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Abstract

A stable net external position requires that the trade balance responds negatively to changes in the net external position. If financial integration makes financing external imbalances less costly, we expect slower external adjustment in more integrated economies. The study estimates theoretically founded trade balance reaction functions for a panel of seventy countries from 1970-2008. The empirical analysis finds that adjustment in integrated economies is slower. Consistent with the presented theory, the trade balance of integrated economies is more persistent, responds less strongly to net foreign assets, and is more sensitive to fluctuations in net output. Under high integration, the response to the net external position is weak and close to the minimum required to ensure external sustainability.

Keywords: External Sustainability, Financial Integration, Reaction Function, Current Account Dynamics, Net Foreign Assets

JEL classification codes: F32, F36, F41

Résumé

Pour garantir la stabilité de la position extérieure nette, il est nécessaire que la balance commerciale réponde de manière négative aux changements de la position extérieure nette. Si l'intégration financière rend le financement des déséquilibres extérieurs moins coûteux, nous attendons un ajustement externe plus lent dans les pays plus intégrés. Basé sur un modèle théorique, cette étude estime une fonction de réaction de la balance commerciale pour un panel de soixante-dix pays entre 1970 et 2008. L'analyse empirique montre que l'ajustement dans les pays intégrés est plus lent. Conformément à la théorie présentée, la balance commerciale des pays intégrés résiste davantage, réagit plus faiblement aux avoirs extérieurs nets et est plus sensible aux fluctuations de la production nette. Dans le cas d'une intégration forte, la réaction à la position externe nette est faible et s'approche du minimum nécessaire pour assurer la soutenabilité externe.

Mots-clés: Intégration financière, dynamique de la balance courante, avoirs extérieurs nets

Codes classification JEL: F32, F36, F41

1 Introduction

Persistent current account imbalances can be a source of concerns, but can also be seen as a consequence of higher integration. A country's intertemporal budget constraint requires that larger external liabilities today are compensated by higher surpluses in the future. But if financial integration makes it easier to finance external imbalances, the current account adjustment in more integrated economies can be slower, because it is less costly to spread adjustment over many periods.

The study estimates trade balance reaction functions for a panel of seventy industrial and developing countries from 1970-2008. The conditional response of the trade balance to net foreign assets is the parameter of main interest and we can alternatively interpret it as a sustainability or as an integration measure.

The sustainability interpretation comes from the fiscal policy literature: Bohn (1998) shows that a negative response of the primary deficit to public debt, conditional on temporary disturbances, is a sufficient condition for solvency. The intuition behind the sustainability condition is relatively straightforward: the higher the stock of net liabilities, the larger the interest payment, and a larger trade surplus is necessary to stabilize the external position. From the sustainability perspective a weak response of the trade balance to net foreign assets is worrying, as the sustainability condition is almost violated. Although there are a number of studies that use reaction functions to analyze fiscal sustainability in different countries (see e.g. Galí and Perotti, 2003; Mendoza and Ostry, 2008; Wyplosz, 2005), the few studies that apply the technique to external deficits focus on the United States (Engel and Rogers, 2006; Wickens and Uctum, 1993). The present study provides evidence for a broad panel of seventy countries, highlighting the differences across countries and time. A negative response of the trade balance is necessary for a stable path of external liabilities, but the sustainability analysis leaves the mechanism that triggers adjustment open. For fiscal deficits one might invoke an intrinsic sense of responsibility from the government or pressure from the electorate that pushes towards adjustment, but for external deficits such a mechanism is less plausible. A possible alternative is that foreigners become more reluctant to lend if external liabilities are larger and ask a higher risk premium. The sensitivity of the premium in turn may depend on the country's international integration.

A small intertemporal model motivates the interpretation of the coefficient on net foreign assets as an integration measure. People aim for a stable consumption profile and use the current account to absorb transitory shocks. International financial intermediation is costly and the interest rate increases with the size of external liabilities. Under low integration the unfavorable effect of large external positions

on financing conditions makes large imbalances unattractive and the trade balance reverts quickly to its long run value. The presence of financial frictions also forces people to consume more of a temporary income shock and to have a less persistent consumption pattern than they would otherwise. The model's solution is a trade balance reaction function that can be directly estimated. It predicts that higher integration weakens the response of the trade balance to net foreign assets, while it increases the persistence and the response to net output fluctuations.

The predictions are tested in three steps. I start by comparing industrial, emerging and other, less integrated, developing countries. Consistent with the model, industrial countries tend to have a more persistent trade balance, a weaker reaction to net foreign assets, and to respond more strongly to net output fluctuations than developing countries. Second, an analysis over time shows that the trade balance has become more persistent and less responsive to net foreign assets in recent years. Again, we can expect these developments if integration has increased over time. Third, interactions of the explanatory variables with integration measures help to explain the coefficient heterogeneity across countries and time. The effect of the integration measures on the reaction function coefficients remains significant when including additional controls for other differences between the three country groups and a linear time trend. The study also presents the reaction coefficient estimates for single countries. Most countries' trade balance responds negatively to the external position. Countries with a significantly positive, unsustainable, coefficient are the United States, Iceland, Greece, Norway, and Hong Kong.

The study contributes to the research on capital mobility. There is a large literature that builds on Feldstein and Horioka (1980)'s finding of a high correlation between investment and saving across countries and its interpretation as evidence of low capital mobility. Blanchard and Giavazzi (2002) announce "the End of the Feldstein-Horioka Puzzle" in Europe and emphasize the long run benefits of integration by allowing the poorer members of the European Union to catch up faster and run larger structural deficits. The focus of the present study is on capital mobility in the short and medium run and how integrated countries can use the current account as a buffer to absorb cyclical shocks. A number of studies (see e.g. Hoffmann, 2004; Pelgrin and Schich, 2008; Taylor, 2002) have analyzed saving-investment dynamics in an error correction framework and has generally found that periods of high capital mobility parallel periods of slow adjustment. The cited studies concentrate on selected industrial countries. Here, I take a closer look on how capital mobility has affected adjustment dynamics in the recent past for a broad sample of countries and from a different perspective, focusing on response to the net external position. Additionally, many papers have criticized the Feldstein-Horioka regression because it

lacks a structural interpretation and its results are consistent with a large number of explanations (see Coakley *et al.*, 1998, for a survey). The reaction function approach has the advantage that it is based on a structural model and the results have a clear interpretation.[1]

The study is also related to the a recent literature that investigates theoretically and empirically the role of valuation effects as a new adjustment channel in addition to the traditional channel through trade balance movements, resulting from return differentials between gross external assets and gross external liabilities (see e.g. Cavallo and Tille, 2006; Devereux and Sutherland, 2010; Gourinchas and Rey, 2007). The studies stress that valuation effects are likely to be more important in financially integrated economies. The present study complements this direction of research by focusing on the effects of financial integration on the traditional adjustment channel through the trade balance.

In the remainder Section 2 details how the reaction to net foreign assets can be interpreted as a sustainability measure and proposes a theoretical foundation for the adjustment mechanism. Section 3 describes specification and data. Section 4 presents the main results. Section 5 shows that the results are robust to the use of alternative measures of the external position, additional controls accounting for trends, and endogeneity issues. Section 6 concludes. Technical details and additional empirical results are documented in an appendix.

2 Theory

2.1 The Response to Net Foreign Assets as a Sustainability Measure

We can use the reaction function for sustainability analysis, similar to the approach pioneered by Bohn (1998) in fiscal policy.[2] The reaction function of the trade balance

[1] Ghosh (1995) tests for perfect capital mobility by comparing the empirical current account volatility with the one predicted by an intertemporal model. The present study does not test for perfect capital mobility, but uses a theoretical framework to document how the extent of integration affects adjustment. Decressin and Disyatat (2008) use the intertemporal model in the Euro area to compare the response of the trade balance and investment to productivity shocks at the country level with the response at the regional level.

[2] Additionally, the present analysis allows also for persistence in the primary balance, whereas Bohn's specification does not include a lagged dependent variable. In the theoretical model, the persistence will be motivated through habit formation.

is

$$tb_t = \beta f_{t-1} + \alpha \mathsf{tb}_{t-1} + \sum_{j=1}^{k} \delta_j x_{jt} + \mu, \tag{1}$$

where tb_t is the trade balance to output ratio, f_t is the ratio of net foreign assets to output at the end of the period and x_{jt} controls for temporary influences. If we assume a constant real growth rate g and a real interest rate r, the path of net foreign assets is given by the accumulation equation

$$\Delta f_t = \tilde{r} f_{t-1} + tb_t. \tag{2}$$

where $\tilde{r} = \frac{1+r}{1+g} - 1 \approx r - g$ is the growth adjusted interest rate. The appendix shows that the system is stable, if

$$-2\,(1+\alpha) - (1-\alpha)\tilde{r} < \beta < -(1-\alpha)\tilde{r} \tag{3}$$

Assuming $\tilde{r} > 0$, the path is only stable if $\beta < 0$.[3] The estimated coefficient on net foreign assets can then be used as a sustainability measure. The intuition behind the sustainability condition is relatively straightforward: the higher the stock of net liabilities, the larger will be the amount of interest that has to be served on the stock. A larger trade surplus is necessary to stabilize the external position. Persistence decreases the need for immediate strong adjustment, as the short run impact differs from the long run impact. If the persistence level is high, a reaction coefficient that is very close to zero does not necessarily imply unsustainability.

Compared to other sustainability analysis approaches, the present method has the advantage that few assumptions are required. For example, we do not need to take a stand on the target debt level or the future development of deficit determinants.

2.2 The Response to Net Foreign Assets as an Integration Measure

The subsection presents reluctance of the rest of the world to finance external imbalances as a potential adjustment mechanism. I consider a small open endowment

[3]The lower bound is unlikely to be economically relevant and means that the reaction should not be too strong. A second requirement for sustainability is $\alpha\,(1+r-g) < 1$. Details are worked out in the appendix. The condition above is necessary for a mean stationary path of net foreign assets. Bohn (1998) shows that $\beta < 0$ is a sufficient condition to meet the intertemporal solvency constraint.

economy with an infinitely lived representative consumer. Consumers maximize

$$\max_{C_t,\ F_t} U = \sum_{t=0}^{\infty} \theta^t \frac{\left(C_t - \gamma C_{t-1}\right)^{1-\sigma}}{1-\sigma}, \tag{4}$$

subject to the intertemporal budget constraint

$$\left(1 + r_{t-1}^d\right) F_{t-1} + Y_t + T_t = C_t + F_t, \tag{5}$$

where C_t is consumption at time t , θ is the subjective time discount rate, σ is a measure for the willingness of the agent to substitute consumption across time. I introduce habit formation, captured by parameter γ, as a technical device to make rapid changes in consumption and therefore in the external balance more costly. [4]

The income can be spent on consumption or an international bond F_t that pays a real interest rate r_t^d.

