International Financial Adjustment

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March 2004
First draft: April 2002

Abstract

The paper proposes a unified framework to understand the dynamics of net foreign assets and exchange rate movements. Focusing on the financial account and its determinants, we show that countries' capital gains and losses on net foreign assets constitute an important channel for external adjustment. For example, a depreciation of the domestic currency or a drop in the domestic stock market index improves the sustainability of a country's external position by decreasing the value of its liabilities to foreigners. Our theory implies that deviations from trend of the ratio of net exports to net foreign assets contain information about future portfolio returns and, possibly, future exchange rate changes. Using quarterly data on U.S. gross foreign positions and returns, we find that adjustments in the country's external position occur indeed mostly at short to medium horizons through portfolio revaluations, not through future changes in net exports. At longer horizons, adjustment occurs through changes in net exports. We also find evidence of predictability of net foreign asset portfolio returns at horizons between one quarter to two years. These results cast a new light on the sustainability of US current account deficits.

Ariel Han and Alejandro Justiniano provided outstanding research assistance. A draft of this paper was presented at the May 2002 5th CEPR Conference of the Analysis of International Capital Markets Research Training Network (Gerzensee) under the title 'The Intertemporal Approach to the Financial account'. We thank our discusssants Bartosz Mackowiak and Philip Lane for their comments as well as Mike Devereux, Gene Grossman, Maury Obstfeld, Chris Sims, Lars Svensson, Mark Watson, Mike Woodford and seminar participants at Berkeley, Princeton, Harvard, the IMF and at the 2003 Hong Kong Monetary Authority Conference. This paper is part of a research network on 'The Analysis of International Capital Markets: Understanding Europe's Role in the Global Economy', funded by the European Commission under the Research Training Network Program (Contract No. HPRNŒCTŒ 1999Œ00067) and is part of the project "Exchange Rates, International Relative Prices, and Macroeconomic Models", funded by the ESRC (grant no.L138 25 1043).
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1 Introduction

Understanding the dynamic process of adjustment of a country's external balance is one of the most important questions for international economists. 'To what extent should surplus countries expand; to what extent should deficit countries contract?' asked Mundell (1968). These questions remain as important today as then.

The modern theory which focuses on those issues is the 'intertemporal approach to the current account'. It views the current account balance as the result of forward-looking intertemporal saving decisions by households and investment decisions by firms, under incomplete markets. As Obstfeld (2001)[p11] remarks, 'it provides a conceptual framework appropriate for thinking about the important and interrelated policy issues of external balance, external sustainability, and equilibrium real exchange rates' together with a rigorous, solidly microfounded, analysis of welfare issues for international problems.

This approach has yielded major insights into the current account patterns that followed the two major oil price shocks of the seventies, or the large U.S. fiscal deficits of the early eighties. Yet, in many instances and for most countries, its key empirical predictions are easily rejected by the data. Our paper suggests that this approach falls short of explaining much of the dynamics of the current account because it usually assumes that the only asset traded internationally is a one-period riskfree bond.[1] In reality, international financial markets have become increasingly sophisticated and offer a rich menu of assets (equity, FDI, corporate and government bonds for example). Traditional models therefore ignore a central aspect of the adjustment of countries' external balances, namely, predictable changes in the valuation of foreign assets and liabilities. Fluctuations in the rate of returns of financial assets and in the exchange rate affect in an important way the dynamics of external balances. This link between asset prices, exchange rate and current account dynamics has been ignored in the intertemporal approach to the current account and may explain much of its failure. According to our approach, balance of payments adjustments may occur through this rebalancing of assets and liabilities. Consider the case of the US. It currently has a very negative foreign asset position. The intertemporal budget constraint of the country implies that it will have to reduce this imbalance. The intertemporal approach to the current account suggests that the US

[1]There are exceptions: i) Kray and Ventura (2000) and Ventura (2001) allow for investment in risky foreign capital; ii) the international real business cycle literature usually assumes that markets are complete but this implies that the current account is merely an accounting device and has counterfactual implications; iii) more recently, specific forms of endogeneous market incompleteness have been studied (see for example Kehoe and Perri (2002)).

will need to run trade surpluses. In this paper, we show that this rebalancing can also take place through a change in the returns on US assets held by foreigners relative to the return on foreign assets held by the US. Importantly, this rebalancing may occur via a depreciation of the dollar. With large gross asset positions, as is the case in the data, a given change in the dollar can transfer large amounts of wealth from the rest of the world to the US and vice versa.[2]

Our framework gives therefore novel insights into the dynamics of adjustment of countries' external account *and* ties the dynamics of the exchange rate to net exports and net foreign assets, thereby reconciling the 'asset market view' and the 'goods market view' of exchange rate determination. It recognizes the central importance of intertemporal budget constraints and transversality conditions for the external adjustment process. But it departs from the literature by allowing for a sophisticated array of internationally traded financial assets. Consequently, this paper shifts the emphasis from the *current* account to the *financial* account and its components.[3] Most importantly, the dynamics of the exchange rate plays a major role in our set up by affecting the differential in rates of returns between assets and liabilities. We show in particular in section 4 that the ratio of net exports to net foreign assets contains significant information about future exchange rate changes, even at relatively short horizons.

Lane and Milesi-Ferretti have documented the importance of valuation effects in the process of international adjustment in several papers. In Lane and Milesi-Ferretti (2001), they point out that the correlation between the change in net foreign asset position at market value and the current account is low or even negative. The same authors note in Lane and Milesi-Ferretti (2002b) that rates of return on the net foreign asset position and the trade balance tend to comove negatively, suggesting that wealth transfers affect the trade balance. More recently Tille (2003) discusses the effect of the currency composition of US assets on the dynamics of its external debt while Corsetti

[2]For instance, everything else equal, a depreciation of the domestic currency generates a capital gain on foreign assets holdings, which increases the return on the NFA portfolio. Consider the case of the United States. As of December 2002, the country's net foreign asset position was -\$2.61 trillion (or 24.85% of GDP), with assets representing \$6.47 trillion (61.77%) and liabilities \$9.08 trillion (86.62%). All the US foreign liabilities are in dollars whereas most U.S. foreign assets are in foreign currencies (except about 40% of debt assets, issued in dollars, but these represent a small fraction of U.S. gross foreign assets). Hence a 10% depreciation of the dollar would represent a transfer of around 6.2 % of GDP from the rest of the world to the US. For comparison, the trade deficit on goods and services was 3.98% of GDP in 2002.

[3]The financial account was previously called the capital account. Of course, by balance of payment accounting, the current account, capital account, financial account and changes in official reserves sum to zero. But we focus here on which economic factors *drive* the fluctuations in external accounts, and we put the spotlight on financial determinants rather than goods market influences.

and Konstantinou (2003) provide an empirical analysis of the responses of US net foreign debt to permanent and transitory shocks.

In section 2 we briefly review the intertemporal approach to the current account. We then lay down the basic building bloc of our theory of international financial adjustment in section 3. We present the construction of our dataset in section 4 and our empirical results in part 5.

2 The Intertemporal Approach to the Current Account

The present value model (PVM) is the most widely used form of the intertemporal approach. Assuming certainty-equivalent preferences and a constant gross world real interest rate R equal to the inverse of the subjective discount factor, private consumption equals its permanent-income level,

$$C_t = \frac{R-1}{R} NA_t + \mathrm{E_t}\tilde{Y}_t - \mathrm{E_t}\tilde{I}_t - \mathrm{E_t}\tilde{G}_t$$

where $\tilde{X}_t \equiv \frac{R-1}{R}\sum_{s=t}^{\infty} R^{-(s-t)} X_s$ represents the annuitized permanent value of any variable X.[4] This formulation emphasizes that consumption responds to permanent shocks and not to transitory ones. Following Campbell and Shiller (1987), Sheffrin and Woo (1990) show that this gives rise to the following representation for the current account CA_t,

$$CA_t = -\sum_{s=t+1}^{\infty} R^{-(s-t)} \mathrm{E_t}\left[\Delta\left(Y_s - I_s - G_s\right)\right] \tag{1}$$

where $\Delta X_t = X_t - X_{t-1}$ for any variable X_t.

The PVM emphasizes the quantity-quantity implications of the theory: current account deficits or surpluses forecast future changes in net output, $Y_t - I_t - G_t$.

Unlike the Keynesian approach, the intertemporal approach puts less emphasis on intratemporal relative prices and competitiveness, measured by the real exchange rate. Nonetheless, it provides a useful framework for thinking about equilibrium real exchange rates.[5]

[4]The notation is standard. NA_t is the economy's stock of net foreign claims on the rest of the world at the beginning of period t. Y_t, C_t, I_t and G_t are, respectively, net domestic product, private consumption, net investment and government consumption. $\mathrm{E_t}$ denotes conditional expectations as of time t. R appears in the denominator since we measure net foreign assets at the beginning of the period. This is inconsequential.

[5]Real exchange rates have two effects. First, they affect net exports, by affecting the relative demand between exports and imports. This is the traditional 'expenditure-switching' effect that is at the heart of Keynesian models such as the Mundell-Fleming one. Second, real exchange rate changes tilt consumption profiles. This second effect comes via the Euler equation for consumption and the impact of real exchange rate changes on intertemporal relative prices and real interest rates (see Obstfeld and Rogoff (1995)[p1752] for details, and Razin and Svensson (1983)).

Most empirical studies of the intertemporal approach have relied on the PVM and tested whether observed current accounts —the left hand side of equation (1)— equal predicted current accounts —the right hand side.

The results of these tests have not been particularly successful (see Nason and Rogers (2002) for some recent evidence). For most countries and most periods, the testable restrictions imposed by the model have been statistically rejected by the data. Even though predicted current accounts bear some resemblance to observed ones, they appear much less volatile than actual current accounts.

There has also been little systematic investigation of the implications of the intertemporal approach for exchange rates. While some studies have focused on the long run or equilibrium real exchange rate (Lane and Milesi-Ferretti (2002a)), few have investigated the implications of the intertemporal approach for exchange rate movements (but see Rogoff (1992) for an important exception). This is perhaps not so surprising given the extensive evidence of low pass-through of exchange rate movements to consumer prices. This low pass-through would hinder both the expenditure switching and the consumption tilting effects that the model highlights (see Engel (2002)).[6]

But more fundamentally, the main reason why the intertemporal approach to the current account has little empirical content is that assuming international investors trade only in a risk-free bond is grossly at odds with reality. In practice, investors have access to a rich menu of financial assets: corporate and sovereign bonds, equity, foreign direct investment and bank loans. While international capital market transactions used to be dominated by bank loans and sovereign bonds, equities and corporate bonds are now major components of these flows. [7]

Modelling a richer menu of assets has three main advantages.

First this helps to explain the volatility of observed current accounts. The net foreign asset (NFA) portfolio of countries contains both assets and liabilities. Therefore, a country's NFA position can be interpreted as a leveraged portfolio, short in domestic assets and long in foreign assets. Its return exhibits more volatility than that of the U.S. one-period ahead risk-free real interest rate, often used as proxy for the world interest rate.

Second, since asset returns exhibit some degree of predictability[8], so will capital gains or losses

[6]Numerous scholars have also extended the simplest framework and incorporated precautionary saving (Gosh and Ostry (1995)), non-separable utility (Gruber (2000), Bergin and Sheffrin (2000)), barriers to capital mobility (Cole and Obstfeld (1991), Mendoza (1991), Schmitt-Grohe and Uribe (2002)), fiscal shocks (Ahmed and Rogers (1995)), investment dynamics (Glick and Rogoff (1995)) and shocks to the world real interest rate (Neumeyer and Perri (2002)). These extensions improve the fit between the models and the data.

[7]See Tesar and Werner (1998), Warnock and Cleaver (2002) and Froot and Tjornhom (2002).

[8]The empirical asset pricing literature has produced a number of financial and macro variables with forecasting

on NFA positions. We find that these predictable components contribute significantly to the process of external adjustment.

Third, differences of valuation across asset classes and exchange rate fluctuations will have a direct impact on the external position of a country since individual asset returns are measured in the domestic currency.

3 International Financial Adjustment.

This paper lays down the first building block of an intertemporal approach to the financial account: an intertemporal budget constraint and a long run stability condition.

Consider the accumulation identity for net foreign assets between t and $t+1$:

$$NA_{t+1} \equiv R_{t+1} \left(NA_t + NX_t \right) \tag{2}$$

NX_t represents net exports, defined as the difference between exports X_t and imports M_t and net foreign assets NA_t are defined as the difference between gross foreign assets A_t and gross foreign liabilities L_t, measured in the domestic currency.[9] Equation 2 states that the net foreign position increases with net exports and with the *total* return on the net foreign asset portfolio R_{t+1}.[10]

We work with net exports NX_t instead of the current account CA_t. From a national income point of view, the current account records net factor payments, i.e. net dividend payments and net interest income, that are part of the *total* return R_{t+1}. If these were the only sources of capital income, then the current account —usually defined— would equal changes in net foreign assets, and equation (1) would hold. However, in presence of capital gains and exchange rate fluctuations, neither the Balance of Payment nor National Income and Product Account definitions of the current account coincide with the change in net foreign assets evaluated at market value. The reason is that the both account systems record only produced transactions and omit unrealized capital gains

power for stock returns and excess stock returns in the U.S. and abroad: the dividend-price and price-earning ratios (Fama and French (1988), Campbell and Shiller (1988)), the detrended T-bill rate (Hodrick (1992)), the term spread —the difference between the 10-year and one-year T-bill yields— and the default spread —the difference between the BAA and AAA corporate bond rates (Fama and French (1989)), the aggregate book-market ratio (Vuolteenaho (2000)), the investment/capital ratio (Cochrane (1991)) and more recently, the aggregate consumption/wealth ratio (Lettau and Ludvigson (2001)).

[9] Accumulation equation (2) implies that net foreign assets are measured at the beginning of the period. This timing assumption is innocuous. One could instead define $\widetilde{NA}_t$ as the stock of net foreign assets at the end of period $t-1$, i.e. $NA_t = R_t \widetilde{NA}_t$. The accumulation equation becomes: $\widetilde{NA}_{t+1} \equiv R_t \; \widetilde{NA}_t + NX_t$.

