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THE IMPLICATIONS FOR TRADE AND FDI FLOWS FROM LIBERALISATION OF CHINA'S CAPITAL ACCOUNT

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Abstract

We model the partial liberalisation of the capital account by China using a dynamic CGE model of the world economy. Our results indicate that a reduced capital controls on FDI would lead to a significant increase in FDI capital in China and a significant reduction in the cost of capital in China relative to the rest of the world. Further, we observe an increase in capital stocks in all regions, which benefits all regions in terms of GDP and GNP. The economies of China (1.7%), East Asia (1.3%) and Australia/New Zealand (0.5%) grow most strongly. The rental price of capital falls significantly in these regions, which lowers domestic costs and they experience a real depreciation of the exchange rate and thus increased exports relative to other regions. We also observe an across-the-board increase in the saving rate driven by the rise in the price of consumption relative to investment (saving) in all regions.

JEL codes: C68, E22, F21, F23, F38, F40.

Keywords: capital controls, China, computable general equilibrium, FDI, multinational firms, trade.

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1. Introduction

Two important global macroeconomic policy issues that have emerged since the turn of the century are exchange rate flexibility and capital account liberalisation by China. Both of these issues have become more prominent since the Chinese economy became the second largest in the world in 2010.[1] The Chinese authorities have stated publicly that the removal of capital controls is a medium-term objective (Prasad *et al*., 2005). There is evidence that the removal of capital controls by developing countries can have significant macroeconomic effects (Sedik and Sun, 2012). Given this, what might be the likely nature and size of the macroeconomic effects of a move towards capital account liberalisation by the Chinese authorities? We address this question by applying an analytical framework that captures the most important macroeconomic features of this issue as they relate to global foreign direct investment (FDI) and trade.

China's capital account is tightly controlled (Jeanne, 2012) and the capital controls have tended to be more restrictive for volatile capital flows (e.g., portfolio investment) compared to more stable capital flows (e.g., FDI). The controls seem to have initially focused on restricting outflows but have evolved to manage both inflows and outflows so as to maintain the official exchange rate (Ma and McCauley, 2007). It is likely that this is a result of an increasing gap, over time, between the official exchange rate and the likely market exchange rate under a flexible exchange rate scheme. The large current account surpluses posted by China since 2005 suggest that the management of inflows has probably been more important than the management of outflows; this view is supported by the accumulation of enormous foreign exchange reserves by China.[2] If the management of inflows has been the dominant role of capital controls, then this would have the effect of limiting arbitrage between the (Chinese) domestic cost of capital and global cost of capital.[3] In fact, macroeconomic observers have expressed the view that the capital controls have had the effect of creating a positive cost of capital differential between the domestic cost of capital in China and the world cost of capital (Ma and McCaualey, 2010; Prasad and Wei, 2005). There is also evidence that this differential has increased over time (Chen, 2012; Cheung and Herrala, 2014).

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[1] This is according to current price data in US$ (IMF, 2014).

[2] China's current account surplus has averaged 4.5% of GDP between 2001 and 2013 (IMF, 2014). China's foreign exchange reserves are the world's largest holdings and are in the order of US$3.8 trillion at the end of 2013 (CIA, 2014).

[3] By 'cost of capital' we mean the average cost (return) of raising (investing) funds across asset classes, including bonds, equity (or shares), and physical capital. Changes in the return on bonds e.g., the interest rate, affect the return on other asset classes as investors seek to maximise the return on their investment portfolio.

Thus, any move to remove or reduce capital controls by China would be expected to lead to a smaller positive cost of capital differential between China and the rest of the world as FDI and financial capital would be expected to flow into China from other countries to exploit the differential. Such inflows are likely to have direct macroeconomic consequences for China: an increase in the capital stock implying increased investment, in turn, implying higher productivity and GDP growth in the short-run and permanently higher levels of productivity and GDP in the long-run. Countries investing in China would likely experience increased income due to increased investment in China in an attempt to exploit the cost of capital differential. Therefore, *a priori*, we would expect capital flows between China and other countries to increase due to the relaxation of capital controls by China. But, we would also expect an increase in trade flows between China and other countries as higher GDP growth by China would mean an increased demand for imports and an increased supply of exports to other countries.

There are no existing studies examining how capital account liberalisation by China would affect global FDI, trade and other macroeconomic variables. Two related studies quantify the macroeconomic effects of China's internal and external policies. Song *et al*. (2014) use an overlapping generations model of China to analyse the effects of different aspects of China's monetary and structural policies, including capital controls, and their interaction with China's growth path and other variables. Bénassy-Quéré *et al*. (2011) use a two-country (China and the US) overlapping generations model to analyse the interaction of structural reforms under different policy regimes in China, including the partial liberalisation of capital controls. In both studies, capital controls are found to be important in determining how China and other economies react to structural reforms by China. One area to which the current study is distantly related is the literature on economywide evaluations of removing barriers to trade in services: a major share of trade in services occurs through FDI (see Christen *et al*., 2012, for a thorough review of this literature). These evaluations examine the removal of general or sector-specific barriers to FDI in China and many other countries, but they do not consider the impact of capital controls, or other macroeconomic policies, on FDI and trade. Thus, the current work represents a first in examining the effects of capital account liberalisation by China on global trade and FDI.

2. China's capital account policy

China has applied capital controls as part of its economic policy since 1949 (Cheung and Herrala, 2014). These controls did not attract much attention until the turn of this century, but

China's high and sustained economic growth since 1980s has slowly increased attention on all aspects of its economic policies.[4] Along with exchange rate flexibility, capital account liberalisation by China has emerged as an important global macroeconomic policy issue. These two issues are related but distinct (Prasad *et al*., 2005).

A move towards exchange rate flexibility and capital account liberalisation has been argued to pose risks to the Chinese financial sector by allowing outflows from the banking system in order to exploit foreign investment opportunities. Nevertheless, allowing greater exchange rate flexibility in the presence of capital controls will not expose China's underdeveloped financial system to dangerous risks as Chinese domestic banks are not heavily exposed to currency risk (Prasad *et al*., 2005). Furthermore, allowing greater exchange rate flexibility while maintaining capital controls does not require an immediate move to a freely floating rate (IMF, 2004). In contrast to the seemingly low risks associated with allowing greater exchange rate flexibility while maintaining capital controls, there is evidence that liberalising capital controls while maintaining exchange rate inflexibility has contributed to financial crises in developing economies (Prasad *et al*., 2005).

While China's capital account is tightly controlled (Jeanne, 2012), the capital controls have tended to be more restrictive for volatile capital flows (e.g., portfolio investment) compared to more stable capital flows (e.g., FDI). The controls were also initially focused on restricting outflows, presumably to shield domestic banks from currency risk, but have evolved to manage both inflows and outflows so as to maintain the official exchange rate (Ma and McCauley, 2007). Jeanne (2012) and Reinhart and Tashiro (2013) show that control of the capital account (i.e., net capital inflows) and the official exchange rate (i.e., reserve accumulation) allow the current account balance to also be tightly controlled. The large current account surpluses posted by China since 2005 suggest that the management of inflows has probably been more important than the management of outflows; this view is supported by the accumulation of the world's largest holdings foreign exchange reserves. Macroeconomic observers have expressed the view that the capital controls have had the effect of creating a positive cost of capital differential between the domestic cost of capital in China and the world cost of capital (Ma and McCaualey, 2010; Prasad and Wei, 2005).

[4] According to current price data in US$, the Chinese economy has grown from being 7% of the size of the US economy in 1990 to 56% in 2013 (IMF, 2014).

The Chinese authorities have stated publicly that the removal of capital controls is a medium-term objective (Cheung and Herrala, 2014; Prasad *et al*., 2005). Any move to remove or loosen the capital controls would be expected to lead to the reduction of the positive cost of capital differential between China and the rest of the world; foreign-sourced loanable funds within China would increase at the expense of loanable funds in the rest of the world. Given China's very high saving rate (around 50%) and its status as the second-largest economy in the world, it is likely that the removal of capital account controls would also lead to other significant effects on global capital markets. A freer flow of capital between China and global capital markets is likely to lead to a substantial repatriation of foreign-currency assets (particular US dollar assets) held by Chinese residents. Clearly, this will raise yields on US dollar and other foreign currency assets, and reduce yields on renminbi-denominated assets in China. A freer flow of capital between China and global capital markets is also likely to lead to a redirection of funds from non-renminbi assets into renminbi assets in China to exploit their high relative yields. Both of these effects are will reduce the positive cost of capital differential between China and the rest of the world.

