Working Paper No. 1087

A Model of External Debt Sustainability and Monetary Hierarchy

by

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July 2025

I would like to thank my advisors, Luiz Fernando de Paula and Karsten Köhler, for their guidance, valuable suggestions, support and inspiration, as well as Alberto Botta (discussant), Gilberto Lima, Ricardo Summa and Giuliano Yajima for their detailed and insightful comments. This paper has also benefited from discussions and feedback from Rolando Gárciga Otero on impulse-response shocks, José Luis Oreiro for suggesting a holistic approach to debt analysis, and Iván Weigandi on interest rates. I would also like to thank the participants in the 2020 IX Research Conference at IE-UFRJ, the 2023 YSI Conference on Debt Sustainability at Boston University Global Development Policy Center, the 2024 Brownbag Sessions at Leeds University Business School, and the 2024 15th Post-Keynesian Economic Society Ph.D. Conference at the University of Greenwich. This research and my Ph.D. thesis at UFRJ were supported by CNPq, the National Council for Scientific and Technological Development, and CAPES, the Coordination for the Improvement of Higher Education Personnel, Brazil.
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ISSN 1547-366X

ABSTRACT

I develop a dynamic macroeconomic model of a small open economy to identify two key vulnerabilities that prevent emerging markets from fully integrating into global markets: high financial integration costs and their low position in the international monetary hierarchy. These vulnerabilities make them susceptible to financial traps, jeopardize debt sustainability, and increase volatility. I show that the weak response of capital flows to interest rates further limits the ability of monetary policy to stabilize the system. As a result, these economies have restricted policy options and often resort to mimicking external monetary policy strategies in times of financial distress.

KEYWORDS: external debt sustainability; currency hierarchy; financial trap; balance of payments constraint; subordinated integration.

JEL CODES: E12, E32, E44, F34.

1. INTRODUCTION

In recent years, emerging economies—particularly in Latin America—have experienced a renewed rise in external debt-to-export ratios, reaching levels reminiscent of the vulnerabilities that precipitated the Asian crisis of the late 1990s (see Figure 1).[1] While global integration offers potential benefits, for many developing countries it has taken the form of a *subordinated* or *segmented* integration into global markets, marked by volatility, dependence, and repeated crises.[2] Latin America's historical cycles raise pressing questions: What dangers does the growing external debt burden pose? Is the current path of integration sustainable, and how should monetary authorities respond?

This paper identifies and formally models two structural vulnerabilities which are characteristic of emerging economies. The first is the high cost of financial integration, driven by risk premia, exchange rate instability, and imperfect asset substitutability (e.g., Eatwell and Taylor 2000; Palma 2003; Frenkel 2008; Ocampo 2016). The second—rooted in Keynes (1936) and structuralist traditions—is the low position these countries occupy within the international monetary hierarchy, which restricts their monetary policy autonomy and raises borrowing costs (e.g., Mehrling 2012; Paula, Fritz, et al. 2017; Bonizzi et al. 2021; Paula, Leal, et al. 2024). Although interrelated, I treat these two vulnerabilities analytically as distinct channels which jointly contribute to cycles of financial fragility and constrain development.

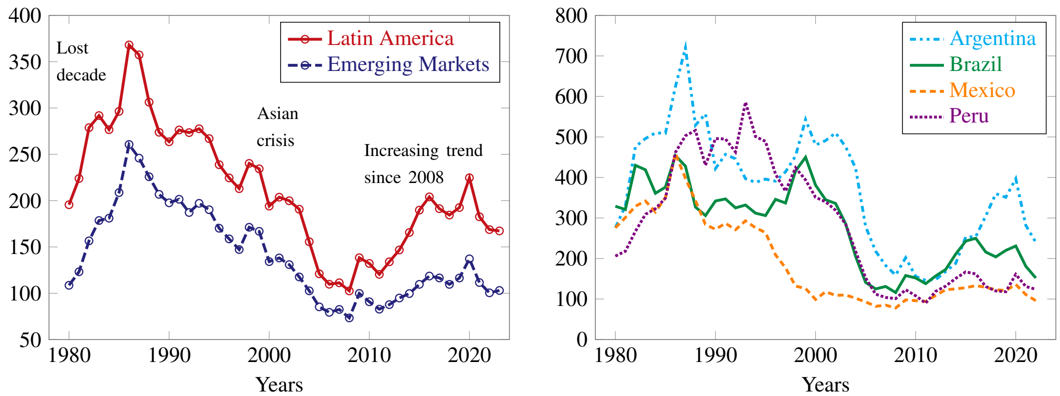
To explore these relationships, I develop a dynamic model of a small open economy subject to balance-of-payments constraints. The model reveals how these structural disadvantages reinforce boom-bust cycles and increase the risk of falling into what Frenkel (2008) calls a "financial trap." In particular, the model shows that external debt becomes unsustainable not only when interest rates exceed export growth, but more subtly when the *cost of integration* exceeds *the rate of export expansion*. This distinction is critical: even if traditional debt sustainability indicators appear favorable, underlying financial frictions and monetary subordination can render an economy highly fragile.

