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The Composition and Cyclical Behavior of Trade Flows in Emerging Economies

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The Composition and Cyclical Behavior of Trade Flows in Emerging Economies[1]

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Abstract

Trade flows data show that the composition and cyclical properties of *imports* are similar in developed economies and emerging markets (EM) but this is not the case for *exports*. Unlike developed economies, (i) EM export few or only a selective set of capital goods and (ii) capital good and overall exports tend to be acyclical. The lack of procyclicality in exports drives the strong countercyclicality of EM trade balances observed in previous studies. A quantitative exercise demonstrates how the standard small open economy business cycle model can be improved for EM by incorporating these features.

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I. Introduction

Trade balances are strongly countercyclical in emerging economies (EM) but weakly countercyclical or even acyclical in developed markets.[1] The recent literature has explored different channels to explain this difference. Neumeyer and Perri (2005) argue that the two types of economies face different environments in international credit markets and that countercyclical interest rate shocks explain a bigger fraction of net exports in EM.[2] The key message of Aguiar and Gopinath (2007), on the other hand, is that EM and developed markets are subject to aggregate shocks with different statistical properties. Shocks to trend growth rather than transitory fluctuations around a stable trend are the primary source of business cycle fluctuations in EM, and strong income effects generate strongly countercyclical trade balances.

This paper takes a different route by analyzing the composition and cyclical properties of the components of the trade balance using UN-NBER data available for 1980-2000. I find that the composition and cyclicality of *imports* in EM and developed markets are rather similar. The share of capital goods in total imports is roughly a third. Turning to cyclical properties, these capital good and total imports are procyclical in both EM and developed economies. The similarity does not hold when the analysis turns to *exports*. Most emerging economies export few or, when they start exporting more capital goods, only a selective set of capital goods.[3] More important for business cycle analysis, capital good exports are acyclical in EM. Without procyclical durables, overall exports tend to be acyclical in EM. Countries such as Argentina or Mexico even have countercylical real exports. This stands in sharp contrast to the trade structure of developed economies, where exports are the mirror image of imports. Capital goods constitute a third of overall exports and their strong procyclicality drives to a large extent the procyclicality of overall exports.

The combination of national accounts and UN-NBER trade data suggests that the cyclical demand for capital good imports during expansions is an important factor driving the countercyclicality of current accounts in EM. In the intertemporal equilibrium approach, consumer optimization endogenously determines the correlation between external accounts and output. For the trade balance to be countercyclical the pro-borrowing effect induced by an expansionary productivity shock must dominate the pro-saving effect, a dimension on which standard small open economy models fail.[4] The last section evaluates the role of a two-sector

[1]The seminal papers are Mendoza (1991), Neumeyer and Perri (2005) and Aguiar and Gopinath (2007). Engel and Wang (2007) present a recent study for OECD countries.

[2]Oviedo (2005) discusses the conditions under which interest-rate shocks cause business cycles.

[3]See also Eaton and Kortum (2001) and Duttagupta and Spilimbergo (2004).

[4]General equilibrium models with incomplete markets and optimizing agents that have been successful in replicating the dynamics of the trade balance in G-10 do not generate a sufficiently countercyclical trade balance. Even the small open economy model with the type of preferences proposed in Greenwood et al. (1988) gives rise

set-up that incorporates the facts that EM need to import equipment and exports are uncorrelated with the domestic business cycle. The model is otherwise similar to the standard small open economy model. It has preferences and adjustment costs in line with those surveyed in Schmitt-Grohe and Uribe (2003). Compared to the one-sector model, agents need to borrow more to benefit from an expansionary productivity shock and the trade balance becomes strongly countercyclical.

The paper is organized as follows. Section II. analyzes the composition and cyclical properties of trade flows. Section III. presents a small open economy model with two sectors. Section IV. calibrates the model. Section V. studies the implications of the two-sector model and makes a comparison with standard small open economy models. Section VI. concludes.

II. Composition and Business Cycle Features of Trade Flows

This section documents the composition and cyclical properties of trade flows for a total of 17 emerging economies (EM). To highlight the distinct features of EM, I also report statistics for 6 developed economies and 3 G-7 countries. Appendix A summarizes the data sources and available sample periods, and describes the construction of the variables.

A. Composition and Magnitude of Capital Good Exports and Imports

Observation 1 *According to trade data, capital good imports represent more than a third of the total imports in both emerging and developed economies. Unlike developed economies, emerging countries export few or only a selective set of capital goods.*

The first two columns of table 2 display the median shares of capital good exports and imports in total good exports and imports over the period 1980-2000. The table shows that there is a stark group difference between the emerging and developed countries. Whereas the median country share of capital goods imports $M^{K,\$}$ in total goods imports $M^{\$}$ is similar (37.24 in the group of EM versus 36.59 in the group of developed economies), the median share of capital goods $X^{K,\$}$ in total exports $X^{\$}$ is only 8.77 percent in EM compared with 31.66 for the group of the developed economies. A non-parametric Wilcoxon rank-sum test rejects the null hypothesis at the 5 percent level that the median capital good export shares for the developed and emerging economies come from the same distribution. The test does not reject the same distribution hypothesis for the capital good import shares. Table 2 can be interpreted as the time series version of Eaton and Kortum (2001). Using a cross-section of 34 countries in the year 1985, Eaton and Kortum (2001) show that innovative activity is highly concentrated in a handful of advanced countries. These countries also produce most of the world's capital goods and the rest of the world imports capital goods from these countries.

to at best a weakly countercyclical trade balance (Mendoza (1991) and Schmitt-Grohe and Uribe (2003)).

Observation 2 *According to trade and national accounts data, capital good imports are a sizable fraction of Gross Domestic Product (GDP).*

The last two columns of table 2 present the median shares of capital goods imports $M^{K,\$}$ and capital goods exports $X^{K,\$}$ in GDP over the 1980-2000 period. The median share of exported capital goods as a fraction of GDP in the emerging market group is less than two per cent, whereas the median share of capital good imports in GDP is 6.98 percent in this group. In both emerging and developed economies the share of capital goods imports in GDP is about the same as the share of equipment investment in GDP.

Evolution over time

The above observations are not set in stone as countries move from emerging to developed market. In fact, digging deeper in the UN-NBER data one can distinguish two groups of EM countries. In the case of Argentina, Chile or South Africa, capital good exports remain a small fraction of overall exports up to 2000, the last year available in the NBER dataset. For other members of the EM space such as Brazil, the Philippines, and South Korea, the nineties saw a sharp increase in the export share of capital goods to up to a third of total exports. However, these capital good exports are limited to a selective set of goods such as road vehicles and semiconductors (respectively subcategories 78 and 776 in SITC Rev.2), which are not necessarily related to the domestic business cycle.[5] In comparison, the shares of capital goods in imports and exports of developed markets are stable and show more variety at the product level.

B. Business Cycle Properties

Figures 1 and 2 show the cyclical behavior of output Y, the trade balance over output ratio TB/Y, total imports, total exports and capital good imports for Argentina and Thailand respectively. As below, all the series are filtered using the Hodrick-Prescott (HP) filter with a smoothing parameter of 6.25 proposed for annual data by Ravn and Uhlig (2002). Aside TB/Y, all the variables are in logs. The gray shades are the official liberalization dates of Bekaert and Harvey (2000).

The upper panel of the figures plots output together with trade balance over output and shows a negative comovement of output with the trade balance. The lower panel of the figures plots the deviation from trend of imports, exports and capital goods imports. For both countries contractions and expansions coincide with big jumps and drops in total imports and capital goods imports, up to thirty percent above or below trend. Exports, on the other hand, do not display a clear cyclical pattern. The remainder of this subsection argues that these observations hold more generally within the emerging market group.

[5] Duttagupta and Spilimbergo (2004) also find that semiconductors account for a large proportion of exports for Korea, Malaysia, and Singapore. In terms of cyclicality in external demand, they find that the world demand for machinery and semi-conductors did not decline during 1995 and 1998.

