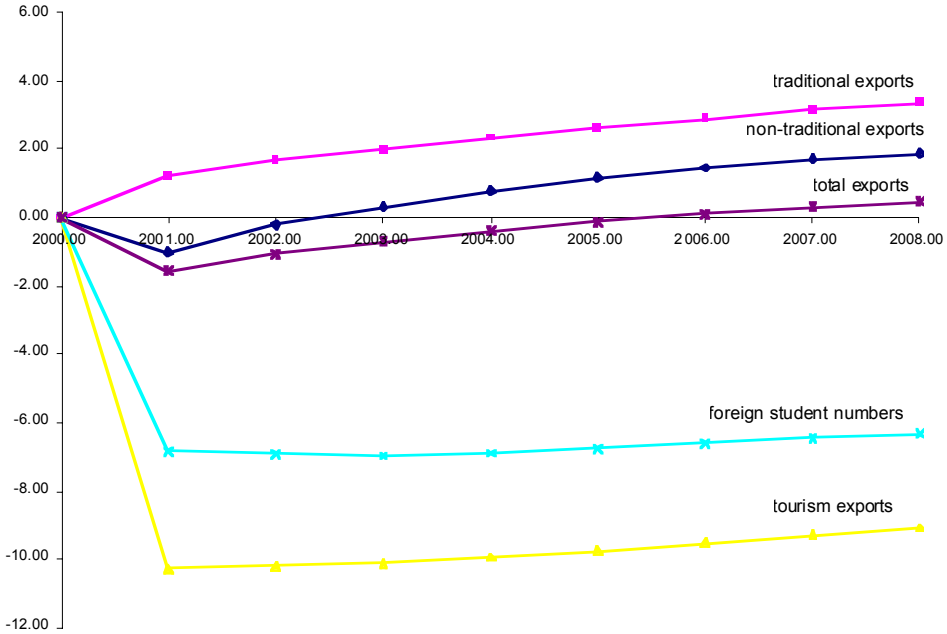


Chart 8.6. Food GST-free, before-tax: The real exchange rate and investment (% deviation from basecase forecasts)

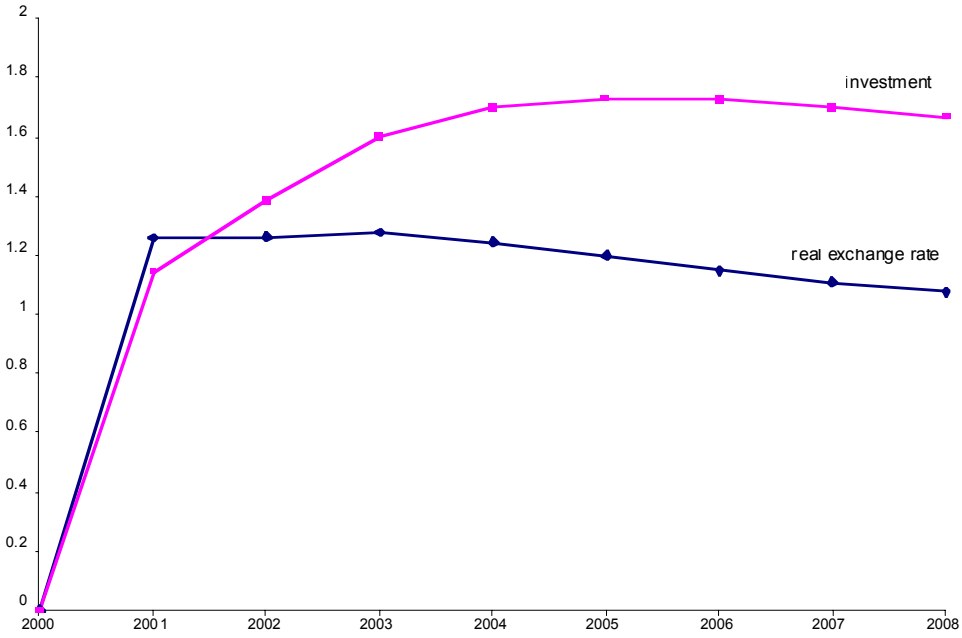


Chart 8.7. Food GST-free, before-tax: Real GDP and factor inputs (% deviation from basecase forecasts)

