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Appreciating the *Renminbi*

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Appreciating the *Renminbi*

Abstract

International pressure to revalue China's currency stems in part from the expectation that rapid economic growth should be associated with an underlying real exchange rate appreciation. This hinges on the Balassa-Samuelson hypothesis, which sees growth as stemming from improvements in traded sector productivity and associated rises in wages and non-traded prices. Yet, despite extraordinary growth after the mid-1990s China's real exchange rate showed no tendency to appreciate until after 2004. We use a dynamic general equilibrium model to simulate the economy and show that, during this period, trade reforms and a rising national saving rate were offsetting forces in the presence of elastic labour supply. We then examine the possible determinants of the striking transition to real appreciation thereafter, noting mounting evidence that an improved rural terms of trade has tightened China's labour market. We show that, should the Chinese government bow to international pressure by appreciating the *renminbi* either via an extraordinary monetary contraction or via export disincentives the consequences would be harmful for both Chinese and global interests.

1. Introduction

China's arguably low *Renminbi* (RMB) has been at the centre of political debates over current account imbalances for more than a decade. In scholarly circles, while a few, including McKinnon (2006), argue that a RMB appreciation would not address the imbalances of concern to the US, numerous studies have supported the view that the currency is undervalued, by margins ranging from 'small' to as high as 50%,¹ and some conclude that a unilateral appreciation of the RMB is essential.² Expectations that China's exchange rate should be appreciating are based commonly on the Balassa (1964) – Samuelson (1964) hypothesis (BSH). This implies a positive relationship between economic growth and the underlying real exchange rate, driven by productivity catch-up in developing countries' tradable sectors and, in association, rising wages and prices in their non-traded sectors.

Empirical evidence from studies by Lu (2006), Fogel (2006) and Tyers et al. (2008) suggests that China's tradable productivity growth has been double that of the US since the early 1990s (Gordon 2003, 2006). The productivity pattern therefore appears to support a real appreciation relative to the US consistent with the BSH. More controversial, however, is the expectation that the productivity gains force relative growth in real wages. That this is true to some degree is clear from the official statistics (Garnaut and Huang 2007). Yet the real wages of non-*hukou* workers are less formally recorded and Meng and Bai (2007), among others,

¹ See, for example, Frankel (2004), Wang (2004), Goldstein (2004), Coudert and Couharde (2005), Tyers et al. (2008) and Cheung et al (2007a, 2007b).

² See, for example, Cline, W. (2005).

suggest that these grew more slowly, if at all, at least until the mid-2000s. The BSH then posits that faster Chinese growth in both tradable productivity and real wages should cause a rise in relative non-traded services prices, which is also observed through the mid-2000s (Lu 2006, Tyers et al. 2008). In spite of all this evidence supporting the BSH, there was no significant real appreciation between the mid-1990s and 2004.

The resolution of this puzzle requires a number of generalisations of the BSH; most significant amongst which is the relaxation of the assumption that the law of one price applies for all traded goods. This greatly broadens the set of determinants of the real exchange rate. The net effect of China's rapid economic growth on its real exchange rate is then seen to depend on the sources of that growth and the consequent pattern of endowment changes and sectoral distributions of productivity growth and tradability. Of considerable importance in the decade to the mid-2000s is the short run impact of China's widening current account surplus, which stems from its extraordinarily high total saving rate, and the WTO accession trade reforms.

We show that a strong reversal of the earlier tendency for the *real* exchange rate to depreciate against the BSH occurred after 2004, raising China's production costs by a third, relative to the US. We explore this change and discuss its determinants, noting mounting evidence not for a return to the dominance of the BSH but instead for a tightening labour market associated, at least in part, with an improved rural terms of trade. Turning to macroeconomic policy, we then examine the controversy over China's extensive holdings of official foreign reserves, finding these to be a consequence of its capital controls and its high saving rate. By international standards, however, we show that they do not appear to represent extraordinary holdings of generic foreign assets. We then examine the exchange rate target as monetary policy, concluding that, should the Chinese government respond to international pressure with a premature nominal revaluation or some form of export restraint, the consequences would be harmful to both Chinese and global interests.

The next section offers a brief formalisation of the BSH and presents the Chinese evidence. A generalisation is then presented in Section 3, enabling the decomposition of China's real exchange rate path to the mid-2000s and showing the importance of the saving rate and trade reforms in this period. The section then goes on to review evidence as to the reasons for the more recent appreciating trend. The role of China's macroeconomic policy is discussed in Section 4. In section 5, two scenarios for short term unilateral appreciation of the RMB are offered. General conclusions and policy implications are presented in Section 6.

2. China's real exchange rate puzzle

If the nominal exchange rate, E , is defined as the number of units of foreign exchange obtained for a unit of the domestic currency, the real exchange rate, e^R , can be defined correspondingly as the rate of exchange between the home product bundle and corresponding bundles produced abroad. It follows that the bilateral real exchange rate for a focus (home) country with foreign trading partner i can be approximated as the common currency ratio of the gross domestic product (GDP) prices (deflators) of the two countries, $P^Y(p^N, p^T)$ and $P_i^Y(p_i^N, p_i^T)/E_i$, where p^T and p^N are indices over all the focus country's non-traded and traded goods and services, respectively.³

$$e_i^R = \frac{P^Y(p^N, p^T)}{P_i^Y(p_i^N, p_i^T)/E_i} = E_i \frac{P^Y(p^N, p^T)}{P_i^Y(p_i^N, p_i^T)} \quad (1)$$

This is the identity linking the real and nominal exchange rates. Consider the case in which prices at home and abroad are measured in a common currency, the share of non-traded products in GDP, θ , is the same at home and abroad, prices are aggregated appropriately using a Cobb-Douglas index and the law of one price applies to all traded goods. The latter implies that trade is costless and undistorted, so that $p^T = p_i^T$. Under these conditions, the real exchange rate becomes

$$e_R = \frac{(p^N)^\theta (p^T)^{1-\theta}}{(p_i^N)^\theta (p_i^T)^{1-\theta}} = \left(\frac{p^N}{p_i^N} \right)^\theta \quad (2)$$

From this, the key role of non-traded goods prices is clear. When prices are measured in a common currency, or relative to a common numeraire, it is the ratio of the home and foreign non-traded goods prices that matters in determining the real exchange rate.

To illustrate the associated dependence on productivity, imagine that labour is the single fixed factor and that the rates of output per worker in the home traded and non-traded sectors are A^T and A^N . In trading partner i , the corresponding rates are A_i^T and A_i^N . The relationships between the wage rate and product prices in the traded and non-traded sectors follow from equating the wage in both sectors with the values of the marginal products of labour in each: $W = A^T P^T = A^N P^N$, $W_i = A_i^T P_i^T = A_i^N P_i^N$, from which it follows that the divergence in wage rates between trading partners depends only on their tradable productivities: $W/W_i = A^T/A_i^T$.

³ Here we imagine that, rather than the continuum of tradability that is observed across goods and services, traded and non-traded goods are separated starkly as T, N .

If the non-traded productivity level is the same in all trading partners ($A^N = A_i^N \forall i$), we then have that

$$\frac{P^N}{P_i^N} = \frac{A^T}{A_i^T} = \frac{W}{W_i} \text{ and } e_i^R = \left(\frac{P^N}{P_i^N} \right)^\theta = \left(\frac{A^T}{A_i^T} \right)^\theta = \left(\frac{W}{W_i} \right)^\theta \quad (3)$$

Under the assumptions of the BSH, then, an economy that is growing faster than its trading partners also has 1) faster tradable productivity growth, $\hat{A}^T > \hat{A}_i^T$, 2) faster wage growth $\hat{W} > \hat{W}_i$, 3) relative service price inflation $\hat{p}^N > \hat{p}_i^N$, and 4) an appreciating real exchange rate ($\hat{e}_R > 0$). The hypothesis then implies that, if developing countries are poorer because their tradable labour productivity is lower, then their comparatively rapid growth should be associated with real appreciations against their richer trading partners. Support for the hypothesis requires that all four of its predictions be observed.

While wider empirical evidence in support of the BSH is mixed, when price levels are compared through time and across large numbers of countries the pattern of real appreciation amongst the more rapidly growing countries is observed.⁴ For the case of China, we observe convincing evidence of faster tradable productivity growth (Table 1) and higher price inflation in the service sector (“tertiary” industry and construction) through the mid-2000s (Figure 1). Yet, as Figure 2 shows, no real appreciation was observed until after 2003. For a reflection of this on monthly data we use Chinese and US producer price indices in Figure 3, which shows the same real depreciating trend through the mid-2000s with a subsequent sharp real appreciation in the lead-up to the GFC. Clearly, to understand the path of China’s real exchange rate we require a generalization of the BSH, and this means relaxing key assumptions.

3. Determinants of the path of China’s real exchange rate

An understanding of the path of China’s real exchange rate first requires a generalization of the BSH assumptions. We review these briefly and go on to quantify the determinants more generally using a numerical model of the global economy. Then we use that model to decompose the forces affecting it in the period 1997 to 2006.

⁴ Cheung et al. (2007b) and Bergin et al. (2006) show the trend across countries and through time well. Other studies with more mixed results include those by Engel (1999), Choudhri and Khan (2004) and Miyajima (2005).

Generalising the BSH assumptions

Tradable productivity gap: BSH assumes that non-tradable sector productivities are the same across countries, thus only the tradable productivity gap matters. This assumption is often violated in reality, especially for developed/developing country pairs. Whatever the relative performance of China's services sector in the past, recent evidence suggests substantial potential for catch-up and accelerated productivity growth in the future (Ma, 2006).