Observation 3 *According to trade and national accounts data, emerging economies have strongly countercyclical trade balances whereas trade balances in developed economies are acyclical or moderately countercyclical.*

The first two columns of table 3 print the correlation of real GDP with the trade balance over output ratio TB/Y and the goods trade balance over output ratio TB^G/Y. The table confirms the findings on the cyclicality of trade balances in emerging markets documented in earlier work by Prasad et al. (2004), Neumeyer and Perri (2005), and Aguiar and Gopinath (2007). The trade balance is strongly countercyclical in EM (a median correlation of -0.66), whereas there is no clear pattern in the group of developed economies (median correlation of -0.16). A non-parametric Wilcoxon rank-sum test rejects the null hypothesis at the 1 percent level that the correlations for the developed and emerging economies are drawn from a single population. The second column of table 3 shows that these conclusions also hold when services are excluded.

Observation 4 *According to trade and national accounts data, emerging economies have acyclical exports (including capital good exports) and procyclical imports (including capital goods imports).*

Table 4 presents the correlation of Y with exports X, capital good exports X^K, the share of X^K in total exports, imports M, capital good imports M^K, and the share of M^K in total imports. The table shows that exports are procyclical in developed countries but *not* in EM. A number of EM even have countercylical to strongly countercyclical exports (correlation between real exports X and GDP is -0.60 for Argentina, -0.70 for Mexico). The median correlation of output with exports in the emerging market group is -0.03. This is also consistent with detailed East Asian price-quantity export data presented in Duttagupta and Spilimbergo (2004). They find that in the period 1989 until June 1995 East Asian export prices and volumes expanded continuously. From 1995-2000, volumes continued to expand after prices started falling and export revenues were relatively stable at a time when these economies went into recession. The table also shows that total imports M and equipment imports M^K are procyclical to strongly procyclical in EM. The group median for the correlation of equipment imports with output is 0.59.

If the procyclicality of imports is a common feature for both EM and advanced economies, understanding why the cyclical behavior of exports varies across countries is key for understanding the countercyclicality of the external account. The above findings suggest that countries that are bigger net capital good importers (EM) tend to have countercyclical trade balances. Figure 3 presents a scatter plot of the correlations between output and the goods trade balance, and the median of the capital goods trade balance (capital good exports X^K minus capital good imports M^K over output) over the period 1980-2000. The linear regression line shown in figure 3 is:[6]

$$a = -0.37 + \underset{(1.80)}{0.036} \cdot b, \tag{1}$$

where a is the cyclicality of the goods trade balance, b the median of the capital goods trade balance and the number in parentheses is the t statistic. Equation (1) shows that the degree of net capital good imports and the cyclicality of the trade balance have a statistically significant relationship.

Observation 5 *At business cycle frequencies, capital good imports and exports measured using trade data are more volatile than investment measured from national accounts data.*

The standard deviation of equipment imports M^K relative to the standard deviation of output Y is reported in the last column of table 5. For a number of countries the relative standard deviation of this variable is double the relative standard deviation of investment measured from national accounts data (displayed in the fourth column of table 5). The relative standard deviations of total exports and imports, on the other hand, are in the range of gross fixed capital formation measured from national accounts data.

III. The Model

This section lays out an extended small open economy model with two sectors. The economy is populated by a large number of identical agents who are price takers. All variables are in per capita terms.

A. Production and Investment Technology

A.1 Home and Export Sector

Firms in the home sector produce a non-tradable commodity Y_t^H with a Cobb-Douglas production function:

$$Y_t^H = A_t \left(K_t^H\right)^{\alpha} \left(N_t^H\right)^{1-\alpha}. \tag{2}$$

A_t is the level of random productivity in the domestic sector. K_t^H is the capital stock. N_t^H is the number of hours worked in the domestic sector. The remainder of hours worked N_t^E is allocated to the export sector. Total hours worked N_t is the sum of the two:

$$N_t = N_t^H + N_t^E.$$

[6] The linear regression is used to summarize the information in the scatter plot. The correlation is a bounded measure so alternatives like the logistic regression could also have been used.

Firms in the export sector of the economy produce an export good with a Cobb-Douglas production technology:

$$Y_t^E = B_t \left(K_t^E\right)^{\alpha} \left(N_t^E\right)^{1-\alpha}, \tag{3}$$

where K_t^E is the capital stock, and N_t^E labor services. B_t is productivity in the export sector.

A.2 Resource Constraints and Trade Balance

The resource constraints for the home and export sector are respectively:

$$\begin{aligned} C_t + I_t^H &\leq Y_t^H \\ I_t^F + \left[(1+R^*) D_{t-1} + \Psi(D_t)\right] &\leq D_t + Y_t^E. \end{aligned} \tag{4}$$

The output in the domestic sector Y_t^H can be used either for consumption C_t or investment I_t^H. In the traded sector, the country imports investment goods I_t^F and exports Y_t^E. The difference between Y_t^E and I_t^F is the trade balance. D_t are the outstanding foreign assets, R^* is the exogenously determined interest rate charged on foreign assets and $R^* D_{t-1}$ is the interest due on previously acquired assets. As in Schmitt-Grohe and Uribe (2003),the function $\Psi(\cdot)$ induces stationarity in the model by assuming that agents face convex costs of holding assets in quantities different from a long-run level $\bar{D}$. The functional form for $\Psi(\cdot)$ is:

$$\Psi(D_t) = \frac{\psi}{2}\left[D_t - \bar{D}\right]^2. \tag{5}$$

The first-order condition associated with the debt position is:

$$\lambda_t \left[1 - \psi(D_t - \bar{D})\right] = \beta \mathbf{E}_t \left[\lambda_{t+1}(1+R^*)\right] \tag{6}$$

Equation (6) states the marginal benefit of a unit debt increase equals the marginal cost of a unit debt increase. The loglinearized version is:

$$\hat{\lambda}_t - \psi D \hat{D}_t = \hat{\lambda}_{t+1} + \frac{R}{1+R}\hat{R}^*.$$

The current account balance ca_t is defined as the change in the value of the economy's net foreign asset:

$$ca_t \equiv D_{t-1} - D_t \equiv nx_t - R^* D_{t-1},$$

where nx_t is net exports (or trade balance).

A.3 Final Investment Good

A constant elasticity of substitution aggregator $G(I_t^H, I_t^F)$ describes the production of new investment goods:

$$G(I_t^H, I_t^F) = \left[\omega_H^{1-\xi}\left(I_t^H\right)^{\xi} + \omega_F^{1-\xi}\left(I_t^F\right)^{\xi}\right]^{\frac{1}{\xi}}. \tag{7}$$

The aggregate investment good $G(I_t^H, I_t^F)$ is a composite of domestically produced investment goods I_t^H and imported investment good I_t^F. ω_H is the share of domestic, nontradable goods and $\omega_H = 1 - \omega_N$ the share of imported investment goods. The elasticity of substitution between foreign and domestic investment goods is $\sigma_I = \frac{1}{1-\xi}$. Different production functions are nested in equation (7). Firms buy domestic investment goods at price P_t^H. With the imported investment good as the numeraire, total investment expenditures are:

$$P_t^H I_t^H + I_t^F. \tag{8}$$

To obtain the relation between I_t^H and I_t^F in equilibrium, I solve the following minimization problem:

$$\min_{I_t^H, I_t^F} \quad P_t^I \cdot G(I_t^H, I_t^F), \tag{9}$$

subject to the CES aggregator (7) and (8). In equilibrium the relationship between $I_{N,t}$ and $I_{F,t}$ is:

$$P_{H,t} = \left(\frac{1-\omega_H}{\omega_H}\frac{I_t^H}{I_t^F}\right)^{-1/\sigma_I}. \tag{10}$$

The investment price index is then:

$$P_t^I = \left[\omega_H\left(P_t^H\right)^{\frac{\xi}{\xi-1}} + (1-\omega_H)\right]^{\frac{\xi-1}{\xi}}. \tag{11}$$

