WP/11/133

IMF Working Paper

Business Cycles in Emerging Markets: The Role of Durable Goods and Financial Frictions

Fernando Alvarez-Parra, Luis Brandao Marques, and Manuel Toledo

INTERNATIONAL MONETARY FUND

 WP/11/133

IMF Working Paper

IMF Institute

Business Cycles in Emerging Markets: The Role of Durable Goods and Financial Frictions

Prepared by Fernando Alvarez-Parra, Luis Brandao Marques, and Manuel Toledo[1]

Authorized for distribution by Jorge Roldós

June 2011

Abstract

This paper examines how durable goods and financial frictions shape the business cycle of a small open economy subject to shocks to trend and transitory shocks. In the data, nondurable consumption is not as volatile as income for both developed and emerging market economies. The simulation of the model implies that shocks to trend play a less important role than previously documented. Financial frictions improve the ability of the model to match some key business cycle properties of emerging economies. A countercyclical borrowing premium interacts with the nature of durable goods delivering highly volatile consumption and very countercyclical net exports.

JEL Classification Numbers: E32, F41, F47.

Keywords: emerging markets, real business cycles, durables, financial frictions.

Author's E-Mail Address: falvarez@caf.com, lmarques@imf.org, and matoledo@eco.uc3m.es.

[1] Alvarez-Parra is research economist at the Corporación Andina de Fomento, Brandao Marques is senior economist at the IMF Institute, and Toledo is assistant professor at Universidad Carlos III de Madrid. The authors thank Pravin Krishna, Jorge Roldós, and Mico Loretan for helpful comments. Toledo is grateful to the Spanish Ministry of Science and Innovation for financial support through grant Juan de la Cierva.

Contents Page

I. INTRODUCTION

The business cycle in emerging market economies is characterized by a strongly countercyclical current account and by sovereign interest rates which are also highly countercyclical, very volatile, and significantly higher than the World interest rate. In addition, total consumption expenditure volatility exceeds income volatility. Aguiar and Gopinath (2007) report that consumption is 40 percent more volatile than income for emerging economies, while slightly less volatility than income for developed economies. This fact is known as the *excess volatility of consumption puzzle*.

The ultimate goal of this paper is to explore possible explanations for business cycle regularities observed in emerging market economies when considering the existence of both consumer durable and nondurable goods. For this effect, we build a model which combines shocks to trend and shocks to cycle (Aguiar and Gopinath, 2007) with financial frictions and durable goods. The disaggregation of consumption into durable and nondurable goods imposes some discipline to our calibration exercises and creates a channel through which shocks can deliver more countercyclical net exports and more volatile expenditure in durable goods. We calibrate the model to match key business cycle facts for Mexico.

One leading explanation for these regularities relies on shocks to trend growth. Aguiar and Gopinath (2007) find that a standard equilibrium model is consistent with the cyclical properties of emerging economies once the income process incorporates shocks to trend in addition to transitory fluctuations around the trend. The intuition comes from the permanent income hypothesis: a change in the trend of income implies a stronger response of consumption than a transitory fluctuation around the trend. They conclude that the business cycle in emerging economies is principally driven by shocks to trend growth. However, we show this result does not hold once we add durable goods to the consumption bundle.

Limited access to international borrowing and other shocks which directly or indirectly affect external interest rates have also been used as an explanations for the puzzle. This is a natural driving force because empirical findings indicate a strong relation between sovereign interest rates and output. In early real business cycle models for small open economies, interest rates disturbances play a minor role in driving the business cycle (Mendoza, 1991). When one adds endogenous borrowing limits to a model of a small open economy, however, consumption volatility increases substantially as savings cannot be used to smooth consumption when the borrowing limit binds (De Resende, 2006). Alternatively, the excessive volatility of consumption can be explained with a financial friction in the form of a working capital borrowing requirement (Neumeyer and Perri, 2005). In this case, a countercyclical borrowing premium amplifies the variability of consumption because it makes the demand for labor more sensitive to the interest rate. Furthermore, shocks to the volatility of the borrowing premium also play a significant role in explaining the volatility of consumption in emerging market economies (Fernández-Villaverde, Guerrón-Quintana, Rubio-Ramírez, and Uribe, 2009).[1] None of these papers, however, consider durable goods.

Other papers in the literature study the importance of durables in shaping business cycles in small open economies. For instance, De Gregorio, Guidotti, and Vegh (1998) study inflation stabilization programs in emerging market economies and the consumption of durable goods. There, a boom-recession cycle in consumption is generated through the wealth effect associated with disinflation (in a cash-in-advance economy) and the existence of non-convex adjustment costs for the purchase of durables. For the large open economy case, Engel and Wang (2011) present a two-country model with durables and nondurables and use it to study the volatility and cyclicality of exports and imports in the United States. Just as we do, they also exploit the fact that, while durables are mostly tradable, nondurables are not. Neither De Gregorio, Guidotti, and Vegh nor Engel and Wang, however, explore the joint role of financial frictions and durable goods in shaping emerging markets business cycles.[2]

Besides Aguiar and Gopinath (2007), our paper relates most to Neumeyer and Perri (2005) and to García-Cicco, Pancrazi, and Uribe (2010). Unlike the latter two, however, we stress the importance of financial frictions in the presence of durable goods. The interaction between financial frictions and durable goods is important in explaining the dynamics of emerging markets' business cycles. This is so because the flow of services coming from the stock of durables yields utility over time; as a consequence, at least part of the purchase of durables that take place today can be seen as postponed consumption (i.e., saving).[3] Therefore, the purchase of durable consumption goods should response strongly to the interest rate. If the latter is countercyclical, an economic expansion caused by a temporary income shock will encourage consumers to borrow from abroad to take advantage of better credit conditions and thus finance the acquisition of durables. This generates highly volatile purchases of durables and a strongly countercyclical trade balance.

[1] There are other explanations for the emerging market consumption volatility puzzle which are not explored here. For instance, Boz, Daude, and Durdu (2008) extend Aguiar and Gopinath's (2007) model to include imperfect information and Restrepo-Echevarria (2008) explores the role of the informal economy.

[2] It is true that the wealth effect created by falling inflation present in De Gregorio, Guidotti, and Vegh's work can be understood as a type of financial friction. Their model, however, only applies to exchange rate-based stabilization programs and not to emerging markets' business cycles in general.

[3] A similar hypothesis has been tested, for instance, by Rosenzweig and Wolpin (1993), according to whom, farmers in India use a durable capital good (bullocks) as the primary vehicle for saving and dissaving.

The present paper enhances our understanding of business cycles in emerging markets. In terms of empirical regularities we find that, after decomposing consumption into durables and nondurables, the excess volatility of consumption puzzle is explained away in the sense that nondurable consumption *is not* more volatile than income either in emerging or in developed economies. In particular, we find that the ratio of the standard deviation of nondurable consumption relative to that of income is 0.9, for a sample of emerging economies, and 0.72, for a sample of developed economies. Furthermore, our quantitative exercises show that, with durable and nondurable goods, the role played by shocks to trend as a driving force for the cycle in emerging economies seems smaller than what is found in Aguiar and Gopinath (2007). We show that a financial friction in the form of a countercyclical borrowing premium (in the sense of the *induced country risk* hypothesis suggested by Neumeyer and Perri, 2005) vastly improves the model's ability to match the key business cycle moments in Mexico while, at the same, greatly reduces the importance of shocks to trend. So, at this stage, we can claim that in order to account for the main characteristics of business cycles in developing economies we need to consider explicit financial frictions and not rely only on the properties of the technology shocks affecting the economy.

The rest of the paper is organized as follows. In the next section, we present some stylized facts about business cycles in open economies. In Section III, we set up a dynamic equilibrium model where preferences are defined over nondurables, durables, and leisure, and where technological shocks include an aggregate shock to trend and two sector-specific shocks to the cycle. Section IV describes the calibration procedure and Section V presents the results. Section VI concludes.

II. Data and Stylized Facts

A. Data

Our sample is restricted to the countries for which we are able to find data on durable goods' spending. We split the sample into developed and emerging market economies placing in the latter group the ones rated as such by MSCI for most of the sample period.[4] We then divide the sub-sample of developed economies into two groups according to size and follow the rule

[4]This criterion means that we include Israel as an emerging market economy since, for the entire sample period it was defined as such by MSCI and only recently upgraded to advanced economy status (May 2010). The criterion also means we include the Czech Republic in the pool of emerging market economies in spite of the IMF's World Economic Outlook having upgraded this country to advanced economy status, in April 2009 (after the end of our sample period).

that an economy is large if its GDP represented at least 2% of the world's GDP from 2001 till 2008 (period for which we had data for all developed economies). This leaves us with three groups: small developed economies (Canada, Denmark, Finland, Netherlands, New Zealand, and Spain), large developed economies (France, Italy, Japan, United Kingdom, and United States), and emerging market economies (Chile, Colombia, Czech Republic, Israel, Mexico, Taiwan Province of China, and Turkey). For each country we collect data (in real terms) on gross domestic product, total private consumption expenditure, consumption of nondurable goods, expenditure in durable goods, investment, and the trade balance. All data is quarterly, except for Colombia for which it is annual. Sample sizes vary and are detailed in Tables 1 and 2.

Our data come from a variety of sources. For the developed economies and the Czech Republic, all data is from the OECD's Quarterly National Accounts, except for the U.S., for which it is from the Bureau of Economic Analysis. For Chile, data is from Central Bank of Chile. Data for Colombia comes from DANE - Departamento Administrativo Nacional de Estadística. Data for Israel is from the Bank of Israel and the Central Bureau of Statistics. Mexican data comes from INEGI - Instituto Nacional de Estadística y Geografía. For Taiwan Province of China, we retrieve the data from National Statistics, Republic of China (Taiwan). Finally, for Turkey we use data from the Turkish Statistical Institute. All variables are seasonally adjusted when needed, converted to logs and detrended using the Hoddrick-Prescott filter.

B. Facts

When it comes to emerging market economies and small open developed economies, the following stylized facts about the business cycle are often cited in the literature (see Aguiar and Gopinath, 2007; Neumeyer and Perri, 2005; Uribe and Yue, 2006, and García-Cicco, Pancrazi, and Uribe, 2010):

1. Real interest rates are countercyclical and leading in emerging markets and acyclical and lagging in developed economies;

2. Emerging market economies have higher volatilities of output and consumption when compared to developed economies;

3. Consumption expenditure is more volatile than output in emerging markets while it is not (quite) as volatile as output in developed economies;

4. Net exports are more volatile and more countercyclical in emerging markets when compared to developed economies.

To these facts we add the following concerning spending in nondurables and durable goods, based on our sample:

- Consumption of nondurables is not more volatile than output in either small open economies or emerging markets. We find that the ratio of standard deviation of consumption-to income is 0.9, for a sample of emerging economies, and 0.72, for a sample of developed economies (see Table 3);
- Spending in durable goods is much more volatile than output in both sets of economies;
- Overall, consumption spending in both durables and nondurables is relatively more volatile in emerging markets than in developed economies.