A smaller cost of capital differential between China and the rest of the world is likely to lead to direct macroeconomic consequences for China. A lower cost of capital in China, *ceterus paribus*, is likely to lead to an increase in the capital stock employed (i.e., capital deepening), which implies increased investment and faster growth in the capital stock that in turn implies higher productivity and GDP growth. A lower cost of capital for Chinese households is likely to lead to a rise in the consumption rate as Chinese households take on debt (or reduce saving) to increase current consumption and reduce future consumption. A rise in the consumption rate would be likely to increase imports and reduce exports:[5] that is, a reduction in net exports. A fall in net exports, *ceterus paribus*, is likely to partially offset GDP growth in China, with the overall effect of the fall in the cost of capital likely to be positive for China's GDP growth.

A rise in the world cost of capital would also have implications for nations holding historically high levels of net foreign debt, e.g., most developed countries, as their servicing obligations would rise. An increase in servicing obligations would reduce the amount of income available for both consumption and investment. Lower investment would mean lower growth in capital and output, *ceterus paribus*, which would mean lower GDP growth.

[5] An increase in the consumption rate would mean higher domestic prices relative to world prices.

The direct macroeconomic consequences described above are likely to have noticeable impacts on trade flows between China and highly indebted developed countries, but also on other countries. Beyond this, any fall in loanable funds available to highly indebted developed economies will also have implications for FDI as these same countries are also the major sources of FDI (Lakatos and Fukui, 2013). Thus, one way that FDI is financed by these regions is through foreign debt accumulation, as reflected by large and persistent current account deficits. If the supply of funds available to these countries decreases, it may mean a rise in FDI by these regions. If the cost of borrowing to fund all forms of investment rises, this may induce investors to transfer funds from less risky low return investments (e.g., portfolio investment and sovereign debt) to more risky high return investments such as FDI.

3. The model

In this study we apply a modified version of the USITC-FDI model (Lakatos and Fukui, 2013). The model represents the global economy within a computable general equilibrium framework with a focus on FDI, multinational companies differentiated by region of ownership, and global foreign affiliate data. The model has been modified in order to capture important elements of modelling liberalisation of China's capital account. Below we describe the production and demand structure of the model and the modifications made for this study.

3.1 Production technology

Representative firms are assumed to treat the factors of production (labour and physical capital) as variable and take factor prices as given in minimising costs. Demands for primary factors are modelled using nested production functions consisting of two levels. At the top level, the *j* (=1,…,6) firms located in the *r* (=1,..,9) regions and owned by the *o* (=1,..,9) regions decide on the (percentage change in) demand for the primary factor composite (i.e., an aggregate of labour and capital) q^F_{jro} using CES (constant elasticities of substitution) production technology: [6]

$$q^F_{jro} = q_{jro} - \sigma\left(p^F_{jro} - p_{jro}\right); \qquad (1)$$

[6] In the formal presentation of the model theory, we use lowercase Latin characters to represent the percentage-change form of a variable (e.g., *p*), and equivalent uppercase Latin characters to represent the levels form of a variable (e.g. *P*).

where $\sigma(=0.1)$ is the elasticity of substitution between the primary factor composite and intermediate inputs, q_{jro} is (the percentage change in) the (j,r,o)-th industry's activity level, p^F_{jr} is the price of the primary factor composite, and p_{jro} is the price of output by the firm.[7] Clearly, equation (1) consists of a scale term $\left(q_{jro}\right)$ and a substitution term $\left(p^F_{jro} - p_{jro}\right)$. Thus, with no change in relative prices, changes in output will lead to changes in the demand for the primary factor composite. With output fixed, changes in relative prices will lead to changes in the demand for the primary factor composite; this effect will be larger the greater the value of σ. All of these effects reflect standard optimising behaviour by the firm.

At the second level, firms decide on their demand for the *i* (=2) factors of production, q^F_{ijro}, again using CES production functions:

$$q^F_{ijro} = q^F_{jro} - \omega_j\left(p^F_{ijro} - p^F_{jro}\right); \qquad (2)$$

where ω_j is the elasticity of factor substitution and ≤ 0.5 for all *j* industries, and p^F_{ijro} is the price of the *i*-th primary factor. Like equation (1), equation (2) consists of a scale term and a substitution term. The value of ω_j is based upon parameter choices that have been extensively applied in other studies.[8]

Firms are also assumed to be able to vary the *k* (=1,…,6) intermediate inputs they use in production, the prices of which they also take as given in minimising costs. In combining intermediate inputs, all firms are assumed to use nested production functions. At level 1, all firms decide on their use of the intermediate input composite q^I_{kjro} using CES production technology;

$$q^I_{kjro} = q_{jro} - \sigma\left(p^I_{kjro} - p_{jro}\right), \qquad (3)$$

where p^I_{kjro} is the price of the *i*-th intermediate input composite. Equation (3) determines firms' use of the intermediate input composite as a function of scale and substitution terms.

At level 2, firms decide on their use of individual intermediate inputs from domestic $\left(qd^I_{kjro}\right)$ and imported $\left(qm^I_{kjro}\right)$ sources also using CES production technology:

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[7] In describing the production technology, we omit technical change terms to simplify the exposition.

[8] See, for example, Adams *et al*. (2000), Dixon and Rimmer (2002), Dixon *et al*. (2011), Horridge *et al*. (2005) and Wittwer *et al*. (2005).

$$qd^I_{kjro} = q^I_{kjro} - \zeta_k \left(pd^I_{kjro} - p^I_{kjro} \right), \tag{4}$$

$$qm^I_{kjro} = q^I_{kjro} - \zeta_k \left(pm^I_{kjro} - p^I_{kjro} \right), \tag{5}$$

where $pd^I_{kjro}\left(pm^I_{kjro}\right)$ is the price of the *k*-th domestic (imported) intermediate input composite, and ζ_k is the elasticity of substitution between domestic and imported commodities. The values for the CES at this level range over 2.3–3.3 for traded goods (i.e., agriculture, mining, and manufacturing), and over 0.1–0.5 for nontraded goods (i.e., services).

All firms are assumed to operate in perfectly competitive markets and so a zero-pure-profits condition is imposed that equates revenues with costs, which in levels is

$$P_{jro}.Q_{jro} = P^F_{jro}.Q^F_{jro} + \sum_k P^I_{kjro}.Q^I_{kjro} \,. \tag{6}$$

3.2 Market clearing and commodity preferences

The supply price of the (*j*,*r*,*o*)-th industry $\left(P_{jro}\right)$ is linked to the market price $\left(PMKT_{jro}\right)$ via $PMKT_{jro} = P_{jro}.(1+T_{jro})$, where T_{jro} is the output tax on the (*j*,*r*,*o*)-th industry. $PMKT_{jro}$ is determined via a market-clearing condition, which in percentage-change form is

$$q_{jro} = SD_{jro}.qd_{jro} + \sum_s SX_{jros}.qx_{jros} \,, \tag{7}$$

where qd_{jro} is domestic sales of the (*j*,*r*,*o*)-th good (i.e., sales to firms, households and government), qx_{jros} is export sales of the (*j*,*r*,*o*)-th good to region *s* (=9), and the *S*s are the relevant shares of domestic and export sales in total output.

Domestic sales across firms producing the *j*-th commodity $\left(qd_{jro}\right)$ is determined by CES preferences as

$$qd_{jro} = qd_{jr} - \zeta_j \left(pmkt_{jro} - pmkt_{jr} \right), \tag{8}$$

where qd_{jr} is domestic sales of the *j*-th good across all firms (i.e., across all owners), and pm_{jr} is the average market price for good *j* produced by all firms in region *r*.

Export sales of the (*j*,*r*,*o*)-th good across the *s* regions is determined by CES preferences as

$$qx_{jros} = qm_{jr} - \zeta_j \left(px_{jros} - pm_{jr} \right), \tag{9}$$

where qm_{jr} is import sales of the *j*-th good in region *r* by all agents (i.e., firms, households and government), and pm_{jr} is the average c.i.f. price for good *j* imported by region *r* from all source regions.

3.3 Regional and sector-specific investment

In original form, USITC-FDI assumes that there is a single investment good available for all sectors. This assumption is at odds with the assumption of sector-, location- and owner-specific (physical) capital in the model. Thus, we modify the assumption of a single investment good by apportioning regional investment across sectors. The apportionment uses capital stock shares in each region, so the implicit assumption is that investment-capital ratios are equal across sectors in a region. Once regional investment data has been apportioned across sectors, it is necessary to determine how sectoral investment will determined in the model.