Aggregate investment I_t in the model is defined as:

$$I_t \equiv P_t^I \cdot G(I_t^H, I_t^F)$$

Motivated by the work of Bems (2008), I use the Cobb-Douglas specification by setting $\xi = 0$ such that $\sigma_I = 1$, $G(I_t^H, I_t^F)$ becomes:

$$G(I_t^H, I_t^F) = \left(I_t^H\right)^{\omega_H}\left(I_t^F\right)^{1-\omega_H}.$$

B. Preferences and Budget Constraint

The representative household maximizes expected lifetime utility:

$$U(C_t, N_t) = \mathbf{E}_t\left(\sum \beta^t u(C_t, N_t)\right), \quad 0 < \beta < 1, \tag{12}$$

where β is the discount factor, and C_t and N_t are random sequences of period t consumption and hours worked, respectively. $\mathbf{E}_t$ is the expectation based on the information set available at time t. Two specifications for $u(\cdot)$, Cobb-Douglas (CD) and Greenwood et al. (1988) (GHH) preferences, have been widely used in the small open economy literature. To motivate the use of GHH preference in the two-sector model, I briefly review the CD specification.

B.1 Cobb-Douglas Specification

The CD specification for utility is:

$$u(C_t, N_t) = \frac{(C_t^{\theta}(1-N_t)^{1-\theta})^{1-\sigma}}{1-\sigma}. \tag{13}$$

This specification is a commonly used preference in the open economy literature.[7] θ determines the fraction of labor in steady state, whereas the labor supply schedule is determined by:

$$w_t = -\frac{U_N}{U_c} = \frac{C_t}{1-N_t}\frac{(1-\theta)}{\theta}.$$

CD preferences have two (related) properties. First, the preferences make consumption in the model insufficiently volatile. To get some intuition for this, consider the case where $\sigma = 1$ and the Euler condition for consumption becomes:

$$\frac{1}{C_t} = \beta \mathbf{E}_t \left(\frac{1}{C_{t+1}} \right),$$

making the process for consumption $\{C_t\}_{t=0}^{\infty}$ very smooth. If one calibrates $\sigma > 1$, smoothing the marginal utility of consumption does not imply smooth consumption but rather that movements in consumption are proportional to movements in labor $\epsilon \hat{C}_t = \hat{N}_t$. Calibrating N at a high value will then correspond to lower values of ϵ. This is not problematic if the goal is match the volatility of consumption observed in the data. The drawback, however, is that a

[7] Studied in Backus et al. (1992), Correia et al. (1995), Neumeyer and Perri (2005), Aguiar and Gopinath (2007), and Raffo (2008).

high steady state value of N reduces the Frish elasticity of labor supply ε^{λ}:[8]

$$\varepsilon^{\lambda} = \frac{1-N}{N}\frac{(1-\theta(1-\sigma))}{\sigma}.$$

A low value for ε^{λ} decreases the variation in labor effort. This explains why a small open economy model with CD preferences is not able to simultaneously match the volatility of consumption and hours worked. A related property associated with these preferences is that they generate a procyclical trade balance (Schmitt-Grohe and Uribe (2003)). Under CD preferences the optimal response to productivity shocks in a wide range of calibrations is to smooth consumption. As a consequence there is less incentive to borrow after an expansionary productivity shock.

B.2 GHH Specification

An alternative specification widely used in open economy models are the GHH-preferences proposed in Greenwood et al. (1988):

$$u(C_t, N_t) = \frac{(C_t - \omega\frac{N_t^{1+\theta}}{1+\theta})^{1-\sigma} - 1}{1-\sigma}. \tag{14}$$

These preferences undo income effects on labor supply that are present under CD.[9] In equilibrium the marginal product of labor is equal to the marginal rate of substitution between consumption and leisure:

$$w_t = -\frac{U_N}{U_c} = \omega N_t^{\theta}, \tag{15}$$

so there is no intertemporal substitution associated with leisure. Labor supply at time t is entirely determined by the current real wage (no C-term on right-hand side in equation 15). The uncompensated labor supply elasticity $1/\theta$ equals the Frisch elasticity ε^{λ}. In the context of multi-country models, Raffo (2008) has shown that GHH preferences improve the empirical performance of two-country models by generating sufficient volatility in consumption *and* labor compared to CD preferences.

[8]The general formula for the Frish elasticity implied by a class of momentary utility functions $U(C,N)$ is:

$$\varepsilon^{\lambda} \equiv \frac{dN}{dw}\frac{w}{N}\mid_{\lambda} = \frac{1}{N}\frac{\lambda w}{-U_{NN} + \frac{U_{CN}^2}{U_{CC}}} = \frac{1}{N}\frac{U_N}{U_{NN} - \frac{U_{CN}^2}{U_{CC}}}.$$

The elasticity shows how labor supply responds to an intertemporal reallocation of wages that leaves the marginal utility of wealth unaffected.

[9]To cite Mendoza (1991) these preferences "...allows the model to focus expressly on the interaction of foreign assets and domestic capital as alternative vehicles of savings, at the cost of eliminating the wealth effect on labor supply."

B.3 Budget Constraint

The per-period budget constraint is:

$$\begin{aligned} & P_t^H C_t + P_t^I \cdot G(I_t^H, I_t^F) + \Psi(D_t) + \Phi(K_{t+1}, K_{t+1}^E, K_t, K_t^E) \\ \leq \ & r_t^K K_t + w_t N_t + \left[D_t - (1+R^*)\, D_{t-1}\right]. \end{aligned} \tag{16}$$

Households own the capital stock and rent it to firms at rental rate r_t^K. They receive a wage w_t. C_t and P_t^H represent domestic consumption and price of home goods. $G(I_t^H, I_t^F)$ is a new investment good, which can be purchased at price P_t^I. $\Phi(K_{t+1}, K_{t+1}^E, K_t, K_t^E)$ are the costs associated with adjusting the aggregate capital stock K and the sector-specific capital stock K^E. As above $\Psi(D_t)$ is the function that determines the cost of adjusting the portfolio.

C. Factor-market Inflexibilities

C.1 Capital Adjustment Costs

The stock of capital evolves according to:

$$K_{t+1} = (1-\delta)K_t + G(I_t^H, I_t^F), \tag{17}$$

where δ is the rate of depreciation. Unlike closed-economy models, adjustment costs to capital are needed in open-economy models to avoid excessive responses in aggregate investment I_t to domestic-foreign interest rate differentials. Small capital adjustment costs suffice to bring the volatility of investment in the model in line with the volatility of investment observed in the data. The two-sector structure poses an additional problem. Empirically we observe that capital is not very mobile across sectors and comoves (Boldrin et al. (2001)), so I need to impose adjustment costs $\Phi(K_{t+1}, K_{t+1}^E, K_t, K_t^E)$ on both the aggregate capital stock and sector-specific capital stock. The functional form for these costs is:

$$\Phi(K_{t+1}, K_{t+1}^E, K_t, K_t^E) = \frac{\phi}{2}(K_{t+1} - K_t)^2 + \frac{\phi}{2}(K_{t+1}^E - K_t^E)^2.$$

These type of quadratic capital adjustment costs have been widely used. The restrictions on $\Phi(K_{t+1}, K_{t+1}^E, K_t, K_t^E)$ are such that non-stochastic steady-state adjustment costs are zero and the domestic interest rate equals the marginal product of capital net of depreciation.