Looking at the data in Table 1 in more detail, it becomes apparent that the relative volatilities of total consumption spending (i.e., the ratio of the standard deviation of consumption to the standard deviation of GDP) and of nondurable consumption show considerable variation within each group. In the case of the emerging market economies, we have Chile, Israel, and Turkey at the high end and Taiwan Province of China, Colombia, and the Czech Republic at the low end.[5] While the low value (1.02 for total consumption and 0.81 for nondurable consumption) of Colombia can be attributed to the annual frequency at which the data is sampled, the values for Taiwan Province of China (0.80 and 0.92, respectively) and the Czech Republic (0.98 and 0.88, respectively) deserve further exploration.

For the Czech Republic one can argue its integration in the European Union and its overall greater integration into international capital markets made it less sensitive to external shocks and borrowing constraints. As for Taiwan Province of China, a possible explanation is that its consumers seldom face binding borrowing constraints because of a high saving rate. In Figure 1 we plot the relative volatility of consumption against the average saving rate for the 1960-1995 period for all countries in our sample.[6] Although we do not want to imply any sort of causation, at this stage, there clearly is a negative relationship. This is an issue we explore

[5]For Israel and using data after 1995, for which reliability is higher, volatilities of consumption and investment are lower than what is found using the entire sample. Regardless of the sample used for this country, results do not change qualitatively.

[6]Data is from the World Bank's World Saving Database.

more below, when we deal with the calibration and simulation of a model of a small open economy with nondurables and durables, with and without financial frictions.

Table 2 shows the same variability within emerging market economies, now in terms of the correlation of the trade balance with output. While developed economies show uniformly mildly countercyclical trade balances (in line with the averages of -0.17 and -0.25 for OECD countries reported by Aguiar and Gopinath, 2007 and Engel and Wang, 2011, respectively), emerging economies display results which go from mildly procyclical (Taiwan Province of China at 0.25) to strongly countercyclical net exports (Mexico at -0.82). In fact, the average correlation of the trade balance with GDP is, in our sample, only -0.20. These results, however, suffer from a small sample bias as they refer to a group of only a few emerging economies, somewhat biased towards the most developed countries of that population. With a larger sample for emerging economies at hand (but for which data on nondurables and durables is missing), Aguiar and Gopinath find the average correlation between net exports and output to be -0.51.

III. The model

The model we use here is a two-sector neoclassical growth model similar to the one in Aguiar and Gopinath (2007). In our small open economy, however, there are two types of consumption goods: durables and nondurables. The nondurable good is assumed to be non-tradable while the durable good is tradable across borders.[7] This assumption is supported by the work of Engel and Wang (2011) who find that for the average OECD country, the share of durables in imports and exports (excluding raw materials and energy) is 69 percent and 65 percent, respectively. For Mexico, these shares increase to 74 percent and 78 percent. So, although durables represent a smaller fraction of total expenditure than nondurables, they account for most of the trade in goods.

We assume that markets are incomplete since individuals have only access to one financial asset, a risk-free bond which pays interest in units of the durable good. Output in each sector is produced with labor and sector-specific capital. Durables can be used either for consumption or for capital accumulation. Nondurables can be used for consumption or as intermediate inputs for the production of durables. The economy is subject to two temporary sectoral

[7]The assumption that nondurable goods are not traded across countries is needed to avoid an overdetermination arising from the small country assumption for the bond market and factor price equalization across sectors. See Appendix A.3 for a more detailed argument.

aggregate TFP shocks and one aggregate shock to trend. The technology in the nondurable good sector takes the following Cobb-Douglas form:

$$Y_{n,t} = e^{z_{n,t}} K_{n,t}^{\alpha_n} (\Gamma_t L_{n,t})^{1-\alpha_n} \equiv F_n(K_{n,t}, L_{n,t}, z_{n,t}, \Gamma_t). \tag{1}$$

For the durable good sector we assume a production function that combines a nondurable intermediate input in fixed proportions with capital and labor. This assumption of zero elasticity of substitution between the intermediate input and the value added component (which depends on capital and labor) is common in static general equilibrium models and seems to be appropriate for a dynamic setting as well.[8] The value-added component for durables depends on capital and labor combined as in a Cobb-Douglas production function. The technology for the production of durables is

$$Y_{d,t} = \min\Bigg\{ \underbrace{e^{z_{d,t}} K_{d,t}^{\alpha_d} (\Gamma_t L_{d,t})^{1-\alpha_d}}_{\equiv F_d(K_{d,t}, L_{d,t}, z_{d,t}, \Gamma_t)} ; \frac{M_{n,t}}{\Omega} \Bigg\}, \tag{2}$$

where $M_{n,t}$ is the nondurable intermediate input used in the production of the durable good and Ω is the number of units of the intermediate input needed to produce one unit of the durable good (see Kehoe and Kehoe, 1994). The presence of intermediate goods acknowledges the important inter-sectoral links that characterize modern industrial economies. Moreover, studies show that explicitly accounting for such relations in a model improves its ability to reproduce some business cycle regularities; in particular, the comovement in output among sectors (Hornstein and Praschnik, 1997). In (1) and (2), Γ_t is the common trend and $K_{i,t}$ and $L_{i,t}$ denote capital and labor inputs, $\alpha_i \in (0,1)$ represents the capital's share of output, and $z_{i,t}$ is the temporary stochastic productivity process in sector i, for $i \in \{n,d\}$. As in Aguiar and Gopinath (2007), $\Gamma_t = \Gamma_{t-1} e^{g_t}$, where g_t is the (stationary) shock to trend. It is assumed that each shock follows an AR(1) process such that

$$z_{n,t} = \rho_n z_{n,t-1} + \varepsilon_{n,t}, \tag{3}$$

$$z_{d,t} = \rho_d z_{d,t-1} + \varepsilon_{d,t}, \tag{4}$$

$$g_t = (1-\rho_g) \ln \mu_g + \rho_g g_{t-1} + \varepsilon_{g,t}, \tag{5}$$

where $\varepsilon_{g,t}$ is i.i.d $N(0, \sigma_g^2)$ and $\{\varepsilon_{n,t}, \varepsilon_{d,t}\}$ is an i.i.d. bivariate random variable $N(0, \Sigma_Z)$. The contemporaneous covariance matrix of the shocks to the sectoral productivity processes, Σ_Z,

[8] Using a dynamic general equilibrium model at quarterly frequency, Kouparitsas (1998) estimates the elasticity of substitution between these two components at 0.1, which is very close to the Leontief case.

is given by

$$\Sigma_Z = \begin{bmatrix} \sigma_n^2 & \rho_{nd}\sigma_n\sigma_d \\ \rho_{nd}\sigma_n\sigma_d & \sigma_d^2 \end{bmatrix}, \tag{6}$$

where $\rho_{nd} \neq 0$ allows for contemporaneous correlation between the productivity processes. This is needed to generate comovement between sectoral outputs (Baxter, 1996) as we will show in the next section. The assumption that the nondurable goods and the durable goods sectors share a common shock to trend is justified and is not overly restrictive.[9] For instance, Galí (1993) models the changes in consumption of nondurables and durables as ARMA processes using the same assumption. Moreover, shocks to trend are often associated with clearly defined changes in government policy (Aguiar and Gopinath, 2007) and are therefore expected to affect all the sectors.

We assume that labor can be freely allocated between these two sectors so that in each period,

$$L_t = L_{n,t} + L_{d,t}. \tag{7}$$

The representative agent's expected lifetime utility is

$$E_0 \sum_{t=0}^{\infty} \beta^t U(C_t, 1 - L_t), \tag{8}$$

where $C_t = C(N_t, D_t)$ is a total consumption bundle which depends on both the current consumption of nondurable goods N_t and the stock of durable goods D_t.

We assume a constant elasticity of substitution between durables and nondurables, constant relative risk aversion, and a Cobb-Douglas specification for the aggregate consumption bundle and leisure. The period utility function takes the form

$$U(C_t, 1 - L_t) = \frac{\left(C_t^{\theta}(1 - L_t)^{1-\theta}\right)^{1-\sigma}}{1 - \sigma}, \quad \text{where} \tag{9}$$

$$C_t \equiv \left(\mu N_t^{-\gamma} + (1 - \mu) D_t^{-\gamma}\right)^{-\frac{1}{\gamma}}, \tag{10}$$

and $\frac{1}{1+\gamma}$ is the elasticity of substitution between durables and nondurables, μ is the utility share of nondurables, θ is the utility share of consumption, and σ is the coefficient of relative risk aversion.

[9] In fact, all that is required, with respect to this, in order for the problem to have an interior solution is to restrict the trends to have the same long run mean growth.

Following our assumptions on the tradability versus nontradability of durables and nondurables, the economy has the following two resource constraints:

$$
\begin{aligned}
X_{d,t} + X^d_{k,t} + X^n_{k,t} + q_t B_{t+1} &= Y_{d,t} + B_t, \qquad (11)\\
N_t &= Y_{n,t} + M_{n,t}, \qquad (12)
\end{aligned}
$$

where B_t denotes holdings of one-period risk-free bonds, and q_t is the price of bonds issued in period t, $X^i_{k,t}$ is capital investment in sector i, and $X_{d,t}$ represents expenditure in durable goods.

The laws of motion for aggregate capital in both sectors and for the stock of durables are given by

$$
\begin{aligned}
K_{n,t+1} &= X^n_{K,t} + (1-\delta_k)K_{n,t} - \Phi(K_{n,t+1}, K_{n,t}), \qquad (13)\\
K_{d,t+1} &= X^d_{K,t} + (1-\delta_k)K_{d,t} - \Phi(K_{d,t+1}, K_{d,t}), \text{ and} \qquad (14)\\
D_{t+1} &= X_{d,t} + (1-\delta_d)D_t - \Psi(D_{t+1}, D_t), \qquad (15)
\end{aligned}
$$

where δ_d and δ_k are depreciation rates. Moreover, $\Psi(D_{t+1}, D_t)$ and $\Phi(K_{i,t+1}, K_{i,t})$ represent quadratic adjustment cost for durables and each sector's capital stock, respectively. The addition of adjustment costs for the stock of capital is often used to prevent the simulated model from delivering excessive volatility in investment. Likewise, the addition of convex adjustment costs can help explain the observed inertia observed for durables purchases at the aggregate level.[10] There is also the assumption of a second hand market for durable goods as is implicit in (15) since $X_{d,t}$ is allowed to be negative.

We assume that the adjustment costs have the following (standard) functional forms:

$$
\begin{aligned}
\Phi(K_{i,t+1}, K_{i,t}) &= \frac{\phi}{2}\left(\frac{K_{i,t+1}}{K_{i,t}} - \mu_g\right)^2 K_{i,t} \quad i \in \{n, d\}, \text{ and}\\
\Psi(D_{t+1}, D_t) &= \frac{\psi}{2}\left(\frac{D_{t+1}}{D_t} - \mu_g\right)^2 D_t.
\end{aligned}
$$

The price of debt depends on the aggregate level of outstanding debt $\tilde{B}_{t+1}$. As in Schmitt-Grohé and Uribe (2003), households take the bond price as given. To reflect an increased borrowing premium during recessions (possibly the consequence of higher perceived probability of default as in Eaton and Gersovitz, 1981) we also allow q_t to depend on the expected next-

[10]To generate the observed lumpiness and discontinuous nature of this spending at the micro level, however, some degree of consumer heterogeneity and non-convexities in the adjustment technology is needed (Caballero, 1993).

period output level. This way,

$$q_t = \frac{1}{1+r^* + \chi\left[\exp\left(\frac{\tilde{B}_{t+1}}{\Gamma_t} - \bar{B}\right) - 1\right] + \eta\left(E_t \frac{Y_{t+1}}{\Gamma_t} - \bar{Y}\right)}, \tag{16}$$

where $\bar{B}$ and $\bar{Y}$ are the steady-sate levels of the detrended counterpart of the stock of bonds and total output. The countercyclical borrowing premia typically observed in emerging economies should imply an η which is negative and much smaller for that type of economy than for developed economies. The borrowing premium implicit in (16) can be seen as a reduced form of several underlying mechanisms that potentially could generate a strongly countercyclical real interest rate (see Neumeyer and Perri, 2005, for instance).