The law of one price for tradable goods: Failures of the law of one price have been observed for tradable goods in specific instances.⁵ Goods and services are not homogeneous across countries but are differentiated at minimum by country of origin.⁶ Supply and/or demand side factors that raise the volume of tradable production move the home country down the global demand curves for its product varieties, reducing its supply prices and resulting in deterioration in the terms of trade and a depreciation of its real exchange rate. Factor endowment growth and changes in policy that lead to substitution in demand for home products therefore depreciate real exchange rates.

Labour arbitrage: In most developing economies, there is a Harris-Todaro gulf between wages in the modern and rural sectors. If labour mobility between the rural and industrial sectors is inferior to that between the rural and service sectors (particularly the construction sector), then industrial productivity growth does not necessarily drive up service wages or service costs, at least not to the same extent on average.⁷

*Closed capital account:*⁸ The assumption that the real exchange rate depends only on interactions among countries associated with trade in merchandise is clearly violated in many of today's developing countries, and particularly in China. Its violation, in concert with failures of the law of one price for traded goods, means that any influx of payments (in the form of a foreign direct investment, portfolio capital flow or a repatriation of official foreign reserves) raises home aggregate demand. Since traded goods are supplied more elastically via imports than are non-traded goods — which depend on home resources—such an influx must raise relative non-traded prices and therefore appreciate the real exchange rate. Conversely, effluxes like China's extraordinary foreign reserve accumulations cause depreciation.

⁵ See, for example, Bergin et al. (2006); Crucini et al. (2005); and Drine and Rault (2005).

⁶ This is a standard assumption in the most widely used numerical models of open economies and global trade. See, for example, Dixon et al. (1982); McKibbin and Sachs (1991); Hertel (1997); and Dixon and Rimmer (2002).

⁷ Evidence for this is offered by Chang and Tyers (2008).

⁸ Here we adopt a working definition of the capital account as broadly including all flows on the balance of payments associated with asset acquisition. As such, it encompasses the more narrowly defined capital account, the financial account and official reserve transactions.

Allowing for failures of the law of one price for tradable goods, there are numerous other forces tending to depreciate the real exchange rate in the long term. During the past two decades one such force has been China's 'demographic dividend', stemming from the high proportion of working-aged people in the total population. This, according to Cai and Wang (2005), accounted for about one-quarter of per capita GDP growth between 1980 and 2003.⁹ It has played a critical role in keeping wages and hence the real exchange rate low, thereby enabling the rapid expansion of labour-intensive manufactured exports. Eventually, however, the "one child policy" will age the population, having the opposite effect, placing upward pressure on real wages and the real exchange rate.¹⁰

Another potential driver of China's real exchange rate is education and training. Fogel (2006) shows that increasing secondary and tertiary enrolment ratios have a sizeable impact on the per capita GDP growth rate.¹¹ To the extent that services are skill intensive (as they are according to past data), this will boost performance in the service sector—again, tending to depreciate China's real exchange rate.

Modelling the impacts of growth shocks on the real exchange rate

Here we examine quantitatively the relationship between shocks associated with China's economic growth and its real exchange rate. To do this effectively, a numerical model is required that is global in scope and that incorporates the generalisations of the BSH discussed above. Recall that these included productivity growth in non-tradable as well as tradable sectors, departures from the law of one price for tradable goods, a more sophisticated representation of the labour market and an open capital account. With these generalisations, almost all shocks to the economy have implications for the real exchange rate.

Drawing on Tyers and Golley (2008) and Tyers et al. (2008), we use a multi-region, multi-product dynamic simulation model of the world economy that subdivides the world into 14 regions, with China defined to include Taiwan and Hong Kong.¹² Industries are aggregated into three sectors: food (agriculture, including processed foods), industry (mining

⁹ See Bloom and Williamson 1998 for a generic discussion of the demographic dividend in developing countries.

¹⁰ Golley and Tyers 2006 confirm this, finding that the non-working aged dependency ratio could rise to 43 per cent.

¹¹ For example, he calculates that if the tertiary enrolment ratio rose from six to 25 in the next 20 years (putting China where the Western European nations were in 1980), the growth rate of labour productivity would rise by 4.4 per cent between 2000 and 2020, and that this would account for more than 60 per cent of the per capita GDP growth target set in 2002. With the tertiary ratio increasing from 12.5 per cent to 19 per cent between 2000 and 2004, if anything, his estimates could be too conservative.

¹² The regions are Australia, North America (Canada, US, Mexico), Western Europe, Central Europe and the former Soviet Union, Japan, China, Indonesia, Other East and Southeast Asia, India, Other South Asia, Latin America, Sub-Saharan Africa, North Africa and the Middle East and the rest of the world.

and manufacturing) and services (including construction)—the latter being little traded in comparison with the other two. Failures of the law of one price are represented by product differentiation, so that consumers substitute imperfectly between products from different regions. As in other dynamic models of the global economy, the primary endogenous component of simulated economic growth is physical capital accumulation. Technical change is introduced in the form of exogenous productivity growth that is sector and factor specific, allowing the analysis of productivity performance that differs between tradable and non-tradable sectors.

Regional capital accounts are open and investors have adaptive expectations about real regional net rates of return on installed capital. In each region, the level of investment is determined by a comparison of expected net rates of return on domestic installed capital with borrowing rates yielded by a global trust, to which each region's saving contributes, adjusted by calibrated region-specific interest premiums. Lagged adjustment processes ensure, however, that financial capital is not fully mobile internationally in the short term, but that the paths of domestic and global interest rates become parallel, separated only by exogenous premiums in the long term. In representing China, general financial reform is represented by a diminution of the interest premium and this causes an unambiguous rise in Chinese investment and hence a decrease in its current account surplus and an acceleration in its rate of physical capital accumulation.

To augment the model's characterisation of changes in labour supply and quality, it encompasses both demographic and economic change. It tracks populations in four age groups, two genders and two skill categories: a total of 16 population groups in each defined region. The skill subdivision is between production labour (unskilled) and professional labour (skilled).¹³ Each age-gender-skill group is represented as a homogeneous sub-population with a group-specific birth and death rate, labour force participation rate, saving rate and rates of immigration and emigration. Because the non-traded sector is relatively intensive in skill, trends in skill composition prove to be particularly important. These depend on the rate at which each region's education and social development institutions transform unskilled (production-worker) families into skilled (professional-worker) families. Each year a particular proportion of the population in each production-worker age-gender group is transferred to professional status. The initial values of these proportions depend on the

¹³ The subdivision between production workers and professionals and para-professionals accords with the International Labour Organisation's occupation-based classification and is consistent with the labour division adopted in the GTAP Database. See Liu et al. (1998).

regions' levels of development, the associated capacities of their education systems and the relative sizes of their production and professional labour forces. Rates of transformation change through time in response to corresponding changes in real per capita income and the skilled wage premium.¹⁴

We focus on shocks associated with China's growth. The most significant of these are productivity increases, skill transformation rate increases, interest premium *decreases* (*increases* in net financial inflows) and tariff *decreases* (*increases* in openness). In each case, we run a new simulation in which the determinant in question is shocked once and for all, as of 2005. We then extract the elasticity of China's real exchange rate to each shock, tracking the values through time to 2030. We focus on the bilateral real exchange rate, measured as in Equation (1), between China (including Taiwan and Hong Kong) and 'North America' (including Canada and Mexico), since this best parallels China's nominal exchange rate policy and the *renminbi* valuation debate. The results are summarised in Figure 4. Consider each determinant in turn.

Sectoral total factor productivity: The elasticities shown represent the percentage departure of the projected real exchange rate for each percentage per annum increase in total factor productivity. The appreciating effects of tradable (industrial) productivity increases are consistent with the BSH and are, as expected, due to wage growth and relative service price inflation. They are bolstered in the short term by increased investment and hence greater net inflows on the capital account. In the long term, however, the enlargement of the industrial capital stock reduces costs and hence offsets the real exchange rate gains. Also, as expected from the dominance of non-traded sector prices in Equation (2), faster service productivity growth depreciates the real exchange rate—modestly in the early years but to a dominant extent in the long term, when it is reinforced by associated capital accumulation.

Skilling of the labour force: When the skill acquisition rate is increased in China, where the unskilled (or production) worker population is larger than its skilled (or professional) counterpart, the proportional boost to skilled workers is larger than the proportional loss of unskilled workers. The result is greater output and, other things being equal, a real depreciation. This tendency is enhanced by the fact that the services sector is comparatively skill intensive, so that the shock causes a relatively large boost to service output and hence a relatively large fall in the home service price (relative to North America). The result is a

¹⁴ China's skill share is projected to rise through time while that in its real exchange rate comparator, North America, remains static. The contrast is due to North America's higher initial skill share, its high rate of unskilled immigration and its higher fertility rate (Tyers and Bain 2006).

relatively large real depreciation in the long run. The elasticities in this case are percentage departures of the real exchange rate for each per cent of the production-worker (unskilled) population that is transformed each year. Defined this way, skill transformation places downward pressure on the real exchange rate of a magnitude similar to total factor productivity in services.