[10] In practice, net foreign assets could also increase because of unilateral transfers, or because of transactions not recorded in the trade balance or the financial account (errors and omissions). We abstract from these additional terms. See the appendix for a discussion.

coming from changes in asset prices or exchange rates. These valuation effects can be important when the net foreign portfolio is leveraged, and are incorporated in the return R_{t+1}. It is therefore conceptually simpler to work with net exports.

To explore further the implications of (2), we log-linearize following a methodology close to the work of Campbell and Mankiw (1989) and Lettau and Ludvigson (2001) for closed economy budget constraints.[11] Assume first that the ratio of net exports to net foreign assets NX_t/NA_t is stationary. Assuming that NA_t is different from zero and dividing (2) through by NA_t, this ratio is equal to

$$\frac{NX_t}{NA_t} = \frac{1}{R_{t+1}}.\frac{NA_{t+1}}{NA_t} - 1$$

A sufficient condition for this ratio to be stationary is that the rate of growth of net foreign assets NA_{t+1}/NA_t as well as the portfolio total return R_{t+1} are themselves stationary. We believe that these are mild conditions, likely to be satisfied in any model with a well specified balanced growth path in which the economy, as well as net foreign assets, grow at a constant rate.[12] In what follows, we assume that these two assumptions are satisfied and denote γ the steady state growth rate and R the steady state return on the net foreign portfolio.

The steady state ratio of net exports to net foreign assets μ_s satisfies:

$$\mu_s = \frac{\gamma}{R} - 1$$

A natural assumption is that γ is smaller than R -a condition necessary to avoid explosive solutions– implying that $\mu_{xa} < 0$. This is an intuitive condition: it says that in the long run, there are only two types of countries: net creditors running trade deficits and net debtors running trade surpluses. Assumption 1 summarizes this discussion.

Assumption 1: The growth rate of net foreign assets and the portfolio return are stationary and satisfy $\gamma < R$.

While Assumption 1 is not very restrictive, we need to make additional assumptions in order to log-linearize properly equation (2). Specifically, we need to assume that the ratios X_t/A_t, M_t/A_t and L_t/A_t are stationary. These assumptions guarantee that we do not inadvertently take the log of some negative quantity!

While these assumptions are more specific, there are large classes of models where they are likely to be satisfied. For instance, this will be the case if investors choose stationary shares of domestic

[11]In what follows, log variables (or linear combinations of log variables) will be denoted by lower case letters.

[12]Our assumptions obviously rule out models with balanced trade and no net foreign position.

and foreign assets in their portfolios. In such a model, denote α the steady share of foreign assets in total wealth. Then A_t/L_t is stationary around $\alpha/(1-\alpha)$. Such allocation obtains, for instance, as the solution to a Merton problem when investors' preferences and the structure of asset returns are stationary. It only requires that domestic and foreign assets be imperfect substitutes. This is a natural assumption in an international context, where assets are denominated in different currencies and often subject to different uninsurable exposure.

This assumption is also sufficient to guarantee that X_t/A_t and M_t/A_t are stationary, as long as export and imports are stationary relative to total wealth. In that case, the ratio X_t/A_t would fluctuate around $(X/W)/\alpha$.

Assumption 2: The ratios X_t/A_t, M_t/A_t and L_t/A_t are stationary around μ_{xa}, μ_{ma} and $\mu_{la} > 0$ respectively. The steady state ratios satisfy $\mu_{xa} - \mu_{ma} \neq 0$ and $\mu_{al} \neq 1$.

Equipped with Assumptions 1 and 2, a few steps of tedious algebra (relegated to the appendix) deliver the log-linearization to equation (2). Using lowercase to denote log variables (e.g. $x_t = \ln(X_t)$), we obtain:

$$\Delta na_{t+1} = r_{t+1} + \left(1 - \frac{1}{\rho}\right)(nx_t - na_t) \tag{3}$$

where $\rho = 1 + \mu_r = \gamma/R < 1$ and Δ denotes the difference operator: $\Delta na_{t+1} \equiv na_{t+1} - na_t$. $nx_t = \mu_x x_t - \mu_m m_t$ is a linear combination of log exports and imports that we call, with some abuse of language, net exports. The weights μ_x and μ_m have the same sign and reflect the relative importance of exports and imports in the trade balance in steady state. They are defined as:

$$\mu_x = \frac{\mu_{xa}}{\mu_{xa} - \mu_{ma}}; \; \mu_m = \frac{\mu_{ma}}{\mu_{xa} - \mu_{ma}} = \mu_x - 1$$

Similarly, $na_t = \mu_a a_t - \mu_l l_t$ is a linear combination of log gross assets and gross liabilities that we call, with some abuse of language, net foreign assets. The weights μ_a and μ_l have the same sign and are defined analogously to μ_x and μ_m :

$$\mu_a = \frac{1}{1 - \mu_{la}}; \; \mu_l = \frac{\mu_{la}}{1 - \mu_{la}} = \mu_a - 1$$

Equation (3) carries the same interpretation as equation (2). Consider a creditor country. According to our convention, μ_a, $\mu_l > 0$ while $\mu_x, \mu_m < 0$.[13] Net foreign assets increase ($\Delta na_{t+1} > 0$) if there is a high portfolio return (r_{t+1}), or if the country exports (nx_t low since μ_x is negative).

[13]The opposite would be true for a debtor country. Observe that μ_x and μ_a always have opposite signs (since $\mu_x/\mu_a = \mu_{xa}\mu_r < 0$).

Subtracting and adding $nx_{t+1} - nx_t$ to the left hand side of equation (3), and after a few steps of algebra, we obtain:

$$(na_{t+1} - nx_{t+1}) + \Delta nx_{t+1} = r_{t+1} - \frac{1}{\rho}(nx_t - na_t)$$

This is a difference equation in $nx_t - na_t$, which can be interpreted, again with some abuse of language, as the log-ratio of net exports to net foreign assets. Since $\rho < 1$, this difference equation can be solved forward, if we impose a terminal condition:

Assumption 3: $nx_t - na_t$ satisfies the terminal condition

$$\lim_{j \longrightarrow \infty} \rho^j (na_{t+j} - nx_{t+j}) = 0 \ a.s.$$

Under Assumption 3, the ratio of net export to debt does not grow faster than the interest rate (adjusted for growth) along (a.s) every sample path. The log-ratio of net exports to net foreign assets can be written as:

$$nx_t - na_t = \sum_{j=1}^{+\infty} \rho^j (r_{t+j} - \Delta nx_{t+j}) \tag{4}$$

Equation (4) is simply a restatement of the intertemporal budget constraint that the country must satisfy. It must hold ex-post as well as ex-ante along every sample path. Accordingly, we can take expectations:

$$nx_t - na_t = \sum_{j=1}^{+\infty} \rho^j \mathrm{E}_t [r_{t+j} - \Delta nx_{t+j}] \tag{5}$$

This equation plays a central role in our approach. It shows that if the ratio of net exports to net foreign assets is not constant, it must forecast either changing portfolio returns or changing net export growth. This ratio can only vary if either of these variables is predictable.

Consider first the case where returns on net foreign assets are constant: $r_{t+j} = r \equiv \ln(R)$. In that case, equation (5) posits that any adjustment *must* come through future improvements in net exports ($\Delta nx_{t+j} > 0$) that may require exchange rate changes. This is the standard implication of the intertemporal approach to the current account.[14]

We emphasize instead that the adjustment *may* come from predictable net foreign portolio returns. This return is the realized return on the NFA portfolio in real domestic terms between t and $t+1$ and satisfies:

$$R_{t+1} \equiv w_t R^a_{t+1} - (1 - w_t) R^l_{t+1} \tag{6}$$

[14] See Obstfeld and Rogoff (2001) for an analysis along these lines.

where R^a_{t+1} and R^l_{t+1} denote respectively the simple total real returns (in domestic currency) on gross assets and gross liabilities between period t and period $t+1$. The possibly time-varying portfolio weight w_t measures the share of NA_t invested (long) in gross assets A_t or (short) in gross liabilities L_t and needs not be positive or smaller than one. Under the assumption that the expected returns on gross assets and liabilities are the same, we can log-linearize (6) and obtain:[15]

$$r_{t+1} \approx \mu_a r^a_{t+1} - \mu_l r^l_{t+1} \tag{7}$$

The assumption that gross assets and liabilities have the same expected return simplifies the algebra. However, it is not innocuous: in the general case, portfolio rebalancing also affects the total return on net foreign assets. We abstract from that particular channel in this paper.

Finally, suppose that domestic financial assets are issued in domestic currency while foreign financial assets are issued in foreign currency. We can then rewrite (7) as

$$r_{t+1} \approx \mu_a \left(\tilde{r}^a_{t+1} + \Delta e_{t+1} \right) - \mu_l \tilde{r}^l_{t+1} - \pi_{t+1} \tag{8}$$

where $\tilde{r}^a_{t+1}$ and $\tilde{r}^l_{t+1}$represent the gross nominal return *in local currency*, Δe_{t+1} the rate of depreciation of the domestic currency and π_{t+1} the realized rate of domestic inflation between periods t and $t+1$. This expression emphasizes the role of the exchange rate on net portfolio returns. Holding local currency returns constant, a currency depreciation increases the return on gross assets (held in foreign currency), an effect that can be magnified by the degree of leverage of the net foreign asset portfolio ($\mu_a > 1$).

To gain further intuition into equation (5), using the definition of nx_t and na_t, we normalize (5) by μ_x and define nxa_t :

$$nxa_t \equiv x_t - \frac{\mu_m}{\mu_x} m_t - \frac{\mu_a}{\mu_x} a_t + \frac{\mu_l}{\mu_x} l_t$$

nxa_t has the interpretation of the deviation of the ratio of net exports to net foreign assets from its steady state value. With our convention $\mu_a/\mu_x < 0$ and $\mu_l/\mu_x < 0$ so x_t and a_t enter positively in nxa_t while m_t and l_t enter negatively. This is intuitive: an increase in exports or gross assets improves the net foreign asset position relative to trend. Conversely, an increase in imports or gross liabilities worsens the net foreign asset position. Hence, we can rewrite nxa_t as

$$nxa_t = x_t - \beta_m m_t + \beta_a a_t - \beta_l l_t$$

[15] See Campbell (1996). The approximation also includes an unimportant constant.

where $\beta_i > 0$ and equation (5) as

$$nxa_t = -\sum_{j=1}^{+\infty} \rho^j \mathrm{E_t} \left[\frac{1}{|\mu_x|} r'_{t+j} + \Delta nx'_{t+j} \right] \tag{9}$$

where $r'_t = |\mu_a|\, r^a_t - |\mu_l|\, r^l_t$ increases with r^a_t and decreases with r^l_t and $\Delta nx'_t = \Delta x_{t+j} - (\mu_m/\mu_x)\, \Delta m_{t+j}$ increases with export growth and decreases with import growth.

Consider the case of a country like the U.S. with a large trade deficit and a substantial net foreign liability. For such a country, nxa is below equilibrium. Equation (9) indicates that equilibrium can be restored either through an increase in net exports ($\Delta nx_{t+j} > 0$), or via larger future returns on net foreign positions $\left(r'_{t+j} > 0\right)$. Importantly, according to equation (8) such predictable returns can occur via a *depreciation* of the dollar. While such depreciation is certainly consistent with an improvement in future net exports, the important point is that it operates through an entirely different -and until now unexplored- channel: a wealth transfer from foreigners to US residents. We are interested in measuring the relative importance of these two channels.

It is important to emphasize that equation (5) is an identity. As we already mentionned, it holds in expectations, but also along every sample path. Accordingly, one cannot hope to 'test' it.[16] Yet it presents several advantages that guide our empirical strategy. First, this identity contains useful information: *the ratio of net foreign assets to net exports can move only if it forecasts either future returns on net foreign assets, or future net export growth.* We propose to evaluate empirically the relative importance of these two factors.

Second, under Assumption 1 and 2, one can show that nxa_t is stationary.[17] This is consistent with equation (9) since we assumed that r'_{t+j} and Δnx_{t+j} are stationary.[18] This is important since data on gross assets and liabilities are likely to be measured with error. Cointegration techniques provide an efficient method to recover deviations from trend as long as the measurement errors are stationary.

Third, since our modeling relies only on the intertemporal budget constraint and a long run stability condition, it is consistent with most behavioral models. We see this as a strength of our approach, since it nests any model that incorporates an intertemporal budget constraint. But this also limits the interpretation of the evidence. For instance, our analysis so far is silent as to the

[16] Technically, only equation (2) is an identity. Equation (5) holds if (a) Assumption 1-3 hold and (b) expectations are formed rationally.

[17] See the appendix for a proof.

[18] It is not the case, however, unlike what is often claimed in the literature, that stationarity of r'_{t+j} and Δnx_{t+j} guarantees stationarity of nxa_t, even when $\rho < 1$. See Cochrane (1992) for a counterexample.

horizon at which the adjustment should take place, or through which mechanism.

4 U.S. Net foreign assets, net exports, asset returns and exchange rates.

We apply our methodology to the external adjustment problem of the United States. Our methodology requires constructing net and gross foreign asset positions over relatively long time series. It also requires computing the return on global country portfolios.

4.1 Positions.

Data on the net and gross foreign asset position of the U.S. is available from two sources: the U.S. Bureau of Economic Analysis (BEA) and the Federal Reserve Flows of Funds Accounts for the rest of the world (FFA). The BEA reports annually its International Investment Position of the United States (IIP). The IIP details gross and net foreign asset positions at the end of the year since 1976. In addition, the BEA reports quarterly flow data in the US International Transactions (USIT) tables since 1960 for some flow series, 1982 for others.[19] The BEA data uses Balance of Payment concepts, in accordance with the IMF's Manuel of the Balance of Payments (1993).[20] Following official classifications, we split U.S. net foreign portfolio into four categories: debt (corporate and government bonds), equity, Foreign Direct Investment (FDI) and other. The 'other' category includes mostly bank loans and trade credits. Most positions in the BEA are available at market value, except for Foreign Direct Investment, recorded at market value since 1980 only.[21]

For its part, the Federal Reserve publishes since 1952, as part of the flow of funds accounts, the quarterly flows and positions for the "rest of the world" account. The main drawback of the FFA data is that only equity is recorded at market value. Debt, FDI and 'other' claims and liabilities are recorded at historical costs. Second, the FFA uses uses National Income and Product Account (NIPA) concepts that differ subtly from their BoP equivalent. However, it is important to realize that most of the primary data source is identical for the BEA and the FFA.[22]

Our strategy consists in re-constructing market value estimates of the gross external assets and liabilities of the U.S. that conform to the BEA definitions by using flow of funds data and

[19]For instance, equity and debt flows are available separately after 1982 only.