We focus on the Pareto optimal allocation by solving the planner's problem. The planner maximizes (8) subject to (1), (2), (7), and (11)-(16). This problem can be written as a stationary dynamic programming problem. For this effect, we drop time subscripts and define $\hat{W}$ as the detrended counterpart of variable W (i.e., $\hat{W} \equiv W/\Gamma_{-1}$). Let $\hat{S} = (\hat{D}, \hat{K}_d, \hat{K}_n, \hat{B}, z_d, z_n, g)$ be the state vector and $\hat{x} = (\hat{N}, \hat{D}', \hat{K}_d, \hat{K}_n, L_d, L_n, \hat{M}_n)$ be the choice vector. Let us also denote $\tilde{\beta} \equiv \beta e^{g\theta(1-\sigma)}$. Then, the planner's dynamic programming problem is described by the following Bellman equation:

$$V(\hat{S}) = \max_{\hat{x}} \left\{ \frac{\left(\hat{C}^{\theta}(1-L)^{1-\theta}\right)^{1-\sigma}}{1-\sigma} + \tilde{\beta} E\left[V(\hat{S}')|\hat{S}\right] \right\} \tag{17}$$

subject to

$$\begin{aligned} e^g(\hat{D}' + \hat{K}_n' + \hat{K}_d' + q\hat{B}') &= F_d(\hat{K}_d, L_d) + (1-\delta_k)(\hat{K}_n + \hat{K}_d) + (1-\delta_d)\hat{D} - \\ &\quad \frac{\phi}{2}\left(e^g \frac{\hat{K}_d'}{\hat{K}_d} - \mu_g\right)^2 \hat{K}_d - \frac{\phi}{2}\left(e^g \frac{\hat{K}_n'}{\hat{K}_n} - \mu_g\right)^2 \hat{K}_n - \\ &\quad \frac{\psi}{2}\left(e^g \frac{\hat{D}'}{\hat{D}} - \mu_g\right)^2 \hat{D} + \hat{B}, \end{aligned} \tag{18}$$

$$\hat{N} = F_n(\hat{K}_n, L_n) - \hat{M}_n, \tag{19}$$

$$L = L_n + L_d \leq 1, \tag{20}$$

$$\hat{C} = (\mu \hat{N}^{-\gamma} + (1-\mu)\hat{D}^{-\gamma})^{-\frac{1}{\gamma}}, \tag{21}$$

nonnegativity constraints $L_i \geq 0, K_i' \geq 0,\ i \in \{n,d\}$, $N \geq 0$, and $D' \geq 0$; and stochastic processes (3)-(5). Aggregate bond holdings are made consistent with per capital bond holdings such that $\tilde{B} = B$. Moreover, the planner takes the bond price q as exogenous as she does not internalize the effect of B' on q. This is to be consistent with the fact that households also take q as given, as mentioned above.

We follow Kehoe and Kehoe (1994) and assume producers minimize costs and earn zero profits so that we can write

$$\hat{M}_n = \Omega \hat{Y}_d. \tag{22}$$

Using (22), the first-order optimality conditions coming from this problem are:

$$U_C \mathscr{C}_N p \left[1 - \Psi_{D'}\right] e^g = \tilde{\beta} E_{\hat{S}} \left\{ U_{C'} \left[\mathscr{C}_{D'} + \mathscr{C}_{N'} p' \left(1 - \delta_d - \Psi'_{D'}\right)\right]\right\}, \tag{23}$$

$$U_C \mathscr{C}_N p \left[1 - \Phi_{K'_n}\right] e^g = \tilde{\beta} E_{\hat{S}} \left\{ U_{C'} \mathscr{C}_{N'} \left[F_{n,K'} + p' \left(1 - \delta_k - \Phi'_{K'_n}\right)\right]\right\}, \tag{24}$$

$$U_C \mathscr{C}_N p \left[1 - \Phi_{K'_d}\right] e^g = \tilde{\beta} E_{\hat{S}} \left\{ U_{C'} \mathscr{C}_{N'} \left[p' \left(F_{d,K'} + 1 - \delta_k - \Phi'_{K'_d}\right) + \Omega F_{d,K'}\right]\right\}, \tag{25}$$

$$U_C \mathscr{C}_N p q e^g = \tilde{\beta} E_{\hat{S}} \left[U_{C'} \mathscr{C}_{N'} p' \right], \tag{26}$$

$$U_C \mathscr{C}_N F_{n,L} = U_L, \qquad \text{and} \tag{27}$$

$$F_{n,L} = (p - \Omega) F_{d,L}, \tag{28}$$

where $E_{\hat{S}} = E[\cdot|\hat{S}]$ is the conditional expectation operator, U_C and U_L are the marginal utilities of consumption and leisure, $\mathscr{C}_D$ and $\mathscr{C}_N$ are the derivatives of the consumption aggregator with respect to durables and nondurables, $F_{i,K}$ and $F_{i,L}$ are the marginal products of capital and labor in sector i, and similarly $\Psi_{D'}$ and $\Phi_{K'_i}$ are the derivatives of the adjustment cost functions with respect to D' and K'_i. Moreover, we define p as the ratio (λ_d/λ_n) of the Lagrange multipliers associated with the resources constraints (18) and (19), which can be interpreted as the relative price of durables to nondurables.

The first four equations correspond to intertemporal trade-offs between current nondurable consumption and the accumulation of durable goods, capital and debt. The last two equations represent static optimality conditions for the consumption-leisure decision and labor allocation between sectors.

IV. Calibration

We calibrate the model to the Mexican economy at quarterly frequency. Our parametrization follows as much as possible that of Aguiar and Gopinath' (2007) but accommodates for the inclusion of durable goods. Specifically, the income share of labor is set to 0.48 for nondurables and 0.68 for durables, as used in Baxter (1996). From the same source, the annual depreciation rates for capital and durables are set to 7.1 percent and 15.6 percent, respectively. We set the intermediate input coefficient (Ω) to 0.3, which is close to what Kouparitsas (1998) documents for Mexico (0.28) and within the range (between 0.26 and 0.38, depending on the measure) observed for the U.S. by Hornstein and Praschnik (1997).

The utility share of nondurables (μ) is set to 0.881 to match the average share of consumption of nondurable goods in total consumption expenditure of 91.8 percent. The Cobb-Douglas exponent for consumption in the utility function (θ) is set to 0.413 in order to match a steady-state share of time devoted to work of 1/3. As in Aguiar and Gopinath, we work with a discount factor (β) of 0.98, a coefficient of relative risk aversion (σ) of 2, and a coefficient for the adjustment costs of the capital stocks (ϕ) of 4. From the same paper we take the means and autocorrelation coefficients for the error processes (μ_g,ρ_g,ρ_n, and ρ_d). Following Gomes, Kogan, and Yogo (2009), the elasticity of substitution $\left(\frac{1}{1+\gamma}\right)$ is set to 0.86.[11]

The steady-state level of debt relative to GDP ($-\bar{B}/\bar{Y}$) is fixed at 0.1,[12] and the parameter that determines the sensitivity of the bond price to the debt level (χ) is set to -0.001. The choice of a small value for χ (but different from zero) is justified with the need to avoid the well-known unit root problem of net foreign assets in small open economy models (Schmitt-Grohé and Uribe, 2003) without changing the short-run dynamics. Parameter values are summarized in Table 4.

We calibrate the remaining parameters - the variances of the TFP shocks (σ_g^2, σ_n^2, and σ_d^2), the correlation between shocks to durables and shocks to nondurables (ρ_{nd}), the coefficient for adjustment cost of durables (ψ), and the financial friction parameter (η), by trying to replicate certain business cycle moments.[13] The moments to match vary across different calibration exercises as described below. The resulting parameter values are shown in Table 5.

V. Results

In this section we investigate the business cycle properties implied by our model economy. To that end, we first solve the model using a standard first-order log-linearization procedure, and then compute relevant theoretical moments.[14]

[11]This value means that the two goods are gross substitutes (the condition being $\sigma > 1 + \gamma/\theta$). It is also consistent with Ogaki and Reinhart's (1998) finding that the intratemporal elasticity of substitution between durables and nondurables is significantly higher than the intertemporal elasticity of substitution.

[12]This parameter only matters to determine the steady-state level of net exports and is immaterial for results.

[13]None of these parameters affect the deterministic steady state around which the linearization is performed.

[14]For this effect, we use Dynare for Matlab Version 4.1. The solution consists of policy functions for the control variables (consumption of nondurables, spending in durables, output of nondurables and durables, labor

Table 5 presents business cycle moments for GDP (total value added), sectoral output (industrial production), total consumption expenditure, nondurable consumption, spending in durables, the net exports-output ratio, investment, and the borrowing premium. Moreover, we show a measure of the quality of fit of the simulation (the sum of the square deviations of all the simulated moments relative to the sample moments, normalized by the total variation of all the sample moments) and three measures of the contribution of the permanent shock to nondurables (w_n), to durables (w_d), and to the variance of output.[15] Each column (1)-(5) displays the results for a different calibration exercise as we now explain.

A. No Financial Frictions Case

Our first exercise is to solve for the variances of the TFP shocks as well as ψ and ρ_{nd} to match the volatilities of GDP, consumption of nondurables, durables expenditure, and the net exports-GDP ratio as well as the correlation between the two sectoral outputs.[16] Here, we stay as close as possible to Aguiar and Gopinath's (2007) model. In particular, we set the borrowing premium parameter $\eta = 0$. We call this scenario the *no financial frictions case*.[17] We obtain $\sigma_g = 1.8340$, $\sigma_n = 1.4209$, $\sigma_d = 1.4528$, $\psi = 0.5336$ and $\rho_{nd} = 0.3631$, as shown in column (1) of Table 5, and are able to exactly match the targeted moments (in bold). The estimates of the random walk component of the sectoral Solow residuals are substantially smaller than what Aguiar and Gopinath find for Mexico (0.28 and 0.43 for nondurables and durables, respectively against 0.96). As a result, the permanent shock accounts for about 32 percent of GDP volatility.

As an initial conclusion based on this first simulation results, we find that our framework does a good job at capturing the high volatility of consumption of nondurables and spending in durables. It does reasonably well in mimicking the volatility of total consumption spending

---

for durables and nondurables, and the relative price of durables) and laws of motion for the endogenous states (capital stocks, durables stock, and bond holdings) as a function of the states and forcing variables (shocks to durables and nondurables and shock to trend).

[15] The first two measures are the random walk components for the nondurable and durable sectors calculated as in equation (14) of Aguiar and Gopinath's (2007) paper and the third comes from a variance decomposition of GDP.

