Currency Crises in Reverse: Do Large Real Exchange Rate Appreciations Matter for Growth?

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January 2013

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Abstract

While currency crises have been extensively studied, the opposite phenomenon, large appreciations, has been far less researched. We fill this gap by providing an empirical exploration of historical episodes of large real exchange rate appreciations, using a sample of 28 advanced and 25 emerging market economies, with annual data going back to 1970. We focus on the impact of large appreciations on output growth. Our first finding is that countries experiencing large real exchange rate appreciations display distinct patterns: large appreciations significantly lower export growth and boost import growth on impact. Strikingly, however, output growth is higher, on average, despite the adverse impact on exports. Our second finding is that these aggregate numbers hide substantial heterogeneity, which we link to the nature of the shocks that cause the appreciation. In particular, appreciations associated with so-called "capital flow bonanzas" have a marked downward effect on growth. This pattern is consistent with the insights from a simple model that contrasts the impact of productivity shocks with that of capital inflows shocks. Higher productivity in the traded sector leads to a boom in traded output and a current account surplus, while higher foreign lending leads to a boom in non-traded output and an external deficit as traded output falls and consumption increases.

Keywords: exchange rate, currency crises, endaka, international trade, international capital flows, lending booms, small open economy macroeconomics.
JEL classification: F10, F30, F41.

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[*] The views presented in this paper are those of the authors and do not necessarily reflect those of the Banque de France or the Eurosystem. We are grateful to Philippe Bacchetta, Christiane Baumeister, Bruno Cabrillac, Menzie Chinn, James Hamilton, Lutz Kilian, Céline Mistretta and Robert Vigfusson for helpful comments and suggestions. We also would like to thank Catherine Martin for outstanding research assistance.

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1. Introduction

Currency crises (large real exchange rate depreciations) have figured very prominently on the research agenda of international macroeconomics for several decades. Their adverse effects have been broadly documented, leading academics and policy makers to develop tools to detect when the economy is at risk of a crisis and policies to limit their impact, such as limiting exchange rate movements – a pattern known as "fear of floating" (Calvo and Reinhart, 2002).[1]

In contrast to the impact of large exchange rate depreciations, relatively little is known about the effect of large appreciations, even though concerns about such appreciations are clearly pervasive in the policy debate. Sharp appreciations can lead to a loss in competitiveness and therefore may reduce growth through net trade. This fear has been repeatedly expressed by a broad range of prominent policy makers, with selected quotes given in Appendix I.[2]. While the recent concern about "currency wars" – where the expansionary monetary policy in advanced economies leads to capital flows to emerging markets and an appreciation of their currencies – has been widely noted, the concern is not limited to emerging markets. Japanese policy makers for instance have repeatedly expressed their worries, having experienced several episodes of large real exchange rate appreciations, in the early 1970s in the wake of the Smithsonian Agreement, from 1985 to 1995 after the Plaza Accord, and in the current crisis.[3] The concern is however not universally shared. Paul Krugman (1994) has dubbed it "a dangerous obsession" and argues that "concerns about competitiveness are, as an empirical matter, almost completely unfounded".

[1] The adverse effects on growth are documented by, among others, Cerra and Saxena (2008), and Bussière, Saxena and Tovar (2012). Examples of efforts to develop statistical tools aiming to detect currency crises in advance include so-called early warning models (Kaminsky, Lizondo and Reinhart, 1998, Goldstein and Reinhart, 2000) and logit models (Frankel and Rose, 1996, Eichengreen, Rose and Wyplosz, 1995, Berg and Pattillo, 1999, Bussière and Fratzscher, 2006).

[2] Appendix I reveals that viewpoints are not identical. We reproduce here two quotes that illustrate these different views. On the one hand, Mishkin (2007) clearly expresses concern about the competitiveness channel (*"An appreciation of the dollar, in turn, restrains exports (because the price of U.S. goods rises when measured in foreign currencies) and stimulates imports (because imports become cheaper in dollar terms). The resulting decrease in net exports implies a reduction in aggregate demand"*). On the other hand, Noyer (2007) brings a more balanced view: *"It is clear that the price-competitiveness of French industries has deteriorated significantly in recent years. Has the euro's appreciation played a role in this? On the one hand, it undoubtedly penalises export sectors whose competitors are located in other monetary areas. But, on the other hand, it benefits those sectors which are large consumers of imported commodities. At this stage, the overall effect on France's growth and external balance is not clearly apparent"*.

[3] There is even a special word in Japanese to refer to a period of strong appreciation ("endaka").

This active debate raises the question of the observed impact of large appreciations: is it so clear that growth suffers in countries whose currency appreciates, relative to other countries? To investigate this question, we assemble a large dataset of 52 countries (28 advanced economies and 25 emerging markets), with annual data from 1970 to 2011. We identify large appreciation episodes by relying on the approach of Kappler et al. (2011). As we focus on large appreciations, we do not consider that a nominal appreciation, in one given year, qualifies, but instead restrict ourselves to sustained and large real exchange rate movements. We first present key stylized facts on the effect of large appreciations using descriptive statistics and event-case analysis. Second, we show how the empirical pattern is consistent with the results from a simple theoretical model.

Our main empirical results are as follows. First, large appreciations are neither uncommon nor limited to emerging economies. We identify 30 episodes among which about two-thirds took place in advanced economies.[4] Second, large appreciations are on average associated with lower exports and higher imports compared to other time periods. This result would comfort policy makers who worry about the effects of large appreciations on net trade. Our third finding is that this ceteris paribus effect is however compensated by other factors, with the consequence that output growth is on average higher during large appreciation episodes despite the adverse effect on net exports. This result therefore puts fears about the growth impact of large appreciations in perspective. Fourth, we document substantial heterogeneity across episodes. In particular, we find that appreciations associated with large net capital inflows (capital flow bonanzas) and rapid growth in domestic credit ("lending booms") are characterized by lower output growth.

The empirical pattern can be accounted for by a simple open economy model with differentiated traded and non-traded sectors. The Home country's real exchange rate appreciates when productivity increases in the Home traded sector or when the propensity to save in the rest of the world increases, a proxy for capital flow bonanzas. A given appreciation can be associated with very different growth patterns depending on the nature of the shock. Higher productivity in the Home traded sector leads to higher output in the traded sector and overall, and a current account surplus if the shock is temporary. Higher savings in the Foreign country by contrast lead to a

[4] By contrast there are 95 instances of a nominal appreciation in a given year.

smaller increase in overall output, a large shift of output composition towards the non-traded sector, and a current account deficit.

While the literature on large appreciation is thinner than the one on currency crises, we are by no means the first paper to consider the issue. Kappler et al. (2011) were the first to formally define a large exchange rate appreciation and to look at the effects of such episodes on the current account balance and on real output. Compared to Kappler et al. (2011), we are both more restrictive (to the extent that we do not look at the current account balance) and more encompassing, as we consider cross-country heterogeneity in addition to average responses. To understand why some countries faced with a large appreciation manage to grow at a robust pace, while others seem to be particularly affected, we pay particular attention to the cases of large appreciations associated with "capital flow bonanzas" (Reinhart and Reinhart (2008)) or with "lending booms" (Gourinchas et al. (2001)), a focus that to our knowledge has not been taken previously.

Our paper also relates to other studies on similar issues. Rodrik (2008) focuses on a related (but markedly different) concept, that of undervaluation (and overvaluation). He emphasizes that "*Avoiding overvaluation of the currency is one of the most robust imperatives that can be gleaned from the diverse experience with economic growth around the world, and it is one that appears to be strongly supported by cross-country statistical evidence*", referring to the work of Razin and Collins (1997), Johnson, Ostry, and Subramanian (2007), and Easterly (2005). We differ from Rodrik as we focus on large appreciations and do not refer to a particular benchmark, therefore abstracting from the question of over- or undervaluation. Our approach is motivated by the considerable uncertainty that surrounds estimates of equilibrium exchange rates -- see for instance the discussion in Bussière et al. (2010).[5]

The rest of the paper is organised as follows. Section 2 introduces the definition of large exchange rate appreciations, and presents key stylized facts by means of event case analysis. Section 3 presents a simple theoretical model and contrasts the growth pattern in appreciation

[5] A given appreciation does not necessarily coincide with an overvaluation: it could be that the exchange rate is converging towards a new equilibrium, correcting a past undervaluation. Having said that, the definition we use excludes large appreciations that followed a currency crisis: given that such crises are well-known to give rise to an overshooting effect, such episodes would most likely correspond to a correction towards an equilibrium value.

episodes depending on the nature of the underlying shock. Section 4 concludes and presents possible policy implications.

2. The impact of large appreciations: stylized facts

2.1. Definition of large real exchange rate appreciations episodes

Our focus being on episodes of large and sustained appreciations, and not on temporary ones, we first define the criteria used to identify these episodes in the data. Because of the limited number of studies of large appreciations, we cannot rely on a large body of literature to provide a widely accepted rigorous (numerical) definition of what constitutes a "large real appreciation". Our selection reflects two aspects. First, as we are interested in the aggregate macroeconomic outcome, we focus on effective (rather than bilateral) exchange rates. Second, we establish clear thresholds (for the nominal and real exchange rates) and take account of the behavior of the exchange rate before and after the year of the appreciation to focus on lasting episodes and not just sudden (and transitory) jumps.

We follow Kappler et al. (2011)'s definition of large appreciations, which requires the simultaneous meeting of the following three criteria:

A. the nominal effective exchange rate is revalued by at least 10 percent or more relative to the average level two years before, allowing to capture one-time step revaluations, but also a number of smaller appreciation steps that happen within a short time window.

$$\ln[(NEER_t)] - \ln[(NEER_{t-2})] \geq 0.1$$

B. the nominal appreciation must lead to sustained real appreciation, hence the real effective exchange rate must remain stronger by, at least 10 percent on average for three years relative to the beginning of the appreciation process.

$$\frac{\ln[(REER)_{t+1}] + \ln[(REER)_{t+2}] + \ln[(REER)_{t+3}]}{3} - \ln[(REER)_{t-2}] \geq 0.1$$

C. There was no depreciation of similar magnitude prior to the appreciation

$$\ln[(REER)_{t-1}] - \frac{\ln[(REER)_{t-3}] + \ln[(REER)_{t-4}] + \ln[(REER)_{t-5}]}{3} \geq -0.1$$

These criteria ensure that the identified episode display a large movement in the exchange rate (criteria A), that this movement is not reverted in the short run (criteria B) and that it does not constitute a "catch up" following a large depreciation of the currency (criteria C).

Table 1 presents the identified episodes. The first column shows the ones that only meet criteria A, i.e. the episodes where the currency underwent an appreciation of 10 percent or more in a given year. We find 95 such country/time episodes. The second column shows the episodes that meet all three criteria. Including all criteria narrows the number of large appreciations episodes to 30, clearly illustrating how one needs to look beyond the behavior of the nominal exchange rate in a given year. Out of these 30 episodes, 21 took place in advanced economies. The inclusion of criteria B and C eliminates episodes where a large nominal appreciation is offset by low domestic inflation (or deflation). For instance, all three large nominal appreciations by Germany and five out of seven large nominal appreciations by Japan are excluded from the end definition. Our definition also excludes a number of appreciations that took place just after a currency crisis; this removes for example Korea and Thailand just after the Asian crisis. Among the large advanced economies, it is noteworthy that the definition selects two episodes for the United States: in the early 1980s (1982-83) and in the late 1990s (1997-98).

2.2. Variables of interest

We next turn to the main variables of interest in our analysis. As concerns about large appreciations stress their detrimental effect through international trade, we consider overall GDP growth, as well as the growth of exports and imports. All three variables are expressed in year-on-year growth rates in real terms (first log differences).

In addition to looking at the unconditional effect of exchange rate appreciations on real output and trade, we contrast the pattern between appreciations that are associated with unusual developments in the financial sector with that of other appreciations. Financial market conditions are proxied by large net capital inflows and increases in lending to the domestic sector. This focus is motivated by the fact that swings in international financial markets are a major driver of economic performance in emerging countries, but also in advanced ones as the current crisis highlights.

Our definition of the "capital flow bonanza" follows Reinhart and Reinhart (2008). Inflows are measured as a percentage of GDP, and correspond to the sum of portfolio and FDI inflows.[6] Following Reinhart and Reinhart (2008), we construct a "*capital flow bonanza*" dummy, CFB, which is equal to 1 in years when net inflows exceed the 80th percentile of the entire sample.[7] Domestic credit to the private sector is also measured as a percentage of GDP. We follow the definition of the World Bank and focus on domestic credit provided by the banking sector including all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net.[8] We construct a *"lending boom*" dummy variable that is equal to 1 in years when domestic credit to the private sector exceeds the 80th percentile of the entire sample for each country.

2.3. Descriptive statistics and event case analysis

We undertake an event case analysis that allows us to highlight key patterns in the relation between large appreciations and output growth. The top panel of Table 2 presents the values of GDP growth (mean and median) in episodes of large appreciations, both overall and distinguishing between advanced and emerging countries. The bottom panel reports the corresponding numbers in the absence of a large appreciation. Three key results stand out. First, international trade behaves as expected. Episodes of large currency appreciations are associated with weaker export growth: when all three criteria are met (i.e the dummy variable ABC is one), the annual growth rate of real exports reaches 4.7% on average, compared to 6.2% otherwise. This is in line with the competitiveness effect of the appreciation on exports. We note that this effect is particularly strong for the advanced economies (3.4% against 5.7%), whereas for

[6] According to the World Bank definition, portfolio equity includes net inflows from equity securities other than those recorded as direct investment and including shares, stocks, depository receipts (American or global), and direct purchases of shares in local stock markets by foreign investors; foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors.

[7] Here two definitions can be used: either consider capital flows in current terms and use the distribution for each country (which leads to select the same number of episodes per country), or consider the overall distribution (i.e. for the whole sample), expressed as a percentage of GDP to be able to compare small and large countries. We chose to focus on the latter, although we also considered the former, with qualitatively similar results.

[8] In the World Bank definition, the banking sector includes monetary authorities and deposit money banks, as well as other banking institutions where data are available (including institutions that do not accept transferable deposits but do incur such liabilities as time and savings deposits).

emerging market economies the difference is not very large. Similarly, large appreciations are associated with stronger growth in imports (8.2% on average, against 6% in normal times, this effect being particularly large in EMEs, 12.7% against 6.8%). This first set of results supports the concerns expressed on the adverse competitiveness effect of large appreciations on net trade.

More surprisingly, our second result shows that the pattern for net exports is a poor proxy for overall growth. In spite of the ceteris paribus effect described above, growth tends to be larger during appreciation episodes (4.1%) than during normal times (3.3%). This is the case both for advanced and emerging market economies, and particularly so for emerging economies. There thus appears to be other factors, coinciding with large appreciations, which boost growth sufficiently strongly to offset the adverse effect of the appreciation through trade. In other words, it is important to bear in mind that the exchange rate and growth are both endogenous variables that react to some underlying shock, and thinking solely of the impact of the exchange rate on competitiveness can be highly misleading.

As Table 2 only shows static results with the contemporaneous growth rate of key variables depending of whether the country experiences a large appreciation or not, we now turn to the dynamic effects of appreciations. We use an event case analysis that encompasses not just the contemporaneous impact but also its aftermath. Figure 1 shows the impact of a large exchange rate appreciation by looking at the dynamic behavior on GDP growth (panel A), real imports (panel B), and real exports (panel C). In each panel year *t* corresponds to the year when the three criteria are met (ABC=1). Each panel shows the patterns across all countries, as well as among advanced economies, and among emerging markets. Figure 1 also shows the path of the real effective exchange rate itself (panel D) to illustrate its evolution after the time when the three criteria are met. The variables in all panels are expressed in terms of the net effect relative to normal times, i.e. when ABC=0. For example, the value at time *t* in panel A corresponds to the difference shown in Table 2 between the average growth rate when ABC=1 (4.1%) and when ABC=0 (3.3%), i.e. 0.8% for all countries taken together.

Figure 1 shows a substantial degree of heterogeneity. Panel A reveals that although countries experiencing a large appreciation grow more robustly on average at the time of the depreciation, the effect varies over time and across country groups. Advanced economies experience a sustained pickup in growth, while emerging economies only experience a temporary increase in

growth, followed by a contraction within two years. In line with this markedly different evolution of aggregate demand, import growth tends to accelerate after the appreciation for advanced economies, but strongly decelerates for emerging economies (panel B). Turning to export growth (panel C), a large appreciation reduces exports on impact for advanced economies. This effect persists for one year, after which exports recover. Emerging countries, by contrast, see a better performance of exports on impact, but this is temporary and it is followed by a sizable deterioration. Figure 1 therefore reveals that the response of key macroeconomic variables differs dramatically across countries, following a large appreciation. Among the different factors that may explain this, we focus on the role of large capital inflows and domestic lending. Our focus on these proxies for conditions in financial markets is motivated by the well-documented role of financial shocks in driving macroeconomic conditions in emerging markets, but also in advanced economies.

Figure 2 shows how the impact of large appreciations differs depending on whether the economy also experiences a capital flow bonanza (top panels) or a lending boom (bottom panels). All panels show the dynamic pattern on GDP growth at the time of the large appreciations and in subsequent years. In addition, each panel presents the growth difference between large appreciation episodes (ABC=1) and normal times, a positive value indicating higher growth during a large appreciation episode.

The impact of a large appreciation is quite sensitive to the simultaneous presence of a capital flows bonanza. Panel E shows that an appreciation occurring along with a bonanza is associated with a moderate increase in growth in advanced economies, but a contraction in emerging economies. By contrast, a large appreciation that is not accompanied by a bonanza (Panel F) is associated with somewhat stronger growth in advanced economies, and a sizable – albeit short lived – boom in emerging markets. Considering the role of credit booms instead of bonanzas leads to a similar picture. Appreciations that are concurrent to credit booms are associated with sharp contractions in emerging economies (Panel G), whereas countries experience a temporary acceleration in activity when the appreciation is not accompanied by a credit boom (Panel H). The pattern is similar for advanced economies, albeit with smaller magnitudes. One potential reason why results differ across country groups may be related to the fact that financial supervision is in general more developed in advanced countries, compared to developing

countries, such that "capital flow bonanzas" and "lending booms" may be more disruptive in the latter.

To sum up, our analysis shows that while large appreciations have the expected adverse effect on net trade, this does not lead to an overall contraction in GDP, to the contrary. The event study analysis shows a substantial extent of heterogeneity through time, across countries, and depending on the underlying financial conditions. Most strikingly, large appreciations associated with capital flow bonanzas or lending booms are characterized by a weaker growth performance than appreciations occurring without bonanzas or booms.

3. The contrasted impact of productivity and capital flows shocks: a simple model

In this section we present a simple model that contrasts the impact of productivity shocks with that of financial shocks on the real exchange rate, output and lending. For brevity we focus on the main features and results, and leave more details to the appendix.[9] We first present the building blocks and the solution method. We then derive the analytical solution for a simple combination of parameters, and present numerical results for the more general parametrizations.

