THE US CURRENT ACCOUNT DEFICIT: A RE-EXAMINATION OF THE ROLE OF PRIVATE SAVING

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This paper represents preliminary work on a study that is co-authored with John H Rogers, Board of Governors of the Federal Reserve, to be presented at the Carnegie-Rochester Conference Series on Public Policy, on the topic of International Trade and Globalization, 18–19 November 2005. Rogers has directly contributed most of the data work in this paper, and the overall discussion has evolved through our discussions. We have greatly benefited at this stage from many discussions with David Backus, Menzie Chinn, and the staff at the Reserve Bank of Australia. The views expressed in this paper do not necessarily represent those of the Board of Governors of the Federal Reserve or the Reserve Bank of Australia.

Abstract

The large recent US current account deficits have been the subject of an enormous amount of study in academia, among government and central bank economists, in business economic reports, and in the press. Many different explanations of the cause of the deficit have been offered, and to varying degrees we believe that all may have played a role: low private saving in the US; large public-sector budget deficits; a 'glut' of savings in the rest of world; and, perhaps even a misalignment of nominal exchange rates. In this paper we explore the role of one other factor that also has been mentioned prominently: private saving in the US is low because income growth is expected to be strong.

We rework the standard neoclassical two-country model to show how a country will be a net borrower when its future share of world GDP is expected to increase above its current share. Our research ultimately is motivated by the question of whether the US current account is 'sustainable'. The way we approach the question is to see whether the high level of US spending currently is compatible with an optimal path of borrowing. In particular, what assumptions about expected future growth of the US's share of world output could justify its current account deficit? We show that if the deficit can be explained by higher future income shares, then the size of the real depreciation, that may otherwise be required to reduce the deficit, may be quite small.

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1. Introduction

The large United States (US) current account deficits of recent years have been the subject of an enormous amount of study in academia, among government and central bank economists, in business economics reports, and in the press.[1] Many different explanations of the cause of the deficit have been offered, and to varying degrees we believe that all may have played a role in the evolution of the deficit: low private saving in the US generated by financial innovations or asset price inflation; large public-sector budget deficits; a 'glut' of savings in the rest of the world driven by demographic factors in the rich countries and capital market imperfections in the emerging markets; and, perhaps even misalignment of the nominal exchange rate leading to excessively cheap import prices for the US in the short run.

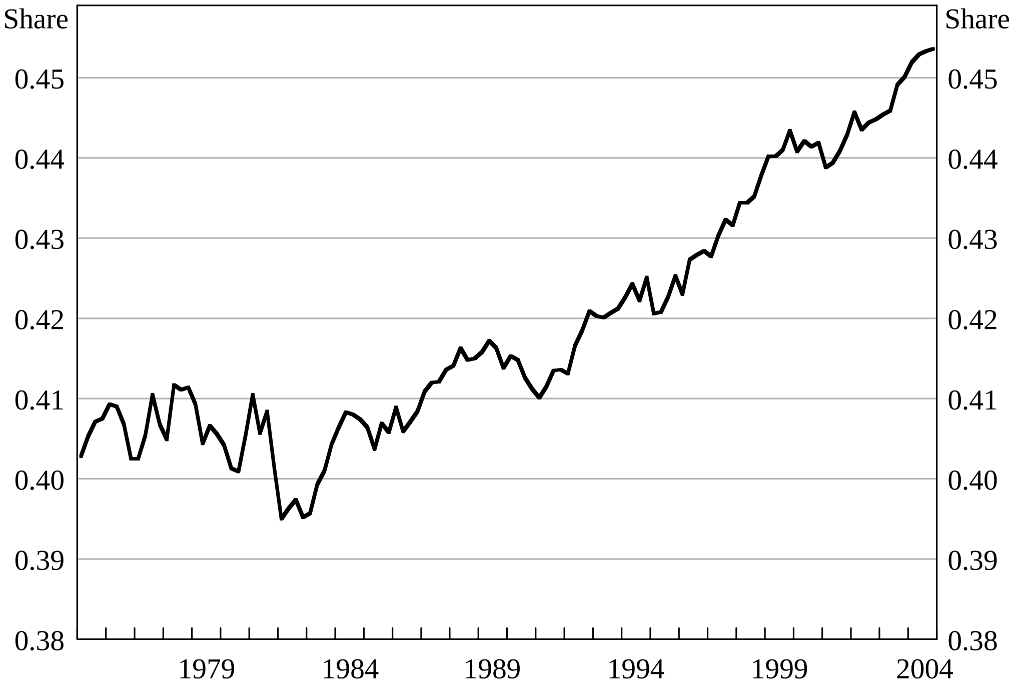
In this paper we explore the role of one other factor that also has been mentioned prominently: private saving in the US is low because income growth is expected to be strong in the US. We will discuss briefly some of the other factors that deserve consideration, but here our focus is on the question of how much of the current account deficit can be understood in the context of a model of optimal saving. We rework the standard neoclassical two-country model to show how a country will be a net borrower when its future share of world GDP (net of investment and government spending) is expected to increase above its current share.

Figure 1 is the starting point of our analysis. It shows what is perhaps one of the most striking economic developments of the last 25 years: the dramatic increase in

1 See, for example, Backus *et al* (2005), Bernanke (2005), Blanchard, Giavazzi and Sa (2005), Chinn (2005), Clarida, Goretti and Taylor (2005), Edwards (2005), Gourinchas and Rey (2005), Kouparitsas (2005), Kraay and Ventura (2005), Obstfeld and Rogoff (2000, 2004, 2005), and Truman (2005). The US current account deficit stood at almost 6 per cent of GDP in 2004, the largest deficit on record over the last 40 years.

US output relative to the rest of the high-income world. Specifically, the figure plots US GDP less government spending and investment as a share of the sum of G7 GDP less government spending and investment. We net out government spending and investment because our theory suggests that consumption spending ultimately depends on income that is available for household consumption, but a plot of unadjusted GDP shares looks very similar. The figure also eliminates the influence of exchange rate swings by comparing real GDP growth relative to GDP shares in 1990, in a way that will be explained in greater detail later.

Figure 1: US Share of Adjusted G7 GDP



Source: author's calculations

The striking thing about this figure is that since some time in the 1980s, the US share appears as if it is on an upward linear trend. Its share has increased from a trough in 1982 of around 39.5 per cent to its level in 2004 of approximately 45.3 per cent. Prior to 1982, it appears that the US share fluctuated around a level of roughly 40.5 per cent.

GDP shares capture two factors that are typically considered separately in the neoclassical approach to the current account. First, if the country's income is expected to rise, it may borrow now and run a current account deficit. Second, if the world interest rate is low, the country's incentive may be to borrow more now.

One factor that may lead to lower interest rates is high saving in the rest of the world, which might in turn be generated by poor growth prospects in those countries. Typically, the two-country model (in which the world interest rate is determined endogenously) has been used when studying a 'large' country, such as the US.

Our models recast the neoclassical model to show how we can (under certain assumptions) express the optimal consumption path as a function of the current and expected future discounted sum of the country's share of world output (adjusted for government spending and investment). This representation is useful because it expresses the economic forces in a transparent and intuitive way; it also gives us a way of testing the model that does not require modelling of world real interest rates. The effects of real interest rates are implicitly captured by the 'shares' model. For example, if the rest of the world's income growth is expected to be slow, in the standard representation, their high saving will lower interest rates and these low rates will stimulate consumption at home. In the 'shares' approach, we see directly that home borrowing is encouraged by low growth in the rest of the world, because that low growth will lead to higher future output shares for the home country.