[16] We use quarterly data for industrial production in the sectors of consumer durables and nondurables. This data is also from INEGI and covers the same sample period as all other data used for Mexico.

[17] We are aware that the fact that the bond price is sensitive to the aggregate debt level is in itself a financial friction. As mentioned before, the size of that friction (χ) is set to such a small value that it does not significantly affect the short run dynamics of the simulated economy.

and the overall comovement observed in the data.[18] The model also delivers a countercyclical trade balance although it reproduces only about half of what is found in the data. The model performs poorly, however, with respect to some other moments. For instance, it underestimates the relative volatility of investment (3.28 compared to 6.11 in the data) and delivers a strongly procyclical borrowing premium (a correlation with GDP of 0.56 against -0.49 in the data).

A possible solution for the first problem is to add the volatility of investment as an additional moment to match and solve for the capital adjustment cost parameter, ϕ, as well. Unfortunately, we are not able to solve exactly for all six moments using the available six parameters and a lower ϕ has a very modest impact on the volatility of investment.[19] Furthermore, other studies (for example, Neumeyer and Perri, 2005), using different sample periods, find in the data a much lower volatility of investment than we do. For the remainder of this section we fix ϕ at 4 and focus on consumption spending and net exports.

At this stage, it is relevant to ask whether it is important to include durable spending in the model. Specifically, we want to know if durability plays a role. We argue that it does. To this end, we shut down durability by setting $\delta_d \approx 1$ and the adjustment cost of durables ψ to zero. We also recalibrate the parameters μ and θ in order to keep the share of consumption of both goods and the time devoted to work in the steady state unchanged. This allows us to answer the question in the least costly way by not having to change the model into one with two nondurable goods (one tradable and one nontradable). We use the same value for the correlation between the two temporary shocks ρ_{nd} as in column (1), and target the volatility of total consumption spending instead (in addition to that one of GDP and net exports). One caveat is in order: this exercise is only an approximation since spending in durables translates into next period consumption.

The results are displayed in column (2) of Table 5 and show that the model's ability to match the data moments is not substantially different, except for the fact that we cannot find an exact solution. In fact, we get a corner solution since $\sigma_d = 0$. This means that when the consumption goods are different mostly in terms of their tradability and not so much in terms of their durability, the only way we can get a high volatility of consumption without generating too much output volatility is by having the only shock impacting the tradable (and not so durable)

[18] This applies to total hours worked as well since our solution delivers a correlation of 0.76 with GDP which compares to 0.90 in the data (total hours worked in manufacturing for the same sample period). This finding is noteworthy given the difficulty of matching the cyclicality of hours worked in real business cycle models without assuming GHH preferences.

[19] Halving ϕ to 2 only accomplishes a very small increase in σ_i, while making the trade balance more countercyclical and reducing the importance of shocks to trend. Results available from the authors upon request.

good being of a permanent nature. This naturally increases the importance of shocks to trend, which now contribute with 57 percent of GDP volatility.

The exercise of column (2) incorporates two changes when compared to our first calibration in column (1). First, we are shutting down durability. Second, we are targeting total consumption instead of disaggregated consumption. We argue that both changes increase the relevance of shocks to trend. On the one hand, since we no longer target the (low) relative volatility of nondurable consumption, we do not impose so much discipline on the shock process and particularly on σ_g. To isolate this effect, we redo column (2) with δ_d at its benchmark value and ψ at its calibrated value in column (1). We find that shocks to trend contribute with about 37 percent of output variance (column 3), which is around 10 percent greater than in column (1). We attribute this increase to the fact that we are targeting the volatility of total consumption instead of the volatilities of each component of spending. On the other hand, with low durability, “durable" expenditure does not respond nearly as much to shocks, and the only way to generate high volatility of total consumption is by having a significantly larger σ_g.

This point is further reinforced by inspecting Figure 2. There, we plot how the relative volatilities of nondurable consumption, durable spending, and total consumption spending, as well as the correlation between net exports and GDP, react to an increase in σ_g (in the x-axis of each panel). All other parameters are fixed at the same values as the ones used for column (1) of Table 5, except for the rate of depreciation of durables which can take three values: 0.039 (its benchmark value), 0.99 as in column (2), or an intermediate value of 0.51 (results not reported). We can see that, when durability is low (the two higher δ_d), it takes a very large σ_g to deliver a sufficiently volatile total consumption. In contrast, with high durability ($\delta_d = 0.039$), a modest variance of the shock to trend is enough to deliver high volatility of total consumption because of its effect on the volatility of durable expenditure. Regardless of durability, more volatile shocks to trend yields a more countercyclical trade balance. However, in order to get a sufficiently negative correlation of net exports with GDP, the model requires shocks to trend to be so large that consumption, and particularly durable expenditure, becomes too volatile. This suggests more is needed in order to match the cyclical behavior of the Mexican trade balance. We explore next how financial frictions may help in this and other dimensions of the emerging markets’ business cycles.

B. Financial Frictions Case

Two dimensions where the model thus far fares poorly are in capturing the volatility of the borrowing premium (which it grossly underestimates) and in mimicking its countercyclical behavior (in the first two simulations it comes very procyclical). Here we attempt to discipline the dynamics of the model in this dimension by introducing financial frictions.

One simple way to do this is to match the volatility of the borrowing premium by choosing an appropriate value for χ. This is what García-Cicco, Pancrazi, and Uribe (2010) do in a RBC model with financial frictions but no durables. They do not report, however, the simulated moments for the borrowing premium and focus on the autocorrelation of net exports.

An alternative way of introducing a financial friction is to have a non-zero income-elasticity of the borrowing premium, which is defined by the parameter η. A negative value for η implies a countercyclical borrowing premium and is consistent with what Neumeyer and Perri (2005) call the *induced country risk* case. We choose this route instead of calibrating χ because, if we target the observed correlation of the borrowing premium with output, the latter may introduce a bias against shocks to trend. The reason for this bias is that a positive permanent shock causes agents to borrow more and increase their stock of debt which, given $\chi < 0$, causes the borrowing premium to increase as well and, therefore, to be counterfactually procyclical. Therefore, targeting the cyclical dynamics of the borrowing premium may diminish the importance of shocks to trend.

In column (4), we present the results when we target the volatilities of GDP, nondurables consumption, expenditure in durables, the net exports-GDP ratio, and the borrowing premium as well as the correlation between the two sectoral outputs by solving for σ_g, σ_n, σ_d, ψ, ρ_{nd} and η. What we do here is to extend the calibration exercise in column (1) by adding one parameter (η) and one moment ($\rho_{bp,y}$). First, we should note that we are able to find an exact solution and that there is a substantial improvement in the quality of fit of the model compared to column (1). Second, we get an estimate for η of -0.0077, consistent with the *induced country risk* hypothesis. Third, even though we were not explicitly targeting this moment, the correlation of net exports-GDP ratio with GDP (at -0.72) gets much closer to its sample counterpart. Fourth, the importance of the shocks to trend falls, accounting now for about 24 percent of GDP variance.

The reason why a model with durables and financial frictions is able to deliver more countercyclical net exports can be found in the interaction between the accumulation of durables and the countercyclical borrowing premium. The financial friction introduced in our model, which mimics an empirical fact, implies that interest rates are countercyclical and relatively more volatile. As a consequence, during booms the economy can take advantage of cheaper credit by borrowing more to build capital and increase the stock of durables. Since durables are mostly tradable (another empirical fact), part of the accumulation of durables (and capital) will resort to imports. As a consequence, net exports fall during economic expansions making the trade balance countercyclical.

This point is made clear when we compare the impulse-response functions generated by the model with and without the financial friction, which we present in figures 3 through 5.[20] In Figure 3, we show the response of our model economy to a permanent technology shock. It is clear that for all variables except the borrowing premium, the financial friction does not play a significant role when a permanent shock hits the economy. The main intuition why financial frictions are not crucial in the case of a permanent shocks is that (transitory) changes in the borrowing premium do not affect durable spending because the wealth effect induced by the shock is much stronger than the intertemporal substitution effect coming from any change in the interest rate.

In contrast, the financial friction does seem to generate very different dynamics when there exists a temporary shock to nondurable's TFP. As shown in Figure 4, the borrowing premium falls only in the presence of the friction. Therefore, with the financial friction, the interest-rate-sensitive durable spending and investment increase much more and net exports relative to GDP experience a larger drop. In the absence of the friction, durables' accumulation responds less to the shock, borrowing initially increases but eventually declines (standard result under the permanent income hypothesis) and the net exports-GDP ratio drops less and increases earlier.

By inspecting Figure 5, we observe that the financial friction does not seem to be nearly as important in the case of a temporary shock to durables' production. The reason for this is that durables represent a relatively small fraction of total output. Therefore, this shock does not cause output to deviate as much from its steady state and, consequently, the borrowing premium does not move as much either as in the case of a transitory nondurable shock.

To highlight the impact of financial frictions on key business cycle moments and show how they interact with the relative importance of shocks to trend, we show in Figure 6 how the relative volatilities of consumption expenditure (nondurable, durable, and total), as well as the correlation of the net exports-output ratio and GDP, respond to an increase in financial

[20] In these figures, we use the parameters values in column (4) of Table 5 unless otherwise indicated.

frictions (lower η in the x-axis of each panel) for three different values of σ_g. The remaining parameter values are the same as in column (1) of Table 5. We observe that as financial frictions increase, the correlation of net exports with GDP is much less sensitive to changes in the magnitude of the shock to trend (relative to the magnitude of the temporary TFP shocks) and is basically determined by the size of the friction. The relative volatility of the shock to trend, in turn, helps pin down the volatilities of nondurable consumption and durable spending because both expenditures vary with σ_g for any level of η.

C. Robustness

Uribe and Yue (2006) argue that other shocks to the interest rate, independent of income, are more important to explain the movements of country interest rate premia. For this reason we modify (16) by adding an orthogonal shock to the borrowing premium, ε_b,[21] with variance σ_b^2. We then try to match the volatility of the borrowing premium as well. In this case, according to the results presented in column (5), we are not able to exactly match the seven moments. The overall quality of fit, however, remains almost the same and the estimate for σ_b is zero. In fact, the results column (5) can be seen as an overdetermined version of the estimation results presented in column (4). We interpret this result as evidence of the existence of other types of financial frictions in emerging economies which need to be correlated with income.

A more serious robustness concern relates to a possible bias against shocks to trend, in the presence of financial frictions, built into our specification of the borrowing premium. In (16), the borrowing premium depends on the induced country risk term, $\eta(E_t Y_{t+1}/\Gamma_t - \bar{Y})$. With a negative η, the borrowing premium increases whenever output falls below trend. This happens not only when we have negative temporary income shocks but also when we have a positive permanent shock. This is clear in the impulse response of the borrowing premium to a permanent shock, which we plot in Figure 3. After such a shock, output initially grows below trend and the interest rate increases. This, in turn, makes the borrowing premium counterfactually procyclical. Therefore, in order to have a countercyclical borrowing premium, shocks to trend need to be small. The concern is, then, that the smaller role of shocks to trend might be a by-product of the way we specify the induced country risk term.