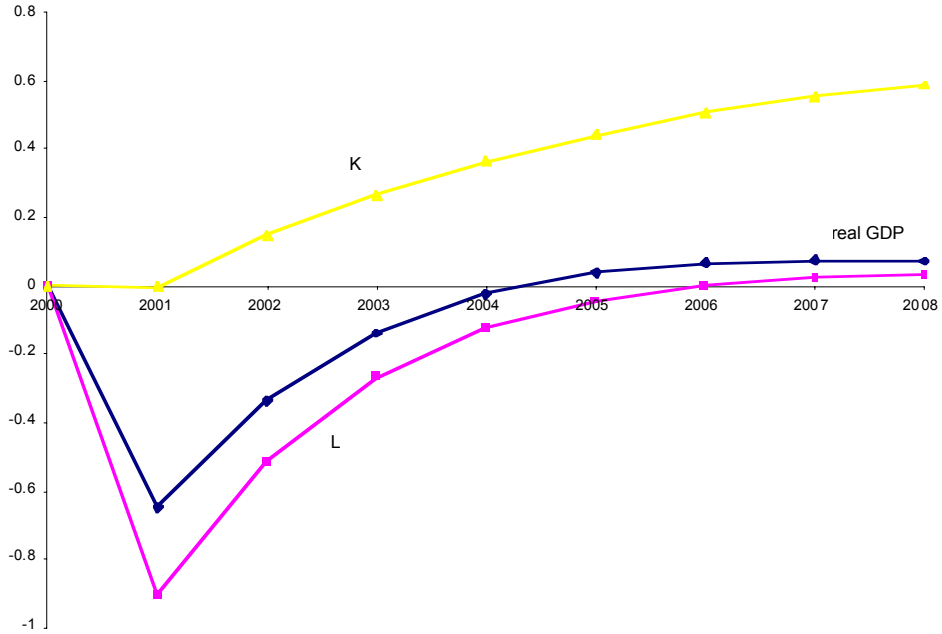


Chart 8.8. Food GST-free, before-tax: Real consumption and welfare (% deviation from basecase forecasts)

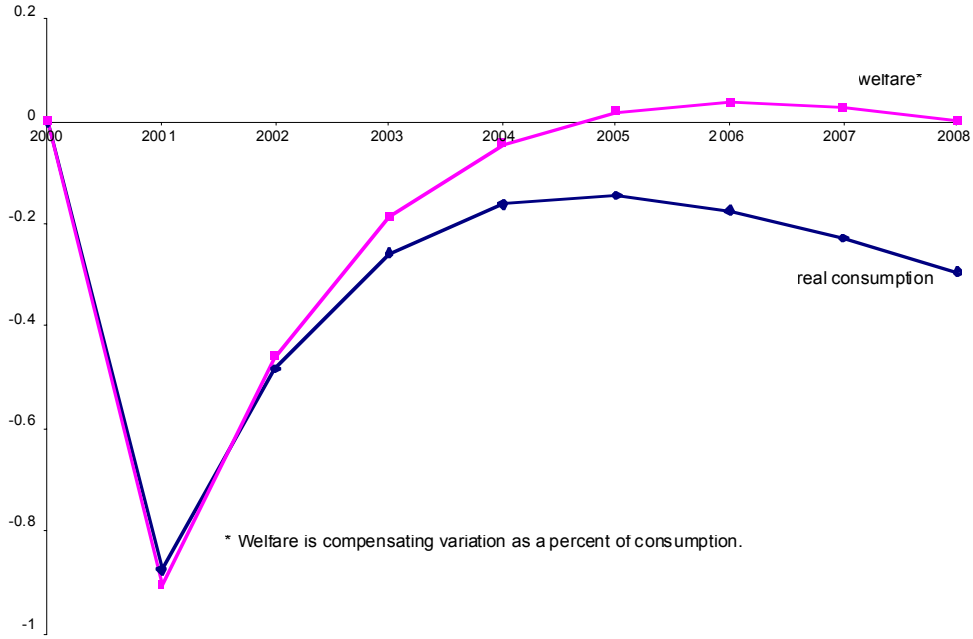


Chart 8.9. Food GST-free, before-tax: Output of main winners (% deviation from basecase forecasts)