Another nice feature about the 'shares' representation of the two-country model is that it applies for countries of any size. There is no difference in the representation for countries that are too small to affect world real interest rates, and large countries that can.

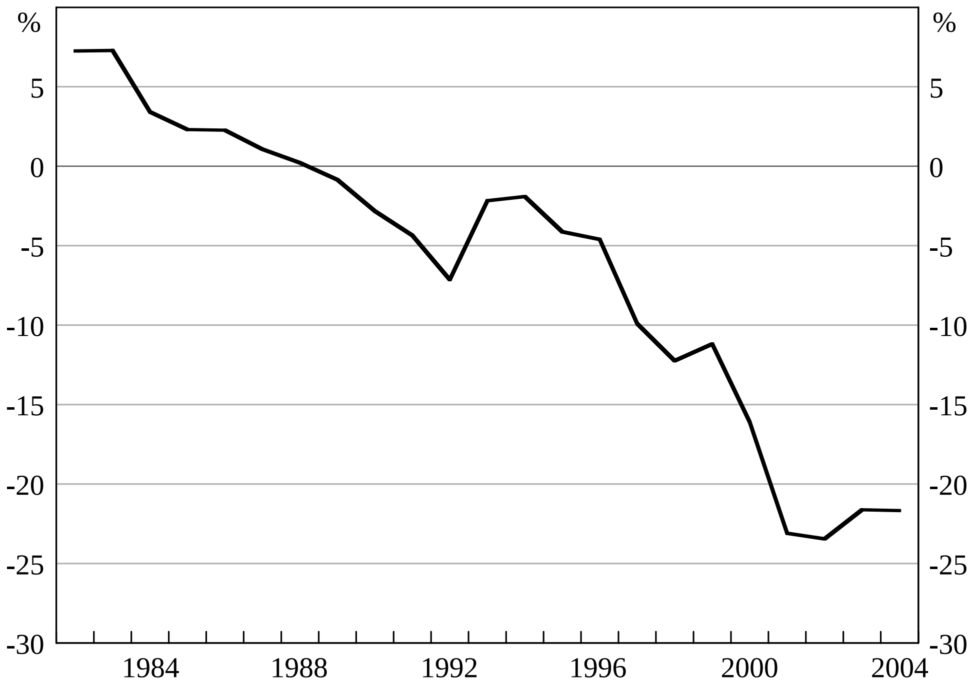
Our research ultimately is motivated by the question of whether the US current account is 'sustainable'. The definition of 'sustainability' is a bit slippery and differs from study to study, and we do not offer a definition here. We begin from the observation that while the US is building up debt obligations which may imply high debt service obligations in the future, it will almost certainly also be the case that US GDP will be much higher in the future. We need some yardstick to measure how burdensome those debt service obligations will be in the future. Will the US be worse off from its high current spending at the expense of having to devote some of future output to servicing its external debt?

It seems like the natural way to answer this question is in the context of an optimising model. This allows us to compare the trade-off between current and future consumption. The way we approach the question is to see whether the high level of US spending currently is compatible with an optimal path of borrowing. In particular, what assumptions about expected future growth of the US's share of world output could possibly justify its current account deficit?

It is obvious that the US cannot run primary deficits forever – although even here, a caveat is necessary. Figure 2 plots the decline in the US external net asset position since 1982. Although there are serious and well-known measurement issues, the chart reproduces the conventional wisdom that the US has emerged as a large debtor. But Figure 3 shows the US net investment income as a share of GDP. That also has declined since 1982, which is consonant with the decline in the US asset position. But the decline in investment income has not been nearly as sharp as the decline in the net asset position, and the chart shows that US net investment income in 2004 was still positive.

Figure 2: US Net International Investment Position

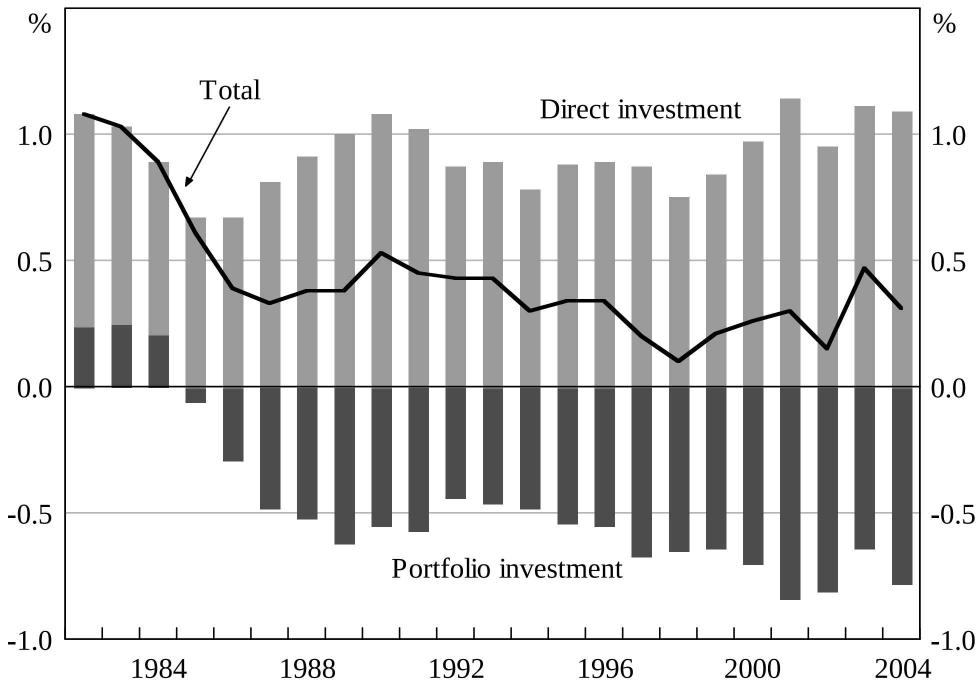
Per cent of nominal GDP



Source: Bureau of Economic Analysis (BEA), International Economic Accounts

Figure 3: US Net Investment Income

Per cent of nominal GDP



Source: author's calculations

The usual explanation for this disconnect – that the US is a net debtor, but its net investment income is positive – is that the US earns more from its foreign investments than foreigners earn from their investments in the US. This in turn is explained by the claim that the US external portfolio is dominated by direct investment and equities, while foreigners' portfolio of US assets is dominated by holdings of Treasury securities. Whatever the reason, if the US can always earn more on its foreign investments than foreigners earn on their investments in the US, then indeed even a primary current account deficit could be sustained forever. The US could maintain a position of zero net investment income in this situation if the ratio of foreign assets that it acquires to US assets acquired by foreigners were to equal the rate of return on these US assets relative to the rate of return on foreign assets acquired by the US. If the latter ratio is less than one, then the former ratio can also be less than one, which implies a primary current account deficit.

We will abstract from this possibility in our discussions. Primarily we will take an approach that sets the current US net investment income to zero, and assumes that on future transactions the returns on US borrowing and lending are equal. We acknowledge that in some circumstances this may underestimate the future debt service obligations of the US if markets have properly priced long-term asset positions. But under the conventional wisdom, this assumption actually is conservative. That is, we try to uncover what assumptions about US growth relative to the rest of the world would justify the high US current account deficit. High US growth combined with low growth in the rest of the world is required. The most likely deviation from this situation is one in which total world GDP growth turns out to be lower than the markets currently expect. But if that were to happen, future short-term interest rates would be lower than those implied by our model. The way in which the US could get into trouble with its current debt obligations (which we are, in essence, ignoring on the grounds that its current net investment returns are not negative) is if interest rates are higher when the current debt is rolled over at maturity. But that would require future interest rates to be higher than the rates that are implicit in our model, not lower.