3.1 Building blocks

Our setup builds on Obstfeld and Rogoff (1996 ch 4). We consider a general equilibrium model with two countries, Home and Foreign, of sizes *n* and *1-n* respectively. In the Home country, a representative agent of size *n* consumes a basket C_t of non-traded and traded goods, with the latter consisting of Home and Foreign goods:

$$C_t = \left[\gamma^{\frac{1}{\lambda}} \left(C_{T,t}\right)^{\frac{\lambda-1}{\lambda}} + (1-\gamma)^{\frac{1}{\lambda}} \left(C_{N,t}\right)^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}$$

$$C_{T,t} = \left[(n+(1-n)\chi)^{\frac{1}{\theta}} \left(C_{H,t}\right)^{\frac{\theta-1}{\theta}} + ((1-n)(1-\chi))^{\frac{1}{\theta}} \left(C_{F,t}\right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$$

[9] The fully detailed steps of the model solution, and associated Matlab programs, are available on request.

where *t* denotes time, $C_{T,t}$ and $C_{N,t}$ are the consumptions of traded and non-traded goods, respectively, and $C_{H,t}$ and $C_{F,t}$ are the consumptions of Home traded and Foreign traded goods, respectively. λ is the elasticity of substitution between traded and non-traded goods, and θ is the elasticity of substitution between Home traded and Foreign traded goods. $\chi \in [0,1]$ is the degree of domestic bias in traded goods consumption.

The consumption baskets of the representative agent of size *1-n* are similar, with asterisks denoting Foreign variables:

$$C_t^* = \left[\gamma^{\frac{1}{\lambda}} \left(C_{T,t}^*\right)^{\frac{\lambda-1}{\lambda}} + (1-\gamma)^{\frac{1}{\lambda}} \left(C_{N,t}^*\right)^{\frac{\lambda-1}{\lambda}} \right]^{\frac{\lambda}{\lambda-1}}$$

$$C_{T,t}^* = \left[(n(1-\chi))^{\frac{1}{\theta}} \left(C_{H,t}^*\right)^{\frac{\theta-1}{\theta}} + (1-n+n\chi)^{\frac{1}{\theta}} \left(C_{F,t}^*\right)^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}}$$

The allocation of consumption reflects the various relative prices, namely the price of Home traded goods $P_{H,t}$ the price of Foreign traded goods $P_{F,t}$ (both prices are the same in the two countries), the price indexes of traded goods $P_{T,t}$ and $P_{T,t}^*$, and the consumer price indexes P_t and P_t^*. The price indexes are:

$$P_{T,t} = \left[(n+(1-n)\chi)\left(P_{H,t}\right)^{1-\theta} + (1-n)(1-\chi)\left(P_{F,t}\right)^{1-\theta} \right]^{\frac{1}{1-\theta}}$$

$$P_{T,t}^* = \left[n(1-\chi)\left(P_{H,t}\right)^{1-\theta} + (1-n+n\chi)\left(P_{F,t}\right)^{1-\theta} \right]^{\frac{1}{1-\theta}}$$

$$P_t = \left[\gamma \left(P_{T,t}\right)^{1-\lambda} + (1-\gamma)\left(P_{N,t}\right)^{1-\lambda} \right]^{\frac{1}{1-\lambda}} \quad ; \quad P_t^* = \left[\gamma \left(P_{T,t}^*\right)^{1-\lambda} + (1-\gamma)\left(P_{N,t}^*\right)^{1-\lambda} \right]^{\frac{1}{1-\lambda}}$$

We define the terms-of-trade as the price of Foreign traded goods to Home traded goods, $T_t = P_{F,t} / P_{H,t}$, and the relative prices of non-traded goods relative to traded goods as $R_t = P_{N,t} / P_{T,t}$ and $R_t^* = P_{N,t}^* / P_{T,t}^*$. The real exchange rate $Q_t = P_t^* / P_t$ reflects the terms-of-trade (in the presence of domestic bias) and the relative prices of non-traded goods:

$$Q_t = \left[\frac{n(1-\chi) + (1-n+n\chi)(T_t)^{1-\theta}}{(n+(1-n)\chi) + (1-n)(1-\chi)(T_t)^{1-\theta}} \right]^{\frac{1}{1-\theta}} \left[\frac{\gamma + (1-\gamma)(R_t^*)^{1-\lambda}}{\gamma + (1-\gamma)(R_t)^{1-\lambda}} \right]^{\frac{1}{1-\lambda}}$$

The production of traded and non-traded goods relies on a technology that uses labor with decreasing returns to scale. The total labor supply in the Home and Foreign country are set to *n* and *1-n*. The outputs of the two sectors in the Home country are $Y_{H,t} = A_{H,t}(n - L_{N,t})^{1-\alpha}$ and $Y_{N,t} = A_{N,t}(L_{N,t})^{1-\alpha}$ where $L_{N,t}$ denotes the labor input in the non-traded sector, and $A_{i,t}$ is an exogenous productivity term in sector *i = H, N* that is our first source of shocks. The parameter $\alpha \in [0,1]$ reflects the degree of returns to scale. The case of $\alpha = 1$ corresponds to an endowment economy, while the case of $\alpha = 0$ corresponds to constant returns to scale. The outputs in the Foreign country are $Y_{F,t}^* = A_{F,t}^*(1-n-L_{N,t}^*)^{1-\alpha}$ and $Y_{N,t}^* = A_{N,t}^*(L_{N,t}^*)^{1-\alpha}$.

Borrowing and lending takes place through a bond denominated in Foreign traded goods, without loss of generality. A unit of bond held between period *t* and *t+1* yields an interest rate of $1+r_{t+1}$. We denote the per capita holdings of bonds by the Home agent at the end of period *t* by B_{t+1}. The intertemporal constraints faced by the Home and Foreign agent are:

$$nP_tC_t + nP_{F,t}B_{t+1} = P_{H,t}A_{H,t}(n - L_{N,t})^{1-\alpha} + P_{N,t}A_{N,t}(L_{N,t})^{1-\alpha} + n(1+r_t)P_{F,t}B_t$$
$$(1-n)P_t^*C_t^* - nP_{F,t}B_{t+1} = P_{F,t}A_{F,t}^*(n - L_{N,t}^*)^{1-\alpha} + P_{N,t}^*A_{N,t}^*(L_{N,t}^*)^{1-\alpha} - n(1+r_t)P_{F,t}B_t$$

where we used the fact that bonds are in zero net supply worldwide. As in each country the consumption of non-traded goods is equal to its supply, we split the constraint in each country between the market clearing condition for the non-traded sector:

$$nC_{N,t} = A_{N,t}(L_{N,t})^{1-\alpha} \quad ; \quad (1-n)C_{N,t}^* = A_{N,t}^*(L_{N,t}^*)^{1-\alpha} \tag{1}$$

and the intertemporal constraint in terms of traded goods:

$$n\left(C_{H,t} + T_tC_{F,t}\right) + nT_tB_{t+1} = A_{H,t}(n - L_{N,t})^{1-\alpha} + n(1+r_t)T_tB_t \tag{2}$$
$$(1-n)\left(C_{H,t}^* + T_tC_{F,t}^*\right) - nT_tB_{t+1} = T_tA_{F,t}^*(n - L_{N,t}^*)^{1-\alpha} - n(1+r_t)T_tB_t \tag{3}$$

The clearing of the market for Home traded goods requires that the supply matches the demand:

$$nC_{H,t} + (1-n)C^*_{H,t} = A_{H,t}(n - L_{N,t})^{1-\alpha} \qquad (4)$$

A similar relation holds for the clearing of the Foreign traded good, but is redundant given (1)-(4). The appendix presents the expressions for (1)-(4) using the expressions for the intratemporal allocation of consumption.

The Home representative agent maximizes an intertemporal utility of consumption over an infinite horizon $U_t = \sum_{s=0}^{\infty} \left(\beta_{H,t+s}\right)^s \ln\left(C_{t+s}\right)$. The Foreign representative maximizes a similar utility $U^*_t = \sum_{s=0}^{\infty} \left(\beta_{F,t+s}\right)^s \ln\left(C^*_{t+s}\right)$. We assume that the discount factors of the Home agent, $\beta_{H,t+s}$, can differ from that of the foreign agent, $\beta_{F,t+s}$. These discount factors are our second source of shock. An increase in the Foreign factor represents a higher willingness to lend by the Foreign agent, leading to capital flows towards the Home country all else equal.

The intertemporal optimization leads to two conditions for each country. The first ones are the Euler conditions for the dynamics of consumption:

$$C_{t+1} = \beta_{H,t+1}(1 + r^C_{t+1})C_t \quad ; \quad C^*_{t+1} = \beta_{F,t+1}(1 + r^{C*}_{t+1})C^*_t \qquad (5)$$

where r^C_{t+1} and r^{C*}_{t+1} are the real interest rates in terms of the consumption baskets:

$$1 + r^C_{t+1} = (1 + r_{t+1})\frac{P_{F,t+1}}{P_{F,t}}\frac{P_t}{P_{t+1}} \quad ; \quad 1 + r^{C*}_{t+1} = (1 + r_{t+1})\frac{P_{F,t+1}}{P_{F,t}}\frac{P^*_t}{P^*_{t+1}} \qquad (6)$$

The second set of conditions reflects the optimal allocation of labor across the traded and non-traded sectors:

$$A_{H,t}P_{H,t}(n-L_{N,t})^{-\alpha} = P_{N,t}A_{N,t}(L_{N,t})^{-\alpha} \quad (7)$$

$$A^*_{F,t}P_{F,t}(1-n-L^*_{N,t})^{-\alpha} = P^*_{N,t}A^*_{N,t}(L^*_{N,t})^{-\alpha} \quad (8)$$

The appendix presents the real interest rates in (5) and the allocations (6)-(7) in terms of relative prices. Note that when Home and Foreign traded goods are perfect substitutes, so that $P_{H,t} = P_{H,t} = P_{T,t} = P^*_{F,t}$, and there are constant returns to scale in production, (7)-(8) imply that the relative price of non-traded goods only reflects relative productivities: $R_t = A_{H,t}/A_{N,t}$ and $R^*_t = A^*_{F,t}/A^*_{N,t}$.

3.2 Solution method

As the model is highly non-linear, we approximate it around a symmetric steady state. In that steady state, where variables are indexed by 0, agents are equally patient ($\beta_{H,0} = \beta_{F,0} = \beta_0$) which removes incentives to save and borrow internationally. In addition no country holds claims on the other ($B_0 = 0$). The Euler conditions (5) imply that the real interest rates are all equal to the inverse of the discount rate.

The baseline steady-state is characterized by the two market clearing conditions for non-traded goods (1), the intertemporal constraints (2)-(3), the market clearing for the Home traded good (4), and the labor allocations (7)-(8). For simplicity, we put restrictions on the productivity levels[10] that ensure that all relative prices are unity ($T_0 = R_0 = R^*_0 = 1$), that consumption levels are equalized in the two countries ($C_0 = C^*_0 = A_{H,0}(n\gamma)^{-\alpha}$), and that the labor allocations reflect the weight of the two sectors in preferences ($L_{N,0} = n(1-\gamma)$ and $L^*_{N,0} = (1-n)(1-\gamma)$).

We express the model in terms of log-linear approximations around the baseline steady state and denote log deviations by hatted values, with for instance $\hat{C}_t = (C_t - C_0)/C_0$. As

[10] Specifically, we set $A_{N,0} = A_{H,0}(\gamma/(1-\gamma))^{-\alpha}$, $A^*_{F,0} = A_{H,0}(n/(1-n))^{-\alpha}$ and $A^*_{N,0} = A_{H,0}(\gamma/(1-\gamma))^{-\alpha}(n/(1-n))^{-\alpha}$.

international bond holdings are zero in the steady state, we define $\hat{B}_t = B_t/(\gamma C_0)$. The approximations of equations (1)-(8) are presented in the appendix.

We consider that the economy is initially in the baseline steady state. The economy is then hit by shocks, and we distinguish between the short run (first period with shocks) and the long run (subsequent periods). Shocks in the short run affect the discount factors, $\hat{\beta}_H$ and $\hat{\beta}_F$, and the productivity levels $\hat{A}_H$, $\hat{A}_N$, $\hat{A}_F^*$ and $\hat{A}_N^*$. In the long run the economy reaches a new steady state where the discount factors revert to their initial value β_0 and productivity levels stabilize at levels that can differ from the initial ones. The long run productivity levels are denoted by $\hat{A}_{H,ss}$, $\hat{A}_{N,ss}$, $\hat{A}_{F,ss}^*$ and $\hat{A}_{N,ss}^*$ with the *ss* subscript denoting the new steady state.

With this specification, the model is a linear system with 18 endogenous variables,[11] 10 exogenous variables,[12] and 18 equations.[13] In addition to the 18 variables, we compute the real exchange rate of the Home country that reflects the terms-of-trade (to the extent that there is domestic bias in consumption) and the cross-country difference in the relative price of non-traded goods:

$$\hat{Q}_t = \chi\hat{T}_t - (1-\gamma)(\hat{R}_t - \hat{R}_t^*) \tag{9}$$

The output in the Home sectors and the overall Home output, measured in terms of Home traded goods, are written as:

[11] The Home and Foreign consumptions in the short and long run, the relative prices of non-traded goods in the Home and Foreign countries in the short and long run, the terms-of-trade in the short and long run, the labor used in the non-traded sectors in the Home and Foreign countries in the short and long run, the Home assets accumulated in the short run, the real interest rates in terms of consumption baskets between the short and long run, and the real interest rate in terms of the Foreign traded goods between the short and long run.

[12] The shocks to productivity levels in the four sectors (Home and Foreign traded and non-traded) in the short and long run and the shocks to the Home and Foreign discount factors between the short and long run.

[13] The first four equations are the market clearing conditions for non-traded goods (1) in the short and long run, the next four are the intertemporal constraints (2)-(3) in the short and long run, the next two are the market clearing for the Home traded good (4) in the short and long run, the next two are the Euler equations (5) between the short and long run, the next two are the real interest rates in terms of consumption baskets (6) between the short and long run, and the final four are and the labor allocations (7)-(8) in the short and long run.

$$\hat{Y}_{H,t} = \hat{A}_{H,t} - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t} \quad ; \quad \hat{Y}_{N,t} = \hat{A}_{N,t} - (1-\alpha)\hat{L}_{N,t}$$
$$\hat{Y}_t = \gamma\hat{A}_{H,t} + (1-\gamma)\hat{A}_{N,t} + (1-\gamma)\left[\hat{R}_t + (1-n)(1-\chi)\hat{T}_t\right] \tag{10}$$

While this linear system has a unique solution, the analytical solution is quite cumbersome for the general model. We therefore first present the analytical solution for a specific case, before presenting a numerical illustration of the general case.

3.3 A simple case

We simplify the model in two ways. First, we consider that Home and Foreign goods are perfect substitutes ($\theta \to \infty$), so that there is a common traded good. The terms-of-trade are then always equal to one, so we lose one endogenous variable as $\hat{T}_t = 0$. We also lose one equation as the market clearing condition (4) corresponds to the sum of (2) and (3). In addition the degree of domestic bias χ is irrelevant. The second simplification is to set the elasticity of substitution between traded and non-traded goods λ equal to one.

In the long-run the economy reaches a new steady-state, with the cross-country asset holdings $\hat{B}_{ss}$ as a state variable. For brevity, we focus on short term shocks, and present the solution in terms of cross-country differences. When the Home country is a net creditor ($\hat{B}_{ss} > 0$), it is characterized by higher consumption, relative to the Foreign one, a higher price of non-traded goods, which translates into an appreciated currency, and a shift of labor towards the non-traded sector:

$$\hat{C}_{ss} - \hat{C}^*_{ss} = \gamma\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n} \quad ; \quad \hat{R}_{ss} - \hat{R}^*_{ss} = \alpha\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n}$$
$$\hat{Q}_{ss} = -(1-\gamma)(\hat{R}_{ss} - \hat{R}^*_{ss}) \quad ; \quad \hat{L}_{N,ss} - \hat{L}^*_{N,ss} = \gamma\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n}$$

The cross-country asset holdings $\hat{B}_{ss}$ are endogenously determined in the short run. We define a summary intertemporal measure of shocks $\hat{Z} = (\hat{\beta}_H - \hat{\beta}_F) + (\hat{A}_H - \hat{A}_F^*)$. A positive value indicates that the Home country is relatively more patient ($\hat{\beta}_H > \hat{\beta}_F$) or that it has a temporary productivity advantage in the traded sector ($\hat{A}_H - \hat{A}_F^* > 0$). The Home country accumulates assets if this measure is positive:

$$\frac{\hat{B}_{ss}}{1-n} = \frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

Short run consumption is higher in the Home country, relative to the Foreign country, if it benefits from higher productivity or if the intertemporal pattern of shocks leads it to borrow ($\hat{Z} < 0$). The Home country is characterized by a higher price of non-traded goods, and an appreciated real exchange rate, if it has an advantage in traded sector productivity or if the intertemporal pattern of shocks leads it to borrow, thereby boosting demand for non-traded goods:

$$\hat{C} - \hat{C}^* = \gamma(\hat{A}_H - \hat{A}_F^*) + (1-\gamma)(\hat{A}_N - \hat{A}_N^*) - \gamma\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\hat{R} - \hat{R}^* = (\hat{A}_H - \hat{A}_F^*) - (\hat{A}_N - \hat{A}_N^*) - \alpha\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\hat{Q}_{ss} = -(1-\gamma)(\hat{R} - \hat{R}^*)$$

Borrowing by the Home country shifts the allocation of labor towards the non-traded sector. The Home country is finally characterized by a high real interest rate (in terms of consumption basket) if the intertemporal pattern of shocks leads it to borrow, or if it has an advantage in traded sector productivity:

$$\hat{L}_{N,ss} - \hat{L}_{N,ss}^* = -\gamma\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\beta_0(dr^C - dr^{C*}) = -\frac{(1-\gamma)\alpha}{\gamma + (1-\gamma)\alpha}\hat{Z} + (1-\gamma)\left[(\hat{A}_H - \hat{A}_F^*) - (\hat{A}_N - \hat{A}_N^*)\right]$$

We illustrate the impact of the various shocks through a numerical example. We set the Home country to be very small with n =0.1. We assume that traded good account for 30 % of the total consumption basket ($\gamma = 0.3$), that there are decreasing returns to scale ($\alpha = 0.3$), and set the discount factor β_0 to 0.95.