C.2 Labor Adjustment Costs

One-sector business cycle models do not typically have labor adjustment costs. Because of the two-sector set-up described above, however, I introduce adjustment costs on sectoral hours worked, N_t^E and N_t^H to avoid strong negative comovement of labor across the two sectors.[10] The adjustment costs take a quadratic form. In the export sector, for example, the present value of profits is:

$$\Pi^E = \mathbf{E}_0 \sum_{t=0}^{\infty} \beta^t \frac{\lambda_t}{\lambda_0} \left[Y_t^E - r_t^K K_t - w_t N_t^E - \frac{\theta}{2}(N_t^E - N_{t-1}^E)^2 \right]$$

The first-order condition for N_t^E is:

$$(1-\alpha)\left(K_t^E/N_t^E\right)^\alpha = w_t - \theta(N_t^E - N_{t-1}^E) - \frac{\beta\lambda_{t+1}}{\lambda_t}\theta(N_{t+1}^E - N_t^E).$$

D. Equilibrium

A competitive equilibrium is a set of allocations for sectoral output, consumption, capital, labor, debt and prices $\left\{P_t^H, P_t^I, r_t^K, r_t^f, \lambda_t, w_t\right\}_{t=0}^{\infty}$ such that given exogenously determined processes for $\{A_t, B_t\}_{t=0}^{\infty}$: (i) the households maximize utility subject to the budget constraint and the capital accumulation technology. (ii) Factor markets clear. Firms choose to maximize profits given prices. (iii) Markets clear.

IV. Parameterization

The model is calibrated at quarterly frequency on Argentina, a widely studied country in the literature.[11] Table 6 summarizes the benchmark parameter values.

A. Preferences and Labor Supply

The quarterly discount rate β matches the average real interest rate on Argentine foreign debt, and is in line with values used by Neumeyer and Perri (2005). The depreciation rate is set to match an average investment to GDP ratio of 20 percent (the average in the 1980-2000 period). The capital exponent in the production functions α is set to 0.4.

The labor exponent in the GHH specification for the utility function, $1+\theta$, is set to 1.45 in Mendoza (1991) and Schmitt-Grohe and Uribe (2003), 1.66 in Neumeyer and Perri (2005), and 1.7 in Correia et al. (1995). In the baseline calibration I set $\theta = 0.60$, implying a Frisch

[10] See Christiano and Fitzgerald (1998) on the comovement of factor inputs in two-sector models.

[11] Most calibrated parameter values (capital share, depreciation rate, Frisch elasticity) are similar across emerging and developed economies. The annualized model statistics are similar.

elasticity of $1/\theta = 1.66$. The calibration for the labor weight ω corresponds to a steady state supply of labor of 0.30. As in Mendoza (1991) and Schmitt-Grohe and Uribe (2003), I set the utility curvature $\sigma = 2$.

B. Investment Aggregator and Adjustment Costs

Following Bems (2008), I set $\sigma_I = 1$ corresponding to the Cobb-Douglas aggregator and the share ω_H of home investment in the aggregator is 0.50. The adjustment cost parameters for aggregate and sector-specific capital are set to match the observed volatility of aggregate investment and the capital stock.

C. Asset Market and the Trade Balance

As in Schmitt-Grohe and Uribe (2003) and Neumeyer and Perri (2005), the coefficient Ψ on the interest rate premium takes a small value. The steady-state level of debt D is chosen such that the steady-state average trade balance to output ratio equals about one percent. For Argentina, the average trade balance to output ratio was 0.77 percent, whereas the average goods trade balance to output ratio was 1.68 percent over the period 1980-2000.

D. Productivity Shocks

The logarithm of the productivity shock in the domestic sector follows an $AR(1)$ process with coefficient ρ_a :

$$\log(A_t) = \rho_a \log(A_{t-1}) + \varepsilon_{A,t} \tag{18}$$

$$\varepsilon_{A,t} \sim N(0, \sigma_A) \tag{19}$$

The estimation of the process for shocks to total factor productivity is not possible in the case of emerging economies as hours worked are not available, so the parameters of the $AR(1)$ process are calibrated as in Kydland and Prescott (1982). Persistence ρ_a is chosen so that the model generates a persistence of output of about 0.70, about the serial correlation that is typically observed in EM. The standard deviation σ_a of the innovation ε_A is set such that the model matches the volatility of output.

The logarithm of the productivity shock in the export sector follows an $AR(1)$ process with coefficient ρ_B :

$$\log(B_t) = \rho_B \log(B_{t-1}) + \varepsilon_{B,t}.$$

In what follows, the only exogenous driving forces in the two-sector model are productivity shocks to the home sector, according to the AR(1) process in equation (18). To generate volatility in exports in line of what is observed in the data, shocks to B_t have to be added.

V. Implications of the Model

This section evaluates the performance of the two-sector small open economy model with respect to the trade balance. This is the model described in section III., with GHH preferences, and quadratic portfolio, capital and labor adjustment costs. To facilitate the comparison with the earlier literature and motivate the use of GHH preferences, I re-examine a variant of the standard one-sector small open economy model before turning to the two-sector model. A summary of this model with quadratic capital and portfolio adjustment costs, can be found in appendix B.

A. Cyclicality of the Trade Balance

As emphasized in Mendoza (1991), the defining feature of a small open economy model is the separation between savings and investment. After a serially correlated productivity shock, two opposing forces determine if and for how long the economy will borrow abroad. On the one hand, agents can invest some of the windfall abroad and receive the exogenous world interest rate R^* as return. In this case, savings go up in anticipation of lower income in the future. On the other hand, agents can borrow internationally and build more domestic capital to benefit from the temporarily higher level of productivity. Savings decrease in the latter case. Figure 4 shows the impulse responses of output, labor effort, consumption, investment and the trade balance to output ratio to a one standard deviation productivity shock in the standard one-sector small open economy model with CD and GHH preferences. The models are calibrated so that they have the same persistence of output and volatility of output and investment.

The first column of table 7 summarizes the models' implications for the cyclicality of the trade balance. In the standard one-sector model with CD preferences, the trade balance is procyclical. The correlation between output and the trade balance over output ratio is 0.58. In the model with GHH preferences, on the other hand, the trade balance is acyclical. The correlation of output with the trade balance over output ratio is 0.01. Figure 4 shows the difference in cyclicality of the trade balance can be traced down to the response of consumption. The responses of output and investment are similar in both models (remember the models are calibrated to have the same persistence and volatility of output and investment). The response of consumption to a productivity shock, on the other hand, is much larger with GHH preferences than with standard preferences. As discussed in section III., in a model with CD preferences consumption is very smooth and the savings effect dominates. Using GHH preferences implies a stronger response of consumption, and the economy will borrow from abroad.

I now turn to the two-sector model with GHH preferences. Figure 5 shows the impulse responses of real output, real consumption, real aggregate investment, the real price of investment and the trade balance to a one standard deviation productivity shock.[12] The real price of investment is defined as the price of investment P_t^I over the price of domestically produced goods P_t^H. The figure dissects the mechanism behind the strongly countercyclical trade balance in the two-sector model. In response to the one standard deviation shock to productivity in the home sector, the production of domestically produced consumption C_t and investment I_t^H increase. The price of these domestically produced goods P_t^H falls. On the other hand, the small open economy is a price taker for the export good Y_t^E and the imported investment good I_t^F. The productivity shock in the home sector did not increase the output in the export sector. As I_t^F is needed to produce aggregate investment I_t, the price of investment P_t^I will decrease proportionaly less than the price of domestically produced goods P_t^H (see equation 11 defining the investment price index P_t^I). Consequently, the real price of investment increases following the productivity shock in the home sector. Compared to a one-sector model with similar preferences and that is calibrated to generate the same persistence and volatility of output and investment, the economy borrows more to import investment I_t^F and the trade balance turns countercyclical. The first column of table 7 shows that the model produces a strongly countercyclical trade balance.

B. Second Moments

To judge how the model performs with respect to volatility, table 8 reports unconditional second moments observed in the data and implied by the different models. The first row reports the median of the second moments observed in EM.[13] Numbers for the standard small open economy models are similar to what has been found in previous work. The table confirms that in a model with CD preferences the volatility of consumption relative to the volatilty of output is low compared to the case of GHH preferences and that GHH preferences match the volatility in the hours worked series. In the one-sector models investment is more volatile than output and output is in turn more volatile than consumption. The table shows that the two-sector model is also consistent with these observations.