The economy's potential endowment $\bar{Y}_t$ grows at a constant rate g. Cyclical deviations $\hat{y}_t = \frac{Y_t - \bar{Y}_t}{\bar{Y}_t}$ from potential output follow an AR(1) process.

$$\hat{y}_t = \rho \hat{y}_{t-1} + \varepsilon_t = 0,$$

where ε_t is iid endowment shock.

The exchange of international bonds has to be processed by banks and is modeled as in Uribe and Yue (2006) and Boileau and Normandin (2008). Banks acquire international bonds F_t that pay a constant real interest rate r and offer a domestic interest rate r_t^d to consumers. Banks have convex operating costs that increase quadratically with the volume of funds intermediated. The financial sector is perfectly competitive and firms maximize profit $(1+r)F_t - \left(1 + r_t^d\right) F_t - \psi/2\,(1+r)\,F_t^2$. Profits are redistributed as a lump sum transfer to consumers. The first order condition to the maximization imply that banks charge an interest rate on domestic loans that increases with the country's external liabilities

$$1 + r_t^d = (1+r)\left(1 - \psi F_t/\bar{Y}_t\right), \tag{6}$$

Boileau and Normandin (2008) discuss several motivations for convex operating costs in banking and cite microeconomic evidence: risk averse banks want compensation for undesired foreign exposure and default risk. Another explanation are monitoring costs that increase with size of the outstanding position. Lane and Milesi-Ferretti (2001) provide empirical evidence for interest rates being a function of the

[4] Gruber (2004) shows that accounting for habit formation improves the empirical performance of the intertemporal model by increasing the volatility of the current account.

the external position. They find that real interest differentials with the United States decrease with net foreign assets and interpret the result as consistent with a portfolio balance model where investors have home bias: a country with a negative external position needs to pay higher interest rates on its liabilities liabilities in order to generate a shift of foreign investors into domestic assets.[5] As in Nason and Rogers (2006) or Devereux and Smith (2007), the debt elastic domestic interest rate serves as a short cut for restricted capital mobility.[6] Higher financial integration, for example through less regulations on capital flows or technical progress that facilitates international transactions, is then reflected as a lower ψ.

The standard assumption in small open economy models $1 + r = \frac{(1+g)^\sigma}{\theta}$ allows to abstract from trends in the current account. The assumption holds in the steady state in a model with many small identical economies. To achieve stationarity, all variables are normalized by trend output, using notation $x_t = \frac{X_t}{Y_t}$. Plugging in the domestic interest rate r_t^d set by banks, the first order conditions are

$$\left(c_t - \frac{\gamma}{(1+g)} c_{t-1}\right)^{-\sigma} - \frac{\theta\gamma}{(1+g)^\sigma} \mathrm{E}_t \left(c_{t+1} - \frac{\gamma}{1+g} c_t\right)^{-\sigma} - \lambda_t = 0, \tag{7}$$

$$-\lambda_t + (1 - \psi f_t) \mathrm{E}_t \lambda_{t+1} = 0, \tag{8}$$

where λ_t can be interpreted as a stationary transformation of the marginal utility of income.

The Euler equation (8) shows that financial frictions ψ make it more costly to stabilize the marginal utility of income. In order to avoid large financing costs people want an external position close to zero and consume more (less) if external wealth is positive (negative) than in a frictionless world. Equation (7) displays that because of habit formation the marginal utility of income falls faster than the marginal utility of consumption.

To analyze local adjustment dynamics I linearize the first order condition around the steady state , with $\hat{x}_t = (x_t - \bar{x})$. [7] Using the methodology of Blanchard and Kahn (1980) the decision rule for consumption can be expressed as a function of the

[5]The analysis focuses on real returns on government bonds for a sample of industrial countries. The explanatory variable in the reported results is net foreign assets over exports, but the authors indicate that they obtained similar results when scaling with nominal GDP.

[6]Apart from restricting capital mobility, the discussed operating costs also avoid the technical problems that come with unit roots in small open economy models (Schmitt-Grohé and Uribe, 2003).

[7]If financial frictions are low, persistence and interest rates are high, it is possible to have no stable steady state. A sufficient condition for stability is $\gamma(1+g)/(1+r) < 1$. See footnote 3.

three state variables.

$$\hat{c}_t = b\hat{f}_{t-1} + a\hat{c}_{t-1} + d\hat{y}_t.$$

The coefficients of the decision rule depend on the model's structural parameters. Using the identity $tb_t = y_t - c_t$ and the steady state relationship $tb = f = 0$, we have a trade balance reaction function in levels that will be used in the empirical part

$$tb_t = \beta f_{t-1} + \alpha tb_{t-1} + \delta_1 \hat{y}_t + \delta_2 \hat{y}_{t-1}, \tag{9}$$

with $\beta = -b$, $\alpha = a$, $\delta_1 = (1-d)$, $\delta_2 = -a$.

In general no analytical solution for the coefficients in (9) exists and we are forced to consider numerical simulations. Keeping all parameters fixed but one, allows to analyze the effect of each parameter on the four coefficients of the reaction function.[8] The financial friction parameter is $\psi = 0.028$ as in Nason and Rogers (2006) (adjusted for annual data), who calibrate to Canada. It implies that a one percentage point increase in the liabilities to output ratio increases the interest rate by 2.8 basis points. For the other parameters the baseline values are $r = 0.04$, $g = 0.02$, $\rho = 0.5$, $\sigma = 2$, and $\gamma = 0.7$.[9]

Figure 1 shows how the reaction function coefficients depend on ψ and γ. A higher level of financial frictions ψ reduces the incentive to spread the correction of an external imbalance over many periods and prompts for a strong reaction to net foreign assets. For the same reasons, the trade balance responds less to income shocks, if financial frictions are high. People are willing to bear a relatively large part of the income shock immediately if external finance is costly. A high degree of habit formation makes consumption more persistent. People know that their present reaction will be carried over to future periods and respond more weakly to net foreign assets. The preference for a smoother consumption profile will also make them save a larger amount of a temporary output shock and lead to larger trade imbalances. High financial frictions reduce persistence and weaken the effects of habit formation.

Quantitatively, the baseline case with $\psi = 0.028$ implies a response to net foreign assets $\beta = -0.041$, Persistence $\alpha = -\delta_2 = 0.61$ and the coefficient δ_1 on net output is 0.93. As financial frictions ψ tend to zero, dynamics get smoother and we have we have $\beta = -0.006$, $\alpha = 0.67$,$\delta_1 = 0.99$. Although the model is probably too stylized to

[8] Additionally, there are two special cases with analytical solutions. Without habit formation $\gamma = 0$, we have $\beta = -\left(\tilde{r} + \sqrt{4\psi/\sigma + \tilde{r}^2}\right)/2$, $\alpha = \delta_2 = 0$, and $\delta_1 = 1 - \left(\tilde{r} + \sqrt{\tilde{r}^2 + 4\,\psi\,/\sigma}\right) / \left(\tilde{r} + \sqrt{\tilde{r}^2 + 4\,\psi/\,\sigma} + 2\,(1-\rho)\right)$. With very low frictions $\psi \to 0$, we have $\alpha = \delta_2 = \frac{\gamma}{1+r}$, $\beta = -(1-\alpha)\tilde{r}$. and $\delta_1 = 1 - (1-\alpha)\,\tilde{r}/\,(1 + \tilde{r} - \rho)$

[9] The value ρ for corresponds to estimated persistence of the net output gap in the empirical analysis. Regarding γ see Gruber (2004) for empirical estimates

give exact quantitative predictions, the example shows that relatively small, reasonably parametrized, frictions have a measurable impact on trade balance dynamics. In the theoretical model the sustainability restriction will always be satisfied, but countries that have very easy access to external finance (ψ near zero) will come close to the limit.

3 Empirical Specification and Data

3.1 Model

Based on equation (9), the reaction function of the trade balance for country i is

$$\mathsf{tb}_{it} = \beta \mathsf{nfa}_{it-1} + \alpha \mathsf{tb}_{it-1} + \delta_1 \mathsf{nogap}_{it} + \delta_2 \mathsf{nogap}_{it-1} + \mu_i + v_{it}$$

where tb_t is the trade balance to trend net output ratio, nfa_t is the ratio of net foreign assets to trend net output and the net output gap measure nogap_{it} controls for temporary income shocks. v_t is an iid error term which can be motivated as a time preference shock. I add an ad-hoc country specific effect μ_i to account for heterogeneities in steady state net foreign assets. [10]

3.2 Data

The data sample consists of yearly observations for 22 industrial and 52 developing countries from 1970-2008. I use Prasad *et al.* (2004)'s sample of developing countries and their distinction between, more financially integrated, emerging countries and, less financially integrated, other developing countries. The countries, their abbreviations and their classifications are listed in the appendix.

Real net output is defined as nominal GDP minus government expenditure and minus investment, divided by the GDP deflator. The reason for using net output is that the model does not explain investment dynamics and government expenditure. Net output is then the part of GDP of which consumers can dispose (see e.g. Ghosh, 1995). The net output gap (nogap) is the cyclical component of Hodrick-Prescott filtered log real net output. I experimented also with linear detrending, as the assumed constant growth rate in the theory part implies, which gave very similar results. The

[10] Under stability the steady state is $\mathsf{nfa} = -\frac{\mu}{(1-\alpha)(r-g)+\beta}$ and $\mathsf{tb}=\frac{\mu(r-g)}{(1-\alpha)(r-g)+\beta}$. The study is concerned with adjustment to temporary shocks and does not not attempt to explain differences in long run positions explicitly, see Lane and Milesi-Ferretti (2001) for a study on long run determinants of external positions.

trade balance is the current account minus net income and sometimes also called primary current account. Consistent with the model I normalize the deflated trade balance and net foreign assets with potential net output. Data sources, construction, and abbreviations are in the appendix.