Figure 3 presents the impact of three shocks on the short-run Home variables. These are a temporary increase in Home traded productivity ($\hat{A}_H > 0$, grey bars), a permanent increase in Home productivity ($\hat{A}_H = \hat{A}_{H,ss} > 0$, stripped bars), and an increase in Foreign patience ($\hat{\beta}_F > 0$ black bars). The increase in Foreign patience can be interpreted as a capital inflows shock. Another approach to assess the impact of financial conditions on the exchange rate is found in Benigno and Romei (2012) who consider a tightening of borrowing constraints, but abstract from the distinction between traded and non-traded goods. To facilitate the comparison across the three shocks, they are calibrated to lead to a unit appreciation in the Home currency.

The responses of the various variables depend crucially on the nature of the shock. Consumption increases most when the real appreciation reflects a capital inflow, and is financed by running a sizable current account deficit. By contrast a temporary productivity shock is smoothed through a current account surplus and leads to a contraction in consumption. All three shocks raise the price of non-traded goods.[14] The impact on the real interest rate (in terms of the consumption basket) is contrasted: a temporary productivity improvement raises the interest rate and induces a postponement of consumption, whereas a surge in capital inflows lowers the interest rate and brings consumption forward.

Overall output increases under all shocks, but does so substantially more under a productivity improvement. The composition of output markedly differs across shocks. An increase in productivity in the traded sector leads to a shift of labor towards that sector. As a result traded output surges thanks to more labor used in that sector and higher productivity, while non-traded output falls because of the labor reallocation. The pattern is opposite under a shock to

[14] One may notice that the relative price of non-traded goods in the Home country does not increase equally across all shocks, even though the real exchange rate impact is the same. This simply reflects the fact that the real exchange rate is also affected by the relative price of non-traded goods in the Foreign country.

patience. The capital inflows into the Home country fuel a higher demand for non-traded goods that is met by reallocating labor through the traded sector. As a result, traded output falls.

Figure 3 thus clearly illustrates the central result of the model, namely that a given appreciation of the real exchange rate can be associated with sharply different situations. An appreciation due to a productivity gain is associated with an output boom led by the traded sector, a higher real interest rate, and a current account surplus (if the gain is temporary). An appreciation fuelled by capital inflows by contrast leads to a credit-fuelled consumption boom, with a low real interest rate, and only a moderate overall output boom as the surge of non-traded output is offset by a contraction in traded output.

3.4 The general case

We now turn to the general case where the elasticities of substitution θ and λ can take more general values. As the analytical solution is complex, we focus on a numerical illustration. We keep the same parameters as in the previous section and assume that there is no domestic bias in consumption ($\chi = 0$).

Figures 4 to 5 show the response of the short run Home variables to a unit temporary improvement in productivity in the traded sector ($\hat{A}_H = 1$, Figure 3), a permanent improvement ($\hat{A}_H = \hat{A}_{H,ss} = 1$, Figure 4) and a temporary increase in Foreign patience ($\hat{\beta}_F = 1$, Figure 6). Each panel shows the value of the variables for different elasticities of substitutions between traded and non-traded goods (λ going from 1 to 8 on the horizontal axis) and between Home and Foreign traded goods (θ being set at 1, 3, 6 or infinity). The particular case of the previous section corresponds to the leftmost point of the thick line. For brevity we focus our discussion on the main patterns.

Allowing for more elasticity between traded and non-traded goods, or allowing for a limited substitutability beteween Home and Foreign traded goods, reduces the magnitudes of the impact of shocks.

A temporary improvement of traded productivity (Figure 4) lowers consumption and raises savings, unless Home and Foreign traded goods are poor substitutes in which case consumption increases. The higher productivity reduces the price of Home traded goods and

deteriorates the terms-of-trade ($\hat{T} > 0$) especially when traded goods are poor substitutes among themselves. The relative price of non-traded goods increases, leading to a real appreciation, although the magnitude depends on the elasticities. The impact on traded and non-traded outputs and labor reallocation is qualitatively similar to the simple case, but is dampened by a low substitutability between Home and Foreign traded goods. The impact on the elasticities of substitution is broadly similar when the improvement in productivity is permanent (Figure 5).

The sensitivity of the various variables to the elasticities of substitution is more moderate when the economy is hit by a shock to Foreign patience (Figure 6). The magnitude of the consumption boom and borrowing is somewhat higher when there is more substitutability between traded and non-traded goods, or between Home and Foreign traded goods. The movements in the relative price of non-traded goods and the real exchange rate are lowered when traded and non-traded goods are closer substitute, as any reallocation then requires less movement in prices. The impact of the shocks on traded and non-traded outputs and labor reallocation is qualitatively similar to the simple case, but is dampened by a low substitutability between Home and Foreign traded goods or by a high substitutability between traded and non-traded goods. As labor is reallocated towards the non-traded sector, the output of Home traded goods falls. This raises their price and leads to an improvement in the terms-of-trade, especially when a limited substitutability between Home and Foreign traded goods limits the impact of price movements on quantities.

To facilitate the contrast between the various shocks, Figure 7 presents their impact when the shocks are calibrated to lead to a unit real appreciation of the Home currency in the short run. For each variable we show the impact of a temporary increase in productivity in the traded sector (left panel), that of a permanent increase (middle panel) and that of a capital inflows stemming from higher patience in the Foreign country (right panel).[15]

The impact of consumption is relatively insensitive to the elasticity of substitution between Home and Foreign traded goods, but react more to the elasticity of substitution between traded and non-traded goods, with a higher elasticity leading to a larger increase in consumption. The panels show that the consumption boom is much larger in the case of a capital inflows

[15] The rounded line corresponds to $\theta = 1$ in Figures 2 to 4, but to $\theta = 1.5$ in Figure 5 as the real exchange rate movement can be zero when $\theta = 1$.

shocks than in the case of a productivity shock. A higher elasticity of substitution between traded and non-traded goods raises the magnitude of the current account response to temporary shocks.

The terms-of-trade react most when Home and Foreign traded goods are poor substitutes, as a given quantity adjustment then requires larger price movements. The contrast between a productivity improvement, which worsens the terms-of-trade, and a capital inflows boom, which improves them, is larger when traded and non-traded goods are poor substitutes. The relative price of non-traded goods by contrast shows limited sensitivity to the elasticities, which simply reflects our parametrization that the real exchange rate appreciates by the same value in all cases.

The pattern for the real interest rate is robust to the elasticities of substitution, with a productivity improvement leading to a higher interest rate (unless Home and Foreign traded goods are poor substitutes and traded and non-traded goods are close substitutes) and a capital inflows increase lowering the interest rate, especially with higher substitutability between traded and non-traded goods.

Moving away from the simple case by increasing the substitutability between traded and non-traded goods or lowering that between Home and Foreign traded goods magnifies the impacts on outputs. A productivity improvement substantially raises traded output, at the expense of non-traded output, with the opposite pattern being observed following an increase in Foreign patience. Moving away from the simple model thus reinforces the contrast shown in Figure 3.

Our analysis so far abstracts from domestic bias in consumption, which implies that the real exchange rate only reflects the relative prices of non-traded goods. We relax this restriction by setting $\chi = 0.3$, which implies that the ration between the demand for local and imported traded goods is three times as large as in the absence of domestic bias. Figures 8 to 10 show the impact of temporary and permanent improvements in traded productivity and the impact of a temporary increase in Foreign patience, and correspond to Figures 4 to 6 where χ was set to zero.

For brevity we focus on the aspects that are affected by domestic bias in consumption. Following an improvement in Home traded productivity, the most salient difference is for the real exchange rate, as it is now pulled in two opposite directions. First, the higher traded productivity lowers the price of Home traded goods, which raises the relative price of non-traded goods, and tends to appreciate the real exchange rate as before. The reduction in Home traded price also worsens the term-of-trade, which now pushes the real exchange rate towards a

depreciation. The balance between these two effects depends on the elasticities of substitution, and a real depreciation occurs when Home and Foreign traded goods are poor substitutes (as the terms-of-trade then move by more) and traded and non-traded goods are closer substitutes (as the relative price between them then moves by less).

The real interest rate is also affected, and increases by less than in the absence of domestic bias. As a result, Home consumption raises, or falls by less than in the absence of bias. The pattern of the various outputs is little affected by the presence of domestic bias.

Turning to the impact of a permanent increase in Home traded productivity shows a similar pattern. The impact of domestic bias in consumption is however limited, with a few exception such as the real exchange rate when Home and Foreign traded goods are poor substitutes.

The presence of domestic bias in consumption affects the response of the variables to a shock in Foreign patience to some extent, primarily when there is little substitutability between Home and Foreign traded goods. In that case, the consumption boom somewhat reduced, and the real exchange rate appreciation magnified as the improvement in the terms-of-trade now reinforces the impact of the higher relative price of non-traded goods. The impact on the various outputs is also somewhat reduced.[16]

Overall our numerical illustration of the general model reinforces the patterns shown in Figure 3. A real appreciation due to a productivity improvement in the traded sector leads to an output boom in that sector and a current account surplus. The same appreciation stemming from an increase in Foreign savings is associated with a credit fuelled consumption boom and a limited increase in overall output as resources shift towards the non-traded sector.

4. Conclusion

This paper assesses the effect of large currency appreciations on growth and trade, by means of stylized facts and event case analysis, and shows how the identified patterns are consistent with a simple theoretical model. The main empirical results are threefold. First, and as expected, large exchange rate appreciations are associated with weaker export growth and stronger import

[16] As in some cases the real exchange rate depreciates, we do not build a figure corresponding to Figure 5 where a real unit appreiciaton is imposed.

growth, compared to normal times. However, the second result is that output growth is actually stronger in the wake of a large appreciation, suggesting that other factors are sufficiently powerful to offset the effect through trade. Third, there is a substantial degree of heteorogeneity across appreciation episodes. Appreciations that are associated with so-called capital flow bonanzas (large capital inflows) or "lending booms" (large increases in lending to the private sector) are characterized by weaker growth compared to episodes with no lending boom and no capital flow bonanzas. These patterns are consistent with a simple theoretical model which shows that appreciations stemming from productivity improvements are associated with a stronger economic performance than appreciations stemming from easier borrowing conditions in world financial markets.

In terms of policy implications, our analysis shows that policy should not be designed solely in response to exchange rate movements, but instead needs to identify the driving factors. Financial inflows and credit booms emerge as sources of concern. These however are likely to be best dealt with through targeted management of capital flows and credit growth, for instance using macroprudential tools. A policy aimed at the exchange rate, which is merely a consequence of the underlying shocks, could well be too blunt a tool to effectively address legitimate policy concerns.

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Table 1: List of country episodes selected with the first criterion and in the final definition

Country	Years identified according to:		Country	Years identified according to:	
	A	A, B and C		A	A, B and C
Argentina	1993-2001	1997-1998	Korea	1989-1990	2005-2005
Australia	1973-1974	2004-2004		2000-2000	
	1981-1981			2005-2006	
	1989-1990				
	1997-1997				
	2003-2004		Malaysia	1983-1983	
	2011-2011			1993-1993	
Brazil	2005-2008	2007-2008	Morocco	1989-1989	
	2011-2011			1994-1994	
			Netherlands	1987-1987	
Canada	1989-1989	2004-2006	New Zealand	1994-1996	1995-1995
	2004-2007			2003-2005	2004-2004
	2011-2011			2011-2011	
Chile	1981-1982	1992-1995	Norway	1974-1974	
	1989-1995			2002-2002	
	2005-2006		Pakistan	1981-1981	
China	1975-1976		Peru	2001-2001	
	1980-1980		Philippines	2007-2007	2007-2007
	1989-1989		Poland	2001-2001	
	1997-1998			2006-2006	
	2009-2009			2008-2008	
Colombia	1994-1995	1995-1995	Saudi Arabia	1974-1974	
	2005-2005	2008-2008		1981-1983	
	2008-2008			1997-1998	
	2011-2011		Singapore	1982-1983	1982-1982
Czech Rep.	2002-2003	2002-2003		1990-1991	1990-1991
	2006-2006	2006-2006	South Africa	2004-2004	
	2008-2008	2008-2008		2010-2010	
Euro Area	1986-1987	1987-1987	Spain	1988-1990	1988-1989
	2003-2004	2003-2004	Sweden	2011-2011	
	2008-2008		Switzerland	1974-1979	1977-1977
Finland	1995-1995			1983-1983	
				1987-1987	
				1995-1995	
Germany	1973-1974			2010-2011	
	1977-1978		Thailand	1999-1999	2007-2007
	1987-1987		UK	1980-1981	1980-1981
Hong Kong	1994-1994			1997-1998	1997-1998
Hungary	1976-1977				
	1980-1982		USA	1976-1977	1982-1983
Indonesia	2010-2010			1981-1985	1997-1998
Ireland	2003-2004	2003-2004		1989-1991	
Israel	2008-2008	2008-2008		1993-1994	
Italy	1997-1997			1997-1998	
Japan	1972-1973	1984-1987	Uruguay	1981-1982	1993-1993
	1977-1979	1992-1994		1989-1990	
	1981-1981			1993-1994	
	1984-1989			2006-2006	
	1992-1995			2011-2011	
	1999-2000				
	2009-2010				

Table 2 : Summary statistics: impact of a strong appreciation

In situation of strong appreciation (ABC=1)	GDP	export	import
All countries			
mean	4.1	4.7	8.2
median	*4.1*	*4.0*	*8.3*
Developed countries			
mean	3.4	3.4	6.6
median	*3.9*	*2.9*	*7.8*
EMEs countries			
mean	5.9	8.4	12.7
median	*5.3*	*8.7*	*10.0*
Not in situation of strong appreciation (ABC=0)	**GDP**	**export**	**import**
All countries			
mean	3.3	6.2	6.0
median	*3.3*	*6.1*	*6.2*
Developed countries			
mean	2.6	5.7	5.4
median	*2.6*	*5.4*	*5.8*
EMEs countries			
mean	4.2	7.0	6.8
median	*4.8*	*7.1*	*8.1*

Figure 1: event case analysis

Impact of a strong appreciation at time t on

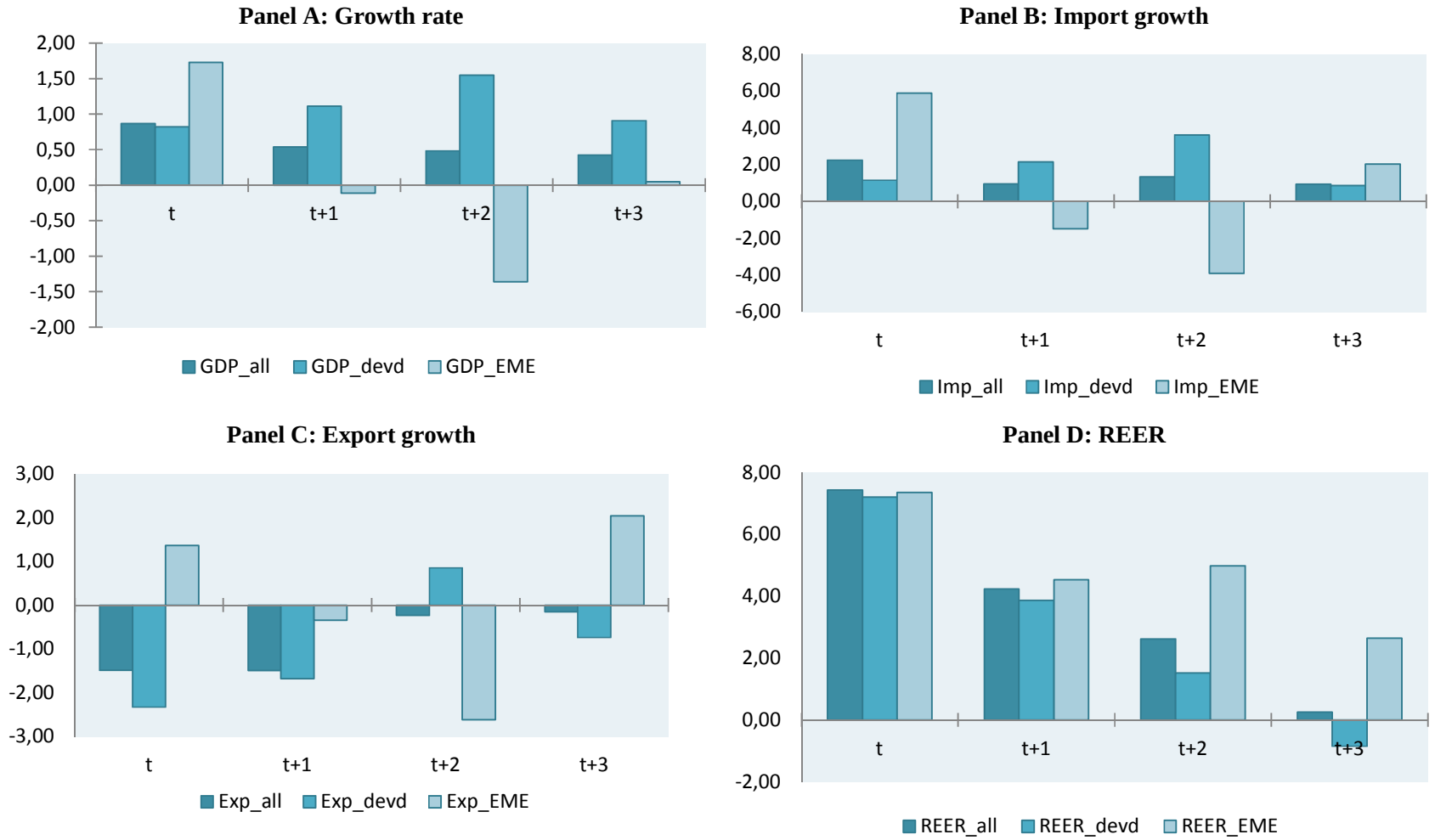
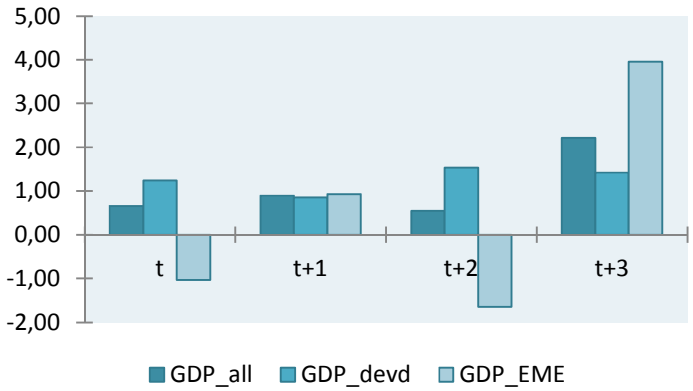