VI. Conclusion

This paper focuses on the business cycle properties of trade flows in EM. A key result of the earlier literature is that EM business cycles are characterized by strongly countercyclical trade balances. The innovation of my paper is to explore the role of the composition and cyclicality of trade flows and highlight differences with a group of developed economies. From the trade data I find that in a typical emerging economy capital good imports are procyclical, whereas

[12] Real variables were obtained by scaling by P_t^H.

[13] For hours worked, the series used in Neumeyer and Perri (2005) is reported.

exports tend to be acyclical. The paper then studies the dynamics of savings and investment in a model environment where countries import part of the capital stock. In contrast to earlier work on small open economy models, this model is able to generate a strongly countercyclical trade balance.

This research could be extended in several dimensions. From an empirical point of view, explaining why the cyclicality of exports differs across emerging and developed countries, is a line of research certainly worth pursuing. One could examine the presence and evolution of a common shock across countries and the role of trade as a transmission channel. From a model point of view, one could develop models documenting how emerging economies mature, and study the implications of this transition for the behavior of the trade balance, consumption and variety of exports at the product level.

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Appendix A: Data Sources

National Accounts Data

National accounts data are from the IMF International Financial Statistics (IFS). The emerging market classification follows the Standard and Poor's and the International Finance Corporation (IFC).[14] As in Neumeyer and Perri (2005), real variables for gross domestic product, consumption, gross fixed capital formation, imports and exports, are obtained by dividing nominal components of GDP by the GDP deflator.

Trade Data

Feenstra et al. (2005) present bilateral trade data by commodity for the period 1962-2000.[15] The data are constructed from United Nations data over two periods: (i) 1962-83, where the data covers all trading partners and classification follows the Standard International Trade Classification (SITC) Rev.1 and (ii) UN comtrade data for 1984-2000, covering trade flows above $100,000 dollar per year from 72 reporter countries classified by SITC Rev. 2. The dataset updates the Statistics Canada World Trade Database with that difference that Feenstra et al. (2005) give priority to the trade flows reported by the importing country. Arguably these are more accurate than exporters'reports. If the importer report is not available then the corresponding exporter report is used.

Capital Good Imports and Exports constructed from Trade Data

The UN-NBER trade data are available by type of product but do not distinguish by use as intermediate, consumption, or investment good. Eaton and Kortum (2001) approximate trade in capital equipment by trade in goods associated with major equipment producing industries. They identify equipment-producing industries after consulting input-output tables and capital flows tables of domestic transactions for each of the three major capital-good producers (Germany, Japan, and the United States). The three industries identified as major capital goods producers are: (i) electrical machinery, (ii) nonelectrical machinery, and (iii) instruments. The output of these three industries is much more likely to be produced for investment, though about half of the output of equipment-producing countries is used as intermediate inputs.[16]

[14] The two criteria used in defining a country as an emerging market are that (i) it is a low- or middle-income country as defined by the World Bank and (ii) its "investable" market capitalization is low relative to its most recent GNP figures. The IFC continues to include new markets as they open their doors to foreign investment. IFC markets during the sample period include: Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela; China, Korea, Philippines, and Taiwan, China; India, Indonesia, Malaysia, Pakistan, Sri Lanka, and Thailand; Czech Republic, Egypt, Greece, Hungary, Israel, Jordan, Morocco, Nigeria, Poland, Portugal, Russia, Saudi Arabia, Slovakia, Turkey, South Africa, Zimbabwe. The IFC graduated Portugal from its index series in 1999.

[15] See www.nber.org/data.

[16] See page 1231 in Eaton and Kortum (2001). An important caveat to this classification is that investment goods are also produced by the textile products industry, wood processing, paper products, and metal processing.

For the three major equipment producing countries, the three industries cover at least 60% of the manufacturing sector's total output of investment goods and the equipment-producing industries generate about 80% of the investment goods used by the manufacturing sector.

For each country I construct two variables measuring total capital good imports ($M^{K,\$}$) and exports ($X^{K,\$}$) of machinery and transport equipment in a given year. In the SITC Rev. 2, this corresponds to category 7, machinery and transport equipment. This category includes: power-generating machinery and equipment (71), machinery specialized for particular industries (72), metalworking machinery (73), general industrial machinery and equipment (74), office machines and automatic data processing (75), telecommunications (76), electrical machinery, apparatus and appliance (77), road vehicles (78), and transport equipment (79).

Deflator series for imported and exported equipment are not available for most countries and an equipment deflator for a given country corresponds to the price of equipment used in that country and could be different from the price of equipment produced in and exported from that country.[17] Despite these data limitations a number of researchers have argued equipment is a highly tradable good and suggested the price of capital goods is the same across countries. Hsieh and Klenow (2007) find that capital goods tend to be no more expensive in poor countries than in rich countries. The relative price of capital in poor countries is high because consumption goods are much cheaper, not because investment goods are more expensive. This empirical regularity suggests the high relative price of investment in poor countries is driven by the denominator rather than the numerator.[18] Purchasing power parity investment rates are lower in poor countries largely because the price of investment goods *relative* to consumption goods is higher in these countries. This motivates the use of a world price of capital to obtain real import and export values. The U.N. International Comparison Program (ICP) collects data on the prices of between 500 and 1500 individual goods and services. Unfortunately these data only exist for selected countries and years.[19] The countries in the ICP are benchmark countries for the Penn World Tables. For non-benchmark years country-years, prices and PPP values are then inferred from fitted values of price regressions on the benchmark data. Hsieh and Klenow (2007) also point out that PPP prices provided by the Penn World Tables are effectively the prices prevailing in the rich countries.[20]

[17]Navaretti et al. (2000) find that poorer countries tend to import a higher share of used equipment.

[18]De Long and Summers (1993) present evidence that the price of investment goods relative to the GDP deflator as a whole is much greater in poor than in rich countries. The relative price of equipment is close to the inverse of the national product deflator. Eaton and Kortum (2001) also point out that price measures from the ICP show no systematic differences in capital goods prices among rich and poor countries.

[19]Benchmark data exist for 1970 (16 countries), 1975 (34 countries), 1980 (61 countries), 1985 (64 countries), 1990 (24 countries), and 1996 (115 countries).

[20]Hsieh and Klenow (2007): "The Penn World Tables use a Gheary-Kamis procedure to calculate PPP prices. The PPP price of a good, say consumption (individual goods are finer than this) would be defined as $P_c = \sum_j \frac{P_c^j}{E^j} \frac{C^j}{C^w}$, where P_c^j is the domestic currency price of consumption in country j, $C^w = \sum_j C^j$ is world

Given the data issues, I convert the dollar value of capital good imports $M^{K,\$}$ and capital good exports $X^{K,\$}$ in the national currency, $M^{K,DOM}$ using the spot exchange rate (domestic currency in terms of foreign currency) S_t. Under the assumption of freely traded capital goods, absolute purchasing power holds:

$$P_t^K = P_t^{K,\$} \cdot S_t^{DOM/\$},$$

where P^K ($P_t^{K,\$}$) is the imported equipment price (foreign equipment price). As with the national accounts variables, real quantities in domestic currency are calculated by dividing the nominal domestic currency values by the GDP deflator $Defl_t^{GDP}$. For example, real capital good imports M_t^K are calculated as follows:

$$M_t^K = \frac{M_t^{K,\$} \cdot S_t^{DOM/\$}}{Defl_t^{GDP}}.$$

Appendix B: Small-Open Economy Model

This appendix briefly describes the baseline small-open economy model referred to in the text. Close variants of this model can be found in Mendoza (1991) and Schmitt-Grohe and Uribe (2003).