4 Main Results

The model predicts that easier access to external finance increases the trade balance's persistence and its sensitivity to income shocks, while weakening its response to lagged net foreign assets. Of course, the friction parameter ψ is not directly observable. A first step to test the prediction is to compare industrial, emerging countries and other developing countries. We would expect that the trade balance of industrial countries is more persistent, less sensitive to the external position and more sensitive to net output shocks. Second, if integration has increased over time, a trend of the coefficients in the predicted direction should be observed. Third, the study interacts international integration measures with the explanatory variables and tests whether they can explain coefficient heterogeneities.

4.1 Comparison across countries

Table 1 displays results from panel fixed effects regressions for the whole sample and separately for industrial countries, emerging countries, and other developing countries. All coefficients have the expected signs and, except for the coefficient on net foreign assets in industrial countries, are statistically significant.

The ranking of the coefficients across groups is in line with the model's predictions. The trade balance in industrial countries is more persistent, responds less to net foreign assets, and is also more sensitive to temporary income fluctuations than in less financially integrated developing countries. Wald tests show statistically significant differences at the five percent level in all four cases.[11] As expected, the estimates for emerging economies lie between those for industrial countries and those for other developing countries. The differences between emerging countries and other developing countries are again significant for all four coefficients. The differences between emerging and industrial countries go always in the predicted direction and are, except for the coefficient on net foreign assets, statistically significant. [12]

[11]The Wald Test is based on a joint regression that interacts all explanatory variables with country group dummies and uses a covariance matrix estimate that is robust against heteroskedasticity.

[12]The stronger response of the trade balance to net output gap in industrial country does not contradict studies (see e.g. Neumeyer and Perri, 2005) that find the trade balance to be more

The long run response to net foreign assets $\alpha/(1-\beta)$ is -0.026, -0.061, and -0.078 for industrial, emerging, and other developing countries. If we assume a growth adjusted rate of return $\tilde{r} = 0.02$, all country groups satisfy sustainability condition (3).[13] The adjustment path is, however, different. Using the assumption on the growth adjusted interest rate together with the reaction function (1) and the accumulation equation (2), we can simulate numerically which fraction of the initial deviation from steady state net foreign assets remains after ten years. The whole sample estimates imply that 87% of the deviation persists. Industrial countries overshoot to 113%, whereas the values for emerging economies and other developing countries are substantially lower at 89% and 62%.

The theoretically derived reaction function (9) implies a coefficient restriction $\alpha = -\delta_2$. A positive net output shock in the previous period affects lagged consumption and matters, because of habit formation, also in the present period. However, conditional on net foreign assets and the present net output gap, it should not have any influence on the trade balance beyond its effect via lagged consumption. A Wald test does not reject the restriction for industrial countries, but rejects for the three other samples.[14] Possibly financial restrictions in developing countries are more severe than the model assumes. The finding could be rationalized in an extended model where a fraction of the population is liquidity constrained (Decressin and Disyatat, 2008; Campbell and Mankiw, 1991) and cannot borrow or lend at all, which dampens the response of trade balance further.

Univariate country by country regressions can serve as a check whether the results above are by driven outliers. Table 2 shows the mean, standard deviation, and median of the coefficients from the single country regressions for the whole sample and the three country groups. The results confirm the picture from the panel regressions. The mean and median have similar magnitudes as the panel estimates and the ranking across country groups is preserved. However, different from the panel estimates, the response of the trade balance to net foreign assets in emerging counties is similar to the response in other developing countries and further away from industrial countries. A discrepancy between fixed effects and group mean can be evidence of substantial coefficient heterogeneity, potentially because of different

countercyclical in emerging countries. First, as the study does not consider investment, it uses a different measure of output (net output instead of GDP). Second, it looks at conditional responses instead of unconditional correlations.

[13] Only the long run coefficient in developing countries is statistically different from the upper bound.

[14] The restriction can be either rejected because the model is invalid or because the transitory output components are computed incorrectly. The non rejection for the industrial countries therefore indirectly also supports the chosen HP filtering as a method to extract cyclical deviations.

levels of integration in the emerging countries group. Below the study will take this issue into account by allowing coefficients to vary with the level of integration.

When comparing the coefficients across single countries, I focus on the response to net foreign assets, the central coefficient when assessing sustainability. Figures 2 -4 display the results for the three groups. Dashes represent the 95% confidence intervals, statistically significant estimates are in black. For a majority of countries the coefficient is negative. Among industrial countries, Iceland, Norway, the United States, and Greece have a significantly positive, unsustainable, reaction coefficient. The positive coefficient for the United States is line with work by Engel and Rogers (2006) who find the coefficient to be unsustainable for a much longer period of time (1791-2004). They explain the result with the rising US share on world output. The results of the present study indicate that US trade balance dynamics are nonetheless quite exceptional. Since the outbreak of the recent global financial crisis, Greece and Iceland have problems to finance their external imbalances. The effect of oil price fluctuations on the nominal trade balance is a possible explanation for Norway's positive coefficient. Mainland China and Hong Kong have the largest coefficient among emerging countries, but only Hong Kong has a statistically significant positive coefficient. There is no developing country with a statistically significant positive coefficient.

4.2 Comparison across time

Figures 5 to 8 display rolling regression estimates with a 19 years window (approximately half the sample length). The initial sample goes from 1971 to 1989 and the last estimate covers the period from 1990 to 2008. The ordering of the coefficients across country groups is again in line with theory. Across time we can observe observe a downward trend in the size of the net foreign assets coefficients for all three groups, while the persistence of the trade balance increases. Wald tests that compare the coefficients from the first half (1971-1989) with those from the second half (1990-2008) confirm the visual impression. I find significant differences at the five percent level across the two time periods net foreign assets coefficients in all three groups. The null of equal persistence in both periods can be rejected for industrial and emerging countries at the five percent level, but cannot be rejected for developing economies. The less strong results for developing countries maybe due to the less uniform trend towards higher integration. There is no visible trend for the coefficients on the net output gap and statistical tests find no significant differences. The ordering across groups is again in line with theory. The responsiveness to the lagged net output gap increases slightly over time in all three country groups, but the difference is not

statistically significant.[15]

4.3 Interaction with Integration Measures

The specification is augmented with interaction terms of the explanatory variables with different integration measures that approximate friction parameter ψ. The integration measure enters also in levels to control for a potential direct effect. I use a de facto and a de jure measure for international financial integration. The de jure measure (kaopen) is an index constructed by Chinn and Ito (2008) varies between 2.6 and -1.8. The de facto measure is the sum of gross foreign assets and liabilities normalized by GDP, as proposed by Lane and Milesi-Ferretti (2007). Access to external finance may also be affected by the development of the domestic financial sector. Higher domestic financial development means easier access to credit and can therefore also facilitate international transactions. I use therefore two measures for financial development. De facto financial development (findev) is private credit over GDP. The de jure measure (finreform) is an index from Abiad *et al.* (2008) that varies between 0 and 21 and quantifies the degree of financial market liberalization. The last integration indicator measure is trade openness, defined as the sum of nominal exports and imports of goods and services divided by nominal GDP.[16] De facto financial openness, de facto financial development, and trade openness are potentially affected by the contemporaneous trade balance. To avoid endogeneity problems I lag these three indicators by one period. To reduce the influence of outliers I also apply the transformation $\log(x+1)$ on the two measures, where x is the value of the integration measure.

Table 3 presents the results. For brevity only the coefficients on the interaction terms are reported. Column (1) displays the estimates for interactions with kaopen. All interaction terms are statistically significant and have the expected signs. Consider a country that switches from a completely closed capital account (kaopen= -1.8) to a completely open capital account (kaopen= 2.6). The persistence of the trade balance increases by about 0.35, the reaction to the external

[15] I also checked whether the persistence of the gap measure varies across time and country groups. In theory, a higher persistence in cyclical fluctuations would dampen the response of the trade balance because people consume a larger fraction of the shock. Statistical tests indicate no significant differences across countries and time.

[16] Trade openness may slow down adjustment through two channels: First open economies with large tradable sector should find it easier to rebalance, which may allow the financing of larger and more persistent external imbalances. Second, trade integration also fosters financial integration. For example Aviat and Coeurdacier (2007) find that higher bilateral trade links also lead to an increase in bilateral asset holdings.

position becomes by about 0.03 weaker. The response to the contemporaneous and lagged net output gap increases by about 0.5.

The specification of column (2) adds interaction of the four explanatory variables with country group dummies and with a linear time trend as additional control variables. The country group dummies account for the possibility that the results maybe driven by other differences between the country groups that are correlated with capital account liberalization. A linear time trend controls for other events in time that paralleled capital account liberalization. The results are not strongly affected, only the effect of capital account openness on persistence is substantially lower. All coefficients remain statistically significant.

For de facto financial openness the results are similar. Again all coefficients have the expected sign and are statistically significant. In industrial countries the median log financial openness increased from 4.7 in 1990 to 6 in 2007. According to column (2) this development means an increase in the the persistence by about 0.20, while the response to the net external position should have decreased by about 0.01.

The results for de facto and de jure financial development again confirm the predictions of the model for all four coefficients. The results suggest a role for domestic financial development in affecting the speed of external adjustment. Trade openness also seems to play a role with all coefficients having the right sign. The effect on the response to net foreign assets is however only marginally significant.[17]

5 Extensions

The study proceeds with a series of extensions. For space reason most of the regression results are not reported and relegated to an appendix.

5.1 Varying Return Rates

The analysis so far has implicitly assumed that the rate of return paid on the net external position is constant. The present subsection attempts to account for the fact that the rate of return varies across countries and time. Lane and Milesi-Ferretti (2005) document substantial differences in investment income returns on external positions across countries. Prominent anomalies are the United States and United

[17]To explore which of the five measures is more important I run a regression that includes all integration measures at the same time (available on request): The effects are strongest for de jure financial development and trade openness, where all interaction coefficients have the right sign and three remain significant. The results should be taken with some caution, as there is a clear multicollinearity problem when we use all five measures at the same time.

Kingdom. Since the mid-nineties both countries have a positive net investment income despite a negative net external position, because of return differentials between gross external assets and gross liabilities. Growing gross positions have also increased the importance of capital gains through exchange rate and asset price fluctuations and have made the external position more volatile in recent years. If the cross sectional variation of returns on the external position is important and systematic, the net position becomes a less accurate measure for the trade balance that is necessary to achieve stability. An alternative explanation for a weak response of the trade balance to net foreign assets is therefore a weak link between net investment income and the net foreign asset position. Variation in the rate of return over time, for example driven by variation in the unobservable world interest rate, may have a similar effect.