[21] Since (16) now becomes $q_t = \frac{1}{1+r^*+\chi\left[\exp\left(\frac{\tilde{B}_{t+1}}{\Gamma_t}-\bar{B}\right)-1\right]+\eta\left(E_t\frac{Y_{t+1}}{\Gamma_t}-\bar{Y}\right)+\varepsilon_b}$, this new shock can also be interpreted as an orthogonal shock to the world interest rate.

For this reason, we rewrite the borrowing premium in order to make it explicitly dependent on each of the three shocks to income. Therefore, we replace (16) with

$$q_t = \frac{1}{1 + r^* + \chi\left[\exp\left(\frac{\tilde{B}_{t+1}}{\Gamma_t} - \bar{B}\right) - 1\right] + \eta_g(g_t - \mu_g) + \eta_n z_{n,t} + \eta_d z_{d,t}}.$$

A priori we have no reason to expect the η parameters to be positive or negative. In fact, a positive η_g, for instance, can be capturing increased interest rates not because of improved economic activity but because of increased borrowing following a permanent shock. We call this the *indebtness effect*. This effect could, in principle, be captured by more debt-elastic interest rates, i.e., by χ being more negative. For this reason, we solve the model for different values of χ: -0.0005, -0.001, and -0.0015. If the indebtness effect is at play, the estimated η_g parameter should decrease in value as χ becomes more negative.

Table 6 shows this conjecture to be correct.[22] In particular, η_g is positive for small values of χ. Therefore, for the benchmark value of $\chi = -0.001$, the bias introduced by our original specification of the borrowing premium is of second order since the positive association between shocks to trend and the borrowing premium, implied by the term $\eta(E_t Y_{t+1}/\Gamma_t - \bar{Y})$ in our original specification, is explained by the indebtedness effect. When comparing the results of Table 6 to those of columns (4) and (5) in Table 5, we find that they are qualitatively the same, except for the fact that the contribution of the permanent shock to the volatility of GDP is even smaller. Furthermore, the original specification has the advantage of being more parsimonious and actually delivering a better fit. We conclude, then, that our results are robust to this source of misspecification.

VI. Conclusions

This paper presents a small open economy neoclassical growth model with consumer durables, nondurable goods, shocks to the trend, and temporary sector-specific shocks. We calibrate the model to the Mexican economy as representative of an emerging market. We find that financial frictions in the form of a countercyclical country risk premium play an essential role in explaining a few empirical facts that characterize cyclical fluctuations in developing econ-

[22]There, we try to match the same seven moments as in column (5) of Table (5) by solving the variances of the three shocks to income, the correlation between the sector-specific shocks, and the three η parameters. In order to have an exactly identified problem, we need to fix one previously free parameter. We choose to set $\psi = 0.6$, which is within the range of values we get from the baseline specification.

omies. Namely, financial frictions are important to explain a strongly countercyclical trade balance, and a countercyclical and very volatile borrowing premium.

Our result is in line with Neumeyer and Perri's (2005) finding. The main difference, however, is that we do not need to introduce any friction on the firm side and exploit only the nature of durables accumulation to achieve the desired magnification effect on spending. This result is also consistent with and reinforces that of García-Cicco, Pancrazi, and Uribe (2010). Our paper, however, stresses the interaction of durables expenditure (not considered by García-Cicco, Pancrazi, and Uribe) with financial frictions.

Our results indicate that shocks to trend are somewhat relevant in explaining output and consumption fluctuations in developing countries. These shocks, however, do not appear to be the main source of economic fluctuation in emerging economies. The simulations seem to show, though, that some additional work needs to be done in terms of matching some moments, namely the volatility of investment.

A natural extension to this paper is to consider other types of shocks. For instance, exogenous shocks to the borrowing premium when durables and nondurables are present should be considered as a complementary explanation, as the work by Uribe and Yue (2006), Fernández-Villaverde and others (2009) and Gruss and Mertens (2009) seems to suggest. We find that orthogonal shocks to the interest rate do not seem to be important to match business cycle moments in emerging markets. We feel, however, that other types of shocks to the borrowing premium may play a role and that more work is needed.

Another possibility for future research should consider exploring the importance of other types of financial frictions and external shocks in explaining the properties of business cycles in emerging markets. For example, we can think of shocks to external wealth which interact with domestic spending in a variety of ways. One straightforward channel is to see how these shocks trigger a portfolio rebalancing and cause foreign investors to sell out assets in emerging markets. This in turn depresses domestic asset prices and lowers permanent income thereby affecting consumption of both durables and nondurables.

An alternative driving force to be considered, under the presence of durable goods, comes from shocks to the terms of trade. Many emerging economies are fundamentally producers of commodities and the prices of many commodities, by their nature, are subject to regime switching. Consider, for example, an increase in the variance of the terms of trade. As external income becomes more volatile, default incentives get smaller and, as a consequence, foreign debt conditions endogenously improve. On the one hand, this allows for smoother consumption of nondurables, but on the other hand, the purchase of durables may react as households want to take advance of better borrowing conditions. As a consequence, this type of shocks may imply a high volatility in the purchase of durable goods and a relatively small volatility of consumption of non-durables with respect to income volatility. This extension would also be important in adding micro-foundations to the borrowing premium within a business cycle model, an important avenue for future research.

APPENDIX A. ADDITIONAL DERIVATIONS

In this appendix, we show the stationary version of the basic model setup and the non-stochastic steady state relations. We describe an equivalent problem to the planner's problem described in the text (with a slight change in notation). Here the relative price of durables P used ahead is equal to the ratio of the multipliers associated with resources constraints (19) and (18). We end with an informal proof of the need for tradables and nontradables in the model.

A.1. Equivalent planner's problem

$$V(S) = \max\left\{\frac{\left(C^{\theta}(1-L)^{1-\theta}\right)^{1-\sigma}}{1-\sigma} + \beta G^{\theta(1-\sigma)} EV(S')\right\} \tag{A.1}$$

subject to

$$\begin{aligned} N + PG(D' + K_n' + K_d' + QB') = {} & Y_n + PY_d + (1-\delta_k)P(K_n + K_d) - \\ & P\frac{\phi}{2}\left(G\frac{K_n'}{K_n} - \mu_g\right)^2 K_n - P\frac{\phi}{2}\left(G\frac{K_d'}{K_d} - \mu_g\right)^2 K_d + \\ & (1-\delta_d)PD - P\frac{\psi}{2}\left(G\frac{D'}{D} - \mu_g\right)^2 D + PB, \end{aligned} \tag{A.2}$$

$$Y_n = N + M, \tag{A.3}$$

$$M = \Omega Y_d, \tag{A.4}$$

$$L = L_n + L_d, \tag{A.5}$$

with

$$C \equiv \left(\mu N^{-\gamma} + (1-\mu)D^{-\gamma}\right)^{-\frac{1}{\gamma}}, \tag{A.6}$$

$$L \leq 1, \tag{A.7}$$

$$L_i \geq 0,\ i \in \{n, d\} \tag{A.8}$$

$$K_i \geq 0,\ i \in \{n, d\} \tag{A.9}$$

$$Q = \left(1 + r^* + \chi(\exp(B' - \bar{B}) - 1) + \eta(EY' - \bar{Y})\right)^{-1}, \tag{A.10}$$

$$Y_n = Z_n K_n^{\alpha_n}(GL_n)^{1-\alpha_n}, \tag{A.11}$$

$$Y_d = Z_d K_d^{\alpha_d}(GL_d)^{1-\alpha_d}, \tag{A.12}$$

$$\ln G' = (1-\rho_g)\ln\mu_g + \rho_g \ln G + \varepsilon_g, \tag{A.13}$$

$$\ln Z_n' = \rho_n \ln Z_n + \varepsilon_n, \tag{A.14}$$

$$\ln Z_d' = \rho_d \ln Z_d + \varepsilon_d. \tag{A.15}$$

The exogenous variables in this problem are the shocks to Z_n, Z_d, and G. The endogenous states are K_n, K_d, D, and B. The controls are P, N, L_n, and L_d.

A.1.1. First order conditions

$$U_C C_N P\left[1+\phi\left(G\frac{K_n'}{K_n}-\mu_G\right)\right]G = \beta G^{\theta(1-\sigma)} E V_{K_n'}, \tag{A.16}$$

$$U_C C_N P\left[1+\phi\left(G\frac{K_d'}{K_d}-\mu_G\right)\right]G = \beta G^{\theta(1-\sigma)} E V_{K_d'}, \tag{A.17}$$

$$U_C C_N P\left[1+\psi\left(G\frac{D'}{D}-\mu_G\right)\right]G = \beta G^{\theta(1-\sigma)} E V_{D'}, \tag{A.18}$$

$$U_C C_N Q G = \beta G^{\theta(1-\sigma)} E V_{B'}, \tag{A.19}$$

$$\left(1+\frac{1+\theta}{\theta}\frac{C}{C_N(1-\alpha_n)Y_n}\right)L_n = 1-L_d, \tag{A.20}$$

$$(1-\alpha_n)\frac{Y_n}{L_n} = (P-\Omega)(1-\alpha_d)\frac{Y_d}{L_d}. \tag{A.21}$$

A.1.2. Envelope conditions

$$V_{K_n'} = U_{C'} C_{N'}\left\{\alpha_n \frac{Y_n}{K_n} + P'\left(1-\delta_k+\frac{\phi}{2}\left[\left(\frac{G'K_n''}{K_n'}\right)^2-\mu_G^2\right]\right)\right\}, \tag{A.22}$$

$$V_{K_d'} = U_{C'} C_{N'}\left\{P'\left(\alpha_d \frac{Y_d}{K_d} + 1-\delta_k+\frac{\phi}{2}\left[\left(\frac{G'K_d''}{K_d'}\right)^2-\mu_G^2\right]\right)+\Omega\alpha_d\frac{Y_d}{K_d}\right\}, \tag{A.23}$$

$$V_{D'} = U_{C'}\left\{C_{N'}P'\left(1-\delta_d+\frac{\psi}{2}\left[\left(\frac{G'D''}{D'}\right)^2-\mu_G^2\right]\right)+C_{D'}\right\}, \tag{A.24}$$

$$V_{B'} = U_{C'} C_{N'}, \tag{A.25}$$

where

$$U_C = \theta C^{\theta(1-\sigma)-1}(1-L)^{(1-\theta)(1-\sigma)}, \tag{A.26}$$

$$C_N = \mu N^{-\gamma-1}\left(\mu N^{-\gamma}+(1-\mu)D^{-\gamma}\right)^{-\frac{1}{\gamma}-1}, \text{ and} \tag{A.27}$$

$$C_D = (1-\mu)D^{-\gamma-1}\left(\mu N^{-\gamma}+(1-\mu)D^{-\gamma}\right)^{-\frac{1}{\gamma}-1}. \tag{A.28}$$