Baseline model

The utility function is time-separable:

$$E_0 \sum \beta^{t-1} U(C_t, L_t),$$

and L_t is leisure and employment $N_t = 1 - L_t$. Popular specifications for the utility function $U(\cdot)$ used in the literature are either Cobb-Douglas or Greenwood-Hercowitz-Huffman discussed in section III.. The budget constraint is:

$$C_t + I_t + \left[(1 + R_{t-1}^*)D_{t-1} + \Psi(D_t)\right] + \Phi(K_{t+1} - K_t) \leq Y_t + D_t, \tag{20}$$

R_{t-1}^* denotes the world interest rate at which the small open economy borrows internationally and I_t is expressed in terms of consumption units. D_t is the foreign (dollar denominated) non-indexed bond (net foreign asset position). The timing for the bond in the budget constraint specification is similar to Schmitt-Grohe and Uribe (2003). The functional form for $\Psi(\cdot)$ is**:**

$$\Psi(D_t) = \frac{\psi}{2}(D_t - \bar{d})^2.$$

consumption and $E^j = \frac{P^j{}_c C^j + P_i^j I^j}{P_c C^j + P_i I^j}$ is the PPP exchange rate of country j. In addition, E^{US} is typically normalized to 1 so that the units are US dollars. Because the weights used to aggregate country prices are aggregate quantities, rich country prices are over-weighted relative to poor country prices."

The first order condition for bond holdings is then:

$$
\begin{aligned}
\underbrace{\lambda_t \left[1 - \psi(D_t - \bar{d})\right]} &= \beta E_t \left[\lambda_{t+1}(1 + R^*_{t+1})\right] \\
\text{Marginal Benefit} &= \text{Marginal Cost of Unit Debt Increase} \\
\hat{\lambda}_t - \psi D \hat{d}_t &= \hat{\lambda}_{t+1} + \frac{R}{1+R}\hat{R}^*_{t+1}.
\end{aligned}
$$

Schmitt-Grohe and Uribe (2003) interpret this condition as follows; if the household chooses to borrow an additional unit, then current consumption increases by one unit minus the marginal portfolio adjustment cost $\psi(D_t - \bar{d})$. The value of this increase in consumption in terms of utility is given by the left-hand side. Next, the household must repay the additional unit of debt plus interest. Following Mendoza (1991), Schmitt-Grohe and Uribe (2003), Neumeyer and Perri (2005) or Aguiar and Gopinath (2007), the functional form for the capital adjustment function $\Phi(\cdot)$ is quadratic:

$$
\Phi(K_{t+1} - K_t) = \frac{\phi}{2}(K_{t+1} - K_t)^2.
$$

Equilibrium

A equilibrium is a set of allocations and prices such that given exogenously determined prices :

- the households maximize utility subject to the budget constraint and the capital accumulation technology.
- Factor markets clear. Given the import price of capital and the demand for exports firms choose to maximize the profit functions.
- Markets clear.

Table 1: Data Sources

Country	Code	Source NA	Trade Data
Emerging			
Argentina	arg	IFS	UN-NBER
Brazil	br	IFS	UN-NBER
Chile	chl	IFS	UN-NBER
Colombia	col	IFS	UN-NBER
Greece	gr	IFS	UN-NBER
Indonesia	ind	IFS	UN-NBER
Israel	is	IFS	UN-NBER
Korea Rep	ko	IFS	UN-NBER
Malaysia	mal	IFS	UN-NBER
Mexico	mex	IFS	UN-NBER
Peru	per	IFS	UN-NBER
Philippines	ph	IFS	UN-NBER
Portugal	port	IFS	UN-NBER
South Africa	sa	IFS	UN-NBER
Thailand	th	IFS	UN-NBER
Turkey	tk	IFS:1987	UN-NBER
Venezuela	ven	IFS	UN-NBER
Developed			
Australia	aus	IFS	UN-NBER
Austria	austr	IFS	UN-NBER
Belgium	bel	IFS	UN-NBER
Canada	can	IFS	UN-NBER
Denmark	den	IFS	UN-NBER
Netherlands	nl	IFS	UN-NBER
Spain	spa	IFS	UN-NBER
Sweden	swe	IFS	UN-NBER
G-7			
Italy	it	IFS	UN-NBER
Japan	jp	IFS	UN-NBER
USA	us	IFS	UN-NBER

Note: The definition of an emerging market follows the classification of the International Finance Corporation. IFS: International Financial Statistics. UN-NBER is data from Feenstra et al. (2005).

Table 2: Capital Goods Import and Export Shares in EM and Developed Economies

Country	$X^{K,\$}/X^{\$}$	$M^{K,\$}/M^{\$}$	$X^{K,\$}S/Y$	$M^{K,\$}S/Y$
Emerging				
Argentina	5.99	40.66	0.52	2.21
Brazil	17.28	30.74	1.53	1.75
Chile	0.97	42.13	0.25	7.62
Colombia	2.02	37.24	0.24	4.27
Greece	6.02	30.33	0.66	6.61
Indonesia	1.52	37.50	0.43	6.61
Israel	23.49	31.25	4.93	8.92
KoreaRep	36.13	34.28	9.37	9.42
Malaysia	33.54	50.40	25.75	33.20
Mexico	39.16	46.36	6.17	5.17
Peru	0.90	36.21	0.10	4.25
Philippines	25.65	29.37	5.64	8.28
Portugal	19.23	35.81	4.18	10.93
South Africa	2.32	42.90	0.62	7.34
Thailand	20.87	40.08	5.80	15.26
Turkey	8.77	34.68	1.02	6.00
Venezuela	1.06	43.76	0.31	5.57
Group Median	8.77 [5.99,25.65]	37.24 [36.21,40.08]	1.02 [0.52,5.64]	6.61 [5.57,8.28]
Developed				
Australia	6.39	44.23	0.59	3.51
Austria	35.92	37.12	8.23	10.21
Belgium	27.40	25.55	15.78	15.29
Canada	36.31	51.90	8.81	11.79
Denmark	23.08	30.90	3.76	4.49
Netherlands	22.25	30.97	10.48	12.06
Sweden	42.78	38.14	11.33	8.93
Group Median	31.66 [25.24,36.30]	36.59 [30.94,37.63]	8.52 [6.16,9.65]	9.57 [7.66,11.79]
G-7				
Italy	35.68	28.62	5.59	4.76
Japan	69.69	15.31	7.12	0.94
USA	45.94	43.31	3.20	3.84

Note: To calculate the GDP share of imports and exports in national currencies, the dollar value of traded capital goods was multiplied by the average exchange rate in a given year. Block-bootstrapped 95% confidence intervals in brackets.

Table 3: Business Cycles Characteristics

Country	Correlations with output Y			
	TB/Y	TB^G/Y	C	I
Emerging				
Argentina	-0.87	-0.86	0.74	0.93
Brazil	-0.37	-0.47	0.05	0.51
Chile	-0.71	-0.72	0.85	0.87
Colombia	-0.31	-0.22	0.43	0.72
Greece	-0.22	-0.27	-0.04	0.65
Indonesia	-0.39		0.76	0.86
Israel	-0.51	-0.49	0.58	0.58
Korea Rep	-0.72	-0.74	0.89	0.84
Malaysia	-0.71	-0.68	0.81	0.89
Mexico	-0.68	-0.68	0.69	0.80
Peru	-0.58	-0.61	0.77	0.80
Philippines	-0.68	-0.57	0.74	0.91
Portugal	-0.41	-0.31	-0.05	0.64
South Africa	-0.65	-0.69	0.77	0.78
Thailand	-0.88	-0.89	0.89	0.97
Turkey	-0.61	-0.63	0.73	0.87
Venezuela	-0.77	-0.75	0.60	0.84
Group Median	-0.66 [-0.71,-0.51]	-0.65 [-0.70,-0.49]	0.73	0.80
Developed				
Australia	-0.52	-0.51	0.27	0.90
Austria	-0.15	-0.07	0.69	0.64
Belgium	-0.21	-0.09	0.36	0.89
Canada	-0.16	-0.18	0.62	0.75
Denmark	-0.12	-0.08	-0.05	0.89
Netherlands	-0.35	-0.35	0.77	0.80
Sweden	-0.12	-0.08	-0.05	0.89
Group Median	-0.16 [-0.35,-0.12]	-0.09 [-0.35,-0.07]	0.39	0.89
G-7				
Italy	-0.21	-0.22	0.91	0.90
Japan	-0.57	-0.53	0.63	0.95
USA	-0.47	-0.40	0.71	0.94

Note: Trade Balance (TB) is exports of goods and services (EXP) minus imports of goods and services (M) over GDP (Y). The Goods Trade Balance (GTB) is goods exports minus goods imports over GDP. Consumption (C) is private consumption. Investment (I) is gross fixed capital formation. All series except the trade balances are in logs.Block-bootstrapped 95% confidence intervals in brackets.