The new specification of the reaction function is

$$\mathsf{tb}_{it} = \beta_1 * \mathsf{ninc}_{it} + \beta_2 * \mathsf{kgain}_{it} + \alpha \mathsf{tb}_{it-1} + \delta_1 \mathsf{nogap}_{it} + \delta_2 \mathsf{nogap}_{it-1} + \mu_i + \varepsilon_{it}. \quad (10)$$

The total return on net foreign assets ($r_t NFA_t$) is the sum of net income and capital gains. Scaling with with trend net output at time t, we have $\tilde{r}_t \mathsf{nfa}_{t-1} = \mathsf{kgain}_t + \mathsf{ninc}_t$. The ex post growth adjusted rate r_t can be split in an expected component $\bar{r}_t$ and a random component e_t with mean zero. As an approximation I associate all of the expected component with net investment income and capital gains with the unexpected. We can then see ninc_{it} as a rescaled version of nfa_{t-1} that takes into account variations in returns, whereas we would expect the coefficient on unpredictable kgain_{it} to be zero. [18] Apart from the discussed advantages of the new specification, a disadvantage is that the assumption of predeterminedness is more doubtful for ninc_{it} than for nfa_{it-1}, since net investment income may also be affected by contemporaneous events.[19]

Table 4 presents results. For all the coefficients the ranking across groups preserved and in line with the theoretical predictions. Consider the first column: The coefficient estimate on net income is -0.357. The coefficient is exactly equivalent to the estimate of Table 1 if the growth adjusted rate of return is 4.3% (0.014/0.357), which seems a reasonable number. The response to kgain_t is small and not statisti-

[18] The approximation is consistent with Habib (2010)'s cross country finding that return differentials on net investment income are persistent, but return differentials on capital gains fluctuate around zero.

[19] A regression of ninc_{it} on nfa_{it-1} yields a statistically significant coefficient of 3.8 % and can be interpreted as an estimate for the growth adjusted rate of return $\tilde{r}$. The R Square is 0.33. Splitting the sample into two subsample from 1970-1989 and 1989-2008. the coefficient estimates are 5.2% and 3.1%, with R Squares of 0.46 and 0.26. The declining R Square is in line with a growing importance of return differentials.

cally significant for any country groups. This is consistent with the idea that a large fraction of capital gains are unpredictable.

Replacing the net external position in sustainability condition (3) by net investment income $\tilde{r}f_{t-1}$ allows to express the upper bound independently of the interest rate $\beta'/(1-\alpha) < -1$, whith$\beta' = \beta/r$. The null of $\beta_1/(1-\alpha) = -1$ cannot be rejected for any of the country groups. The results imply a one to one long run relationship between the trade balance and net investment income and is in line with findings by Lane and Milesi-Ferretti (2002). Using a different methodology, they document a long run one to one relationship between the trade balance and the total returns paid on net foreign assets in OECD countries. The presents analysis provides evidence that the trade balance adjusts mainly to the net investment income part of total returns.

Figure 9 shows the evolution of the response to net investment income over time. The response weakens for all three country groups over time, but the upward trend is less strong for emerging and developing countries. The result is consistent with an interpretation that in developing countries a substantial part of the weakening response can be attributed to lower rates of return. [20] The results with interaction terms parallel those of Table 3 and are reported in Table 3. They confirm the effects of international integration and developed financial markets on external adjustment. All coefficients on the interaction terms (except capital gains) are statistically significant and have the correct signs.

5.2 Alternative Determinants of the Adjustment Speed

The country size and the exchange rate regime are two potential alternative determinants of the adjustment speed. The theoretical model in Section 2.2 maintains a small open economy assumption where the world interest rate is unaffected by the country's borrowing and saving. The sample includes, however, several large countries where the assumption might not be fully justified. An decrease in the national savings of a large country increases the world demand for external funds and leads to a rise in the world interest rate. A decrease in the national savings of a large country leads to a rise in the world interest rate. Within the theoretical model such an effect

[20]Equation (9) from the theory part can be rewritten in terms of net investment income instead of net foreign assets. A lower interest rate will lead to a stronger response to ninc. This can be seen easily for the version without habit formation with reaction coefficient described in footnote 8 $\beta' = \beta/r = -\left(1 + \sqrt{4\psi/\left(\sigma\tilde{r}^2\right) + 1}\right)/2$. With given net investment income *ninc* a lower interest rate $\tilde{r}$ implies a higher principal (in absolute terms) b. A stronger response of the trade balance is necessary to run down the principal.

can be approximated by a higher y, i.e. the interest rate that a large country has to pay on its external obligations is more sensitive to changes in its overall external financing needs (net foreign assets).

To control for country size I interact the explanatory variables with relative country size, defined as the country's nominal GDP in US Dollars divided by the cross sectional average. Table 6 presents the results with country group dummies and the time trend as additional controls, in addition to de jure financial openness.[21] None of the interactions with country size is statistically significant. A possible explanation is that the effect might be nonlinear as only very large countries have an effect on the world interest rate. To account for such an nonlinearity, the second column uses a dummy that takes one if the country's size is in the last decile of the cross sectional distribution of a given year. While the interaction with the net output gap measures are statistically significant and have the right sign, the interaction with the lagged trade balance and lagged net foreign assets are not statistically significant. The effect of financial openess is robust to the additional controls.

A further potential determinant of external adjustment is the exchange rate regime. A fixed exchange rate might lead to a slower adjustment of relative prices and therefore to a slower external adjustment. As a measure for the flexibility of exchange rate regime I use the Reinhart and Rogoff (2004) de facto classification (updated in Ilzetzki *et al.* (2008) see the data section for details). A higher value of the index indicates higher exchange rate flexibility. The third row of Table 6 shows that the exchange rate regime does neither affect the responsiveness of the trade balance to net foreign assets nor the trade balance persistence. The result is therefore in line with Chinn and Wei (forthcoming) who find no relationship between exchange rate flexibility and current account persistence. Flexible exchange rate are however associated with stronger responses of the trade balance to net output fluctuations. Overall,the effect of international integration is robust to all three additional controls.

5.3 The Composition of Net Foreign Assets

To explore whether the response of the trade balance depends of the composition of the external position, I split net foreign assets into net foreign debt assets and net foreign equity assets.[22] From a theory view, it is not clear whether the response

[21]Results with the other presented integration measures and with only country size are similar.

[22]It would be interesting to split equity further into portfolio equity and foreign direct investment. As many developing countries lack portfolio equity investments, such an investigation is however not possible for the whole country sample. The data set does not allow to discriminate between

to net foreign equity assets should be weaker or stronger. On the one hand, equity does not involve a commitment to repay the principal to the foreign investors at a specific point in time, which would encourage a weaker response. On the other hand, the intertemporal budget constraint is still binding and since equity returns are typically higher, the country ultimately needs to ship more goods abroad and the response should be stronger. Table 7 shows the empirical results. There is no evidence for a difference in the response to net foreign equity and net foreign debt. The relative strength of the responses varies none systematically across country groups and in none of the cases the difference between the response to debt and to equity is statistically significant.

5.4 Trend in Net Foreign Assets

Net foreign assets are highly persistent and conventional univariate and panel unit root tests generally fail to reject the null of a unit root (not reported). It was exactly a similar finding in public debt that motivated Bohn (1998) to propose a reaction function approach: He argued unit root tests fail to reject the null because they do not account for cyclical factors that drive the balance temporarily off its equilibrium path. The results of the estimated reaction function indicate mean reversion in net foreign assets for less integrated economies and near unit root behavior for integrated economies. This is in line with the predictions of the theoretical model. One might nonetheless be concerned about the use of asymptotic inference and the estimate of the country specific effect (from which the long run external position can be derived) might be imprecise. As an alternative I estimate the reaction function in deviations from a trend and remove low frequency variation from net foreign assets and the trade balance. with a Hodrick-Prescott filter ($\lambda = 100$).[23] The approach implicitly allows the steady state external position to change over time, for example, because of changes in demographics. Most of the previous analysis assumed a constant country specific effect μ, although the rolling regression estimates allowed for some variation in the intercept. A disadvantage is that some information gets lost through the filtering. The estimates are documented in the appendix. The qualitative results and the ranking of coefficients across country groups again not affected. Again, industrial countries adjust less strongly than developing countries. Naturally, filtering has removed persistence from the data and the estimates for the persistence parameter are substantially lower for all country groups. A specification

portfolio debt and loans.

[23] In a different context Gourinchas and Rey (2007) choose a similar approach no meet stationarity concerns.

that includes interactions with integration measures confirms the main results from the previous analysis.

5.5 System GMM estimates

Nickell (1981) showed that the presence of a lagged dependent variable in a fixed effects model leads to biased estimates when time dimension T is small. To counter the bias Arellano and Bond (1991) have developed a GMM estimator that yields consistent estimates in micro panels with fixed T, but requires a large cross section N. The fixed effects estimator gives consistent estimates for large T. For the present sample with a relatively large $T = 38$ we can expect that the bias in the fixed effects estimate is not too strong. Estimates using the System-GMM version of the estimator of the dynamic panel estimator (Blundell and Bond, 1998) lie in similar regions as in Table 1 and confirm previous findings. To account for a potential simultaneity between the trade balance and net output, e.g because external demand shocks, the contemporaneous net output gap is also instrumented with its lags.[24]

6 Conclusion

The study has explored the consequences of higher financial integration on the adjustment process of the trade balance. It estimates trade balance reaction functions for a sample of developed and developing countries. A negative response of the trade balance to net foreign assets is a sufficient condition to meet the intertemporal solvency constraint and the regression coefficient on net foreign assets can be used for sustainability analysis. The study then provides a theoretical foundation for a trade balance reaction function, derived from an intertemporal model. Theory predicts that the trade balance of highly integrated countries is more persistent, more sensitive to fluctuations in net output, and reacts less to net foreign assets. The predictions find empirical confirmation, both when comparing coefficients across time and country groups. Measures for financial integration and financial development help to explain the variation in coefficients.