I examine the long-term sustainability of foreign debt by focusing on the development of debt in relation to exports. Following McCombie and Thirlwall (1994), I consider the external sector as the main

[1] The world, especially the emerging markets, is experiencing a period of high foreign currency over-indebtedness (UNCTAD 2024). The consequences of the pandemic, exacerbated by the ongoing Russia-Ukraine conflict, have driven external debt to a peak, placing emerging economies in a precarious position (Kose et al. 2022). Although this peak declined after the pandemic, debt levels remain high.

[2] Subordinate integration of emerging economies into global markets refers to structural features—i.e. a form of integration characterized by asymmetric financial structures, currency hierarchy and limited monetary autonomy—that limit the ability of those countries to pursue economic policies on their own terms.

Figure 1: External debt-to-export ratio (in %)



Note: Foreign debt is a common problem for emerging economies, but Latin America is an exemplary case. The region was among the first to participate in financial globalization in the late 1960s and early 1970s, which eventually led to the debt crisis of the 1980s, commonly referred to as the "lost decade." In the 1990s, the region experienced another financial boom that led to a peak in debt and culminated in a financial collapse triggered by contagion from the Asian crisis. The following decade was characterized by a commodity boom and rapid economic expansion. Following this boom, the region experienced weak growth and excessive debt, as evidenced by the recent crisis in Argentina in 2019. Brazil shows a similar, albeit less pronounced, pattern. Conversely, Mexico and Peru have managed to stabilize this ratio at around 110% and 160% respectively since the second half of the 1990s. The case of Peru is particularly interesting. Although the ratio peaked in 1993, this did not mean a crisis, as the country experienced an economic boom under the government of Alberto Fujimori. The Mexican "tequila" crisis of 1995 is not reflected in this ratio, as although external debt rose, exports also increased following the NAFTA agreement signed in 1994, which led to a subsequent stabilization. Data are sourced from the IMF and World Bank.

determinant of the stability of this ratio. It is important to clarify that this debt-to-export ratio is not in itself a predictor of a crisis; its importance depends on the phase of the business cycle. The model takes into account Minsky's boom-bust dynamics (see Minsky 2008) and is based in particular on the perspective proposed by Frenkel and Rapetti (2009) for emerging markets. In this approach, fragility does not arise from domestic financial over-indebtedness *per se*, but from external channels—in particular capital inflows and trade deficits—under conditions of macroeconomic openness. During the boom, the economy grows while accumulating foreign debt and running trade deficits, temporarily easing financial conditions. When the boom fades, financial fragility increases as the economy becomes increasingly dependent on external financing and exposed to capital flow volatility and market risk. These deteriorating external conditions reduce the resilience of the system and increase the likelihood of a crisis even before clear macroeconomic imbalances emerge.[3]

In contrast to advanced economies, where Minsky's fragility originates in the financial system, in emerging economies the process runs through the balance of payments, so that sustainability depends on

[3]While each crash has unique characteristics, they generally follow this recognizable pattern. Understanding this cycle is critical to preparing for the next *inevitable* crash, as Yueh (2024) points out.

international factors such as interest rate differentials, liquidity premia and trade performance. I formalize this mechanism through a sustainability rule designed to prevent the economy from crossing a critical threshold—a structural equivalent of Minsky's survival constraint for open economies. The model also takes into account the role of the monetary authority in managing capital flows and debt shocks over the cycle. The degree of deviation from equilibrium depends crucially on the country's position in the international monetary hierarchy and the interest rate elasticity of capital inflows. A higher position in the hierarchy, combined with an elastic capital response, allows for greater monetary policy autonomy and reduces the chances of having to import the monetary policy of the core countries. This in turn reflects the logic of Rey (2015)'s dilemma—where capital mobility constrains monetary policy autonomy unless it is offset by strong financial positioning.

Building on this framework, the paper makes three main contributions. First, it challenges the standard indicator for debt sustainability, which typically focuses on the gap between the interest rate on debt and the growth rate of output. This "$r-g$" rule has been central to economics debates on public and external debt sustainability (see, e.g., Simonsen 1985; Pasinetti 1997; Taylor 2009; Blanchard 2019). I argue that this metric is insufficient for assessing the external debt sustainability of a small, open, and emerging economy. Instead, I show that the relevant indicator is the gap between the cost of financial integration into international markets, denoted C, and the export growth rate, x.[4] The cost curve, C, captures the frictions arising from the imperfect substitutability of assets on the international financial markets—including risk premia and segmentation effects not fully accounted for in the standard interest rate measures. I assume that these financial frictions influence the development of the nominal exchange rate. While the monetary authority has the task of steering the exchange rate towards its long-run equilibrium—which is consistent with a non-arbitrage condition—this adjustment remains incomplete in the presence of partial capital mobility. As a result, the exchange rate becomes "disconnected" from the underlying financial conditions, reinforcing the idea that the observed interest rate on external debt does not reflect the full extent of external financial pressures.[5] This means that a situation in which the interest rate on foreign debt is lower than the growth rate of exports is not necessarily a sign of macroeconomic robustness. It may coexist with $C > x$, indicating hidden fragility. I show that shocks to C, which are typical of emerging markets, can lead to turning points that push the economy from a boom into a bust. Emerging markets are particularly vulnerable to these dynamics due to their structurally higher C, which makes them more prone to falling

[4] Dornbusch and Fischer (1986), Simonsen and Cysne (2009) and Bhering et al. (2019) show how they approach the sustainability problem using the differential between the interest rate on foreign debt and the growth rate of exports.