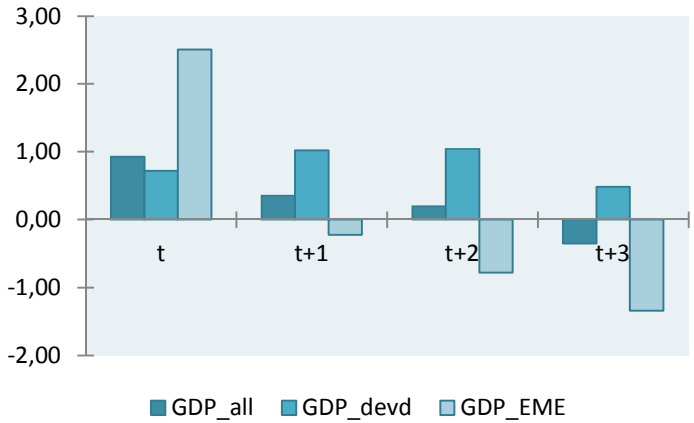
Figure 2: event case analysis

Impact of a Capital Flow Bonanza on

Panel E:Growth rate, CFB=1 at time t

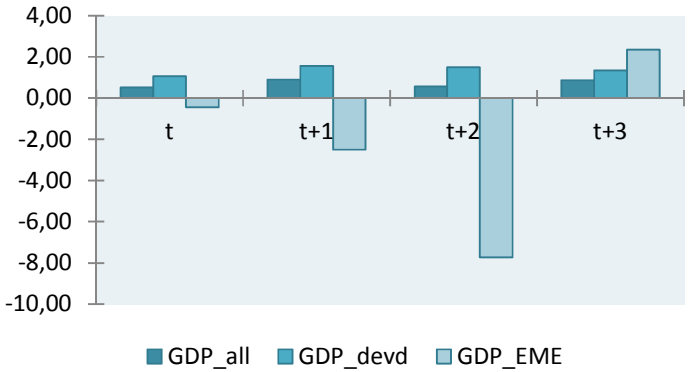


Panel F:Growth rate, CFB=0 at time t



Impact of a lending boom on

Panel G:Growth rate, LB=1 at time t



Panel H:Growth rate, LB=0 at time t

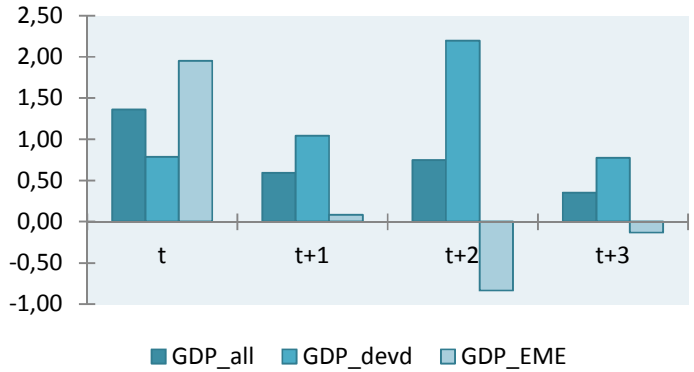
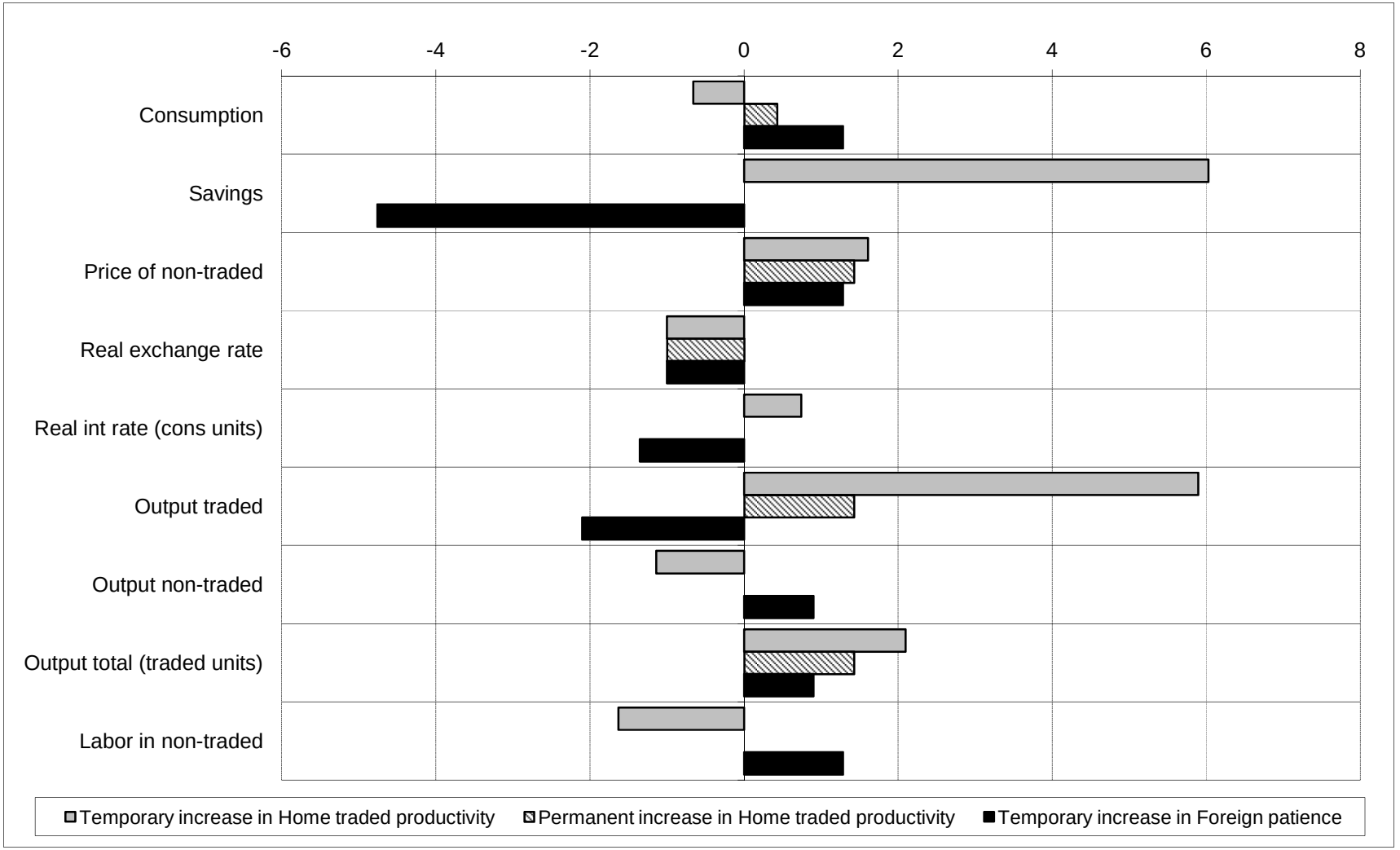


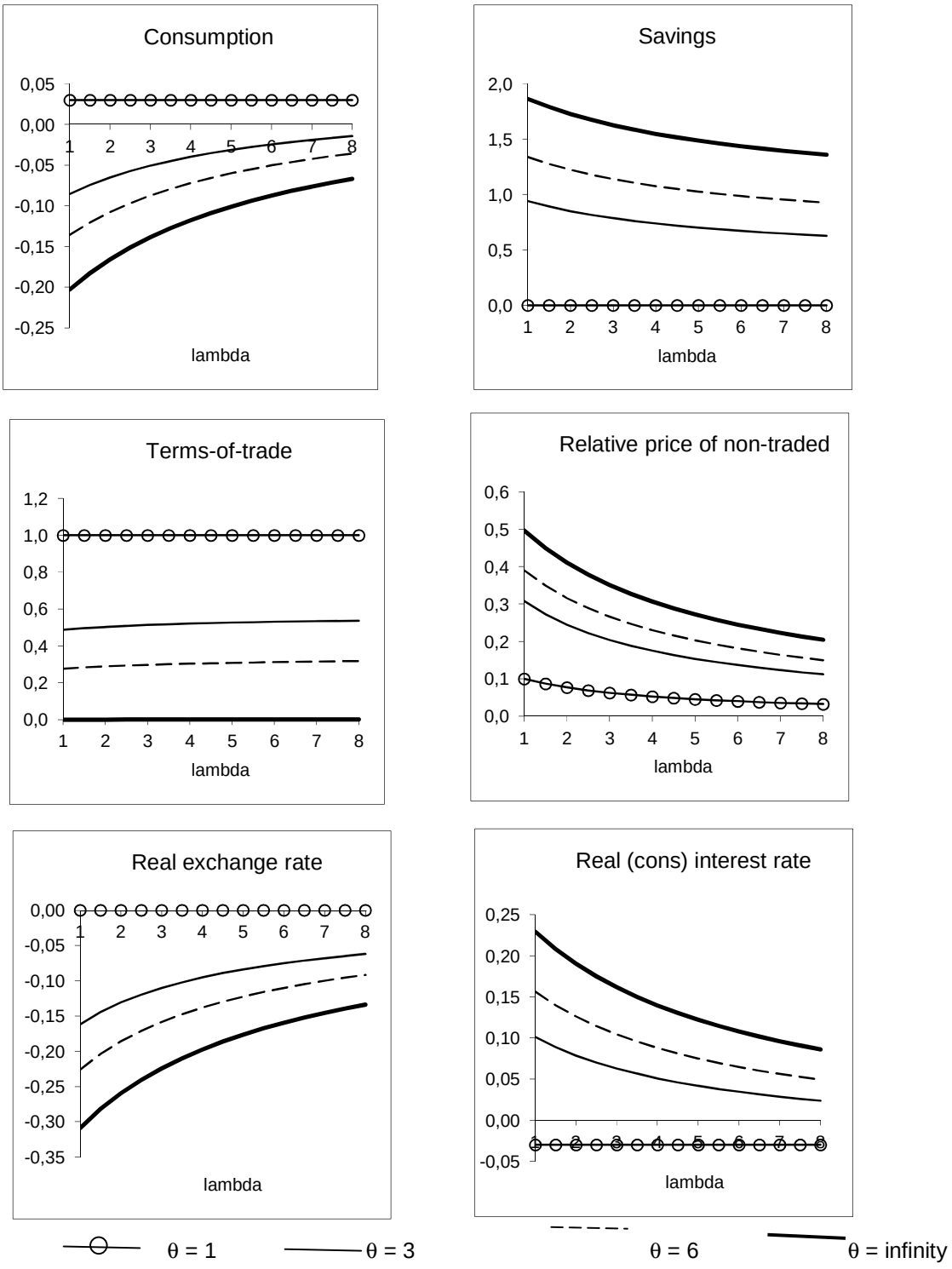
Figure 3: Impact on short run Home variables, simple model

All shocks imply a unit Home real appreciation in the short run



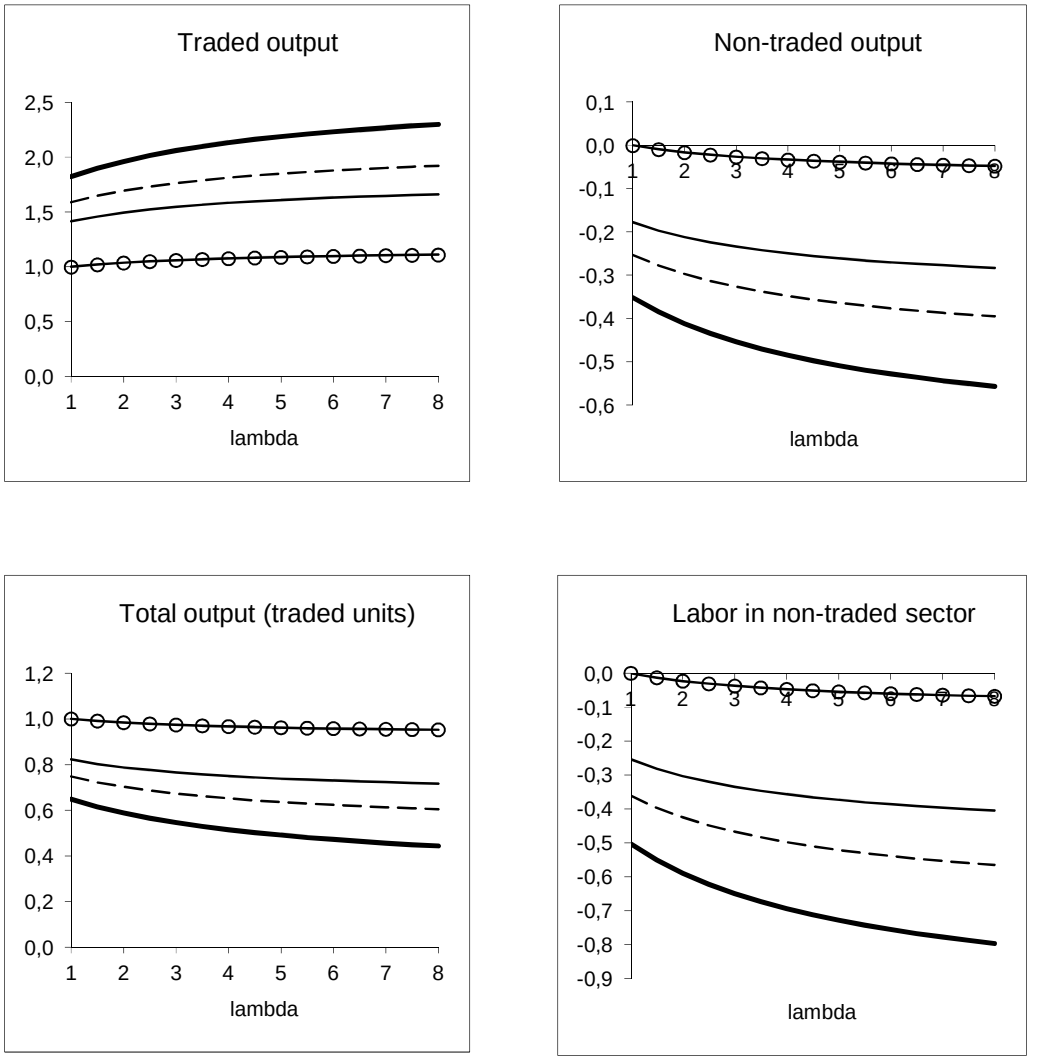
Parameters: n = 0.1, l = 1, q = infinity, g = 0.3, a = 0.3, b0 = 0.95

Figure 4: Temporary increase in Home traded productivity



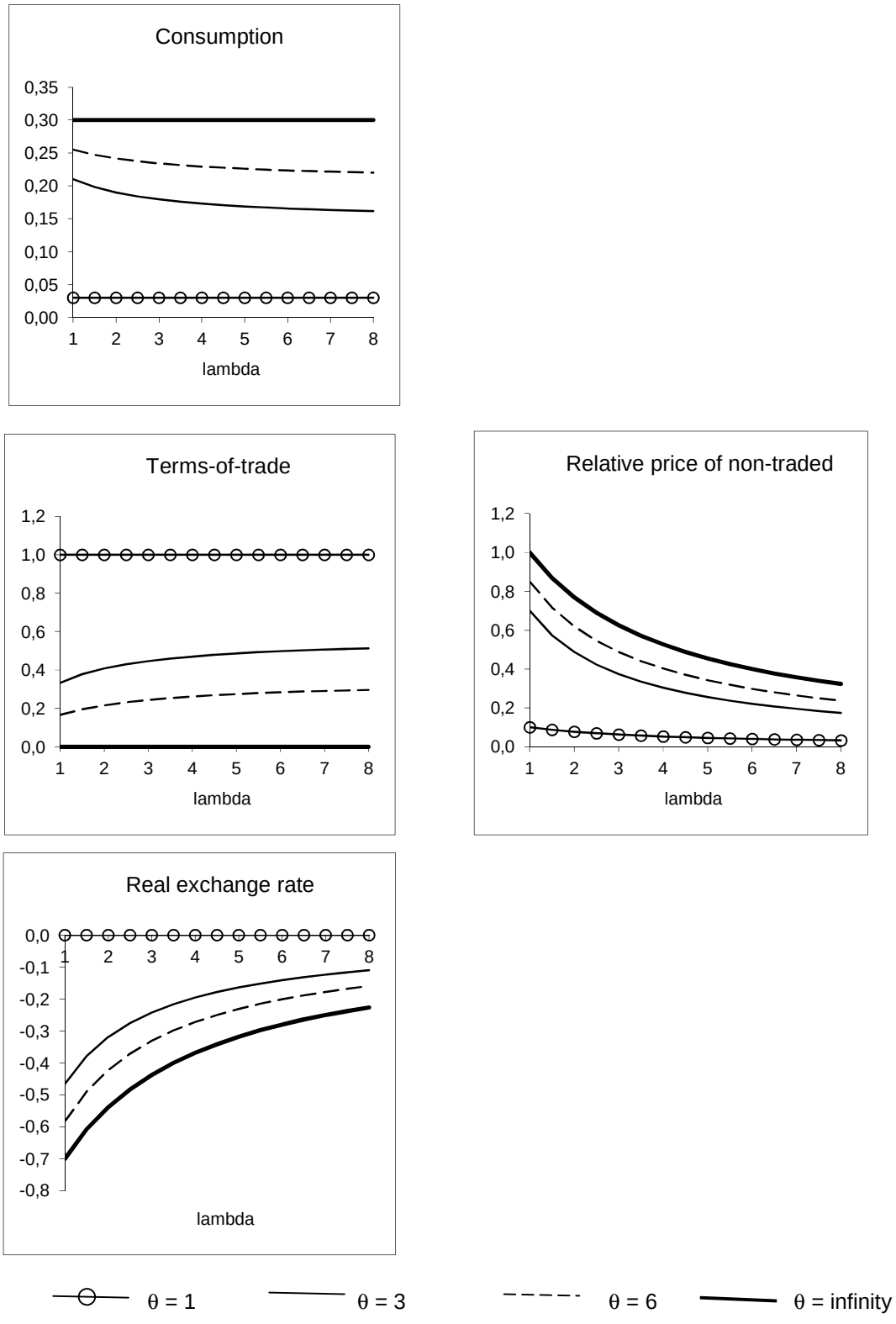
Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0$, $\beta 0 = 0.95$