The study provides evidence that, in general, countries respond weakly to their net external position because they can: easy access to finance makes fast corrections unnecessary and allows for a more stable consumption pattern. A comparison of

[24]To avoid a finite sample bias because of too many instruments, I follow Roodman (2007)'s recommendations to restrict the number of lags to five and "collapse" the moment conditions. As predetermined, but not strictly exogenous variable lagged net foreign assets are instrumented as well.

coefficients across countries and time from a sustainability perspective needs some care as it has to be conditional on financing conditions. During the period considered the process towards slower adjustment has been gradual, consistent with a gradual increase in integration. The recent global financial crisis has shown that integration, at least when using de facto measures for financial openness, can change rapidly. Once a sufficient amount of new data is available, it will be interesting to see how these developments are reflected in the evolution of the adjustment coefficients.

Figures

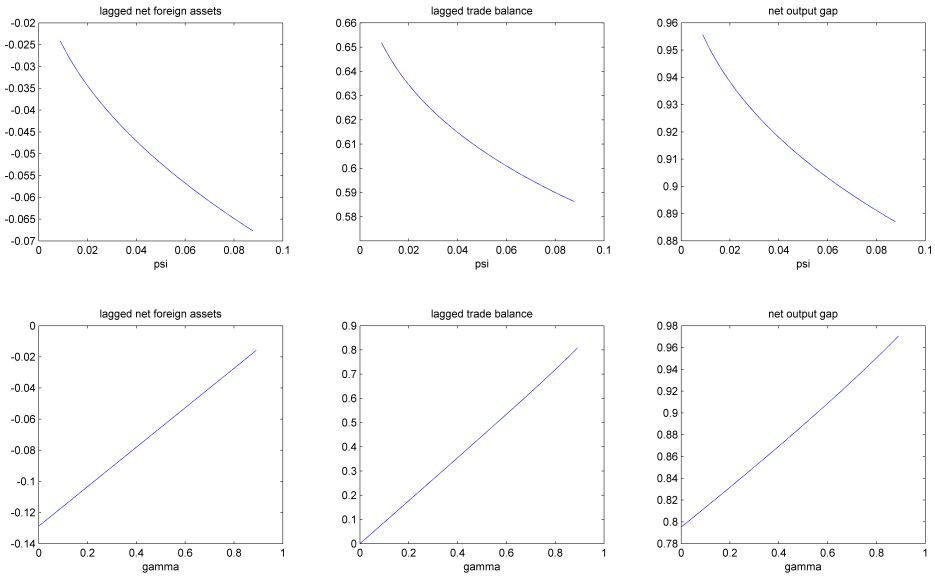

Figure 1: Sensitivity of the reduced form coefficients to the structural parameters

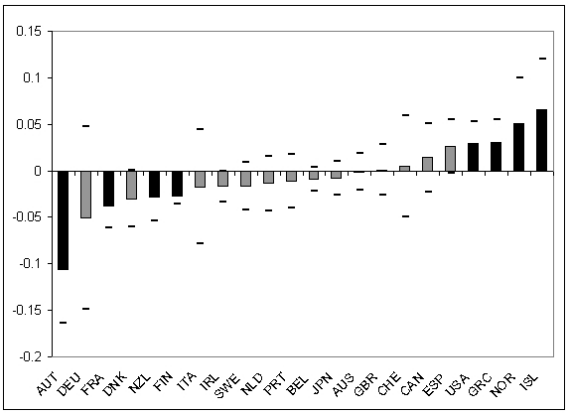

Figure 2: Response to Net Foreign Assets: Industrial Countries

Dashes represent the 95% confidence intervals, statistically signficant estimates are in black.

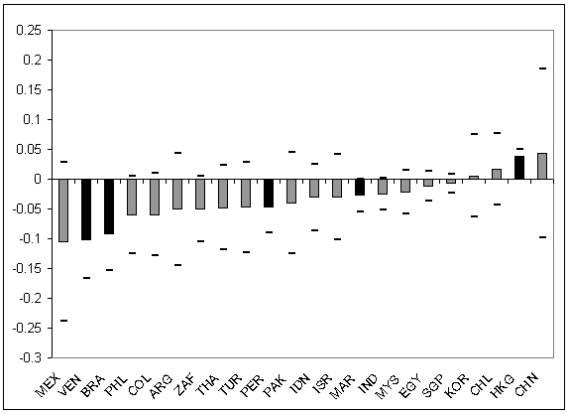

Figure 3: Response to Net Foreign Assets: Emerging Countries

Dashes represent the 95% confidence intervals, statistically signficant estimates are in black.

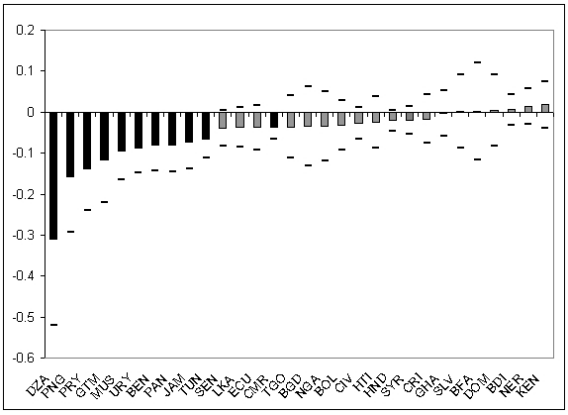

Figure 4: Response to Net Foreign Assets: Other Developing Countries

Dashes represent the 95% confidence intervals, statistically signficant estimates are in black.

