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Institutional Quality and Sovereign Flows*

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Abstract

This paper evidences the relevance of mercantilism and sudden stops in emerging market economies as a joint explanation for positive net public foreign assets, while political-economy frictions account for the varying degrees that asset accumulation is achieved across economies with similar characteristics. An increase of 50 percent in these frictions implies a reduction of almost 20 percentage points of GDP in net foreign public assets, in the context of economies with growth externalities, therefore a motive for mercantilism exists. In its absence, on the other hand, the sovereigns accumulate net foreign liabilities, which makes their access to international markets more infrequent. In a model without mercantilist motives, political-economy frictions explain less of the differences in net foreign positions (5 percentage points of GDP), but can explain great differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

Resumen

Este artículo documenta la relevancia del mercantilismo y las detenciones súbitas en las economías de mercados emergentes como una explicación conjunta de posiciones internacionales netas positivas del gobierno, mientras que las fricciones de economía política explican la variedad de grados de tal acumulación de activos entre economías con similares características. Un aumento de 50 por ciento de tales fricciones implica una reducción de casi 20 puntos porcentuales de PIB en activos internacionales netos del sector público, en un contexto donde hay externalidades de crecimiento y motivos mercantilistas. En ausencia de estos últimos, el soberano acumula, en cambio, pasivos netos internacionales, haciendo que su acceso a mercados internacionales sea menos frecuente. En un modelo sin motivos mercantilista, las fricciones de economía política explican menos de las diferencias de las posiciones netas (5 puntos de PIB), pero pueden explicar grandes diferencias en riesgo soberano: una reducción de 70 por ciento de las fricciones de economía política pueden reducir el spread soberano en 800 puntos base.

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1 Introduction

Global imbalances are an important feature of the international economy: high-growth emerging-market economies export capital to advanced economies.¹

These capital inflows are rooted in sovereign-to-sovereign flows, mostly international reserve accumulation and foreign public debt consolidation ([Alfaro et al., 2014](#); [Gourinchas and Jeanne, 2013](#); [Krishnamurthy and Vissing-Jørgensen, 2007](#)). The literature has dealt with three main reasons for this phenomenon: precautionary savings ([Durdu et al., 2009](#); [Jeanne and Rancière, 2011](#)), mercantilist motives ([Benigno and Fornaro, 2012](#); [Korinek and Servén, 2010](#)), and the assurance by the government against expropriation risk to foreign investors ([Aguiar and Amador, 2011](#); [Aguiar et al., 2009](#)). However, none of these three explanations alone can explain the extent and diversity of this phenomenon, and focusing in one mechanism at the time does not allow the assessment of their relative importance.²

In this respect, this paper shows the great importance of mercantilist motives and sudden stops in emerging market economies in explaining the existence of net positive international public assets, while political economy frictions can account for the varying degrees that asset accumulation is achieved across economies with similar characteristics. An increase of 50 percent in these frictions implies a reduction of almost 20 percentage points of GDP in net foreign public assets, in the context of economies with growth externalities, so there is a motive to engage in mercantilism. On the other hand, if mercantilism is not taken into account, sovereigns accumulate net foreign liabilities, which dampens their access to international markets. In a model without mercantilism, political-economy frictions have less power to explain differences in net foreign positions (5 percentage points of GDP), but can explain differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

As far as I know, this is the first paper providing a plausible framework for a small open

¹ For a specific definition and discussion on global imbalances, see [Gourinchas and Rey \(2014\)](#).

² More recently, [Bianchi et al. \(2012\)](#) have proposed a fourth motive, rollover risk, which will not be dealt with in the present work.

economy where the government builds a positive net foreign asset position as an optimal policy, while stressing the important difference that political-economy frictions and mercantilist strategies make regarding net foreign-asset positions of governments in emerging-market and developing economies.³

The present work builds a two-sector small-open-economy model featuring political-economy frictions, sovereign default, exogenous sudden stops affecting firms' working capital, and learning-by-trade externalities. Political-economy frictions consist of time-inconsistent preferences originating in the differences in consumption valuation of incumbent versus opposition parties, which increases the risk that the government expropriates foreign assets in the country. For this paper, instead of modelling the nationalisation of foreign capital, a sovereign default is introduced, as default has been far more common during this era of globalisation than nationalisation, as shown by [Tomz and Wright \(2010\)](#). Sovereign default risk can be interpreted also as expropriation risk, since the government may appropriate future debt payments belonging to their creditors.

In this setting, firms in the tradable sector face occasional exogenous sudden stops, which affect their working capital. In practical terms, they face financing shortages when purchasing imported goods to be used in their production processes. When this happens, the government may step in and provide credit, but in an inefficient and limited way, since it is usually subject to sudden stops as much as their firms ([Bianchi et al., 2012](#)). This provides a strong precautionary savings motive.

The presence of externalities in the tradable sector is due to the fact that the aggregate stock of knowledge utilised to produce a modern tradable good has a positive covariance with the amount of imported inputs utilised. However no firm can exploit this covariance privately. The government cannot provide direct subsidies to the tradable sector to exploit these externalities,

³ Most papers yield a positive stock of foreign reserves ([Benigno and Fornaro, 2012](#); [Jeanne and Rancière, 2011](#)) but without considering the stock of public debt; [Benigno and Fornaro \(2012\)](#) manages to explain jointly a positive net foreign asset position of the overall economy, but is silent about foreign public debt. [Bianchi et al. \(2012\)](#) manages to achieve a joint explanation of the existence of public debt and reserve assets, although the net balance is still negative. [Aguiar and Amador \(2011\)](#) and [Aguiar et al. \(2009\)](#) explain why economies reduce their foreign liabilities in order to reassure investors lower expropriation risk and promote growth, but the net foreign position of the government is still negative.

since such subsidies are forbidden by international trade law. The only instrument she has to exploit this externality is the accumulation of net foreign assets. This motive of net foreign asset accumulation by the government is called “mercantilism” and is still subject to debate in policy and academic research, both on the empirical and theoretical front.

The next section features a literature review, which is followed by a discussion of the empirical facts, the quantitative model and its properties, and the final results and conclusions.

2 Literature

The closest strand of literature to this chapter is that on small open economies with political-economy frictions. The political-institutional setting in this paper comes directly from [Aguiar and Amador \(2011\)](#). The authors propose a theory of political-economy frictions causing governments to vary their net foreign assets to reduce the *expropriation risk*. This expropriation consists of nationalising the capital brought in by foreign investors, enduring autarky forever as a punishment. Hence, economies with better institutions (less political-economy frictions) secure foreign investors’ property rights by increasing public foreign savings. This also promotes faster convergence to the steady state. However, my paper is different in that it models sovereign default: it considers the fact that expropriation of foreign creditors to the sovereign are far more frequent than nationalisations of foreign physical capital; it also considers the presence of sudden stops that arrive from abroad and reduces access to finance by the overall economy, and adds a growth trend which is affected by the externalities present in the tradable sectors.

Other papers focus on the government’s gross positions. As for gross debt, [Amador \(2003, 2012\)](#) and [Aguiar and Amador \(2014\)](#) assume that politicians demand debt ex-post due to their inability to save stemming from political-economy frictions similar to those in [Aguiar and Amador \(2011\)](#), so the desire to borrow again in the future enforces repayment today. [D’Erasmus \(2008\)](#), using a different political structure, shows that a benevolent government transiting between two states of patience replicates the observed default frequency and the ratio of gross sovereign debt to gross national product at the moment of default.

For foreign gross sovereign assets (for which reserve accumulation is the main component), literature linking reserves and institutions is rather scant. [Aizenman and Marion \(2004\)](#) show both empirically and theoretically that corruption and short-term incentives reduce the demand for foreign reserves, which is qualitatively consistent with papers addressing gross foreign sovereign debt.

Our paper leaves as a future extension to consider gross positions of the government, both for ease of modelling and exposition, as the impact on gross and net asset positions with respect to measures of institutional quality are the same empirically, as expected.

Another literature worth mentioning is that studying institutional quality and fiscal counter-cyclicity. Governments from countries with strong, savvy institutions tend to lower fiscal spending during booms and increase it during busts, as shown in [Frankel et al. \(2013\)](#). Fiscal counter-cyclicity depends on the level and changes in the measures of institutional quality. Also, there is a literature linking institutional quality and private capital flows: [Gourio et al. \(2015\)](#) shows that the VIX forecasts political risk, and that when it increases, capital inflows decrease and outflows increase. The *expropriation risk* in their model is a stochastic tax on capital inflows, i.e. a nationalisation of foreign capital. Despite the fact that *expropriation risk* is not endogenous, their work highlights the mechanisms by which institutional quality influences private capital inflows, as found previously by [Alfaro et al. \(2008\)](#) and [Papaioannou \(2009\)](#).

Also, there is a vast literature on foreign reserve accumulation that addresses the basic economic motives for governments to accumulate assets. Precautionary savings is one important motive. International reserves provide a defence against sudden stops under increasing financial globalisation ([Durdu et al., 2009](#)). Other aspects are explored in [Aizenman and Lee \(2007\)](#), [Choi et al. \(2007\)](#), [Alfaro and Kanczuk \(2009\)](#), and [Caballero and Panageas \(2008\)](#). Despite its importance, the precautionary motive in isolation fails to account for a positive net foreign asset position, which has been very common during the last decades, as governments increased their net reserve hoarding and decreased their international sovereign debt positions. Explaining a positive net foreign asset position is an important achievement of my paper.

Another important motive for reserve accumulation is mercantilism.⁴ Some economies do not let their currencies appreciate in order to promote economic growth through exports (Dooley et al., 2004; Eichengreen, 2004). Accumulating reserves, hence, is a result of preventing real appreciation, and this is how reserve accumulation can be related to output growth (Rodrik, 2008).⁵ Models of mercantilist reserve accumulation rely on endogenous growth with externalities present in the tradable sector. To exploit these externalities, the central planner hoards reserves as a second best mechanism to direct subsidies (Korinek and Servén, 2010). As a by-product, these reserves also provide foreign working-capital flow during sudden stops (Benigno and Fornaro, 2012).⁶

These models describe the mechanisms by which mercantilism works, but explaining why successful cases of mercantilism are so few requires looking at political and institutional factors. There are well-studied cases of failed export-led growth strategies, such as Latin America between 1870 and 1930 (Catão, 1992; Cortés-Conde, 1992; Gómez-Galvarriato and Williamson, 2009), where political issues were connected with the failure of these policies.^{7,8} In this paper, I show that political-economy frictions can account for differences in the amount of foreign savings across government. Also, political economy frictions can explain significant differences in the output per capita in the long run.

Other motives for hoarding reserves which I do not address are their role in enhancing domestic policies by allowing exchange-rate manipulation (Alfaro and Kanczuk, 2013), and the

⁴ Mercantilism refers to the prevalent economic doctrine in Europe during the XVII-XIX centuries, where countries accumulated monetary reserves (mainly gold) by running trade balance surpluses of finished goods. For a reference, see Ekelund and Hébert (2013).

⁵ This view, however, has been challenged by Reinhart et al. (2016), as reserve accumulation seems to crowd out private investment in East-Asian economies, excluding China and India (which coincidentally feature strict capital controls.) Woodford (2009) argues, on the other hand, that undervaluation is just a consequence of excess savings and strict capital controls, instead of means to promote growth by exporting.

⁶ An important matter is why reserves are held despite yielding lower returns compared to other instruments. One reason is its imperfect substitutability with private foreign debt (Benigno and Fornaro, 2012). Intermittent access to international capital markets leaves reserves as the sole backstop to tradable-goods producing firms. Under perfect substitutability, it is optimal to reduce debt holdings and hold no foreign reserves (Alfaro and Kanczuk, 2009).

⁷ After the Great Depression, most countries in Latin America embarked in Import-Substitution strategies, following the “Prebisch Doctrine” (Prebisch and Martínez-Cabañas, 1949). For a contrast with Emerging Asia, see Baer (1984).