Figure 4 (cont.): Temporary increase in Home traded productivity



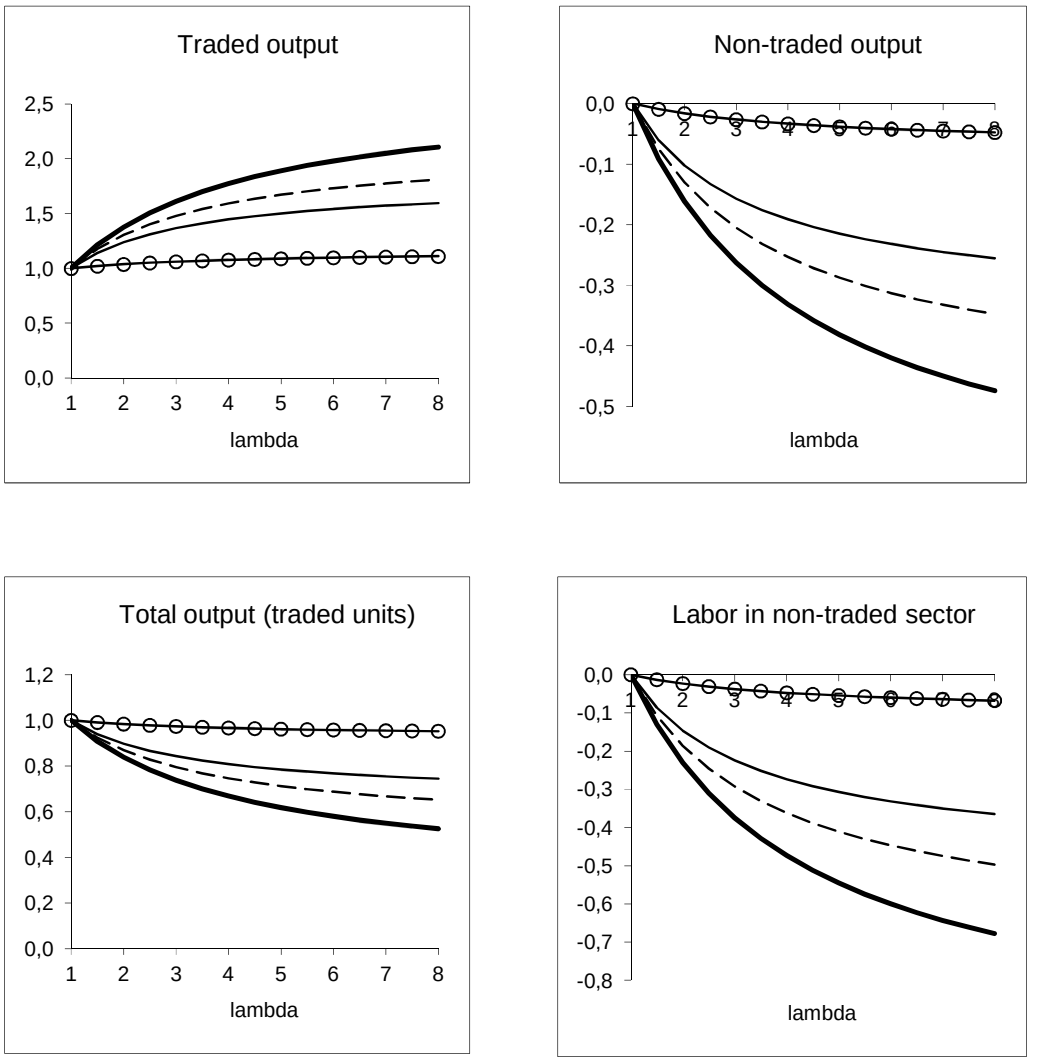
Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0, $\beta 0$ = 0.95

Figure 5: Permanent increase in Home traded productivity



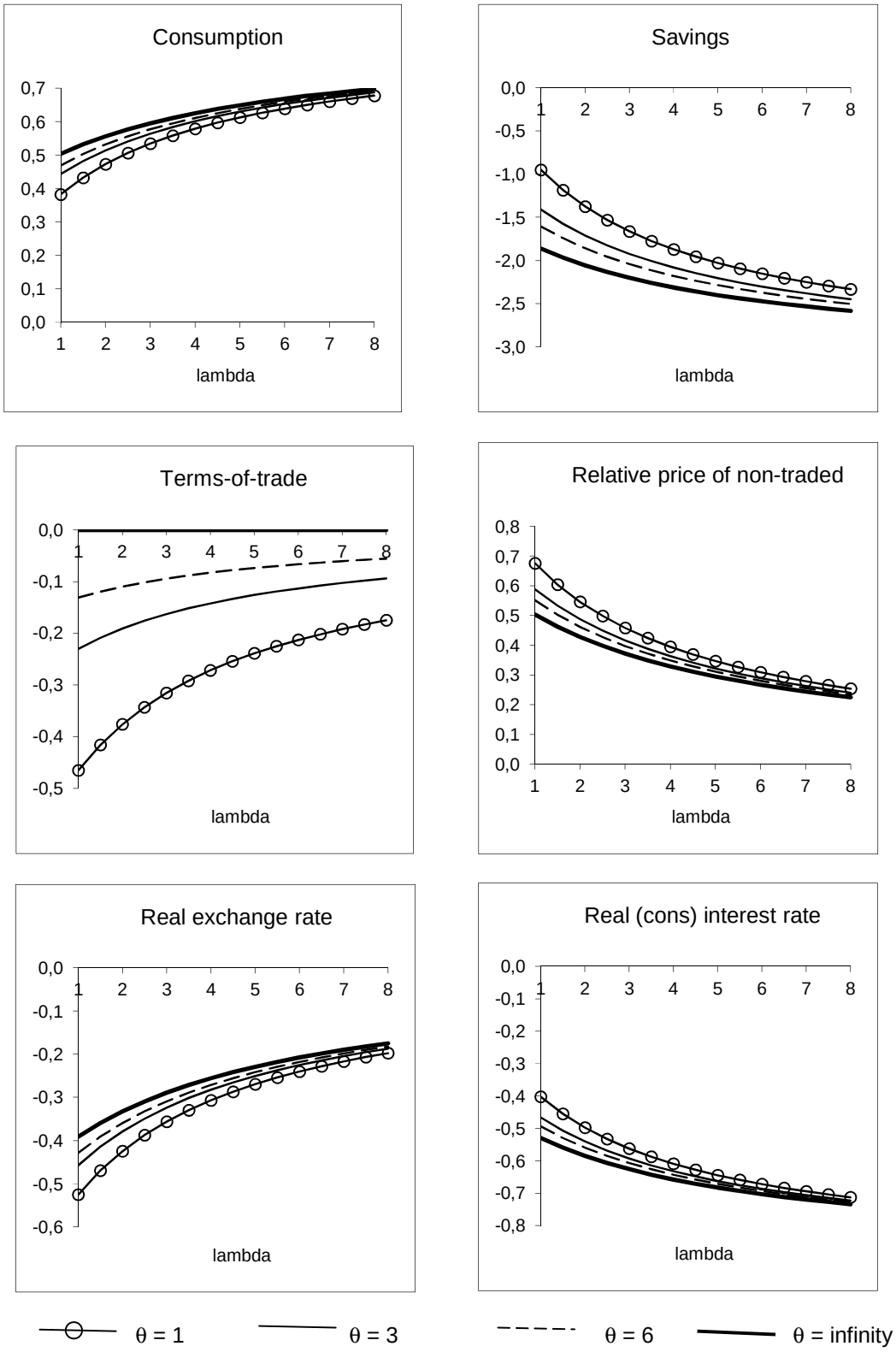
Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0$, $\beta 0 = 0.95$

Figure 5 (cont.): Permanent increase in Home traded productivity



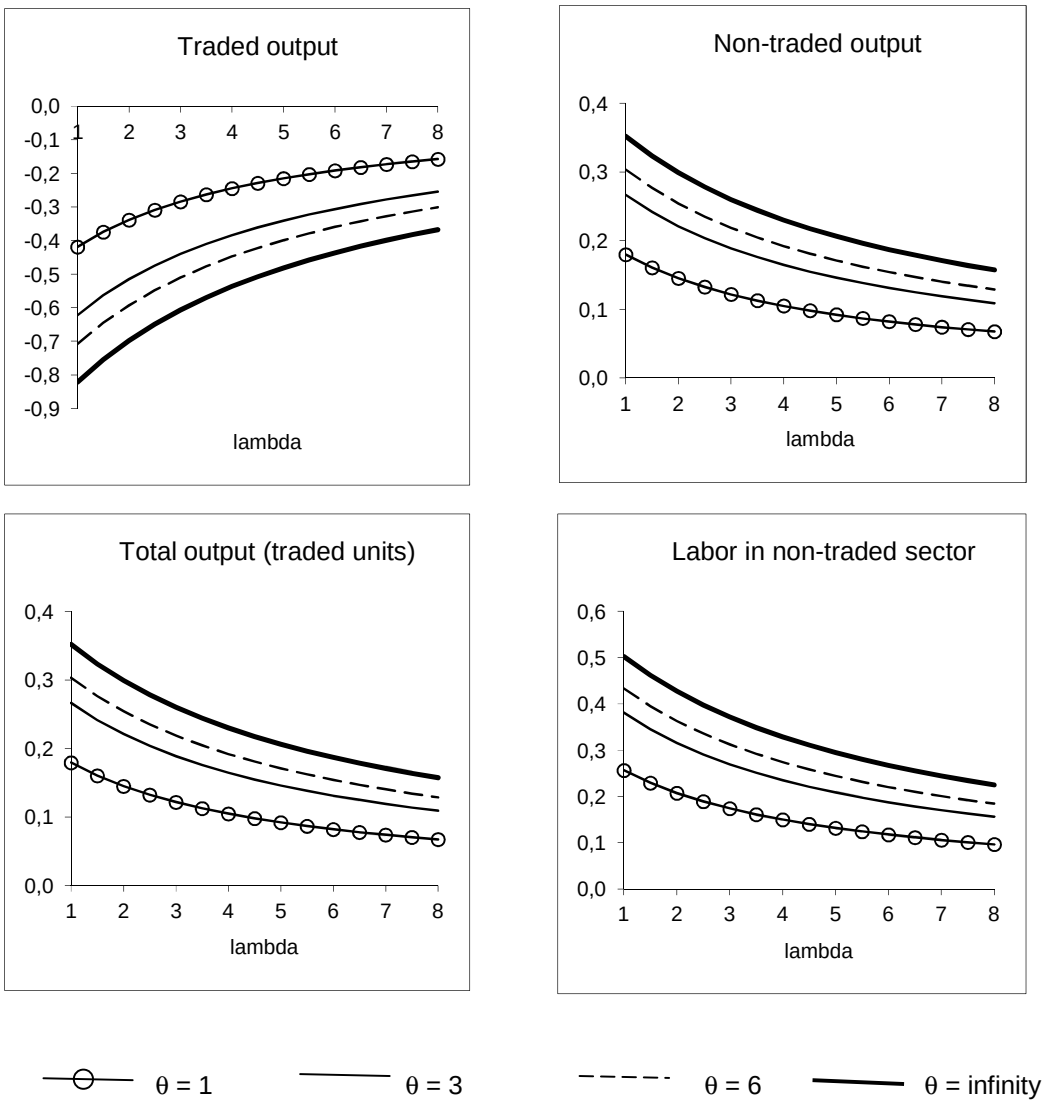
Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0$, $\beta 0 = 0.95$

Figure 6: Temporary increase in Foreign patience



Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0$, $\beta 0 = 0.95$

Figure 6 (cont.): Temporary increase in Foreign patience

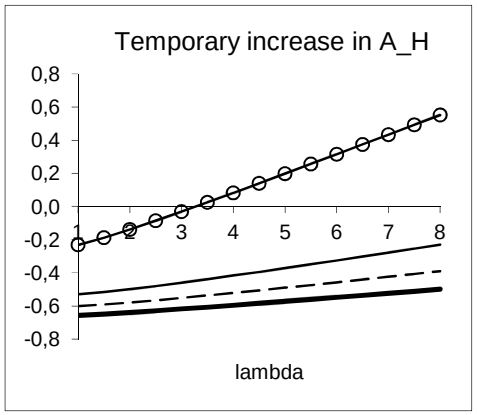


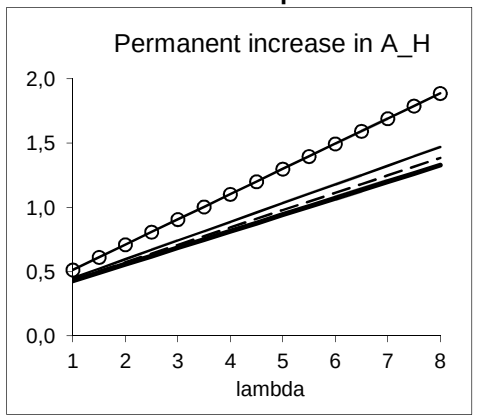
Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0$, $\beta 0 = 0.95$

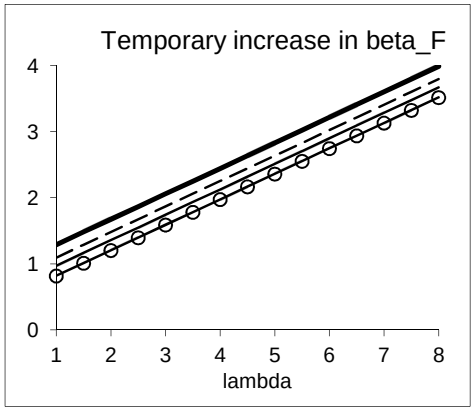
Figure 7: Impact on short run Home variables

All shocks imply a unit Home real appreciation in the short run

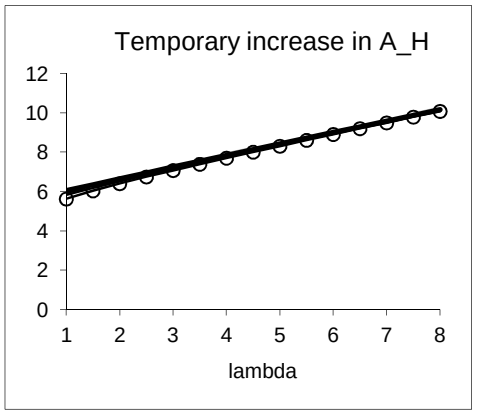
Consumption

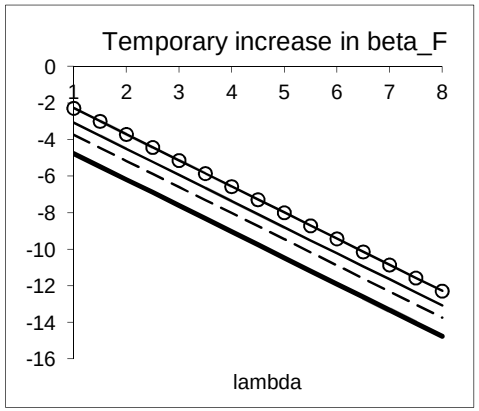






Savings



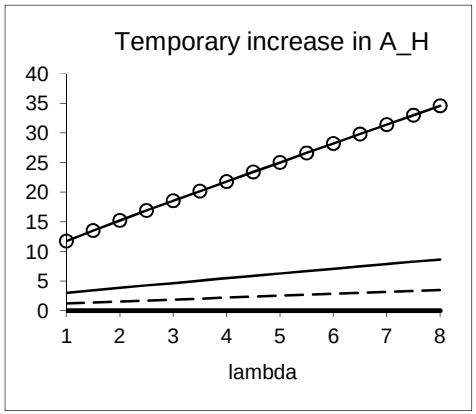


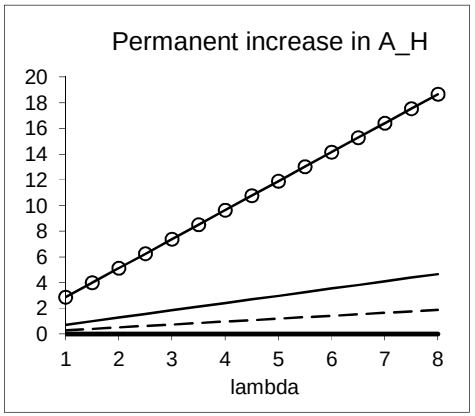
θ = 3 θ = 6 θ = infinity

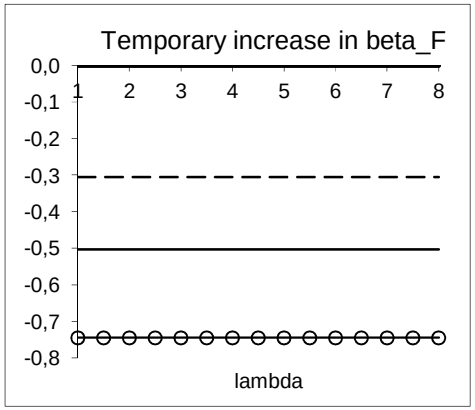
Figure 7 (cont.): Impact on short run Home variables

All shocks imply a unit Home real appreciation in the short run

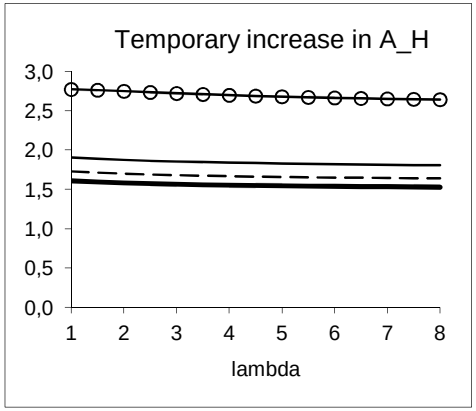
Terms-of-trade

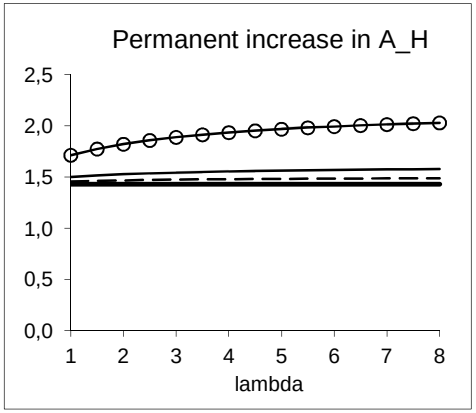


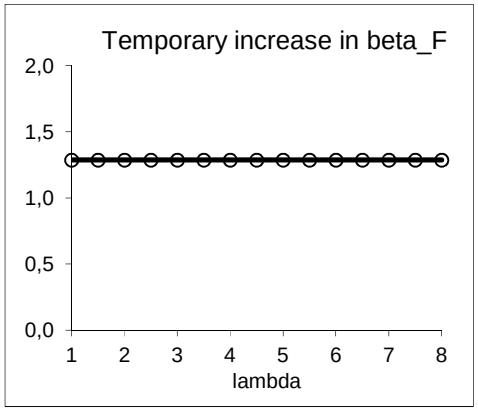




Relative price of non-traded



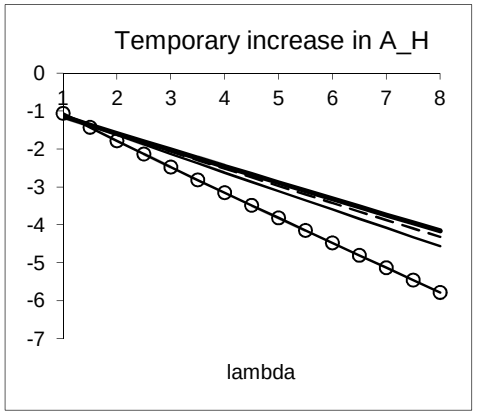


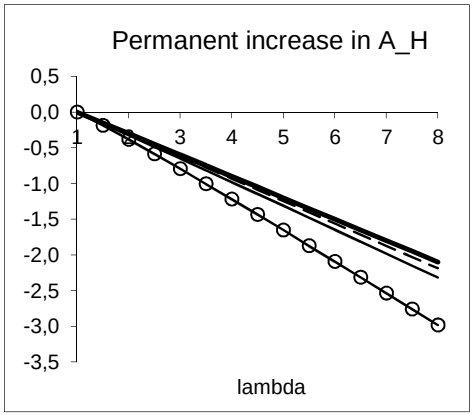


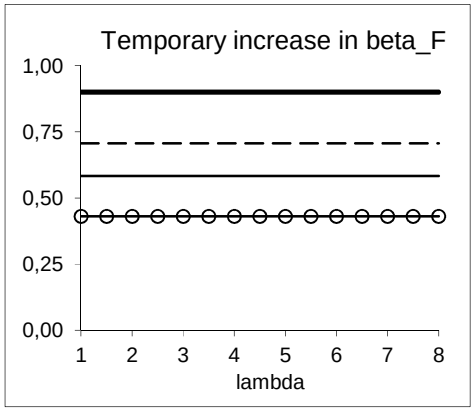
θ = 3 θ = 6 θ = infinity

Figure 7 (cont.): Impact on short run Home variables
All shocks imply a unit Home real appreciation in the short run