Financial influx: This is induced by a decline in China's interest premium. It raises investment and therefore increases aggregate demand and the real exchange rate. A positive demand-driven effect is therefore expected in the first instance. In the long term, however, when the effect of the investment on the capital stock is realised, the supply side dominates. More abundant and hence cheaper capital reduces production costs, yielding a real depreciation. The elasticity to investment premium decline (financial capital inflow) is large and positive in the short term, with the lag to the switch in sign measuring at least 15 years.¹⁵

Trade liberalisation: This switches demand away from home-produced goods and services towards imported varieties. For a single region, the supply of goods and services from the much larger foreign market is more elastic than that of home varieties, constrained as they are by local factor supplies and technology. The effect of the demand switch, then, is to reduce the relative prices of the home varieties and hence to depreciate the real exchange rate. The elasticity is constructed by dividing the percentage change in the real exchange rate by the percentage point change in the import penetration ratio (the ratio of the value of imports to the total value of domestic consumption). The shock on which it is based is a marginal reduction in all China's merchandise trade barriers.¹⁶ The elasticity, also shown in Figure 4, has the expected negative sign, and its magnitude grows through time. The growth in the magnitude of the elasticity through time is due to increased investment and hence capital growth. This occurs because the industrial sector, while it suffers from reduced protection, also benefits from lower tariffs on imported intermediate inputs.¹⁷

Decomposing the real exchange rate changes of 1997-2004

While it is clear that the BSH appreciating force has been in action in China, our generalisations allow consideration of countervailing forces and it is these that must have

¹⁵ A corresponding shock to group saving rates was also introduced with similar results except that increased saving raises financial outflow, other things equal, and therefore depreciates the real exchange rate in the short run.

¹⁶ The elasticity is insensitive to the scale of the liberalisation though not to the composition of China's protection. For the levels of protection embodied in the database for 1997, see Dimaranan and McDougall (2002).

¹⁷ This effect is discussed in detail in Rees and Tyers (2008).

prevented any significant real appreciation between the mid-1990s and the mid-2000s. Strong depreciating forces that might have caused this include skill acquisition, which helps control wage costs in the skill-intensive services sector and therefore non-traded output prices, trade reforms and financial flows on the balance of payments.

The elasticities presented in Figure 4 confirm that financial flows dominate in the short to medium run. The significance of this for China is clear from Figure 5, which shows that the saving-investment gap (the current account surplus) expanded substantially after the Asian financial crisis. This expansion in net *outflows* diverted domestic demand abroad and so placed *downward* pressure on China's real exchange rate. To see this, note that the equality of net inflows of payments on the capital account (net outflows on the current account)¹⁸ to the investment–saving gap follows from the standard aggregate expenditure and disposal identities.¹⁹ Defining net inflows as positive, the capital account surplus can be written as: $KA = S_{NF} - \Delta R = I - S_D$ where I is investment, S_D is total domestic saving, S_{NF} (net foreign saving) is net private inflow on the financial account and ΔR is the annual addition to official foreign reserves. In the presence of capital controls, S_{NF} is roughly equal to officially approved inward FDI.²⁰ Both sides of the equation are negative in the case of China, indicating net outflows. Extraordinarily, even though investment accounts for 45 per cent of China's GDP, more than half of its GDP is saved. While these outflows have surely been a depreciating force, the other two candidates may also have been important. The recent surge in overall income growth and urbanisation has seen an acceleration of skill acquisition and a boost to the service economy. At the same time, the lead-up to China's WTO accession saw a substantial reduction in trade distortions.

To separate the effects of each of these forces on the real exchange rate we begin with the baseline model simulation over the period 1997-2006. This simulation incorporates all measured changes in sectoral productivity, skill acquisition and trade liberalisation.²¹ Finally, the trade reform shocks associated with the WTO accession are from Rees and Tyers (2008: Table 3). Note, first, that, at eight per cent, the real depreciation over this period is larger than observed in Figure 2 because of the country aggregations. Hong Kong and Taiwan

¹⁸ For our working definition of the “capital account”, KA , see note 10.

¹⁹ The right hand side of this identity stems from the combination of aggregate expenditure on GDP, $Y = C + I + G + X + M$; the fact that GNP is $Y_N = Y + N$, where N is net factor income from abroad; the GNP disposal identity, $Y_N = C + T + S$, and the balance of payments, $BoP = 0 = KA + CA$, where the current account is $CA = X - M + N$.

²⁰ China's capital controls have been leaky but, as Ma and McCauley (2007) find, remain very effective.

²¹ The skill acquisition rates are calibrated using the model from wage and sectoral employment data, as described in Tyers and Bain (2006).

experienced larger real depreciations against the US in this period and Canada and Mexico both experienced real appreciations against the US. By the simulating each shock separately, the model is used to construct the decomposition summarised in Table 2.

Higher Chinese productivity growth is seen to have offered the expected BSH appreciating force. Net financial outflows on China's balance of payments and inflows on the North American balance of payments both tend to depreciate the Chinese real exchange rate. Similarly, skill acquisition (which reduces the cost of supplying mainly skill-intensive services) and trade reform offer the expected depreciating forces. In combination, the current account imbalances in both China and North America contribute a real depreciation of more than five per cent. Surprisingly significant, however, is the depreciating effect of WTO accession trade reforms, which contribute more than four per cent to the overall real depreciation. In the end, the current account imbalances prove to be, in combination, the most important depreciating forces to the mid-2000s.

The real appreciation since 2004

The exchange rate reforms launched by the Chinese authorities in July 2005 were intended to at least demonstrate a departure from the *de facto* fixed US dollar peg, nominally allowing the currency to fluctuate by up to 0.3 per cent each day. The appreciation accelerated in 2007 and the net nominal appreciation amounted to around 20 per cent by July 2008, after which the global financial crisis induced the Chinese government to return to the *de facto* US dollar peg. This round of revaluation was accompanied by significant domestic inflation, implying a substantially larger appreciation of the underlying real exchange rate after 2004 (Figure 2), amounting to at least 30 per cent. As is evident from Figure 3, the difference between the bilateral nominal and real appreciations was associated with faster growth of China's producer prices than those of the United States.

This change in the path of the real exchange rate is too recent for a detailed decomposition. Sufficient evidence does exist, however, to enable us to discuss some alternative hypotheses. In what follows we discuss a number of alternative explanations, eventually settling on one in particular.

Decreasing current account surplus: After a rapid increase in early 1990s, household saving rates fluctuated between 20 and 25 per cent during 1997-2006 (Tyers and Lu, 2009). The initial surge in household saving had been associated with the 1990s round of privatisation and restructuring, which increased household funding responsibilities for health, education and retirement expenses. In more recent years the government has embarked on national

schemes for health and retirement insurance, including the extension of medical pension insurance to cover rural areas and the establishment of urban subsistence security systems.²² These have lessened this concern, leading at least to the stabilisation of household saving rates. At the same time, a surge in government spending commenced with the onset of the global financial crisis after 2007. This reduced the government's contribution to national saving. As shown in the Figure 5, the Chinese current account surplus has stabilised since 2005 and recently contracted. The prior period of real depreciation had been associated with the expansion of this surplus and hence the diversion of increasing shares of Chinese income into expenditures abroad. The cessation of this trend would at least stem further real depreciation.

Increasing oligopoly rents: Lu et al. (2008) point out that Chinese state-owned enterprises (SOEs) still dominate industries such as metals, motor vehicles, aircraft, transport, telecommunication, finance and insurance and that they became extremely profitable during the 2000s. Tyers and Lu (2009) attribute these profits to oligopolistic behaviour and see the associated rents as having expanded with the post-accession growth surge, financing the huge corporate savings of the period. The effect of these rents on China's real exchange rate has two channels. First, higher mark-ups in largely non-traded industries raise prices and hence cause appreciation. Second, the rents gained by SOEs comprise a primary part of corporate saving, which has tended to divert Chinese expenditure abroad and thus depreciate the real exchange rate. As Tyers and Lu show, the latter effect was dominant to 2005. The more recent decline in the corporate saving rate (Bayoumi et al. 2009) may have shifted this balance toward the appreciating effect of the mark-ups.

Slowing-down of trade reform: China's 2001 WTO accession saw a wide range of tariff cuts and market-opening policy changes. Since then trade reform has slowed.²³ As discussed previously, trade liberalisations depreciate the real exchange rate and so this slow-down might be seen as at least relaxing depreciating pressure. Yet trade reforms are never Pareto improving without compensation. The sector bearing the most negative effects from the WTO accession has been agriculture, the stagnation of which in the early years after the WTO accession probably contributed to the substantial rural-urban migration of the period (Chang and Tyers 2008; Rees and Tyers 2008). Since then a major concern of the central government

²² See Chamon and Prasad (2008), Wen (2008).

²³ According to the WTO's *Trade Policy Review* (2008), the tariff is still one of China's main trade policy instruments. The overall average applied MFN tariff was 9.7% in 2007, the same as in 2005. The average applied MFN tariff rates for agricultural and non-agricultural products were 15.3% and 8.8%, respectively, also the same as in 2005.

has been the welfare of farmers and other rural dwellers. Unlike the corresponding experiences of Japan, Korea and Taiwan during their growth surges, because of the WTO commitment, China has not been able to address the rural-urban divide using trade protection (Anderson et al., 1986; Anderson, 2009; Duncan et al., 2008). A consequence has been a trend from negative assistance to agriculture in the early reform period to positive and significant protection today, channelled via domestic marketing, transport, storage and other budgetary assistance, allowed under WTO rules for developing countries.²⁴ Beyond agriculture, a number of trade-biased policies have emerged that cut against the spirit of the pre-accession reforms. Since 2005, the value-added tax (VAT) rebate for exporting firms has been re-raised nine times up to 17%, covering approximately 3800 export products, including textile, clothing, toys, machinery, electric appliances, medicines, communication devices and steel.²⁵ Such export encouraging policies divert home supplies abroad, raising the relative prices of domestic goods and hence appreciating the real exchange rate.