⁸ For a description of the prevailing international monetary system prevailing during 1870-1930 see Eichengreen (1992) and Obstfeld and Taylor (2003).

prevention of rollover risk in long-term sovereign foreign debt ([Bianchi et al., 2012](#)). The former requires a monetary model, which is beyond the scope of this paper, while the latter requires modelling gross positions, which is left to future extensions.

In a broader sense, the current paper relates to the global imbalances literature, which has been prolific and well-cited. The first theories emphasised the presence of a global *savings glut* ([Bernanke, 2005](#)) –although with no regard to which sectors actually engaged in saving– while connecting this to the *conundrum* of low long-term interest rates in the United States ([Greenspan, 2005](#)). On the other hand, [Dooley et al. \(2004\)](#) and [Eichengreen \(2004\)](#) explain global imbalances instead using mercantilism, by comparing the current global imbalances (1996 to present) to those of the Bretton Woods era (1946-1973). Countries pursuing export-led growth strategies –such as Germany and Japan at that time– resisted depreciation of their currencies, just as Emerging Asia is thought as doing recently.⁹

Another view is financial sector development, which is low in economies less able to diversify away idiosyncratic risk ([Angeletos and Panousi, 2011](#); [Buera and Shin, 2009](#); [Mendoza et al., 2009](#)), which explains why firms in less financially developed countries export capital to firms in more financially developed economies. Although some supporting evidence exists for advanced economies ([Mendoza et al., 2009](#)), for the rest of the world [Alfaro et al. \(2014\)](#) and [Gourinchas and Jeanne \(2013\)](#) show that these savings were channelled abroad by the public sector rather than the private sector. Moreover, [Chinn et al. \(2014\)](#) shows that government budget deficits in advanced economies and public savings in emerging-market economies are related under global imbalances. This is reserve accumulation in form of safe instruments such as Treasuries, Gilts, BTFs, and *Bunds*. As shown in my paper, emerging-market countries with better institutional will demand more foreign reserve assets. This demand increase the extent to which global safe assets are scarce ([Caballero et al., 2008](#)), and hence strengthen global imbalances.

Although less directly, this paper relates to work on the economic effect of institutions such as [Acemoglu et al. \(2001\)](#), [Acemoglu et al. \(2014\)](#), [Alesina and Dollar \(2000\)](#), [Jones and Olken](#)

⁹ For a general review on possible causes of global imbalances, refer to [Eichengreen and Park \(2006\)](#) and [Eichengreen \(2006\)](#).

(2005), [Jones and Olken \(2009\)](#), [Lindqvist and Östling \(2010\)](#) and [Azzimonti and Talbert \(2014\)](#), among other works.

The following section will show stylised facts on the relation between institutional quality and foreign public assets in the data.

3 Stylised Facts

This section shows the relationship between institutional quality and public net and gross foreign assets. Data come primarily from the World Development Indicators Database Archive. Net foreign savings is measured as the difference between stock of international reserves (excluding gold) and the stock of Public and Publicly Guaranteed Debt. To extend data availability, I use vintages of the World Development Indicators (WDI) and Global Development Finance (GDF) issues dating back to 1989, as some countries are dropped from the dataset as soon as they become high-income economies, according to the World Bank classification.

Data on national accounts, purchasing-power-parity (PPP) measures and foreign exchange rates come from the Penn World Tables (PWT) version 8.1 ([Feenstra et al., 2015](#)). This new version makes available data on national accounts at current and constant local-currency prices in addition to the PPP-adjusted series.

Another important set of indicators for this topic are the capital account openness measures from [Chinn and Ito \(2008\)](#), and the Political Risk Index and its subcomponents, from International Country Risk Guide (ICRG), available monthly since 1984.¹⁰ I will particularly use the *investment profile* subcomponent as a measure of expropriation risk. The *investment profile* category is an assessment of factors affecting the risk to investment that are not covered by other political, economic, and financial risk components in the total ICRG index of Political Risk, and it is composed of three subcategories: contract viability/expropriation, profits repatriation, and payment delays. The first measures the risk of unilateral contract modification or cancellation and, at worst, outright expropriation of foreign owned assets; the second measures to what ex-

¹⁰ Another set of indices widely used in the literature are those related to political structure and are much longer dated, for example, Polity IV, Freedom House, [Keefer and Stasavage \(2003\)](#), and [Beck et al. \(2001\)](#). However, they do not measure expropriation risk as directly as some subcomponents of ICRG.

tent can profits be transferred out of the host country (impediments include exchange controls, excessive bureaucracy, a poor banking system, etc.); and the latter is the risk associated with receiving and exporting payments from the country (impediments include poor liquidity, exchange controls, an inadequate banking system, etc.). Although the first subcomponent is the most direct measure of expropriation risk, it is available only starting 2001. For this reason I use the broader investment profile time series, dating back to 1984.

Ideally, we would like to make series as comparable as possible, both internationally and intertemporally. Following [Gourinchas and Jeanne \(2013\)](#), I use an implicit trade deflator Q_{ct}^T for country c and year t ,¹¹ from PWT 8.1, as a combination of the export and import deflators,¹² weighted by their shares in GDP:

$$Q_{ct}^T = \frac{X_{ct}}{X_{ct} + M_{ct}} Q_{ct}^X + \frac{M_{ct}}{X_{ct} + M_{ct}} Q_{ct}^M \quad (1)$$

where X and M corresponds to the average-of-period shares in current PPP-adjusted exports and imports, respectively. In previous versions, this trade deflator is not available, so the investment deflator is used to compare across countries; however, to compare across periods, the investment deflator is adjusted further with the GDP deflator:

$$\hat{Q}_{ct}^T = Q_{ct}^T \times \frac{CGDP_{ct}}{RGDP_{ct}} \quad (2)$$

where $CGDP$ ($RGDP$) is the GDP in current (chained) PPP-adjusted 2005 dollars. The adjusted stocks of foreign assets and liabilities, which I denote as real stocks, are scaled by GDP in chained PPP 2005 dollars. The results are reserves and PPG debt adjusted across period and country, and scaled by real GDP.

In Figure 1 I depict the relation between net sovereign foreign assets and expropriation risk (as measured by *investment profile* component of the ICRG Political Risk Index.) The relation is

¹¹ They use version 7.1 of PWT, which does not report deflators for exports and imports, so the authors deflate series using the price of investment; however, they recommend the use of trade deflators for capital flows whenever possible.

¹² These deflators are normalised such that the price level of GDP in the United States in 2005 is equal to 1.

significant and positive. When decomposing the net foreign public assets into foreign reserves and PPG debt, as shown in Figure 2, it is clear PPG debt is negatively correlated with the index of expropriation risk, while foreign reserves are positively correlated. All of these relations are maintained when controlling for outliers.

It is important, however, to control for other determinants of the public international investment position. I will follow the empirical strategy of [Gourinchas and Jeanne \(2013\)](#). This strategy follows from a neoclassical model that, although differing from the model I build in this chapter, features also a small open economy.

Their right hand side variables consist of international capital flows, both private and public. These are accumulated flows between 1980 and 2000, scaled by GDP. I will focus on the public flows, which are composed of Public and Publicly Guaranteed (PPG) Debt and International Reserves, as explained in previous paragraphs. On the left hand side I will control for productivity catch-up with the United States, the ratio of initial capital to GDP, and the ratio of foreign public debt to GDP, the growth of the 15-64 year-old population, capital openness (as measured by [Chinn and Ito, 2008](#)), and the expropriation risk measure from ICRG.¹³

The results are shown in Table 1. The results from columns 1 to 4, reproduce the original results. The coefficients must be interpreted with the opposite sign, this is, an increase in productivity catch-up will increase the outflows of the public flows (recall that in the Balance of Payment Manual 5 an outflow is indicated with a negative sign), as does an increase in capital account openness.

Columns 5 to 8 add the expropriation risk measure as independent regressor, where results suggests that expropriation risk is a fundamental factor for public flows, affecting the public foreign savings mainly through reserve accumulation. An increase of one standard deviation in the measure of expropriation risk, the investment profile subcomponent of the ICRG political risk index increases net foreign assets in 20 pp of GDP. In other words, an increase in the investment profile subcomponent, which corresponds to a lower expropriation risk, implies a

¹³ These regressions use the original data, available from their publisher, except for the investment profile variable from ICRG. For a description on these variables, data, and countries included in the sample, refer to [Gourinchas and Jeanne \(2013\)](#).

greater accumulation of public net foreign assets of 20 pp of GDP.

Columns 9 to 12 show the results adding an interaction between the productivity catch-up and expropriation risk, which is significant at the 10 percent level, while the result is only significant at levels of 5 percent through foreign reserves. This indicates that lower expropriation risk by the government magnifies the effect of higher productivity catch-up in the accumulation of public net foreign assets.

The next section describes the model I use to account for the expropriation risk effects on net foreign public savings, under sudden stops and default risk.

4 Model

I consider an infinite-horizon small open economy, where time is discrete and indexed by t , populated by a continuum of mass 1 of households and by a large number of firms. The firms are owned by the households. Some produce tradable goods, and the rest, nontradable consumption goods. The government is run by one of several political parties, which is elected at the beginning of each period t . A political-economy friction leads political parties to value consumption more as an incumbent rather than as opposition, generating less-than-optimal policies. The government is the only agent engaged in borrowing/saving in the international capital markets with foreign investors. In every period the government can repay its debt or default on it. The following subsections provide further detail on each aspect of the model.

4.1 Political Environment

The political environment of this economy follows [Aguiar and Amador \(2011\)](#). There is a set $\mathcal{I} = \{1, 2, 3, \dots, N + 1\}$, where $N + 1$ is the number of parties. The government is controlled by an incumbent party, chosen at the beginning of every period from the set \mathcal{I} . This party may lose and come back into power eventually. The key assumption is that the incumbent party strictly prefers consumption occurring under its rule.

Assumption 1 (Political Economy Friction). *A party enjoys a utility flow $\tilde{\theta}u(C_t)$ when in power and a utility flow $u(C_t)$ when out of power, where C is the per-capita consumption basket by the domestic households and where $\tilde{\theta} > 1$.*

There are several possible interpretations for the parameter $\tilde{\theta}$. In principle, this parameter captures difference in intertemporal comparisons between the party in office and the opposition. One interpretation is disagreement regarding government expenditures. Another one is corruption where the ruling party captures a disproportionate share of consumption per-capita.