[20]The Lane and Milesi-Ferretti (2001) data set includes annual data since 1973 and coincides with the BEA data after 1982. Unfortunately this does not offer enough datapoints for our analysis.

[21]Technically, the BEA provides data on FDI at market value since 1982. However, the IMF constructed market value positions for 1980 and 1981. We use these estimates in our analysis.

[22]See Hooker and Wilson (1989) for a detailed comparison of the Flow of Funds and BEA data.

valuation adjustments before 1980. We also construct market value position at quarterly frequency by interpolating end of year positions and including a valuation correction.

Denote $\tilde{X}_t$ the end of period t position for some asset X. We use the following updating equation:

$$\tilde{X}_t = \tilde{X}_{t-1} + FX_t + DX_t$$

where FX_t denotes the flows corresponding to asset X that enter the balance of payments, and DX_t denotes a discrepancy reflecting a market valuation adjustment or (less often) a change of coverage in the series between periods $t-1$ and t.

Using existing sources, we construct FX_t by mapping the FFA flows into their BEA equivalent. We then construct an estimate of DX_t as $r_t^c \tilde{X}_{t-1}$ where r_t^c represents the estimated dollar capital gain on asset X between time $t-1$ and time t.[23]

Starting in 1980, for FDI, and 1976 for other categories, we construct estimates of market valued positions backwards according to

$$\tilde{X}_{t-1} = \frac{\tilde{X}_t - FX_t}{1 + r_t^x}$$

Our approach requires that we specify market returns r_t^x for each sub-category of the Financial Account.

4.2 Returns.

We construct returns on the various subcategories of the financial account as follows. For capital gains on equity liability (i.e. the U.S. stock market), we use the quarterly returns on the Center for Research in Security Prices (CRSP) weighted price series excluding dividends. For equity assets (i.e. dollar returns on foreign equity), we use a weighted average of quarterly returns (excluding dividends) on foreign countries stock prices. The individual countries stock indices are from the Global Financial Database and converted into dollar using IFS end of quarter exchange rates. The foreign equity weights are constructed from the 1997 foreign equity holdings by country, reported in the 1999 U.S. Treasury report on U.S. holdings of long term securities. The weights range from 25.44% for the U.K. to 3.64% for Australia.[24]

[23]According to the Balance of Payments manual, direct investment income in the current account includes distributed earnings as well as the share of reinvested earnings. There is an offsetting entry in the financial account. So the correct return r_t^x should exclude interest income as well as dividends.

[24]We exclude some countries for which no stock price data was available. Our estimate reflects about 70% of foreign equity holdings in 1997.

We adjust the positions on debt liability (i.e. U.S. government and corporate bonds) as follows. First, we construct the quarterly holding return on 10-year U.S. government bonds. We then subtract the current yield (distributed as income). This net return applies to long term debt. According to the TICS data, long term debt represents 60% of U.S. government, Treasury and corporate bond holdings. We assume that there is no capital gain adjustment for short term debt.[25]

We apply the same methodology for debt assets (holdings of foreign government and corporate debt). Since much foreign debt is issued in dollars, it is important to use currency and not country weights.[26] We use currency weights for year 1994, reported in the 1999 U.S. Treasury report on U.S. holdings of long term securities. Our estimate covers about 90% of the foreign long term debt held by the U.S. The U.S. dollar represents 52%, while the rest is spread between Japan (10%), Germany (8%), the U.K. (4.5%) and other smaller countries. We convert the net returns into dollars at the end of the period.

We apply no valuation adjustment to 'other' asset and liabilities, since these are mostly short term loans, trade credit, or illiquid bank loans.

Finally, we apply a mixed valuation approach to the Foreign Direct Investment series. After 1982, the BEA reports FDI at market value. We construct within year positions on FDI liabilities by fitting the implicit annual return used by the BEA onto the CRSP capital gain series used for quity liability valuation. For FDI assets, we fit the implicit return in the BEA estimate onto a FDI weighted capital gain series, where the weights are constructed using the BEA's estimates of U.S. Direct Investment Position Abroad on a Historical-Cost Basis from 1966 to 2002.[27] In both cases, we obtain a very good fit.[28] Difficulty appears if we want to apply the same methodology before 1980. Using the same valuation adjustment delivers large and negative U.S. FDI assets and liabilities before 1970!! Instead, we strike a compromise and construct FDI assets and liabilities with an exchange rate adjustment before 1980.[29] This nominal effective exchange rate is constructed

[25]This approach assumes away any spread between corporate and government debt.

[26]For lack of coverage, we assume away coutry risk and assume that debt issued in dollars pays the U.S. return.

[27]Before 1966, we assume constant weights equal to the 1966 weights.

[28]It should be observed that the fact that we obtain a good fit simply indicates that we are able to replicate the BEA valuation approach accurately, not necessarily that the resulting market estimates are accurate. It is extremely difficult to obtain precise market estimates of FDI positions. The BEA reports that its estimates for 1976 forward are linked to the 1977, 1982, 1989, and 1994 benchmark surveys of U.S. direct investment abroad. However these benchmark survey only provide information on the historical costs of projects. All valuation adjustments are done by the BEA using equity returns.

[29]We also experimented with a series that valued FDI with exchange rate adjustments throughout the sample. The results are somewhat weaker. It is unclear to us that this would be a relevant approach since it would disregard the

using the time-varying FDI historical position country weights and is defined such that an increase in the exchange rate represents a depreciation of the dollar. This exchange rate proxies the true financially weighted exchange rate that affect the dollar return on gross foreign assets.[30]

We also need to construct total returns on the various subcategories of the financial account. For total returns on equity and FDI liabilities we use the quarterly total return on the Standard & Poors 500 (S&P500) since 1952. The total return on debt liabilities is constructed as the quarterly holding return on 10-year U.S. government bonds. The total return on 'other liabilities', mostly bank loans and trade credit, is constructed as the quarterly return on three-months U.S. government Treasury Bills. For total returns on equity assets, we use a weighted average of (dollar) total returns on major foreign stock markets. Quarterly total returns for individual countries in local currency since 1952 are obtained from the Global Financial Database and are converted in dollars using end of quarter exchange rates against the U.S. dollar. Total returns on FDI assets are obtained similarly with weights derived from the BEA's estimates of U.S. Direct Investment Position Abroad on a Historical-Cost Basis from 1966 to 2002. To construct total returns on debt assets, we use a weighted average of the quarterly (dollar) holding returns on long term foreign government bond, using the 1994 currency weights for long term debt holdings from the 1999 U.S. Treasury report on U.S. holdings of Long-Term securities.[31] We construct total return for 'other assets' (mostly bank loans) using a weigthed average of 3-months foreign interest rates with currency weights for short term debt from the 2001 U.S. Treasury report on U.S. holdings of foreign securities. All returns (except exchange rate changes) are adjusted for U.S. inflation by subtracting the quarterly change in the Personal Consumer Expenditure deflator.

Our constructed series of net foreign asset position for the US is shown in Figure 1, relative to household net worth. We see a strong deterioration of the U.S. net foreign asset position after 1982.

[Figure 1 about here]

information from the BEA's annual estimates after 1980.

[30]We checked the robustness of our results by using alternate definitions of the multilateral exchange rate, based on equity or debt weights. The results are qualitatively unchanged. We note also that the correlation between the rate of depreciation of our multilateral exchange rate and the rate of depreciation of the Federal Reserve 'major currencies' trade weighted multilateral nominal rate is high at 0.86. This is perhaps not surprising if we think that some of the determinants of trade flows are also determinants of financial flows (see Portes and Rey (2003)).

[31]The weights range from 59.9% for the U.S. dollar to 4.9% for the French Franc.

5 Empirical results.

The previous section showed that (a) (log) exports, imports, gross foreign assets and liabilities should be cointegrated; and (b) the deviation from trend should contain information about future net export growth or future net foreign asset returns. Our empirical implementation proceeded therefore in two steps. First we tested for unit roots in exports, imports, assets and liabilities. We then test for the stationarity of the three series X_t/A_t, M_t/A_t and L_t/A_t using Johansen cointegration tests. Third, having found the existence of three cointegrating relations, we estimate the cointegrated vector linking our four variables of interest and explore its forecasting properties. In order to preserve space, we do not report here the unit root and cointegration tests. The results support our assumption 2: we find that all variables are I(1), and that the ratios have a common trend. The assumptions behind the derivation of (9) seem satisfied.

5.1 The asset channel of external adjustment

To estimate the coefficients β_i, we use Stock and Watson's ((1993)) dynamic least square technique. This technique generates optimal estimates of the cointegrating coefficients. Specifically, we estimate the following equation by OLS:

$$x_t = \alpha + \beta_m m_t - \beta_a a_t + \beta_l l_t + \sum_{i=-k}^{k} b_{m,i}\Delta m_{t-i} + \sum_{i=-k}^{k} b_{a,i}\Delta a_{t-i} + \sum_{i=-k}^{k} b_{l,i}\Delta l_{t-i} + \epsilon_t \tag{10}$$

The OLS estimates $\hat{\beta}_m$, $\hat{\beta}_a$ and $\hat{\beta}_l$ provide consistent estimates of the cointegrating coefficients β_m, β_a and β_l. The leads and lags of the first differences of the right hand side variables allow to correct for the endogeneity of the regressors. $\widetilde{nxa}_t$ denotes our estimated deviation from trend $x_t - \hat{\beta}_m m_t + \hat{\beta}_a a_t - \hat{\beta}_l l_t$.

We estimate the regression in equation (10) using quarterly data from the first quarter of 1952 to the third quarter of 2003 and 4 leads and lags.[32] We obtain the following point estimates, with robust standard errors in parenthesis:

$$\begin{array}{ccccccccc} x_t & = & 1.94 & + & 0.71 m_t & - & 0.48 a_t & + & 0.46 l_t \\ & & (0.27) & & (0.04) & & (0.11) & & (0.11) \end{array}$$

We observe that each coefficient is statistically significant and satisfies the sign restrictions discussed above: $\widetilde{nxa}_t = x_t - 0.71 m_t + 0.48 a_t - 0.46 l_t$ increases with exports and gross assets

[32] We choose the lag length according to Akaike's information criterion. The results are qualitatively unchanged if we use leads and lags between 2 and 8.

and decreases with imports and gross liabilities. The coefficients on exports and imports are close in absolute value and imply an absolute export share $|\mu_x| = 3.43$.[33] The coefficients on gross assets and liabilities are close and of opposite signs and imply an absolute steady state export ratio $|\mu_x| = \left|\left(\hat{\beta}_l - \hat{\beta}_a\right)^{-1}\right| = 58.66$, where we used the restriction $\mu_a - \mu_l = 1$. Since μ_x enters the denominator of each coefficient, the difference between the two implied values reflects the fact that the data on gross assets and liabilities may be noisier and needs to be scaled down by the cointegrating vector. For comparison, we constructed the coefficients β_i using the average shares over the sample.[34] We obtain $|\mu_x| = 22.23$ and $|\mu_a| = 8.61$, implying $\beta_m = 0.96$, $\beta_a = 0.39$ and $\beta_l = 0.34$. These coefficients are surprisingly close to the estimated ones, with a higher loading on imports (hence a lower loading on net exports) and a lower loading on gross assets and liabilities. Since the data on positions is likely to be measured with error, we use the Dynamic OLS estimates as our preferred estimate of nxa_t.

Econometric theory tells us that the cointegrating residual nxa_t *must* forecast the growth rate of at least one of our four series: exports, imports, gross assets or gross liabilities, provided enough lags are included in the regression. This is the Granger Representation Theorem. It is equivalent to saying that there is an error-correction representation. We investigate this question by estimating a four-variable cointegrated vector autoregression where log differences in exports, imports, gross assets and liabilities are regressed on their own lags as well as the (lagged) estimated cointegrated variable $\widetilde{nxa}_t$. The results are presented in Table 1, using one lag.[35]

[Table 1 about here]

Three properties emerge from Table 1. First, deviations from the common trend predict future adjustment in gross assets, gross liabilities and imports. As we will show in section **XXX**, the predictability in gross assets and liabilities comes in part from the predictability of future net foreign asset portfolio returns. Second, the point estimates indicate that a positive deviation from trend today –coming either from high net exports or high net foreign assets– will be associated with future increases in gross assets and liabilities. Nevertheless, the increase in gross liabilities

[33] Recall that $\beta_m = \mu_m/\mu_x = 1 - 1/\mu_x$.

[34] These are constructed from the average of the absolute value of the shares of exports, imports, gross assets and liabilities respectively.

[35] The lags are selected in accordance with the Akaike and Schwarz criterion. The results are similar using two or three lags.

is larger than the increase in gross assets, ensuring that net foreign assets return to equilibrium. Lastly, we find that import growth is predictable, a result consistent with an expenditure switching mechanism. This last result is less robust to the lag length selection. With three or more lags, import growth becomes unpredictable, while gross assets and liabilities remain significant.[36] Taken together, the results suggest that movements in nxa_t are best described as transitory movements in gross assets, gross liabilities and, to a smaller extent, imports. This is consistent with our proposed reinterpretation of the external adjustment mechanism. It emphasizes that gross assets and liabilities are at least as important as exports and exports in bringing the ratio back to its equilibrium value.

Next, we investigate the predictability of transitory movements in gross assets and liabilities by looking at the predictability of gross and net returns on the net foreign asset position. Equation (9) indicates that nxa should help predict either future returns on the net foreign asset portfolio r'_{t+j}, or net export growths $\Delta nx'_{t+j}$.