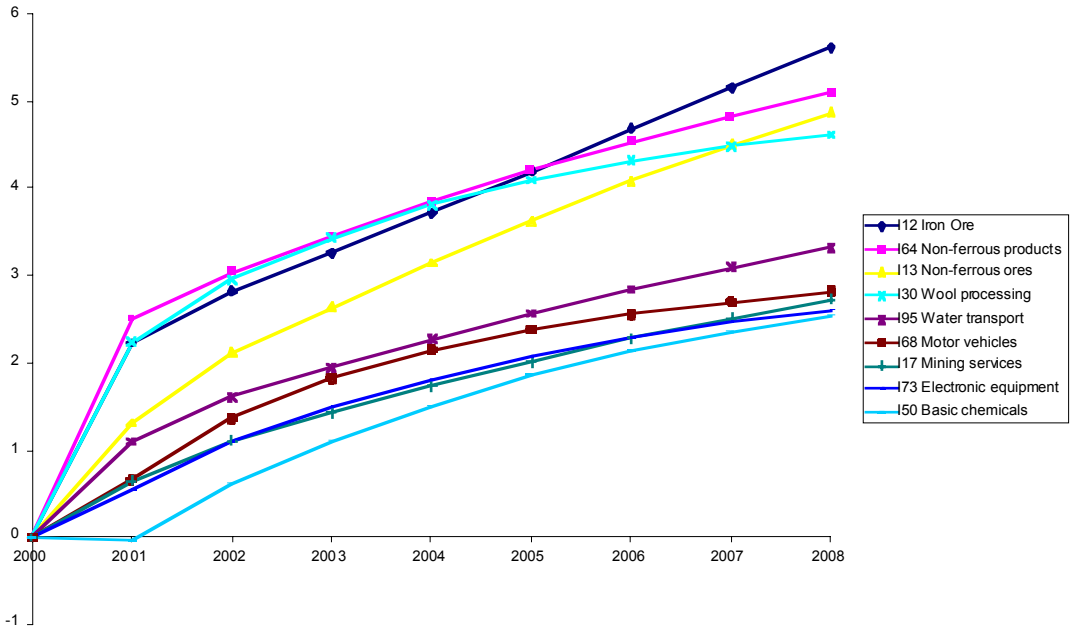


Chart 8.10. Food GST-free, before-tax: Output of main losers (% deviation from basecase forecasts)

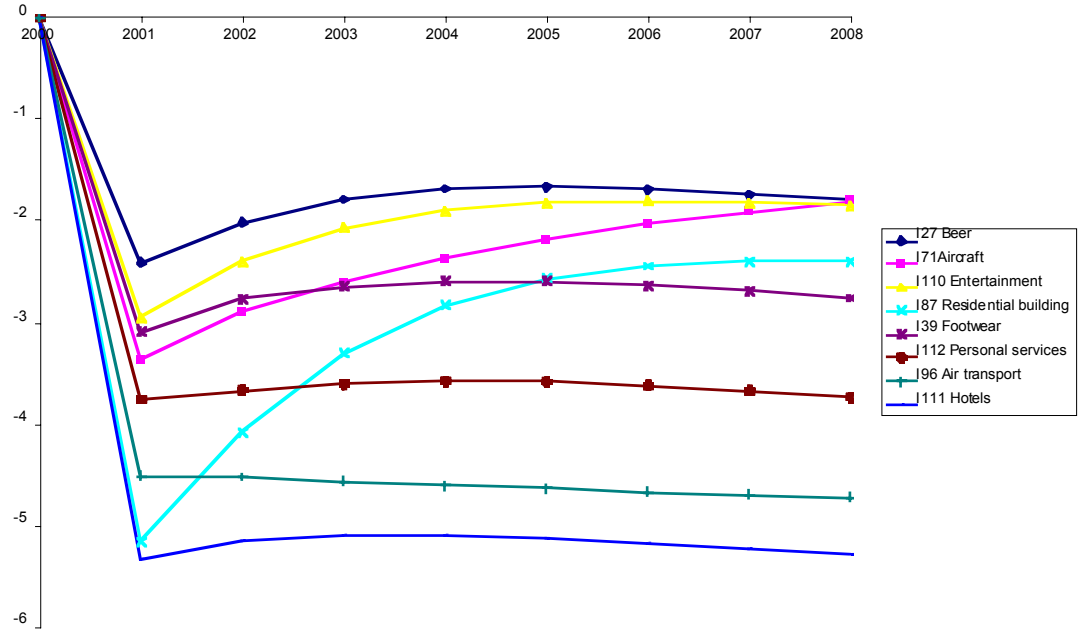


Chart 9.1. Lagged pass through: Capital and labour inputs
(% deviation from basecase forecasts)