The transfer of power is modelled as an exogenous Markov process. Denote p as the probability that the party in office retains power. If the party in office loses, each party in the opposition has an equal probability of gaining power. Denote q as the probability of regaining power, i.e. $q \equiv (1 - p) / N$. In particular, $(p - q) \in [-N^{-1}, 1]$ represents the incumbent advantage on elections. Denote $p_{t,s}$ as the probability in period t that the incumbent will be in office in period $s > t$. A Markov political process can be represented as:

$$p_{t,s+1} = p \times p_{t,s} + q \times (1 - p_{t,s}) \quad (3)$$

Starting from $p_{t,t} = 1$, this equation has the following solution:

$$p_{t,s} = \bar{p} + (1 - \bar{p}) (p - q)^{s-t} \quad (4)$$

where $\bar{p} = \lim_{s \rightarrow \infty} p_{t,s}$ is the unconditional probability of taking office. For $p < 1$, $\bar{p} = (N + 1)^{-1}$, while for $p = 1$, $\bar{p} = 1$. As a consequence of the political process and the political-economy friction, the utility of the incumbent can be written as:

$$\tilde{W}_t = \mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} p_{t,s} \tilde{\theta} u(C_s) + \sum_{s=t}^{\infty} \beta^{s-t} (1 - p_{t,s}) u(C_s) \right] \quad (5)$$

For ease of analysis, let us define the following ratios:

$$\theta \equiv \frac{\tilde{\theta}}{\bar{p}\tilde{\theta} + (1 - \bar{p})} \quad (6)$$

$$\delta \equiv p - q = \frac{p - \bar{p}}{1 - \bar{p}} \quad (7)$$

The parameter θ is the ratio of the conditional valuation of consumption flow during incumbency over the unconditional valuation when in the opposition. The parameter δ will represent the incumbency advantage, and can also be interpreted as the persistence of θ in the planning horizon of the incumbent. Using these new parameters, Equation (5) can be rescaled using equations (6) and (7), yielding the following representation of the incumbent preferences:

$$W_t \equiv \frac{\tilde{W}_t}{\bar{p}(\tilde{\theta} + N)} = \mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} (\theta \delta^{s-t} + 1 - \delta^{s-t}) u(C_s) \right] \quad (8)$$

The differences between the incumbent's and the opposition's preferences stem from the discounting processes. The intertemporal discount factor varies over periods, which is different from the case of a constant discount rate β . Between t and $t + 1$ the discount factor is $\beta(\theta\delta + 1 - \delta) / \theta$ and between $t + 1$ and $t + 2$ it's $\beta(\theta\delta^2 + 1 - \delta^2) / (\theta\delta + 1 - \delta)$. Only as $t \rightarrow \infty$ does the intertemporal discount rate converge to β . This is a feature of quasi-hyperbolic discounting à la [Laibson \(1997\)](#), and the comparison is exact when $\delta = 0$ and $p = q = (1 + N)^{-1}$ (no incumbency advantage), in which case preferences are given by:

$$W_t = u(C_t) + \frac{1}{\theta} \mathbb{E}_t \sum_{s=t+1}^{\infty} \beta^{s-t} u(C_s) \quad (9)$$

where the discount factor between period t and $t + 1$ is β/θ , and afterwards $\beta > \beta/\theta$. The parameter $\delta > 0$ makes the differences in discount rates persist over time, given $\tilde{\theta} > 1$. Notice as well that autocratic governments, where $\delta = 1$, will yield the same results as the case where $\theta = 1$, so any differences in consumption/saving behaviour of their economies will come from the degree of impatience they exhibit, represented by parameter β . In the following sections I will describe households, firms, and further details on the public sector.

4.2 Households

The representative household derives utility from consumption C_t and supplies labour inelastically each period. The household's lifetime expected utility is given by

$$\mathbb{E}_t \left[\sum_{s=t}^{\infty} \beta^{s-t} \frac{C_s^{1-\sigma}}{1-\sigma} \right] \quad (10)$$

In this expression, \mathbb{E}_t is the expectation operation conditional on information available at time t , $\beta < 1$ is the subjective discount factor, $\sigma > 0$ is the coefficient of relative risk aversion and C_t denotes a consumption basket. This consumption basket is a constant-elasticity-of-substitution (CES) combination of tradable C_t^T and nontradable C_t^N goods. The parameters are a , which is the share of income destined to buy tradable goods, and ζ , which is the inverse of one minus the elasticity of substitution between tradable and non tradable goods:

$$C_t = \left[a \left(C_t^T \right)^{-\zeta} + (1-a) \left(C_t^N \right)^{-\zeta} \right]^{-1/\zeta} \quad (11)$$

Each period the household faces the following flow budget constraint:

$$C_t^T + P_t^N C_t^N = W_t + \Pi_t^T + P_t^N \Pi_t^N + T_t \quad (12)$$

The budget constraint is expressed in units of the tradable good. The left-hand side represents the household's expenditure, where P_t^N represents the relative price of the nontradable good in terms of the tradable good, so $C_t^T + P_t^N C_t^N$ is the household's consumption expenditure expressed in units of the tradable good. The right-hand side represents the income of the household. W_t denotes the household's labour income. Π_t^T and Π_t^N are the dividends the households receives from firms operating in the tradable and in the nontradable sector, respectively. T_t represents the net tax/transfers to/from the government after its net asset decisions are made. For simplicity, domestic households do not trade directly with any foreign investors. Each period the representative household chooses C_t^T and C_t^N to maximise expected utility (10) subject to

the budget constraint (12). The first order condition is:

$$\left(\frac{1-a}{a}\right) \left(\frac{C_t^T}{C_t^N}\right)^{1+\zeta} = P_t^N \quad (13)$$

where P_t^N will be considered as a proxy for the real exchange rate. The consumer-price index is given then by

$$P_t = \left[a^{-\zeta} + (1-a)^{-\zeta} \left(P_t^N \right)^{1+\zeta} \right]^{\frac{1}{1+\zeta}} \quad (14)$$

which is the composite price-index of the consumption basket C_t .

4.3 Firms in the tradable sector

Firms in the tradable sector produce the final tradable good Y_t^T using labour L_t^T and imported intermediate goods M_t . The production function is Cobb-Douglas with labour share α , a labour-augmenting productivity factor Γ_t , and a temporary technology shock z_t .

$$Y_t^T = z_t (\Gamma_t L_t^T)^\alpha M_t^{1-\alpha} \quad (15)$$

The labour-augmenting productivity factor Γ_t is the knowledge used to produce the tradable good, which is public and non-rival, and the transitory technology shock z_t has its logarithm autocorrelated of first order with persistence ρ and white noise innovations ε_t , whose mean is 0 and its standard deviation, σ_ε .

$$\log z_t = (1 - \rho) \log \mu_z + \rho \log z_{t-1} + \varepsilon_t \quad (16)$$

$$\mathbb{E} \varepsilon_t = 0, \quad \mathbb{E} \varepsilon_t^2 = \sigma_\varepsilon^2$$

A constant fraction ϕ of the purchases of imported intermediate goods must be financed with foreign intra-period loans every period, up to a stochastic borrowing limit κ_t . In addition, the government can provide public loans D_t in case the constraint binds, and foreign financing is

not sufficient to purchase the intermediate imported inputs:

$$\phi P_t^M M_t \leq \kappa_t \Gamma_t + D_t \quad (17)$$

This borrowing limit κ_t can take two values: κ_L and $\kappa_H > \kappa_L$; and follows a Markovian discrete process with transition probability $\mathbb{F}(\kappa_t | \kappa_{t-1})$. The higher value κ_H is enough to ensure that the borrowing constraint is never binding, while κ_L makes the borrowing constraint bind under certain states. Whenever the latter arises, the government will provide public loans, subject to its availability of funds. The profit function for the entrepreneurs is given then by:

$$\Pi_t^T = z_t \left(\Gamma_t L_t^T \right)^\alpha M_t^{1-\alpha} - P_t^M M_t - W_t L_t^T + \mu_t \left(\phi P_t^M M_t - \kappa_t \Gamma_t - D_t \right) \quad (18)$$

where μ_t stands for the multiplier of the borrowing constraint. The first order conditions for the tradable firms are:

$$z_t \alpha (\Gamma_t)^\alpha (L_t^T)^{\alpha-1} (M_t^T)^{1-\alpha} = W_t \quad (19)$$

$$z_t (1 - \alpha) (\Gamma_t L_t^T)^\alpha (M_t^T)^{-\alpha} = P_t^M (1 + \phi \mu_t) \quad (20)$$

$$\mu_t \left(\phi P_t^M M_t - \kappa_t \Gamma_t - D_t \right) = 0 \quad (21)$$

It is important to highlight that even if the government had the resources to step in, the multiplier μ_t would still be positive unless it can restore the full first-best choice of the firm.

4.4 Knowledge accumulation process

The stock of knowledge available to firms in the tradable sector evolves according to the following process:

$$\Gamma_{t+1} = v \Gamma_t + M_t^\xi \Gamma_t^{1-\xi} \quad (22)$$

where $v \geq 0$ and $0 \leq \xi \leq 1$. This formulation captures the idea that imports of foreign capital goods represent an important transmission channel through which discoveries made in

developed economies spill over to developing countries. As mentioned before, knowledge is assumed non-rival and non-excludable. This, along with the large number of firms assumed in the tradable sector, implies that firms do not internalise the impact of their actions on the evolution of the economy's stock of knowledge. We can rewrite the equation of the evolution of knowledge as follows:

$$g_{t+1} \equiv \frac{\Gamma_{t+1}}{\Gamma_t} = v + \left(\frac{M_t}{\Gamma_t} \right)^{1-\xi} \quad (23)$$

where g_{t+1} is the growth rate of the knowledge stock.

4.5 Firms in the nontradable sector

The nontradable sector represents a traditional sector that does not engage in international trade. Its output is produced using labour according to the function:

$$Y_t^N = \Gamma_t (L_t^N)^\gamma \quad (24)$$

where Γ_t is the growth of the stock of knowledge in the economy, and $0 \leq \gamma \leq 1$ is the share of labour in profits. The first order condition for labour is:

$$\gamma P_t^N \Gamma_t (L_t^N)^{\gamma-1} = W_t \quad (25)$$

In addition, the labour market must clear $L_t^T + L_t^N = 1$, as must the market of non-tradable goods $C_t^N = Y_t^N$.

4.6 Private Sector Equilibrium

Definition 1 (Private Sector Equilibrium). *A Private Sector Equilibrium is characterised by a set of allocations $\{C_t^T, C_t^N, L_t^T, L_t^N, M_t\}_{t=0}^\infty$, and prices $\{W_t, P_t^N\}_{t=0}^\infty$ such that, taking as given government policies $\{T_t, D_t\}_{t=0}^\infty$, knowledge process $\{\Gamma_t\}_{t=0}^\infty$, and stochastic processes $\{\kappa_t, z_t\}_{t=0}^\infty$:*

- (i) *Households satisfy Equation (12) and Equation (13), taking as given prices, profits from tradable firms Π_t^T , profits from nontradable firms Π_t^N , and government lump sum net transfers T_t .*

- (ii) Firms satisfy Equation (19), Equation (20), Equation (21) and Equation (25) and satisfy labour and non-tradable goods market clearing, taking as given prices, the knowledge process, and government policies.

For a solution of the private sector equilibrium, see Section A.

4.7 The Government Budget Constraint

The sovereign can issue one-period, non-contingent discount bonds, so contingent claims markets are incomplete. Alternatively, it can buy other one-period, non-contingent discount bonds in the foreign market, which are risk-free. The face value of these bonds specifies the amount to be repaid/received in the next period, B_{t+1} . The government borrows if $B_{t+1} < 0$ and saves if $B_{t+1} > 0$. The set of the net government savings is thus $\mathcal{B} \subset \mathbb{R}$.

The lower bound \underline{b} is usually set to be higher than $-\overline{GDP^T}/r^*$, an annuity of tradable value added, which is the largest debt that the country could repay under full commitment. Alternatively, the upper bound \bar{b} can be set lower than $\overline{GDP^T}/r^*$, which is the largest savings that the country can accumulate. Hence $\mathcal{B} = [\underline{b}, \bar{b}]$, and $0 \in \mathcal{B}$. The price of these bonds is q_t^B which is a function $q^B(B_{t+1}, \Gamma_t, z_t, \kappa_t)$ set by foreign investors.

In addition, the government can provide tradable-goods producing firms with intraperiod working capital loans D_t when they are under distress. However, when providing these loans, the government incurs on efficiency loss, which amounts to $\psi / (1 - \psi) D_t$ (Gertler and Karadi, 2011). Therefore, the government budget constraint is given by:

$$B_t = T_t + q_t^B B_{t+1} + \frac{\psi}{1 - \psi} D_t \quad (26)$$

where T_t is the amount of net transfers to the households. The loans to the private sector cannot exceed the net savings the government has at the moment, so:

$$D_t \in [0, (1 - \psi) B_t]$$

The public loans to the private sector are thus the minimum between the amount that tradable-

goods producing firms need to finance the unconstrained imported inputs purchases, and the total amount of resources the government can provide to this sector. Hence, the rule is given by the following equation:

$$D_t = \max \left\{ \min \left\{ \phi P_t^M M_t^u - \kappa_t \Gamma_t, (1 - \psi) B_t \right\}, 0 \right\} \quad (27)$$

where M_t^u is the unconstrained level of imported inputs used by the firms in tradable sector, ϕ is the fraction of imported inputs financed with short-term foreign loans, and κ is a credit shock to the foreign borrowing limit the tradable firms face, scaled by the technology long-term trend Γ_t . An additional assumption, common in the literature (see [Bianchi et al., 2012](#)) is that the government cannot borrow in the international markets during a sudden stop.¹⁴

4.8 Default

The sovereign cannot commit to repay its debt. As in [Eaton and Gersovitz \(1981\)](#), when the country defaults it does not repay at date t and is excluded from the world credit markets starting the same period. The country may re-enter into the international capital market with an exogenous probability η , starting with a fresh record and zero debt.