Rising relative wage costs: The sectoral price indices of Figure 1 are revealing in that, since the mid-2000s they do not show any rise in the prices of services (the “tertiary” and construction sectors) relative to the tradable goods sectors. This suggests that the appreciation since 2004 is not due to the BSH force (relatively high productivity growth in China’s tradable sectors). Indeed, the striking change is in the price index for primary products, indicating a substantial improvement in the agricultural terms of trade. While this is due in part to higher prices of import competing commodities, we have already seen that there have been a number of favourable changes to policies affecting agriculture and the rural sector generally. These changes would have raised the marginal product of rural labour and therefore the incentive required for rural workers to migrate to Eastern cities.

A simple analysis suggests a structural change in real wage growth for the agricultural and construction sectors around 2004, as indicated for agricultural wages in Figure 6. The labour forces in these sectors are mainly unskilled and the rural labour market is the source of most non-*hukou* workers in construction, other services and manufacturing. The official

²⁴ Huang et al. (2009) show the trend in assistance to agriculture clearly in Table 3.5. Still more recently, the speech by Wen (2010) indicates the central government plans to raise the agricultural subsidy to 133 billion Yuan in 2010. The same speech indicates that agricultural tax reductions were carried out in Anhui province in 2000 and were then extended to 30 provinces in 2003. By 2005, agricultural production taxes were completely cancelled in 28 provinces. Farmers’ benefits were estimated at 133.5 billion Yuan per year.

²⁵ See Ministry of Commerce of the People’s Republic of China (2009).

agricultural real wage grew at 3.1 per cent per year (with standard error 0.0012) in the period 1994-2004 and at 4.7 per cent per year (with standard error 0.002) in the period 2005-2008.²⁶

In their study of the real wages of unskilled factory workers in Guangdong, Meng and Bai (2007) used payroll data to ensure the inclusion of non-*hukou* workers. They show a much smaller annual growth rate of between 0.5 and 1.5 per cent per year up to 2004, controlling for education and firm tenure. The take-off in rural wages after that time suggests, however, that real non-*hukou* rates have increased since, and this is to be expected from the improvements in net returns from agricultural activity. Increasingly, it is likely that potential “floating workers” are choosing to continue their rural employment. Anecdotal indications of tightening labour markets have been abundant, including increased labour unrest suggesting improved labour market power in manufacturing provinces.²⁷ What is in evidence is a slowing of urban labour supply growth, which drives up the cost of both tradable and non-tradable goods relative to China’s trading partners, and hence causes the real exchange rate to appreciate. While this seems to be associated with agricultural incentives in the short term, along with improvements in infrastructure that have boosted local services sectors, in the long term the prospect can only be for a continuation. This is because demographic change already long in train will see China’s total labour force begin to decline during the next decade (Cai and Wang 2006, Golley and Tyers 2006). In short, this change may be heralding the end of the era of the Dooley et al. (2003) “revived Bretton Woods *trade account*” regions generating export growth on the back of surplus rural labour, at least so far as China is concerned (Feenstra and Hong 2007).

4. Macroeconomic Policy and the *Renminbi*

The real and nominal exchange rates are linked by definition (Equation 1) as $e_R = P_Y / (E P_Y^*) = E \cdot P_Y / P_Y^*$, where E is the nominal exchange rate (in foreign currency per unit of home currency), P_Y is the price of the home product bundle (the GDP price) and P_Y^* is the corresponding foreign GDP price. Since the foreign price level is outside the realm of home monetary policy, changes in the real exchange rate (determined as discussed in the previous sections) are transmitted domestically through changes in either the nominal exchange rate or the home price level. The choice as to how these are combined is a matter

²⁶ The growth rates were obtained from a simple OLS regression of the log of the nominal agricultural wage deflated by the CPI against time. The standard errors on the growth rate coefficients in both regressions are very small, suggesting the growth rates are significantly different.

²⁷ Strikes at key joint venture plants and other activism led to substantial increases in manufacturing wages in 2009 in engine room provinces of Guangdong and Zhejiang (Gardner 2010).

for home monetary authorities. By adjusting the supply of home money via the short interest rate or bank reserve requirements, a real appreciation can be transmitted at one extreme as a nominal appreciation (inflation targeting) or, at another, as an inflation (exchange rate targeting). This is complicated, particularly in China's case, by the dependence of the real exchange rate on capital account flows, which are dominated by reserve accumulation, where the choice of reserves is also an instrument of monetary policy.

Reserve accumulation and monetary mercantilism

China's reserve accumulation has led to allegations of 'monetary mercantilism' (Aizenman and Lee, 2006). It is implied that reserve accumulation is chosen freely in order to keep the real exchange rate low. In our view the monetary mercantilist critique is misplaced. The root of its unfairness is evident from the identity derived previously, $KA = S_{NF} - \Delta R = I - S_D$ and, therefore $\Delta R = S_D - I + S_{NF}$, where S_{NF} includes approved FDI and illegal private inflows. As long as total domestic savings exceed investment and capital controls prevent the matching of inward FDI by private outflows, ΔR must be positive. Indeed, under certain conditions we can state that *China's current account surplus must be matched by reserve accumulation and the imbalance is not amenable to feasible changes in macroeconomic policy, narrowly defined.* Those conditions are:

- 1) the capital controls are justified on stability grounds,
- 2) the high private saving rate is impervious to macroeconomic policy in the short run,
- 3) government revenue is increasing so quickly that the government cannot easily offset private saving with public dis-saving, and
- 4) investment is already beyond absorptive capacity at 45 per cent of GDP.

Consider each of these in turn.

Capital controls: The capital controls are conceptually simplest. They stem from "fear of floating" and short memories of the currency run with which China was threatened in the late 1990s during the Asian financial crisis. Moreover, some PBC suspicions remain as to the prudential reliability of China's commercial banks in exchanging large volumes of foreign currency. Financial institutions are variously perceived as not sufficiently distant from decades of soft budget constraints associated with the channelling of government subsidies to state-owned enterprises through accumulated debt. And there are concerns that the commercial banks lack access to or sufficient experience with derivative markets for currency

and debt instruments to do the necessary hedging. Though their continued effectiveness is vouched for by Ma and McCauley (2007), the controls are slowly being relaxed.

The high saving rate: As indicated earlier, China's high private saving rate is due to comparatively high household saving and extraordinarily high corporate saving. While the former has ceased to rise and is expected to decline slowly with time as health and retirement insurance systems develop (Chamon and Prasad 2008), the latter, as argued by Tyers and Lu (2009) is due to the profitability of key state owned enterprises and is therefore an issue for industrial policy, which will take time to resolve. The causes of high saving are therefore deeply structural and the subject of long term programs of microeconomic policy reform. None is amenable to action by the central bank alone.

The level of investment: As noted by Xiao (2006), it has been suggested that the surplus of saving over investment implies that the rate of investment is too low. At 45 per cent of its GDP, however, China's investment is extraordinarily high. It is difficult to imagine how additional projects might be conceived and implemented given service sector planning and facilitation constraints. Moreover, China's low official domestic financing rates notwithstanding, recent surveys by the PBC show that a very substantial proportion of investment still takes place through the informal sector at rates that remain high by international standards. It will take some time yet for financial intermediation costs in China to fall to developed country levels and so financing costs must continue to be a break on investment.²⁸

Government dis-saving: Prior to the global financial crisis, China's fiscal policy maintained a tight balance between revenue and expenditure. During the crisis the government committed to a substantial fiscal expansion, including an ambitious program of infrastructural investments, with a view to reducing the national saving rate and raising private consumption expenditure. This prospect faces two difficulties. First, public infrastructure investment to that point already absorbed a larger share of GDP in China than in any other developing country of comparable income per capita (Roland-Holst et al. 2005). Second, revenue collections have grown faster than China's GDP as its tax system has improved in effectiveness and as more of China's economic activity has occurred in the relatively taxable

²⁸ The effect of high financial intermediation costs on China's growth rate is modelled by Tyers and Golley (2010).

“modern” sectors. It is yet unclear whether the accelerated spending has outpaced revenue collections. Certainly there has yet been no dramatic rise in government bond issues.²⁹

This support of the “four conditions” suggests that the Chinese government has little true discretion over its rate of reserve accumulation and therefore over the rate at which domestic income is diverted into expenditure abroad, weighing on its underlying real exchange rate. The extent to which the national saving rate has stabilised very recently suggests, however, that reserve accumulation may be a more neutral force in future.

Liquidity and sterilisation

Through 2008 at least, the PBC absorbed foreign currency inflows (export revenue) net of import costs because, short of long term reforms affecting financial depth and while the capital controls remained, the Chinese commercial banks could not move the required volume of foreign currency. This required acquisition of this foreign currency surplus with newly minted domestic currency. To avoid excess liquidity, annual reserve increments were sterilised. PBC holdings of domestic credit were insufficient for this sterilisation, however, so ‘sterilisation bonds’ were issued on the debit side of the balance sheet shown in Table 3.