[5] For an in-depth analysis of exchange rate disconnection in response to economic shocks, see Itskhoki and Mukhin (2021).

into financial traps. These mechanisms are explored in detail in sections 2 and 3.

Second, I develop a sustainability rule for external debt—the so-called $\mathcal{S}$-curve—which identifies the critical threshold beyond which an explosive dynamic sets in and debt becomes unsustainable. This builds on the early contributions of Simonsen (1985) and Simonsen and Cysne (2009)'s baseline textbook debt model, who proposed conditions for external solvency but generally focused on stable equilibria within a stylized framework. In contrast, following Frenkel (2005), the $\mathcal{S}$-curve in this model is constructed around an unstable equilibrium that marks the tipping point at which $C > x$ applies. The focus is not on convergence to a safe path, but on *avoiding* a collapse by meeting a minimum condition for the ratio of debt to exports at the onset of a shock.

This unstable threshold defines the maximum initial stock of external debt consistent with a crisis-free trajectory and can be interpreted as an analogy to Minsky's survival constraint in an open economy—the point at which the system retains just enough credibility to secure foreign exchange (via trade or financing) to reduce its debt burden.[6] This interpretation extends the Minsky literature, in which the survival constraint in open economies is still under-researched. A more recent exception is Kapadia (2024), who describes the constraint and relates it to the monetary hierarchy, but without formulating a dynamic threshold condition.

Importantly, the $\mathcal{S}$-curve rule derived here illustrates that sustainability is not just a matter of initial debt levels, but also a question of policy. For example, a tax on financial rentiers or speculative inflows could reduce C, shifting the sustainability threshold and stabilizing the external position of the economy. This contribution is explained in Section 4.

Third, I formalize the concept of monetary hierarchy within a dynamic macroeconomic framework. While the literature on monetary hierarchy provides a well-developed conceptual understanding of external financial subordination in emerging markets (see, e.g., Paula, Fritz, et al. 2017; Bonizzi et al. 2021), it rarely provides a formal modeling of the implications of this hierarchy for macroeconomic policy and systemic stability. To fill this gap, I develop a comparative framework for two economies that differ in their position within the international monetary hierarchy. The economy with the lowest hierarchical position faces a structurally higher equilibrium interest rate, r^*, reflecting its weaker external status.

[6] Throughout this paper, I use the term credibility to refer to an economy's perceived ability to meet its external obligations and maintain stable external accounts—rather than its commitment to low inflation, as in standard inflation-targeting frameworks.

The model traces the effects of this asymmetry across different phases of the macroeconomic cycle, focusing on how capital inflows and debt shocks interact with financial fragility. In particular, it shows that a lower hierarchical position implies greater volatility in the domestic interest rate during the boom, which increases the likelihood of a transition to a bust. Moreover, when the interest rate elasticity of capital flows is low, the ability of the monetary authority to pursue countercyclical policies is severely constrained.

This formalization leads to an important insight: hierarchically subordinate economies have structurally limited monetary policy autonomy. It is more likely that their interest rate decisions will mimic global monetary trends, even if domestic fundamentals justify a different stance. For example, global tightening may trigger capital flight and force a rate hike even though domestic conditions are weak. I also show that regulation of capital flows—such as targeted macroprudential instruments—can mitigate these effects by lowering integration costs, C, and restoring limited policy space. This result provides a new theoretical basis for recent policy debates on monetary autonomy and external vulnerability in developing and emerging economies.

Finally, the model contributes to the literature on balance-of-payments–constrained growth (McCombie and Thirlwall 1994; Thirlwall 2011) by introducing financial integration costs and asymmetries in the business cycle into the external constraint. In standard Thirlwall models, the growth rate of output is monotonically linked to the growth of exports and the terms of trade under the assumption of stable financial conditions (see Blecker 2016). This paper complicates this picture by embedding the export growth mechanism in a Minskyan boom-bust cycle. I show that the level of output consistent with external equilibrium falls when the cost of financial integration rises, and increases with higher export growth, x. However, with capital mobility, the relationship between x and output growth becomes cyclical and non-linear.

Especially in the boom phase, an increase in export growth can reduce output growth if it worsens the trade balance (e.g., by triggering capital flight or a premature strengthening of the currency). This reverses the expected outcome and increases fragility. In contrast, export growth only makes a positive contribution to output if it generates a trade surplus. In this model, the mechanism that maintains equilibrium in balance of payments works counter-cyclically, with financial conditions mediating the impact of trade dynamics on growth. This adds a channel of dynamic instability to the theory of external constraint, showing that improvements in trade performance do not always lead to higher growth. The third contribution and this extension with their implications for long-run adjustment are discussed in Section 6.