A.2. Steady-state relationships

The steady state variables are: $\bar{Q}$, $\bar{P}$, $\bar{L}_n$, $\bar{L}_d$, $\bar{K}_n$, $\bar{K}_d$, $\bar{Y}_n$, $\bar{Y}_d$, $\bar{N}$, and $\bar{D}$. The steady state is defined by the following relationships:

$$\bar{Q} = \beta\mu_g^{\theta(1-\sigma)-1}, \tag{A.29}$$

$$\bar{D} = \left(\frac{(1-\mu)\bar{Q}}{\mu\bar{P}\left(1-\bar{Q}(1-\delta_d)\right)}\right)^{\frac{1}{1+\gamma}}\bar{N}, \tag{A.30}$$

$$1-\bar{L}_d = \left(1+\frac{1-\theta}{\theta}\frac{\bar{C}}{\bar{C}_N(1-\alpha_n)\bar{Y}_n}\right)L_n, \tag{A.31}$$

$$(1-\alpha_n)\frac{\bar{Y}_n}{\bar{L}_n} = (1-\alpha_d)\bar{P}\frac{\bar{Y}_d}{\bar{L}_d}, \tag{A.32}$$

$$\alpha_n\frac{\bar{Y}_n}{\bar{K}_n} = \frac{\bar{P}(1-(1-\delta_k)\bar{Q})}{\bar{Q}}, \tag{A.33}$$

$$\alpha_d\frac{\bar{Y}_d}{\bar{K}_d} = \frac{\bar{P}-\Omega}{\bar{P}}\frac{1-(1-\delta_k)\bar{Q}}{\bar{Q}}, \tag{A.34}$$

$$\bar{Y}_n = \bar{K}_n^{\alpha_n}(\mu_g\bar{L}_n)^{1-\alpha_n}, \tag{A.35}$$

$$\bar{Y}_d = \bar{K}_d^{\alpha_d}(\mu_g\bar{L}_d)^{1-\alpha_d}, \tag{A.36}$$

$$\begin{aligned}\bar{N} = {} & \bar{Y}_n+(\bar{P}-\Omega)\bar{Y}_d+\bar{P}(1-\delta_k-\mu_g)(\bar{K}_n+\bar{K}_d+ \\ & \bar{P}(1-\delta_d-\mu_g)\bar{D}+\bar{P}(1-\bar{Q}\mu_g)\bar{B},\end{aligned} \tag{A.37}$$

$$\bar{Y}_n = \bar{N}+\Omega\bar{Y}_d. \tag{A.38}$$

A.3. Tradability assumption

In this appendix we argue why we need to make the assumption that one good must be non-tradable. We can do this informally by looking at the steady-state conditions above. In particular, consider equations (A.32)-(A.34). From the assumption of Cobb-Douglas technology, both $\bar{Y}_i/\bar{L}_i$ and $\bar{Y}_i/\bar{K}_i$ are functions of $\bar{K}_i/\bar{L}_i$.

Let us argue by contradiction. Let both goods be tradable and the economy be in the deterministic steady state. In this case, $\bar{P}$ is exogenously given because of our small economy assumption. $\bar{Q}$ is given exogenously for the same reason. Therefore, the capital-labor ratios $\bar{K}_i/\bar{L}_i$, $i \in \{n, d\}$, are pinned down by equations (A.33) and (A.34). As a result, both the LHS and RHS of equation (A.32) are given. They only depend on parameters and exogenous variables $\bar{P}$ and $\bar{Q}$. Clearly, they need not be equal and, thus, the economy may not be at the deterministic steady state.

References

Aguiar, Mark, and Gita Gopinath, 2007, "Emerging Market Business Cycles: The Cycle is the Trend," *Journal of Political Economy*, Vol. 115, No. 1, pp. 69–102.

Baxter, Marianne, 1996, "Are Consumer Durables Important for Business Cycles?" *Review of Economics and Statistics*, Vol. 78, No. 1, pp. 147–155.

Boz, Emine, Christian Daude, and Ceyhun B. Durdu, 2008, "Emerging Market Business Cycles Revisited: Learning About the Trend," International Finance Discussion Paper 927, Federal Reserve Board.

Caballero, Ricardo J., 1993, "Durable Goods: An Explanation for Their Slow Adjustment," *Journal of Political Economy*, Vol. 101, No. 2, pp. 351–384.

De Gregorio, Jose, Pablo E. Guidotti, and Carlos A. Vegh, 1998, "Inflation Stabilisation and the Consumption of Durable Goods," *Economic Journal*, Vol. 108, No. 446, pp. 105–131.

De Resende, Carlos, 2006, "Endogenous Borrowing Constraints and Consumption Volatility in a Small Open Economy," Working Paper 06-37, Bank of Canada.

Eaton, Jonathan, and Mark Gersovitz, 1981, "Debt with Potential Repudiation: Theoretical and Empirical Analysis," *Review of Economic Studies*, Vol. 48, No. 2, pp. 289–309.

Engel, Charles, and Jian Wang, 2011, "International Trade in Durable Goods: Understanding Volatility, Cyclicality, and Elasticities," *Journal of International Economics*, Vol. 83, No. 1, pp. 37–52.

Fernández-Villaverde, Jesús, Pablo A. Guerrón-Quintana, Juan Rubio-Ramírez, and Martín Uribe, 2009, "Risk Matters: The Real Effects of Volatility Shocks," Working Paper 14875, National Bureau of Economic Research.

Galí, Jordi, 1993, "Variability of Durable and Nondurable Consumption: Evidence for Six O.E.C.D. Countries," *Review of Economics and Statistics*, Vol. 75, No. 3, pp. 418–428.

García-Cicco, Javier, Roberto Pancrazi, and Martín Uribe, 2010, "Real Business Cycles in Emerging Countries?" *American Economic Review*, Vol. 100, No. 5, pp. 2510–31.

Gomes, João F., Leonid Kogan, and Motohiro Yogo, 2009, "Durability of Output and Expected Stock Returns," *Journal of Political Economy*, Vol. 117, No. 5, pp. 941–986.

Gruss, Bertrand, and Karel Mertens, 2009, "Regime Switching Interest Rates and Fluctuations in Emerging Markets," Economics Working Paper ECO2009/22, European University Institute.

Hornstein, Andreas, and Jack Praschnik, 1997, "Intermediate Inputs and Sectoral Comovement in the Business Cycle," *Journal of Monetary Economics*, Vol. 40, No. 3, pp. 573–595.

Kehoe, Patrick J., and Timothy J. Kehoe, 1994, "A Primer on Static Applied General Equilibrium Models," *Federal Reserve Bank of Minneapolis Quarterly Review*, Vol. 18, No. 1, pp. 2–16.

Kouparitsas, Michael, 1998, "Dynamic Trade Liberalization Analysis: Steady State, Transitional and Inter-Industry Effects," Working Paper WP-98-15, Federal Reserve Bank of Chicago.

Mendoza, Enrique G., 1991, "Real Business Cycles in a Small Open Economy," *American Economic Review*, Vol. 81, No. 4, pp. 797–818.

Neumeyer, Pablo A., and Fabrizio Perri, 2005, "Business Cycles in Emerging Economies: The Role of Interest Rates," *Journal of Monetary Economics*, Vol. 52, No. 2, pp. 345–380.

Ogaki, Masao, and Carmen M. Reinhart, 1998, "Measuring Intertemporal Substitution: The Role of Durable Goods," *Journal of Political Economy*, Vol. 106, No. 5, pp. 1078–1098.

Restrepo-Echevarria, Paulina, 2008, "Business Cycles in Developing vs. Developed Countries: The Importance of the Informal Economy," Working paper, UCLA.

Rosenzweig, Mark R., and Kenneth I. Wolpin, 1993, "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-Income Countries: Investments in Bullocks in India," *Journal of Political Economy*, Vol. 101, No. 2, pp. 223–244.

Schmitt-Grohé, Stephanie, and Martín Uribe, 2003, "Closing Small Open Economy Models," *Journal of International Economics*, Vol. 61, No. 1, pp. 163–185.

Uribe, Martín, and Vivian Z. Yue, 2006, "Country Spreads and Emerging Countries: Who Drives Whom?" *Journal of International Economics*, Vol. 69, No. 1, pp. 6–36.

Figure 1. Relative Volatility of Consumption and Saving Rates Across Countries

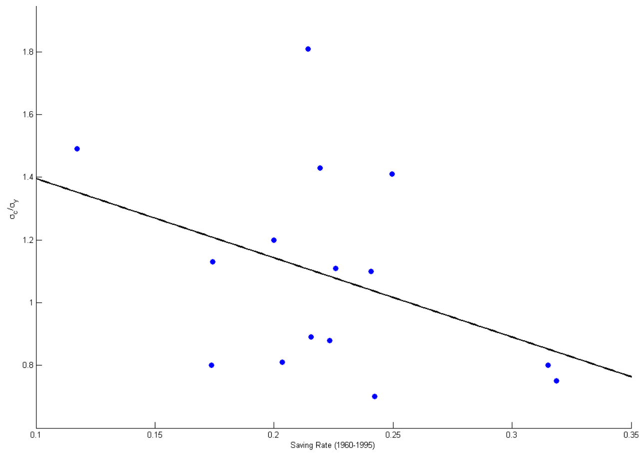


Figure 2. Effect of Shocks to Trend on Key Moments

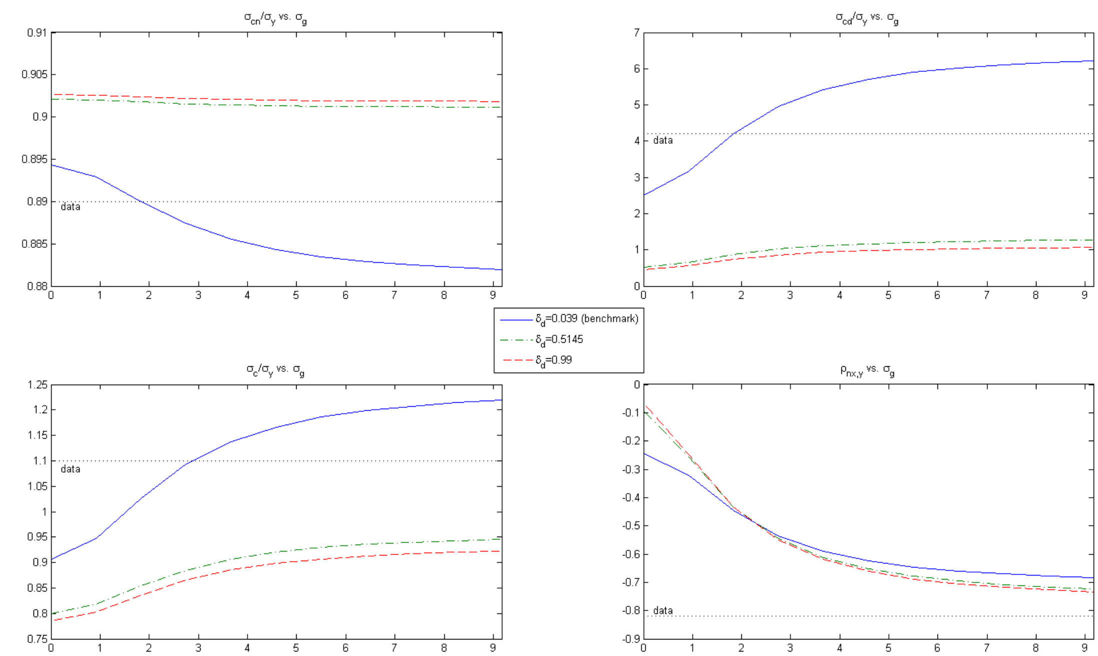
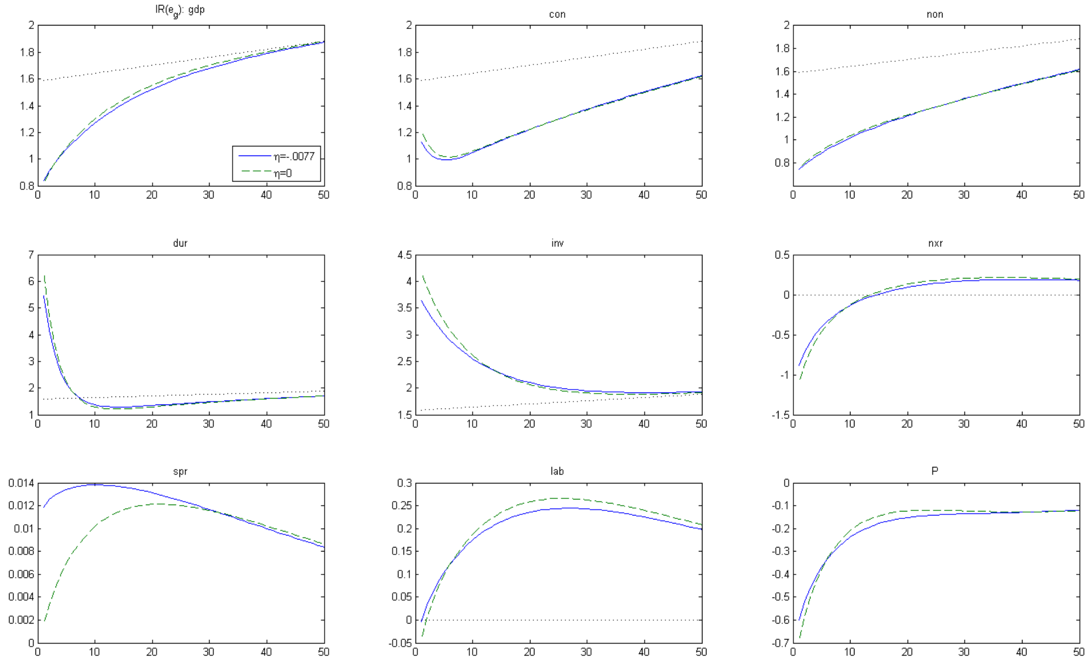