Sectoral investment by industry *j* in region *r*, I_{jr}, is assumed to be a fixed ratio of sectoral capital, K_{jr}, with an adjustment via the shift term FI_r;

$$\frac{I_{jr}}{K_{jr}} = FI_r . \tag{10}$$

With I_{jr} determined in (10), industry demands for the *k* inputs to investment I_{kjr} are determined by CES (constant elasticities of substitution) production technology, represented below in percentage changes;

$$i_{kjr} = i_{jr} - \sigma\left(pi_{kjr} - pi_{jr}\right). \tag{11}$$

where pi_{kjr} is the (percentage-change in the) price of the *i*-th input to investment, pi_{jr} is the (percentage-change in the) average price of inputs to investment. Once I_{kjr} has been determined, demands for inputs to investment between domestic and foreign sources is determined by CES production technology as applied in the original model (see, for example, equations (4)–(5)).

At the top level of the investment technology nest, regional investment I_r is determined as a share of GDP with an adjustment for the relative rate of return on capital:

$$\frac{I_r}{GDP_r} = \left(\frac{ROR_r}{ROR}\right)^{\delta} .FG_r . \tag{12}$$

where ROR_r (ROR) is the post-tax net (of depreciation) rate of return on capital in the *r*-th region (globally), δ (=0.5) is a positive parameter, and FG_r is a shifter that ensures both sides of (12) are equal in the initial solution. To ensure consistency between I_r and I_{jr}, we add an adding up constraint:

$$I_r = \sum_j I_{jr} . \qquad (13)$$

To ensure that equation (13) is consistent with equations (10) and (12), FI_r in (10) is set as endogenous.

3.4 Aggregate household consumption, government expenditure and saving

The USITC-FDI model follows the GTAP model (Hertel and Tsigas, 1997) by allocating net (of depreciation) national income across aggregate government consumption, aggregate household consumption and net (of depreciation) saving to maximise a Cobb-Douglas utility function with variable scale and share parameters. Therefore, the nominal values of aggregate government consumption, aggregate household consumption and net (of depreciation) saving are almost fixed shares of nominal net national income. This treatment of household consumption is at odds with the life-cycle theory of consumption and saving, which predicts that changes in real wealth will influence household aggregate spending over and above any changes in current income or other factors. The policy issue analysed in this work is expected to lead to significant changes in real wealth, and in order to capture the effects of these changes on household consumption we implement a life-cycle theory of consumption and saving.

Following Dornbusch and Fisher (1978, pp. 141–54), we assume aggregate nominal household expenditure (*C*) in a region moves with nominal household disposable income[9] (*HDY*) and real wealth (*RW*):

$$C = \left[APC.HDY + \alpha.RW\right].FD , \qquad (14)$$

where *APC* is the average propensity to consume out of *HDY*, α (=0.06) is a positive parameter that controls the average propensity to consume out of real wealth, and *FD* is scaling factor that ensures that both sides of (14) are equal in the initial solution.

The above treatment of household consumption replaces the original treatment in USITC-FDI, which also affects the treatment of government consumption and saving. Government

[9] This is household income from all sources minus income taxes.

consumption (*G*) is now assumed to be a fixed share of *GDP*, in nominal terms. Thus, saving (*S*) is now a residual, being the difference between *GNP*, or national income, and household consumption and government consumption. This means that the saving rate, *S*/*GNP*, is endogenous and is determined by equation (14), i.e., 1 – (*C* + *G*)/*GNP*.

3.5 Wealth accumulation

The USITC-FDI model is comparative-static. As we wish to be able to use the model in dynamic form, i.e., apply the model to forecast the evolution of each region's economy from today to some period in the future, we add dynamics to the model in the form of wealth accumulation. The derivation of the wealth accumulation mechanism and its explanation follows Dixon and Rimmer (2002, pp. 43–7).

In applying the model in dynamic form, we can simulate the evolution of regional and global economies between two points in time, e.g., 2013-2023. With such a simulation, there is only a single time period but its length is 10 years. Thus, any accumulation relationship over this 10-year period requires an assumption about how model variables evolve through the simulation period. Following Dixon and Rimmer (2002), we assume model variables growth smoothly over the period. This means that stock and flow values from 2013 are treated as parameters in the model and those for 2023 are treated as variables. Thus, we assume that each region's wealth accumulates over the period as:

$$W_{t+s+1} = W_{t+s} + NS_{t+s}, \quad s = 0,1,...,9. \tag{15}$$

where W_t is the value of wealth at the beginning of year *t*, and NS_t is the value of net (of depreciation) saving during year *t*.

Equation (15) says that wealth at the beginning of year *t*+*s*+1 equals wealth at the beginning of the previous year plus net saving during year *t*+*s*. Equation (15) can be written in terms of $W_{t+\tau}$ as

$$W_{t+\tau} = W_t + \sum_{s=0}^{\tau-1} NS_{t+s}. \tag{16}$$

Now assume that net saving grows smoothly over the simulation period, i.e.,

$$NS_{t+s} = NS_t . \left(\frac{NS_{t+\tau}}{NS_t} \right)^{s/\tau}. \tag{17}$$

Let *t* represent 2014 and *t*+*τ* represent 2023; (16) can then be written as

$$W_{t+\tau} = W_t + \sum_{s=0}^{\tau-1} NS_t . \left(\frac{NS_{t+\tau}}{NS_t} \right)^{s/\tau} + FW \,, \qquad (18)$$

where *FW* is a variable representing the preference for wealth accumulation. Note that W_t and NS_t in (18) are parameters and set to values from 2013.[10]

3.6 Wealth allocation across asset classes

We define wealth for each regional investor as consisting of two assets: physical capital and bonds. Physical capital (*K*) is already defined in USITC-FDI by industry *j*, location *r*, and owner *o*: K_{jro}, where the location and owner dimensions refer to regions in the model. In allocating wealth between physical capital and bonds, the choice refers to total capital owned by owner *o*: $K_o = \sum_j \sum_r K_{jro}$.

Here, bonds (*B*) represent all forms of debt and equity financing, i.e., all financial assets and liabilities.[11] Thus, bonds are calibrated for each region so they represent net foreign income on all assets other than physical capital; this is achieved by setting regional net income from bonds so that the capital account balance matches observed values.[12] In this way, bonds (i) allow the capital account to be closed, (ii) give investors a choice of two types of assets in which to invest their saving, with bonds representing a lower risk investment, and typically a lower return investment, than FDI. The inclusion of bonds thus represents investor choices and global capital markets more realistically than would otherwise be the case. As bonds represent a composite of all financial assets, they are modelled as net stocks for each region.

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[10] One flaw in (18) is that it does not accord with 2013 values of wealth and net saving. That is, (18) is not an initial solution given the starting values (i.e., the values in 2013) of wealth and net saving. If all $t+\tau$ (2023) values in (18) are replaced with *t* (2013) values, then the left-hand side (LHS) of (18) equals W_t but the right-hand side (RHS) equals $W_t + \tau NS_t$: the LHS and the RHS are not equal to each other. This flaw is overcome by adding to (18) the term $\left[-\tau NS_t . (1-U) \right]$, where $U = 0$ in the initial solution and $U = 1$ in the final solution. In the modified form of (18), if all $t+\tau$ (2023) values are replaced with *t* (2013) values, both the LHS and the RHS equal W_t. Setting $U = 1$ in the final solution imposes the original relationship in (18).

[11] This treatment of bonds is originally due to McDougall (1993) but its application here more closely follows Hanslow *et al*. (1999).

[12] Such data is available from McDougall *et al*. (2012).

In allocating wealth between physical capital and bonds, each regional investor chooses K_o and B_o so as to maximise $\left[K_o.RK_o - VD_o + B_o.RB\right]$ subject to $QW_o = CET\left[K_o, B_o\right]$,[13] where CET[.] is a constant elasticity of transformation utility function (Powell and Gruen, 1968), RK_o is the average post-tax rental price of capital received by investor *o*, RB is the global bond rate, and QW_o is real wealth of investor *o*. $VD_o = \sum_{jr} K_{jro}.PI_{jr}.D_{jr}$: i.e., the value of depreciation of capital owned by investor *o*, where D_{jr} is the depreciation rate on capital used by industry *j* in region *r*.

Thus, investors seek to maximise returns on wealth, which comprises (i) post-tax returns on capital net of depreciation $\left(K_o.RK_o - VD_o\right)$, plus (ii) returns on bonds $\left(B_o.RB\right)$, given RK_o, PI_{jr} and RB. Note that returns on bonds could be positive or negative depending on the initial value of *B*: thus $\sum_o B_o = 0$. Note also that there is only a single bond rate as we assume perfect international arbitrage in the bond rate.