1.2 Related Literature

This paper contributes to a literature that emphasizes the subordinate integration of emerging economies into international financial markets, particularly in relation to external debt and balance of payments. This tradition emphasizes how financial globalization, which began in the 1970s, has exposed these economies to cycles of capital inflows, sudden stops, and external fragility. Foundational analyses of these dynamics include Frenkel (1980), Frenkel (1983), Ffrench-Davis (1983), Bacha (1984), Dornbusch (1984), Diaz-Alejandro (1985), Simonsen (1985), Dornbusch and Fischer (1986), and Eaton and Taylor (1986). More recent contributions—i.e., Eatwell and Taylor (2000), Palma (2003), Frenkel (2008), Akyuz (2011), Mehrling (2012), Bresser-Pereira et al. (2014), Paula, Fritz, et al. (2017), Fritz et al. (2018), Bonizzi et al. (2021), and Paula, Fritz, et al. (2024a)—further develop the role of financial hierarchy, currency asymmetries and structural limits to currency autonomy in peripheral economies. This paper formalizes these insights by modeling how monetary hierarchy and integration costs jointly shape external sustainability and macroeconomic dynamics in emerging markets.

Building on these foundations, the proposed framework extends and complements existing formulations of the business cycle in emerging markets, including Minskyan (Taylor and O'Connell 1985; Gatti et al. 1994; Foley 2003; Taylor 2005; Botta 2017; Kohler 2019), risk-based (Frenkel 2005), international monetary hierarchy (Fritz et al. 2018) and Thirlwall's law perspectives (Bhering et al. 2019).

In contrast to Foley (2003) and G. T. Lima and Meirelles (2006)—who model financial fragility through the behavior of domestic firms or banking markups—this paper emphasizes external fragility through the debt-to-export ratio and its sensitivity to integration costs. Frenkel (2005) develops a risk-based framework to explain external vulnerability, but does not link policy thresholds to the financial trap, as is done here through the sustainability rule. Botta (2017) and Kohler (2019) integrate Minsky cycles into open-economy models, but neither endogenize financial integration costs nor link instability to the notion of monetary hierarchy. While Bhering et al. (2019) extend Thirlwall's law to include financial feedback, this paper introduces capital account shocks, the exchange rate disconnection, and a policy-dependent sustainability curve into the external adjustment mechanism.

The *dominance* approach proposed by Ocampo (2016) is in line with the spirit of this paper, as it emphasizes the role of external shocks transmitted through the balance of payments as drivers of domestic cycles. This paper builds on this insight by embedding these shocks in a formal dynamic structure and relating them to the costs of integration and external debt sustainability. While Foley (2003) and G. T. Lima and Meirelles (2006) also use Minskyan frameworks, they focus primarily on internal fragility—through capital accumulation or bank behavior—rather than on balance-of-payments vulnerability and financial hierarchy, which are the focus here. In contrast, the model developed here treats external financial stability as a key constraint and introduces explicit policy trade-offs characterized by the interaction between global financial conditions and domestic policy instruments.

Countercyclical monetary policy is subject to particular structural constraints in this framework—a mechanism that distinguishes this model from the more closed-economy approach of earlier Minsky models—as policy measures to stabilize financial markets can cause destabilizing movements in capital flows and exchange rates. Following Frenkel (1980), this model contains a law of motion for the interest rate based on excess demand on foreign credit markets. Although related in spirit to Gatti et al. (1994)—who based the interest rate adjustment on corporate debt accumulation—and to Foley (2003) and G. T. Lima and Meirelles (2006)—who used capital accumulation and banking markups, respectively—this paper differs by anchoring the interest rate adjustment to capital account pressures and external market conditions. This shift reflects the central theoretical claim that subordinate integration exposes monetary policy to externally driven dynamics that are not accounted for in typical models of financial instability.

In contrast to studies that analyze business cycles using Minsky's taxonomy of corporate behavior (hedge, speculative, and Ponzi)—such as Foley (2003), G. T. Lima and Meirelles (2006), and Nishi (2012)—this model simplifies the cycle into two distinct phases: boom and bust. While a hedge-like regime appears in the boom phase, characterized by a stable debt–export ratio and a trade surplus ($C < x$), this situation is both analytically marginal and empirically rare and was briefly observed in Latin America in the early 2000s. This two-phase simplification provides clearer insights into macro-financial instability without relying on micro-level financial classifications, as in Guilmi and Carvalho (2017), Davis et al. (2019), Nishi (2018), Pedrosa (2019), and Reissl (2020), who all emphasize micro-macro linkages.

The model also represents a further development of the previous treatment of exchange rate dynamics in heterodox macro models. While Taylor (2009), Kohler (2019), and Kohler and Stockhammer (2022) emphasize the role of financial flows and trade fundamentals, this paper adapts the approach of Harvey (2009) by tying movements in the nominal exchange rate to deviations from the uncovered interest rate parity condition. This decision reflects the view that financial markets dominate the short-term determination of the exchange rate, especially under conditions of financialization of the commodity sector (Cheng and Xiong 2014). In contrast to models in which exchange rates are primarily determined by current account imbalances, here the exchange rate acts as a barometer of external financial pressures and reserve accumulation.

2. BASELINE MODEL

This model examines a small, open emerging market economy that acts as a price taker on the international goods market over an infinite, continuous time horizon. Interaction with the international market (the rest of the world, RoW), which I see as representative of a developed economy, is assumed to be frictionless and subject to the law of one price on the tradable goods side. The non-tradable goods sector is taken as given—there is no government intervention, and international inflation is assumed to be negligible. Consequently, nominal exchange rate adjustments have a complete pass-through effect on the prices of tradable goods, leading to a positive relationship between these adjustments and the real exchange rate.[7] On the financial side, the economy issues bonds in international and domestic currency, which are traded in both markets, so that agents can buy both types of bonds at market prices. However, I assume imperfect substitutability of assets, which might violate the non-arbitrage condition.