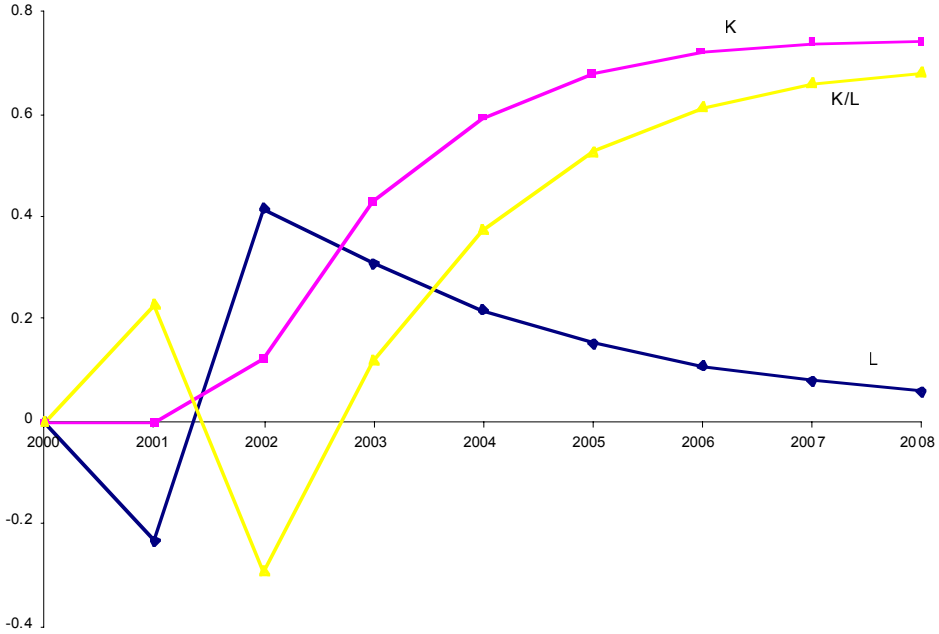


Chart 9.2. Lagged pass through: Investment and capital
(% deviation from basecase forecasts)

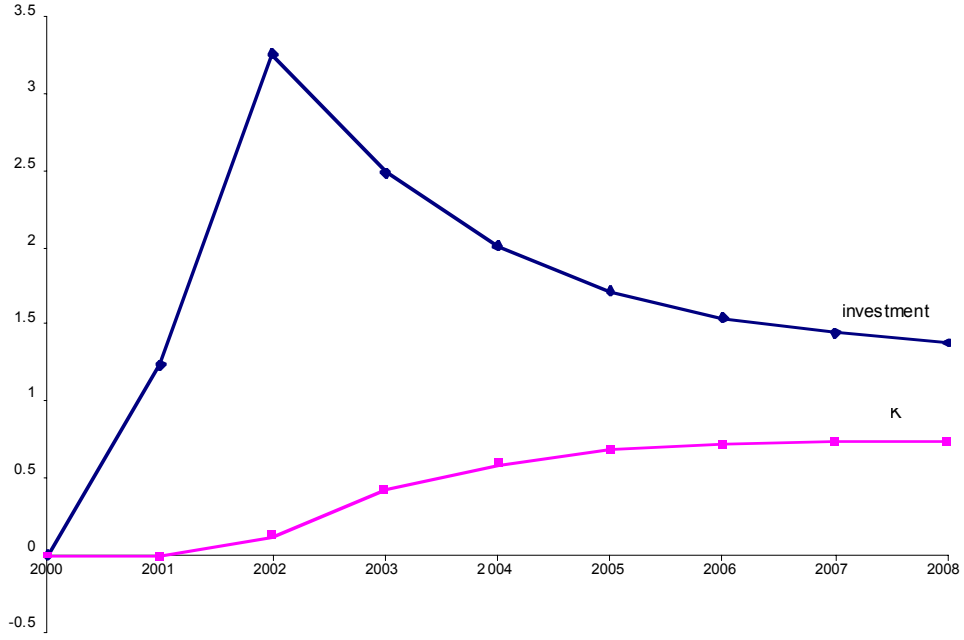


Chart 9.3. Lagged pass through: Employment and real wage rates (% deviation from basecase forecasts)