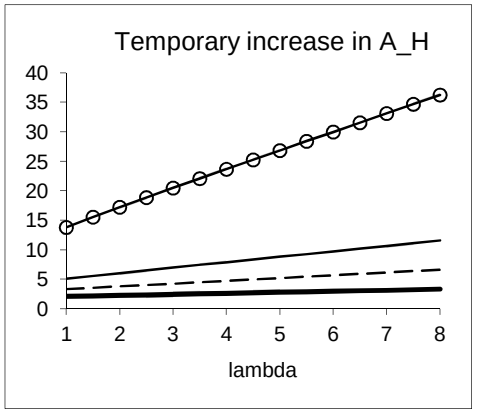
Non-traded output

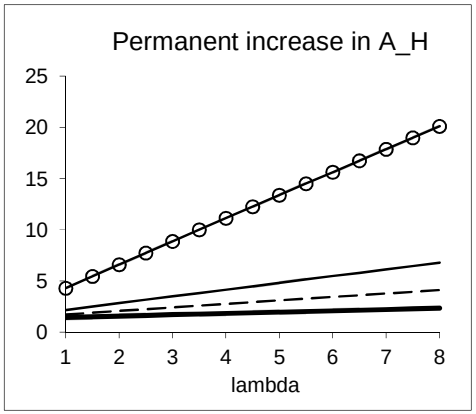


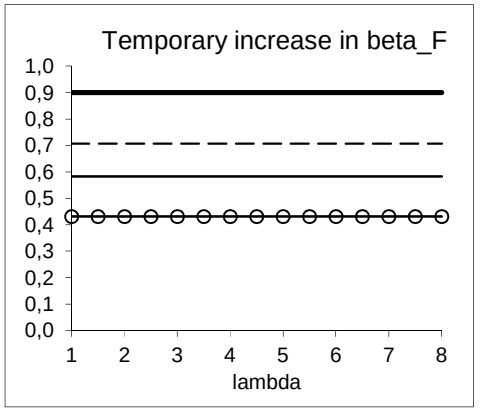




Total output (traded units)

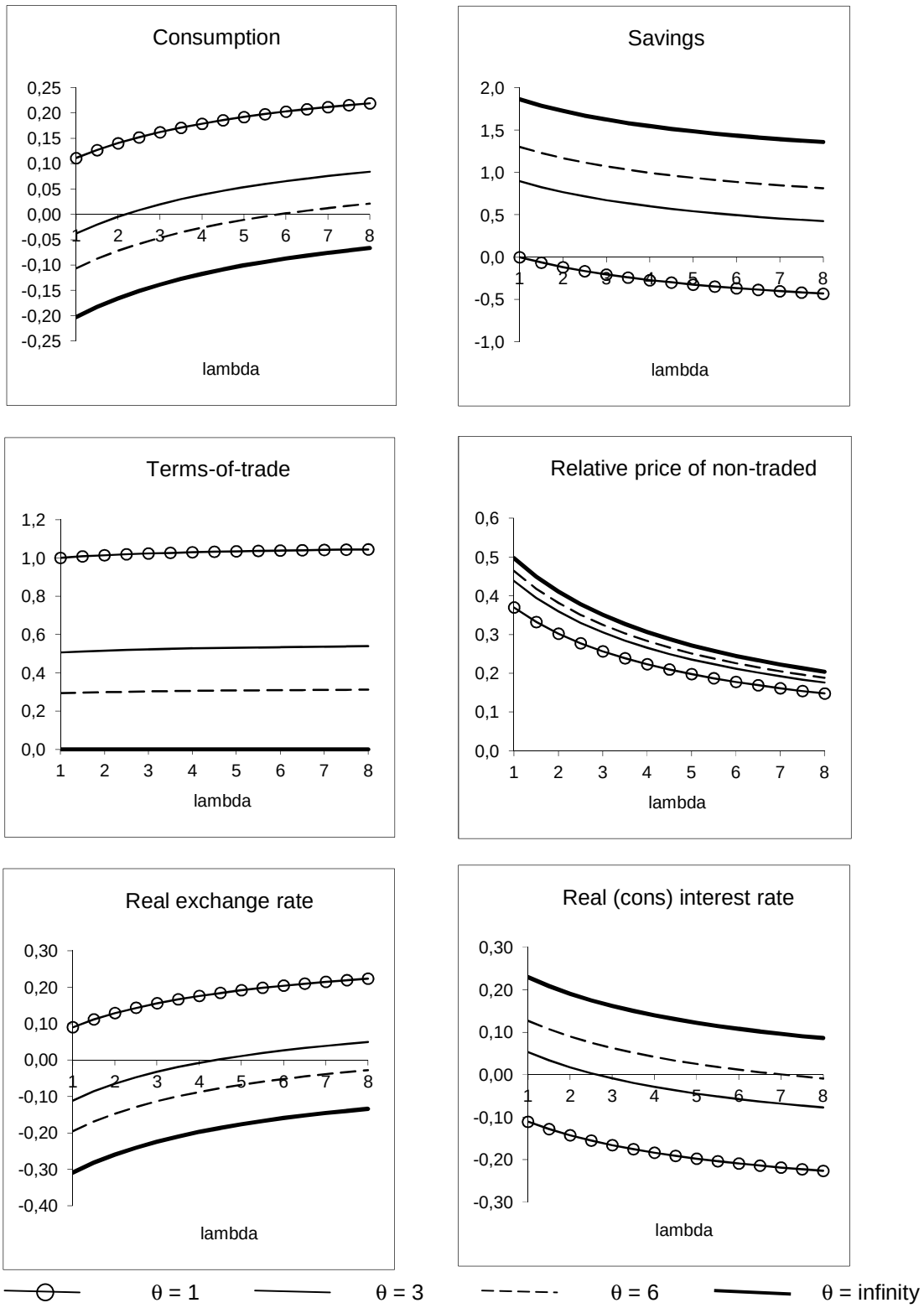






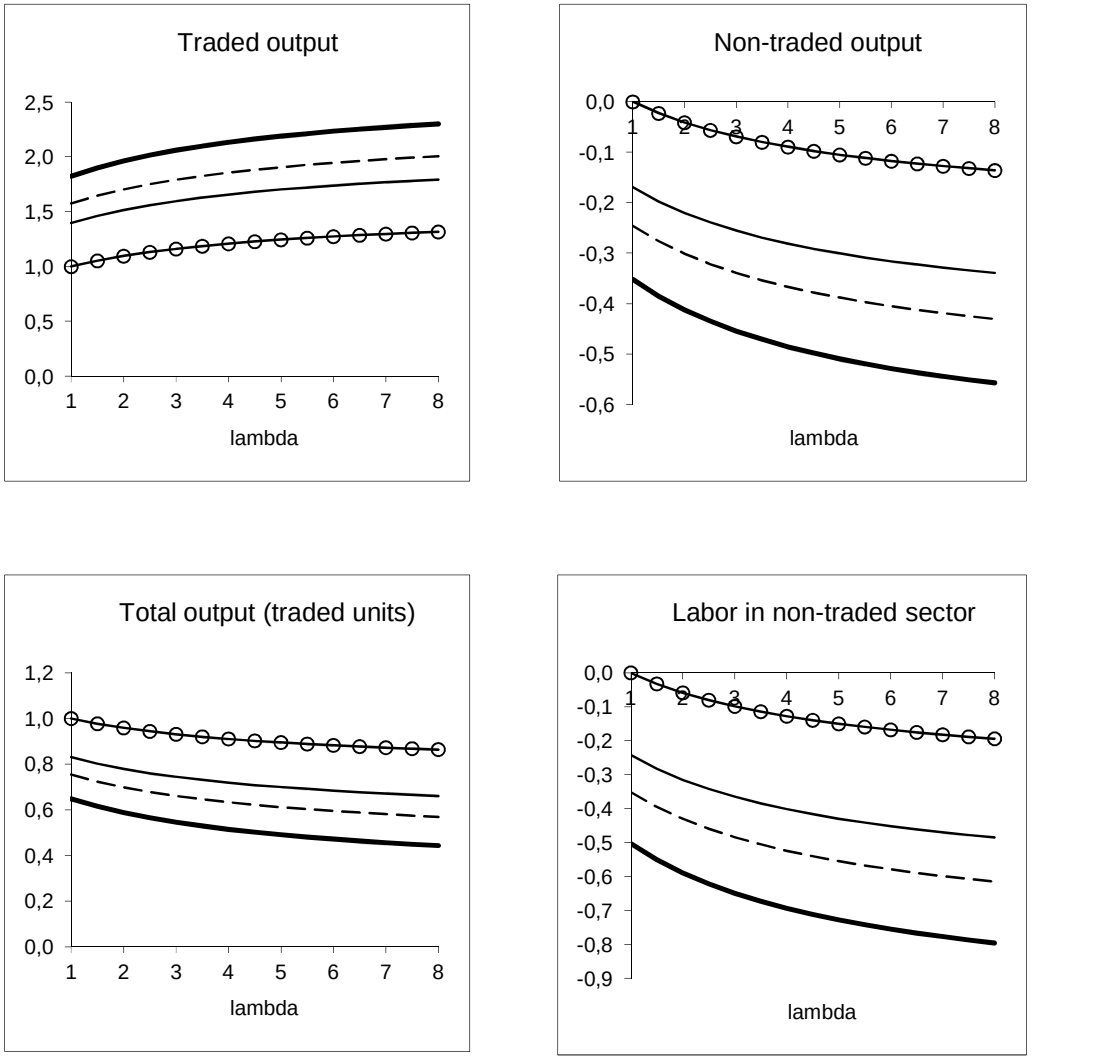
θ = 3 θ = 6 θ = infinity

Figure 8: Temporary increase in Home traded productivity, with bias



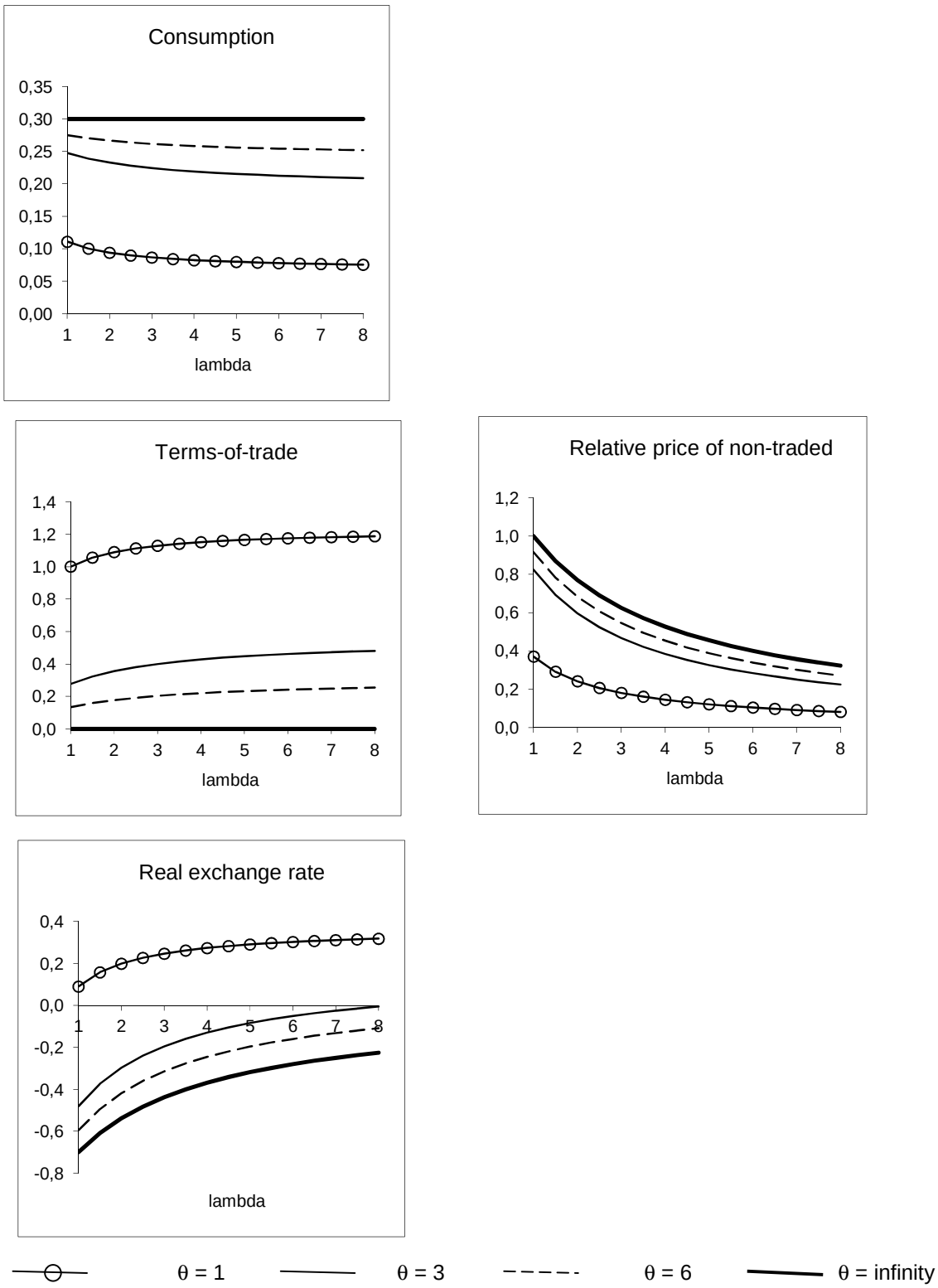
Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0.3, $\beta 0$ = 0.95

Figure 8 (cont.): Temporary increase in Home traded productivity, with bias



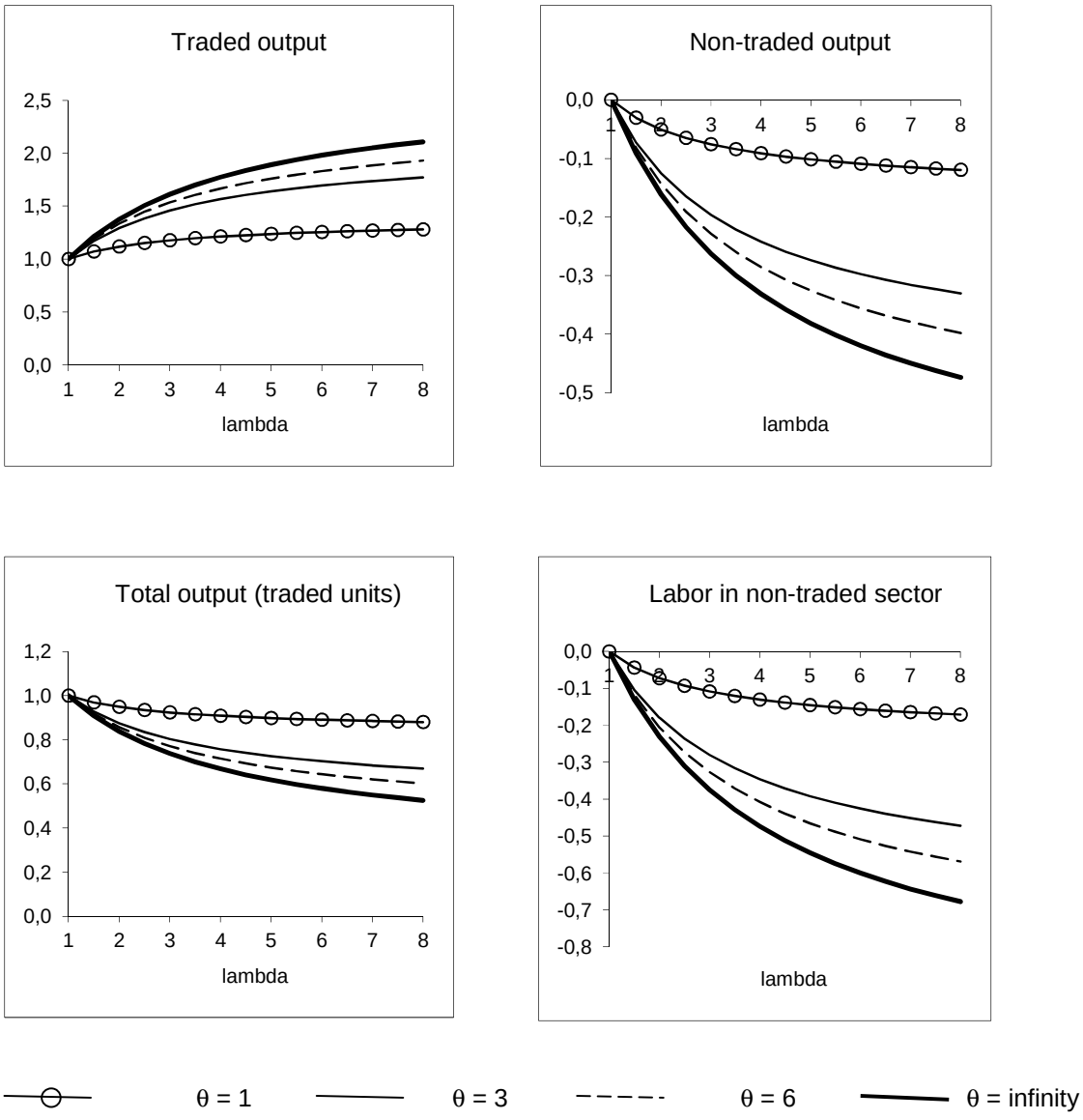
Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0.3, $\beta 0$ = 0.95