The basic identity. I begin this discussion with a brief explanation of the current account (CA) and financial account (FA) identities given by

$$CA(t) \equiv \mathrm{nx}(t) - \eta \cdot D(t) \qquad \text{and} \qquad FA(t) \equiv \mathrm{ci}(t). \tag{1}$$

The current account comprises the net exports of goods and services, $\mathrm{nx}(t)$, and the stock of net external debt, $D(t)$, which represent the net foreign asset position vis-à-vis foreign income. For the sake of simplicity, I assume that net liabilities are always positive and that all creditors are non-residents. $\eta \equiv \alpha r + (1-\alpha)\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}S$ is a composite measure of the nominal yield on external debt that combines the interest rate on domestic currency bonds r and on foreign currency bonds S and weighs it by the parameter α. The parameter α denotes the share of total external debt (public and private) denominated in domestic currency. It captures the general currency composition of foreign liabilities and is treated as an exogenous constraint reflecting the persistent inability of many emerging markets to borrow in their own currencies

[7] This means that an increase in the nominal exchange rate leads to a real depreciation and, conversely, a decrease leads to a real appreciation.

on international markets. Following the stylized empirical evidence, I assume $\alpha = 0.5$ throughout the analysis.[8] This assumption also reflects the degree of subordinate integration: the lower a country's position in the international monetary hierarchy, the less it can borrow in its own currency. Therefore, α captures not only the currency composition of external debt, but also the structural vulnerability of an economy to the global financial markets. While a greater proportion of debt denominated in domestic currency does not eliminate financial risk—given the potential for capital flight or speculative attacks on domestic bonds—it does preserve a greater degree of policy autonomy, as the monetary authority retains the ability to influence domestic interest rates and intervene in times of financial stress.

The accounts of the economy in this model are denominated in domestic currency; therefore, the yield on foreign currency bonds is adjusted for the rate of change in the nominal exchange rate, $\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}$.[9] [10] The movement of the exchange rate captures (*ex-post*) gains and losses in domestic currency from returns on bonds denominated in foreign currency. In the financial account, $\mathrm{ci}(t)$ corresponds to the net capital inflows (financing requirements minus capital outflows), where $\mathrm{ci}(t) = \dot{D}(t)$.[11] Since the balance of payments of an economy is always in equilibrium, it can be expressed as

$$CA(t) + FA(t) - \dot{R}(t) \;=\; \mathrm{nx}(t) - \eta \cdot D(t) + \mathrm{ci}(t) - \dot{R}(t) \;\equiv\; 0. \tag{2}$$

For tractability, I assume that the change in international reserves, $\dot{R}(t)$, is included in the net acquisition of assets by the nation. This assumption will be discussed again later.

Foreign currency interest rates. Given inflation in the RoW, the real yield on foreign currency bonds issued by the domestic economy is represented as $S = \tilde{r} + k\big(\mathrm{nx}, \phi, \ldots\big)$. In this equation, following Frenkel (2008), $\tilde{r}$ denotes the risk-free interest rate for bonds on the world market, while $k(\cdot)$ denotes the country

[8] Recent estimates confirm significant differences in foreign currency borrowing in emerging markets (EMDE). According to the OECD (2025), the share of foreign currency debt in total government borrowing in 2024 was on average between 20% and 30% in medium-sized EMDEs (with a GDP of between USD 300 billion and USD 1,000 billion), while it was closer to 40% in smaller economies (GDP < USD 300 billion). In countries such as Argentina, Chile and Colombia, foreign currency debt accounts for up to half of the total bond portfolio. This data supports the assumption of $\alpha = 0.5$ as a stylized average for structurally constrained EMDEs. In contrast, the average for advanced economies is only 6%—much of which is hedged—highlighting structural asymmetry in currency denomination capacity. While the available data generally refer to government debt, I use α as a proxy for total external debt, which is also subject to structural currency mismatches. The structural currency mismatches observed in the emerging economies are in contrast to the theoretical ideal of monetary sovereignty, which is examined in K. P. F. Lima (2024) in relation to a country's ability to issue debt in its domestic currency.

[9] In accordance with conventional notation, the dot above a variable stands for its derivation in relation to time.

[10] Similar formulations of the interest rate are discussed in Blanchard (2005), Gourinchas (2008) and Farhi and Maggiori (2018).

[11] While this assumption may be somewhat severe, since not all capital inflows into the economy are in the form of debt, it is deliberately chosen in order to examine the stabilizing role of the interest rate.

risk premium required to hedge foreign loans. It is common for bond issuers to include into this premium several factors that are characteristic of an open emerging market, including—but not limited to—the ratio of external debt to total debt, exchange-rate volatility, political stability, and creditworthiness. Consequently, $k(\cdot)$ is a decreasing function of both the trade surplus and ϕ, the ratio of international reserves to foreign debt in foreign currency.