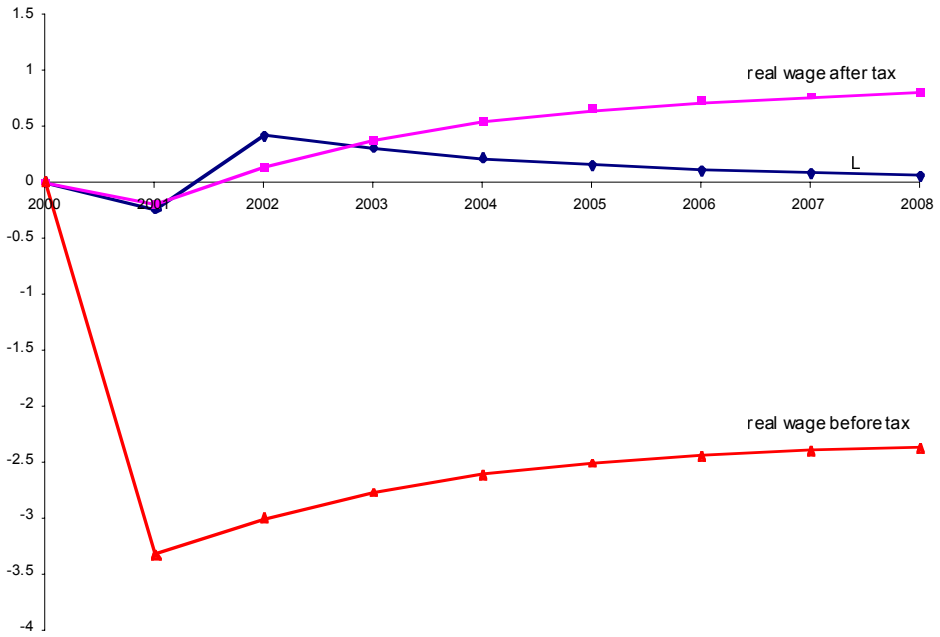


Chart 9.4. Lagged pass through: Exports, imports and the terms of trade (% deviation from basecase forecasts)

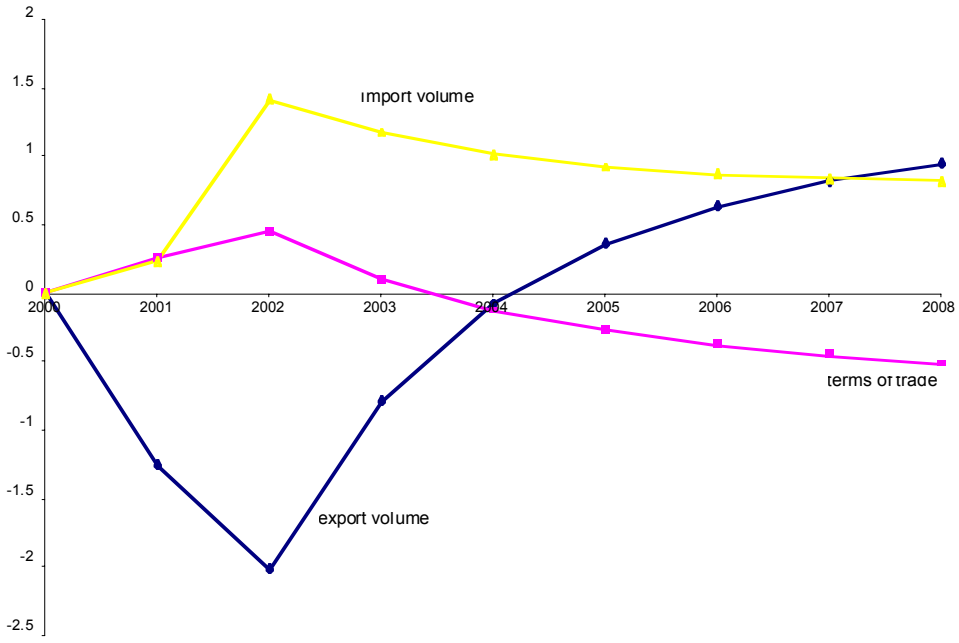


Chart 9.5. Lagged pass through: Export volumes (% deviation from basecase forecasts)