We construct the financial returns on the net foreign asset portfolio as follows. First, we use the definition of $r'_t = |\mu_a|\, r^a_t - |\mu_l|\, r^l_t$. Then, we express r^a_t and r^l_t as weighted average of the returns on the four different subcategories of the financial account: equity, foreign direct investment, debt and 'other'. For instance, we write the total return on gross assets r^a_t as:

$$r^a_t = w^a_e r^{*e}_t + w^a_f r^{*f}_t + w^a_d r^{*d}_t + w^a_o r^{*o}_t$$

where r^{*i}_t denotes the real (dollar) total return on asset category i (equity, fdi, debt or other) and w^a_i denotes the average weight of asset category i in gross assets. A similar equation holds for the total return on gross liabilities r^l_t.

Table 2 reports some summary statistics on the different asset returns as well as our variable nxa, the growth rate of its components and the rate of depreciation of our multilateral exchange rate. Table 2 indicates that the components of nxa are quite volatile, with export and import growth more volatile than growth in gross assets and liabilities. The volatility of export and import growth (4.23 and 3.86) is comparable to the volatility of returns on gross assets and gross liabilities and much smaller than the volatility on the net portfolio return (18.05). Looking at the subcomponents, we find that domestic and foreign dollar equity and fdi average returns r^e_t, r^{*e}_t and r^{*f}_t exceed average bond returns r^{*d}_t and r^d_t, in turn larger than returns on short term assets r^{*o}_t and

[36] Results not presented and available upon request.

r_t^o. As is well-known, the volatilities satisfy the same ranking. The exchange rate exhibits a smaller volatility than equity returns, comparable to the volatility of bond returns. Finally, most returns and the exchange rate exhibit little autocorrelation. By contrast, nxa exhibits a high degree of autocorrelation (0.91).[37]

Tables 3 and 4 report the cross correlation for nxa, the portfolio return and its components, the rate of depreciation and the growth rates of exports, imports, assets and liabilities. We observe first that the total return on gross assets r_t^a is very correlated with the dollar return on foreign equity r_t^{*e} (0.94). Similarly, the total return on gross liabilities r_t^l is very correlated with the return on U.S. equity (0.93). To a first approximation, then, returns on assets and liabilities are dominated by the equity components of the financial account, that are the most volatile. Domestic and foreign equity returns are highly positively correlated (0.78), and we observe also a sizeable correlation between the dollar return on assets r_t^a and the rate of depreciation (0.39).

Most interestingly for us, the table indicates that nxa is negatively correlated with net foreign asset returns (-0.24), a result consistent with our interpretation of Eq. (9): high exports or gross assets are associated with lower net returns on the net foreign asset portfolio. Looking at the subcomponents of r_t, we observe that nxa is mostly correlated with the return on gross assets, and especially with the rate of depreciation (-0.28), a finding consistent with our interpretation.

The net foreign returns are also more correlated with the growth rates in gross assets than with export and import growth.

[Tables 2-4 about here]

Figure 2 plots the (opposite of) the return on the net foreign asset portfolio return r_t –akin to the excess return on US assets relative to foreign assets– together with the lagged deviation from trend nxa (both variables are standardized). The figure shows that the deviation from trend captures the broad pattern of returns on the U.S. net foreign position. For instance, starting in 1983, nxa_t predicted a relatively low return on U.S. assets. The excess return on U.S. assets became large and negative in 1984 and remained so until 1987. More recently, nxa has predicted low excess returns on U.S. assets since 1999. Excess returns stayed high until the end of 2002 and dropped precipitously since.

[37] Of course, by construction of the cointegrated vector, nxa is stationary.

[Figures 2-3 about here]

It is perhaps no coincidence that these two episodes where marked by large movements in the dollar. Figure 3 reports the (opposite) of the quarterly rate of depreciation of the dollar Δe_t together with nxa_{t-1} over the post Bretton-Wood period (the variables are standardized). The figure reveals a substantial degree of correlation between nxa and the subsequent rate of depreciation of the currency. In the mid 1980s and again in the late 1990s, the deviation from the common trend indicated that a depreciation of the dollar was necessary to restore long term solvency.

5.2 Forecasting Quarterly Returns: the role of valuation effects

This section explores in more details the ability of our variable nxa to forecast future net foreign asset portfolio returns and exchange rates at quarterly horizon. Tables 5-8 report a series of results using the lagged deviation nxa_{t-1} as a predictive variable. Each line of the tables reports a regression of the form:

$$y_t = \alpha + \beta \; nxa_{t-1} + \gamma \; z_{t-1} + \epsilon_t$$

where y_t denotes a quarterly return between $t-1$ and t and z_t denotes additional controls shown elsewhere to contain predictive power for asset returns or exchange rates.

Looking first at Panel A of table 5, we see that the deviation from trend has significant forecasting power for the net portfolio return r_t' one quarter ahead (line 1). The $\bar{R}^2$ of the regression is 0.09 and the negative and significant coefficient indicates that a positive deviation from trend predicts a decline in net portfolio return that is qualitatively consistent with equation 9. We observe also that there is essentially no forecasting power from either lagged values of the net portfolio return, or lagged domestic and foreign dividend-price ratios.

We also regress quarterly portfolio returns on the deviation from the shared trend in (log) exports and imports. This ratio, denoted xm_t, is estimated by Dynamic OLS. xm_t contains information about the trade balance, but no information about the net foreign position of the U.S. at market value. If the predictive power of nxa were to come exclusively from information about deviations from trend of the trade balance, and incorporate no information about net foreign asset positions, xm_t should perform just as well as nxa_t in predicting returns. While we see (line 4) that xm_t does contains significant predictive ability about quarterly returns, we observe that the $\bar{R}^2$ is smaller (0.07 against 0.09). More importantly, the regression including both nxa_t and xm_t

indicates that nxa_t contains all the predictive power while xm_t becomes insignificant and has the wrong sign (line 5).

We emphasize that the predictive power of nxa_t is large: the coefficient of 0.59, coupled with a standard deviation of nxa of 0.09 indicates that a one-standard deviation increase in nxa predicts a decline in the net portfolio return of about 540 basis points over the next quarter, equivalent to about 23 percent at an annual rate.

Panel B of table 5 reports the results of similar regressions for the excess equity total return, defined as the quarterly dollar total return on foreign equity r_t^{*e} (a subcomponent of US assets) minus the quarterly total return on U.S. equity r_t^e (a subcomponent of US liabilities). Since r_t^a is very correlated with r_t^{*e} and r_t^l is very correlated with r_t^e, it is natural to investigate the predictive ability of nxa on this measure of relative stock market performance. To the extent that the weights μ_a and μ_l are imperfectly measured, the degree of leverage of the net foreign asset portfolio could also be mismeasured, which could influence our results on total net portfolio returns. Focusing on the less noisy measure of net equity returns, we are able to confirm our results.

Panel B largely confirms our previous results: nxa can predict one-quarter ahead relative stock market performance. The $\bar{R}^2$ of the regression is equal to 0.10 (line 8) and the sign of the statistically significant coefficient is negative, as expected. The domestic and dividend price-ratios are not significant on their own (line 10), while xm's predictive power (line 11) is sucked out by nxa (line 12). The dividend price ratios become significant once included jointly with nxa (line 13). The $\bar{R}^2$ of this regression is an impressive 0.14 (recall that we are predicting one quarter ahead *relative* stock market performance).

The predictive impact of nxa on $r_t^{*e} - r_t^e$ is smaller than on r_t, yet it is highly economically significant. With a coefficient of -0.20, a one-standard deviation increase in nxa predicts a decline in excess returns of 171 basis points, or 7 percent annualized. To illustrate, as of September 2003 (the last point in our sample), nxa predicted a 3.77 percent quarterly decline in the relative stock return performance of the rest of the world relative to the U.S. To reiterate, these results accord well with the intuition behind equation (9) and indicate that a potential mechanism for international financial adjustment is via changes in return on domestic and foreign assets and the associated wealth transfers.

[Tables 5-8 about here]

We now turn to the components of the total portfolio return r'_t. Recall that we can write $r'_t = |\mu_a| r^a_t - |\mu_l| r^l_t$. Does nxa predict the return on gross liabilities or gross assets? We start by investigating in Panel C in table 6 the predictive ability of nxa for r^l_t, the return on gross liabilities. Recall that U.S. gross foreign liabilities mean U.S. financial assets owned by foreigners. Panel D investigates the ability of our variable nxa to predict U.S. total equity return r^e_t. It is immediate that the predictive ability of the deviation from trend for both variables is very weak: the coefficient on nxa is never significant and the $\bar{R}^2$ is essentially nil. By contrast, we find that two variables that are shown elsewhere to contain predictive power for U.S. stock returns variables, the ratio of domestic prices to dividends dp_t and the deviation from trend of the ratio of nondurable consumption to total wealth cay_t, are better predictors of one quarter ahead U.S. total equity returns.[38] Table 6 indicates clearly that nxa does not forecast domestic equity returns at short horizons.[39]

Table 7 looks at the predictive power for the total dollar return on gross assets r^a_t (Panel E) and the foreign total dollar equity return (Panel F). Both panels indicate that -while weaker, there is a significant predictive power at one quarter. The $\bar{R}^2$ stays small, around 0.02 for nxa_t alone (line 1). Similar results obtain for the foreign total equity return. An increase in nxa predicts a decline in future dollar returns on foreign assets, in line with the intuition behind equation (9).

Interestingly, lines 6 and 12 indicate that xm and nxa are now too correlated to be identified separately. It is possible, therefore, that the effect on gross asset returns arises from deviations of the trade balance from equilibrium. The economic effect is also smaller, with a one standard deviation increase in nxa leading to a decline of 54 basis point (2.2% annualized) in the expected return on foreign assets and a larger 153 basis points (6% annualized) decline in the dollar return on foreign equity. The results from tables 5-7 also indicate that the correlation structure between returns on gross assets and liabilities plays an important role for in understanding the adjustment of net foreign asset returns r'_t.

The results from table 7 beg an obvious and tantalizing question: can nxa predict exchange rate movements? Could it be that the predictability in the dollar return on gross assets arises from some predictability in the exchange rate? After all, the return on gross foreign assets can be written as $r^a_t = \tilde{r}^a_t + \Delta e_t - \pi_t$ where e_t represents (the log of) a financially-weighted U.S. nominal

[38]See Campbell and Shiller (1991) and Fama and French (1988) for the dividend price ratio, and Lettau and Ludvigson (2001) for cay.

[39]Similar results (not included) obtain for xm.

effective exchange rate and $\tilde{r}_t^a$ represents the return on gross assets in some compound foreign currency. As discussed previously, it is difficult to construct precise estimates of the financially-weighted nominal effective exchange rate. There is little available evidence on the currency and country composition of total foreign assets. In practice, the benchmark Treasury Survey ((2000)) reports country and currency composition for long-term holdings of foreign securities in benchmark years. Because little data is available before 1994, the weights are likely to be substantially off-base at the beginning of our sample. Instead we present estimates using an FDI-weighted effective exchange rates as described above (e_t) in Panel G of Table 8 as well as using the Federal Reserve trade-weighted multilateral exchange rate for major currencies (e_t^m) in Panel H. to the extent that the geographical determinants of trade flows also influence financial flows, as argued by Portes and Rey (2003), the trade-weighted exchange rate may be a better approximation of the true implicit exchange rate than e_t that reflects only FDI weights at historical value. The sample period covers the post-Bretton Woods period, from 1973:1 to 2003:3.

We observe first that nxa contains strong predictive power for both exchange rate series (line 1 and 8). The coefficient is negative (-0.11 and -0.12 respectively) and significant, implying that a current negative deviation from the common trend of exports, imports, assets and liabilities predicts a subsequent depreciation of the dollar against major currencies that increases the returns on gross assets, reduces the return on gross liabilities and helps restopring long term solvency. The $\bar{R}^2$ are high (0.10 and 0.12 respectively). For comparison, Mark (1995) reports in-sample $\bar{R}^2$ between 0.02 and 0.06 for the monetary model at one-quarter horizon.[40] The effects are also economically large: a one-standard deviation decrease in nxa predicts a 99 basis points (4% annualized) increase in the expected rate of depreciation of the multilateral exchange rate over the subsequent quarter.

Our results are robust to the inclusion of xm_t, the deviation of exports and imports from a shared trend, or the inclusion of the three-month interest rate differential $i_t - i_t^*$ where we construct i_t^* using 1997 weights from U.S. Treasury. While xm_t predicts significantly future exchange rate changes (line 3 and 10) we observe that the $\bar{R}^2$ are smaller. More importantly, in a horse race between nxa and xm, the former remains significant while the latter drops out and changes signs. These results illustrate that it is not enough to look at deviations from the long-run trade balance: including information on the market value of gross assets and liabilities is important as well.

[40]Mark (1995) uses Bootstraps estimates to correct the small sample bias in the estimates of the slope coefficient. We plan to investigate in subsequent work the impact of these small sample bias on our estimates.

Lines 4 and 11 test the well-known Uncovered Interest Rate Parity condition. As is abundantly documented in the literature (see Gourinchas and Tornell (forthcoming) for recent estimates), the coefficient on the forward premium $i_t - i_t^*$ is often insignificant or negative. We find a similar result: short term interest rate differentials do not help predicting one quarter ahead changes in exchange rate. Including nxa and $i_t - i_t^*$, the interest rate differential becomes marginally significant, but with the 'wrong' sign (line 6 and 13): if anything, an increase in U.S. interest rates is associated with a future expected appreciation of the dollar. We also note that the risk premium (defined as the difference between the three-month forward rate and the depreciation rate) is explained by our cointegrating residual. A regression of the risk premium on nxa produces an $\bar{R}^2$ of 0.08 while nxa is significant at the 1% level.

Finally, panels I to M of table 8 test the quarter-ahead predictive power of nxa against bilateral nominal rates of depreciation of the dollar against the Sterling pound, the Japanese yen, the Canadian dollar the German DMark (Euro after 1999) and the Swiss Franc. We find a significant predictive power for all currencies, with $\bar{R}^2$ ranging from 0.04 to 0.08. The largest effect is on the DM/Euro and the weakest on the Canadian dollar. A one-standard deviation decrease in nxa predicts an increase in the expected bilateral rate of depreciation between the dollar and the euro of 162 basis points (6.3% annualized) over the subsequent quarter.