Just as the reserves have come to dominate the asset side of the balance sheet, sterilisation bonds assumed significance on the debit side. In effect, the PBC has acted as a conduit for domestic savers who might otherwise acquire foreign assets but are restricted from doing so by capital controls. The pressure from abroad to revalue therefore creates two difficulties for the PBC. First, since the assets of the PBC are primarily in US dollars and its liabilities are in *renminbi*, too prompt an appreciation of the *renminbi* would result in substantial losses that would need to be covered in *renminbi* from the government budget. This concern was addressed in 2007 with the issue of US\$ 200 billion in government debt to be exchanged with the PBC for reserve assets, the latter to be maintained by China’s “sovereign wealth fund”, the state-run China Investment Company (CIC).³⁰

As shown in Figure 7, this sterilisation process kept a lid on the monetary base as a proportion of GDP until the mid-2000s. Liquidity growth was substantial thereafter. It is our

²⁹ According to the Ministry of Finance, during 2006-2009, the Chinese government issued bonds worth 888, 798, 862 and 778 billion Yuan, respectively, showing no increasing trend. Besides this, 1550 billion Yuan in special bonds were issued in 2007, and exchanged with the PBC for the equivalent from its stock of reserves. The result was a substitution on the asset side of about 8% of GDP from reserves to domestic credit.

³⁰ The CIC takes the formerly-established “foreign exchange financial investment company” (the *Hui Jin Co*: literally translated as foreign exchange and gold) as its subsidiary. *Hui Jin* mainly does equity investment in domestic financial industries while its parent company CIC focuses on overseas investment. Thanks are due to the PBC for this detail.

view that this has stemmed from the on-going financial reforms, which have greatly expanded commercial bank intermediation (in place of pre-existing and relatively costly informal credit structures and credit cooperatives). This has been valuable but the associated expansion in deposits has also boosted overall money supply growth, contributing since 2006 to inflationary pressure. The PBC responded with higher bank reserve requirements and higher short interest rates. The latter added to speculative (illegal) private inflows driven by the expectation that the RMB would be allowed to appreciate further, bringing upward pressure on the real exchange rate in the lead-up to the global financial crisis and since. As Figures 2 and 3 show, however, during the crisis the drop in export demand caused a temporary real depreciation. The return to the de facto peg then necessitated contractionary monetary policy and a temporary deflation.

The effect of relaxing capital controls

As capital controls are relaxed, a key issue will be the extent of private outflows on the financial account. Prasad et al. (2005) point to the potential for this to create a depreciating force as Chinese private investors seek to diversify their portfolios. The scale of this force depends on whether the PBC's existing foreign reserves are the equivalent of the private sector's desired foreign holdings. A crude assessment of this can be made by comparing the foreign shares of collective portfolios across developed and developing countries. Assets are many and various and net positions are poorly documented, however. For a sample of countries we have constructed a crude approximation to foreign shares in collective portfolios using estimates of capital stocks and recorded flows on balances of payments. The results require a sceptical eye, since capital stocks are measured differently across countries and foreign shares can be expected to be higher in smaller and more open economies irrespective of their levels of development, as in the cases of Hong Kong, Singapore and the UK.

The resulting foreign asset shares are listed in Table 4. The countries are then ranked on their estimated foreign shares in Table 5. Most striking is that, large official foreign reserves notwithstanding, China ranks rather low on the list, even when compared with other Asian developing countries. Its foreign share appears to have doubled between 2000 and 2005 and its ranking rose. By 2005 it ranked above Japan, Korea, Thailand, India and Brazil but below the other developed countries and Malaysia, Taiwan and Chile. Its ranking above Japan and the other two of the world's very large developing countries, India and Brazil, suggests its foreign share may be on the high side, though none of these economies is as open

as China already is to foreign trade and ownership (Lardy 2006). On the other hand, its ranking below the developed countries suggests that continued growth, combined with comparative openness, will take its share higher. At the very least, these results do not lend clear weight to the thesis that financial liberalisation will automatically raise private inflows and appreciate the RMB. Moreover, a surge in private rebalancing outflows could prove a healthy outcome since the PBC could readily offset this by repatriating its reserves and sterilising the inflow by liquidating its “sterilisation bonds”. This would take the pressure off the CIC by restoring the PBC’s balance sheet to something more conventional as well as stabilise the home financial capital market.

5. Unilateral appreciation scenarios

If the tendency toward real appreciation since 2004 is indeed due to labour market tightening, it heralds a long term appreciating trend. This will make it easy for the PBC to allow a corresponding appreciation in the RMB. Any decision to revalue faster than the underlying rate of real appreciation would require further monetary tightening and possibly a return to the growth-sapping deflation of the late 1990s.

McKinnon’s (2004) sage preference for an East Asian dollar standard notwithstanding, the bilateral pressure by the US government for an RMB revaluation is understandable in one respect. Ignoring the benefits accruing to the US economy from Chinese investment, it perceives a substantial current account imbalance, a proportion of which stems from its bilateral trade with China, and it expects that a US\$ depreciation will help to correct it (Woo 2006). Not only does the inflexibility of the RMB rate frustrate the US government, inciting the critical rhetoric (Bernanke 2006) and the draft legislation to “punish” China (Callan 2007), but it also causes frustration in Europe, where the burden of appreciation against the US\$ is greatest.³¹

Ironically, while the refusal by some other Asian countries to appreciate their currencies significantly against the RMB might well be motivated by “monetary mercantilism”, we believe that the sluggishness of China’s appreciation against the US\$ is motivated internally. The sticking point is a fear of financial (including exchange rate) volatility, confirmed by adherence to the US dollar peg during the GFC. Were the Chinese government nonetheless to agree to revalue faster than the underlying rate of real appreciation, it could either undertake a substantial monetary tightening, and hence

³¹ See RGE Monitor, 2007a. European rhetoric also represents this view, as in a speech by Pascal Lamy, then EU Trade Commissioner, on 23 December 2003.

experience a further deflation, or it could accelerate the underlying real appreciation with a return to distorted trade.

Appreciation by monetary contraction

In the absence of any substantial upward movement in the underlying real exchange rate, the PBC could simply declare a higher US\$/RMB rate. This is the option advocated by Tung and Baker (2004), who suggested a 15% one-off revaluation and argue that the risk of consequent deflation is minimal, due to inflationary pressure from other sources. In the absence of an underlying appreciation of the real exchange rate, this argument lacks foundation.³²

The defence of the stronger RMB would require a contraction of the domestic money supply (or a slowdown in its growth) and a boost to domestic short term interest rates and other financing barriers. If the revaluation were large enough the result would likely be a return to the deflation of the late 1990s and this would hurt employment in the tradable goods sectors. Income would decline (or grow more slowly), as would consumption and saving. Slower employment growth in the modern sector would reduce capital returns and, combined with higher financing costs, this would also contract investment (or reduce its growth), and so the implications for China's external imbalance would then depend on the relative size of the saving contraction. For external balance there are, therefore, two cases to consider.

Optimistic households: If Chinese households are optimistic they expect that the contraction is temporary and unrestrained growth will be restored in the future. Faced with reduced current income they would then smooth consumption by reducing current saving. Even with such a reduction in the saving rate, however, our simulation shows that the effect of lower employment growth on capital returns causes a bigger *proportional* fall in investment than in saving. Total domestic saving is initially larger than investment, so the reduction in saving still outweighs that in investment and the net effect is to reduce China's current account surplus. This result is indicated in the first column of Table 6. There is a real appreciation against North America and a slight reduction in the latter's current account deficit. In addition, there is a slight addition to North America's politically sensitive industrial employment, though this comes at the expense of a service sector employment contraction due to North America's real depreciation against China. Both China and North America

³² This is broadly consistent with the view expressed by Huang (2010).

suffer losses in overall GDP and real income per capita. The loss in China is substantial, however, amounting to almost a year's growth.³³

Pessimistic households: A second possibility is that Chinese households are pessimistic and believe that the contraction is permanent. In response to the monetary contraction and reduced income they would then exhibit behaviour seen in Japan in the 1990s, smoothing their consumption forward and raising their saving rate.³⁴ As shown in the second column of Table 6, this exacerbates the contraction in Chinese economic activity and income. Moreover, because saving does not fall and investment does, China's current account surplus is raised. The additional financial outflow causes a real *depreciation*, suggesting that, to achieve a particular nominal appreciation target, the monetary contraction in this case would need to deliver a larger deflation than before (Equation 1). Internationally, this shock reduces global interest rates and raises North America's current account deficit. Even though there are small gains in North America's terms of trade and real income, the exacerbation of current account imbalances and the associated decline in industrial employment would further frustrate the US politically. It is difficult to conclude other than that there is little to be gained from RMB appreciation by monetary contraction.

Taxing trade

The other "unhealthy" approach to a unilateral appreciation is via trade distortions. We can dismiss a rise in import tariffs as fanciful, since China's WTO accession conditions offer very little room between applied and bound tariff rates. In any case, the returns from the resulting openness have been so considerable that trade policy reversals are unlikely to rise much above the radar. Export restraints are possible, however, of the type followed by Japan in the late 1980s, when it was under similar pressure from the US. Since these are not directly protectionist and hence would not attract mercantilist objections from abroad. In principle at least, like import tariffs, they might be expected to divert domestic demand from foreign to home products and thereby appreciate the real exchange rate, allowing the central bank to also appreciate the nominal exchange rate. The downside is that they would also be a tax on the most rapidly expanding sectors in the economy and so they would sacrifice growth in urban employment and income.

³³ The simulations described here are indicative only, since the model lacks a closure with forward looking expectations. Here we try to capture the range of possible impacts by simulating optimistic and pessimistic scenarios.