Returning to Figure 1, it is obvious that it is difficult to forecast the US's future share of adjusted G7 GDP. As we have noted, it appears that the US share has been on an upward linear trend since some time in the 1980s. But mathematically it is impossible for the share to continue upward on a linear trend. If nothing else, the trend must stop when the US share reaches one, but obviously it will stop long before then. But it is hard to read the tea leaves from Figure 1. Will the US share continue to rise, and then level out at a higher share? If so, what will that share be? Or will the trend reverse, and the US share return to somewhere around 40.5 per cent? We consider different scenarios based on alternative econometric approaches, but ultimately there is no answer in which we can be very confident. Indeed, that is the core conclusion we reach: there is a great deal of uncertainty about the future path of the US share of world output. There are certainly plausible scenarios in which modest continued growth in the US share could justify high US external borrowing today.

Our study is an exercise in generating intuition about the magnitude of the effect of growth in future output shares, rather than a definitive study of the US current account. As we noted from the start, there are many factors that contribute to the deficit, and we consider only one of them. We perform a delicate balancing act in ignoring many of these factors.

One of the first questions that might be raised is why Figure 1 considers the US share of adjusted G7 GDP? If we included China, India, and the east Asian tigers, for example, would not the figure show a falling share? Certainly, the increase in the US share would not appear as dramatic if it were to include these countries, but we leave them out for good reason. If we were to treat these countries symmetrically with the US, the model implies that they should be running large current account deficits. Indeed, it is a puzzle that this set of countries, which must be expecting high future income growth, have current account surpluses in a world of low real interest rates. Bernanke (2005) offers the 'saving glut' explanation for their behaviour. He argues that this set of countries saves a lot now because they do not have full access to world capital markets. The aftermath of the 1997 crisis has led outside lenders to be cautious, and required the emerging-market countries as a whole to finance investment internally. In addition, some countries (such as China) may have been building up a 'war chest' as protection against the event of a future crisis, even if private capital markets have been willing to lend. And, Bernanke notes, the oil-producing countries have had high saving rates recently that have been associated with the recent increase in the price of oil.

From the perspective of the US, the relevant point is that these countries are not borrowers on international capital markets. Since they are running current account surpluses, they are contributing to the pool of world saving. This increases the incentive for any other country to borrow today. It is a conservative assumption on our part to ignore this pool of saving in assessing what sort of income growth in the US could justify its current low level of saving.

Of course our neoclassical model could directly incorporate an explanation for the glut of saving in the emerging markets, and the extended model could be tested. We do not take this approach for three reasons. First, we do not believe the exercise of determining optimal behaviour for the US necessarily depends on the explanation for the saving glut. Whatever the reason, it will lead to lower interest rates than those implied by our model, and imply an even greater incentive for the US to borrow. Second, we are intent on examining a simple and intuitive version of the model. Third, there is a sense in which the 'shares' model can incorporate a high desired saving level in the rest of the world in a straightforward way. We can simply make the ad hoc assumption that the rest of the world puts a higher weight on future utility of consumption than does the US. We show that in this context, the optimal deficit for the US is still a weighted average of current and future expected output shares. But the model implies, naturally, that the US consumption level will be higher the higher the discount factor (the lower the discount rate) in the rest of the world.

We also do not directly consider demographic explanations for different saving rates around the world. There is a sense, however, in which our model does capture these effects. We model behaviour in each country as determined by an infinitely-lived representative household. We do not even consider changes in the number of people in each household. Maintaining this fiction, one might suppose that in some households, future production will fall (or grow more slowly) as members of the household retire and leave the workforce. In other households, income will grow as the fraction of working members of the households increases and their output rises. In the 'young' countries, output is expected to increase more rapidly than in the 'old' countries. From this vantage, demographics can be seen as an underlying determinant of income growth, and therefore a driving variable in the determination of future output shares. For example, the OECD recently has predicted very low GDP growth in the eurozone economies in the decade of the 2020s.[2] The primary reason for this low growth projection is demographic – the OECD forecasts a shrinking workforce in these economies.

One of the most controversial issues that we are sidestepping is the role of the US government budget deficits in contributing to the current account deficit. Figure 1 nets out government spending. To the extent that budget deficits are caused by increased public expenditure, we have already factored them into our analysis. That is, higher public expenditure implies a lower share of GDP left over for private consumption. So we are only trying to explain that part of the US current account deficit that cannot be explained by higher government spending.

On the other hand, our model is based on an infinitely-lived representative household, and so the timing of taxes does not matter for consumption decisions. That is, Ricardian equivalence holds. In practice, however, it may be that a reduction in taxes does not lead to a dollar for dollar increase in private saving. The empirical evidence is ambiguous on this point, but our feeling is that Ricardian equivalence does not hold. So when we ask whether the saving behaviour of the US could be consistent with an optimising framework, we are to some extent assuming that the government is using its taxing powers to determine optimal

[2] See, for example, Martins *et al* (2005).

saving. That is, it lowers taxes in those cases in which it believes that the outcome of decisions by private households and businesses leads to too much saving. Put another way, the question is whether the tax policy decisions of the government are irresponsible, or whether they could be consistent with a responsible government that has higher expectations of growth, or possibly a lower discount factor (higher discount rate), than the public. In particular, we want to judge whether the expected growth or the discount factor that is needed to reconcile the US current account with plausible estimates of its future income share is 'responsible' or 'irresponsible'.

We examine the current account question entirely from the perspective of a neoclassical model. We take this approach because we view the current account deficits of the US, and the eventual adjustment of its primary deficit, as a long-run phenomenon. This does not mean that short-run considerations are unimportant. They certainly might matter for the short run, and Keynesians believe that short-run considerations matter for policy. We do not believe, however, that short-run fluctuations in exchange rates or income will account for much of the long-run adjustment process, so we ignore such factors in order to simplify the analysis.

In Section 2 below, we lay out the basic 'shares' model and consider a couple of simple generalisations. Section 3 takes up a related issue – does the adjustment of the US current account require a large real depreciation? We show that if indeed the deficit can be explained by higher future income shares, then the size of the required real depreciation may be quite small indeed. Section 4 then provides some simple numerical exercises with the model to assess the impact of the role of growth in future output shares on the current account. Readers not interested in the technical details may want to skip Sections 2 and 3, and head straight for the bottom line in Section 4. Conclusions are drawn in Section 5.

2. The Model

We build a two-country general equilibrium model in which households choose consumption optimally over an infinite horizon. We begin with the case in which households in each country discount future utility by the same factor, β (where $0 < \beta \leq 1$), and utility of aggregate consumption is logarithmic (implying a unitary intertemporal elasticity of substitution). We examine the model under the assumption of perfect foresight.

2.1 Equal Discount Factors, Logarithmic Utility

In general, if preferences are homothetic, we can write a household's total nominal expenditure on consumption as $P_t C_{it}$, where P_t is the exact consumer price index, and C_{it} is the real consumption bundle for household *i*. If we assume that there are *N* identical households in the home country, then the total national nominal expenditure is $P_t C_t$, where P_t is the exact consumer price index, and $C_t \equiv N \cdot C_{it}$ is the aggregate real consumption index. We can also use the notation Y_t^V to be the total nominal value of output in the home country, net of investment and government spending. (We use *V* as the superscript to denote 'value'.) The corresponding variables for the foreign country are labelled with a '*'.