The government chooses a saving/borrowing policy and whether to default or not, taking the private sector decisions as given, according to the following rule:

$$W_t^o = \max \left\{ W_t^c, W_t^d \right\} \quad (28)$$

where W_t^c is the expected utility for the incumbent at t of not defaulting, and W_t^d is the expected utility of defaulting; W_t^o is the maximum between the expected utilities of defaulting and not

¹⁴ A sudden stop in this paper is defined as a situation where government resources are not enough to restore first-best levels of unconstrained imported inputs. In other words, when $\kappa_t = \kappa_L$, the government may have to intervene but will not have enough resources.

defaulting. The government will default whenever $W_t^c \leq W_t^d$. The expected utilities are:

$$W_{t,t}^c = \theta u(C_t) + \beta \mathbb{E}_t [W_{t,t+1}^o] \quad (29)$$

$$W_{t,t}^d = \theta u(C_t^d) + \beta \mathbb{E}_t [\eta W_{t,t+1}^o + (1 - \eta) W_{t,t+1}^d] \quad (30)$$

Notice that $W_{t,t+1}^o$ corresponds to the value function of the incumbent in period $t + 1$ but from the perspective of period t . Since the government does not commit and has naïve hyperbolic discounting (as explained in section 4.1), it is very likely that $W_{t,t+1}^o \neq W_{t+1,t+1}^o$. We can write down the value functions for any horizon $h \geq 0$ as follows:

$$W_{t,t+h}^o = \max \{ W_{t,t+h}^c, W_{t,t+h}^d \} \quad (31)$$

$$W_{t,t+h}^c = (\theta \delta^h + 1 - \delta^h) u(C_{t,t+h}) + \beta \mathbb{E}_{t+h} [W_{t,t+h+1}^o] \quad (32)$$

$$W_{t,t+h}^d = (\theta \delta^h + 1 - \delta^h) u(C_{t,t+h}) + \beta \mathbb{E}_{t+h} [\eta W_{t,t+h+1}^o + (1 - \eta) W_{t,t+h+1}^d] \quad (33)$$

Hence the probability of default depends on the likelihood that $W_{t,t+h}^c < W_{t,t+h}^d$. Denote this probability $Y_{t,t+h} \equiv \Pr [W_{t,t+h}^c < W_{t,t+h}^d]$. This probability will be used by foreign investors to assess the value of the government portfolio.

4.9 Foreign investors

International creditors are risk-neutral and have complete information. They invest in one-period sovereign bonds and in within-period private working capital loans. Foreign lenders behave competitively and face an opportunity cost of funds equal to r^* . Competition implies zero expected profits at equilibrium and full arbitrage between the sovereign debt and the world's risk-free asset. Hence, the price of the sovereign net international investment position is given by:

$$q_t^B = \begin{cases} 1/(1 + r^*) & \text{if } B_{t+1} \geq 0 \\ (1 - Y_{t+1})/(1 + r^*) & \text{if } B_{t+1} < 0 \end{cases} \quad (34)$$

where Y_{t+1} is the probability of sovereign default in the next period. This result assumes that in sovereign default, all assets and liabilities are seized, while whenever foreign assets are greater than foreign liabilities, the sovereign does not default, as it can repay debt using those assets. This provides an important simplification, although the confiscation of foreign assets seldom occurs ([Wright, forthcoming](#)).

4.10 A Recursive Formulation

For a recursive formulation, we first denote $s = \{\kappa, z\}$ as the vector of exogenous state variables, while B and Γ are the endogenous state variables. At any given horizon $h \in \mathbb{N}_0$, the value functions for continuation W_h^c , default W_h^d , and for the default option W_h^o are given below:

$$W_h^c(B, \Gamma, s) = \max_{B'} \Omega_h u(C_h) + \beta \mathbb{E}_h W_{h+1}^o(B', \Gamma', s') \quad (35)$$

$$W_h^d(\Gamma, s) = \Omega_h u(C_h^d) + \beta \mathbb{E}_h \left[\eta W_{h+1}^o(0, \Gamma', s') + (1 - \eta) W_{h+1}^d(\Gamma', s') \right] \quad (36)$$

$$W_h^o(B, \Gamma, s) = \max \left\{ W_h^c(B, \Gamma, s), W_h^d(\Gamma, s) \right\} \quad (37)$$

where we define $\Omega_h \equiv \delta^h \theta + 1 - \delta^h$. For a tractable recursive representation it is important to consider that as t goes to infinity, the discount rate between consecutive periods, $\beta \Omega_{h+1} / \Omega_h$, tends to β . By using the definition of limits, it is possible to find a horizon τ such that for any $h > \tau$, the discount rate between any two consecutive periods is always β as in a classical sovereign default problem.

Proposition 1. *For a sufficiently small ϵ , $\theta > 1$, and $\delta \in (0, 1)$, there exists τ such that for $h > \tau$:*

$$\left| \frac{\Omega_{h+1}}{\Omega_h} - 1 \right| < \epsilon$$

and hence $\lim_{h \rightarrow \infty} \Omega_{h+1} / \Omega_h = 1$.

Proof. Define $\tau = \log_\delta \epsilon - \log_\delta [(\theta - 1)(1 - \delta - \epsilon)]$. Hence for $h > \tau$ the intertemporal discount rate in subsequent periods is close enough to β . \square

Note that also τ is such that $W_h = V$ for any $h \geq \tau$, where V is the value function of households. Note that if $\delta = 0$, then $\tau = 0$, and $W_1 = V$; if $\delta = 1$ and $\theta \geq 1$, $W_h = V, \forall h \in \mathbb{N}_0$.

As an illustration, in fig.3 the discount rate $\beta^h \Omega_h(\delta, \theta)$ is depicted for various values of δ , given parameters $\beta = 0.95$ and $\theta = 1.5$. Note that the discount rate for the first period converges in $h = 1$ if $\delta = 0$, to the value that a benevolent sovereign would discount. When $\delta = 0.25$, Ω_h converges after $h = 10$ for $\varepsilon = 10^{-6}$, and after $h = 41$ for $\delta = 0.75$. The importance of this discount function discussion is that it allows us to solve the problem by using backward induction. We solve for a benevolent sovereign for $h \geq \tau$ and then solving backwards using the corresponding factor Ω_h . Using this result, for horizons $h > \tau$ we can solve a classical sovereign-default recursive problem:

$$V^c(B, \Gamma, s) = \max_{B'} u(C) + \beta \mathbb{E} V^o(B', \Gamma', s') \quad (38)$$

$$V^d(s) = u(C^{\text{def}}) + \beta \mathbb{E} [\eta V^o(0, \Gamma', s') + (1 - \eta) V^d(\Gamma', s')] \quad (39)$$

$$V^o(B, \Gamma, s) = \max \{ V^c(B, \Gamma, s), V^d(\Gamma, s) \} \quad (40)$$

The definitions of the default set and the probability of default are standard from Eaton-Gersovitz models ([Arellano, 2008](#)). For a debt position $B < 0$, default is optimal for the set of realisations of s for which $V^d(B, \Gamma, s)$ is at least as high as $V^c(B, \Gamma, s)$:

$$\mathcal{D}(B) = \{s : V^c(B, \Gamma, s) \leq V^d(B, \Gamma, s)\} \quad (41)$$

The probability of default at $t + 1$ perceived at t , $Y(B', \Gamma, s)$, can be deduced from default set and transition probability function F of shocks to productivity z and credit κ , as follows:

$$Y(B', \Gamma, s) = \int_{\mathcal{D}(B')} dF(s', s) \quad (42)$$

The transition probability for technology shocks z is continuous $G(z', z)$, given by Equation (16),

while that for credit shocks κ is discrete, and given by $H(\kappa', \kappa)$:

$$Y(B', \Gamma, s) = \sum_{\kappa' \in \mathcal{D}(B')} \int_{z' \in \mathcal{D}(B')} h(\kappa', \kappa) g(z', z) dz' \quad (43)$$

With this probability in mind, the price function of the sovereign portfolio is calculated as:

$$q^B(B', \Gamma, s) = \frac{1 - Y(B', \Gamma, s)}{1 + r^*} \quad (44)$$

where $Y = 0$ for all $B' \geq 0$.

After having solved the “terminal” problem, we proceed to iterate backwards until we arrive to horizon $h = 0$. An important assumption is that foreign investors know whether the government behaves hyperbolically or not, so they will calculate the default rule as:

$$\mathcal{D}_0(B) = \left\{ s : W_0^c(B, \Gamma, s) \leq W_0^d(B, \Gamma, s) \right\} \quad (45)$$

$$Y_0(B', \Gamma, s) = \sum_{\kappa' \in \mathcal{D}_0(B')} \int_{z' \in \mathcal{D}_0(B')} h(\kappa', \kappa) g(z', z) dz' \quad (46)$$

$$q^B(B', \Gamma, s) = \frac{1 - Y_0(B', \Gamma, s)}{1 + r^*} \quad (47)$$

which is possible, because bonds are issued at one-period maturity.

4.11 Detrended Form

To solve the recursive formulation numerically, it is important to remove the productivity trend Γ , as to reduce the number of states in the economy. This is a feasible procedure, given that the value functions are homogeneous of degree $1 - \sigma$ in Γ , and that the price function of the sovereign portfolio is homogeneous of degree zero in Γ and B' . This derives from the utility function specification and the fact that the budget and borrowing constraints are homogeneous

of degree one in Γ . The detrended form is given hence by:

$$v^c(b, s) = \max_{b'} u(c) + \beta (g')^{1-\sigma} \mathbb{E} v^o(b', s') \quad (48)$$

$$v^d(s) = u(c^{\text{def}}) + \beta (g')^{1-\sigma} \mathbb{E} [\eta v^o(0, s') + (1 - \eta) v^d(s')] \quad (49)$$

$$v^o(b, s) = \max \{v^c(b, s), v^d(s)\} \quad (50)$$

and $g' \equiv \Gamma'/\Gamma = v + m^{\tilde{\epsilon}}$ is the future growth rate of the economy, which is known in current period, although not internalised by the private sector. It is important to add that the constraints for the private sector equilibrium are also scalable:

$$c_T + P_N c_N = z m^{1-\alpha} L_T^\alpha + P_N (1 - L_T)^\gamma - P_M m + b - q^B(b', s) b' g' - \frac{\psi}{1 - \psi} d \quad (51)$$

$$\phi P^M m \leq \kappa + d \quad (52)$$

$$d = \max \left\{ \min \left\{ \phi P^M m^u - \kappa, (1 - \psi) b \right\}, 0 \right\} \quad (53)$$

The resource constraint of the economy is given by equation (51), while the borrowing constraint is given by (52).