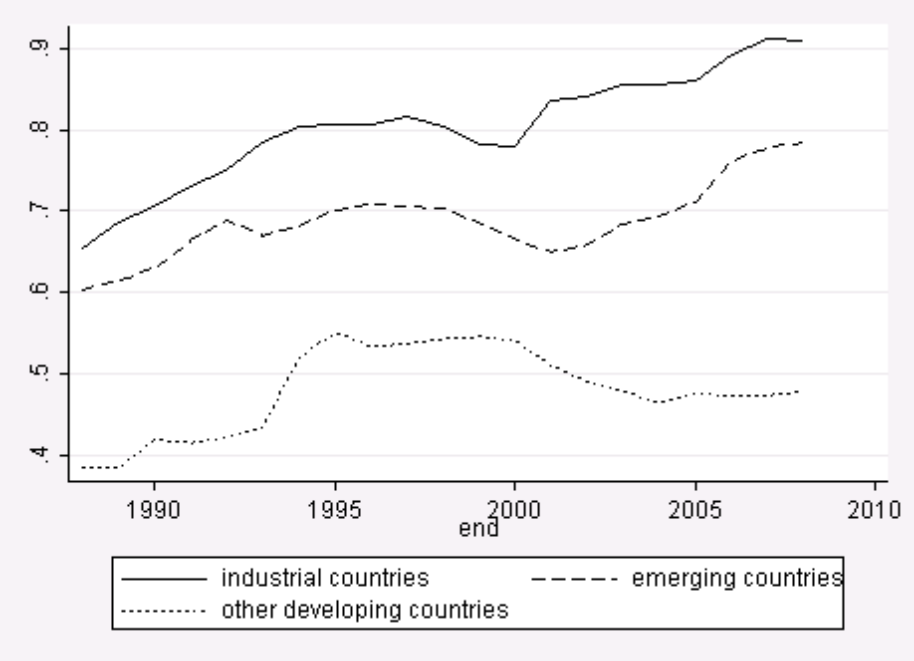

Figure 5: Rolling Regression: lagged trade balance

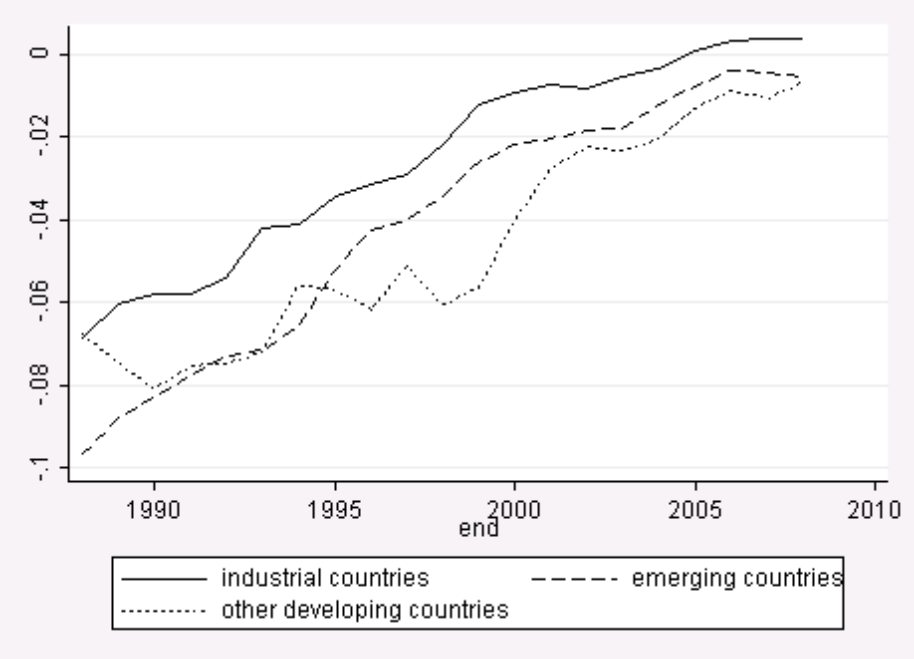

Figure 6: Rolling Regression: Net Foreign Assets

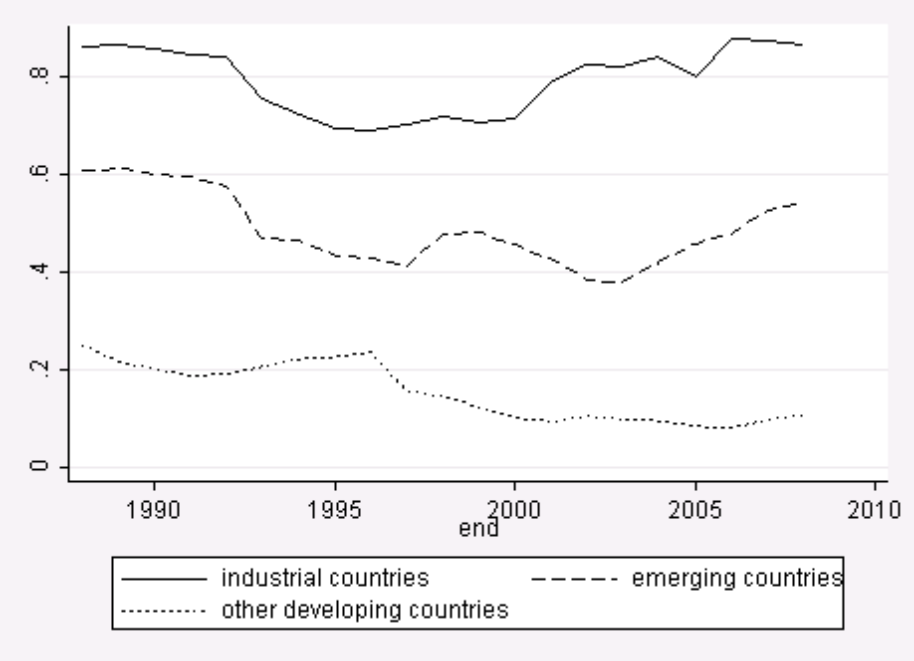

Figure 7: Rolling Regression: net output gap

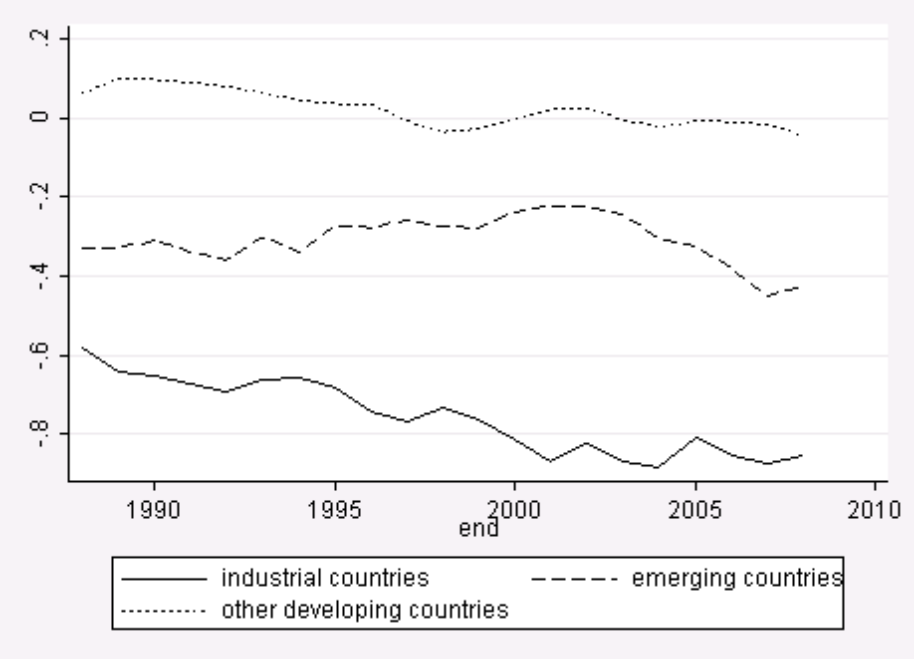

Figure 8: Rolling Regression: lagged net output gap

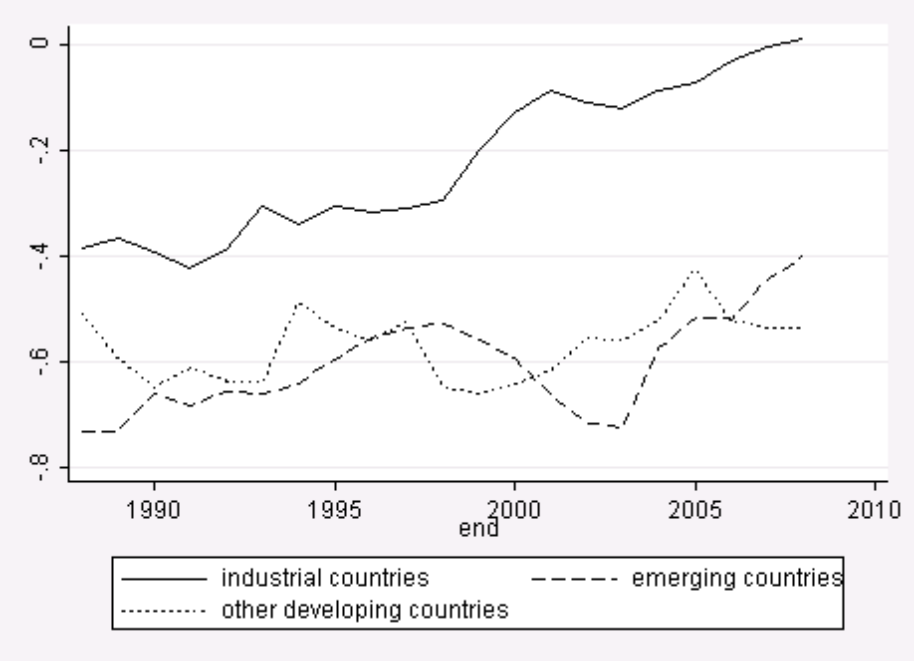

Figure 9: Rolling Regression: net investment income

Table

dependent variable: tb

	all countries	industrial countries	emerging countries	other dev. countries.
lagged tb	0.717***	0.911***	0.833***	0.536***
lagged nfa	-0.014***	-0.002	-0.010*	-0.036***
	(0.005)	(0.004)	(0.006)	(0.010)
nogap	0.339***	0.880***	0.589***	0.189***
	(0.055)	(0.084)	(0.075)	(0.065)
lagged nogap	-0.186***	-0.883***	-0.479***	-0.001
	(0.048)	(0.085)	(0.086)	(0.057)
N	2307	739	682	886

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 1: Panel Regressions

		all countries	industrial countries	emerging countries	other dev. countries.
lagged tb	median	0.661	0.808	0.718	0.511
	mean	0.737	0.823	0.748	0.570
	st.dev	0.257	0.135	0.205	0.284
lagged nfa	median	-0.033	-0.007	-0.034	-0.053
	mean	-0.028	-0.010	-0.035	-0.036
	st.dev	0.054	0.036	0.039	0.067
netgap	median	0.508	0.743	0.520	0.326
	mean	0.470	0.804	0.483	0.289
	st.dev	0.481	0.418	0.578	0.369
lagged netgap	median	-0.379	-0.686	-0.387	-0.148
	mean	-0.405	-0.702	-0.438	-0.105
	st.dev	0.455	0.347	0.501	0.355

Table 2: Country by Country regressions

	dependent variable: tb								
	kaopen		finopen		finreform		findev		trade
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)
INT * lagged tb	0.079***	0.030*	0.166***	0.081***	0.022***	0.024***	0.182***	0.106***	0.159***
	(0.013)	(0.017)	(0.046)	(0.030)	(0.004)	(0.005)	(0.040)	(0.030)	(0.039)
INT *lagged nfa	0.007***	0.006**	0.009***	0.010**	0.002***	0.002**	0.008*	0.004	0.006
	(0.002)	(0.002)	(0.003)	(0.004)	(0.000)	(0.001)	(0.005)	(0.005)	(0.005)
INT *nogap	0.127***	0.103***	0.138**	0.197***	0.018**	0.052***	0.277***	0.163***	0.354***
	(0.032)	(0.032)	(0.063)	(0.056)	(0.008)	(0.010)	(0.057)	(0.058)	(0.068)
INT * lagged nogap	-0.115***	-0.075***	-0.151***	-0.129**	-0.024***	-0.046***	-0.260***	-0.112**	-0.216***
	(0.028)	(0.029)	(0.059)	(0.062)	(0.008)	(0.009)	(0.056)	(0.055)	(0.062)
N	2256	2256	2307	2307	1828	1828	2291	2291	2307

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. INT is the corresponding integration variable. For space reasons only the interaction terms of interest are reported, other explanatory variables are omitted. (1) is the base line specification with additional explanatory variables lagged tb, lagged nfa, net output gap, lagged output gap, and INT (2) additionally interacts the four explanatory variables with a linear time trend and dummies for the three country groups.

Table 3: Interaction with Integration Measures

dependent variable: tb				
	all countries	industrial countries	emerging countries	other dev. countries.
lagged tb	0.684***	0.904***	0.802***	0.490***
	(0.039)	(0.024)	(0.029)	(0.075)
ninc	-0.357***	-0.086*	-0.451***	-0.536***
	(0.065)	(0.050)	(0.097)	(0.119)
kgain	-0.017	0.002	-0.029	-0.030
	(0.011)	(0.007)	(0.025)	(0.022)
nogap	0.340***	0.883***	0.565***	0.211***
	(0.055)	(0.084)	(0.074)	(0.065)
lagged nogap	-0.176***	-0.875***	-0.476***	0.008
	(0.048)	(0.084)	(0.084)	(0.055)
N	2290	738	671	881

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Panel Regression on Total Returns

dependent variable: tb				
	kaopen	finopen	finreform	findev
INT *lagged tb	0.041**	0.106***	0.027***	0.146***
	(0.016)	(0.028)	(0.005)	(0.030)
INT * nincn	0.161***	0.266***	0.039***	0.282***
	(0.029)	(0.047)	(0.010)	(0.077)
INT *kgainn	-0.011	0.026*	-0.004	-0.006
	(0.010)	(0.014)	(0.004)	(0.018)
INT *nogap	0.094***	0.212***	0.049***	0.161***
	(0.032)	(0.055)	(0.010)	(0.056)
INT * lagged nogap	-0.074**	-0.123**	-0.043***	-0.096*
	(0.029)	(0.062)	(0.009)	(0.055)
N	2256	2290	1828	2274

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. INT is the corresponding integration variable. For space reasons only the interaction terms of interest are reported, other explanatory variables are omitted. Additional explanatory variables lagged tb, lagged nfa, net output gap, lagged output gap, and INT. I also interact the four explanatory variables with a linear time trend and dummies for the three country groups.