The model we examine is one in which only real values are determined. It is helpful to maintain the notion that prices are expressed in terms of a currency, because then the symmetry between the home and foreign countries will be clearer. But we should interpret all nominal prices as being expressed in a common currency, as if these two countries were in a currency union. To reiterate, this is merely notational convenience, and has no implications for the results in the model.

We have not assumed that preferences are identical between the home and foreign country. A household could, for example, have a home bias in consumption, whereby it gives greater weight in preferences to goods produced in its own country. There could be non-traded goods, so that only home-country households consume home-country non-traded goods, and likewise for foreign households. All that we require is that preferences be homothetic, so that we can define consumption aggregates for each household and their exact price index.

We can aggregate across the budget constraint for each household in the home country to write:

$$P_0 C_0 + \frac{P_1 C_1}{R_1} + \frac{P_2 C_2}{R_1 R_2} + \ldots = R_0 B_0 + Y_0^V + \frac{Y_1^V}{R_1} + \frac{Y_2^V}{R_1 R_2} + \ldots. \quad (1)$$

Here, R_t is the gross nominal interest rate for period t. B_t is the home country's nominal claims on the foreign country at time t (so that if the home country is a debtor, B_t is negative). The Euler equation for consumption is given by:

$$\frac{P_{t+1}C_{t+1}}{P_tC_t} = \beta R_{t+1}. \tag{2}$$

Using this equation and its foreign counterpart, we get:

$$\begin{aligned} Y_{t+1}^W &= Y_{t+1}^V + Y_{t+1}^{*V} = P_{t+1}C_{t+1} + P_{t+1}^*C_{t+1}^* = \beta R_{t+1}(P_tC_t + P_t^*C_t^*) \\ &= \beta R_{t+1}(Y_t^V + Y_t^{*V}) = \beta R_{t+1} Y_t^W. \end{aligned} \tag{3}$$

In this derivation we have used the equilibrium condition that the total value of world consumption is equal to the total value of world output (net of investment and government spending) in each period. We use the notation Y_t^W to denote the value of world output at time t. From Equation (3) it follows that:

$$R_t = \frac{Y_t^W}{\beta Y_{t-1}^W}. \tag{4}$$

Substituting Equations (2) and (4) into (1), we get:

$$\left(\frac{1}{1-\beta}\right) P_0C_0 = R_0B_0 + Y_0^W\left(\gamma_0 + \beta\gamma_1 + \beta^2\gamma_2 + \ldots\right). \tag{5}$$

Here, $\gamma_t \equiv Y_t^V / Y_t^W$ is the home country's share of world net GDP at time t. We can rewrite this equation slightly, and express nominal consumption at time t as:

$$P_tC_t = (1-\beta)R_tB_t + (1-\beta)\frac{Y_t^V}{\gamma_t}\left[\gamma_t + \beta\gamma_{t+1} + \beta^2\gamma_{t+2} + \ldots\right]. \tag{6}$$

This is the key equation of our model. It says that the consumption/output ratio for a country will depend on the discounted sum of its current and future share of world net GDP, relative to its current share. To see this, define the present value relationship:

$$\Gamma_t \equiv (1-\beta)\left[\gamma_t + \beta\gamma_{t+1} + \beta^2\gamma_{t+2} + \dots\right]. \tag{7}$$

Then we can write Equation (6) as:

$$\frac{P_t C_t}{Y_t^V} = \frac{(1-\beta)}{\beta}\frac{B_t}{\gamma_t Y_{t-1}^W} + \frac{\Gamma_t}{\gamma_t}. \tag{8}$$

(We have used Equation (4) to substitute out for the equilibrium interest rate.)

Equation (8) tells us that the home country will tend to have a high ratio of current consumption to output when its expected discounted current and future shares of world net GDP, Γ_t, is high relative to its current share of world net GDP, γ_t. The interest rate does not appear in Equation (8), since it can be solved for in terms of the growth rate of world output (and the discount factor) according to Equation (4). The relationship in Equation (8) could be consistent with any world growth rate. That is, what matters for the country's consumption/output ratio is its current and expected future shares of world output. The higher is its future share of world output compared to its current share, the greater will be its consumption/output ratio. That is true whether its share of world output is rising because its own output is rising faster than the rest of the world's output is rising, or it is falling less quickly than the rest of the world's output is falling.

To see how growth in the share of world income might matter, consider this simple autoregressive model for the home country's net GDP share:

$$\gamma_{t+j} = \alpha^j \gamma_t + (1-\alpha^j)\bar{\gamma}. \tag{9}$$

Then,

$$\Gamma_t = \frac{1-\beta}{1-\alpha\beta}\gamma_t + \frac{\beta(1-\alpha)}{1-\alpha\beta}\bar{\gamma} \tag{10}$$

so the discounted sum of the current and future shares, Γ_t, is a weighted average of the current share and the long-run steady-state share, $\bar{\gamma}$. The more weight that individuals put on the future in their utility (larger β) or the faster the convergence to the steady-state value (smaller α), then the greater the importance of the long-run output share in determining current consumption.

To get to the empirical model that we will examine in our Carnegie-Rochester paper, we use the national income accounting identity, $Y_t^V = P_t C_t + NX_t$, where NX_t is the home country's net export of goods and services (not including interest payments on its debt). We can rewrite Equation (6) above as:

$$Y_t^V - NX_t = (1-\beta)R_t B_t + (1-\beta)\frac{Y_t^V}{\gamma_t}\left[\gamma_t + \beta\gamma_{t+1} + \beta^2\gamma_{t+2} + \ldots\right]. \qquad (11)$$

The current account is given by $CA_t = NX_t + (R_t - 1)B_t$. We propose the following approximation: $CA_t \approx NX_t + (1-\beta)R_t B_t$. Obviously this is not exact, but how far off is it? That is, how close is $(1-\beta)R_t B_t$ to $(R_t - 1)B_t$? From the solution for the interest rate above, we have that $R_t = G_t^W(1/\beta)$, where G_t^W is the growth rate of world output. Then,

$$(1-\beta)R_t B_t = \left(1 - \frac{G_t^W}{R_t}\right)R_t B_t = (R_t - G_t^W)B_t.$$

If $G_t^W = 1$, the approximation would be exact. But we believe the difference between $CA_t = NX_t + (R_t - 1)B_t$ and $CA_t \approx NX_t + (R_t - G_t^W)B_t$ is small, so the approximation is reasonable. With this approximation, we can then rewrite the model as:

$$CA_t = Y_t^V - (1-\beta)\frac{Y_t^V}{\gamma_t}\left[\gamma_t + \beta\gamma_{t+1} + \beta^2\gamma_{t+2} + \ldots\right] \qquad (12)$$

or

$$z_t\gamma_t = \gamma_t - (1-\beta)\left[\gamma_t + \beta\gamma_{t+1} + \beta^2\gamma_{t+2} + \ldots\right], \qquad (13)$$

where $z_t \equiv \frac{CA_t}{Y_t^V}$.

We have derived all of this under perfect foresight. Now we arbitrarily incorporate an expectations sign in Equation (13), to get:

$$z_t \gamma_t = \beta \gamma_t - (1-\beta) E_t \left[\beta \gamma_{t+1} + \beta^2 \gamma_{t+2} + \ldots \right]. \tag{14}$$

If we had derived the model from the beginning under the assumption of uncertainty, then Equation (14) would not hold exactly. So Equation (14) is not, strictly speaking, derived from the Euler equation under uncertainty and the rest of the model. Perhaps future work can assess the error involved with the approximations used to derive Equation (14).