The solution of the model is equivalent to a constrained-centralised solution where the central planner (the sovereign) takes the growth rate of the economy g' as given, yielding the same first order conditions of the private sector equilibrium. Once the *terminal* value functions and policy rules are solved, we iterate backwards and find the solutions for shorter horizons, starting in period $h = \lfloor \tau \rfloor$ until $h = 0$:

$$w_h^c(b, s) = \max_{b'} \Omega_h u(c_h(b, s)) + \beta (g')^{1-\sigma} E_h w_{h+1}^o(b', s') \quad (54)$$

$$w_h^d(s) = \Omega_h u(c_h^d(s)) + \beta (g')^{1-\sigma} E_h [\eta w_{h+1}^o(0, s') + (1 - \eta) w_{h+1}^d(s')] \quad (55)$$

$$w_h^o(b, s) = \max \{w_h^c(b, s), w_h^d(s)\} \quad (56)$$

where the private sector constraints are:

$$c_h^T + P_h^N c_h^N = z m_h^{1-\alpha} (L_h^T)^\alpha + P_N (1 - L_h^T)^\gamma - P_M m_h + b - q_h^B(b', s) b'_h g' - \frac{\psi}{1-\psi} d_h \quad (57)$$

$$\phi P^M m_h \leq \kappa + d_h \quad (58)$$

$$d_h = \max \left\{ \min \left\{ \phi P^M m_h^u - \kappa, (1 - \psi) b \right\}, 0 \right\} \quad (59)$$

5 Economy-Wide Equilibrium

Definition 2 (Recursive Equilibrium). *A Recursive Equilibrium is characterised by a set of value functions $\{w_h^o(b, s), w_h^c(b, s), w_h^d(s)\}_{h=0}^\tau$ and $v^o(b, s), v^c(b, s)$, and $v^d(s)$; a default rule $\{Y_h(b, s)\}_{h=0}^\tau, Y(b, s)$, a sovereign portfolio rule $\{b'_h(b, s)\}_{h=0}^\tau, b'(b, s)$, a sovereign portfolio price function $\{q_h^B(b, s)\}_{h=0}^\tau, q^B(b, s)$, a credit policy $\{d_h(b, s)\}_{h=0}^\tau, d(b, s)$, and a transfer policy $\{t_h(b, s)\}_{h=0}^\tau, t(b, s)$, such that:*

- (i) *Policy rules $\{b'_h(b, s)\}_{h=0}^\tau, b'(b, s)$ and $\{d_h(b, s)\}_{h=0}^\tau, d(b, s)$ solve the problem in (48)-(59), given the price function $\{q_h^B(b, s)\}_{h=0}^\tau, q^B(b, s)$. That is the government's default and borrowing decisions are optimal given the interest rates on sovereign debt.*
- (ii) *Private consumption and factor allocations are feasible and consistent with the equilibrium private market defined in Section 4.6.*
- (iii) *The transfer policies $\{t_h(b, s)\}_{h=0}^\tau, \{d_h(b, s)\}_{h=0}^\tau, t(b, s)$, and $d(b, s)$ satisfy the budget constraints of the government.*
- (iv) *Given default regions $\{\mathcal{D}(b, s)\}_{h=0}^\tau$ and $\mathcal{D}(b, s)$, and probabilities of default $\{Y(g, s)\}_{h=0}^\tau$, and $Y(g, s)$, the bond price functions $\{q_h^B(b', s)\}_{h=0}^\tau$, and $q^B(b', s)$ satisfy the arbitrage condition of investors in equation (34).*

A solution to the recursive equilibrium includes solutions for sectoral factor allocations and production during normal periods and default, and sudden stops as well. Solutions for equilibrium wages, profits, and the price of domestic inputs follow then from the firms' optimality conditions and the definition of profits described earlier.

6 Parametrisation

The parameters chosen are shown in Table 2. Parameters σ , β , and r^* have standard RBC values of 2, 0.9, and 4 percent (annual), respectively; for consumption, the parameters a and ζ are taken from [Schmitt-Grohé and Uribe \(2016\)](#), although a has the same value as in [Benigno and Fornaro \(2012\)](#). A value of $\zeta = 0.2$ corresponds to a value of the constant elasticity of substitution of $5/6$.

For the trend process in the tradable sector, I set $v = 0.17$ so as to match the growth rate in a non-stochastic steady state to 3.4 percent, which is the average growth of emerging and developing economies. The elasticity of growth to imported inputs is 0.1 and is slightly lower than in [Benigno and Fornaro \(2012\)](#), although allows for the benchmark economy to have 30 percent of GDP in public net foreign assets. For the transitory process $\rho = 0.96$ and $\sigma_\varepsilon = 1.21\%$, and $\mu_z = 0.49$ is set so total GDP in the non-stochastic steady state is equal to 1. These parameters were calibrated for the Chilean economy, although they are very close to those in [Mendoza and Yue \(2012\)](#) for the Argentinian economy.

For the firms, the share of labour in tradable and nontradable sectors, namely α and γ , are both set to 0.6, which is a standard value. The price of imported inputs is normalised to 1. The share of imported inputs that is financed with imported inputs, ϕ , is set to 0.7 ([Mendoza and Yue, 2012](#)), while the social loss parameter ψ when the government provides credit, is 0.5 ([Benigno and Fornaro, 2012](#)).

The transition probabilities for the borrowing limit κ are such that the economy enters into a bad shock every 10 years, and stays there for 2 years ([Benigno and Fornaro, 2012](#)). The low value κ_L is set to 0.12, which yields a trend growth rate of -2.5 percent during its occurrence.

If the sovereign defaults, the probability of reentry is $1/3$, which means that the economy stays an average of 3 years without accessing the international capital markets ([Bianchi et al., 2012](#)). The political-economy friction parameter θ is set to different values, ranging from 1 to 1.5, while I consider that the incumbency advantage is 0, as in [Aguiar and Amador \(2011\)](#), for ease of calculation.

7 Computation strategy

To solve the model in detrended recursive form, I perform value function iteration using a discrete state-space for b and $s = \{z, \kappa\}$. The values for the policy functions, such as $b'(b, s)$, can lie outside the discrete grids. For this purpose, I use piecewise cubic-Hermite interpolation polynomials (PCHIP), which solve the problems of using splines on monotonic functions, such as the bond-price function, by incorporating its first derivatives.¹⁵

The discrete grid for b is constructed by setting 41 equally spaced points between the hyperbolic tangent of b_{\min} and b_{\max} , and then transforming back using the inverse-hyperbolic tangent. This allows a greater number of points to be close to $b = 0$. The limits are set to $b_{\min} = -0.75$ and $b_{\max} = 1.5$.

The discrete grid for z is constructed using the [Tauchen \(1986\)](#) method using 15 points and an amplitude parameter equal to 3. The discrete grid of κ consists of only 2 points, as mentioned before.

For ease of computation, I collapse the points $z \in \mathcal{Z}$ and $\kappa \in \mathcal{\kappa}$ into $s \in \mathcal{S}$, where $\mathcal{S} = \mathcal{Z} \times \mathcal{\kappa}$ and $s = (z, \kappa)$. The number of points will be 30. The transition probability of s , $\Pr(s', s)$, is a Kronecker product of $\Pr(\kappa', \kappa)$ and $\Pr(z', z)$, and allows calculations of expectations and probabilities.

The stop rule for the value function iteration follows [Chatterjee and Eyigungör \(2014\)](#), which consists of iterating on $V^o(b, s)$ and $q^B(b', s)$ at the same time, until the criterion of convergence falls below a tolerance of 10^{-6} . The criterion of convergence is the maximum between that of the value function and that of the sovereign portfolio price.

Once the *terminal* recursive formulation results are obtained, then I iterate backwards to obtain the results with political-economy frictions, following the steps described in previous sections. Using the *initial* recursive formulation policies, I proceed to simulate the values for the variables of the system for 11,000 periods, using the last 10,000 to calculate the moments of the model.

¹⁵ For a reference, see [Fritsch and Carlson \(1980\)](#), which provides the algorithm used in this chapter.

8 Results

In this section I show the results for several characterisations of the economy under study. First, I review the mercantilist economy without political-economy frictions, and then I address the effects of political-economy frictions. Next, I review the results for economies without mercantilism, and the effect of political economy frictions for this group of economies. For comparisons with the data, we refer to National Accounts data in Penn World Tables 8.1 for emerging market and developing economies, which are the upper-middle, middle, and low income ones as classified by the World Bank in the year 2000, to incorporate economies that now have moved to the upper bracket of national income.

8.1 The mercantilist economy without political-economy frictions

The Table 3 show the moments of the model of the economy with mercantilism ($\xi > 0$) and without political economy frictions ($\theta = 1$), which will be our benchmark. This model yields a volatility of consumption which is greater than that shown in the data, while the volatility of gross domestic product is even greater, which is also the case for the trade balance. On the other hand, the volatility of net foreign assets is lower than that of the data. In terms of cyclicity, the trade balance is highly countercyclical compared to the data where it is mildly pro-cyclical, while consumption and net foreign assets are less pro-cyclical than in the data.

Regarding average moments, this economy features a net public savings to GDP ratio of 30.1 percent, which would be in the 95-99 percentiles in the data, comparable to China during the 2000s. The economy of this model never defaults, and suffers sudden stops in which its tradable firms access public credit 0.8 percent of the time. This economy grows on average 3.6 percent a year, which is slightly higher than the average for an emerging market economy according to data. When the government intervenes in the tradable sector it provides credit equivalent to 9.9 percent of tradable output.

8.2 The political-economy frictions

The effect of the political-economy frictions is clearly depicted in Figure 4. These frictions can explain differences in reserve accumulation of up to 20 percentage points of GDP when the political-economy friction parameter θ is 40 percent or more. This is a vast difference in reserve accumulation, comparable to the impact of an increase of one standard deviation in the expropriation risk measure in the data. The effect on real GDP growth is milder, as an increase of 40 percent in the political economy friction leads to a decrease of around 0.35 percentage points in annual average growth, which is lower than the distribution shown in data. This result is mostly due to the growth trend rate of knowledge coupled with a low elasticity of imported inputs to growth, and persistent effects of lack of access to international credit.¹⁶

The average real exchange rate is mildly appreciated in the benchmark economy compared to economies with political-economy frictions. For values of θ of 0.4 or above, the real exchange rate is depreciated by almost 1.5 percent. Public credit to tradable firms in times of stress, which is almost 10 percent of tradable output in the benchmark economy, falls to 7 percent at the higher levels of the political-economy friction, which makes growth lower during periods of sudden stops. This is due to the fact that the economy enters these episodes with lower amounts of public savings to backstop the tradable firms.

It is important to highlight that within the mercantilist economy, further increases in θ beyond 1.5 do not increase the differences from the benchmark economy, as the cost of not saving becomes prohibitively high for a given level of the mercantilist parameters v and ζ . As this model does not engineer endogenous growth in the traditional sense, as there is no capital accumulation, it is very likely that the degree of mercantilism can be also affected by the degree of political-economy frictions, an issue that remains unaddressed in this paper.

More information on the moments of economies with political-economy friction is shown in Table 4. Two important features are that the volatility of macroeconomic aggregates and

¹⁶ For a review on these effects, refer to [Gornemann \(2014\)](#), which presents an endogenous growth model with a government that is more impatient than their households and can default on its debt. In theory, an economy with political-economy frictions is expected to show more sovereign defaults, and hence, much lower average growth if the type of time-inconsistent preferences shown in this paper are present.

the number of periods under sudden stops decrease with the increase in political-economy frictions. The former can be explained by the fact that during normal periods, the benchmark economy achieves very high growth rates, increasing the volatility compared to the political-economy friction economies; the latter is explained by the fact that demand for imported inputs increases with the savings the government enters the period with, so the chances of having a binding borrowing limit are higher for the benchmark economy than for the economies with political economy frictions.

The next section will show the models with trend growth but no mercantilism, i.e., the learning-by-trading parameter $\xi = 0$.

8.3 “Non-mercantilist” economies

It is important to compare the behaviour of an economy where there is no mercantilism present, i.e. $\xi = 0$, and the trend growth rate of the economy is constant. As can be noticed in Figure 5, the government now has net foreign liabilities. This is due to the fact that the economy does not perceive important costs of not having enough savings to withstand sudden stops. For an economy without political economy frictions, the difference in reserve accumulation between mercantilist and non-mercantilist economies amounts to 46 percentage points of GDP.¹⁷ Additionally, liabilities do not increase monotonically with the degree of political-economy frictions. This stems from the fact that access to international capital markets is curtailed more often than in the mercantilist economies, as shown in panel (c) of Figure 5. This does not correspond to the relation in the data because PPG debt contains also aid flows and official loans. In [Alfaro et al. \(2014\)](#), PPG debt with private lenders is an increasing function of growth, which points out to the effect of access to capital markets in setting a limit to the public borrowing abroad of the government.