The maximisation problem for investors yields the following behavioural equations in percentage-change form:

$$k_o = qw_o - \gamma\left(ror_o - rorw_o\right) + fk_o, \tag{19}$$

$$qb_o = qw_o - \gamma\left(CD_o.rb - rorw_o\right) + fb_o; \tag{20}$$

where k_o $\left(qb_o\right)$ is the quantity of capital (bonds) owned by region *o*, ror_o is the post-tax net (of depreciation) rate of return on capital in region *o*, and $rorw_o$ is the average rate of return on wealth in region *o*. $\gamma\left(=-1.5\right)$ is a negative parameter controlling the degree of transformation between capital and bonds. fk_o and fb_o are terms representing preferences to hold wealth in the form capital and bonds.

Equations (19)–(20) comprise scale and transformation terms. The scale term is determined by real wealth in region *o* $\left(qw_o\right)$: this is nominal wealth $\left(w_o\right)$ deflated by a wealth price index. The transformation terms are a function of the relative rate of return of each asset class and the transformation parameter. Note the coefficient CD_o for the equation determining

[13] As B_o can take a negative value, the representation of the constraint as $QW_o = CET\left[K_o, B_o\right]$ is not strictly correct. In equation (20), this potential problem is handled via the coefficient CD_o.

the quantity of bonds. $CD_o = 1$ for $B_o > 0$ and $CD_o = -1$ for $B_o < 0$; for no region is $B_o = 0$. This coefficient makes qb_o rise (fall) with $\left(rb - rorw_o\right)$ if a region is a net creditor (debtor), i.e., they will lend (borrow) more (less).

3.7 Capital supply across locations and industries

Once capital by owner $\left(K_o\right)$ has been determined at the top level of the asset supply nest, it remains for capital to be allocated across the *r* regional locations and the *j* industries within those locations: K_{jro}. It is common for a CET utility function to be applied in determining K_{jro} given K_o in models designed to analyse FDI, e.g., Hanslow *et al*. (1999). But as Hanslow (2001) demonstrates, if the (*j*,*r*)-th capital stock share, K_{jro}/K_o, is small in the initial data, then this share will stay small as long the (*j*,*r*)-th relative rate of return is approximately constant; this is true regardless of how other rates of return are changing. Therefore, if all capital suppliers to the (*j*,*r*)-th market experience the same change in their relative rates of return, the large suppliers will remain large and the small suppliers will remain small. To avoid this property of the CET function, we follow Hanslow (2001) in applying a modified form of the CRETH (constant ratios of elasticities of transformation, homothetic) utility function (Vincent *et al*., 1980) to determine the bilateral allocation of capital across industries.

Thus, in allocating K_o across locations and industries, each regional owner of physical capital chooses K_{jro} so as to maximise $\sum_{jr}\left[K_{jro}.RK_{jro} - VD_{jro}\right]$ subject to $K_o = CRETH\left[K_{jro}\right]$, where RK_{jro} is average post-tax rental price of capital received by investor *o*. $VD_{jro} = K_{jro}.PI_{jr}.D_{jr}$: i.e., the value of depreciation of capital owned by investor *o* used by industry *j* in region *r*. Thus, investors maximise returns on total physical capital they own given RK_{jro} and PI_{jr}.

The maximisation problem for capital investors yields the following behavioural equations in percentage-change form:

$$k_{jro} = k_o - \varphi_{ro}\left(ror_{jro} - ror_o^*\right) + fk_{jro}, \qquad (21)$$

where ror_{jro} is the post-tax net (of depreciation) rate of return on capital owned by region *o*, used by industry *j* located in region *r*, ror_o^* is the average post-tax net rate of return on capital owned

by region *o* calculated using special shares (see below), and φ_{ro} is a negative parameter controlling the degree of transformation across industries and industries. fk_{jro} represents preferences to hold capital across industries and locations.

In levels, ror_o^* is defined as

$$ROR_o^* = \frac{VPR_o^*}{VK_o^*} - \frac{VD_o^*}{VK_o^*}. \qquad (22)$$

The first term on the right-hand side (RHS) of (22) is the gross rate of return on capital, that is, the ratio of post-tax rentals to the capital stock; the second term is the depreciation rate, that is, the ratio of the value of depreciation to the value of the capital stock. All variables on the RHS of (22) are calculated using 'modified' shares. For example, $VK_o^* = \sum_r \sum_j S_{ro}^* K_{jro}.PI_{jr}$ where $S_{ro}^* = \frac{\varphi_{ro}.VK_{ro}}{\sum_r \varphi_{ro}.VK_{ro}}$.

The CRETH specification allows the elasticity of transformation, φ_{ro}, to vary across the *r* locations where the *o* regions invest. Hanslow (2001) calibrates φ_{ro} so that the values are inversely related to the initial capital rental shares; this avoids the property described above when applying CET functions whereby small initial capital shares stay small if the relative rate of return is constant. Thus, following Hanslow (2001), φ_{ro} is calibrated as

$$\varphi_{ro} = \eta_o.S_{ro}^{-1/N}, \qquad (23)$$

where

$$\eta_o = \frac{\mu.\left(1-\sum_r S_{ro}^2\right).\sum_r S_{ro}^{1-1/N}}{\left(\sum_r S_{ro}^{1-1/N}\right)^2 - \sum_r S_{ro}^{2-2/N}}, \qquad (24)$$

$$S_{ro} = \frac{\sum_j K_{jro}.RK_{jro}}{\sum_r \sum_j K_{jro}.RK_{jro}}. \qquad (25)$$

The parameter μ is the average transformation elasticity desired by the model user over all *r* for K_{jro}; in this case μ = -1. The shares in (25) are post-tax rental shares across locations *r* for each investor *o*. The scheme in (23)–(25) yields CRETH parameters that are inversely related to the initial rental shares. *N* controls the standard deviation of the parameters across locations for each investor given a mean of μ. Higher values of *N* yield a smaller standard deviation and vice versa. Here *N* = 5. Table 1 presents the values of φ_{ro} given by this scheme.

Table 1. Values of φ_{ro}: the elasticity of transformation of capital across locations *r* by owner *o*

Capital location	Capital owner								
	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World
USA	-1.09	-3.11	-4.38	-2.05	-1.74	-2.38	-1.83	-1.76	-2.21
China	-2.23	-1.00	-4.08	-2.86	-1.69	-2.25	-2.22	-2.27	-3.03
India	-3.42	-12.15	-1.00	-8.06	-3.01	-6.77	-3.42	-3.74	-8.84
Japan	-3.45	-4.74	-7.47	-1.04	-3.47	-5.22	-5.47	-3.56	-4.93
East Asia	-2.77	-5.46	-6.89	-5.69	-1.08	-3.77	-3.03	-3.40	-4.20
ASEAN	-2.57	-8.52	-8.58	-5.00	-2.48	-1.02	-2.43	-2.89	-4.06
Aust/NZ	-3.23	-9.81	-10.18	-6.65	-2.50	-3.36	-1.06	-3.18	-4.05
EU27	-1.48	-3.82	-3.07	-2.03	-2.42	-2.56	-2.28	-1.06	-2.17
Rest of World	-1.79	-6.33	-5.98	-4.56	-1.69	-3.05	-1.72	-1.82	-1.03

Source: See text for explanation.

3.8 Capital mobility

Having determined K_{jro}, we define capital supply by industry *j* in region *r* across all owners: $K_{jr} = \sum_o S_{jro}.K_{jro}$. We also define capital demand by industry *j* in region *r* across all owners: $Q^K_{jr} = \sum_o S^F_{ijro}.Q^F_{ijro}$, *i* (= capital). By declaring a market-clearing condition by industry and region, $K_{jr} = Q^K_{jr}$, we define a rental price of capital that is common to all owners of capital in the (*j*,*r*)-th industry: P^K_{jr}. Thus, any change that causes a fall in the price of capital for any supplier of capital to the (*j*,*r*)-th industry will reduce the price of capital for all owners of capital in the (*j*,*r*)-th industry. For example, if a supplier or group of suppliers increase their supply of capital to a given regional industry relative to the demand for capital, then all other suppliers of capital to the industry will experience a fall in their rental price. In this way, any cost-reducing technical change experienced by one capital supplier is transferred to all other suppliers in the same regional industry.

Consistent with this treatment of rental prices by industry, in the initial data we set net rates of return to capital to be equal across all suppliers of capital to a regional industry. Thus, rates of return vary across industries within a region, but they do not vary across owners of capital within the same industry in a region.