Equation (14) implies a relationship between a country's current account relative to world net GDP $(z_t \gamma_t)$ and the country's current and expected future shares of world net GDP.

2.2 Different Discount Factors, Logarithmic Utility

Here we briefly consider how Equation (14) would look if the discount factor in each country were different. This is a simple way to capture the notion that some countries which have very good growth prospects still tend to have high saving rates. Equations (1) and (2) still hold, but Equation (3) is replaced by:

$$\begin{aligned} Y_{t+1}^W &= Y_{t+1}^V + Y_{t+1}^{*V} = P_{t+1} C_{t+1} + P_{t+1}^* C_{t+1}^* = R_{t+1} (\beta P_t C_t + \beta^* P_t^* C_t^*) \\ &= R_{t+1} (\beta \eta_t + \beta^* (1-\eta_t)) Y_t^W, \end{aligned} \tag{15}$$

where $\eta_t \equiv \frac{P_t C_t}{Y_t^W}$. Then, Equation (4) is replaced by:

$$R_t = \frac{Y_t^W}{(\beta \eta_{t-1} + \beta^* (1-\eta_{t-1})) Y_{t-1}^W}. \tag{16}$$

So we can replace Equation (6) with:

$$\left(1+\beta+\beta^2+\dots\right)\eta_0 = \frac{R_0 B_0}{Y_0^W} + \gamma_0 + \left[\beta\eta_0 + \beta^*(1-\eta_0)\right]\gamma_1 \\ + \left[\beta\eta_0 + \beta^*(1-\eta_0)\right]\left[\beta\eta_1 + \beta^*(1-\eta_1)\right]\gamma_2 + \dots. \tag{17}$$

But we can see that:

$$\eta_t \equiv \frac{P_t C_t}{Y_t^W} = \frac{\beta P_{t-1} C_{t-1} R_t}{Y_t^W} = \frac{\beta\eta_{t-1}}{\beta\eta_{t-1} + \beta^*(1-\eta_{t-1})}. \tag{18}$$

Substituting into Equation (17):

$$\left(1+\beta+\beta^2+\dots\right)\eta_0 = \frac{R_0 B_0}{Y_0^W} + \gamma_0 + \left[\beta\eta_0 + \beta^*(1-\eta_0)\right]\gamma_1 \\ + \left[\beta^2\eta_0 + (\beta^*)^2(1-\eta_0)\right]\gamma_2 + \dots. \tag{19}$$

Solving out for η_0, we have:

$$\frac{P_0 C_0}{Y_0^W} = (1-\tilde{\beta}_0)\left[\frac{R_0 B_0}{Y_0^W} + \gamma_0 + \beta^*\gamma_1 + (\beta^*)^2\gamma_2 + \dots\right], \tag{20}$$

where $\tilde{\beta}_0 \equiv \dfrac{\beta(1-\gamma_1) + \beta^*\gamma_1 + \beta^2(1-\gamma_2) + (\beta^*)^2\gamma_2 + \dots}{1+\beta(1-\gamma_1) + \beta^*\gamma_1 + \beta^2(1-\gamma_2) + (\beta^*)^2\gamma_2 + \dots}$. Or, for any time *t*:

$$\frac{P_t C_t}{Y_t^W} = (1-\tilde{\beta}_t)\left[\frac{R_t B_t}{Y_t^W} + \gamma_t + \beta^*\gamma_{t+1} + (\beta^*)^2\gamma_{t+2} + \dots\right], \tag{21}$$

where $\tilde{\beta}_t \equiv \dfrac{\beta(1-\gamma_{t+1}) + \beta^*\gamma_{t+1} + \beta^2(1-\gamma_{t+2}) + (\beta^*)^2\gamma_{t+2} + \dots}{1+\beta(1-\gamma_{t+1}) + \beta^*\gamma_{t+1} + \beta^2(1-\gamma_{t+2}) + (\beta^*)^2\gamma_{t+2} + \dots}$.

In general, $\tilde{\beta}_t$ is not constant over time. It is interesting, however, to see what the model implies about the special case when each country's share is constant over time. Then we have:

$$\tilde{\beta} \equiv \frac{\frac{\beta}{1-\beta}(1-\gamma)+\frac{\beta^*}{1-\beta^*}\gamma}{1+\frac{\beta}{1-\beta}(1-\gamma)+\frac{\beta^*}{1-\beta^*}\gamma} = \frac{\beta(1-\beta^*)+\gamma(\beta^*-\beta)}{1-\beta^*+\gamma(\beta^*-\beta)}.$$

From Equation (21), it follows in this case (setting $\beta_t = 0$) that:

$$\frac{P_t C_t}{Y_t^W} = (1-\tilde{\beta})\frac{R_t B_t}{Y_t^W} + \frac{1-\tilde{\beta}}{1-\beta^*}\gamma = (1-\tilde{\beta})\frac{R_t B_t}{Y_t^W} + \frac{(1-\beta)\gamma}{1-\beta^W}, \tag{22}$$

where $\beta^W \equiv \gamma\beta + (1-\gamma)\beta^*$. Compared to the case of equal discount factors ($\beta_t = 0$), we can now see that the home country's consumption will be higher if it is less patient (has a lower discount factor) than the rest of world.

Another interesting case is when the country's share of world net GDP evolves according to Equation (9). Although the expression for $\tilde{\beta}_t$ is quite complex, and the closed-form solution for Equation (21) is not that intuitive, we can take a linear approximation to the solution around the point $\gamma_t = \bar{\gamma}$:

$$\begin{aligned}\frac{P_t C_t}{Y_t^W} &= (1-\tilde{\beta}_t)\frac{R_t B_t}{Y_t^W} + \frac{(1-\beta)\bar{\gamma}}{1-\bar{\beta}^W} \\ &\quad + \frac{(1-\beta)(1-\beta^*)}{(1-\bar{\beta}^W)^2}\left[\frac{(1-\alpha)(\beta-\beta^*)\bar{\gamma}+(1-\alpha\beta)(1-\beta^*)}{(1-\alpha\beta)(1-\alpha\beta^*)}\right](\gamma_t-\bar{\gamma}),\end{aligned} \tag{23}$$

where $\beta^W \equiv \bar{\gamma}\beta + (1-\bar{\gamma})\beta^*$. To understand this equation, begin by noting that if the share were constant over time so $\gamma_t = \bar{\gamma}$, then Equation (23) would reduce to Equation (22). Also note that if the discount factors were equal, but the shares were not constant over time, Equation (23) would reduce to Equation (6), with the solution for Γ_t from Equation (10) substituted in.