Figure 9: Permanent increase in Home traded productivity, with bias



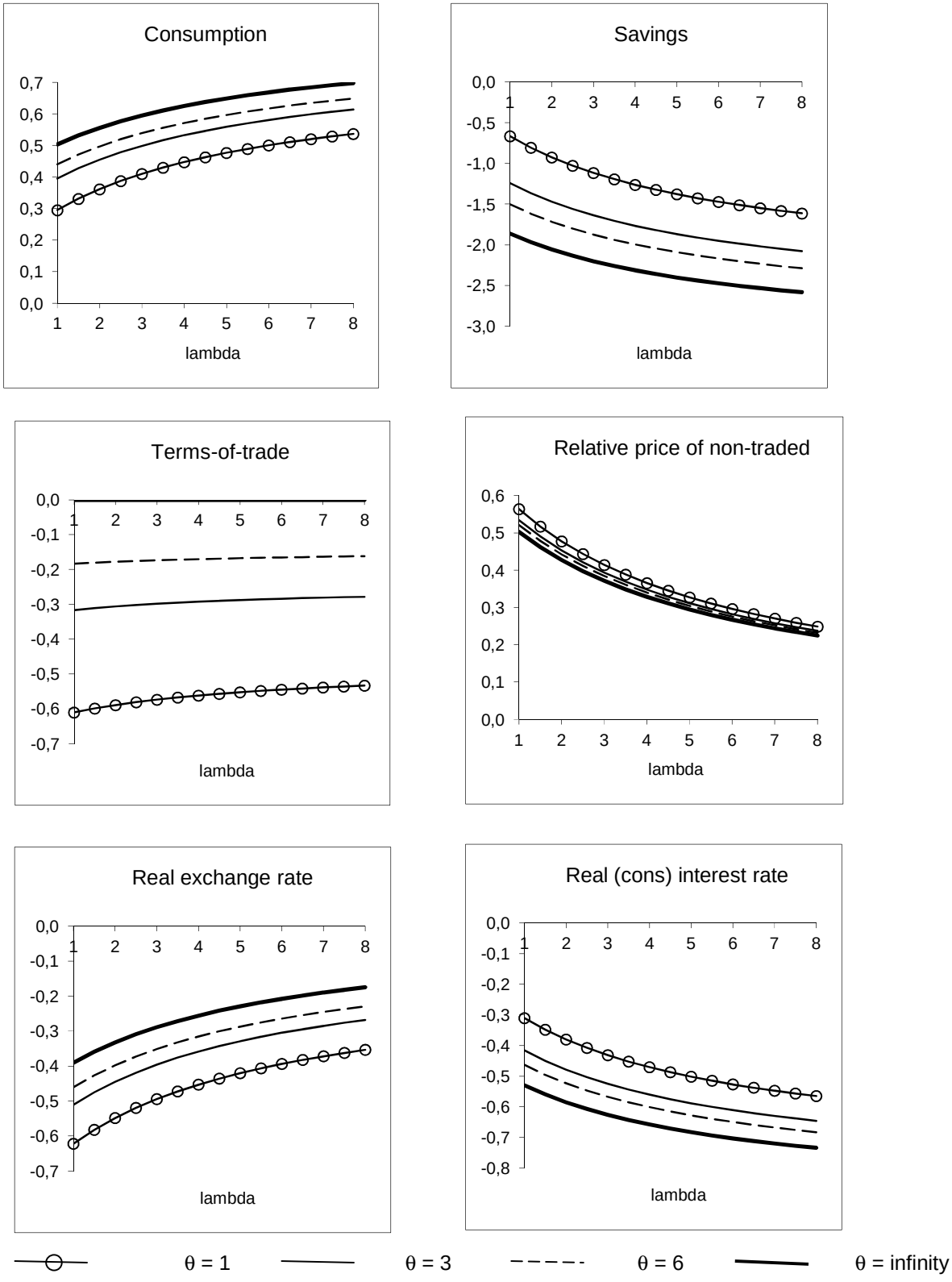
Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0.3, $\beta 0$ = 0.95

Figure 9 (cont.): Permanent increase in Home traded productivity, with bias



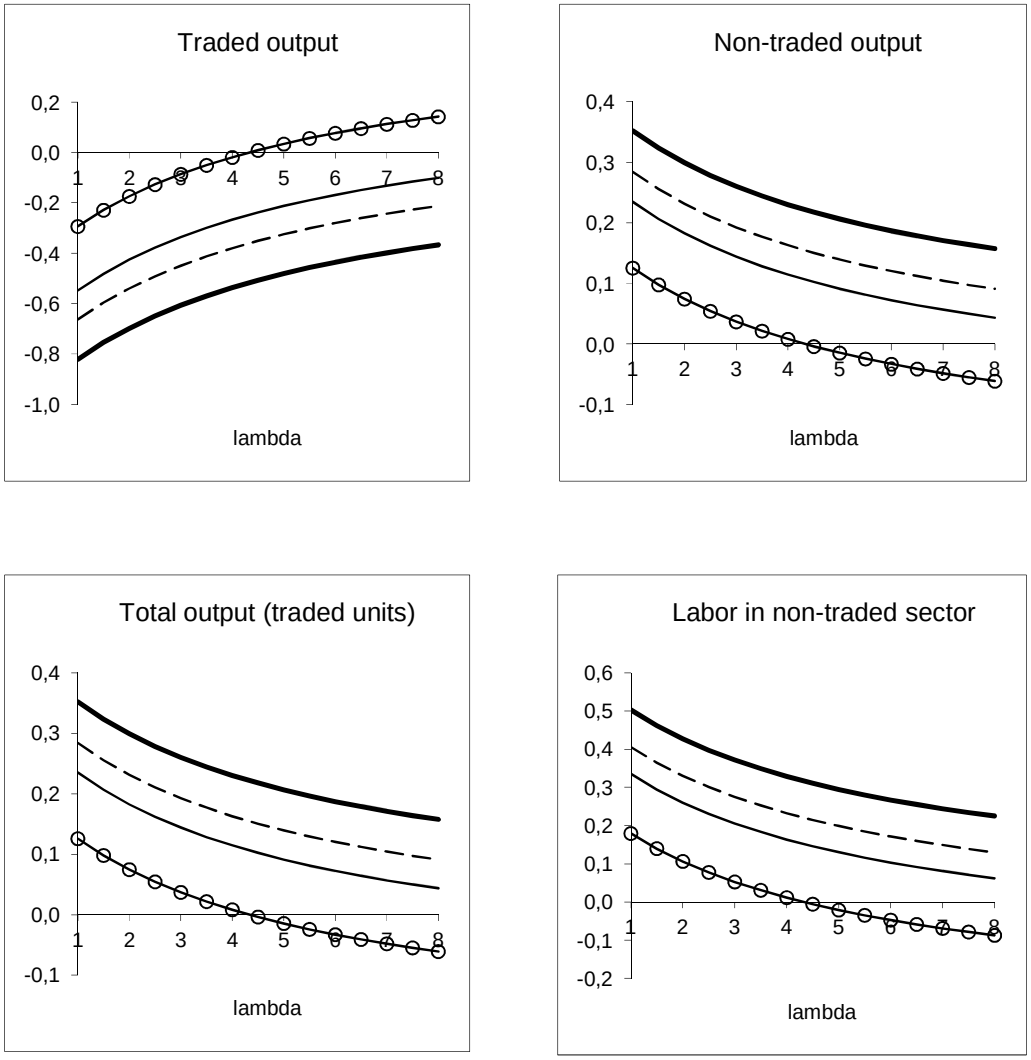
Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0.3, $\beta 0$ = 0.95

Figure 10: Temporary increase in Foreign patience, with bias



Parameters: $n = 0.1$, $\gamma = 0.3$, $\alpha = 0.3$, $\chi = 0.3$, $\beta 0 = 0.95$

Figure 10 (cont.): Temporary increase in Foreign patience, with bias



Parameters: n = 0.1, γ = 0.3, α = 0.3, χ = 0.3, $\beta 0$ = 0.95

Appendix I: selected quotes on exchange rate appreciations

JAPAN

Sayuri Shirai: The euro area crisis, the flight-to-safety premium, and cooperation and coordination among central banks
Remarks by Ms Sayuri Shirai, Member of the Policy Board of the Bank of Japan, at the workshop co-hosted by the Asian Development Bank Institute and the Reinventing Bretton Woods Committee, "Adjusting the World to the New Realities of the International Financial System", Tokyo, 12 October 2012.

"Consequently, capital inflows into securities investment from abroad have contributed to ***the appreciation of the exchange rates*** *of some of these countries, as typically seen in the case of Japan.* ***This has adversely affected the export manufacturing sector****, which had been recovering from the supply-chain disruption and resultant plunge in exports caused by the Great East Japan Earthquake on March 11, 2011."*

Masaaki Shirakawa: Reviewing the economies of Switzerland and Japan
Remarks by Mr Masaaki Shirakawa, Governor of the Bank of Japan, at the 30th Anniversary Luncheon of the Swiss Chamber of Commerce and Industry in Japan (SCCIJ), Tokyo, 10 October 2012.

"More recently, between December 2007 and August 2011, the real effective exchange rates for Switzerland and Japan moved in tandem with each other, appreciating by 16.9 percent and 23.3 percent, respectively. These movements of the last few years are to an extent representative of the fallouts from the Great Financial Crisis. The prevalent mood of risk aversion resulted in the unwinding of carry trades. Both countries are now also confronted by the so-called flight-to-safety capital flows. ***The appreciation of the two currencies coincided with the most severe financial and economic dislocations in the advanced economies."***

Ryuzo Miyao: Economic activity, prices, and monetary policy
Speech by Mr Ryuzo Miyao, Member of the Policy Board of the Bank of Japan, at a meeting with business leaders, Yamaguchi, 5 September 2012.

"Second, there is a risk of further appreciation of the yen. While a positive case can be made for yen appreciation to a certain extent, ***excessive appreciation will worsen the competitiveness and profits of exporting firms again and act as a headwind against firms. If a trend of falling stock prices intensifies, together with the trend of yen appreciation, then firms' and households' confidence will deteriorate and currently solid business fixed investment plans and private consumption will be contained, which will weigh on Japan's economic recovery****."*

Yoshihisa Morimoto: Economic activity and prices in Japan and monetary policy
Speech by Mr Yoshihisa Morimoto, Member of the Policy Board of the Bank of Japan, at a meeting with business leaders, Ishikawa, 2 August 2012.

"Thereafter, however, it (the economy) remained more or less flat on the whole until around the early springof 2012 mainly due to ***the adverse effects of the slowdown in overseas economies and the appreciation of the yen."***

Hirohide Yamaguchi: European debt problem and its impact on Asia

Speech by Mr Hirohide Yamaguchi, Deputy Governor of the Bank of Japan, at the 8th Tokyo-Beijing Forum, Tokyo, 2 July 2012.

*"**Changes in foreign exchange rates**, for example, a substantial yen appreciation might, especially for Japan's economy, **worsen corporate profits and put downward pressure on economic activity.**"*

Masaaki Shirakawa: Japan's economy and monetary policy
Speech by Mr Masaaki Shirakawa, Governor of the Bank of Japan, at a meeting held by the Naigai Josei Chousa Kai (Research Institute of Japan), Tokyo, 4 June 2012.

*"After the beginning of autumn 2011, however, **economic activity temporarily became flat due to the effects of** the slowdown in overseas economies, **the appreciation of the yen**, and the flooding in Thailand."*

Sayuri Shirai: Recent global economic developments and monetary policy in Japan – strengthening Japan's growth momentum through opportunities in emerging Asia
Speech by Ms Sayuri Shirai, Member of the Policy Board of the Bank of Japan, at a meeting with business leaders, Akita, 10 May 2012.

*"From the second half of fiscal 2011, **economic activity remained more or less flat mainly due to an adverse effect on exports and production** of the slowdown in overseas economies **and the appreciation of the yen."***

Other countries

Emmanuel Tumusiime-Mutebile: Oil revenue management
Remarks by Mr Emmanuel Tumusiime-Mutebile, Governor of the Bank of Uganda, at the Oil Revenue Management Seminar, Kampala, 27 February 2012.

*"The second issue which I want to highlight pertains to the potential for Dutch disease. The spending of oil revenues is likely to cause a **real exchange rate appreciation, which could damage the competitiveness of the non oil traded goods sectors of the economy, including both exporters and manufacturing firms which compete with imports."***

Mark Carney: Dutch disease
Remarks by Mr Mark Carney, Governor of the Bank of Canada and Chairman of the Financial Stability Board, to the Spruce Meadows Round Table, Calgary, Alberta, 7 September 2012

*"Some regard Canada's wealth of natural resources as a blessing. Others see it as a curse. The latter look at the global commodity boom and make the grim diagnosis for Canada of "Dutch Disease."1 They dismiss the enormous benefits, including higher incomes and greater economic security, our bountiful natural resources can provide. Their argument goes as follows: record-high commodity prices have led to **an appreciation of Canada's exchange rate, which, in turn, is crowding out trade-sensitive sectors, particularly manufacturing**. The disease is the notion that an ephemeral boom in one sector causes permanent losses in others, in a dynamic that is net harmful for the Canadian economy."*

Jean-Pierre Danthine: Monetary policy is not almighty
Speech by Mr Jean-Pierre Danthine, Vice Chairman of the Governing Board of the Swiss National Bank, at the Journée Solutions Bancaires, Geneva, 31 May 2012.

"An appreciation of the Swiss franc would again expose the Swiss economy to considerable risks and, once more, endanger both price stability and economic situation."

Thomas Jordan: The Swiss economy and global economic outlook
Introductory remarks by Mr Thomas Jordan, Chairman of the Governing Board of the Swiss National Bank, at the Media News Conference of the Swiss National Bank, Berne,
14 June 2012.

"The Swiss National Bank (SNB) will maintain the minimum exchange rate of CHF 1.20 per euro and will enforce it with the utmost determination. It remains prepared to buy foreign currency in unlimited quantities for this purpose. Even at the current rate, the Swiss franc is still high. ***Another appreciation would have a serious impact on both prices and the economy in Switzerland****. The SNB will not tolerate this. If necessary, it stands ready to take further measures at any time."*

Christian Noyer: Monetary policy, the French economy and its outlook
Introductory letter by Mr Christian Noyer, Governor of the Bank of France, to the Bank of France's Annual Report 2006, submitted to the President of the French Republic, the President of the Senate, and the President of the National Assembly, 1 August 2007.

"It is clear that the price-competitiveness of French industries has deteriorated significantly in recent years. ***Has the euro's appreciation played a role in this? On the one hand, it undoubtedly penalises export sectors whose competitors are located in other monetary areas. But, on the other hand, it benefits those sectors which are large consumers of imported commodities. At this stage, the overall effect on France's growth and external balance is not clearly apparent****. Furthermore, two observations must be made: first, it is mainly intra-euro area trade that is worsening; second, many of France's European partners faced with the same constraints are performing better"*

Axel A Weber: Financial markets, economic forecast and monetary policy
Speech by Professor Axel A Weber, President of the Deutsche Bundesbank, at the British Chamber of Commerce in Germany, Frankfurt am Main, 17 April 2008.

"*Third****, the euro's appreciation should not only be viewed from the perspective of external demand. A strong euro simultaneously dampens the prices of import goods. This helps to curb the inflationary pressures resulting from strong rises in energy and food prices and thus has a stabilising effect"***

Frederic S Mishkin: Globalization, macroeconomic performance, and monetary policy
Member of the Board of Governors of the US Federal Reserve System, at the Domestic Prices in an Integrated World Economy Conference, Board of Governors of the Federal Reserve System, Washington DC, 27 September 2007.

*"****An appreciation of the dollar, in turn, restrains exports (because the price of U.S. goods rises when measured in foreign currencies) and stimulates imports (because imports become cheaper in dollar terms). The resulting decrease in net exports implies a reduction in aggregate demand****."*

Appendix II: complete solution of the model

A II.1 Consumption allocation

The allocation of consumption in the Home country is:

$$C_{H,t} = \gamma(n+(1-n)\chi)\left[P_{H,t}/P_{T,t}\right]^{-\theta}\left[P_{T,t}/P_t\right]^{-\lambda}C_t$$
$$C_{F,t} = \gamma(1-n)(1-\chi)\left[P_{F,t}/P_{T,t}\right]^{-\theta}\left[P_{T,t}/P_t\right]^{-\lambda}C_t$$
$$C_{N,t} = (1-\gamma)\left[P_{N,t}/P_t\right]^{-\lambda}C_t$$

The corresponding relations in the Foreign country are:

$$C^*_{H,t} = \gamma n(1-\chi)\left[P_{H,t}/P^*_{T,t}\right]^{-\theta}\left[P^*_{T,t}/P^*_t\right]^{-\lambda}C^*_t$$
$$C^*_{F,t} = \gamma(1-n+n\chi)\left[P_{F,t}/P^*_{T,t}\right]^{-\theta}\left[P^*_{T,t}/P^*_t\right]^{-\lambda}C^*_t$$
$$C^*_{N,t} = (1-\gamma)\left[P^*_{N,t}/P^*_t\right]^{-\lambda}C^*_t$$

A II.2 Market clearing and intertemporal constraints

Using the intratemporal consumption allocation, the clearing conditions for the non-traded goods (1) are written as:

$$n(1-\gamma)\left[\frac{(R_t)^{1-\lambda}}{\gamma+(1-\gamma)(R_t)^{1-\lambda}}\right]^{\frac{\lambda}{\lambda-1}}C_t = A_{N,t}(L_{N,t})^{1-\alpha}$$

$$(1-n)(1-\gamma)\left[\frac{(R^*_t)^{1-\lambda}}{\gamma+(1-\gamma)(R^*_t)^{1-\lambda}}\right]^{\frac{\lambda}{\lambda-1}}C^*_t = A^*_{N,t}(L^*_{N,t})^{1-\alpha}$$

The Home intertemporal constraint in terms of traded goods (2) is written as:

$$n\gamma\frac{\left[(n+(1-n)\chi)+(1-n)(1-\chi)(T_t)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma+(1-\gamma)(R_t)^{1-\lambda}\right]^{\frac{\lambda}{\lambda-1}}}C_t = A_{H,t}(n-L_{N,t})^{1-\alpha}+n(1+r_t)T_tB_t-nT_tB_{t+1}$$

The Foreign intertemporal constraint in terms of traded goods (3) is written as:

$$(1-n)\gamma\frac{\left[n(1-\chi)+(1-n+n\chi)(T_t)^{1-\theta}\right]^{\frac{1}{1-\theta}}}{\left[\gamma+(1-\gamma)(R^*_t)^{1-\lambda}\right]^{\frac{\lambda}{\lambda-1}}}C^*_t = T_tA^*_{F,t}(n-L^*_{N,t})^{1-\alpha}-n(1+r_t)T_tB_t+nT_tB_{t+1}$$