3.9 Labour supply and labour-market clearing

We define a labour supply function in each region as a function of population and the post-tax real wage. We make labour supply sensitive to the real wage consistent with international

evidence on non-zero wage elasticities of labour supply (e.g., Bargain *et al*., 2011). Thus, in each region *r* we define the ratio of the labour supply LS_r to population POP_r as

$$\frac{LS_r}{POP_r} = \left(PRW_r\right)^{\beta} .A_r ; \qquad (26)$$

where PRW_r is the post-tax real wage received by labour in region *r* and A_r and β are positive parameters. Thus, labour supply is a positive function of the real wage and population. We set the labour supply elasticity β = 0.2, making labour supply only slightly responsive to real wage in each region. A_r is a scaling factor that is set to ensure equality between each side of (26) in the initial solution of the model.

In original form USITC-FDI assumes the aggregate demand of labour in each region LD_r is exogenous. With LS_r now defined in (26), we make LD_r endogenous and add the labour-market-clearing condition

$$LS_{lr} = LD_{lr} . \qquad (27)$$

Equation (27) now determines the pre-tax wage received by labour in region *r* W_r by equating labour demand and supply.

3.10 Regional income

With each region earning foreign income it is necessary to redefine regional income to reflect the difference between economic activity within a region, i.e., GDP, and income earned by the region, i.e., GNP. GDP in location *r* from the supply side and the demand side is defined as

$$GDP_r = LY_r + KY_r + IT_r = C_r + I_r + G_r + X_r - M_r , \qquad (28)$$

i.e., the sum of labour income $\left(LY_r\right)$, capital income $\left(KY_r\right)$ and indirect tax receipts $\left(IT_r\right)$ equals the sum of consumption $\left(C_r\right)$, investment $\left(I_r\right)$, government expenditure $\left(G_r\right)$ and next exports $\left(X_r - M_r\right)$. Note that $KY_r = \sum_j \sum_o KY_{jro}$: KY_r includes capital income earned in the all industries by all investors. Also note that $KY_{ro} = \sum_j KY_{jro}$ for *r* = *o* is capital income earned on domestically-owned capital in region *r*, and $KY_{ro} = \sum_j KY_{jro}$ for $r \neq o$ is capital income earned on foreign-owned (or FDI) capital in region *r*.

Regional income is then defined as

$$GNP_r = GDP_r + FKY_r - FKP_r + NINT_r . \quad (29)$$

That is, GDP plus capital income on FDI received by region r (FKY_r), minus capital income paid on FDI in region r (FKP_r), plus net interest receipts on bonds for region r $(NINT_r)$.

4. The baseline

The USITC-FDI model data is based on version 8 of the GTAP database that represents the world economy in 2007. In order simulate the policy change from a more recent representation of the world economy, we update the model database to the most recent year for which historical data is available: 2013. This is the first step of the baseline. The second step of the baseline is to forecast the model into future.

Step 1

Model variables are updated from 2007 to 2013 by applying observed movements in GDP, population, consumer prices, and saving and investment ratios to GDP.[14] The historical data is taken from the IMF's World Economic Outlook publication.[15] The objective of this step is to ensure the model data conforms approximately to the pattern of global economic activity in 2013. Therefore, this step is not intended to strictly represent historical movements in global economic activity but to ensure we have a representation of the global economy in 2013 that conforms approximately to independent sources (i.e., the IMF), and to use that representation to conduct the policy simulations.

The following assumptions are made in applying this step:

- employment is assumed to be determined by market-clearing between the demand and supply of labour in each region: see equation (27);
- regional saving-to-GDP ratios are targeted via accommodating movements in the average propensity to consume (*APC*): see equation (14);
- regional investment-to-GDP ratios are targeted via accommodating movements in preferences for investing (FG_r): see equation (12);

[14] The model is implemented and solved using the GEMPACK economic modelling software (Harrison and Pearson, 1996).

[15] See http://www.imf.org/external/pubs/ft/weo.

- regional GDP is targeted via accommodating movements in labour-saving technical change;
- rates of return on capital are held fixed via accommodating movements in preferences for wealth accumulation (*FW*): see equation (18);

The last two assumptions allow capital-output ratios to remain approximately constant, which accords with historical observation (Romer, 2001, p. 26).

Step 2

The model is then projected forward by 10 years to 2023 using IMF forecasts for GDP, population and consumer prices. The following assumptions are made in applying this step:

- employment is assumed to be determined by market-clearing between the demand and supply of labour in each region: see equation (27);
- household consumption is a function of disposable household income and real wealth: see equation (14);
- investment is a function of GDP and the rate of return on capital: see equation (12);
- regional GDP targets are achieved via accommodating movements in labour-saving technical change;
- rates of return on capital are held fixed via accommodating movements in preferences for wealth accumulation: see equation (18);

Table 2 presents the changes in real macro aggregates for steps 1 and 2 of the baseline.

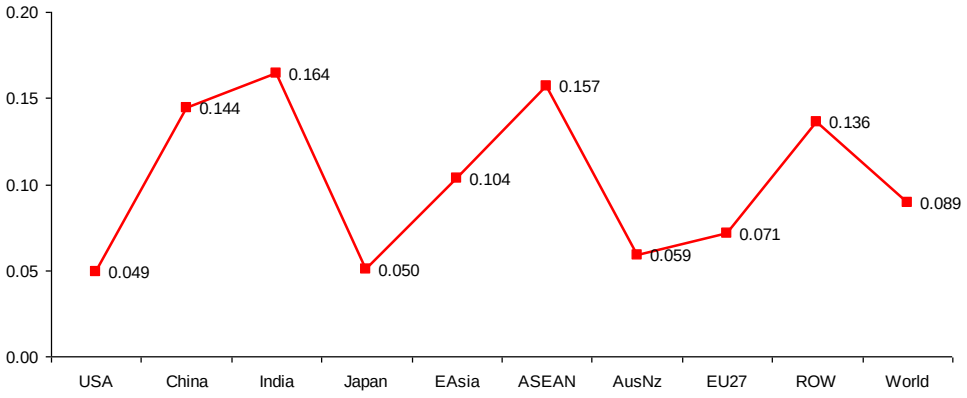
5. The effects of China partially liberalising the capital account

The literature review in Section 2 described that macroeconomic observers have expressed the view that China's capital account controls have had the effect of creating a positive cost of capital differential between China and the rest of the world. The initial rates of return for 2013 in our model are consistent with this view. Figure 1 shows that the global average rate of return is around 9% whereas in China it is around 14%; so there is a 5 percentage point gap between the rate of return in China and the global average. Figure 1 also shows that high-income countries with open capital accounts and flexible exchange rates have the lowest rates of return: USA, Japan, Aust/NZ (Australia and New Zealand) and EU27.

Table 2. Macroeconomic variables in baseline: 2007-2023 (percentage change)

Region	Labour	Capital	Productivity	Consumption	Investment	Exports	Imports	GDP	GNP
	2007-2013								
USA	5.1	6.2	0.6	2.8	8.7	30.9	10.8	5.9	6.5
China	11.3	67.0	21.0	36.2	92.9	56.8	48.5	67.5	67.1
India	13.4	43.6	12.0	35.4	43.8	67.1	37.3	44.8	44.8
Japan	0.2	1.6	-0.4	13.7	-6.3	-21.0	16.3	0.3	0.5
East Asia	6.2	19.5	4.6	31.2	14.6	10.6	22.9	18.3	20.3
ASEAN	12.3	32.4	7.1	38.4	63.0	22.1	36.5	33.6	33.4
Aust/NZ	10.5	14.7	2.5	10.9	16.4	23.7	14.0	15.0	15.9
EU27	1.0	-0.7	-1.2	6.4	-19.4	1.8	1.5	-0.4	0.7
Rest of World	16.8	53.4	14.6	38.8	108.2	44.8	49.4	55.6	54.7
	2014-2023								
USA	11.9	31.6	11.2	39.5	7.0	34.1	40.5	31.1	31.9
China	16.1	95.5	26.6	137.5	60.3	89.9	73.2	95.8	95.6
India	23.7	86.8	20.3	107.5	52.2	74.4	76.6	85.9	85.9
Japan	-0.7	11.0	5.9	15.4	-9.8	28.9	19.1	10.7	11.2
East Asia	11.0	47.4	13.7	63.6	19.4	41.5	49.9	46.1	48.3
ASEAN	21.6	66.4	13.4	82.0	36.8	63.5	62.5	67.2	67.4
Aust/NZ	15.5	32.1	7.9	43.4	8.3	37.0	33.9	32.6	34.3
EU27	4.9	19.7	6.0	28.7	-2.3	17.9	22.9	19.8	21.4
Rest of World	26.2	77.8	17.3	98.5	47.2	67.7	66.9	79.9	79.0

Figure 1. Initial (2013) post-tax net rates of return by location[a]



a This is the ratio of capital rentals (after-tax) to the capital stock minus the depreciation rate.