The real exchange rate, shown in panel (b), also shows important differences between mercantilist and non-mercantilist economies. The latter shows an appreciated level compared to

¹⁷ A pending exercise is to vary the degree of mercantilism, by using values of $\xi \in (0, 0.1)$. This is expected to change the amount of savings the public sector amasses. The range of public sector savings would fall in between the values shown in this paper for the mercantilist and non-mercantilist economies.

the former, which is consistent with the view that mercantilist economies should show more depreciated exchange rates; and moreover, the relative appreciation is higher the higher the political-economy frictions.

It is important to notice that political-economy frictions, as shown in panel (d), can explain large differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

In Table 5 shows more detail regarding the moments of the model for different degrees of political-economy frictions. In contrast with the mercantilist economy, the volatility of macroeconomic aggregates increases with higher political-economy frictions for low levels of θ , then increases for higher levels of θ . As shown before, there is an increase in the number of periods without access to international capital markets, due either to sudden stops or sovereign default.

9 Conclusions

This paper shows the role of mercantilism and sudden stops in emerging market economies in explaining the existence of net positive international public assets, while political economy frictions can account for the varying degrees of asset accumulation across economies with otherwise similar characteristics. An increase of 50 percent in these frictions implies a reduction of almost 20 percentage points of GDP in net foreign public assets, in the context of economies with growth externalities, i.e. mercantilism. On the other hand, if mercantilism is not taken into account, sovereigns accumulate net foreign liabilities, which dampens their access to international markets. For this reason, political-economy frictions explain differences in net foreign positions to a lesser extent (5 percentage points of GDP), but can explain differences in sovereign risk: a reduction of 70 percent in political-economy frictions can reduce the sovereign spread by 800 basis points.

As far as I know, this is the first paper providing a plausible framework for a small open economy where the government builds a positive net foreign asset position, while stressing the important differences that political-economy frictions and mercantilist strategies make between the net foreign-asset positions of the governments in emerging-market and developing econom-

ies. This is important to consider in the perspective of global imbalances: the pursuit of growth externalities in tradable sectors and the improvement in institutional quality in emerging-market and developing markets may exacerbate the savings-glut problem in the world economy.

Further extensions may need to be considered to improve on the explanation of GDP growth outcomes. As mentioned before, it may be necessary to embed models of endogenous growth, such as growth due to increased varieties of tradable goods, and add capital accumulation. This way, growth trends will depend to a greater extent on institutional quality, as a vast literature has shown.

On the other hand, it may be important to study the accumulation of public net foreign asset positions under the lens of monetary and exchange rate arrangements. Recently, small open economies such as Denmark and Switzerland have amassed vast amounts of foreign reserves under pressure during the European Debt Crisis, and many economists have pointed out the use of foreign reserves in order to control exchange rate movements finally, one could explore the use of foreign reserves in mitigating possible banking and currency crises in emerging-market and developing economies.

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Appendix A

In this appendix, I provide further details in the solution of the benchmark model, with mercantilism, sovereign default and sudden stops.

A.1 Competitive equilibrium

To solve the competitive equilibrium for the private sector, I use the detrended first order conditions of the households and firms to obtain an equilibrium equation as a function of labour in the tradable sector, taking as given the net foreign asset decisions of the government.

A.1.1 Unconstrained solution

Starting from the first order conditions of the tradable sector firms', we can find an expression of imported inputs as a function of parameters and tradable labour:

$$m_t = \chi_t^{\frac{1}{\alpha}} L_t^T \quad (60)$$

where $\chi_t = [(1 - \alpha) z_t / P_t^M]$. Using this expression, we can find an expression for the equilibrium wage of the economy:

$$w_t^* = \alpha z_t \chi_t^{\frac{1}{\alpha} - 1} \quad (61)$$

Using the first order condition of nontradable sector firms' and that of households, plus the resource constraint and the nontradable market clearing condition, I arrive to an expression to calculate the equilibrium labour in the tradable sector:

$$F(L_t^T) = \left[\frac{a w_t^*}{(1 - a) \gamma} \right]^{\frac{1}{1+\nu}} \left(1 - L_t^T \right)^{\frac{1+\gamma\nu}{1+\nu}} - w_t^* L_t^T - b_t + q_t \left[v + \chi_t^{\frac{\xi}{\alpha}} \left(L_t^T \right)^{\xi} \right] b_{t+1} \quad (62)$$

This equation has the possibility of having more than one root in the interval $[0, 1]$. For this matter, the algorithm to solve the equation uses 41 Chebyshev collocation points, and brackets the function for the highest root, as to keep the monotonicity of the relation between tradable

labour and next-period sovereign net foreign assets.

Once a solution for labour in tradable sector is calculated, using the resource constraint and the nontradable market clearing conditions, is straightforward to calculate the rest of the variables.

A.1.2 Unconstrained solution under sovereign default

This case is directly solvable by using $b_t = b_{t+1} = 0$ allows for a straightforward solution:

$$F(L_t^T) = \left[\frac{aw_t^*}{(1-a)\gamma} \right]^{\frac{1}{1+\nu}} (1 - L_t^T)^{\frac{1+\gamma\nu}{1+\nu}} - w_t^* L_t^T \quad (63)$$

It is important to highlight that for a sovereign default, the firms are subject to sudden stops with the same parameter κ under no sovereign default, i.e. $\kappa = 0.12$, and there is an symmetrical loss of 10% in tradable and nontradable consumption units.

A.1.3 Constrained solution

When the realisation of borrowing limit κ is a low level, we need to check whether $\phi P^M m_t^u > \kappa_t$, where m_t^u is the unconstrained level of imported inputs. If the sovereign has enough resources, it could finance the gap and restore the first-best equilibrium, or get closer to it:

$$m_t = \frac{\kappa + \max[\min(\phi P_M m_t^u - \kappa_t, (1 - \psi) b_t), 0]}{\phi P_M} \quad (64)$$

Even if the government can help achieve m_t^u , there is a social cost for such credits which impacts transfers to households. Hence, we need to recalculate the level of labour in the tradable sector under this situation, by solving the following:

$$F(L_t^T) = a\alpha z_t (L_t^T)^{\alpha-1} m_t^{1-\alpha} - (1-a)\gamma \left[\alpha z_t (L_t^T)^\alpha m_t^{1-\alpha} + b_t - \frac{\psi}{1-\psi} d_t \right]^{1+\nu} (1 - L_t^T)^{-\gamma\nu-1} \quad (65)$$

In the case of sovereign default, the firms are always subject to a borrowing limit of $\kappa = 0.12$.

Since they default on debt, cannot access debt and cannot provide credit to tradable firms, the calculation is much simpler by substituting $b_t = d_t = 0$ into the previous equation.

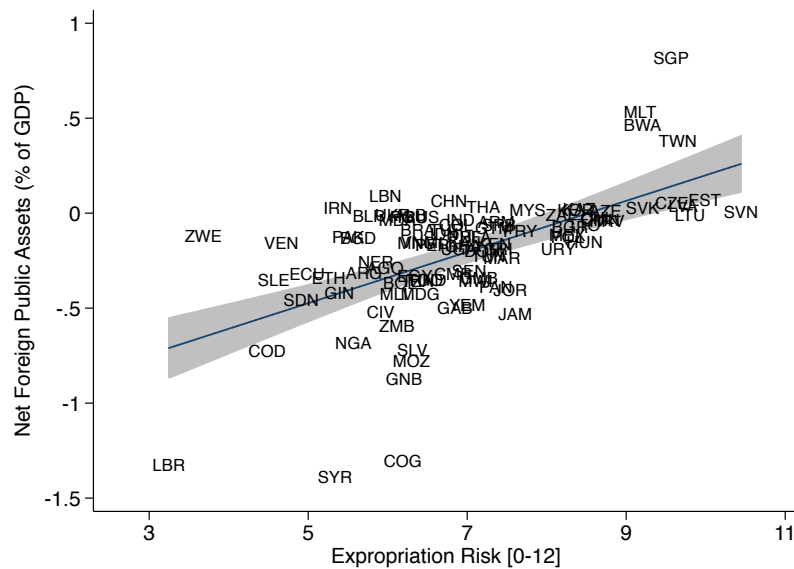
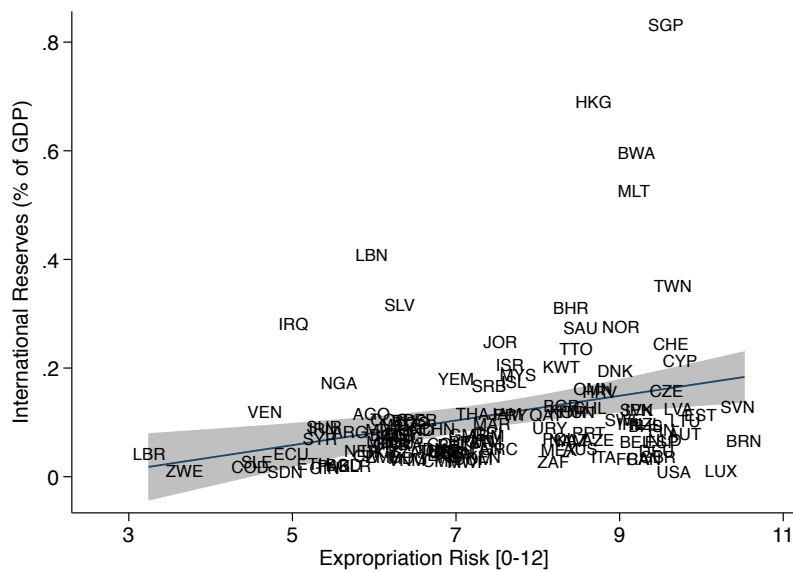
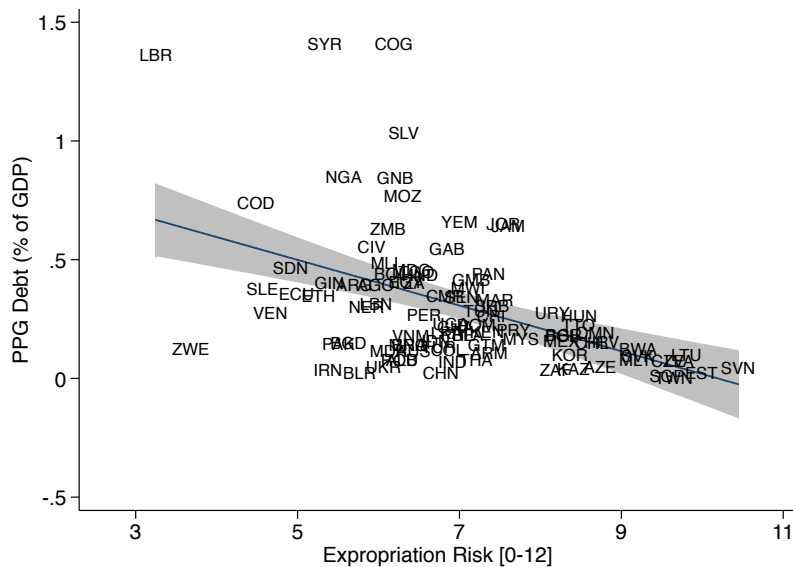


Figure 1: Correlation between Net Public Foreign Assets and Expropriation Risk. Plot shows average real reserves stock as share of real GDP against the average level of the *investment profile* subcomponent of the ICRG political risk index, which measures Expropriation Risk. In the figure, a high value in the Expropriation Risk measure implies a low expropriation risk. Averages are taken over available data between 1980 and 2011. Source: Own elaboration on WDI Database Archive and ICRG.



(a) International Reserves



(b) Public and Publicly Guaranteed Debt

Figure 2: Correlation between Foreign Reserves and PPG Debt, and Expropriation Risk. In the top panel, the plot shows average real reserves stock as share of real GDP against the average level of expropriation risk, as measured by the *investment profile* variable in ICRG. In the bottom panel, the plot shows average real PPG debt as share of real GDP against the average level of expropriation risk. Averages are taken over available data between 1980 and 2011. Source: Own elaboration on WDI Database Archive and ICRG.