We believe that our results are strongly indicative of the promise of our approach. Traditional models of exchange rate determination fare particularly badly at the quarterly-yearly frequencies. Our approach, which emphasizes a more complex set of fundamental variables, is paying off especially at these horizons. Our cointegrating residual variable enters with the predicted sign and is strongly significant: a large ratio of net exports to net foreign assets predicts a subsequent appreciation of the dollar, which generates a capital loss on foreign assets.

5.3 Long horizon forecasts: the importance of net export growth.

A natural question is whether the predictive power of nxa increases with the forecasting horizon. As figure 2 and 3 make clear, the deviation from the common trend in exports, imports, assets and liabilities is picking up more than the quarterly fluctuations in asset returns or the exchange rate. We would expect higher predictability as the forecasting horizon increases. In fact, according to (9), nxa could forecast any combination of r_t', Δx_t Δm_t at long horizons.

We investigate this question by regressing $k-$horizon returns $y_{t,k} \equiv \left(\sum_{i=0}^{k-1} y_{t+i}\right)/k$ between $t-1$ and $t+k-1$ on nxa_{t-1}. Table 9 reports the results for forecasting horizons ranging between

1 and 24. Clearly, when the forecasting horizon exceeds 1 induces $(k-1)^{th}$ order serial correlation in the error since observations are sampled quarterly. Accordingly, we report Newey-West robust standard errors.[41]

Table 9 indicates that the in-sample predictability increases up to 0.20 for net foreign portfolio returns at a 4-quarter horizon, then declines to almost zero. A similar pattern is observed for total excess equity return and the total return on gross assets. The deviation from the common trend never significantly predicts the return on U.S. financial assets: the coefficients for $r^{l}_{t,k}$ (line 3) and $r^{e}_{t,k}$ (line 4) are never significantly different from zero.

[Table 9 about here]

The picture is very different when we look at export and import growth. While nxa never predicts import growth, we find that it predicts a substantial fraction of future export growth. This result is consistent with a long run adjustment via the trade balance. A high current nxa predicts low export growth, and a subsequent worsening of the trade balance that restores equilibrium. It is comforting to find a significant adjustment via net exports, especially at longer horizons (8 quarters and more).

Looking at exchange rates, we find a similarly strong long run predictive power of nxa on the rate of depreciation of the dollar (lines 9 and 10). The $\bar{R}^2$ increase up to 0.46 at 12 quarters. Unlike net portfolio returns, nxa contains significant predictive power for exchange rates at long horizons. Taken together, these findings indicate that two dynamics seem at play. At horizons smaller than two years, the dynamics of the portfolio returns seem to dominate, and exchange rate adjustments create valuation effects that have an immediate impact on external imbalances. At horizon larger than two years, there is no predictability of asset returns any more. On the other hand, there is still substantial exchange rate predictability, that goes hand in hand with a corrective adjustment in future net exports.[42]

The eventual adjustment of net exports is consistent with the predictions arising from expenditure switching models. Because these adjustments take place over a longer horizon, their influence

[41] The truncation lag for the Bartlett window is set according to $q = floor\left(4\left(T/100\right)^{2/9}\right)$, as suggested by Newey and West.

[42] Other factors can also influence the nominal exchange rate at longer horizons. For instance, Mark (1995) demonstrates that the fit of the monetary model improves dramatically beyond 8 quarters.

on the short term dynamics is rather limited. The combination of valuation effects and expenditure switching implies that nxa has significant predictive power for the rate of depreciation both at short and long horizons.

Figure 4 reports the FDI-weighted nominal effective depreciation rate from 1 to 12 quarter ahead against its fitted values with nxa. The improvement in fit is striking as the horizon increases. We also want to emphasize that our predicted variable does well at picking the general tendencies in future rates of depreciations as well as the turning points, even one to four quarters ahead.

[Figure 4]

5.4 Variance Decomposition and VAR representation

It is possible to use equation (9) to decompose the unconditional variance of nxa into components reflecting news about future portfolio returns and news about future net export growth.[43]

Multiply equation (9) by $(nxa_t - \mathrm{E}(nxa_t))$ and take expectations, to obatin:

$$\mathrm{var}(nxa_t) = -\frac{1}{|\mu_x|}\sum_{j=1}^{+\infty}\rho^j \mathrm{cov}\left(r'_{t+j}, nxa_t\right) - \sum_{j=1}^{+\infty}\rho^j \mathrm{cov}\left(\Delta nx'_{t+j}, nxa_t\right)$$

Next, exploiting the linearity of the covariance, and dividing by $\mathrm{var}(nxa_t)$ we write:

$$\begin{aligned} 1 &= -\frac{1}{|\mu_x|}\frac{\mathrm{cov}\left(\sum_{j=1}^{+\infty}\rho^j r'_{t+j}, nxa_t\right)}{\mathrm{var}(nxa_t)} - \frac{\mathrm{cov}\left(\sum_{j=1}^{+\infty}\rho^j \Delta nx'_{t+j}, nxa_t\right)}{\mathrm{var}(nxa_t)} \\ &\equiv \beta_r + \beta_{nx} \end{aligned} \tag{11}$$

Each sum on the right hand side can be approximated by truncation over the sample period. The term $\mathrm{cov}(z_{t+j}, nxa_t)/\mathrm{var}(nxa_t)$ is estimated as the regression coefficient of z_t on $\widetilde{nxa}_t$. When ρ is equal to 1, the decomposition expresses the share of the variance of nxa explained returns (resp. net exports) as the coefficient from a regression of long portfolio returns $\sum_{j=1}^{\infty} r'_{t+j}$ (resp. long run export growth $\sum_{j=1}^{\infty}\Delta n'_{t+j}$) on current nxa_t. It is important to note that this is not an orthogonal decomposition, so terms less than 0 or greater than 100 percent are possible.

Table 10 reports the decomposition for various values of ρ between 1 and 0.94, for two different values of $|\mu_x|$. β_r and β_{nx} are estimated by truncating the sum in (11) at 24 quarters. When using the sample average value of $|\mu_x| = 22.23$ (line 1-7), the share of the table confirms the result from the

[43] This decomposition follows Cochrane (1992).

long-horizon regressions: movements in next exports (line 2) account for a large fraction of the low frequency movements in nxa. By contrast, portfolio net returns (line 1) explain at most 7 percent of the variance. For a discount rate equal to a reasonable 0.96, we find that our decomposition accounts for 100% of the variance in nxa.

Line 3-7 of the table decompose further r'_t and $\Delta nx'_t$ into their respective components, under the assumption that $|\mu_a| = 8.61$, its sample average.[44] Movements in both exports and imports dominate fluctuations in nxa. Exports account for 73 to 107 percent of the variance, while imports account for 11 to 25 percent. By contrast, returns on gross assets and liabilities represent 2 to 3 percent of the variance. These results confirm that the long run properties of nxa are driven by the behavior of exports and imports, and that the data does not reject the decomposition.

Lines 8-11 report the results using the implicit weight $|\mu_x| = 3.43$ estimated from the cointegrating vector. While leaving the contributions of Δnx unchanged, this raises the contribution of returns from about 7% to about 40%.[45] Surprisingly, the table indicates that returns on gross liabilities explain a larger share of net return movements. This results stands in contrast to the short run forecastability.

[Table 10 about here]

The previous decomposition provides useful information about the long run or low frequency properties of nxa. We want also to decompose the conditional variance at different horizons into a return and a net export component. Equation (9) imposes the following restriction:

$$\begin{aligned} nxa_t &= \sum_{j=1}^{+\infty} \rho^j \mathrm{E}_\mathrm{t} \left[\frac{1}{|\mu_x|} r'_{t+j} - \Delta nx'_{t+j} \right] \equiv nxa_t^* \\ &\equiv nxa_t^{*r} + nxa_t^{*\Delta nx} \end{aligned} \tag{12}$$

nxa_t^{*r} is the component of nxa_t^* that forecasts future returns , while $nxa_t^{*\Delta nx}$ is the component that forecasts future change in net exports. We propose to follow Campbell and Shiller (1988) and construct empirical estimates of nxa_t^{*r} and $nxa_t^{*\Delta nx}$ using a VAR formulation. Specifically consider

[44] β_i for $i \in \{a, l, x, m\}$ are defined by analogy with β_r and β_{nx}.

[45] Clearly, the sum of the contributions now exceed 100%. This reflects the fact that the log-linearization (9) ignores the covariance structure between returns and net exports. In fact, as Lane and Milesi Ferreti have documented, this correlation tends to be negative in the long run, which is consistent with a sum of the variance terms in excess of 100%.

the VAR(p) representation for the vector $\left(r'_{t+1}, \Delta nx'_{t+1}, \widetilde{nxa}_t\right)'$. Appropriately stacked, this VAR has a first order companion representation: $\mathbf{z}_{t+1} = \mathbf{A}\ \mathbf{z}_t + \boldsymbol{\epsilon}_{t+1}$. Equation (9) implies that we can construct $\widetilde{nxa}_t^{*r}$ and $\widetilde{nxa}_t^{*\Delta nx}$ as:

$$\begin{aligned} \widetilde{nxa}_t^{*r} &= \beta \mathbf{e}'_r \mathbf{A} \left(\mathbf{I} - \rho \mathbf{A}\right)^{-1} \mathbf{z}_t \\ \widetilde{nxa}_t^{*\Delta nx} &= -\mathbf{e}'_{\Delta nx} \mathbf{A} \left(\mathbf{I} - \rho \mathbf{A}\right)^{-1} \mathbf{z}_t \end{aligned}$$

where $\mathbf{e}'_r$ ($\mathbf{e}'_{\Delta nx}$) defines a vector that 'picks' r'_t ($\Delta nx'_t$). In addition, the testable restriction $\mathbf{e}'_{nxa} \left(\mathbf{I} - \rho \mathbf{A}\right) = \left(\mathbf{e}'_r - \mathbf{e}'_{\Delta nx}\right) \mathbf{A}$ should be satisfied if the model is not rejected by the data.[46]

[TO BE CONTINUED]

5.5 Out-of-sample forecast (still preliminary)

We perform out-of-sample forecasts by rolling estimation of our model and comparing its performance to simple forecasting models. This will enable us to revisit the classic Meese and Rogoff (1983) result. These authors showed that none of the existing exchange rate models could outperform a random walk at short to medium term horizons (we are working exactly at those same horizons) in out-of-sample forecasts, even when the realized values of the fundamental variables were used in the predictions. More than twenty years later, this very strong result still stands.[47] Mark (1995) however shows that the monetary model, defined to be a linear combination of log relative money stocks and log relative real incomes, generally outperforms the random walk at long horizons (for example over three years for the Deutsche Mark).

We construct the out-of-sample forecasts for a given horizon k by running:

$$y_{t,k} = \alpha_k + \beta_k nxa_{t-k} + \gamma_k X_{t-k} + \varepsilon_{t,k} \tag{13}$$

where $y_{t,k}$ represents the $k-$quarter ahead return (resp. depreciation rate) between period $t-k$ and t, nxa_{t-k} is our cointegrating residual at time $t-k$ and X_{t-k} represents other variables that are known to predict $y_{t,k}$, including lagged values of one-period returns $y_{t-k,1}$. We cut the sample in half and use the information available until date t_o[48] to run equation 13. The last observation

[46] See Campbell and Shiller (1988) for an application to U.S. stock prices.

[47] Interestingly, some recent work by Kilian and Inoue (2002) notes that because out-of-sample tests lose power due to the sample splitting, they may fail to detect predictability where in-sample test would find it. According to these authors, both in-sample and out-of-sample tests are valid, provided that correct critical values are used.

[48] In our exchange rate sample, the first observation is 1973:1 and the last one is 2003:3. We therefore take t_o as the first quarter of 1988 (62 observations out of sample). For asset returns, the first observation is 1952:1, and we set t_o as the last quarter of 1977 (103 observations out of sample)

used is therefore $(y_{t0,k}, nxa_{t_o-k}, X_{t_o-k})$ .Once the coefficients $\hat{\alpha}_k(t_o)$, $\hat{\beta}_k(t_o)$ and $\hat{\gamma}_k(t_o)$ have been estimated, we use them to predict the first k-horizon forecast:

$$\hat{y}_{t0+k,k} = \hat{\alpha}_k + \hat{\beta}_k nxa_{t_o} + \hat{\gamma}_k X_{t_o} \tag{14}$$

We then roll our sample forward by one period. We include information at date t_o+1 in our estimating equation and produce a forecast for $\hat{y}_{t0+k+1,k}$. The whole procedure is repeated again in $t_o+2, ...$ until we reach observation T, where T is the total number of observations in our sample. This provides us with $T - t_0 - k + 1$ forecasts out of sample.

5.5.1 Nested Models Forecasts

We first assess the predictive power of our cointegrating residual by comparing the mean-squared forecasting error of two nested models. We use a regression that includes just the lagged one period returns (resp. depreciation rate) as a predictive variable (restricted model) and compare it with a regression that includes both the lagged return and nxa_{t-1} (unrestricted model) at various horizons. Following the methodology of Lettau and Ludvigson (2001),we compute the ratio of the mean-squared errors of the unrestricted model to the restricted model $\frac{MSEu}{MSEr}$and tests whether it is significantly smaller than one using the modified Harvey, Leybourne, and Newbold test statistic (Clark and McCracken (1999)); the null hypothesis is that of equality of the MSE for the restricted and the unrestricted model. The alternative is that $MSEr > MSEu$ We present results using a fixed cointegrating vector $\widetilde{nxa}_t$ estimated on the whole sample. This specification is legitimate since steady state export, import, asset and liability shares are presumably known by the agents. It is therefore appropriate for the econometrician to use the best possible estimate of the underlying stochastic trend when forecasting. The predictability of $\widetilde{nxa}$ stems from the observed deviations from this stochastic trend.