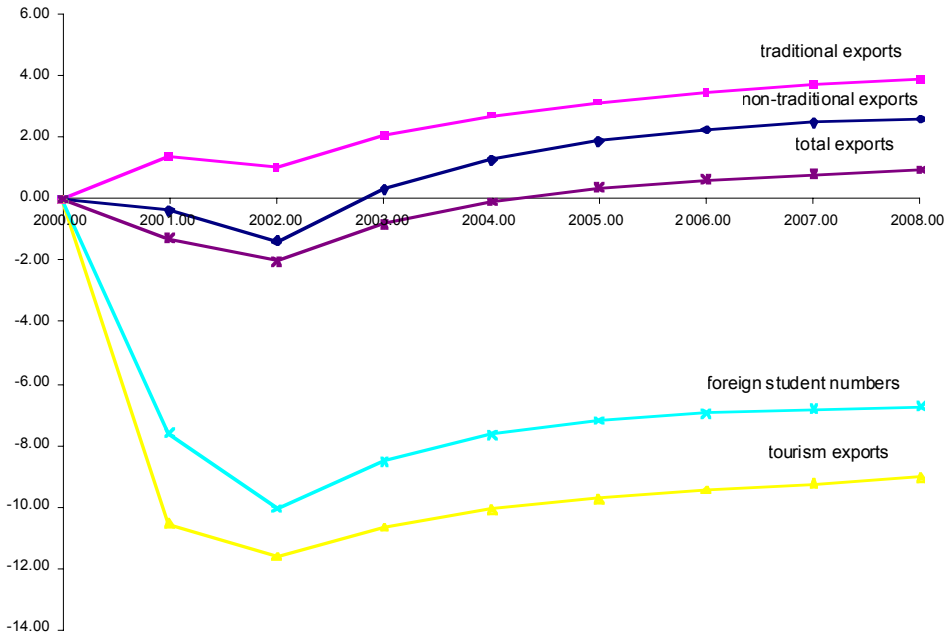


Chart 9.6. Lagged pass through: The real exchange rate and investment (% deviation from basecase forecasts)

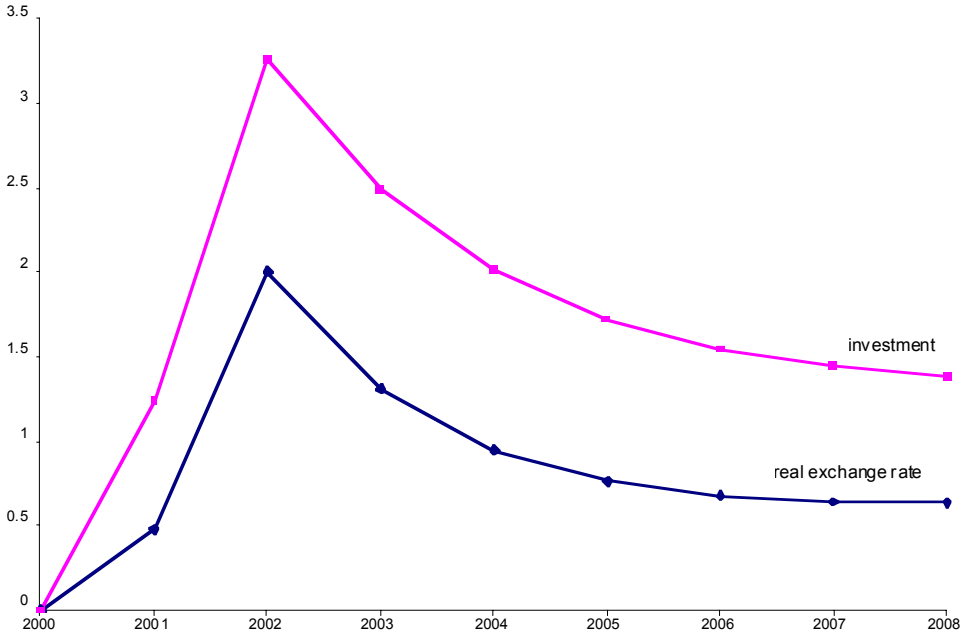


Chart 9.7. Lagged pass through: Real GDP and factor inputs (%

deviation from basecase forecasts)