2.3 Same Discount Factors, Non-logarithmic Utility

Let the utility function each period be given by $(1/(1-\rho))(C_t)^{1-\rho}$. Then the first-order condition becomes:

$$(C_t)^{-\rho} = \beta R_{t+1} \frac{P_t}{P_{t+1}} (C_{t+1})^{-\rho}. \tag{24}$$

In general, we cannot derive anything except in the simple case where there is a single homogenous good that is freely traded and consumed in both countries. In that case, we might as well take the price as constant. So we can rewrite Equation (24) as:

$$C_t = (\beta R_{t+1})^{\frac{-1}{\rho}} C_{t+1}. \tag{25}$$

Adding the equivalent expression for foreign consumption, and using the world equilibrium condition, we get:

$$R_{t+1} = \beta^{-1} \left(\frac{Y_{t+1}^W}{Y_t^W} \right)^{\rho}. \tag{26}$$

The home country's budget constraint is:

$$C_0 + R_1^{-1} C_1 + R_1^{-1} R_2^{-1} C_2 + \ldots = Y_0 + R_1^{-1} Y_1 + R_1^{-1} R_2^{-1} Y_2 + \ldots + R_0 B_0. \tag{27}$$

We can use Equations (25) and (26) to write the left-hand side of Equation (27) as:

$$C_0 \left[1 + \beta^{\frac{1}{\rho}} R_1^{\frac{1-\rho}{\rho}} + \beta^{\frac{2}{\rho}} R_1^{\frac{1-\rho}{\rho}} R_2^{\frac{1-\rho}{\rho}} + \ldots \right] = C_0 \left[1 + \beta \left(\frac{Y_1^W}{Y_0^W} \right)^{1-\rho} + \beta^2 \left(\frac{Y_2^W}{Y_0^W} \right)^{1-\rho} + \ldots \right].$$

The discounted sum of GDP on the right-hand side of Equation (27) can be written as:

$$\left(Y_0^W\right)^{\rho}\left[Y_0\left(Y_0^W\right)^{-\rho}+\beta Y_1\left(Y_1^W\right)^{-\rho}+\beta^2 Y_2\left(Y_2^W\right)^{-\rho}+\ldots\right]$$
$$=\left(Y_0^W\right)^{\rho}\left[\gamma_0\left(Y_0^W\right)^{1-\rho}+\beta\gamma_1\left(Y_1^W\right)^{1-\rho}+\beta^2\gamma_2\left(Y_2^W\right)^{1-\rho}+\ldots\right]$$

Set initial debt to zero so that the expression is easier to look at. Then we can solve Equation (27) as follows:

$$\frac{C_0}{Y_0^W}=\frac{\gamma_0\left(Y_0^W\right)^{1-\rho}+\beta\gamma_1\left(Y_1^W\right)^{1-\rho}+\beta^2\gamma_2\left(Y_2^W\right)^{1-\rho}+\ldots}{\left(Y_0^W\right)^{1-\rho}+\beta\left(Y_1^W\right)^{1-\rho}+\beta^2\left(Y_2^W\right)^{1-\rho}+\ldots}. \tag{28}$$

In this case, initial consumption relative to world income is still a weighted average of current and future shares of world income. Now the weight given on our share in period j is given by:

$$\frac{\beta^j\left(Y_j^W\right)^{1-\rho}+\ldots}{\left(Y_0^W\right)^{1-\rho}+\beta\left(Y_1^W\right)^{1-\rho}+\beta^2\left(Y_2^W\right)^{1-\rho}+\ldots}.$$

Suppose the growth rate of world income is constant. Then we can rewrite Equation (28) as simply:

$$C_0=(1-\tilde{\beta})Y_0\left[1+\tilde{\beta}\frac{\gamma_1}{\gamma_0}+\tilde{\beta}^2\frac{\gamma_2}{\gamma_0}+\ldots\right]. \tag{29}$$

This is identical to the expression we had in the case of unit intertemporal elasticity of substitution, Equation (12), except that the discount factor, β, in Equation (12) is replaced by:

$$\tilde{\beta}\equiv\beta G^{1-\rho}, \tag{30}$$

where $G \equiv Y_{t+1}^{W} / Y_t^{W}$. Assuming $G > 1$, we have $\tilde{\beta} < \beta$ if $\rho > 1$. So, if the intertemporal elasticity of substitution is less than one (that is, $\rho > 1$), then the weight on future shares is lower compared to the model which assumes that utility is logarithmic.

While we are unable to generalise beyond the case of a single homogenous good when the intertemporal rate of substitution is not unity (that is, utility is not logarithmic), we get the general lesson that if $\rho > 1$ and the world growth rate is positive, then households effectively discount future shares at a greater rate than implied simply by the discount rate in utility.

3. Real Exchange Rate Model

Obstfeld and Rogoff (2000, 2004, 2005) have argued that the correction of the US current account will require a large real depreciation. It is interesting to examine what the evolution of the real exchange rate would be if the current account deficit was optimal, reflecting expectations of growth in the US's share of world-adjusted GDP. As in Obstfeld and Rogoff, we need to make some specific assumptions about preferences in order to derive results.

In each country, we assume that preferences are a Cobb-Douglas aggregate over a non-traded consumption good, and a traded consumption aggregate:

$$C_t = C_{Nt}^{\delta} C_{Tt}^{1-\delta} \tag{31}$$

$$C_t^* = \left(C_{Nt}^*\right)^{\delta} \left(C_{Tt}^*\right)^{1-\delta}. \tag{32}$$

The exact price indices are given by:

$$P_t = P_{Nt}^{\delta} P_{Tt}^{1-\delta} (\delta^{-\delta} (1-\delta)^{\delta-1}) \tag{33}$$

$$P_t^* = \left(P_{Nt}^*\right)^{\delta} \left(P_{Tt}^*\right)^{1-\delta} (\delta^{-\delta} (1-\delta)^{\delta-1}). \tag{34}$$

Preferences over traded goods consumption are, in turn, a function of the consumption good produced in each country:

$$C_{Tt} = \left[\theta^{\frac{1}{\varepsilon}} C_{Ht}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\theta)^{\frac{1}{\varepsilon}} C_{Ft}^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}} \tag{35}$$

$$C_{Tt}^{*} = \left[(1-\theta)^{\frac{1}{\varepsilon}} (C_{Ht}^{*})^{\frac{\varepsilon-1}{\varepsilon}} + \theta^{\frac{1}{\varepsilon}} (C_{Ft}^{*})^{\frac{\varepsilon-1}{\varepsilon}} \right]^{\frac{\varepsilon}{\varepsilon-1}}. \tag{36}$$

We assume here that preferences are symmetric, but that there is bias toward the consumption of the good produced locally ($\theta > 1/2$).

Price indices are given by:

$$P_{Tt} = \left[\theta P_{Ht}^{1-\varepsilon} + (1-\theta) P_{Ft}^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}} \tag{37}$$

$$P_{Tt}^{*} = \left[(1-\theta) P_{Ht}^{1-\varepsilon} + \theta P_{Ft}^{1-\varepsilon} \right]^{\frac{1}{1-\varepsilon}}. \tag{38}$$

We have the following demand system:

$$P_{Ht} C_{Ht} = (1-\delta)\theta \left(\frac{P_{Ht}}{P_{Tt}} \right)^{1-\varepsilon} P_t C_t \tag{39}$$

$$P_{Nt} C_{Nt} = \delta P_t C_t \tag{40}$$

$$P_{Ht}^{*} C_{Ht}^{*} = (1-\delta)(1-\theta) \left(\frac{P_{Ht}}{P_{Tt}^{*}} \right)^{1-\varepsilon} P_t^{*} C_t^{*} \tag{41}$$

$$P_{Nt}^{*} C_{Nt}^{*} = \delta P_t^{*} C_t^{*}. \tag{42}$$

We do not need to write down the demand for the foreign-produced traded good. We can ignore that market, because by Walras's law if the markets for the other three goods clear each period and the budget constraints are satisfied, then the market for the fourth good will also clear.