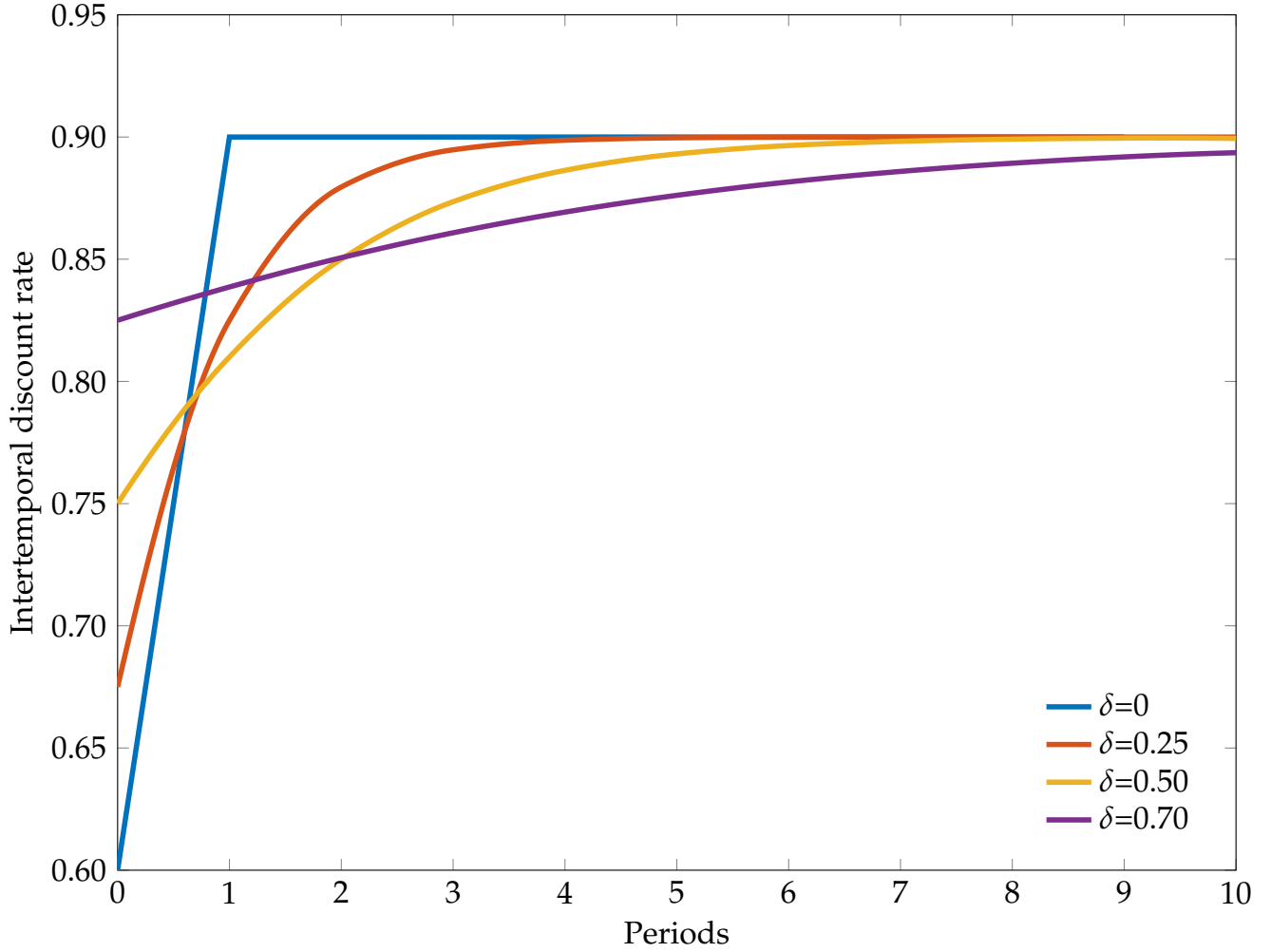


Figure 3: Quasi-hyperbolic discounting. The figure shows the one-period discount function for different horizons, given $\beta = 0.9$, and $\theta = 1.5$. Traditional models feature $\theta = 1$ and $\delta = 0$, so there are no political-economy frictions. If θ increases to 1.5 as in this figure, the discount rate between periods 0 and 1 is lower than the standard case, but in the following period is the same as in a benevolent government. This also the case under standard quasi-hyperbolic discounting à la [Laibson \(1997\)](#), due to the fact that the distortions are not expected to last due to lack of incumbency advantage, i.e. $\delta = 0$. If incumbency advantage is higher (recall $\delta \in [0, 1]$), the difference in discounting is less abrupt than in the case of $\delta = 0$, but persists longer.

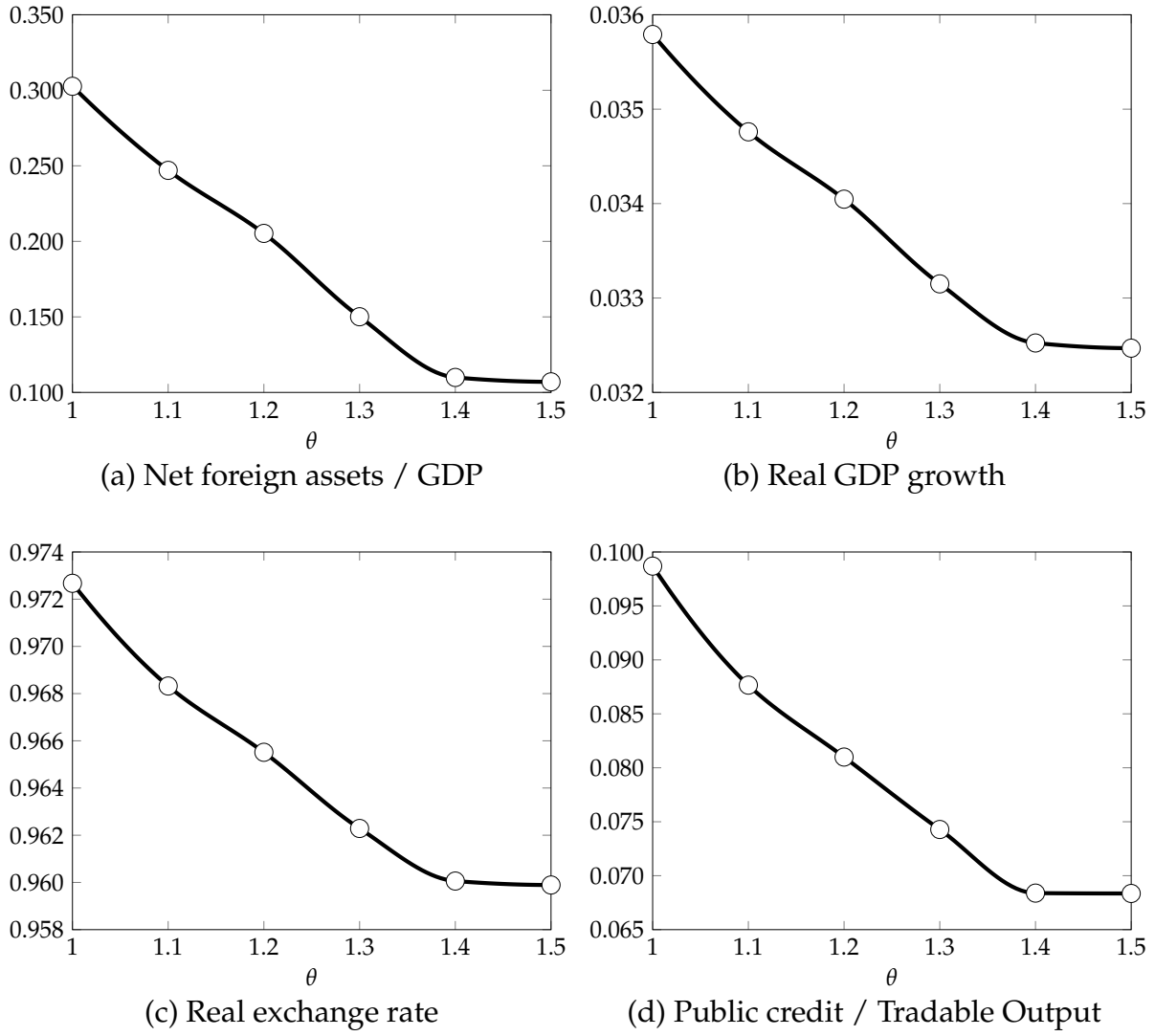


Figure 4: The effects of political-economy frictions θ on key variables of the mercantilist economy. Panel (a) shows the average net foreign assets over GDP accumulated by the government during normal times. Panel (b) shows the average real growth of GDP during all periods. Panel (c) shows the average real exchange rate during all periods. Panel (d) shows the public credit given to the firms in the tradable sector by the government, scaled by the tradable output, during low borrowing limit shocks.

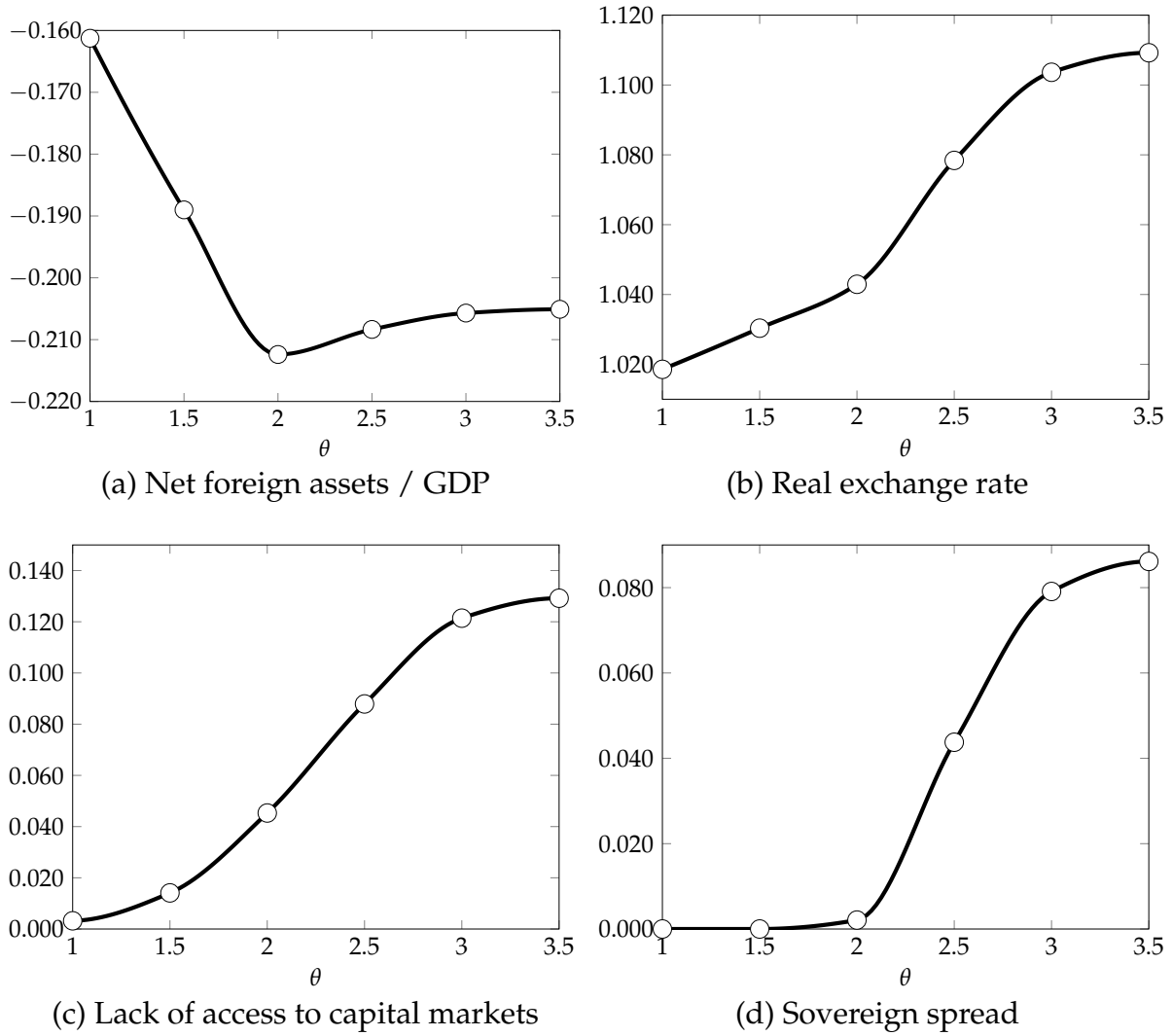


Figure 5: The effects of political-economy frictions θ on key variables of the non-mercantilist economy. Panel (a) shows the average net foreign assets over GDP accumulated by the government during normal times. Panel (b) shows the average real exchange rate during all periods. Panel (c) shows the share of periods that the economy spends under sudden stops and sovereign default. Panel (d) shows the average sovereign spread over the foreign sovereign bonds.