Table 11 Panel A and B reports results for the total return on the net asset portfolio $r'_{t,k} = \left(\sum_{i=1}^{k} r'_{t+i}\right)/k$ as well as for the excess equity return $r^{*e}_{t,k} - r^{e}_{t,k}$ where $r^{*e}_{t,k}$ and $r^{e}_{t,k}$ are defined analogously. In all cases and at horizons from 1 to 4 quarter-ahead, we find that nxa improves the out-of-sample forecastability of net foreign returns dramatically. The improvement in fit is significant, even one-quarter ahead according to the ENC-NEW statistic, and tends to increase with the forecast horizon.[49] However, as the horizon increases beyond four quarters, the forecastability declines. At 16 quarter-ahead, we do not find much predictability again. This is consistent with

[49]The ENC-NEW statistic is only appropriate for one-period ahead forecasts.

our results so far: nxa contains information about returns at short to medium horizons and mimics our in-sample results

Panel C and D of table 11 report our results for the rate of depreciation of the exchange rate. The improvement in fit , although more modest, remains significant (at the 5% level) at for one period ahead forecasts. Perhaps more importantly, we see that the forecastability improves almost monotonically with the forecast horizon. This result is also consistent with our in sample results. Recalling that nxa contains mostly information about net exports at longer horizons, this indicates that the source of information on long term adjustments in the exchange rate comes from net exports.

[**Table 11 about here**]

5.5.2 Random Walk versus Cointegrating Vector: Meese-Rogoff revisited

Since the classic paper of Meese and Rogoff (1983), the random walk has often been considered the appropriate benchmark to gauge the forecasting ability of exchange rate models. We follow the tradition and perform a non-nested comparison exercise. We compare the root mean-squared error of a model featuring only our cointegrating residual nxa_{t-1} and a constant to the root mean-squared error of a driftless random walk. We construct the forecasts involving our cointegrating vector in the exact same fashion as above. We then use our predited depreciation rates to straightforwardly construct a predicted exchange rate series in level. The random walk is given by:

$$e_t^{rw} = e_{t-k}$$

where k denotes the forecast horizon. We then use the Harvey, Leybourne and Newbold (1998) ENC-T statistic as described in Clark and McCracken (1999) to test for the hypothesis that the forecasts from the nxa model encompass the randow walk forecasts. Table 12 presents the results. Looking at the ratio MSE, our model outperforms the random walk in predicting levels of the exchange rate at 3 quarters-ahead and beyond. The improvement in fit is subtantial, as the horizon expands. At 16 quarters, the ratio of MSE is between 0.52 and 0.67. Interestingly, we find an improvement in out of sample performance even at shorter horizons, where traditional models typically fail.[50] The ENC-T statistic indicates that the improvement in fit is substantial even two

[50]Although we do not improve upon a random walk at a quarterly horizon.

quarters-ahead. We can reject the null that the random walk forecasts encompass the forecasts using nxa, in favor of the alternative that nxa contains additional information.

[Table 12 about here]

6 Conclusion

This paper presents a general framework to jointly model the net foreign asset holdings and the exchange rate. We used accounting identities and a minimal set of assumptions to derive our results. In subsequent work, we plan to specify the model further by nesting behavioral assumptions into the current framework. Thereby we are aiming at developing a comprehensive 'Intertemporal Approach to the Financial Account' where the dynamics of valuations of net foreign assets take center stage in the adjustment mechanism and international portfolio allocations result from optimizing behavior of economic agents. The behavioral models nested within our current framework should of course be consistent with the patterns uncovered in our data. We found that large US foreign liabilities (or low net exports) were associated with net future capital losses on US assets relative to foreign assets, in part via a depreciation of the dollar. A natural question is why the rest of the world would hold US assets, knowing that these assets return will underperform. This is a major challenge for a successful modelling of the international adjustment mechanism, and one that has not been addressed so far.[51]. In our international context, the portfolio balance theory[52], which emphasizes market incompleteness and imperfect substitutatbility of assets, seems well suited to formalize these effects.

Our framework has already yielded interesting results regarding the predictability of nominal exchange rates as well as the role of asset revaluation in the external adjustment mechanism. Our approach can also help address three other important issues.

First, it provides a new perspective on the issue of current account sustainability. The typical approach emphasizes the net export surplus that is necessary to sustain a given net external position. By contrast, we emphasize that variations in asset returns and especially the exchange rate may make a given net foreign asset position sustainable, or not. These effects appear to be quan-

[51]Modern asset pricing theory faces a similar challenge since high price dividend ratio predict low future returns, not high future divident growth. Campbell and Cochrane propose an explanation based on habit formation and time-varying risk premium.

[52]See Kouri (1982) and Henderson and Rogoff (1982).

titatively important. Our research should yield new insights into which countries run sustainable trade and current account deficits.

Second, our approach implies a very different channel through which exchange rates affect the dynamic process of external adjustment. In traditional frameworks, fiscal and monetary policies are seen as affecting relative prices on the good markets (competitive devaluations are an example) or as affecting saving and investment decisions and thereby possibly the current account. In our model, fiscal and monetary policies should also be thought of as mechanisms affecting the relative price of assets and liabilities, in particular through interest rate and exchange rate changes. This means that monetary and fiscal policies may affect the economy differently than in the standard New Open Economy Macro models à la Obstfeld and Rogoff. While early contributions to the intertemporal approach did emphasize intertemporal effects —on real interest rates— of terms of trade or exchange rate movements (see Razin and Svensson (1983)), we emphasize a different mechanism through asset revaluations.

Third, we believe that our research should also prove useful for analyzing the process of external adjustment of emerging market economies. In this context, the single biggest difference between emerging market economies and developed countries concerns the currency of denomination of assets and liabilities. Most emerging market economies are indebted in dollars. A depreciation of their currency, in that context, yields a capital loss. Indeed, suppose that all assets and liabilities are in dollars (the foreign currency), then the return on the net foreign asset portfolio can be expressed as:

$$r_{t+1} \equiv \mu_a \tilde{r}^a_{t+1} - \mu_l \tilde{r}^l_{t+1} + \Delta e_{t+1} - \pi_{t+1}$$

If a country is a net borrower, a depreciation increases the rate of return that must be paid on liabilities and makes the external position less sustainable. This liability mismatch is at the center of a number of models of recent crises (e.g. Thailand, Korea, Argentina...). We propose that our approach may yield important insights into the dynamics of adjustment of the balance of payments in these countries as well as the choice of the optimal exchange rate regime.

Appendix A: Loglinearization

The law of asset accumulation is given by:

$$\frac{A_{t+1}/A_t - L_{t+1}/A_t}{1-L_t/A_t} = R_{t+1}\left(1+\frac{X_t/A_t - M_t/A_t}{1-L_t/A_t}\right)$$

For any variable Y_t,we define:

$$\hat{y}_t = \ln(\frac{Y_t}{Y})$$

Capital letters without time subscripts are steady state values.

$$\begin{aligned}
\frac{A_{t+1}/A_t - L_{t+1}/A_t}{1-L_t/A_t} &= A_{t+1}/A_t\left[\frac{\frac{L_{t+1}}{A_{t+1}}-1}{L_t/A_t-1}\right] = \gamma\left(1+\hat{g}^A_{t+1}\right)\frac{\mu_{la}(1+\hat{l}_{t+1}-\hat{a}_{t+1})-1}{\mu_{la}(1+\hat{l}_t-\hat{a}_t)-1} \\
&= \gamma\left(1+\hat{g}^A_{t+1}\right)\left(1+\frac{\mu_{la}}{\mu_{la}-1}(\hat{l}_{t+1}-\hat{a}_{t+1})\right)\left(1-\frac{\mu_{la}}{\mu_{la}-1}(\hat{l}_t-\hat{a}_t)\right) \\
&= \gamma\left(1+\hat{g}^A_{t+1}+\frac{\mu_{la}}{\mu_{la}-1}\left[\hat{l}_{t+1}-\hat{a}_{t+1}\right]-\frac{\mu_{la}}{\mu_{la}-1}\left[\hat{l}_t-\hat{a}_t\right]\right)
\end{aligned}$$

$$\begin{aligned}
\frac{X_t/A_t - M_t/A_t}{1-L_t/A_t} &= \frac{\mu_{xa}\left(1+\hat{x}_t-\hat{a}_t\right)-\mu_{ma}\left(1+\hat{m}_t-\hat{a}_t\right)}{1-\mu_{la}\left(1+\hat{l}_t-\hat{a}_t\right)} \\
&= \mu_r\left[1+\frac{\mu_{xa}}{\mu_{xa}-\mu_{ma}}\left(\hat{x}_t-\hat{a}_t\right)-\frac{\mu_{ma}}{\mu_{xa}-\mu_{ma}}\left(\hat{m}_t-\hat{a}_t\right)-\frac{\mu_{la}}{\mu_{la}-1}\left(\hat{l}_t-\hat{a}_t\right)\right]
\end{aligned}$$

Therefore

$$\begin{aligned}
&\gamma\left(1+\hat{g}^A_{t+1}+\frac{\mu_{la}}{\mu_{la}-1}\left[\hat{l}_{t+1}-\hat{a}_{t+1}\right]-\frac{\mu_{la}}{\mu_{la}-1}\left[\hat{l}_t-\hat{a}_t\right]\right) \\
= \; &R\left(1+\hat{r}_{t+1}\right)\left[1+\mu_r\left[1+\frac{\mu_{xa}}{\mu_{xa}-\mu_{ma}}\left(\hat{x}_t-\hat{a}_t\right)-\frac{\mu_{ma}}{\mu_{xa}-\mu_{ma}}\left(\hat{m}_t-\hat{a}_t\right)-\frac{\mu_{la}}{\mu_{la}-1}\left(\hat{l}_t-\hat{a}_t\right)\right]\right]
\end{aligned}$$

Define $\mu_l = \mu_{la}/\left(\mu_{la}-1\right)$, $\mu_x = \mu_{xa}/\left(\mu_{xa}-\mu_{ma}\right)$, $\mu_a = 1+\mu_l$ and $\mu_m = \mu_x - 1$.
Then:

$$\begin{aligned}
&\hat{g}^A_{t+1}+\mu_l\left[\hat{l}_{t+1}-\hat{a}_{t+1}\right]-\mu_l\left[\hat{l}_t-\hat{a}_t\right] \\
= \; &\hat{r}_{t+1}+\left[\frac{\mu_r}{1+\mu_r}\right]\mu_x\left(\hat{x}_t-\hat{a}_t\right)-\mu_m\left[\frac{\mu_r}{1+\mu_r}\right]\left(\hat{m}_t-\hat{a}_t\right) \\
&+\mu_l\left[\frac{\mu_r}{1+\mu_r}\right]\left(\hat{l}_t-\hat{a}_t\right)
\end{aligned}$$

since in the steady state

$$\frac{\gamma}{R} = \mu_r + 1$$

Define $\rho = 1+\mu_r$ so that

$$\frac{\mu_r}{1+\mu_r} = 1-\rho^{-1}$$

The steady state equality implies $0 < \rho < 1$. Define

$$\begin{aligned} nx_t &= \mu_x \hat{x}_t - \mu_m \hat{m}_t \\ na_t &= \mu_a \hat{a}_t - \mu_l \hat{l}_t \end{aligned}$$

We can rewrite the loglinearization as

$$\begin{aligned} & \hat{a}_{t+1} - \hat{a}_t - \mu_l \hat{a}_{t+1} + \mu_l \hat{a}_t + \mu_l \hat{l}_{t+1} - \mu_l \hat{l}_t \\ = \;& \hat{r}_{t+1} + \left(1 - \rho^{-1}\right) nx_t - \left(1 - \rho^{-1}\right) + \mu_l \left(1 - \rho^{-1}\right) \left(\hat{l}_t - \hat{a}_t\right) \end{aligned}$$

Therefore we obtain the desired expression:

$$\Delta na_{t+1} = r_{t+1} + \left(1 - \rho^{-1}\right) \left(nx_t - na_t\right)$$

Suppose now that Assumption 2 is satisfied. This implies that $x - a$, $m - a$ and $l - a$ are stationary. We can rewrite nxa as:

$$\begin{aligned} nxa_t &= \mu_x x_t - \mu_m m_t - \mu_a a_t + \mu_l l_t \\ &= \mu_x \left(x_t - a_t\right) - \mu_m \left(m_t - a_t\right) - \mu_a a_t + \mu_l \left(l_t - a_t\right) + \left(\mu_x - \mu_m + \mu_l\right) a_t \\ &= \mu_x \left(x_t - a_t\right) - \mu_m \left(m_t - a_t\right) + \mu_l \left(l_t - a_t\right) \end{aligned}$$

where the last equality uses $\mu_x - \mu_m = \mu_a - \mu_l = 1$. Hence nxa is stationary.

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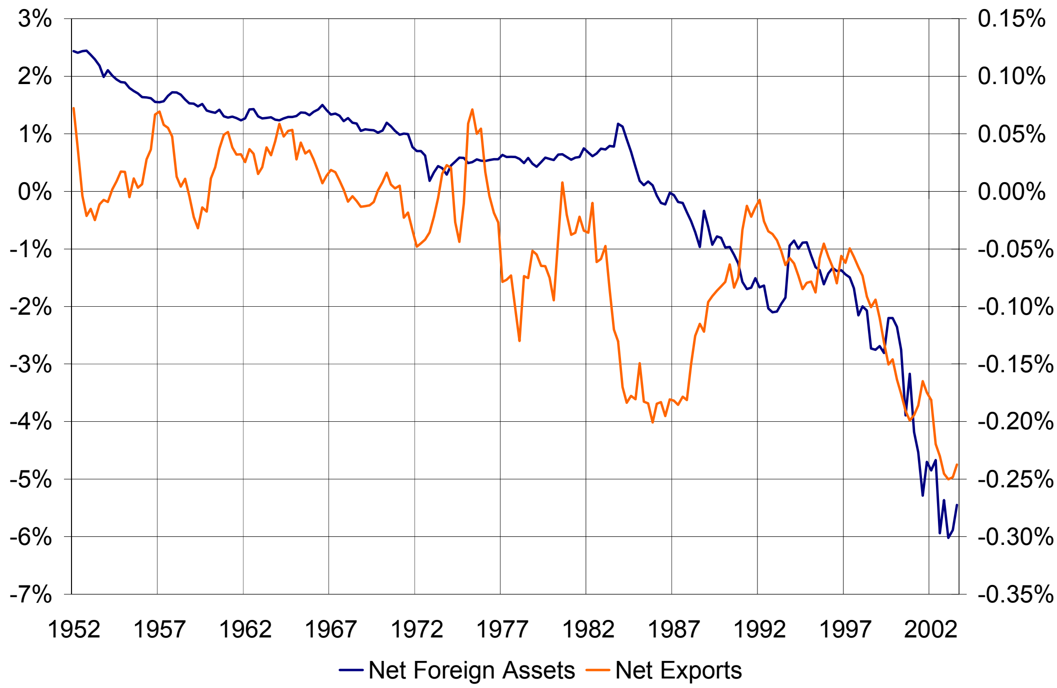

Figure 1: Net Foreign Assets (left scale) and Net Exports (right scale) (% of Household Wealth), U.S., 1952:1-2003:3. Source: Flow of Funds and BEA.