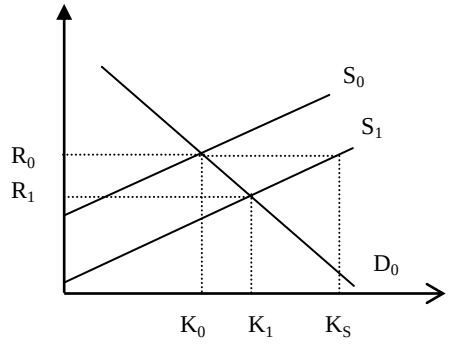
A priori, partial or complete removal of capital controls by China would be expected to lead to an influx of FDI and other capital with the intention of exploiting the high relative rate of return. The literature discussed in Section 2 supports the idea that capital controls have restricted inflows more that outflows. Such an influx would reduce the gap between the rate of return in China and the global average. Further, as we assume that the rental price of capital in each regional industry is the same for all suppliers of capital to that industry, any influx of FDI into

China will reduce the rate of return for all suppliers of capital in each industry, including domestic suppliers. In this way, increased FDI automatically brings with it benefits to the domestic industry in terms of a lower cost of capital and higher productivity.

The literature provides little guidance on the degree to which the rate of return in China would fall relative to the global average by partial or complete removal of capital controls by China. Nevertheless, we would not expect the complete elimination of the rate of return gap even with complete capital liberalisation, as the relatively high rates of return in China would reflect more than just the tightly controlled capital account. For instance, although China's economy is the second largest in the world its GDP per capita is still less than some developing countries, e.g., Mexico. Given this relatively low level of output per capita, one would expect that there would still be many unexploited investment opportunities in such an economy, and this would be consistent with high relative rates of returns. Thus, we would expect only a partial elimination of the gap between rates of return in China and globally even with the complete removal of capital controls in China. From a political economy perspective, the literature does suggest that complete capital account liberalisation by China is unlikely in the medium term unless it also abandons nominal exchange rate targeting.

Given the above discussion, we simulate the partial liberalisation of China's capital account by increasing the preference for other countries to locate FDI in China. This is the variable fk_{jro} in equation (21) (the capital supply function). Capital controls are non-tariff barriers and, as such, we model their reduction by increasing the preference for all regions to invest FDI in China at initial rates of return. This is equivalent to an outward shift of the supply curve for capital in China (see Figure 2). The initial equilibrium is at the intersection of S_0 and D_0 giving an initial rental price of R_0 and capital stock of K_0. We model the removal of capital controls in China as they relate to FDI as a shift from S_0 to S_1, representing an increased preference to invest in China by the distance K_S–K_0. As drawn in in Figure 2, this would lead to a fall in the rental price to R_1 and an increase in the capital stock to K_1. Thus, our simulations should show a fall in the rate of return and an increase in the capital stock in China.

Figure 2. An increase in the supply of capital in China



Initially we increase the preference to invest in China at initial rates of return by 50% in order to observe the pattern of effects we might observe. Subsequently we simulate preference increases of 100% and 200%. In all our simulations we observe a reduction in the rate of return in China relative to the global average: larger increases in preferences lead to larger reductions in the rate of return in China relative to the global average.

5.1 Capital allocation effects

Table 3 shows how the allocation of capital across locations and owners is affected by the policy change; note that diagonal cells represent domestically-owned capital and off-diagonal cells represent FDI capital. All regions increase their (FDI) capital in China with the biggest increases by East Asia (17%), Aust/NZ (13%), USA (13%) and EU27 (12%). In general, the size of the response for each region reflects how much capital they initially have invested in China: East Asia, USA and EU27 are the biggest foreign owners of capital in China. Australia's strong response is driven by the strong trade benefit it derives from the policy change (this is explained later). As predicted by the partial-equilibrium analysis of Figure 2, the responses by regions investing in China are less than the increase in preferences for investing in China (50%) as increasing FDI in China reduces the rate of return earned on such capital (Table 4); this is consistent with each owner optimising the rate of return on their capital so that, other things being equal, less FDI capital is allocated to a destination as the rate of return falls.

Table 3. Capital allocation effects of partial liberalisation of China's capital account[a] (percentage change)

Capital location	Capital owner									
	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World	TOTAL[b]
USA	0.5	1.1	0.0	-0.1	2.4	0.5	1.3	0.4	0.1	0.5
China	13.2	1.7	6.9	9.3	17.4	11.7	13.1	12.4	8.7	2.9
India	1.3	1.5	0.0	0.1	3.6	0.7	1.9	0.8	0.3	0.1
Japan	0.9	1.1	0.1	0.0	2.7	0.6	1.5	0.7	0.2	0.0
East Asia	1.3	0.9	-0.3	-0.1	2.5	0.3	2.1	0.6	-0.1	2.4
ASEAN	1.3	1.6	0.2	0.2	3.5	0.5	1.7	0.8	0.2	0.6
Aust/NZ	0.9	0.9	-0.1	-0.1	2.7	0.3	1.1	0.5	-0.1	1.1
EU27	0.8	1.1	0.0	0.0	2.7	0.4	1.4	0.5	0.1	0.5
Rest of World	1.0	1.5	0.2	0.1	3.1	0.7	1.6	0.7	0.1	0.2
TOTAL[c]	-0.2	1.7	0.0	-0.2	0.7	0.0	0.5	-0.1	0.0	0.7

Source: Model simulation. **a** Diagonal cells represent domestically-owned and located capital and off-diagonal cells represent FDI capital. **b** Row totals represent total capital located in region *r*: this is capital owned and located in region *r* plus foreign-owned capital located in region *r*. **c** Column totals represent total capital owned by region *r*: this is capital owned and located in region *r* plus capital owned by region *r* but located in other regions.

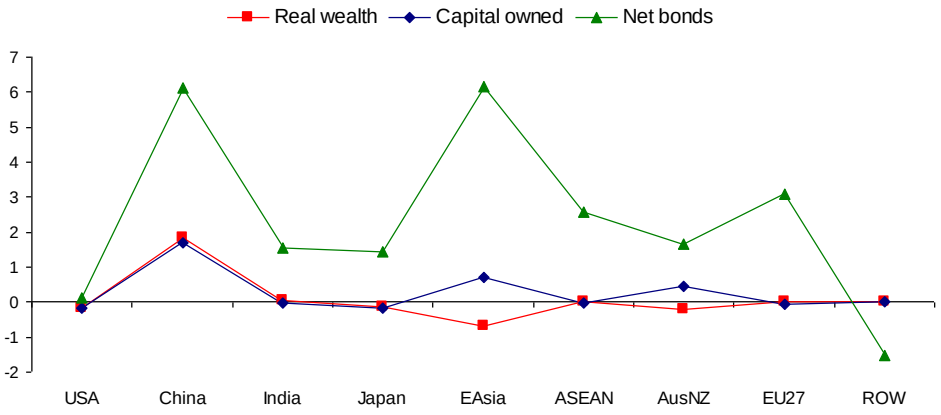
The policy change leads to an increase in capital located in almost all regions (Table 3, last column). The total capital stock located in China (i.e., domestic- and foreign-owned) rises by 2.9%. Most other regions experience much smaller increases in the total capital stock except for East Asia (2.4%). East Asia benefits greatly from the policy change and thus grows strongly. This leads to a larger expansion in domestically-owned capital in East Asia (2.5%) than in foreign-owned capital (0.9%), i.e., the share of foreign-owned capital falls; this is not the case in most other regions.

Although the policy change leads to a noticeable increase in capital located in all regions it does not lead to an increase in capital owned by all regions (Table 3, last row); USA, India, Japan, ASEAN, EU27 and the Rest of World experience either a minor reduction or a minor increase in the capital they own. Despite this, global capital rises by 0.7%. Physical capital and bonds represent the two asset classes owned by a region, and together they constitute wealth by region. Figure 3 shows that, in general, capital owned moves with real wealth due to the policy change. East Asia and Aust/NZ are two notable exceptions to this pattern. In both of these regions, the increases in capital owned are financed by an increase in borrowings (net bonds),[16] and the net effect is to lower real wealth. The net effect across all regions is an increase in real wealth of 0.08%. The wealth accumulation mechanism (equation (18)) is a function of *nominal*

[16] Although it is not obvious in Figure 3, net bonds continue to sum to zero after the reallocation of FDI to China. This is because Figure 3 plots percentage changes in underlying quantities that are positive for some regions (China, India, Japan, ASEAN, and EU27) but negative for all other regions.

net (of depreciation) savings over the period 2013-2023, which rises by about 0.9% globally. This reflects the rise in gross saving in all regions due to a rise in the saving rate in all regions; the rise in saving rates is driven by the global rise in the price of consumption relative to the price of investment: -0.05% cf. -0.005%. The policy change has the effect of increasing the capital-labour ratio in all regions and thus reducing the price of capital relative to labour. As investment is more capital intensive than consumption, the price of investment falls relative to the price of consumption and this encourages households to switch part of their income from consumption to saving.