The equilibrium conditions at time 0 and in the long run are as follows. We set the price of the foreign-traded good equal to one in each period. We also will consider the simple case in which net debt at time 0 is zero. That is because, in applying this model to the US to examine how its real exchange rate will evolve, we will use the approximation that its current net investment income is zero:

$$\gamma_{Ht} = (1-\delta)\left[\frac{\theta P_{Ht}^{1-\varepsilon}}{\theta P_{Ht}^{1-\varepsilon} + 1-\theta}\Gamma_0 + \frac{(1-\theta)P_{Ht}^{1-\varepsilon}}{(1-\theta)P_{Ht}^{1-\varepsilon} + \theta}(1-\Gamma_0)\right] \tag{43}$$

$$\gamma_{Nt} = \delta\Gamma_0 \tag{44}$$

$$\gamma_{Nt}^{*} = \delta(1-\Gamma_0)\,. \tag{45}$$

Here we have defined γ_{Ht} and γ_{Nt} to be the value of the home country's output of traded goods and non-traded goods, respectively, as a share of the value of world output. It is helpful to notice from Equation (44) that because of the assumptions of unitary intertemporal elasticity of substitution and unitary elasticity of substitution between non-traded and traded goods, the value of each country's non-traded output as a share of world output is constant over time. We can write:

$$\gamma_N = \delta\Gamma_0,\ \gamma_{Ht} = \gamma_t - \delta\Gamma_0\,. \tag{46}$$

Now, as in the previous sections, assume a slow increase in the home country's output as a share of world output. Repeating Equations (9) and (10):

$$\gamma_t = \alpha^t\gamma_0 + (1-\alpha^t)\bar{\gamma}\,. \tag{9}$$

Then we can write:

$$\Gamma_0 = \frac{1-\beta}{1-\alpha\beta}\gamma_0 + \frac{\beta(1-\alpha)}{1-\alpha\beta}\bar{\gamma}. \qquad (10)$$

We can now use these equations to solve for P_{Ht}. Define $p_t = P_{Ht}^{1-\varepsilon}$. Given assumptions about γ_0 and $\bar{\gamma}$, we can use Equation (10) to derive Γ_0, and Equations (9) and (46) to derive γ_{Ht}. Equation (43) can then be shown to be a quadratic equation in p_t, whose solution is:

$$p_t = \frac{A\theta^2 + B(2\theta-1) \pm \sqrt{\theta^4 + 2C\theta^2(2\theta-1) + B^2(2\theta-1)^2}}{D\theta(1-\theta)}. \qquad (47)$$

The parameters *A*, *B*, *C*, and *D* are defined by:

$$A = 1 - \frac{2\gamma_{Ht}}{1-\delta}; B = \frac{\gamma_{Ht}}{1-\delta} + \Gamma_0 - 1; C = \Gamma_0\left(1 - \frac{2\gamma_{Ht}}{1-\delta}\right) + \frac{\gamma_{Ht}}{1-\delta} - 1; D = 2\left(\frac{\gamma_{Ht}}{1-\delta} - 1\right).$$

We can then derive P_{Ht} by using $P_{Ht} = p_t^{\frac{1}{1-\varepsilon}}$.

Ultimately, we are interested in calculating the home real depreciation over some time horizon from *t* to *T*, Q_T / Q_t, where $Q_t \equiv P_t^* / P_t$ is the CPI real exchange rate (defined so that a home real depreciation is an increase in Q_t). Using the definitions of the price indices Equations (33) and (34), we have:

$$Q_t = \left(\frac{P_{Nt}^*}{P_{Nt}}\right)^{\delta}\left(\frac{P_{Tt}^*}{P_{Tt}}\right)^{1-\delta}. \qquad (48)$$

Since we are setting $P_{Ft} = 1$, our solution for P_{Ht} allows us to solve for P_{Tt}^* and P_{Tt}.

Even though there is home bias in the consumption of the traded good, this is not a cause of the price of the home-produced traded good, P_{Ht}, changing over time. As we note below, in this model total consumption expenditure in both countries rises at the same rate, so the home bias does not put pressure on either traded goods price. But if the home country's share of world output is growing, then output of the home-traded good is growing faster than the output of the foreign-traded good, so its price must be falling.

What about the behaviour of the non-traded prices? If there were no home bias in consumption of the traded good, any change in the real exchange rate would have to come from movements in the relative non-traded prices. Indeed, Obstfeld and Rogoff (2000, 2004, 2005) emphasise the importance of the non-traded sector.

In our model of consumption, if the net factor income at time *t* is zero, from time *t* into the future we know that home and foreign nominal consumption will grow at the same rate:

$$\frac{P_T C_T}{P_t C_t} = \frac{P_T^* C_T^*}{P_t^* C_t^*}. \tag{49}$$

(We are starting in period *t*, and $T > t$.) This result is actually quite general in the neoclassical model. That is, the result is based on the assumption that preferences are homothetic and that the intertemporal rate of substitution is the same in the two countries. This is less specific than the log specification that we have been using and does not require that preferences are the same in the two countries.

Now under our assumption that there is a Cobb-Douglas utility function defined over traded and non-traded goods we can write:

$$\frac{P_{NT} Y_{NT}}{P_{Nt} Y_{Nt}} = \frac{P_{NT}^* Y_{NT}^*}{P_{Nt}^* Y_{Nt}^*}, \tag{50}$$

where P_{Nt} is the price of the non-traded good, and Y_{Nt} is the output of the non-traded good.

Now we can see how the price of non-traded goods at home changes relative to the price of non-traded goods in the foreign country:

$$\left(\frac{P^*_{NT}}{P^*_{Nt}}\right)\bigg/\left(\frac{P_{NT}}{P_{Nt}}\right)=\left(\frac{Y_{NT}}{Y_{Nt}}\right)\bigg/\left(\frac{Y^*_{NT}}{Y^*_{Nt}}\right). \tag{51}$$

The change in our non-traded price relative to the foreign non-traded price depends only on the growth rates of the non-traded goods. It does not depend at all on the shares of non-traded goods in consumption.

While our optimising model can potentially explain a current account deficit if the country's share of world output is expected to rise over time, under the Cobb-Douglas assumption, none of that increase can come because the value of non-traded output rises as a share of world output. We have noted that γ_{Nt} is constant over time. The assumption that our share of world output is rising does not require any assumption on whether the home country's non-traded output growth is faster or slower than in the rest of the world.

We consider two models for $\left(Y_{NT}/Y_{Nt}\right)/\left(Y^*_{NT}/Y^*_{Nt}\right)$. The first is simply an endowment model, as in Obstfeld and Rogoff (2004). The second model is one in which output is produced using labour, and the growth rates of productivity in the traded and non-traded sector determine $\left(Y_{NT}/Y_{Nt}\right)/\left(Y^*_{NT}/Y^*_{Nt}\right)$.

In that model, output of the traded sector in the home country is given by $Y_{Ht}=A_{Ht}L_{Ht}$, and in the non-traded sector by $Y_{Nt}=A_{Nt}(L-L_{Ht})$. Here, A_{Ht} and A_{Nt} represent productivity, which may grow over time. These equations incorporate labour market equilibrium, with the assumption that the labour supply is fixed and equal to L. If labour markets are competitive, then we have $P_{Nt}/P_{Ht}=A_{Ht}/A_{Nt}$, or $P_{Nt}=(A_{Ht}/A_{Nt})P_{Ht}$. Similarly in the foreign country, we get $P^*_{Nt}/P^*_{Ft}=P^*_{Nt}=A^*_{Ft}/A^*_{Nt}$.