	Equation			
Dependent variable	Δx_t	Δm_t	Δa_t	Δl_t
Δx_{t-1}	-0.035	**-0.230**	-0.009	0.017
(s.e.)	(0.084)	(0.077)	(0.059)	(0.054)
Δm_{t-1}	0.050	**0.177**	0.018	-0.000
(s.e.)	(0.093)	(0.084)	(0.065)	(0.060)
Δa_{t-1}	0.006	0.097	-0.059	-0.004
(s.e.)	(0.130)	(0.118)	(0.091)	(0.083)
Δl_{t-1}	0.131	0.016	0.186	0.137
(s.e.)	(0.141)	(0.128)	(0.099)	(0.090)
$\widetilde{nxa}_{t-1}$	0.003	**0.006**	**0.005**	**0.008**
(s.e.)	(0.002)	(0.002)	(0.001)	(0.001)

Table 1: Estimates from a Cointegrated VAR. 1952:1-2003:3

	Summary Statistics							
	nxa_t	Δx_t	Δm_t	Δa_t	Δl_t	r'_t	r^a_t	r^l_t
Mean (%)	1.89	0.80	1.09	1.17	1.69	-0.61	1.65	1.94
Standard deviation (%)	0.09	4.23	3.86	2.93	2.67	18.05	3.35	3.07
Autocorrelation	0.91	-0.01	0.03	0.05	0.13	0.10	0.05	0.15
	r^{*e}_t	r^e_t	r^{*d}_t	r^d_t	r^{*f}_t	r^{*o}_t	r^o_t	Δe
Mean (%)	2.82	2.67	1.70	1.53	1.76	1.35	1.26	-0.07
Standard deviation (%)	7.73	7.90	3.76	4.19	7.28	0.86	0.69	3.54
Autocorrelation	0.07	0.07	0.13	0.09	0.04	0.41	0.92	0.05

Table 2: Descriptive Statistics: Panel A. sample period is 1952:1-2003:3, except for Δe, 1973:1-2003:3

	Correlation Matrix										
	nxa_t	r'_t	r^a_t	r^l_t	r^{*e}_t	r^e_t	r^{*d}_t	r^d_t	r^{*o}_t	r^o_t	Δe
nxa_t	1	-0.24	-0.11	0.05	-0.14	0.04	-0.12	-0.04	0.00	0.23	-0.28
r'_t		1	0.59	-0.05	0.63	0.02	0.08	-0.19	0.31	-0.09	0.59
r^a_t			1	0.78	0.94	0.77	0.42	0.25	0.31	0.04	0.39
r^l_t				1	0.68	0.93	0.45	0.46	0.14	0.12	0.05
r^{*e}_t					1	0.72	0.28	0.14	0.17	-0.08	0.31
r^e_t						1	0.14	0.11	-0.02	-0.04	-0.02
r^{*d}_t							1	0.89	0.50	0.11	0.56
r^d_t								1	0.27	0.17	0.20
r^{*o}_t									1	0.66	0.63
r^o_t										1	-0.16
Δe											1

Table 3: Descriptive Statistics: Panel B. sample period is 1952:1-2003:3, except for Δe, 1973:1-2003:3

	Correlation Matrix							
	nxa_t	r'_t	r^a_t	r^l_t	Δx_t	Δm_t	Δa_t	Δl_t
nxa_t	1	-0.24	-0.11	0.05	0.05	-0.07	0.10	-0.11
r'_t		1	0.59	-0.05	0.09	0.11	0.42	0.06
r^a_t			1	0.78	-0.04	-0.11	0.68	0.58
r^l_t				1	-0.12	-0.21	0.52	0.68
Δx_t					1	0.57	0.00	-0.02
Δm_t						1	0.03	-0.08
Δa_t							1	0.63
Δl_t								1

Table 4: Descriptive Statistics: Panel C. sample period is 1952:1-2003:3, except for Δe, 1973:1-2003:3

#	*constant*	nxa_{t-1}	*lag*	dp_{t-1}	dp^*_{t-1}	xm_t	$\bar{R}^2$
	(s.e.)	(s.e.)	(s.e.)	(s.e.)	(s.e.)	(s.e.)	
Panel A: Real Total Net Foreign Portfolio Return r'_t							
1	**1.09**	**-0.59**					0.09
	(0.23)	(0.12)					
2	-0.02		0.11				0.01
	(0.01)		(0.08)				
3	-0.03			0.22	-0.07		0.00
	(0.06)			(2.98)	(2.40)		
4	**0.36**					**-0.50**	0.06
	(0.10)					(0.12)	
5	**1.49**	**-0.96**				0.40	0.09
	(0.43)	(0.36)				(0.35)	
6	**1.29**	**-0.72**		-1.85	2.77		0.10
	(0.30)	(0.15)		(2.54)	(1.99)		
7	**1.80**	**-1.25**	0.07	-0.62	1.95	0.63	0.09
	(0.51)	(0.47)	(0.09)	(2.75)	(2.16)	(0.53)	
Panel B: Real Dollar Excess Equity Total Return $r^{*e}_t - r^e_t - \pi_t$							
8	**0.38**	**-0.20**					0.10
	(0.07)	(0.04)					
9	-0.01		0.04				0.00
	(0.01)		(0.07)				
10	0.00			-0.61	0.27		0.00
	(0.01)			(0.79)	(0.68)		
11	**0.14**					**-0.19**	0.09
	(0.03)					(0.04)	
12	**0.37**	-0.19				-0.01	0.09
	(0.13)	(0.11)				(0.11)	
13	**0.45**	**-0.24**		**-1.31**	**1.22**		0.14
	(0.08)	(0.04)		(0.57)	(0.52)		
14	**0.43**	-0.22	-0.03	**1.36**	**1.26**	-0.03	0.13
	(0.14)	(0.13)	(0.09)	(0.66)	(0.61)	(0.15)	

Table 5: Forecasting Quarterly Net Portfolio Returns. Sample: 1952:1 to 2003:3. Robust standard errors in parenthesis.

#	*constant* (s.e.)	nxa_{t-1} (s.e.)	*lag* (s.e.)	dp_{t-1} (s.e.)	cay_{t-1} (s.e.)	$\bar{R}^2$
Panel C: Real Total Return on Gross Liabilities r_t^l						
1	0.01	0.00				0.00
	(0.05)	(0.03)				
2	**0.01**		**0.19**			0.03
	(0.00)		(0.07)			
3	0.00			0.42		0.02
	(0.01)			(0.25)		
4	**0.01**				**0.85**	0.10
	(0.001)				(0.19)	
5	-0.01	0.00		0.42		0.01
	(0.05)	(0.03)		(0.26)		
6	0.02	-0.00			**0.85**	0.10
	(0.05)	(0.03)			(0.20)	
7	0.01	-0.01	**0.19**	0.18	**0.79**	0.13
	(0.04)	(0.02)	(0.06)	(0.27)	(0.18)	
Panel D: Real U.S. Total Equity Return $r_t^e - \pi_t$						
8	-0.03	0.03				0.00
	(0.11)	(0.06)				
9	**0.02**		0.09			0.00
	(0.01)		(0.06)			
10	-0.02			**1.13**		0.02
	(0.02)			(0.58)		
11	**0.02**				**2.02**	0.09
	(0.01)				(0.45)	
12	-0.05	0.02		1.22		0.01
	(0.12)	(0.06)		(0.58)		
13	0.01	0.01			**2.02**	0.09
	(0.11)	(0.06)			(0.45)	
14	0.01	0.00	0.11	0.49	**1.92**	0.09
	(0.10)	(0.05)	(0.06)	(0.59)	(0.43)	

Table 6: Forecasting Quarterly Returns on Gross Liabilities. Sample: 1952:1 to 2003:3. Robust standard errors in parenthesis.

#	*constant* (s.e.)	nxa_{t-1} (s.e.)	*lag* (s.e.)	dp^*_{t-1} (s.e.)	xm_t (s.e.)	$\bar{R}^2$
Panel E: Real Dollar Total Return on Gross Assets r^a_t						
1	**0.13**	**-0.06**				0.03
	(0.06)	(0.03)				
2	**0.01**		0.09			0.00
	(0.01)		(0.09)			
3	0.00			0.06		0.00
	(0.01)			(0.27)		
4	**0.05**				**-0.06**	0.02
	(0.02)				(0.03)	
5	0.14	-0.07		0.20		0.02
	(0.07)	(0.04)		(0.29)		
6	0.12	-0.05			-0.01	0.02
	(0.09)	(0.07)			(0.07)	
7	0.12	-0.07	0.06	0.23	0.00	0.01
	(0.11)	(0.10)	(0.09)	(0.29)	(0.09)	
Panel F: Real Dollar Total Return on Foreign Equity r^{*e}_t						
8	**0.33**	**-0.17**				0.03
	(0.13)	(0.07)				
9	**0.02**		0.09			0.00
	(0.01)		(0.08)			
10	-0.01			0.52		0.00
	(0.02)			(0.62)		
11	**0.15**				**-0.17**	0.04
	(0.04)				(0.07)	
12	**0.33**	**-0.19**		0.89		0.03
	(0.16)	(0.09)		(0.67)		
13	0.18	-0.02			-0.15	0.03
	(0.19)	(0.16)			(0.16)	
14	0.31	-0.17	0.06	0.94	-0.01	0.02
	(0.25)	(0.22)	(0.09)	(0.66)	(0.22)	

Table 7: Forecasting Quarterly Returns on Gross Assets. Sample: 1952:1 to 2003:3. Robust standard errors in parenthesis.

#	*constant* (s.e.)	nxa_{t-1} (s.e.)	*lag* (s.e.)	xm_t (s.e.)	$i_{t-1} - i^*_{t-1}$ (s.e.)	$\bar{R}^2$
Panel G: FDI-weighted depreciation rate Δe_t						
1	**0.21**	**-0.11**				0.10
	(0.04)	(0.02)				
2	-0.00		0.05			0.00
	(0.01)		(0.07)			
3	**0.07**			**-0.09**		0.05
	(0.03)			(0.03)		
4	-0.01				-0.21	0.00
	(0.01)				(0.18)	
5	**0.39**	**-0.28**		0.18		0.12
	(0.09)	(0.09)		(0.10)		
6	**0.20**	**-0.11**			-0.18	0.10
	(0.04)	(0.02)			(0.17)	
7	**0.40**	**-0.28**	-0.06	0.18	-0.01	0.11
	(0.09)	(0.09)	(0.07)	(0.11)	(0.17)	
Panel H: Trade weighted depreciation rate $\Delta e'_t$						
8	**0.23**	**-0.12**				0.12
	(0.05)	(0.03)				
9	0.00		0.14			0.01
	(0.01)		(0.08)			
10	**0.08**			**-0.10**		0.09
	(0.03)			(0.04)		
11	-0.01				-0.30	0.02
	(0.01)				(0.16)	
12	**0.34**	**-0.23**		0.11		0.13
	(0.09)	(0.08)		(0.09)		
13	**0.22**	**-0.12**			-0.27	0.14
	(0.05)	(0.03)			(0.14)	
14	**0.25**	-0.14	-0.03	0.02	-0.26	0.12
	(0.10)	(0.10)	(0.08)	(0.11)	(0.15)	
Panel I: dollar-pound nominal rate of depreciation						
15	**0.22**	**-0.12**				0.05
	(0.07)	0.04				
Panel J: dollar-yen nominal rate of depreciation						
16	**0.31**	**-0.16**				0.06
	(0.09)	(0.05)				
Panel K: US dollar-Canadian dollar nominal rate of depreciation						
17	0.09	**-0.05**				0.04
	(0.05)	0.03				
Panel L: dollar-deutschemark nominal rate of depreciation						
18	**0.35**	**-0.18**				0.08
	(0.09)	0.05				
Panel M: dollar-Swiss franc nominal rate of depreciation						
19	**0.31**	**-0.16**				0.05
	(0.09)	(0.05)				

Table 8: Forecasting Quarterly Rates of Depreciation. Sample: 1973:1 to 2003:3. Robust standard errors in parenthesis.