Figure 3. Responses in real wealth, capital owned and net bonds (percentage change)



The growth in the global capital stock (0.6%) drives down the global rate of return on capital (-0.8%) (Table 4). Rates of return also fall in all regions where the total capital stock increases; that is, everywhere except Japan. For all capital owners except India and Japan, the rate of return on FDI capital invested in most locations also falls reflecting the rise in FDI capital invested in most locations.

Table 4. Rate of return effects of partial liberalisation of China's capital account[a, b] (percentage change)

Capital location	Capital owner									
	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World	TOTAL[c]
USA	-1.2	-1.9	0.1	0.0	-4.1	-0.6	-2.0	-0.9	-0.2	-1.2
China	-13.4	-1.7	-7.9	-10.4	-18.2	-13.0	-14.3	-12.9	-10.3	-3.3
India	-1.4	-1.7	0.1	0.0	-4.1	-0.7	-2.0	-0.9	-0.2	0.0
Japan	-1.6	-1.8	0.1	0.2	-4.5	-0.7	-2.3	-1.0	-0.1	0.1
East Asia	-1.4	-1.8	0.0	0.0	-3.6	-0.8	-2.0	-1.0	-0.2	-3.4
ASEAN	-1.3	-1.7	0.1	0.0	-4.0	-0.3	-1.9	-0.9	-0.1	-0.4
Aust/NZ	-1.5	-1.8	0.1	0.0	-4.4	-0.8	-1.9	-1.0	-0.2	-1.8
EU27	-1.2	-1.9	0.1	0.1	-4.3	-0.7	-2.1	-0.7	-0.1	-0.7
Rest of World	-1.2	-1.8	0.1	0.0	-3.7	-0.6	-1.8	-0.8	-0.1	-0.2
TOTAL[d]	-1.4	-1.7	0.1	0.1	-4.7	-0.6	-2.0	-0.9	-0.1	-0.9

Source: Model simulation. [a] The rate of return is defined as the ratio of capital rentals (after-tax) to the capital stock minus the depreciation rate. [b] Diagonal cells represent the rate of return on domestically-owned capital and off-diagonal cells represent the rate of return on FDI capital. [c] Row totals represent the average rate of return on total capital located in region *r* [d] Column totals represent the average rate of return on total capital owned by region *r*: this is capital owned and located in region *r* plus capital owned by region *r* but located in other regions.

In its initial effect, the policy change does not favour any particular sector in China. Thus, as reflected in Table 5, capital in each sector expands by similar proportions. However, the capital stock increases slightly favour *mining* and *manufacturing* in China. *Mining* capital stocks also grow strongly in other regions where aggregate capital stocks grow strongly (East Asia and Aust/NZ); this reflects the capital-intensive nature of production of *mining*. Thus, *mining* benefits strongly when the relative price of capital falls in these regions. But unlike China, the increases in *mining* capital are driven by mainly by an expansion in domestically-owned capital rather than FDI capital.

Table 5. Sectoral capital effects of partial liberalisation of China's capital account (percentage change)

Sector	Location								
	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World
Agriculture	0.61	2.59	-0.04	-0.26	2.58	0.41	1.22	0.37	0.05
Mining	0.78	3.21	-0.22	-0.32	4.29	0.62	1.96	0.77	0.12
Manufacturing	0.65	3.20	-0.18	-0.31	3.41	0.45	1.38	0.47	0.00
Trade	0.49	2.82	0.10	0.07	2.17	0.67	0.88	0.50	0.24
Transport	0.59	2.47	0.15	0.05	2.24	0.68	1.08	0.53	0.24
Other services	0.51	2.83	0.25	0.10	1.96	0.70	0.93	0.49	0.35

Source: Model simulation.

5.2 Trade effects

Table 6 presents the effects on sectoral and regional exports from the policy change. The effects largely mirror those already discussed for sectoral and regional capital stocks. Exports increase the most in regions that experience the largest increases in total capital – China (2.3%), East Asia (2.8%) and Aust/NZ (1.3%). The large relative expansions in capital stocks in China, East Asia and Aust/NZ cause the rental price of capital to fall in these regions relative to other regions; this is reflected in the average price of primary factors presented in Table 6. With factor prices falling in China, East Asia and Aust/NZ relative to other regions, exports by China, East Asia and Aust/NZ rise relative to other regions and thus exports from these regions gain market share.

Table 6. Export and primary factor price effects of partial liberalisation of China's capital account (percentage change)

Sector	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World
	Exports								
Agriculture	1.38	0.70	-0.74	-0.35	4.44	0.45	2.23	0.40	-0.06
Mining	1.50	3.60	0.21	0.33	4.89	0.70	2.61	0.90	0.19
Manufacturing	0.31	2.39	-1.30	-0.97	3.64	0.18	1.13	0.18	-0.51
Trade	0.37	0.45	0.58	0.78	1.27	0.69	0.64	0.50	0.40
Transport	0.41	0.91	0.14	0.25	1.08	0.40	0.56	0.40	0.26
Other services	0.37	0.75	-0.01	0.17	1.31	0.29	0.69	0.36	0.11
TOTAL	0.37	2.27	-0.92	-0.61	2.81	0.25	1.32	0.26	-0.23
	Average price of primary factors								
	-0.03	-0.29	0.38	0.27	-0.94	0.10	-0.20	-0.09	0.20

Source: Model simulation.

5.3 Macroeconomic effects: GDP

Table 7 presents the GDP effects of the policy change. GDP expands in all regions but China (1.7%) and East Asia (1.2%) experience the largest increases; other regions experience smaller increases: ASEAN (0.4%), Aust/NZ (0.5%) and EU27 (0.25%). The GDP increases reflect the capital stock increases; thus, China, East Asia and Aust/NZ experience the largest GDP increases as they experience the largest increases in capital. The increases in capital relative to labour raise the marginal product of labour and thus the real wage. Increases in the real wage elicit an increase in the amount of labour supplied and thus employment. But the increases in labour are small relative to the increases in capital, i.e., the capital-labour ratio rises. The rise in the capital-labour ratio is consistent with fall in the rental-wage ratio, i.e., the rental price of capital falls relative to the wage rate, observed in all regions.

The pattern of capital responses also drives the response of the real exchange rate: the domestic output price relative to the price of output by trading partners. The real exchange rate depreciates in China, East Asia and Aust/NZ as the large capital stock increases drive down the rate of return in these regions. Thus, domestic prices in China, East Asia and Aust/NZ fall relative to other regions. The real exchange rate depreciation leads to large increase in exports for these regions: China, 2.3%; East Asia, 2.8%; Aust/NZ 1.3%.

Table 7. GDP effects of partial liberalisation of China's capital account (percentage change)

Variable	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World
Labour	0.05	0.50	0.04	0.01	0.31	0.13	0.13	0.07	0.06
Capital	0.54	2.93	0.07	0.02	2.39	0.59	1.09	0.49	0.21
Real exchange rate	0.04	-0.33	0.40	0.40	-0.86	0.18	-0.11	0.00	0.23
Real wage	0.26	2.52	0.19	0.07	1.55	0.65	0.63	0.35	0.28
Consumption	0.16	2.31	0.15	0.07	0.46	0.50	0.31	0.24	0.18
Investment	0.47	0.93	0.95	0.97	0.42	1.07	0.47	0.77	0.93
Exports	0.37	2.27	-0.92	-0.61	2.81	0.25	1.32	0.26	-0.23
Imports	0.26	1.19	0.47	0.56	0.92	0.54	0.34	0.29	0.44
GDP	0.19	1.71	0.06	0.02	1.26	0.41	0.50	0.25	0.15

Source: Model simulation.