Table 1: Results of [Gourinchas and Jeanne \(2013\)](#) controlling for expropriation risk

	(1) Public flows	(2) Public flows	(3) PPG debt	(4) Reserves	(5) Public flows	(6) Public flows	(7) PPG debt	(8) Reserves	(9) Public flows	(10) Public flows	(11) PPG debt	(12) Reserves
Productivity catch-up (π)	-0.84*** (0.19)	-1.18*** (0.19)	-0.04 (0.10)	-1.15*** (0.15)	-0.78*** (0.21)	-1.12*** (0.21)	-0.04 (0.10)	-1.08*** (0.17)	1.08 (0.83)	0.70 (0.74)	0.16 (0.38)	0.54 (0.59)
Initial capital abundance	-0.18+ (0.10)	-0.11 (0.09)	-0.09+ (0.05)	-0.03 (0.08)	-0.13 (0.11)	-0.07 (0.10)	-0.08+ (0.05)	0.02 (0.08)	-0.06 (0.11)	-0.01 (0.10)	-0.08 (0.05)	0.07 (0.08)
Initial debt	0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)	-0.01 (0.00)	-0.00 (0.00)	-0.00+ (0.00)
Population growth	-0.21* (0.09)	-0.15+ (0.08)	0.07+ (0.04)	-0.22** (0.06)	-0.20* (0.09)	-0.14+ (0.08)	0.07+ (0.04)	-0.21** (0.07)	-0.22* (0.09)	-0.16* (0.08)	0.07 (0.04)	-0.23*** (0.06)
Openness (Chinn-Ito)	-0.16* (0.06)	-0.13* (0.05)	0.03 (0.03)	-0.16*** (0.04)	-0.15* (0.06)	-0.12* (0.06)	0.03 (0.03)	-0.16*** (0.04)	-0.14* (0.06)	-0.11* (0.05)	0.03 (0.03)	-0.15*** (0.04)
Openness $\times \pi$	-0.69*** (0.17)	-0.69*** (0.17)	-0.00 (0.09)	-0.69*** (0.14)	-0.66*** (0.18)	-0.66*** (0.18)	0.00 (0.09)	-0.66*** (0.14)	-0.65*** (0.17)	-0.65*** (0.17)	0.01 (0.09)	-0.65*** (0.14)
Investment profile												
investment profile $\times \pi$												
Intercept	0.67* (0.27)	0.50* (0.24)	0.21 (0.13)	0.30 (0.20)	1.18** (0.41)	0.89* (0.38)	0.20 (0.18)	0.69* (0.30)	1.25** (0.40)	0.96* (0.36)	0.21 (0.18)	0.76* (0.28)
Number of observations	62	62	62	62	57	57	57	57	57	57	57	57
Adjusted-R ²	0.37	0.50	0.11	0.59	0.40	0.52	0.10	0.62	0.45	0.57	0.09	0.67

Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Notes: All data is taken from [Gourinchas and Jeanne \(2013\)](#), except for Expropriation Risk, which is the *investment profile* subcomponent of ICRG index, averaged over 1984-2000. The dependent variables are the flows of the mentioned category scaled by GDP: π is productivity catch-up with United States, $(k/y)_0$ is the initial capital ratio, $(d/y)_0$ is the initial stock of assets/debt, n is the average growth of population between 15-64 years old. $KAOPEN$ is the capital openness from [Chinn and Ito \(2008\)](#).

Table 2: Main parameters

Parameter	Value	Description	Source/Target
σ	2	CRRA coefficient	Standard values
a	0.31	Share of tradables in consumption	Schmitt-Grohé and Uribe (2016)
ζ	0.2	CES parameter	Schmitt-Grohé and Uribe (2016)
β	0.90	Intertemporal discount factor	Standard values
r^*	0.04	International interest rate (% , annual)	Standard values
η	1/3	Probability of redemption	Bianchi et al. (2012)
α	0.6	Share of labour in tradable output	Standard values
γ	0.6	Share of labour in nontradable output	Standard values
p^M	1	Price of imported inputs	Benigno and Fornaro (2012)
ψ	0.5	Share of public FC loans lost	Benigno and Fornaro (2012)
ϕ	0.7	Share of foreign-financed imported inputs	Mendoza and Yue (2012)
ξ	0.1	Elasticity of knowledge to imports	Benigno and Fornaro (2012)
v	0.17	Trend growth rate of knowledge	Average annual growth of 3.4%.
θ	1-1.5	Political-economy friction	Aguiar and Amador (2011)
δ	0	Incumbent advantage	Aguiar and Amador (2011)
κ_L	0.12	Low value of κ	Trend growth rate of -2.5%

Table 3: Results for mercantilist economy without political-economy frictions

	Model ¹		Data ^{1,2}	
	Standard deviation	Correlation with GDP	Standard deviation	Correlation with GDP
Tradable output	0.10	-0.65	...	...
Tradable consumption	0.13	0.93	...	...
Nontradable consumption	0.05	0.83	...	...
Consumption	0.08	0.90	0.07	0.40
GDP	0.07	1.00	0.04	1.00
Imported inputs	0.07	0.43	...	...
Wages	0.07	0.99	...	...
Net foreign assets/GDP	0.18	0.15	0.40	0.09
Trade Balance / GDP	0.07	-0.80	0.23	0.03
Domestic interest rate	0.00	0.00	...	...
Real exchange rate	0.15	0.81	...	...
Number of episodes				
Sovereign Default	0			
Sudden stops ³	823			
Average statistics (percent)				
Public savings/GDP ⁴	30.10			
GDP growth ⁵	3.60			
Real exchange rate	97.30			
Public credit/tradable output ⁶	9.9			

¹ Series are detrended using HP filter with parameter $\lambda = 6.25$, and statistics are calculated using the deviations from the trend.

² Uses national accounts data from Penn World Tables 8.1, for countries classified as upper-middle, middle, and low income, according to the World Bank Organisation for the year 2000.

³ Includes only those episodes where the borrowing limit is binding.

⁴ Compared over periods when there is full access to international capital markets.

⁵ Real GDP is computed deflating nominal GDP by the consumer price index of the economy.

⁶ Compared over episodes where the borrowing limit has a low realisation.

Table 4: Results for mercantilist economy with political-economy frictions

	$\theta = 1$		$\theta = 1.1$		$\theta = 1.2$		$\theta = 1.3$		$\theta = 1.4$		$\theta = 1.5$	
	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$
Tradable output	0.10	-0.65	0.08	-0.46	0.07	-0.27	0.05	0.06	0.05	0.39	0.05	0.41
Tradable consumption	0.13	0.93	0.11	0.90	0.09	0.86	0.07	0.82	0.05	0.72	0.05	0.72
Nontradable consumption	0.05	0.83	0.04	0.77	0.04	0.69	0.03	0.59	0.02	0.37	0.02	0.36
Consumption	0.08	0.90	0.07	0.85	0.06	0.79	0.04	0.72	0.03	0.57	0.03	0.56
GDP	0.07	1.00	0.06	1.00	0.05	1.00	0.04	1.00	0.03	1.00	0.03	1.00
Imported inputs	0.07	0.43	0.07	0.49	0.07	0.57	0.07	0.70	0.07	0.77	0.07	0.78
Wages	0.07	0.99	0.05	0.99	0.05	0.98	0.04	0.98	0.03	0.97	0.03	0.97
Net foreign assets/GDP	0.18	0.15	0.14	0.20	0.11	0.24	0.07	0.28	0.05	0.31	0.05	0.30
Trade Balance / GDP	0.07	-0.80	0.06	-0.74	0.05	-0.68	0.04	-0.56	0.03	-0.37	0.03	-0.35
Domestic interest rate	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Real exchange rate	0.15	0.81	0.12	0.73	0.11	0.66	0.09	0.54	0.08	0.44	0.08	0.43

Number of episodes					
Sovereign default	0	0	0	0	0
Sudden stops ¹	823	823	820	770	756

Average statistics (%)					
Public savings / GDP ²	30.3	24.7	20.5	15.0	11.0
Real GDP growth ³	3.6	3.5	3.4	3.3	3.2
Real exchange rate	97.3	96.8	96.6	96.2	96.0
Public credit / tradable output ⁴	9.9	8.8	8.1	7.4	6.8

Series are detrended using HP filter with parameter $\lambda = 6.25$, so statistics are calculated using the deviations from the trend.

¹ Considers those episodes where the borrowing limit is binding.

² Considers the periods when there is full access to international capital markets.

³ For this statistic, the GDP is deflated by the consumer price index of the economy.

⁴ Considers those episodes where the borrowing limit has a low realisation.

Table 5: Results for non-mercantilist economy with political-economy frictions

	$\theta = 1$		$\theta = 1.5$		$\theta = 2$		$\theta = 2.5$		$\theta = 3$		$\theta = 3.5$	
	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$	σ_x	$\sigma_{x,GDP}$
Tradable output	0.04	-0.48	0.05	-0.58	0.07	-0.58	0.06	-0.14	0.06	0.18	0.06	0.29
Tradable consumption	0.13	0.96	0.16	0.96	0.18	0.96	0.14	0.90	0.10	0.86	0.09	0.85
Nontradable consumption	0.05	0.89	0.07	0.90	0.08	0.82	0.09	0.11	0.09	-0.31	0.10	-0.40
Consumption	0.08	0.94	0.10	0.94	0.11	0.91	0.09	0.53	0.08	0.12	0.07	-0.00
GDP	0.06	1.00	0.07	1.00	0.07	1.00	0.07	1.00	0.06	1.00	0.06	1.00
Imported inputs	0.06	0.89	0.06	0.83	0.06	0.73	0.06	0.45	0.07	0.13	0.07	0.08
Wages	0.05	0.99	0.06	0.99	0.06	0.95	0.06	0.39	0.06	-0.08	0.06	-0.19
Net foreign assets/GDP	0.07	0.32	0.08	0.34	0.09	0.33	0.09	0.05	0.09	-0.19	0.09	-0.25
Trade Balance / GDP	0.07	-0.89	0.08	-0.90	0.10	-0.89	0.07	-0.68	0.05	-0.43	0.05	-0.34
Domestic interest rate	0.00	0.00	0.00	0.00	0.01	-0.01	0.05	-0.02	0.05	-0.03	0.05	-0.04
Real exchange rate	0.14	0.73	0.15	0.76	0.16	0.78	0.22	0.76	0.25	0.75	0.26	0.75

Number of episodes				
Sovereign default	0	28	492	830
Sudden stops ¹	32	425	387	384

Avg. statistics				
Public savings/GDP ²	-16.1	-18.9	-21.2	-20.8
Real GDP growth ³	3.5	3.5	3.5	3.6
Real exchange rate	101.9	103.0	104.3	107.8
Public credit/tradable output ⁴	0.0	0.0	0.0	0.0

Series are detrended using HP filter with parameter $\lambda = 6.25$, so statistics are calculated using the deviations from the trend.

¹ Considers those episodes where the borrowing limit is binding.

² Considers the periods when there is full access to international capital markets.

³ For this statistic, the GDP is deflated by the consumer price index of the economy.

⁴ Considers those episodes where the borrowing limit has a low realisation.

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