Figure 3. Impulse-Response Functions for a Permanent Shock



The dotted line refers to the trend of the variable under consideration.

Figure 4. Impulse-Response Functions for a Shock to Nondurables

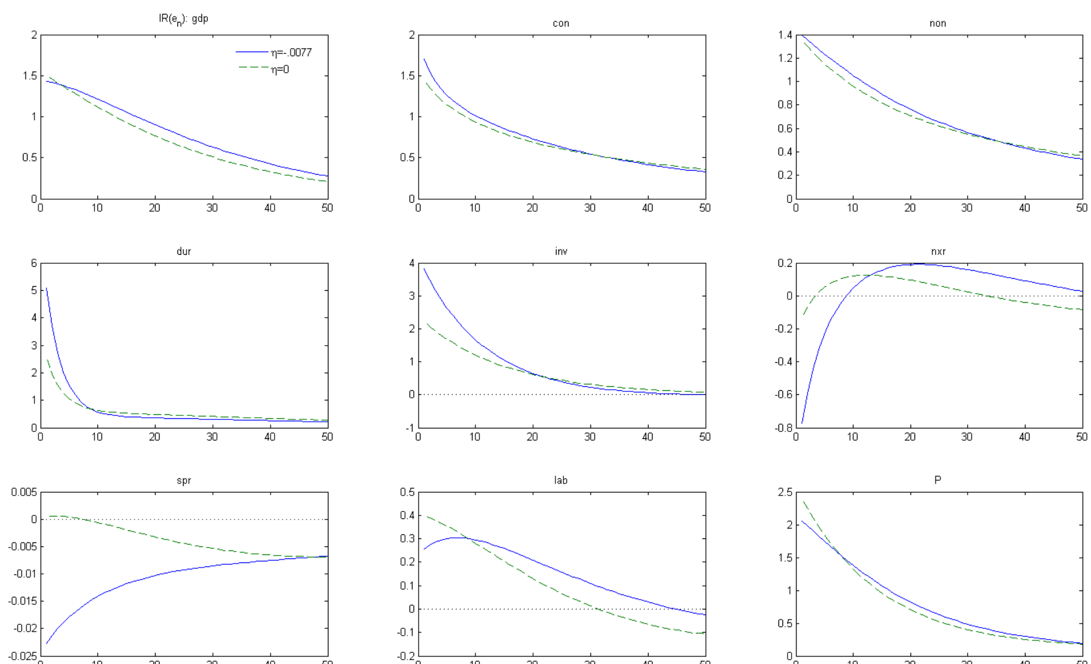


Figure 5. Impulse-Response Functions for a Shock to Durables

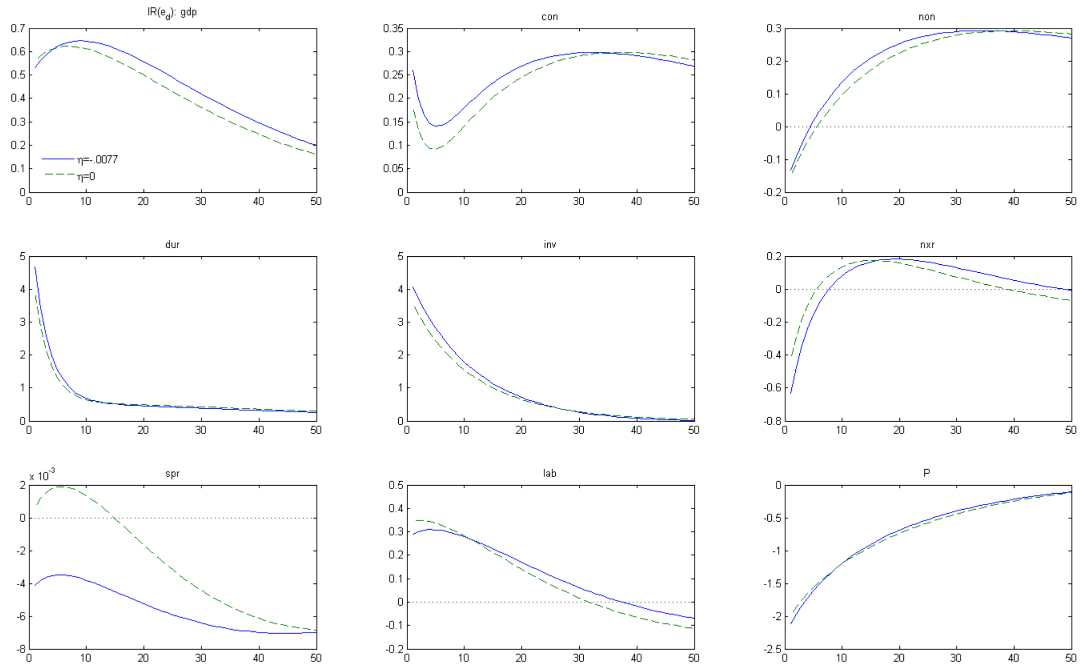


Figure 6. Effect of Financial Frictions on Key Moments

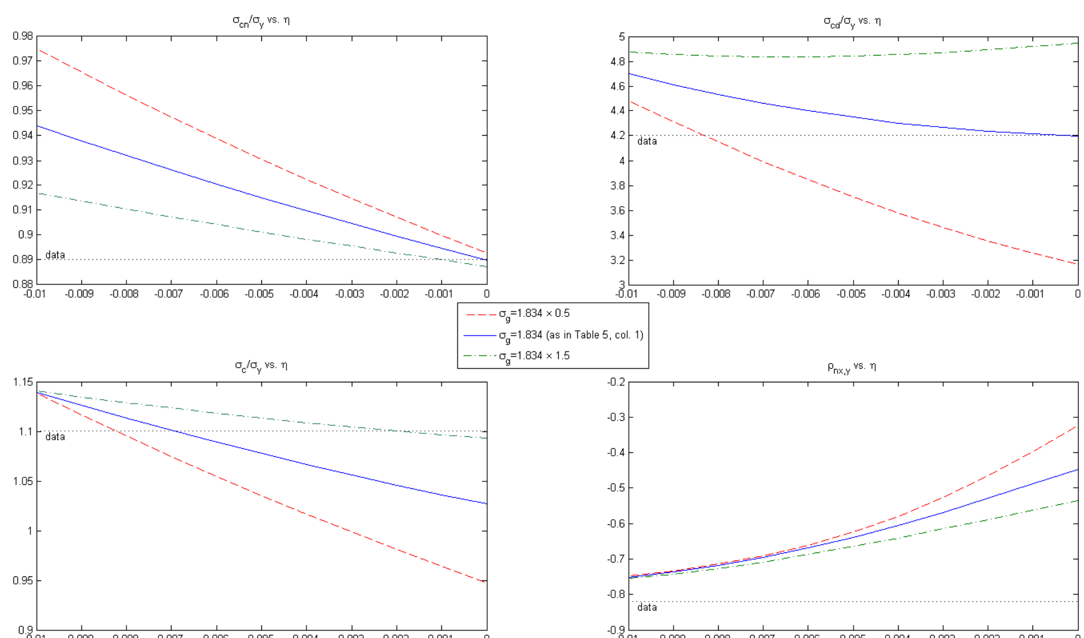


Table 1. Volatility of Output and Relative Volatility of Consumption, Investment and Net Exports

Macroeconomic volatility measured by standard deviation (σ) of GDP (y), total consumption expenditure (c), consumption of nondurable goods (cn), expenditure in durable goods (cd), investment (i), and net exports as a fraction of GDP (nx). All data is quarterly except for Colombia, for which it is annual. All variables are in logs (except nx) and detrended using the HP filter.

Country	Sample	σ_y	σ_c	$\frac{\sigma_c}{\sigma_y}$	σ_{cn}	$\frac{\sigma_{cn}}{\sigma_y}$	σ_{cd}	$\frac{\sigma_{cd}}{\sigma_y}$	$\frac{\sigma_i}{\sigma_y}$	σ_{nx}
Emerging Market Economies										
Chile	96:I-08:I	2.38	3.39	1.43	2.86	1.20	11.05	4.64	1.28	2.78
Colombia	65-06	2.70	2.75	1.02	2.18	0.81	9.53	3.54	3.89	4.94
Czech Republic	96:I-08:I	1.02	1.00	0.98	0.91	0.88	3.35	3.36	1.92	1.53
Israel	80:II-08:I	1.95	3.38	1.74	2.34	1.20	12.72	6.52	3.24	1.22
Mexico	93:I-07:IV	2.35	2.57	1.10	2.09	0.89	9.86	4.20	6.11	1.68
Taiwan Province of China	61:I-08:II	2.05	1.65	0.80	1.88	0.92	1.90	0.93	11.88	1.87
Turkey	87:I-07:III	3.44	5.15	1.50	3.18	0.92	15.85	4.61	4.34	3.25
Small Developed Economies										
Canada	61:I-08:II	1.33	1.18	0.88	0.81	0.60	4.38	3.27	1.89	0.91
Denmark	90:I-08:II	1.20	1.44	1.20	1.05	0.87	7.25	6.03	5.02	0.94
Finland	90:I-08:I	1.68	1.41	0.84	1.00	0.59	8.16	4.85	1.60	1.26
Netherlands	88:I-08:I	1.02	1.07	0.70	0.88	0.58	3.50	2.30	4.32	0.64
New Zealand	88:I-08:I	1.40	1.56	1.12	1.12	0.83	3.83	2.74	5.35	1.45
Spain	01:I-08:I	2.82	5.20	1.84	4.51	1.60	2.55	9.02	1.62	0.56
Large Developed Economies										
France	78:I-08:II	0.86	0.76	0.88	0.54	0.63	4.11	4.77	4.87	0.41
Italy	81:I-08:I	0.91	1.01	1.11	0.78	0.86	3.98	4.38	4.20	0.78
Japan	94:I-08:I	1.02	0.77	0.75	0.59	0.58	4.48	4.37	3.03	0.38
United Kingdom	80:I-08:I	1.14	1.30	1.13	0.96	0.84	4.33	3.79	4.63	0.54
United States	47:I-08:IV	1.65	1.26	0.76	0.79	0.48	5.13	3.11	4.77	0.36

Table 2. Correlations with Output

All data is quarterly except for Colombia, for which it is annual. All variables are in logs (except for nx, which is in levels) and detrended using the HP filter (except for Δy).