5.4 Macroeconomic effects: GNP

In the model, the difference between GDP and GNP is net foreign income. Net foreign income for region *r* comprises: (i) income received from FDI capital owned by region *r* and located abroad minus income paid on FDI capital located in region *r* and owned by other regions; and (ii) interest receipts on net bonds. For most regions the GNP effects are similar to the GDP effects (Table 8), indicating that net foreign income has little impact on GNP. The biggest difference between GDP and GNP is for East Asia: 1.3% cf. 1%. For East Asia, net income on FDI capital makes a small positive contribution to GNP: 0.124 percentage points. But net bonds make a large negative contribution to GNP: -0.513 percentage points. This is because East Asia is a net borrower in the database and in response to the policy change they increase their borrowing (6.2%) and the bond rate rises (1.2%). For the same reasons, net bonds also make a negative contribution to GNP in Aust/NZ (-0.101 percentage points). All other regions experience positive or zero contributions to GNP from net bonds as they either reduce their borrowings (USA and Rest of World) or increase their lending (all other regions).

Table 8. GDP and GNP effects of partial liberalisation of China's capital account (percentage change)

Variable	USA	China	India	Japan	East Asia	ASEAN	Aust/NZ	EU27	Rest of World
GDP	0.19	1.71	0.06	0.02	1.26	0.41	0.50	0.25	0.15
FDI capital									
owned[a]	0.76	0.75	1.04	0.77	1.31	1.72	0.79	0.79	0.83
hosted[a]	0.63	3.08	0.07	0.01	2.53	0.52	1.04	0.54	0.20
net[c]	0.022	-0.171	0.001	0.018	0.124	0.014	0.001	0.019	0.008
Net bonds[c]	0.000	0.092	0.029	0.023	-0.513	0.024	-0.101	0.024	0.005
Bond rate	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18
GNP	0.21	1.67	0.08	0.05	0.95	0.45	0.45	0.29	0.17

Source: Model simulation. [a] For region *r*, this is capital owned but not located in region *r*. [b] For region *r*, this is capital located region *r* but owned by other regions. [c] These are percentage-point contributions to the percentage change in GNP.

For China, net FDI capital makes a negative contribution to GNP (-0.171 percentage points) because of the large increase in inward FDI relative to outward FDI: 3% cf. 0.8%. For all other regions, net FDI capital makes a positive contribution to GNP. For the large FDI exporters – USA, Japan and EU27 – net FDI capital rises because of the large increase in FDI located in China.

6. Sensitivity analysis

A priori, partial or complete removal of capital controls by China would be expected to lead to an influx of FDI and other capital with the intention of exploiting the high relative rate of return in China: the simulation results discussed above have demonstrated that, as expected, such an influx would reduce the gap between the rate of return in China and the global average. In the absence of guidance from the literature on the degree to which the rate of return in China would fall relative to the global average by partial or complete removal of capital controls by China, we have simulated a 50% increase in other regions' preferences for investing in China at initial rates of return. Here we present results for preference increases of 100% and 200%. Figure 4 shows that as the preference for investing in China increases, regional and global capital increases approximately linearly with a peak of 1.7% for the global capital stock. Figure 5 shows that in all three simulations we observe a reduction in the rate of return in China relative to the global average: larger increases in preferences lead to larger reductions in the rate of return in China relative to the global average. Thus our detailed results above provide a picture of the pattern of effects likely to eventuate from such a policy change regardless of the degree of liberalisation that is undertaken.

Figure 4. Capital stock response by location to different increases in preferences for investing in China (percentage change)

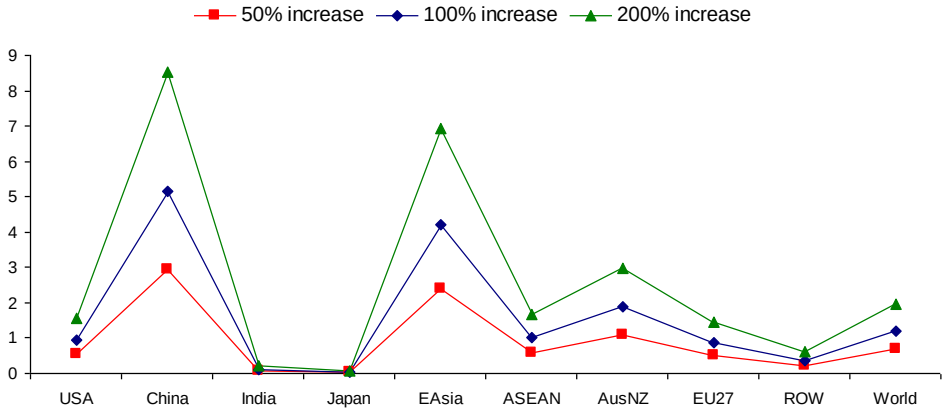
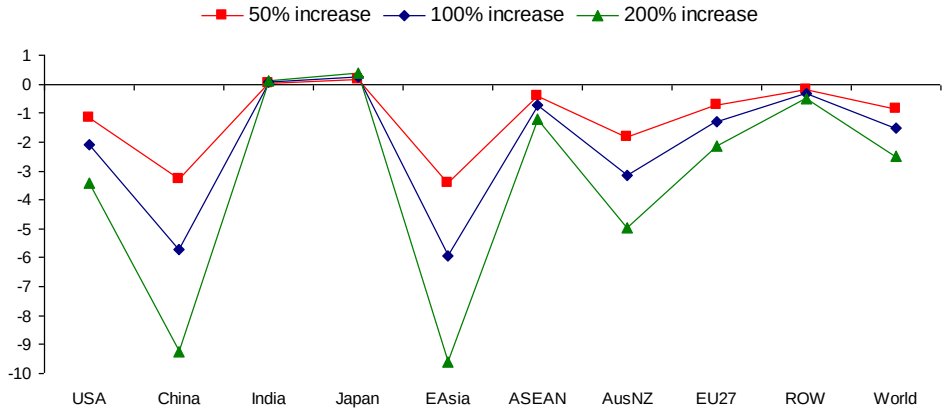


Figure 5. Rate of return response to different increases in preferences for investing in China (percentage change)



7. Conclusion

We model the partial liberalisation of the capital account by China using a dynamic CGE model of the world economy. Specifically, we model reduction of capital controls as they relate to foreign direct investment (FDI). The model incorporates many features to capture the salient macroeconomic effects of such a policy change; that is, we model multinational companies differentiated bilaterally by region of ownership and foreign affiliates, FDI capital stocks held by these firms, existing regional net debt positions, wealth accumulation through time, and a lifecycle approach to consumption and saving. Our results indicate that a significant reduction of capital controls on FDI as reflected by 50% increase in the preference for investing in China, would lead to an increase in FDI capital in China of 13.3%. FDI capital would also increase in

all other regions. The large inflow of FDI into China lowers the rate of return on capital by 3.3% and the global rate of return by 0.8%. Thus, we observe a significant reduction in the cost of capital in China relative to the rest of the world due to the reduction of capital controls; this result accords with the predictions of macroeconomic observers (Ma and McCaualey, 2010; Prasad and Wei, 2005). Sensitivity analysis indicates that the effects of the policy change are approximately linear in the size of the increase in the preference for investing in China: doubling the preference increase from 50% to 100% approximately doubles all effects for all regions.

In the central simulation where we simulate a 50% increase in the preference for investing in China, the fall in the global rate of return of capital reflects falling rental prices in those regions that experience the largest increases in capital: China (2.9%), East Asia (2.3%) and Aust/NZ (Australia and New Zealand) (0.8%). The reduction in the rental price in these regions relative to other regions lowers domestic costs and they experience a real depreciation of the exchange rate. Thus, exports from China, East Asia and Aust/NZ gain market share.

The reduction of capital controls on FDI by China leads to an increase in capital stocks in all regions. This response benefits all regions in terms of GDP and GNP. The economies of China (1.7%) and East Asia (1.3%) grow most strongly in response to this change. The economies of other regions grow less strongly in response to the change: USA (0.1%), ASEAN (0.4%), Aust/NZ (0.5%) and EU27 (0.3%). The GNP effects generally mirror the GDP effects. The size of the GNP effect for each region reflects the importance of FDI rentals on capital located in China as a share of regional income. Thus, the regions with the highest such shares – East Asia (4.4%), ASEAN (1.1%), Aust/NZ (0.8%) and EU27 (0.8%) – are the regions that experience the largest increases in GNP – East Asia (0.95%), ASEAN (0.45%), Aust/NZ (0.45%) and EU27 (0.29%).

We observe an across-the-board increase in the saving rate. The shift from current to future consumption (saving) is driven by the rise in the price of consumption relative to investment (saving) that all regions experience. This reflects the fall in the relative of price of capital that occurs in all regions as investment is more capital intensive that consumption.

Our findings suggest that there are significant potential benefits for all regions from the reduction of capital controls on FDI inflows into China, but China itself is the major beneficiary of reducing such capital controls. Hence, the reduction or removal of such controls is in China's own economic interest but also in the interest of other regions.

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