Table 4: Cyclicality of Trade Flows

Country	Correlations with output Y					
	X	X^K	X^K/X	M	M^K	M^K/M
Emerging						
Argentina	-0.60	-0.24	0.38	0.65	0.62	0.61
Brazil	-0.34	-0.11	0.24	-0.08	0.59	-0.23
Chile	-0.06	0.32	0.32	0.86	0.78	0.53
Colombia	0.10	0.25	0.17	0.66	0.24	0.41
Greece	0.21	0.41	0.35	0.60	0.43	0.31
Indonesia	0.18	-0.02	0.02	0.39	0.46	0.51
Israel	0.01	-0.11	-0.04	0.44	0.50	0.34
Korea Rep	-0.24	0.02	0.52	0.78	0.47	0.27
Malaysia	0.23	0.26	0.25	0.65	0.57	0.09
Mexico	-0.70	-0.89	-0.38	-0.09	0.08	0.11
Peru	-0.40	-0.14	0.04	0.54	0.34	-0.01
Philippines	0.42	0.16	0.26	0.84	0.78	0.65
Portugal	-0.03	0.01	0.22	0.34	0.67	0.52
South Africa	0.16	0.24	-0.27	0.83	0.79	-0.22
Thailand	0.11	0.06	0.06	0.80	0.71	0.37
Turkey	-0.13	-0.35	0.29	0.71	0.90	0.72
Venezuela	-0.48	-0.14	0.06	0.81	0.72	0.51
Group Median	-0.03 [-0.24,0.10]	0.01 [-0.11,0.06]	0.22 [0.04,0.29]	0.65 [0.54,0.80]	0.59 [0.47,0.72]	0.37 [0.11,0.51]
Developed						
Australia	0.29	0.40	-0.54	0.71	0.62	-0.07
Austria	0.58	0.44	-0.07	0.63	0.69	0.29
Belgium	0.44	0.43	0.00	0.44	0.16	-0.20
Canada	0.73	0.55	-0.17	0.77	0.73	0.14
Denmark	0.38	0.24	0.39	0.48	0.16	0.29
Netherlands	0.36	0.55	0.17	0.51	0.77	0.32
Sweden	0.38	0.29	0.04	0.48	0.56	0.62
Group Median	0.38 [0.36,0.58]	0.43 [0.29,0.55]	0.00 [-0.07,0.17]	0.51 [0.48,0.63]	0.62 [0.16,0.73]	0.29 [-0.07,0.32]
G-7						
Italy	0.65	0.72	0.25	0.66	0.77	0.33
Japan	0.65	0.58	-0.33	0.76	0.74	0.08
USA	0.43	0.54	0.17	0.83	0.76	0.08

Note: TB/Y is exports of goods and services (EXP) minus imports of good and services (IMP) over GDP. Consumption (C) is private consumption. Investment (I) is gross fixed capital formation. All series except the trade balance are in logs. Block-bootstrapped 95% confidence intervals in brackets.

Table 5: Business Cycle Volatility in Emerging and Developed Economies

Country	% Standard deviation		% Standard deviation of Variable / % Standard deviation of Y					
	Y	TB/Y	C	I	X	M	X^K	M^K
Emerging								
Argentina	3.49	1.54	1.40	2.72	3.31	3.80	5.58	6.39
Brazil	2.15	1.15	2.68	4.70	5.40	3.19	4.58	6.25
Chile	2.84	2.15	1.20	3.82	2.27	2.72	11.73	6.31
Colombia	1.24	1.79	3.04	8.93	6.89	4.59	14.84	11.17
Greece	0.95	1.01	1.16	7.57	4.87	3.10	20.73	10.73
Indonesia	6.07	1.88	0.68	1.47	1.74	1.65	5.22	2.85
Israel	1.13	1.71	2.52	5.11	4.46	4.10	7.60	8.13
Korea Rep	2.67	4.11	1.53	4.46	1.23	2.36	2.90	3.95
Malaysia	2.21	1.93	1.58	3.32	4.61	3.20	2.20	7.52
Mexico	4.68	2.25	0.99	2.13	2.10	1.66	6.79	5.02
Philippines	2.91	1.88	0.52	3.91	1.56	2.76	2.88	7.35
Portugal	1.34	1.87	2.67	6.10	5.02	4.85	7.38	10.78
South Africa	1.54	2.00	1.48	3.92	3.75	4.72	22.60	7.16
Thailand	2.73	3.10	1.04	3.64	1.59	3.08	3.22	5.71
Turkey	2.84	1.92	1.11	2.36	3.04	2.49	2.46	5.23
Venezuela	2.96	5.91	1.84	5.28	4.14	4.97	7.02	8.20
Group Median	2.67	1.92	1.48	3.91 [3.32,4.70]	3.31	3.10	5.58 [4.58,7.60]	6.40 [6.31,7.35]
Developed								
Australia	1.27	0.75	0.58	3.76	3.09	3.60	7.76	6.43
Austria	1.10	0.44	1.17	1.88	3.33	3.42	5.83	7.48
Belgium	0.95	0.39	0.75	3.97	3.85	4.20	8.95	9.93
Canada	1.49	0.76	0.85	3.04	2.75	3.30	3.08	3.94
Denmark	1.17	0.68	0.89	4.38	3.75	3.81	6.09	7.32
Netherlands	1.01	0.69	1.09	2.60	4.09	3.92	7.20	8.12
Sweden	1.17	0.68	0.89	4.38	3.75	3.81	5.93	8.25
Group Median	1.17	0.68	0.89	3.76 [3.04,3.97]	3.75	3.81	6.09 [5.93,7.20]	7.48 [7.32,8.12]
G-7								
Italy	3.29	0.64	1.00	1.33	1.63	1.88	2.07	3.06
Japan	1.07	0.46	0.70	2.69	5.34	9.08	4.68	8.77
USA	1.17	0.33	0.82	2.40	2.99	3.22	3.15	4.48

Note: Trade Balance (TB) is exports of goods and services (E) minus imports of good and services (M) over GDP. Consumption (C) is private consumption. Investment (I) is gross fixed capital formation. All series except the trade balance are in logs. Block-bootstrapped 95% confidence intervals in brackets.

Table 6: Parameter Values

Parameter	Value	Source
σ	2	Curvature utility function
β	0.96	Discount rate
δ	0.02	Set to match average investment to GDP ratio of 20 percent (Argentina: 1980-2000)
α	0.40	Capital Share
θ	0.60	Labor curvature
σ_I	1	Elasticity of substitution for investment (Bems (2008))
ω		30 percent of overall time spent working
ω_H	0.50	Share of home goods in investment
tb/y	0.01	Average trade-balance to output (Argentina: 1980-2000)

Note: See text for more info.

Table 7: Correlation

$Corr(y,\cdot)$	tb/y	i^F	c	i
Data	-0.65 [-0.70,-0.49]	0.59 [0.47,0.72]	0.73	0.80
Two-Sector Model	-0.47	0.87	1	0.87
One-Sector Model				
Cobb-Douglas Preferences	0.58		0.96	0.80
GHH Preferences	0.01		0.98	0.81

Note: Model statistics are averages over 100 simulations of 200 periods. Series are detrended with the Hodrick-Prescott filter.