Table 5: Interaction with Integration Measures

dependent variable: tb			
	rel csize	largest 10%	Exc Regime
INT *lagged tb	0.020	0.104	0.009
	(0.031)	(0.067)	(0.007)
INT *lagged nfa	-0.004	-0.007	-0.000
	(0.005)	(0.012)	(0.001)
INT *nogap	0.020	-0.555***	0.034***
	(0.039)	(0.145)	(0.011)
INT *lagged nogap	-0.013	0.542***	-0.026**
	(0.040)	(0.116)	(0.012)
kaopen *lagged tb	0.031**	0.030*	0.021
	(0.016)	(0.017)	(0.016)
kaopen *lagged nfa	0.006***	0.006**	0.006**
	(0.002)	(0.002)	(0.003)
kaopenn *nogap	0.109***	0.077**	0.110***
	(0.030)	(0.033)	(0.032)
kaopen * lagged nogap	-0.078***	-0.053*	-0.084***
	(0.027)	(0.029)	(0.029)
N	2256	2256	2039

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. INT is the corresponding control variable. For space reasons only the interaction terms of interest are reported, other explanatory variables are omitted. Additional explanatory variables lagged tb, lagged nfa, net output gap, lagged output gap, kaopen, and INT. I also interact the four explanatory variables with a linear time trend and dummies for the three country groups.

Table 6: Interaction with Alternative Controls

dependent variable: tb

	all countries	industrial countries	emerging countries	other dev. countries.
lagged tb	0.709***	0.910***	0.827***	0.531***
	(0.038)	(0.024)	(0.030)	(0.070)
lagged nfd	-0.011**	-0.001	-0.012	-0.030***
	(0.005)	(0.004)	(0.008)	(0.010)
lagged nfe	-0.014**	-0.002	-0.002	-0.053**
	(0.007)	(0.004)	(0.009)	(0.025)
nogap	0.337***	0.913***	0.587***	0.193***
	(0.055)	(0.085)	(0.079)	(0.064)
lagge nogap	-0.184***	-0.908***	-0.484***	-0.002
	(0.049)	(0.081)	(0.090)	(0.057)
N	2270	729	655	886

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. nfd and nfe stand for net foreign debt assets and net foreign equity assets

Table 7: The Role of the Composition of the Net External Position

A Data

A.1 Sources and transformation.

All nominal data is expressed in US dollars.

Net Output Gap (nogap); potential net output: Source: World Bank Development Indicators (WDI). Nominal net output is nominal GDP minus nominal government expenditure minus investment (Gross capital formation). Real net output is nominal net output divided by the GDP deflator. Net output gap is the cyclical component of HP filtered log real net output ($\lambda = 100$) . [25] Potential net output put is the exponential of the cyclical component of HP filtered log real net output

Net Foreign Assets (nfa): Source: updated and extended version of dataset constructed by Lane and Milesi-Ferretti (2007). Nominal net foreign are deflated with the GDP deflator and scaled by potential net output

Trade balance (tb): Source: WDI. The trade balance is current account minus net income, normalized with potential net output .

Net income (ninc): Source: WDI, normalized with lagged potential net output.

Capital gains (kgain): Capital gains (KGAIN) are calculated as the difference between the change in the stock and the flow. $\mathsf{KGAIN}_t = \mathsf{NFA}_t - \mathsf{NFA}_{t-1} - \mathsf{CA}_t$. The calculated measure is normalized with lagged potential net output.

De jure financial openness (kaopen) Source: Chinn and Ito (2008).

De facto financial openness (finopen) Source: Lane and Milesi-Ferretti (2007).

De jure financial development (finreform) Source: Abiad *et al.* (2008)

De facto Financial Development (findev) Source: WDI. Financial development is private credit over nominal GDP.

Trade Openness (tradeopen) Source: WDI. Trade opennes is the sum of exports and imports of good and services over nominal GDP.

Relative Country Size Source: WDI. Relative country size is calculated as the country's nominal GDP in US Dollars divided by the cross sectional average.

Exchange Rate Regime Source: WDI. Reinhart and Rogoff (2004), updated in Ilzetzki *et al.* (2008), annual fine classification.

A.2 Country Sample

Industrial countries Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Denmark (DNK), Finland (FIN), France (FRA), Germany (DEU), Greece

[25] The filtering requires complete time series. To compute gap measures for countries with missing data, I employ the filter data where missing data is linearly interpolated. In years with missing data I then replace the calculated gap with a missing values

(GRC), Ireland (IRL), Iceland (ITA), Italy (ITA), Japan (JPN), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Portugal (PRT), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Kingdom (GBR), and United States (USA).

Developing Countries The classification follows Prasad *et al.* (2004). The developing countries are split into, more financially integrated, emerging (22) and, less financially integrated, other developing (30 countries. [26]

Emerging countries

Argentina(ARG), Brazil (BRA), Chile (CHL), China (CHN), Colombia (COL), Egypt (EGY), Hong Kong (HKG), India (IND), Indonesia (IDN), Israel (ISR), Korea (KOR), Malaysia (MYS), Mexico (MEX), Morocco (MAR), Pakistan (PAK), Peru (PER), Philippines (PHL), Singapore (SGP), South Africa (ZAF), Thailand (THA), Turkey (TUR), and Venezuela (VEN).

Other Developing Countries

Algeria (DZA), Benin (BEN), Bangladesh(BGD), Bolivia (BOL), Burkina Faso (BFA), Burundi (BDI), Cameroon (CMR), Costa Rica (CRI), Cote d'Ivoire (CIV), Dominican Republic (DOM), Ecuador (ECU), El Salvador (SLV), Ghana (GHA), Guatemala (GTM), Haiti (HTI), Honduras (HND), Jamaica (JAM), Kenya (KEN), Mauritius (MUS), Niger (NER), Nigeria (NGA), Panama (PAN), Papua New Guinea (PNG), Paraguay (PRY), Senegal (SEN), Sri Lanka (LKA), Syrian Arab Republic (SYR), Togo (TGO), Tunisia (TUN), and Uruguay (URY).

[26] I exclude Nicaragua, Botswana, and Gabon as outliers. Nicaragua's net external position to net output ratio varies between -20% and -2000%. Botswana and Gabun display extreme volatility in the trade balance. They account together for half of all observations that lie above the 99.5% or below the 0.5% percentile of the sample distribution. Both countries appear at both ends of the distribution.

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A Additional Empirical Results

A.1 Main Results

A.2 Extensions

A.2.1 Trend in Net Foreign Assets

dependent variable: tb				
	all countries	industrial countries	emerging countries	other dev. countries.
lagged tbgap	0.315***	0.497***	0.441***	0.246***
	(0.054)	(0.037)	(0.046)	(0.078)
lagged nfagap	-0.069***	-0.029***	-0.082***	-0.079***
	(0.010)	(0.006)	(0.014)	(0.017)
nogap	0.319***	0.890***	0.547***	0.168***
	(0.045)	(0.072)	(0.064)	(0.056)
lagged nogap	-0.022	-0.537***	-0.257***	0.106*
	(0.047)	(0.065)	(0.070)	(0.056)
N	2122	678	659	785

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Regressions Using Cyclical Deviations

	kaopen		finopen		finreform		findev	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
INT* tbgap	0.023	0.010	0.126	0.091	0.009*	0.014**	0.137**	0.090*
	(0.020)	(0.023)	(0.081)	(0.056)	(0.005)	(0.007)	(0.058)	(0.046)
INT*nfagap	0.016***	0.008	0.045***	0.024**	0.006***	0.001	0.016	0.005
	(0.004)	(0.007)	(0.012)	(0.011)	(0.001)	(0.002)	(0.011)	(0.013)
INT*nogap	0.129***	0.098***	0.117*	0.178***	0.024***	0.046***	0.241***	0.126**
	(0.028)	(0.028)	(0.060)	(0.054)	(0.007)	(0.009)	(0.051)	(0.051)
INT*lagged nogap	-0.076***	-0.045*	-0.064	-0.055	-0.020***	-0.027***	-0.188***	-0.063
	(0.025)	(0.025)	(0.059)	(0.060)	(0.006)	(0.008)	(0.048)	(0.045)
N	2071	2071	2122	2122	1672	1672	2106	2106
1917 1917								

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. INT is the corresponding integration variable. For space reasons only the interaction terms of interest are reported, other explanatory variables are omitted. (1) is the base line specification with additional explanatory variables lagged tbgap, lagged nfagap, net output gap, lagged output gap, and INT (2) additionally interacts the four explanatory variables with a linear time trend and dummies for the three country groups.

Table 9: Cyclical Deviations: Interaction with Integration Measures

A.2.2 System GMM estimates

dependent variable: tb				
	all countries	industrial countries	emerging countries	other dev. countries.
lagged tb	0.769***	1.006***	0.876***	0.559***
	(0.051)	(0.053)	(0.068)	(0.049)
lagged nfa	-0.010	-0.007	-0.011	-0.055*
	(0.010)	(0.006)	(0.007)	(0.027)
nogap	0.324***	0.807***	0.518**	0.228***
	(0.089)	(0.119)	(0.235)	(0.075)
lagged nogap	-0.217**	-0.881***	-0.487***	-0.052
	(0.100)	(0.116)	(0.181)	(0.072)
N	2307	738	671	881
j	14	14	14	14
Hansen Test	0.01	0.26	0.20	0.38

Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. Estimates are from two step system GMM Blundell and Bond (1998). Lagged trade balance, lagged net foreign assets, net output are instrumented with lags 2 to 5.

Table 10: System GMM estimates

B Additional Theory

B.1 Small Open Economy Model: Linearized First Order Condition

$$\sigma\left(c-\frac{\gamma}{1+g}c\right)^{-\sigma-1}\left(-\left(1+\frac{\theta\gamma^2}{(1+g)^{\sigma+1}}\right)\hat{c}_{t+j}+\gamma\hat{c}_{t+j-1}+\frac{\theta\gamma}{(1+g)^{\sigma}}\hat{c}_{t+j+1}\right)-\hat{\lambda}_{t+j}=0$$

$$-\hat{\lambda}_{t+j}+\mathrm{E}_t\,\hat{\lambda}_{t+j+1}-\psi\lambda\hat{f}_{t+j}=0$$

$$\hat{y}_{t+j}+(1+\tilde{r})\,\hat{f}_{t+j-1}-\hat{c}_{t+j}-\hat{f}_{t+j}=0$$

$$(\hat{y}_{t+j+1})-\rho\,(\hat{y}_{t+j})-\varepsilon_{t_{t+j+1}}=0$$

Steady state: $c=y=1$, $tb=f=0$.