³⁴ Ito (2001: Ch 11, 329-333) shows that, in the post Plaza Accord period the Yen appreciated substantially against the US\$ and Japan's current account surplus rose at the same time, even while real investment also rose.

Our simulation is of the short run impacts of an export tax of 15% graduated over 2007-2009 and levied only on industrial exports. As previously, we consider scenarios with both optimistic and pessimistic households. Surprisingly, as shown in the final two columns of Table 6, in both cases China experiences robust real *depreciations* against North America. This is because China's current account surplus rises even in the optimistic case in which the saving rate falls temporarily. This contradicts the expected story because that emphasises substitution in *final* demand. The true story is about intermediate demand. China's export manufacturing sector relies to an extraordinary extent on imported components, mostly from Asian trading partners.³⁵ When the export tax contracts this sector, imports are similarly contracted. Total exports, in fact, contract by a smaller proportion because there is offsetting expansion in agricultural and service exports that are not intensive in imported inputs. The net effect is an expansion in China's trade surplus.

In North America the current account deficit rises and, as before, there are only small changes in real GDP and real per capita income. Importantly, however, China's export restraints do raise North American industrial employment, again at the expense of services employment, even though North America experiences a real appreciation against China that would otherwise advantage the services sector. In either case, at least in the short run, export restraints would not make it easier for the PBC to appreciate the RMB; in fact quite the opposite.

6. Conclusion

Relative to the US, Chinese productivity has grown faster in the tradable than in the non-tradable sectors, real wages have also grown faster and there has been relative service price inflation. The flat trajectory of its real exchange rate between 1990 and 2004 is therefore a contradiction of the BSH, the resolution of which requires generalisation to incorporate failures of the law of one price for tradable goods, open financial capital markets and a more sophisticated representation of the labour market. This opens the way for depreciating forces that have been offsetting the BSH, including net financial outflows on the balance of payments associated with China's excess saving along with trade and other microeconomic reforms. Decomposition of the flat trajectory of the real exchange rate over

³⁵ An important empirical literature is developing around China's role as an assembler of components made in other Asian countries. Part of the reason for China's bilateral trade surplus with the US is that this intra-Asian trade is reducing the bilateral surpluses of other Asian economies with the US while it exacerbates that of China. See, for example, Athukorala (2005, 2007).

1997-2004 reveals that the BSH is most strongly offset by the excess saving and the associated expansion of net outflows on its capital account, along with a significant additional contribution from WTO accession trade reforms. China's real exchange rate began appreciating in the mid-2000s when the national saving rate stabilised and trade reforms petered out. An examination of the trends in relative product prices and real wages in this period suggests that the real appreciation is not due to a resumption of a dominant BSH. Instead it appears to be due to tightening rural labour markets associated with improvements in the agricultural terms of trade, combined with slowing overall labour force growth.

While much attention is paid in the literature to the "undervaluation" of the *renminbi*, it is in our view incorrect to blame this on China's monetary policy, narrowly defined to include the exchange rate target and the accumulation of foreign exchange reserves. The key constraints are capital controls, motivated by concern about financial (and exchange rate) stability in the face of the relative immaturity of its commercial banking sector, and structurally determined high savings. While ever these remain, reserves will accumulate and exchange rate adjustment will not address the current account imbalance. The only "healthy" way to appreciate the RMB will be to follow the path of the underlying real exchange rate. We show that defiance of this principle in the form of a unilateral appreciation by monetary contraction would be very costly to China, and it would most likely hurt the rest of the world by tightening capital markets and changing the terms of trade adversely. Moreover, if Chinese households were to react pessimistically to the shock, the current account surplus could be enlarged, backfiring on those who clamour for an appreciation to address global imbalances. The other conceptually feasible, but no more healthy, approach to a unilateral appreciation is via the imposition by China of a tax on manufactured exports. As it turns out, because China's export manufacturing sector relies so heavily on imported components, such a tax would actually exacerbate the trade surplus by cutting imports in proportion with manufactured exports while expanding other less import-dependent exports. This would increase China's current account surplus while sacrificing considerable growth. It would hurt the North American economy overall.

In the near term, with an appreciating trend in the underlying real exchange rate, it is reasonable for the central bank to allow a unilateral nominal appreciation of the RMB to ease domestic inflation pressure. To the extent that this appreciating trend is not fast enough for political equilibria in China's trading partners, international pressure would best be focussed on key reforms, including smooth transitions to policies that better regulate large state owned enterprises and address the need for uniform systems of retirement and health insurance, all of

which will reduce the extraordinary saving rate. In the long term, whether there is a sustained upward trend in China's real exchange rate will depend on the relative strengths of appreciating forces, including tradable productivity growth, reduced savings and labour force decline, and depreciating forces that include productivity growth in its services sector.

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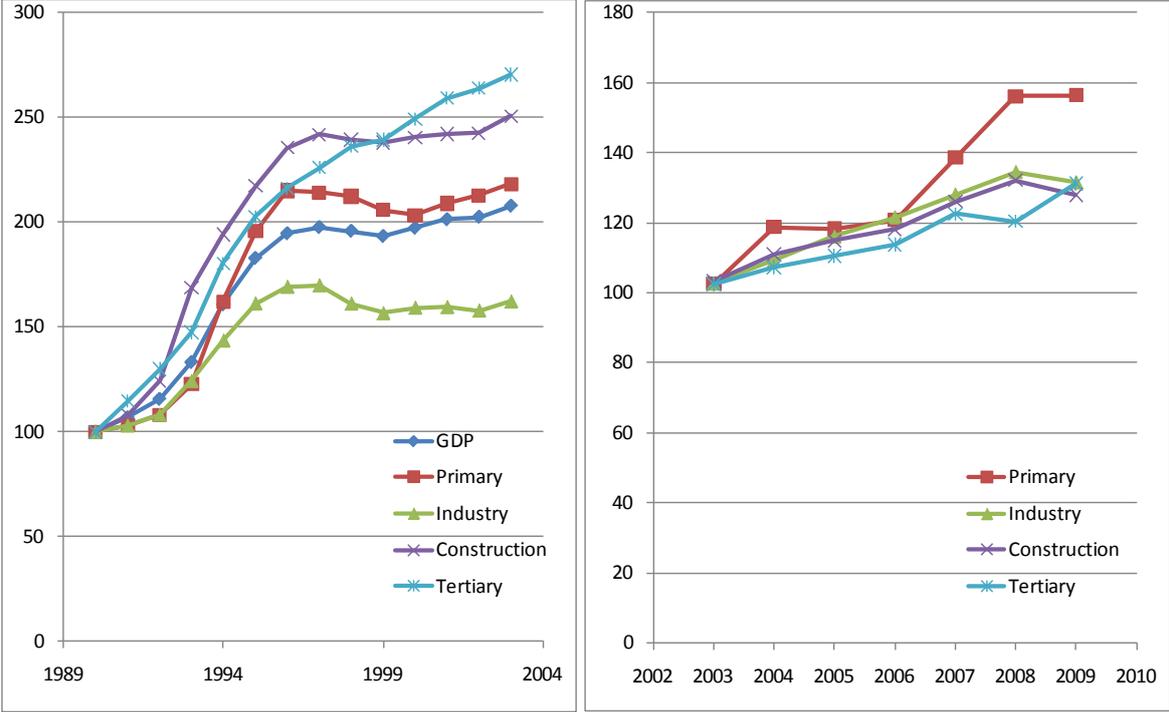
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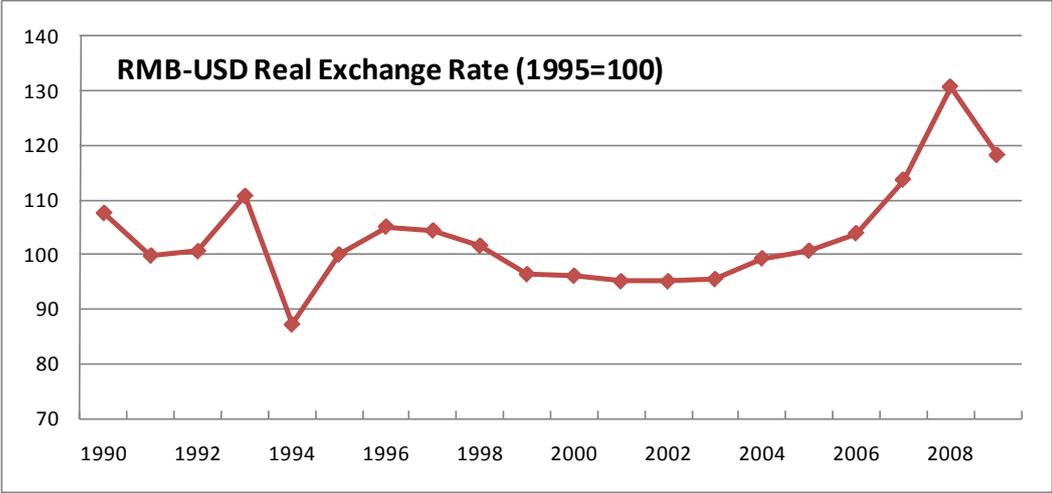
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Figure 1 Chinese sectoral price indices, 1990–2009^a