Domestic currency interest rates and the no-arbitrage condition. Since domestic agents have the possibility to borrow via bonds with a yield of S, they consider this interest rate as their opportunity cost for financing decisions. As a result, the actual yield on domestic currency bonds is expressed as $r = S + \mathbb{E}[\mathcal{E}] + \varepsilon + \ell$, where $\mathbb{E}[\mathcal{E}]$ denotes the expected depreciation rate of $\mathcal{E}(t)$ and ε is its dispersion, reflecting the exchange rate risk premium. ℓ stands for the liquidity premium imposed on the domestic currency, which depends on its ability to fulfill international currency functions. The weaker a currency is in the hierarchy of global currencies, the higher the liquidity premium added to the domestic interest rate. From these two interest rates it can be deduced that,

$$r = \tilde{r} + \mathcal{K}, \tag{3}$$

which is the condition of non-arbitrage (i.e. equilibrium) in the financial market. Here, $\mathcal{K} = k(\cdot) + \mathbb{E}[\mathcal{E}] + \varepsilon + \ell = \mathcal{K}\left(\mathrm{nx}(t), \phi, \mathbb{E}[\mathcal{E}], \varepsilon, \ell, \ldots\right)$ has a negative functional relationship with $\mathrm{nx}(t)$ and ϕ, but is positive with respect to exchange rate expectations and liquidity premia. Equation (3) shows that interest arbitrage tends to equalize domestic borrowing costs with external borrowing costs, adjusted for the variable premium $\mathcal{K}(\cdot)$. However, I assume that substitutability in the bond market is not perfect in the short-term, which means that equality in (3) is *not* always given, which affects exchange-rate mobility. It is the responsibility of the monetary authority, through its autonomous monetary policy decision, r, to achieve the equality in (3) as a long-term equilibrium goal. I examine this in detail in Section 6.

BoP as a ratio. For the analysis of debt sustainability, it is crucial to express this economy as a ratio to the export volume $X(t)$, which facilitates the assessment of the real payment capacity for net international obligations. This ratio has the advantage of reflecting the constraints that an emerging economy may face at the international level. In developing countries or economies that are unable to create international monetary reserves, export volume is the only macroeconomic variable that can effectively provide foreign exchange for debt repayment without increasing external debt. Therefore, the most appropriate way to measure the long-term sustainability of external debt is to express it as a ratio of export volume $\delta(t)$.

Assuming the law of one price in international trade, the prices of exportable goods are denoted by $P_X = \mathcal{E}P_X^*$, where P_X^* is the foreign export price normalized to $P_X^* = 1$. Consequently, the influence of the nominal exchange rate is eliminated if the components of the balance of payments are expressed in domestic currency as a ratio of the export volume.

So, letting $\chi \equiv \frac{\mathrm{nx}(t)}{X(t)}$, $\delta \equiv \frac{D(t)}{X(t)}$, and $\varphi \equiv \frac{\mathrm{ci}(t)}{X(t)}$, the fundamental balance of payments identity (2) is

$$\chi - \eta \cdot \delta + \varphi \equiv 0. \tag{4}$$

Using this equation, I will analyze the asymptotic convergence properties toward the long-run equilibrium of net foreign liabilities. Before this analysis, however, I will examine the financial costs associated with the integration of this economy into foreign markets.

2.1 The Costs of Integration

Exchange rate. Assuming imperfect substitutability between financial assets, the condition (3) that no arbitrage is possible need not apply universally. No endogenous mechanism guarantees its applicability. Deviations can be caused by rigidities on the financial market, abrupt shifts in country risk premiums or exogenous monetary policy decisions, among other things. I assume that these deviations influence the course of the nominal exchange rate over time. Taking exchange rate expectations as static in the short run—in order to isolate the effect of interest rate differentials on spot exchange rate movements—and drawing on the approaches of Harvey (2009), Libman (2017), and Basu et al. (2018), I adopt a Brainard–Tobin-type condition for imperfect asset substitutability. This leads to the following adjustment law for modeling movements in $\mathcal{E}(t)$:

$$\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)} = v\xi. \tag{5}$$

The term $v \in (0, \infty)$ stands for the exchange rate adjustment coefficient, which is interpreted as the degree of financial liberalization and is normalized to one. The fact that v is not infinite allows the rationalization of a financial market without perfect substitution of assets, i.e., $\tilde{r} + \mathcal{K}(\cdot) - r = \xi \neq 0$, where $\xi \gtrless 0$ is the degree of deviation from the no-arbitrage condition. That is, the financial account is open but not open enough to fulfill the no-arbitrage condition, especially in the short to medium term. The Brainard-Tobin feature suggests that if investors view domestic and foreign assets as imperfect substitutes, the expected capital inflows, e.g., due to a sudden drop in $\tilde{r}$, may not fully offset the exchange rate change. In other words, the response of the exchange rate to an interest rate change may be dampened due to this imperfect substitutability. In equilibrium, the fulfillment of the non-arbitrage condition (3) stabilizes the exchange rate and inflation. The following section examines the implications of imperfect substitution on the financial market.

Integration costs curve. Taking into account the interest rate structure of this small, open economy and the imperfect substitutability of assets, the financial costs of integration into international markets can be derived from (4) and (5). This leads to the following definition, which I will use throughout this paper.