B.2 Analytical Solution I: The case without habit persistence $\gamma=0$

The system of difference equations can be written in the form $E_tX_{t+1}=AX_t$

$$\begin{bmatrix}\hat{f}_t\\ E_t\hat{y}_{t+1}\\ E_t\hat{c}_{t+1}\end{bmatrix}=\begin{bmatrix}1+\tilde{r} & 1 & -1\\ 0 & \rho & 0\\ -\psi & 0 & 1\end{bmatrix}\begin{bmatrix}\hat{f}_{t-1}\\ \hat{y}_t\\ \hat{c}_t\end{bmatrix}$$

Applying the Blanchard and Kahn (1980) solution gives the decision rule for consumption

$$\hat{c}_t=-2\,\frac{\psi}{\sigma\,r-\sqrt{\sigma^2r^2+4\,c\psi\,\sigma}}\hat{f}_{t-1}+\frac{\left(\sigma\,r-\sqrt{\sigma^2r^2+4\,\psi\,\sigma}-2\,\sigma\,\rho+2\,\sigma\right)c\psi}{\left(\sigma\,r-\sqrt{\sigma^2r^2+4\,\psi\,\sigma}\right)\left(-\sigma\,\rho^2+2\,\sigma\,\rho-\sigma+\sigma\,r\rho-\sigma\,r+c\psi\right)}\hat{y}_t$$

If we assume $\left(\sigma\,r-\sqrt{\sigma^2r^2+4\,c\psi\,\sigma}-2\,\sigma\,\rho+2\,\sigma\right)\neq 0$, we can do the following simplifications:

$$b=\frac{\left(r+\sqrt{r^2+4\,\psi\,/\sigma}\right)}{2}$$

$$d = \frac{\left(r + \sqrt{r^2 + 4\,\psi\,/\sigma}\right)}{\left(r + \sqrt{r^2 + 4\,\psi/\,\sigma} - 2\;\rho + 2\right)},$$

B.3 Analytical Solution II: Very Small Financial Frictions $\psi \to 0$

The derivation follows Gruber (2004), but in a growing economy. The social planer problem, equivalent to the competitive equilibrium, is

$$\max_{c_{t+s},\; f_{t+s}} \sum_{s=t}^{\infty} E_t \bar{Y}_0 \left(\theta\,(1+g)^{1-\sigma}\right)^{t+s} \frac{\left(c_{t+s} - \frac{\gamma}{1+g} c_{t+s-1}\right)^{1-\sigma}}{1-\sigma}, \tag{11}$$

subject to the intertemporal budget constraint and the law of motion for output

$$(1+\tilde{r})\, f_{t+s-1} + y_t - (1+\tilde{r})\,\frac{\psi}{2} f_{t+s-1}^2 = c_{t+s} + f_{t+s} \tag{12}$$

Define $c_t^* = c_t - \frac{\gamma}{1+g} c_{t-1}$ and maximize with respect to c_t^*, f_t. With $1 + r = \frac{(1+g)^\sigma}{\theta}$, the Euler equation is

$$\left(c_t^*\right)^{-\sigma} = (1 - \psi f_{t-1})\, E_t \left(c_{t+1}^*\right)^{-\sigma}$$

Linearization around the steady state and letting $\psi \to 0$ implies

$$\hat{c}_t^* = E_t \hat{c}_{t+1}^*.$$

Using $x_t^* = x_t - \frac{\gamma}{1+g} x_{t-1}$, a transformed version of the linearized budget constraint reads

$$(1+\tilde{r})\,\hat{f}_{t-1}^* + \hat{y}_t^* = \hat{c}_t^* + \hat{f}_t^*.$$

Forward iteration gives

$$\hat{f}_{t-1}^* = \frac{\hat{c}_t^*}{\tilde{r}} - \frac{1}{1+\tilde{r}} E_t \sum_{t=0}^{\infty} \left(\frac{1}{1+\tilde{r}}\right)^t \hat{y}_{t+s.}^*$$

Solving back for c_t

$$\tilde{r}\left(\hat{f}_{t-1}-\frac{\gamma}{1+g}\hat{f}_{t-2}\right)=\hat{c}_0-\frac{\gamma}{1+g}\hat{c}_{t-1}-\frac{\tilde{r}}{1+\tilde{r}}E_t\sum_{t=0}^{\infty}\left(\frac{1}{1+\tilde{r}}\right)^t\left(\hat{y}_{t+s}-\frac{\gamma}{1+g}\hat{y}_{t+s-1}\right)$$

$$\begin{aligned}\tilde{r}\left(\hat{f}_{t-1}-\frac{\gamma}{1+g}\frac{\hat{c}_{t-1}+\hat{f}_{t-1}-\hat{y}_{t-1}}{(1+\tilde{r})}\right)&=\hat{c}_t-\frac{\gamma}{1+g}\hat{c}_{t-1}-\frac{\tilde{r}}{1+\tilde{r}}E_t\sum_{s=t}^{\infty}\left(\frac{1}{1+\tilde{r}}\right)^{s-t}\rho^{s-t}\hat{y}_t\\&\quad+\tilde{r}\frac{\gamma}{1+g}E_t\sum_{s=t}^{\infty}\left(\frac{1}{1+\tilde{r}}\right)^{s-t}\rho^{s-t}\hat{y}_t+\frac{\tilde{r}}{1+\tilde{r}}\frac{\gamma}{1+g}\hat{y}_{t-1}\end{aligned}$$

$$\hat{c}_t=\tilde{r}\left(1-\frac{\gamma}{1+r}\right)\hat{f}_{t-1}+\frac{\gamma}{1+r}\hat{c}_{t-1}+\frac{\tilde{r}}{1+\tilde{r}-\rho}\left(1-\frac{\gamma}{1+r}\right)\hat{y}_t$$

Solving for the trade balance and using steady state conditions

$$tb_t=-\tilde{r}\left(1-\frac{\gamma}{1+r}\right)f_{t-1}+\frac{\gamma}{1+r}tb_{t-1}+\left(1-\frac{\tilde{r}}{1+\tilde{r}-\rho}\left(1-\frac{\gamma}{1+r}\right)\right)\hat{y}_t-\frac{\gamma}{1+r}\hat{y}_{t-1}.$$

B.4 Derivation of the Sustainability Conditions

The path of net foreign assets is then determined by two equations: the accumulation identity and the reaction function. Rearranging terms, the two equation system in matrix $AX_t = C + BX_{t-1} + E_t$ is

$$\begin{bmatrix}1&-1\\0&1\end{bmatrix}\begin{bmatrix}\mathsf{nfa}_t\\\mathsf{tb}_t\end{bmatrix}=\begin{bmatrix}0\\\mu\end{bmatrix}+\begin{bmatrix}1+r-g&0\\\beta&\alpha\end{bmatrix}\begin{bmatrix}\mathsf{nfa}_{t-1}\\\mathsf{tb}_{t-1}\end{bmatrix}+\begin{bmatrix}0\\\delta_1 y_t+\delta_2 y_{t-1}+\varepsilon_t\end{bmatrix}$$

For stability, both Eigenvalues of the dynamic system must lie within the unit circle. The Eigenvalues are the solution to $|Az - B| = 0$.

$$\begin{aligned}&\left|\begin{bmatrix}z&-z\\0&z\end{bmatrix}-\begin{bmatrix}1+r-g&0\\\beta&\alpha\end{bmatrix}\right|\\&=z^2-(1+r-g+\beta+\alpha)\,z+(1+r-g)\,\alpha\\&=0\end{aligned}$$

The polynomial can be factorized with the implicit solutions

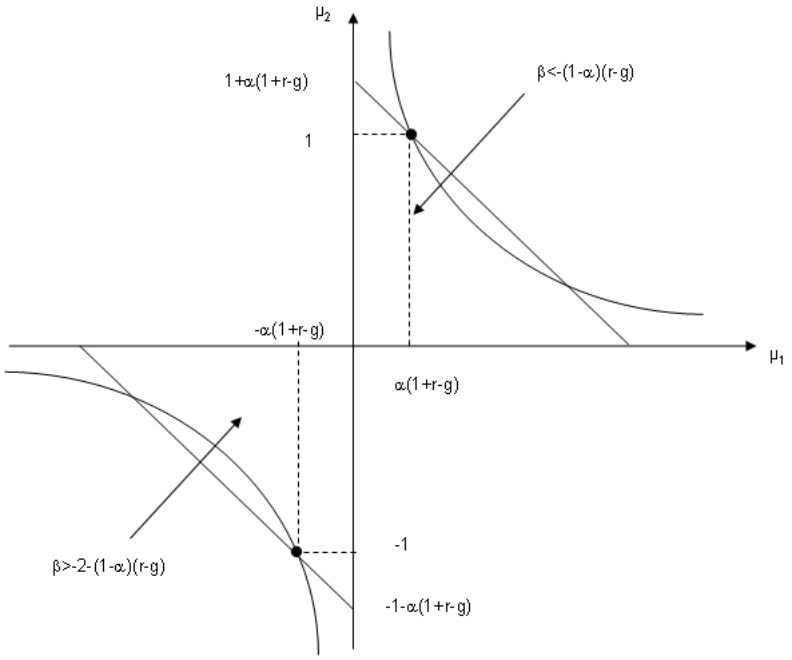

Figure 10: Graphical representation of characteristic root

$$(z-\mu_1)(z-\mu_2)=0.$$

Comparing coefficients, we have two equation with two unknowns:

$$\mu_1+\mu_2=(1+r-g+\beta+\alpha) \tag{13}$$
$$\mu_1\mu_2=(1+r-g)\,\alpha \tag{14}$$

The two equation are represented graphically in figure 10 below.

Equation (13) is a straight line with slope minus one and intercept $(1+r-g+\beta+\alpha)$. Equation (14) is a hyperbola. The two intersections are the solutions. As they are symmetric we can focus on solutions where $|\mu_2|\geq|\mu_1|$. A necessary condition for stability is $|\mu_1\mu_2|<1$. The first requirement, independent of the reaction coefficient β, is therefore

$$|(1+r-g)\,\alpha|<1. \tag{15}$$

An increase in β shifts the intercept upwards. If there is no intersection, the two roots are complex conjugate and stable as long as condition (15) is fulfilled. As can be seen from the graph, stability requires that the intercept lies between two bounds

$$1 + (1 + r - g)\,\alpha > (1 + r - g + \beta + \alpha) > -1 - (1 + r - n)\,\alpha.$$

Solving for β, we have

$$-2\,(1 + \alpha) - (r - g)\,(1 - \alpha) < \beta < -\,(r - g)\,(1 - \alpha)\,.$$

The lower bound means that the reaction should not be too strong. It is likely that the condition will not be economically relevant.

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