We then have:

$$Q_t=\left(\frac{(A^*_{Ft}/A^*_{Nt})}{(A_{Ht}/A_{Nt})}\right)^{\delta}\left(\frac{1}{P_{Ht}}\right)^{\delta}\left(\frac{P^*_{Tt}}{P_{Tt}}\right)^{1-\delta}. \tag{52}$$

On the one hand, we have argued that if the home country's output of the traded good is growing more quickly than the foreign country's, then P_{Ht} must be falling. That implies that the $(1/P_{Ht})^{\delta}$ term in Equation (52) must be rising. In addition, if there is home bias in consumption of traded goods, the $(P^{*}_{Tt}/P_{Tt})^{1-\delta}$ term is also rising. Both contribute to a real depreciation for the home country. But working in the other direction is the fact that the relative growth in the home country's traded output is coming from productivity growth in the traded sector. Unless home's relative growth advantage in the non-traded sector is greater than its relative growth advantage in the traded sector, $((A^{*}_{Ft}/A^{*}_{Nt})/(A_{Ht}/A_{Nt}))^{\delta}$ will be falling. This is the standard Balassa-Samuelson effect. This latter effect might well outweigh the first two effects, so in net terms the home country could be experiencing a real appreciation along the adjustment path as its current account deficit declines.

4. Model Simulations

4.1 Current Account

We ask what the consequences are if the US consumer is expecting an increase in the US's share of net world GDP. Specifically, we ask what the effects are of an expectation of an increase from its current share, γ_t, to some larger share, $\bar{\gamma}$. We assume that the shares will evolve in an autoregressive fashion, with α determining the degree of serial correlation. In particular, if α is large (close to one), then the growth in the GDP share will be slow.

This model of GDP shares is given in Equation (9). We can use the result of Equation (10) to substitute into Equation (12) and get:

$$\frac{CA_t}{Y_t^V} = 1 - \left[\frac{1-\beta}{1-\alpha\beta} + \frac{\beta(1-\alpha)}{1-\alpha\beta} \frac{\bar{\gamma}}{\gamma_t} \right]. \tag{53}$$

Note that the solution for the current account to GDP ratio does not depend on the absolute value of the GDP shares, but only the ratio of the long-run to the current

GDP share. So, the calibration does not depend on any measure of the US's current share, but only on how much its share is expected to increase.

This equation can be inverted to ask what assumption about the long-run increase in the US share of adjusted GDP could account for a current account deficit of 6 or 7 per cent of (net) GDP. The deficit at the beginning of 2004 was around 7 per cent. We get:

$$\frac{\bar{\gamma}}{\gamma_t} = 1 - \frac{1-\alpha\beta}{\beta(1-\alpha)} \frac{CA_t}{Y_t^V}. \tag{54}$$

Following usual calibration exercises, we will assume the annual discount factor in utility is $\beta = 0.98$. If the increase in output shares is very gradual, so that $\alpha = 0.95$, we find that in order to have $CA_t / Y_t^V = -0.07$, we need $\bar{\gamma}/\gamma_t = 1.098$. That is, if the US expects a gradual 10 per cent (not 10 percentage points) increase in its share of world GDP, then a current account deficit of 7 per cent of (net) GDP can be optimal.

That seems like a very large increase in the output share, but it is approximately the size of the increase the US has experienced over the past 15 years, according to Figure 1. If the US share is going to gradually rise by this much, with an autoregressive coefficient of 0.95, then the growth over the next 25 years in the share would need to be about 7.1 per cent. That is, if US consumers are expecting the share of US net GDP to grow by 7.1 per cent over the next 25 years (with an eventual cumulative growth of 9.8 per cent), then the entire current account deficit of the US could be explained by optimal consumption behaviour, without any reference to investment spending or government spending.

But Figure 1 only records the US share of adjusted G7 GDP. It may be less plausible that the US share would grow as fast if it were compared to world GDP. On the other hand, we have noted that some of the fastest growing countries in the rest of the world have high saving rates, so that their current accounts are actually in surplus. If their saving rates were to remain high, then the US deficit now may be optimal even if the US share of world output is not expected to grow. For example, if we use Equation (22) to assess this possibility, then assuming $\beta = 0.98$ but only a slightly higher level for β^*, the model predicts a current account deficit of 7 per cent of (net) GDP. Specifically, we need $1-\beta / 1-\beta^{W} = 1.07$, which implies a value of $\beta^{W} = 0.9813$. If US GDP is approximately 20 per cent of world GDP, then the rest of the world's discount factor would need to equal 0.9816. That is, only a small difference between the US and rest of world discount factor is needed to account for a large current account deficit.

4.2 Real Exchange Rate

Now suppose we take it as given that the assumption that the long-term growth in the US share is given by $\bar{\gamma}/\gamma_t = 1.098$, so that $CA_t / Y_t^V = -0.07$ is optimal (with no difference in discount factors between US and foreign households). What will the evolution of prices look like in such a model?

In addition to assuming $\beta = 0.98$ and $\alpha = 0.95$, we need to make assumptions regarding the degree of home bias in consumption of traded goods, the share of non-traded goods in consumption, and the elasticity of substitution between home and foreign goods. We choose these to be $\theta = 0.7$, $\delta = 0.75$ and $\varepsilon = 6$, respectively, to match the assumptions of Obstfeld and Rogoff (2004).

As we have discussed above, the calibration of the real exchange rate depends on the model that we use for output growth. In the endowment model, we must make an assumption about $(Y_{NT}/Y_{Nt})/(Y_{NT}^{*}/Y_{Nt}^{*})$, the growth rate of the home endowment of the non-traded good compared to the foreign endowment. Let us suppose that the horizon for comparison is 10 years – we would like to know what the change in the US real exchange rate will be over the next 10 years. In an endowment model, a generous assumption would be that the US non-traded share would rise relative to the foreign non-traded share by 10 per cent in 10 years. Under that assumption, the overall real depreciation for the US in 10 years will be only 15.5 per cent.

If instead we take a model in which factors are mobile between the sectors that produce traded goods and non-traded goods within each country, then Equation (52) determines the real depreciation over this period. As we have noted, this model could conclude that there will be a real appreciation rather than a real depreciation for the US. As in the Balassa-Samuelson model, if the US's traded sector is more productive, then the relative price of its non-traded goods will rise. Working in the other direction are the economic forces that tend to drive the prices of US traded goods down relative to the prices of traded goods in the rest of the world.

We must make an assumption about the magnitude of the change in $(A^*_{Ft} / A^*_{Nt}) \big/ (A_{Ht} / A_{Nt})$: the productivity of the rest of the world's traded sector relative to its non-traded sector, compared in turn to the same productivity ratio in the US. We will assume that the US traded sector shows a 10 per cent improvement compared to the rest of the world over the next 10 years. Under this assumption, there is virtually no change in the US real exchange rate. The model implies a real appreciation of 0.7 per cent over 10 years.

So, contrary to the findings of Obstfeld and Rogoff (2004), if the US current account deficit reflects expectations of an increase in the US's future share of world GDP, and if the reduction of the US current account deficit occurs as part of an optimal adjustment path, then the required change in the US real exchange rate might be quite small.

5. Conclusions

At this stage, our results are very preliminary. We have presented a model and provided rough calibrations that suggest that there may be some role for an expected rise in the US share of world GDP in explaining the high US current account deficit of recent years. We present plausible scenarios in which modest continued growth in the US share of world growth could justify high US external borrowing today. We acknowledge, however, that there is a great deal of uncertainty about the future path of the US share of world output.

Our forthcoming Carnegie-Rochester study will examine this model more carefully. It will also estimate a stochastic process for the US share of net GDP, and ask whether the US current account can be seen as being derived from this optimising model. We will also take a much longer horizon on the US current account deficit and implement tests much like those that Bohn (2004) uses to examine the sustainability of the US government budget deficits.

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