Table 8: Actual and Simulated Business Cycle Moments

Reported as %	σ_y	$\frac{\sigma_c}{\sigma_y}$	$\frac{\sigma_i}{\sigma_y}$	$\frac{\sigma_{i^F}}{\sigma_y}$	σ_n	$\sigma_{tb/y}$
Data	2.67	1.92	3.91	6.40	2.99	1.92
Two-Sector Model	2.70	0.71	3.52	3.50	2.94	1.23
One-Sector Model						
Cobb-Douglas Preferences	2.50	0.20	2.90		1.26	1.20
GHH Preferences	2.65	0.73	2.6		2.23	0.35

Note: Model statistics are averages over 100 simulations of 200 periods. Series are detrended with the Hodrick-Prescott filter.

Figure 1: Business Cycles in Argentina, 1980-2000.

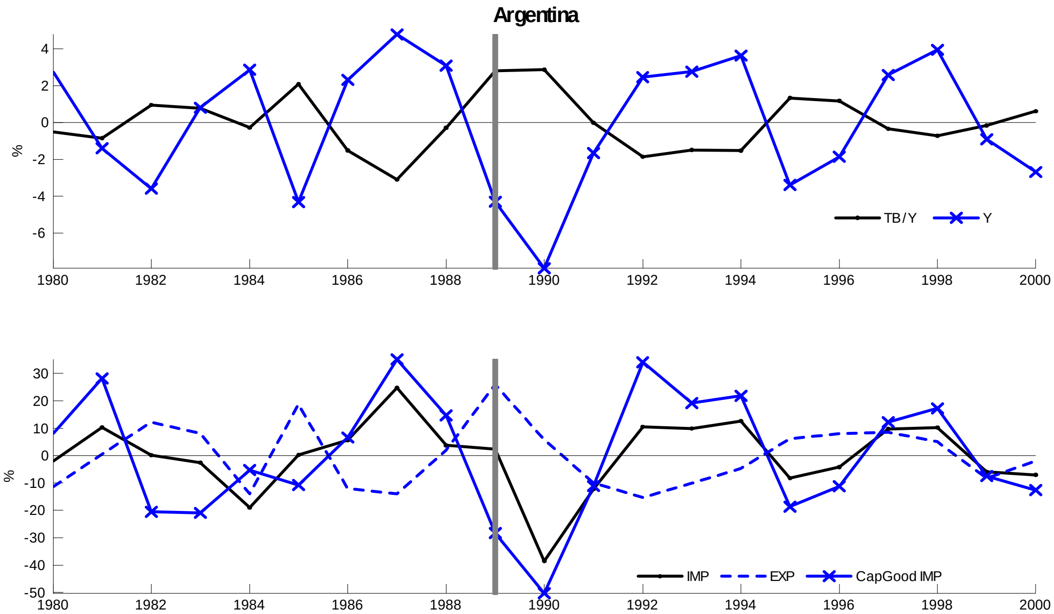

Figure 2: Business Cycles in Thailand, 1980-2000.

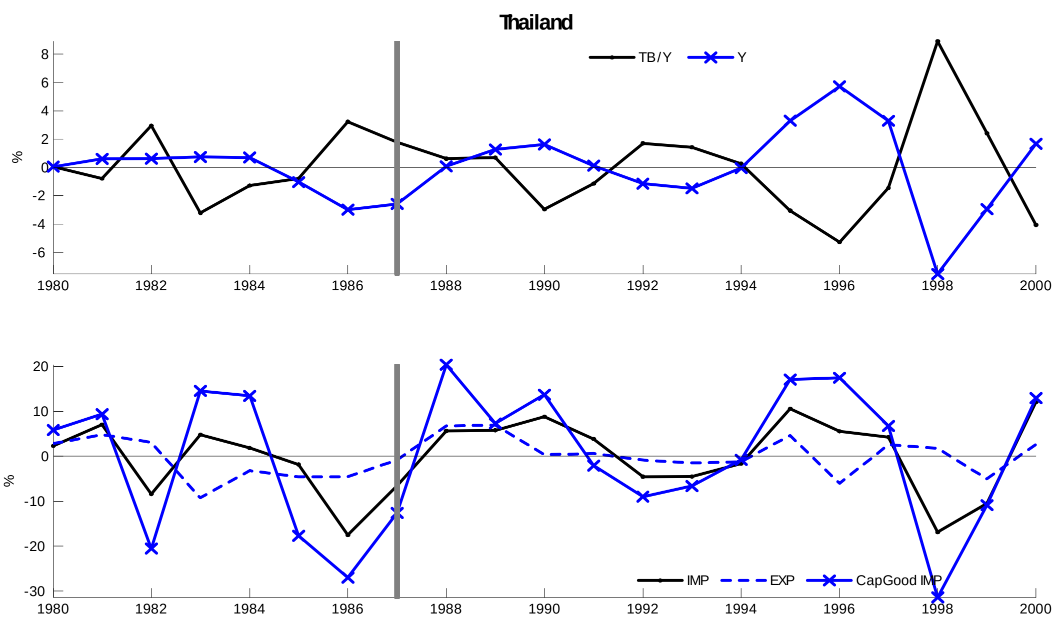

Figure 3: Median Capital Goods Trade Balance and Cyclicality of the Trade Balance, 1980-2000.

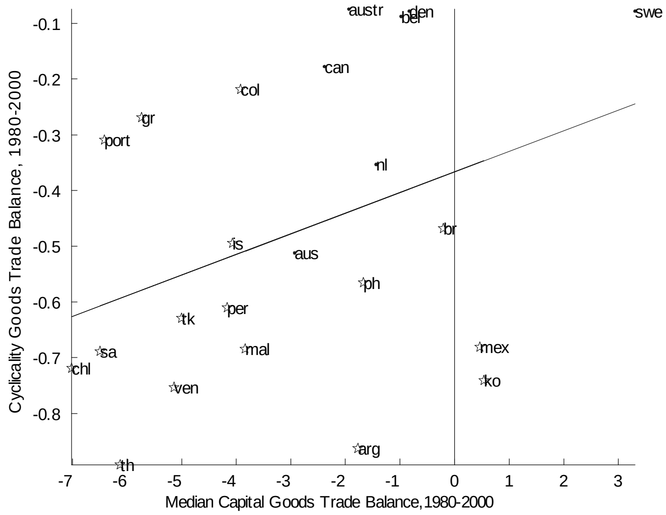

Figure 4: Impulse Response Function to a Productivity Shock in a Standard Small Open Economy Model.

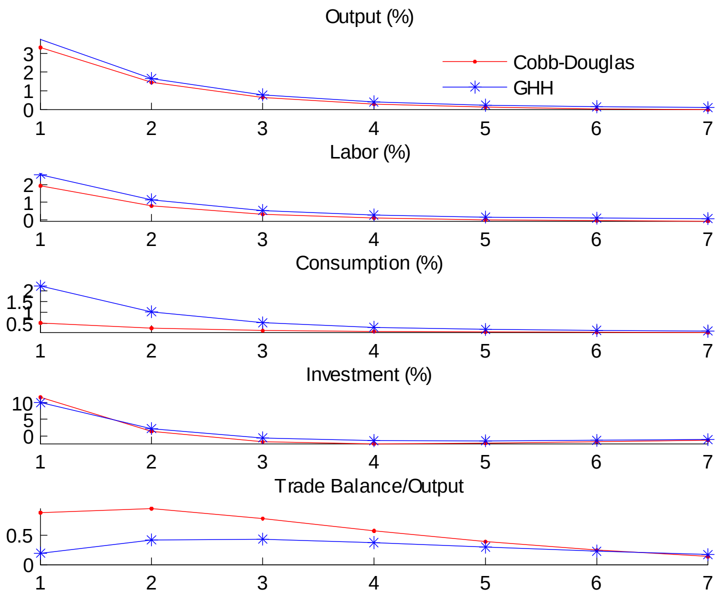

Figure 5: Impulse Response Function to Productivity Shock in the Home Sector.