	Forecast Horizon (quarters)							
Row	1	2	3	4	8	12	16	24
	Real Total Net Portfolio Return $r'_{t,k}$							
1	-0.60	-0.56	-0.55	-0.52	-0.32	-0.17	-0.09	-0.04
	(0.12)	(0.11)	(0.10)	(0.10)	(0.09)	(0.08)	(0.08)	(0.05)
	[0.09]	[0.15]	[0.19]	[0.21]	[0.13]	[0.05]	[0.02]	[0.01]
	Real Total Excess Equity Return $r^{*e}_{t,k} - r^{e}_{t,k}$							
2	-0.19	-0.19	-0.18	-0.17	-0.09	-0.05	-0.02	-0.00
	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)
	[0.09]	[0.17]	[0.22]	[0.23]	[0.13]	[0.05]	[0.01]	[0.00]
	Real Total Return on Gross Liabilities $r^{l}_{t,k}$							
3	0.02	0.00	0.01	0.01	0.02	0.01	0.01	0.01
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]	[0.00]	[0.00]
	Real U.S. Total Equity Return $r^{e}_{t,k}$							
4	0.04	0.02	0.03	0.04	0.05	0.03	0.02	0.01
	(0.06)	(0.06)	(0.06)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]	[0.00]	[0.00]
	Real Total Return on Gross Assets $r^{a}_{t,k}$							
5	-0.06	-0.06	-0.05	-0.05	-0.02	-0.01	-0.00	0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)
	[0.02]	[0.05]	[0.05]	[0.05]	[0.01]	[0.00]	[0.00]	[0.00]
	Real Total Dollar Return on Foreign Equity $r^{*e}_{t,k}$							
6	-0.15	-0.16	-0.16	-0.12	-0.05	-0.02	-0.01	0.00
	(0.07)	(0.07)	(0.06)	(0.06)	(0.05)	(0.04)	(0.03)	(0.02)
	[0.03]	[0.06]	[0.06]	[0.06]	[0.01]	[0.00]	[0.00]	[0.00]
	Real Export growth $\Delta x_{t,k}$							
7	-0.11	-0.10	-0.10	-0.11	-0.11	-0.09	-0.07	-0.05
	(0.04)	(0.04)	(0.03)	(0.03)	(0.02)	(0.01)	(0.01)	(0.01)
	[0.05]	[0.10]	[0.14]	[0.19]	[0.33]	[0.33]	[0.33]	[0.27]
	Real Import growth $\Delta m_{t,k}$							
8	-0.02	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(001)	(0.01)
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.01]
	FDI-weighted effective nominal rate of depreciation $\Delta e_{t,k}$							
9	-0.11	-0.11	-0.11	-0.11	-0.10	-0.08	-0.07	-0.04
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
	[0.10]	[0.18]	[0.29]	[0.34]	[0.45]	[0.46]	[0.43]	[0.32]
	Trade-weighted effective nominal rate of depreciation $\Delta e'_{t,k}$							
10	-0.12	-0.12	-0.12	-0.12	-0.11	-0.09	-0.07	-0.04
	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)
	[0.12]	[0.24]	[0.33]	[0.36]	[0.44]	[0.43]	[0.40]	[0.27]

Table 9: Long Horizon Regressions, Portfolio Returns on lagged nxa: 1952:1 to 2003:3. Robust standard errors in parenthesis. Adjusted R^2 in brackets.

		Discount factor ($\rho = \gamma/R$)			
#	percent	1	0.98	0.96	0.94
		$\lvert\mu_x\rvert = 22.23$			
1	β_r	4.58	5.55	6.22	6.65
2	β_n	132.80	113.16	97.29	84.34
3	β_a	0.06	1.14	2.03	2.74
4	β_l	4.49	4.39	4.18	3.90
5	β_x	107.06	93.46	82.38	73.19
6	β_m	25.74	19.69	14.94	11.15
7	Total	137.35	118.69	103.50	90.98
		$\lvert\mu_x\rvert = 3.43$			
8	β_r	29.69	35.97	40.31	43.07
9	β_a	0.40	7.37	13.14	17.73
10	β_l	29.10	28.48	27.1	25.29
11	Total	155.66	143.92	133.68	124.48

Table 10: Unconditional Variance Decomposition for nxa for various discount rates. Sample: 1952:1 to 2003:3.

Nested Model	ENC-NEW				$\frac{MSEu}{MSEr}$			
Horizon: (quarters)		1	2	3	4	8	12	16
Panel A: Real Total Net Portfolio Return $r'_{t,k}$								
$\widetilde{nxa}$ *vs* $AR(1)$	9.87**	0.940	0.893	0.864	0.812	0.836	1.010	1.134
$\widetilde{nxa}$ *vs* $\frac{d}{p}$ and $\frac{d^*}{p^*}$	20.52**	0.966	0.879	0.775	0.705	0.751	0.774	0.967
$\widetilde{nxa}$ *vs* $AR(1)$, $\frac{d}{p}$ and $\frac{d^*}{p^*}$	18.68**	0.963	0.900	0.808	0.724	0.759	0.777	0.972
Panel B: Real Total Excess Equity Return $r^{*e}_{t,k} - r^e_{t,k}$								
$\widetilde{nxa}$ *vs* $AR(1)$	13.54**	0.914	0.840	0.773	0.710	0.770	0.998	1.098
$\widetilde{nxa}$ *vs* $\frac{d}{p}$ and $\frac{d^*}{p^*}$	30.73**	0.878	0.737	0.603	0.528	0.600	0.605	0.740
$\widetilde{nxa}$ *vs* $AR(1)$, $\frac{d}{p}$ and $\frac{d^*}{p^*}$	30.81**	0.883	0.742	0.600	0.516	0.586	0.611	0.728
Panel C: FDI-weighted depreciation rate $\Delta e_{t,k}$								
$\widetilde{nxa}$ *vs* $AR(1)$	2.62*	0.956	0.889	0.829	0.790	0.608	0.434	0.276
$\widetilde{nxa}$ *vs* $i_t - i^*_t$	2.02*	0.976	0.954	0.879	0.844	0.676	0.549	0.384
$\widetilde{nxa}$ *vs* $AR(1)$, $i_t - i^*_t$	2.70*	0.956	0.896	0.835	0.796	0.619	0.478	0.378
Panel D: Trade weighted depreciation rate $\Delta e'_{t,k}$								
$\widetilde{nxa}$ *vs* $AR(1)$	5.05**	0.956	0.869	0.867	0.900	0.807	0.640	0.366
$\widetilde{nxa}$ *vs* $i_t - i^*_t$	3.62**	1.010	1.012	0.976	0.975	0.882	0.742	0.444
$\widetilde{nxa}$ *vs* $AR(1)$, $i_t - i^*_t$	5.36**	0.962	0.897	0.918	0.966	0.924	0.983	0.942

Table 11: Out of Sample Tests for Equity Returns. Nested Models.
$MSEu$ is the mean-squared forecasting error for an unrestricted model that includes the lagged dependent variable and lagged nxa (model 1); lagged d/p, $d*/p*$ and lagged nxa (model 2); the lagged dependent variable, lagged d/p, $d*/p*$ and lagged nxa (model 3). $MSEr$ is the mean-squared error for the restricted models which include the same variables as above but do not include lagged nxa. d/p (resp. $d*/p*$) is the US (resp. rest of the world) dividend price ratio. Each model is first estimated using the sample 1952:1 1977:4. ENC-NEW is the modified Harvey et al. (1998) statistic, as proposed by Clark and McCracken (1999). Under the null, the restricted model encompasses the unrestricted one. Sample: 1952:1-2003:3. * (resp. **) significant at the five (resp. one) percent level.

Non Nested Model				$\frac{MSEu}{MSEr}$			
Horizon: (quarters)	1	2	3	4	8	12	16
FDI-weighted depreciation rate $\Delta e_{t,k}$	1.001	1.000	0.975	0.959	0.881	0.788	0.520
ENC-T	1.19	1.61	2.54	2.83	5.32	6.05	5.76
p-value (one sided)	0.12	0.05	0.00	0.00	0.00	0.00	0.00
Trade weighted depreciation rate $\Delta e'_{t,k}$	1.005	1.005	0.988	0.997	0.963	0.899	0.675
ENC-T	1.16	1.54	1.99	2.01	3.27	4.88	5.05
p-value (one sided)	0.12	0.06	0.02	0.02	0.00	0.00	0.00

Table 12: Out of Sample Tests for Exchange Rate Level, Non-Nested Models. Each model is first estimated using the sample 1973:1 1988:1.

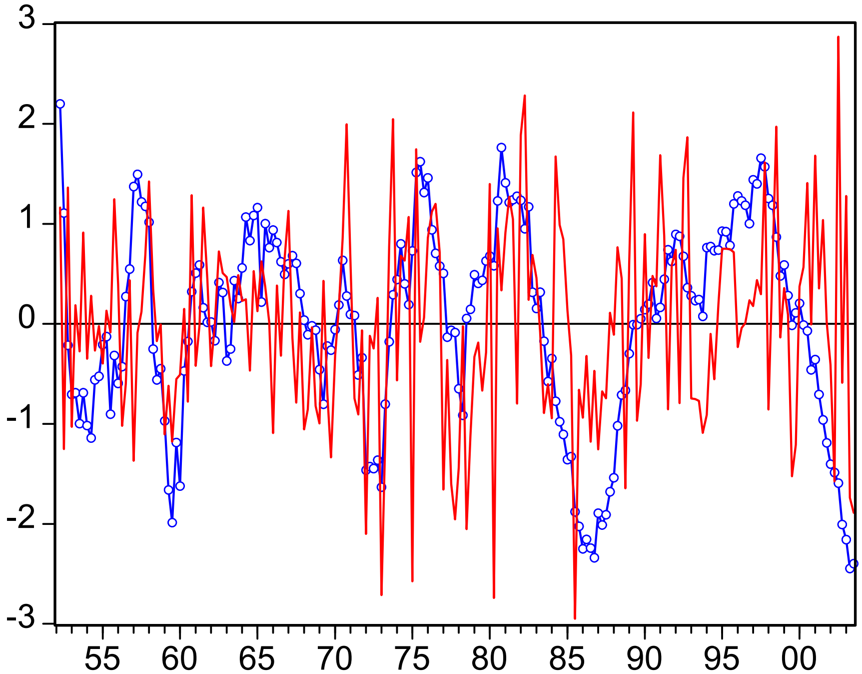

Figure 2: Net foreign portfolio return r_t (-) and lagged deviation nxa_{t-1} (o)

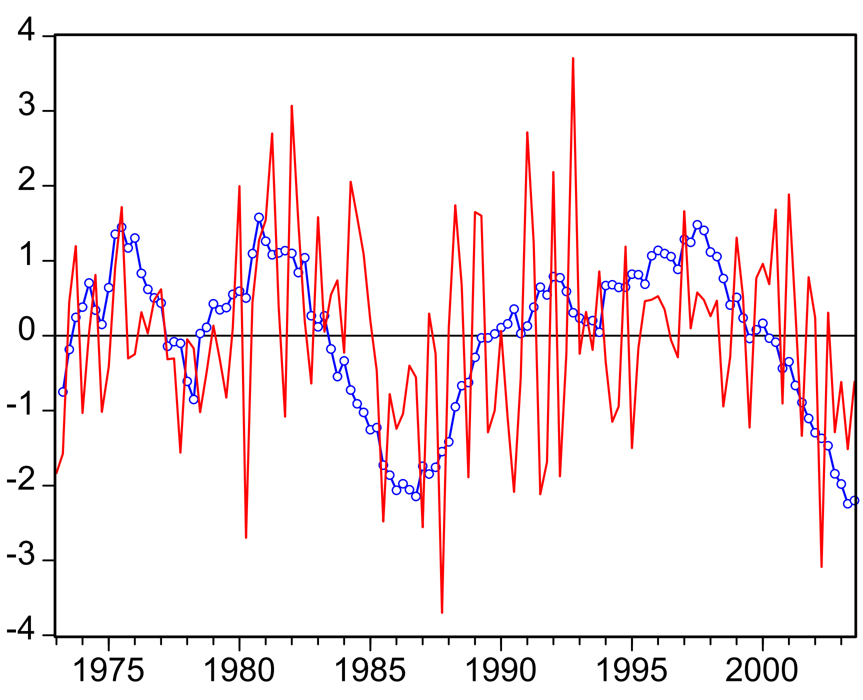

Figure 3: (inverse of) the multilateral rate of depreciation Δe_t (-) and lagged deviation nxa_{t-1} (o)

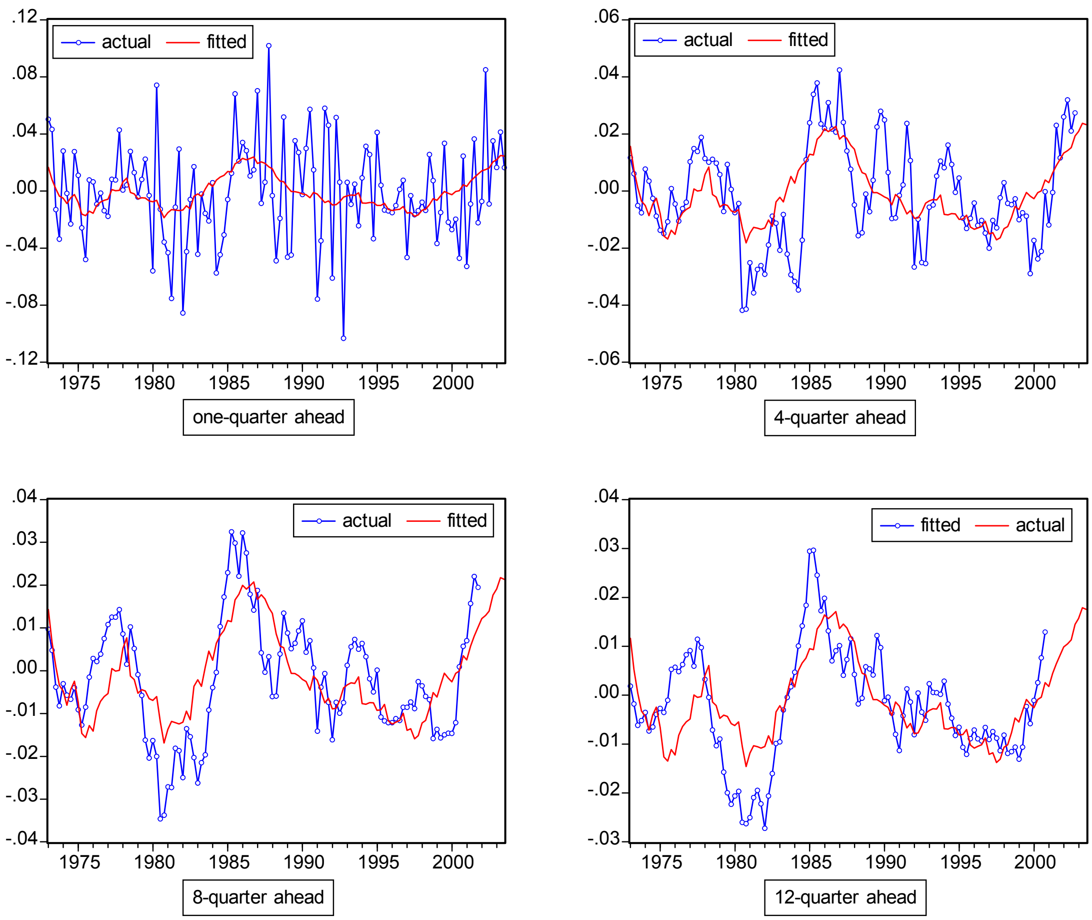

Figure 4: one to 12-quarter ahead depreciation rates. Actual and Fitted using *nxa*.