Definition 1 (integration costs curve). Assuming that $\xi \neq 0$ and $S \in \big(0,1\big)$, the financial cost of integration for a small open economy in international markets can be defined as the weighted average of $\tilde{r} + \mathcal{K}(\cdot)$ and r, where

$$C = \tfrac{1}{2}\Big\{S\big(\tilde{r} + \mathcal{K}(\cdot)\big) + (1-S)\,r\Big\}. \tag{6}$$

The cost curve C corresponds to the interest rate on external debt (η), adjusted for the violation of the non-arbitrage condition. This adjustment ensures that the interest rate reflects the presence of financial frictions, imperfect asset substitution, and arbitrage opportunities in a financial market that deviates from perfect equilibrium in the short to medium terms. Taking this imbalance into account illustrates one of the main factors behind the boom–bust cycle: investors, driven by inflated expectations, exploit interest rate differentials. This behavior also proves to be one of the main causes of instability. During the boom phase, for example, changes in $\mathcal{K}(\cdot)$ may not be fully captured by r (which is assumed here to be under the control of the monetary authority) and vice versa. This dynamic reflects what Gennaioli et al. (2015) refer to as "neglected risks," which can arise from myopia, excessive optimism, or policy decisions, such as those that might inadvertently encourage excessive optimism or mask underlying risks.

Thus, C represents the trade-off between bonds valued in domestic and foreign currencies. A greater reliance on bonds priced in foreign currency makes the effective cost more sensitive to international factors, which is captured by the term $S\big(\tilde{r} + \mathcal{K}(\cdot)\big)$. In contrast, if the economy is more dependent on domestic bonds, costs are primarily influenced by domestic interest rates, $(1-S)\,r$.[12] A higher S increases the influence of the risk-free interest rate $\tilde{r}$ and $\mathcal{K}(\cdot)$ on the total costs and illustrates the dependence of the open economy on international financial conditions. Conversely, a lower S increases the influence of

[12] In the extreme cases not considered here, when $S = 1$, all bonds are denominated in foreign currency, and the cost curve simplifies to $\frac{1}{2}(\tilde{r} + \mathcal{K}(\cdot))$, suggesting that costs depend entirely on the foreign risk-free rate and the additional premiums represented by $\mathcal{K}(\cdot)$. Conversely, when $S = 0$, all bonds are denominated in domestic currency and the cost curve C simplifies to $\frac{1}{2}r$, suggesting that the cost is entirely determined by the domestic interest rate set by the monetary authority.

the domestic interest rate on total costs, emphasizing the influence of domestic monetary policy. The cost curve is weighted to capture the mixed nature of the bond market in emerging markets where bonds are issued in both domestic and foreign currencies. Its structure reflects the proportional impact of each bond type on the total cost of funding and balances the influences of domestic and international financial conditions.

While C reflects deviations from perfect arbitrage, not all frictions have the same impact on macroeconomic stability. The frictions embedded in C are market-driven: they include risk premia, segmented capital markets, and liquidity constraints arising from unregulated financial integration. These forces amplify pro-cyclical dynamics and increase vulnerability to external shocks, especially in emerging markets. In contrast, certain policy instruments—such as capital flow management tools, reserve requirements or taxes on speculative inflows (see Das et al. 2022)—create frictions of a different nature. Although they restrict financial operations, they serve to stabilize them. They help contain excessive volatility, reduce vulnerability to externally induced cost shocks and ultimately lower the effective level of C by changing the composition and behavior of financial flows. This distinction is central to the analysis in Section 4, where it is shown that targeted interventions expand the region of sustainability and prevent boom-bust traps.

2.3 Long-Term External Debt-to-Export Ratio Trajectory

I now examine the long-term equilibrium properties of this economy, focusing on the sustainability of foreign debt. To make the model tractable, I impose the following:

Assumption 1. $\dot{X}(t) = xX(t)$ and $\dot{\chi}(t) = \zeta\chi(t)$.

It is assumed that exports grow at a constant rate x, as suggested by McCombie and Thirlwall (1994). This simplification allows the analysis to isolate the financial consequences of integration costs and the monetary hierarchy. While it is known that exchange rate fluctuations can affect export performance, such effects usually only have an impact in the medium-to-long term. In contrast, shocks to integration costs, C, have an immediate financial impact, which is the focus of this paper. The trade channel is therefore simplified to illustrate how financial vulnerability evolves under different structural constraints. In addition, ζ is the growth rate of the trade balance (or net exports), which is also assumed to be constant. This means that trade adjustment is primarily determined by output, as this directly influences the level of imports.

The fundamental equation of the external debt-to-export ratio. The combination of equations (4) and (5) yields the well-known fundamental equation for the ratio of foreign debt to exports, denoted

$$\frac{\dot{\delta}(t)}{\delta(t)} = \gamma - \frac{1}{\delta(t)}\chi(t). \tag{7}$$

This equation consists of two components: a root $\gamma \equiv \frac{\partial \dot{\delta}(t)}{\partial \delta(t)} = C - x$ (abbreviated for the sake of notational simplicity)—which indicates the stability of the course of $\delta(t)$—and a term that depends on the trade balance, $-\frac{1}{\delta(t)}\chi(t)$. Equation (7) also illustrates the real–financial interplay inherent in an open economy. On the one hand, the component representing the financial costs, C, destabilizes the course of $\delta(t)$, for example through deviations from the no-arbitrage condition. If the cost level is permanently above x, this leads to what Frenkel (2008) calls a *financial (or financing) trap*, in which debt grows faster than repayment capacity, forcing the economic system to run trade surpluses at the expense of lower economic growth, often leading to recessions and financial crises. Conversely, the component reflecting the "real" aspect of international trade, $-\left(x + \frac{1}{\delta(t)}\chi(t)\right)$, stabilizes the development of $\delta(t)$. Being trapped is characterized by this delicate relationship between the real and the financial dimensions.