The clearing of the market for Home traded goods is written as:

$$A_{H,t}(n-L_{N,t})^{1-\alpha} = n\gamma \frac{n+(1-n)\chi}{\left[(n+(1-n)\chi)+(1-n)(1-\chi)(T_t)^{1-\theta}\right]^{\frac{\theta}{\theta-1}}} \frac{1}{\left[\gamma+(1-\gamma)(R_t)^{1-\lambda}\right]^{\frac{\lambda}{\lambda-1}}} C_t$$
$$+(1-n)\gamma \frac{n(1-\chi)}{\left[n(1-\chi)+(1-n+n\chi)(T_t)^{1-\theta}\right]^{\frac{\theta}{\theta-1}}} \frac{1}{\left[\gamma+(1-\gamma)(R_t^*)^{1-\lambda}\right]^{\frac{\lambda}{\lambda-1}}} C_t^*$$

A II.3 Real interest rate and labor allocation

Using the intratemporal consumption allocation, the real interest rates in terms of consumption baskets (6) are written as:

$$1+r_{t+1}^{C} = (1+r_{t+1})\frac{T_{t+1}}{T_t}\left[\frac{\gamma+(1-\gamma)(R_t)^{1-\lambda}}{\gamma+(1-\gamma)(R_{t+1})^{1-\lambda}}\right]^{\frac{1}{1-\lambda}}\left[\frac{(n+(1-n)\chi)+(1-n)(1-\chi)(T_t)^{1-\theta}}{(n+(1-n)\chi)+(1-n)(1-\chi)(T_{t+1})^{1-\theta}}\right]^{\frac{1}{1-\theta}}$$

$$1+r_{t+1}^{C^*} = (1+r_{t+1})\frac{T_{t+1}}{T_t}\left[\frac{\gamma+(1-\gamma)(R_t^*)^{1-\lambda}}{\gamma+(1-\gamma)(R_{t+1}^*)^{1-\lambda}}\right]^{\frac{1}{1-\lambda}}\left[\frac{n(1-\chi)+(1-n+n\chi)(T_t)^{1-\theta}}{n(1-\chi)+(1-n+n\chi)(T_{t+1})^{1-\theta}}\right]^{\frac{1}{1-\theta}}$$

The allocations of labor (7)-(8) are written as:

$$A_{H,t}(n-L_{N,t})^{-\alpha} = \left[(n+(1-n)\chi)+(1-n)(1-\chi)(T_t)^{1-\theta}\right]^{\frac{1}{1-\theta}} R_t A_{N,t}(L_{N,t})^{-\alpha}$$

$$A_{F,t}^*(1-n-L_{N,t}^*)^{-\alpha} = \left[n(1-\chi)+(1-n+n\chi)(T_t)^{1-\theta}\right]^{\frac{1}{1-\theta}} \frac{1}{T_t} R_t^* A_{N,t}^*(L_{N,t}^*)^{-\alpha}$$

A II.4 Log-linear approximations

In terms of log-linear approximations, we write the market clearing conditions for non-traded goods (1) as:

$$-\lambda\gamma\hat{R}_t + \hat{C}_t = \hat{A}_{N,t} + (1-\alpha)\hat{L}_{N,t} \quad ; \quad -\lambda\gamma\hat{R}_t^* + \hat{C}_t^* = \hat{A}_{N,t}^* + (1-\alpha)\hat{L}_{N,t}^*$$

The intertemporal constraints (2)-(3) are:

$$\hat{C}_t + (1-n)(1-\chi)\hat{T}_t + \lambda(1-\gamma)\hat{R}_t = \hat{A}_{H,t} - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t} + \frac{1}{\beta_0}\hat{B}_t - \hat{B}_{t+1}$$

$$\hat{C}_t^* - n(1-\chi)\hat{T}_t + \lambda(1-\gamma)\hat{R}_t^* = \hat{A}_{F,t}^* - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t}^* - \frac{n}{1-n}\frac{1}{\beta_0}\hat{B}_t + \frac{n}{1-n}\hat{B}_{t+1}$$

In the short run we have $\hat{B}_t = 0, \hat{B}_{t+1} = \hat{B}_{ss}$, while in the long run $\hat{B}_t = \hat{B}_{t+1} = \hat{B}_{ss}$. The market clearing for the Home traded good (4) is:

$$\hat{A}_{H,t} - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t} = \theta(1-n)(1-\chi^2)\hat{T}_t + \lambda(1-\gamma)\left[(n+(1-n)\chi)\hat{R}_t + (1-n)(1-\chi)\hat{R}_t^*\right] + (n+(1-n)\chi)\hat{C}_t + (1-n)(1-\chi)\hat{C}_t^*$$

The Euler equations (5) are (where $dr_{t+1}^C = r_{t+1}^C - (1-\beta_0)/\beta_0$):

$$\hat{C}_{t+1} = \hat{C}_t + \hat{\beta}_{H,t+1} + \beta_0 dr_{t+1}^C \quad ; \quad \hat{C}_{t+1}^* = \hat{C}_t^* + \hat{\beta}_{F,t+1} + \beta_0 dr_{t+1}^{C*}$$

In the long run we have $\hat{C}_{t+1} = \hat{C}_t = \hat{C}_{ss}, \hat{\beta}_{H,t+1} = dr_{t+1}^C = 0$ and $\hat{C}_{t+1}^* = \hat{C}_t^* = \hat{C}_{ss}^*, \hat{\beta}_{F,t+1} = dr_{t+1}^{C*} = 0$.

The real interest rates in terms of consumption baskets (6) are:

$$\beta_0 dr_{t+1}^C = \beta_0 dr_{t+1} + (n+(1-n)\chi)(\hat{T}_{t+1} - \hat{T}_t) - (1-\gamma)(\hat{R}_{t+1} - \hat{R}_t)$$
$$\beta_0 dr_{t+1}^{C*} = \beta_0 dr_{t+1} + n(1-\chi)(\hat{T}_{t+1} - \hat{T}_t) - (1-\gamma)(\hat{R}_{t+1}^* - \hat{R}_t^*)$$

The labor allocations (7)-(8) are:

$$\hat{A}_{H,t} + \alpha\frac{1}{\gamma}\hat{L}_{N,t} = \hat{R}_t + \hat{A}_{N,t} + (1-n)(1-\chi)\hat{T}_t \quad ; \quad \hat{A}_{F,t}^* + \alpha\frac{1}{\gamma}\hat{L}_{N,t}^* = \hat{R}_t^* + \hat{A}_{N,t}^* - n(1-\chi)\hat{T}$$

A II.5 A simple case

We set $\theta \to \infty$ and $\lambda = 1$. The approximated non-traded market clearing conditions (1) are then:

$$-\gamma\hat{R}_t + \hat{C}_t = \hat{A}_{N,t} + (1-\alpha)\hat{L}_{N,t} \quad ; \quad -\gamma\hat{R}_t^* + \hat{C}_t^* = \hat{A}_{N,t}^* + (1-\alpha)\hat{L}_{N,t}^*$$

The intertemporal constraints (2)-(3) are:

$$\hat{C}_t + (1-\gamma)\hat{R}_t = \hat{A}_{H,t} - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t} + \frac{1}{\beta_0}\hat{B}_t - \hat{B}_{t+1}$$
$$\hat{C}_t^* + (1-\gamma)\hat{R}_t^* = \hat{A}_{F,t}^* - (1-\alpha)\frac{1-\gamma}{\gamma}\hat{L}_{N,t}^* - \frac{n}{1-n}\frac{1}{\beta_0}\hat{B}_t + \frac{n}{1-n}\hat{B}_{t+1}$$

The market clearing for the Home traded good (4) becomes redundant. The Euler equations (5) are as in the general case, and the real interest rates in terms of consumption baskets (6) are:

$$\beta_0 dr_{t+1}^C = \beta_0 dr_{t+1} - (1-\gamma)(\hat{R}_{t+1} - \hat{R}_t) \quad ; \quad \beta_0 dr_{t+1}^{C*} = \beta_0 dr_{t+1} - (1-\gamma)(\hat{R}_{t+1}^* - \hat{R}_t^*)$$

The labor allocations (7)-(8) are:

$$\hat{A}_{H,t} + \alpha\frac{1}{\gamma}\hat{L}_{N,t} = \hat{R}_t + \hat{A}_{N,t} \quad ; \quad \hat{A}_{F,t}^* + \alpha\frac{1}{\gamma}\hat{L}_{N,t}^* = \hat{R}_t^* + \hat{A}_{N,t}^*$$

In the long-run the economy reaches a new steady-state, with the cross-country asset holdings $\hat{B}_{ss}$ as a state variable. Consumption is higher in the Home country, relative to the

Foreign one, if the Home country has higher productivity of is a net creditor ($\hat{B}_{ss} > 0$). A net creditor position or an advantage in traded sector productivity raises the price of non-traded goods in the Home country, which translates into an appreciated currency. A net creditor position also shifts labor towards the non-traded sector:

$$\hat{C}_{ss} - \hat{C}^*_{ss} = \gamma(\hat{A}_{H,ss} - \hat{A}^*_{F,ss}) + (1-\gamma)(\hat{A}_{N,ss} - \hat{A}^*_{N,ss}) + \gamma\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n}$$

$$\hat{R}_{ss} - \hat{R}^*_{ss} = (\hat{A}_{H,ss} - \hat{A}^*_{F,ss}) - (\hat{A}_{N,ss} - \hat{A}^*_{N,ss}) + \alpha\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n}$$

$$\hat{Q}_{ss} = -(1-\gamma)(\hat{R}_{ss} - \hat{R}^*_{ss})$$

$$\hat{L}_{N,ss} - \hat{L}^*_{N,ss} = \gamma\frac{1-\beta_0}{\beta_0}\frac{\hat{B}_{ss}}{1-n}$$

We denote worldwide averages with a *w* superscript, with for instance $\hat{A}^w_{T,ss} = n\hat{A}_{H,ss} + (1-n)\hat{A}^*_{F,ss}$. The solution is then: $\hat{C}^w_{ss} = \gamma\hat{A}^w_{T,ss} + (1-\gamma)\hat{A}^w_{N,ss}$, $\hat{R}^w_{ss} = \hat{A}^w_{T,ss} - \hat{A}^w_{N,ss}$ and $\hat{L}^w_{N,ss} = 0$.

The short-run cross-country solution is:

$$\frac{\hat{B}_{ss}}{1-n} = \frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\hat{C} - \hat{C}^* = \gamma(\hat{A}_H - \hat{A}^*_F) + (1-\gamma)(\hat{A}_N - \hat{A}^*_N) - \gamma\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\hat{R} - \hat{R}^* = (\hat{A}_H - \hat{A}^*_F) - (\hat{A}_N - \hat{A}^*_N) - \alpha\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\hat{Q}_{ss} = -(1-\gamma)(\hat{R} - \hat{R}^*)$$

$$\hat{L}_{N,ss} - \hat{L}^*_{N,ss} = -\gamma\frac{\beta_0}{\gamma + (1-\gamma)\alpha}\hat{Z}$$

$$\beta_0(dr^C - dr^{C*}) = -\frac{(1-\gamma)\alpha}{\gamma + (1-\gamma)\alpha}\hat{Z} - (1-\gamma)\begin{bmatrix}(\hat{A}_{H,ss} - \hat{A}^*_{F,ss}) - (\hat{A}_H - \hat{A}^*_F) \\ -(\hat{A}_{N,ss} - \hat{A}^*_{N,ss}) + (\hat{A}_N - \hat{A}^*_N)\end{bmatrix}$$

where $\hat{Z} = (\hat{\beta}_H - \hat{\beta}_F) - (\hat{A}_{H,ss} - \hat{A}^*_{F,ss}) + (\hat{A}_H - \hat{A}^*_F)$, so $\hat{Z} > 0$ indicates that the Home country is relatively more patient ($\hat{\beta}_H > \hat{\beta}_F$), or that it has a temporary productivity advantage in the traded sector ($\hat{A}_H - \hat{A}^*_F > \hat{A}_{H,ss} - \hat{A}^*_{F,ss}$).

In worldwide terms, we have $\hat{C}^w = \gamma\hat{A}_T^w + (1-\gamma)\hat{A}_N^w$, $\hat{R}^w = \hat{A}_T^w - \hat{A}_{Ns}^w$ and $\hat{L}_N^w = 0$. In addition, the real interest rates are higher when agents become more impatient on average or future productivity levels exceed current ones:

$$\beta_0 dr = \hat{C}^w = -\hat{\beta}^w + (\hat{A}_{T,ss}^w - \hat{A}_T^w)$$

$$\beta_0 dr^{Cw} = \hat{C}^w = -\hat{\beta}^w + \gamma(\hat{A}_{T,ss}^w - \hat{A}_T^w) + (1-\gamma)(\hat{A}_{N,ss}^w - \hat{A}_N^w)$$

Table A1: list of country episodes selected with the criteria of *lending booms* only and *lending booms* and strong appreciation combined

Country	Years identified according to		Country	Years identified according to	
	LB	LB and ABC		LB	LB and ABC
Australia	2003 - 2011	2004 - 2004	Pakistan	1997 - 2010	2004 - 2004
Austria	1994 - 2011		Peru	1997 - 1997	
Brazil	1989 - 1989			1999 - 2011	
	1993 - 1993		Saudi Arabia	1999 - 2011	
Chile	1998 - 2011		South Africa	1992 - 2010	
Colombia	1997 - 1999	2004 - 2006	Spain	1989 - 1994	
	2001 - 2008			2002 - 2011	
Denmark	2000 - 2011		Sweden	1998 - 1999	
Egypt	2001 - 2011	2003 - 2004		2001 - 2003	
Euro Area	2001 - 2011		Sweden	2008 - 2011	
Germany	1978 - 1984		Switzerland	1980 - 2011	
	2006 - 2011		Thailand	1992 - 2000	2007 - 2007
Greece	2010 - 2011			2002 - 2005	
Hong Kong	1990 - 2011			2007 - 2011	
Ireland	1999 - 2011	2003 - 2004	United Kingdom	1989 - 2011	1997 - 1998
Israel	2008 - 2008	2008 - 2008	United States	1972 - 1973	1983 - 1983
Italy	2007 - 2011		United States	1983 - 2011	1997 - 1998
Japan	1970 - 2011	1984 - 1987			
		1992 - 1994			
Korea	2007 - 2011				
Netherlands	1986 - 1986				
	1992 - 2011				
New Zealand	1996 - 1997				
	1999 - 2011				

Table A2: list of country episodes selected with the criteria of *capital flow bonanzas* only and *capital flow bonanzas* and strong appreciation combined

Country	Years identified according to		Country	Years identified according to	
	CFB	CFB and ABC		CFB	CFB and ABC
Australia	1971 - 1971		New Zealand	1989 - 1989	
	1987 - 1987			1996 - 1996	
	1998 - 1998			1998 - 2002	
	2001 - 2003			2005 - 2005	
	2006 - 2009			2009 - 2009	
Austria	2000 - 2001		Norway	2000 - 2000	
	2007 - 2007			2005 - 2007	
Belgium	2002 - 2010			2009 - 2009	
Brazil	1999 - 2001	2007 - 2007	Pakistan	1984 - 1985	
	2007 - 2007			1990 - 1990	
Canada	1997 - 1997	2008 - 2008		2000 - 2000	
	2005 - 2008		Peru	2000 - 2000	
Chile	1993 - 1998			2005 - 2007	
	2005 - 2008		Philippines	1994 - 1996	
China	1987 - 1987	1994 - 1994		2005 - 2005	
	1989 - 1989			2007 - 2010	
	1994 - 1994		Poland	1996 - 1996	2007 - 2007
	1996 - 2001			2006 - 2007	
	2003 - 2010		Portugal	2006 - 2007	
Colombia	1998 - 2001	2006 - 2006	Russia	1998 - 2000	
Colombia	2006 - 2008			2004 - 2004	
Costa Rica	1998 - 1998			2006 - 2007	
	2004 - 2009		Saudi Arabia	1997 - 1998	
Czech Rep.	1993 - 1993	2002 - 2002		2000 - 2001	
	1995 - 1995			2003 - 2006	
	1998 - 2002			2008 - 2008	
	2004 - 2005		Singapore	2007 - 2007	
	2007 - 2007		South Africa	1997 - 1999	

Table A2(cont.): list of country episodes selected with the criteria of *capital flow bonanzas* only and *capital flow bonanzas* and strong appreciation combined

Country	Years identified according to		Country	Years identified according to	
	CFB	CFB and ABC		CFB	CFB and ABC
Czech Rep.	1993 - 1993	2002 - 2002		2000 - 2001	
	1995 - 1995			2003 - 2006	
	1998 - 2002			2008 - 2008	
	2004 - 2005		Singapore	2007 - 2007	
	2007 - 2007		South Africa	1997 - 1999	
Denmark	1999 - 2001			2001 - 2001	
	2007 - 2007			2005 - 2007	
Egypt	1998 - 2007	2003 - 2004		2009 - 2009	
	2009 - 2010		Spain	1994 - 1995	
Euro Area	1998 - 2002			1998 - 2000	
	2007 - 2008			2002 - 2002	
Finland	1979 - 1979			2006 - 2008	
	2005 - 2008		Sri Lanka	1982 - 1982	
France	1997 - 2002			1984 - 1984	
	2005 - 2007		Sweden	1972 - 2007	1982 - 1982
Germany	1999 - 2001			2009 - 2010	1990 - 1991
	2005 - 2006		Switzerland	1985 - 1986	
	2009 - 2009			1989 - 1989	
Greece	2006 - 2007			1996 - 2002	
Guatemala	1988 - 1988			2006 - 2009	
Hong Kong	1998 - 2010		Thailand	1989 - 1989	2007 - 2007
Hungary	1991 - 1991			1997 - 1999	
	1993 - 1993			2001 - 2001	
	1995 - 2002			2003 - 2007	
	2004 - 2009		Tunisia	2006 - 2007	
Indonesia	2007 - 2007			1981 - 1982	
	2009 - 2009			2006 - 2006	
				2008 - 2008	

Table A2(cont.): list of country episodes selected with the criteria of *capital flow bonanzas* only and *capital flow bonanzas* and strong appreciation combined

Country	Years identified according to		Country	Years identified according to	
	CFB	CFB and ABC		CFB	CFB and ABC
Ireland	1998 - 2007	2003 - 2004	United Kingdom	1987 - 1987	1998 - 1998
	2009 - 2010			1989 - 1989	
Israel	1999 - 2000	2008 - 2008		1993 - 1993	
	2004 - 2008			1998 - 2001	
Korea	1999 - 2000			2005 - 2009	
Mexico	2003 - 2003		United States	1999 - 2000	
Morocco	2001 - 2001		Uruguay	2005 - 2010	
Netherlands	1974 - 1974				
	1981 - 1983				
	1989 - 1997				
	2004 - 2004				
	2006 - 2007				