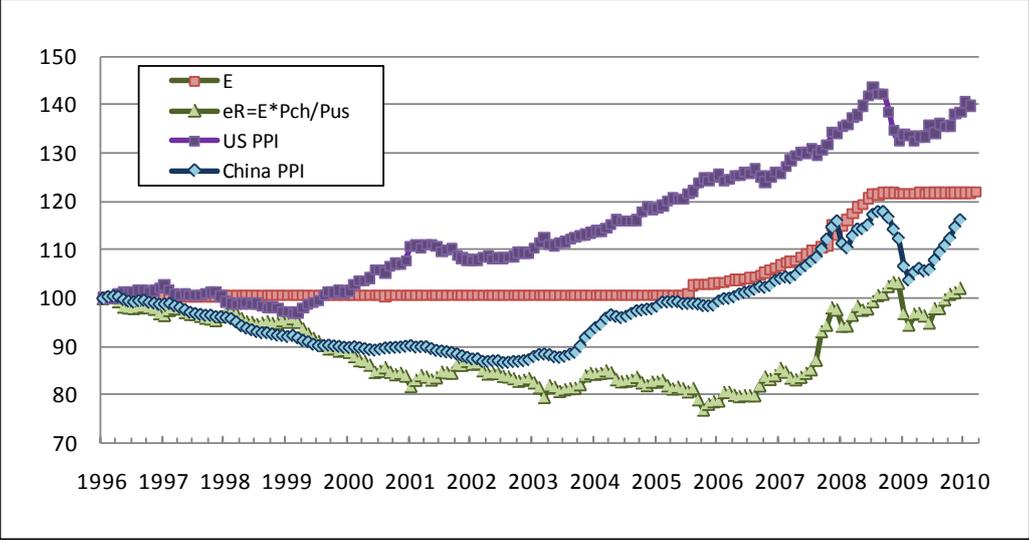
^a These are sectoral price indices for ‘Primary industry’, which is agriculture and rural services; ‘industry’, which is primarily manufacturing, and ‘construction’ (the latter two making up the “secondary” sector); and ‘tertiary industry’, which is other services.
 Source: The price indices are implied by volume and value data from the National Bureau of Statistics of China (NBSC) (2009).

Figure 2 The Mainland China – US real exchange rate on GDP prices^a



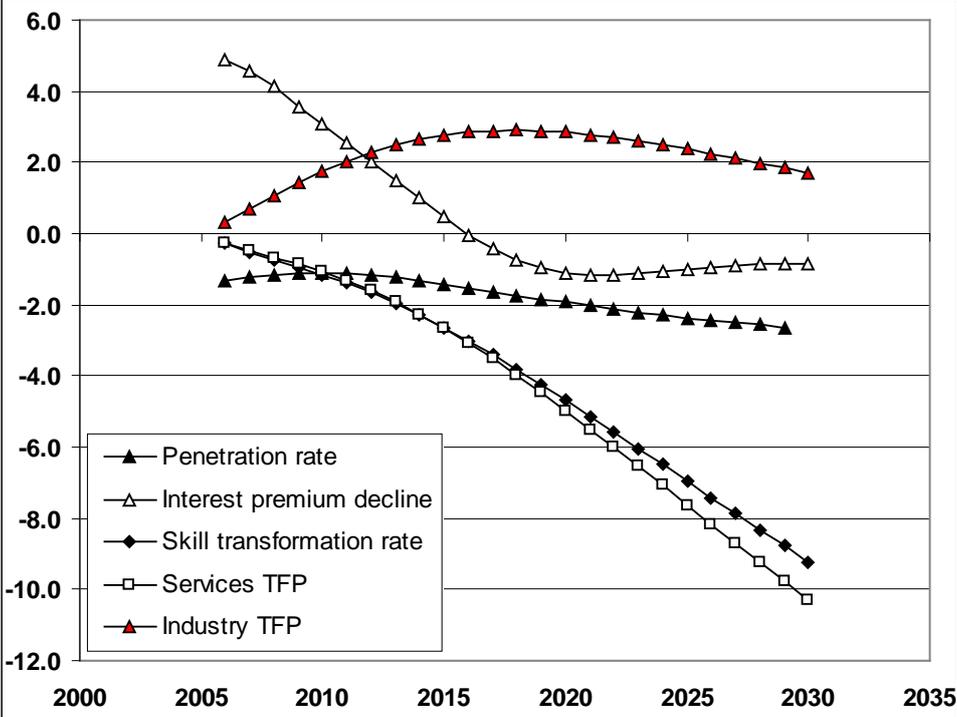
a. These are indices of nominal bilateral rates between mainland China and the US, deflated according to $e_R = E \cdot P_Y / P_Y^{US}$, where E is the nominal exchange rate in US\$ per unit of local currency, P_Y is the local GDP price and P_Y^{US} is the corresponding US GDP price.
 Source: IMF, *International Financial Statistics* (2009).

Figure 3 The Mainland China – US real exchange rate on producer prices^a



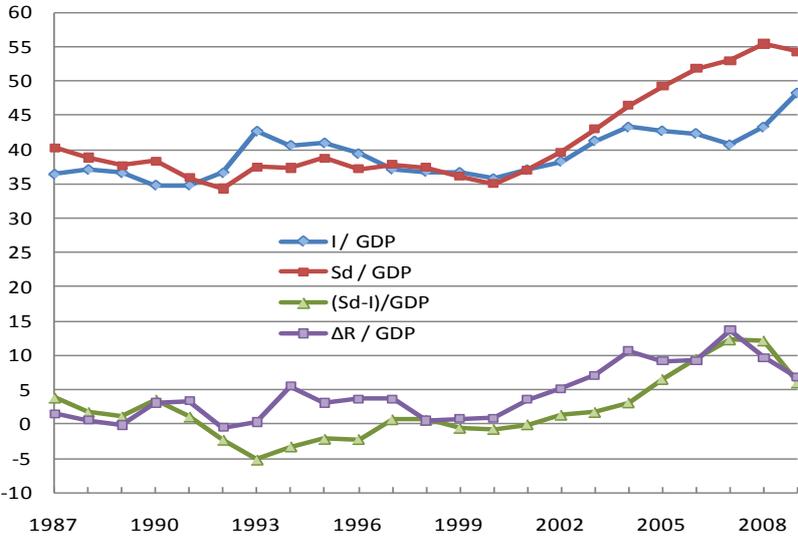
a. Here the home prices are, for the US, the Producer Price Index and, for China, the Corporate Goods Price Index. The Chinese index has more coverage of commodities and services, so this is a less than perfect comparison. The implied real exchange rate is in black.
 Sources: IMF, *International Financial Statistics* (2009), National Bureau of Statistics of China (2009), the Bureau of Labor Statistics, USA.

Figure 4 Elasticities of the projected real exchange rate to its key determinants^a



^aThe penetration rate is the percentage departure of the projected real exchange rate for each percentage increase in the overall import penetration ratio, M/C , caused by tariff reductions that began in 2005.
 Source: Simulations using the model described in the text.

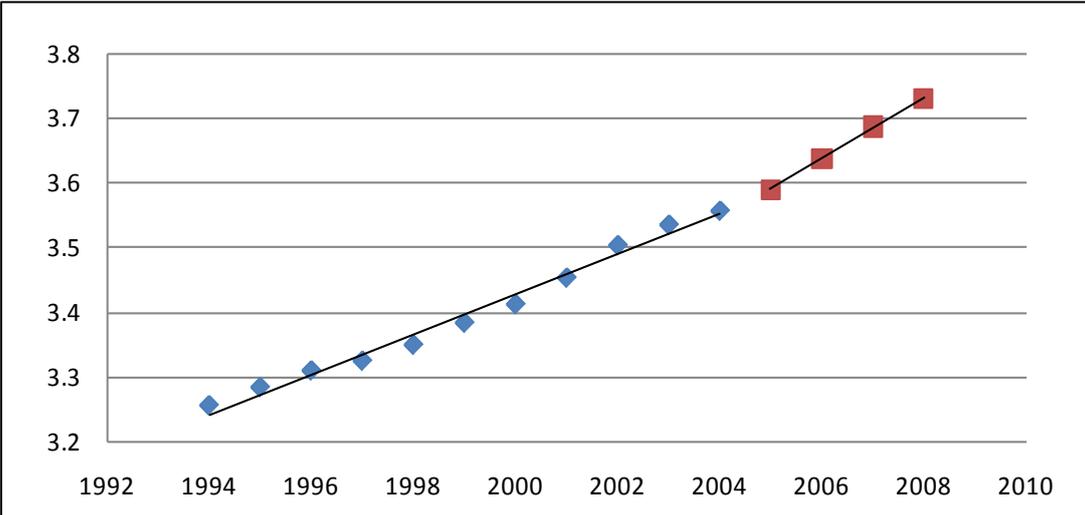
Figure 5 China’s investment–saving and external balances (percentage of GDP)^a



^a Since errors and omissions are large, we have adjusted the least accurately measured items in each sub-account (usually net factor income and net private flows on the financial account) to ensure balance.