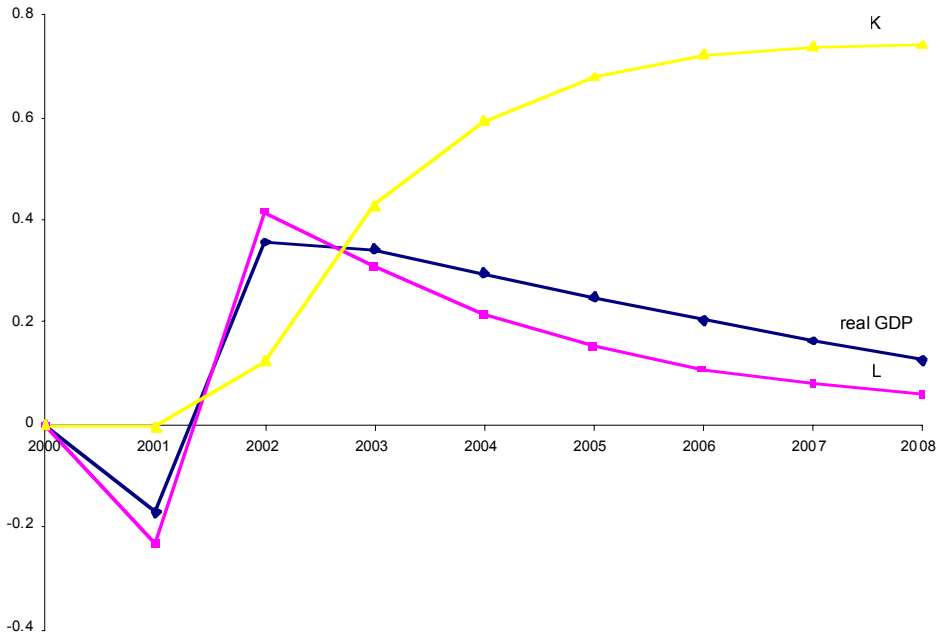


Chart 9.8. Lagged pass through: Real consumption and welfare (% deviation from basecase forecasts)

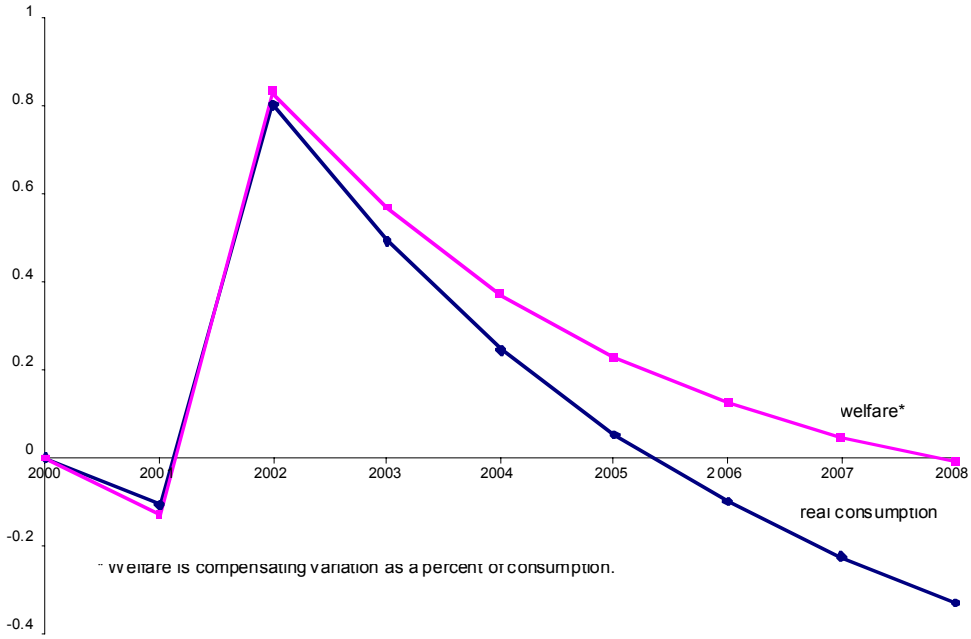


Chart 9.9. Lagged pass through: Output of main winners (% deviation from basecase forecasts)