Country	Sample	$\rho_{y,c}$	$\rho_{y,cn}$	$\rho_{y,cd}$	$\rho_{y,i}$	$\rho_{y,nx}$	$\rho_{y,y_{-1}}$	$\rho_{\Delta y,\Delta y_{-1}}$
				Emerging Market Economies				
Chile	96:I-08:I	0.42	0.54	0.50	0.74	0.11	0.07	-0.52
Colombia	65-06	0.78	0.78	0.64	0.51	-0.45	0.51	-0.30
Czech Republic	96:I-08:I	0.36	0.34	0.29	0.55	0.18	0.89	0.70
Israel	80:II-08:I	0.45	0.41	0.45	0.40	0.04	0.57	0.03
Mexico	93:I-07:IV	0.94	0.92	0.92	0.92	-0.82	0.81	0.25
Taiwan Province of China	61:I-08:II	0.70	0.63	0.57	-0.05	0.25	0.79	0.16
Turkey	87:I-07:III	0.90	0.87	0.83	0.71	-0.70	0.67	-0.02
				Small Developed Economies				
Canada	61:I-08:II	0.81	0.77	0.73	0.77	-0.19	0.84	0.47
Denmark	90:I-08:II	0.51	0.45	0.40	0.64	-0.11	0.55	-0.28
Finland	90:I-08:I	0.79	0.67	0.69	0.85	-0.05	0.91	0.49
Netherlands	88:II-08:I	0.78	0.73	0.67	0.70	-0.17	0.89	0.33
New Zealand	87:II-08:I	0.80	0.58	0.83	0.72	-0.27	0.74	-0.01
Spain	01:I-08:I	0.51	0.58	0.13	0.55	-0.17	0.77	0.32
				Large Developed Economies				
France	78:I-08:II	0.76	0.74	0.59	0.84	-0.30	0.89	0.38
Italy	81:I-08:I	0.66	0.60	0.59	0.78	-0.13	0.85	0.33
Japan	94:I-08:I	0.70	0.45	0.70	0.92	-0.19	0.79	0.13
United Kingdom	80:I-08:I	0.86	0.81	0.80	0.73	-0.32	0.89	0.43
United States	47:I-08:IV	0.76	0.78	0.59	0.83	-0.28	0.84	0.34

Table 3. Average Relative Volatility of Consumption.

All data is quarterly. Emerging Market economies exclude Taiwan Province of China and Colombia. All variables are in logs and detrended using the HP filter.

	Weighted Average of Ratio to σ_y		
Variable	Large Economies	Small Economies	Emerging Economies
Total Consumption	0.94	0.99	1.30
Non-durables	0.68	0.72	0.90
Durables	3.83	3.85	4.48

Table 4. Benchmark Parameter Values.

Benchmark parameters taken from Aguiar and Gopinath (2007), Baxter (1996), and Gomes, Kogan, and Yogo (2009) or chosen to match Mexico's national statistics.

Time discount factor	β	0.98
Consumption utility share	θ	0.413
Exponent in the consumption aggregator function	γ	0.1628
Risk aversion	σ	2
Utility share of nondurables	μ	0.881
Capital income share in nondurables sector	α_n	0.52
Capital income share in durables sector	α_d	0.32
Depreciation rate of capital stock	δ_k	0.01775
Depreciation rate of stock of durables	δ_d	0.039
Amount of nondurable good needed to produce one unit of durable good	Ω	0.3
Aggregate productivity's long-run mean growth rate	μ_g	1.006
Autocorrelation of shock to trend	ρ_g	0.01
Autocorrelation of shock to nondurable goods	ρ_n	0.95
Autocorrelation of shock to durable goods	ρ_d	0.95
Capital adjustment cost	ϕ	4
Debt coefficient on interest rate premium	χ	-0.001
Steady-state normalized debt	$\bar{B}/\bar{Y}$	-0.1

Table 5. Simulated moments and parameter estimates for Mexico

Simulated moments for GDP (y), first difference of GDP (Δy), nondurables production (y_n), durables production (y_d), total consumption expenditure (c), consumption of nondurables (cn), investment in capital goods (i), durable goods expenditure (cd), the borrowing premium (bp), and net exports-output ratio (nx). Standard deviations for all variables (except y, Δy and nx) are relative to that of output. Data for nondurable and durable production is for industrial production and comes from INEGI. Data for the borrowing premium is from Neumeyer and Perri (2005) Results in column (1) through (5) were obtained by solving for the parameters with values in bold in order to match the sample moments with values in bold. Unless otherwise specified, parameters are set at their benchmark values (see Table 4).

		No Financial Frictions			Financial Frictions	
	Data	(1)	(2)	(3)	(4)	(5)
σ_y	2.35	**2.3500**	**2.3579**	**2.3500**	**2.3500**	**2.4056**
$\sigma_{\Delta y}$	1.50	1.7648	1.7564	1.7746	1.7557	1.8012
σ_{y_n}	0.93	0.8988	1.0266	0.9829	0.8988	0.8883
σ_{y_d}	3.31	1.6325	1.0137	1.2299	1.6325	1.6678
σ_c	1.10	1.0267	**1.0025**	**1.1000**	1.0588	1.0404
σ_{cn}	0.89	**0.8900**	1.0351	0.9844	**0.8900**	**0.8780**
σ_{cd}	4.20	**4.2000**	0.9083	4.0090	**4.2000**	**4.2399**
σ_i	6.11	3.2811	3.6215	2.9470	3.6380	3.4737
σ_{nx}	1.68	**1.6800**	**1.6689**	**1.6800**	**1.6800**	**1.6234**
σ_{bp}	2.64	0.9287	0.9884	0.9262	3.3503	**2.6501**
$\rho_{y,y_{-1}}$	0.81	0.7432	0.7523	0.7397	0.7461	0.7441
$\rho_{\Delta y,\Delta y_{-1}}$	0.25	0.0353	0.0662	0.0311	0.0373	0.0327
$\rho_{y_n,y}$	0.71	0.9494	0.9923	0.9810	0.9493	0.9467
$\rho_{y_d,y}$	0.80	0.8693	0.9339	0.8963	0.8693	0.8718
$\rho_{c,y}$	0.92	0.9237	0.9930	0.9525	0.9424	0.9374
$\rho_{cn,y}$	0.92	0.9201	0.9884	0.9709	0.9201	0.9155
$\rho_{cd,y}$	0.92	0.5706	0.7573	0.5179	0.7143	0.6820
$\rho_{i,y}$	0.94	0.7659	0.7120	0.7045	0.8740	0.8595
$\rho_{nx,y}$	-0.82	-0.4468	-0.5245	-0.4076	-0.7206	-0.6688
$\rho_{bp,y}$	-0.49	0.5639	0.5040	0.5175	**-0.4900**	**-0.4876**
$\rho_{lab,y}$	0.90	0.7557	0.4937	0.7454	0.7976	0.8147
ρ_{y_d,y_n}	0.67	**0.6700**	0.8825	0.7931	**0.6700**	**0.6675**
Quality of Fit		0.8363	0.7160	0.7978	0.8969	0.8939
σ_g		**1.8340**	**2.4776**	**1.9107**	**1.5795**	**1.5410**
σ_n		**1.4209**	**1.4461**	**1.5897**	**1.4743**	**1.5164**
σ_d		**1.4528**	**0.0000**	**0.8211**	**1.6428**	**1.6956**
ψ		**0.5336**	0	0.5336	**0.6231**	**0.5213**
ρ_{nd}		**0.3631**	0.3631	0.3631	**0.4702**	**0.4660**
η		0	0	0	**-0.0077**	**-0.0059**
σ_b		0	0	0	0	**0.0000**
δ_d		0.039	0.99	0.039	0.039	0.039
w_n		0.2779	0.4054	0.2500	0.2091	0.1921
w_d		0.4266	1.0202	0.7238	0.3001	0.2768
Share of ε_g in GDP variance decomposition (%)		0.3300	0.5722	0.3684	0.2405	0.2185

Table 6. Simulated moments and parameter estimates for an alternative specifications of the borrowing premium

	$\chi = -.0005$	$\chi = -.001$	$\chi = -.0015$
σ_y	**2.3198**	**2.3436**	**2.3630**
$\sigma_{\Delta y}$	1.7386	1.7501	1.7588
σ_{y_n}	0.8948	0.8980	0.9005
σ_{y_d}	1.6466	1.6354	1.6266
σ_c	1.0253	1.0392	1.0464
σ_{cn}	**0.8854**	**0.8890**	**0.8919**
σ_{cd}	**4.1305**	**4.1851**	**4.2304**
σ_i	3.5447	3.5207	3.4480
σ_{nx}	**1.7007**	**1.6846**	**1.6709**
σ_{bp}	**2.6406**	**2.6401**	**2.6400**
$\rho_{y,y_{-1}}$	0.7436	0.7459	0.7480
$\rho_{\Delta y,\Delta y_{-1}}$	0.0310	0.0350	0.0407
$\rho_{y_n,y}$	0.9483	0.9491	0.9498
$\rho_{y_d,y}$	0.8702	0.8695	0.8690
$\rho_{c,y}$	0.9332	0.9358	0.9343
$\rho_{cn,y}$	0.9182	0.9197	0.9208
$\rho_{cd,y}$	0.6214	0.6466	0.6446
$\rho_{i,y}$	0.7924	0.8186	0.8276
$\rho_{nx,y}$	-0.5402	-0.5918	-0.5975
$\rho_{bp,y}$	**-0.4901**	**-0.4900**	**-0.4898**
$\rho_{lab,y}$	0.7901	0.7900	0.7869
ρ_{y_d,y_n}	**0.6687**	**0.6697**	**0.6705**
σ_g	1.4106	1.5963	1.7643
σ_n	1.4970	1.4716	1.4441
σ_d	1.5960	1.5767	1.5298
ρ_{nd}	0.4488	0.4295	0.3996
η_g	0.0137	0.0098	-0.0053
η_n	-0.0051	-0.0080	-0.0097
η_d	-0.0070	-0.0068	-0.0059
Share of ε_g in GDP variance decomposition	0.0976	0.1317	0.1667