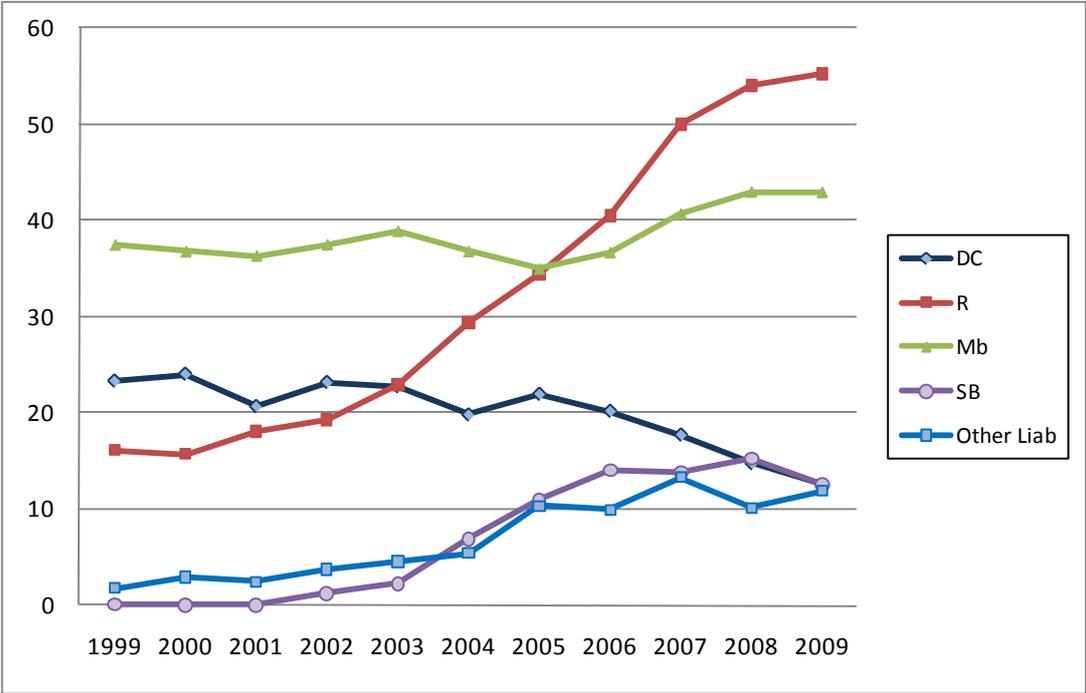
Sources: International Monetary Fund (IMF), 2009a. *International Financial Statistics*, April, International Monetary Fund, Washington, DC. International Monetary Fund (IMF), 2009b. *World Economic Outlook Database*, April, International Monetary Fund, Washington, DC; NBSC, China Statistical Yearbook 2009.

Figure 6 Real wage growth in agriculture^a



^a The vertical axis is the log of the real wage index where the agricultural nominal wage is deflated by the CPI. The nominal wage by sector and the CPI are from NBSC *China Statistical Yearbook 2009*.

Figure 7 Dynamics of the PBC’s balance sheet: assets and liabilities as % of GDP^a



Source: the People’s Bank of China.

Table 1: Estimated Chinese Total Factor Productivity Growth by Sector

% per year	Whole economy	Food	Industry	Services
1986-1989	3.5	1.4	3.8	3.8
1990-1994	5.0	1.6	7.7	2.3
1995-1997	5.7	5.5	3.7	3.2
1998-2001	4.1	-0.2	8.9	-0.5
2002-2005	6.0	5.4	6.3	4.6

Sources: Analysis of Chinese statistics described in Tyers et al. (2006). Original sources are, for output, *China Statistical Year Book* (2005), *China Industrial Economic Statistical Year Book* (every year after 1985) and *China Statistical Abstract* (2006). Employment data are from *China Statistical Year Book* (2005), *China Industrial Economic Statistical Year Book* (every year after 1985) and *China Labor Statistical Year Book* (every year after 1985). China's capital stock, in 2000 prices, is taken from Holtz (2006). Sectoral price indices are from *China Statistical Abstract* (2006). Urban employment is enlarged based on underestimation proportions from Cai and Wang (2006).

Table 2: Contributions to China's Real Exchange Rate Change, 1997-2006

Faster tradable productivity growth – Balassa Samuelson	+1.6%
Faster skill growth	-0.6%
WTO accession trade reforms	-4.2%
Influx on the financial/capital account of North America	-0.4%
Efflux on the financial/capital account (high saving rate)	-4.8%
Net effect over 1997-2006	-8.1%

Source: Comparison of baseline with counterfactual simulations of the model described in the text.

Table 3 The balance sheet of the People's Bank of China, ca. 2009

Assets	Liabilities
Domestic credit, DC Central bank claims on depository and other financial corporations and on the central government 13 per cent GDP	The monetary base, M_B Currency and bank reserves 43 per cent GDP
Official foreign reserves, R 55 per cent GDP	Sterilisation bonds, SB Debt to the Chinese public 13 per cent GDP
	Other liabilities, OL Includes government ownership 12 per cent GDP

Source: People's Bank of China, 2009. *Balance Sheet of Monetary Authority*.

Table 4 Estimates of the Foreign Share of Total Assets, Selected Countries^a

Country	Ratio of Foreign to Total Assets, %					
	2000	2001	2002	2003	2004	2005
China	10	9	9	12	14	18
Hong Kong	55	56	55	59	60	64
Japan	9	12	12	14	14	17
Taiwan	11	14	17	21	22	24
Korea	11	13	13	15	17	16
Malaysia	22	27	28	38	36	41
Singapore	48	50	51	57	57	58
Thailand	18	20	19	19	17	17
India	6	9	9	11	12	11
Brazil	5	6	8	8	7	5
Mexico	7	8	7	8	9	9
Chile	21	23	22	26	25	25
Australia	15	17	17	18	19	21
US	22	19	18	22	25	35
EU15	30	33	30	34	36	47
UK	63	63	52	54	54	68

^a Shares are approximated as the quotient of foreign financial and physical assets and total financial and physical assets. The numerator is the stock of capital owned abroad plus official foreign reserves. The denominator is official foreign reserves plus the home capital stock plus the stock of capital owned abroad less that part of the home capital stock that is foreign owned plus M2 plus gold stocks. International capital ownership is approximated, in turn, by dividing current account net factor income flows by long term bond rates.

Sources: For most countries, foreign reserves, money supplies, gold stocks, net factor income flows on current account balances and long term bond rates are from the IMF, *International Financial Statistics*, various issues. For Taiwan these are from the *Taiwan Statistical Data Book, 2006*. For Chile the money supply is from the Central Bank of Chile; for Australia it is from the Reserve Bank of Australia and for Singapore it is from the Monetary Authority of Singapore. For China and India, bond rates are from *Datastream* and, for the EU15, Malaysia and Chile the bond rates are from the Economist Intelligence Unit. All capital stock estimates are from the GTAP global database.

Table 5 Country Rankings on Foreign Shares of Total Assets

2000	2001	2002	2003	2004	2005
UK	UK	Hong Kong	Hong Kong	Hong Kong	UK
Hong Kong	Hong Kong	UK	Singapore	Singapore	Hong Kong
Singapore	Singapore	Singapore	UK	UK	Singapore
EU15	EU15	EU15	Malaysia	Malaysia	EU15
Malaysia	Malaysia	Malaysia	EU15	EU15	Malaysia
US	Chile	Chile	Chile	US	US
Chile	Thailand	Thailand	US	Chile	Chile
Thailand	US	US	Taiwan	Taiwan	Taiwan
Australia	Australia	Australia	Thailand	Australia	Australia
Korea	Taiwan	Taiwan	Australia	Korea	China
Taiwan	Korea	Korea	Korea	Thailand	Japan
China	Japan	Japan	Japan	China	Thailand
Japan	China	India	China	Japan	Korea
Mexico	India	China	India	India	India
India	Mexico	Brazil	Brazil	Mexico	Mexico
Brazil	Brazil	Mexico	Mexico	Brazil	Brazil

Source: Rankings on the foreign asset shares in Table 4.

Table 6 Short Term Real Effects of a Chinese Monetary Contraction and an Export Tax^a

% departures from baseline	Monetary contraction ^b		Export tax ^c	
	Optimistic	Pessimistic	Optimistic	Pessimistic
China				
Investment	-13.3	-17.8	-17.2	-25.4
Saving	-10.1	0.0	-12.1	0.0
Consumption	0.0	-14.2	0.0	-15.5
Current account surplus	-8.4	48.0	2.5	62.8
Terms of trade	1.1	-0.7	3.8	0.5
Real GDP	-7.5	-8.0	-5.0	-3.5
Real GNP/capita	-7.3	-5.8	-2.4	1.1
Real exchange rate, e_R	1.8	-1.3	-4.8	-9.3
North America				
Current account deficit	-2.1	7.3	0.1	9.9
Terms of trade	-0.15	0.1	-0.6	-0.2
Real GDP	-0.04	0.13	-0.10	0.12
Real GNP/capita	-0.04	0.05	-0.14	-0.02
Employment in "industry"	0.14	-0.19	1.04	0.71
"services"	-0.04	0.09	-0.20	-0.07

a The shocks are implemented over the period 2007-2010 and the 2010 departures from the baseline simulation are shown. Both shocks are implemented under two different assumptions about household inter-temporal decision making. The optimistic case has backward smoothing with a short run saving contraction while the pessimistic case has forward smoothing with a short run contraction in consumption. In both cases investment is driven by the same adaptive expectations over capital returns, except that, in the optimistic cases, the annual rate of decline in China's investment premium, which diminishes through time in the baseline scenario, is held constant for the three years of the shocks to reflect greater optimism on the part of financial investors.

b The monetary contraction is assumed *not* to be unaccompanied by reserve repatriation, so that it is deflationary. It is sufficient to reduce employment by a cumulative 5% per year for three years 2007-2010.

c The Chinese export tax is applied only to industrial products and it accumulates linearly to a total of 15% over 2007-2010. No associated employment contraction is included with the export tax.

Source: Simulations using the model described in the text.