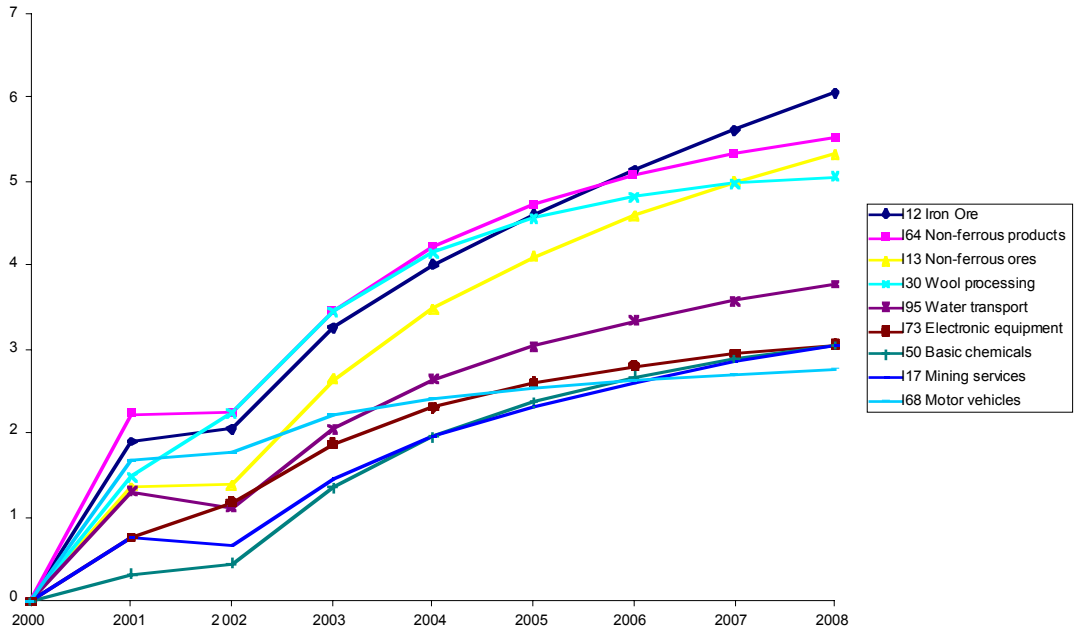


Chart 9.10. Lagged pass through: Output of main losers (% deviation from basecase forecasts)

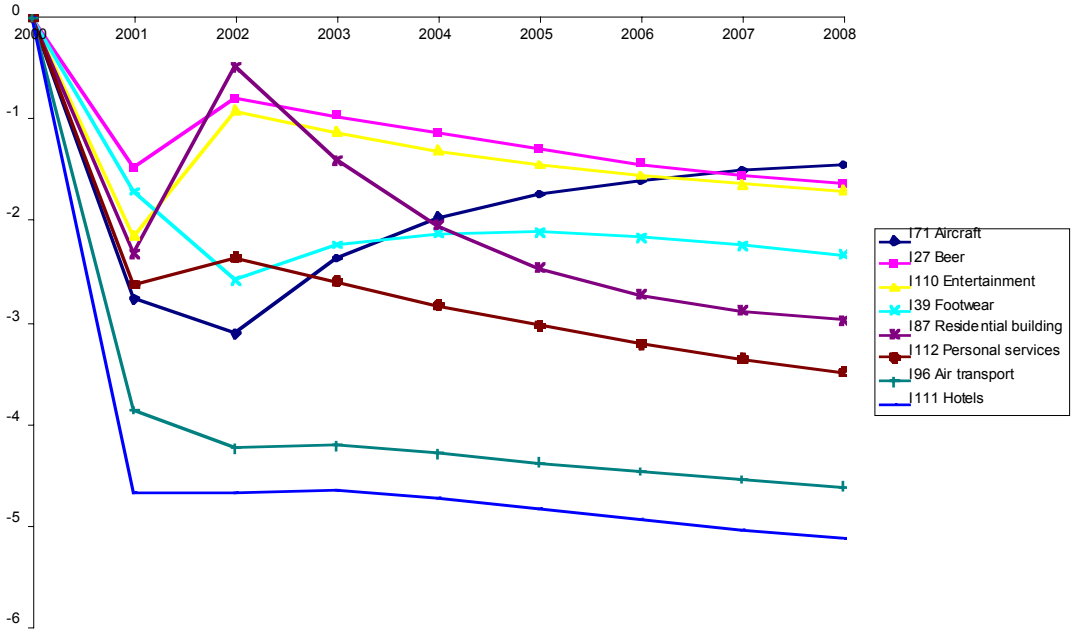


Chart 10.1. Forecasts of nominal GDP and indirect taxes (indexes: value in 2000 equals 1)