The growth rate of exports, which indicates the strength of the real aspect as a counterweight to the financial aspect, is of crucial importance in this interplay. Thus, in a highly financially open system, even with low costs ($C \approx 0$) such that $\frac{\dot{\delta}(t)}{\delta(t)} = -\left(x + \frac{1}{\delta(t)}\chi(t)\right)$, a negative growth rate of exports, which inevitably leads to a trade deficit, $\delta(t)(x + \chi(t)) > 0$, can trap the system. Conversely, even with initially balanced trade $\chi(0) = 0$, a minimal increase in $\gamma\,(> 0)$ can drive the system into the same trap.

Solution and the maximum criterion. The general solution of equation (7) is

$$\delta(t) = \delta(0)e^{\gamma t} - \chi(0)\frac{1}{\gamma - \zeta}\left(e^{\gamma t} - e^{\zeta t}\right), \tag{8}$$

which represents the evolution of $\delta(t)$ over time. Since this ratio is a drag on the economy, exceeding a certain growth threshold is undesirable. To mitigate the potential explosiveness, an approach is taken that uses the maximum criterion of Simonsen (1985) and Frenkel (2005). A first-order condition $\frac{\partial \delta(t)}{\partial t} = 0$ and a second-order condition $\frac{\partial^2 \delta(t)}{\partial t^2} < 0$ are applied to equation (8) to ensure sustainability. So I get

$$\frac{1}{\gamma - \zeta} \cdot \varepsilon \geq \frac{\delta(0)}{\chi(0)}, \tag{9}$$

where $\varepsilon \equiv \left(1-\left(\frac{\zeta}{\gamma}\right)^2 e^{-(\gamma-\zeta)t}\right) \approx 1$. If $\gamma-\zeta > 0$, the intersection point (where equality prevails) represents the highest credibility level at which an economy can maintain control over its debt-to-export ratio. This critical point can be interpreted as a **Minskyan survival constraint in an open economy**, which marks the boundary between sustainable financing and a default that leads to unlimited debt escalation. The initial conditions, $\frac{\delta(0)}{\chi(0)}$, set a "lower bound" in this dynamic that defines the real-financial link necessary to meet obligations. Consequently, this threshold plays a central role in assessing the sustainability of the system's external commitments, a concept that is explained in more detail in Section 4.

2.4 Cost-Induced Trade-Offs: A Stylized View

In this subsection, I define the short-run static equilibrium response of the economy in the face of a cost shock. This static "snapshot" serves as an intuitive guide for the dynamic analysis that follows in later sections. The cost curve plays a crucial role in the representation of the business cycle as it contains the elements that determine the growth of both the output level $Y(t)$ and imports $M(t)$.

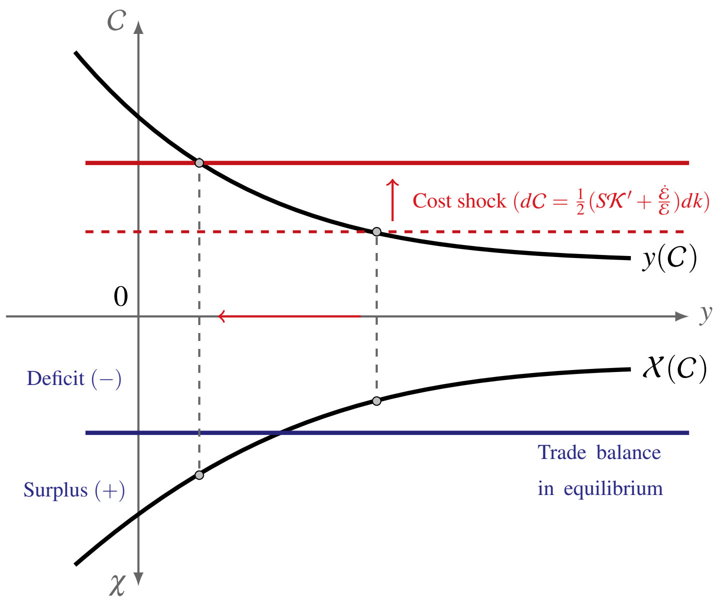
Assumption 2. $\dot{Y}(t) = y(C)Y(t)$ and $\dot{M}(t) = \mu(C)M(t)$.

Definition 2 (imports and output growth rate). The growth rate of imports is a function of the growth rate of output, $m = m(y)$, where, following a stylized fact, I assume a positive relationship, $m'(y) > 0$. Moreover, the growth rate of output is a function of the cost curve $y = y(C)$, with a negative relationship, $y'(C) < 0$. Therefore, the growth rate of imports is a composite function of the integration costs $m = m \circ y(C) = \mu(C)$ where $\mu'(C) < 0$.

The endogenization of output growth with the cost curve as the central driver is a modern approach to understanding the business cycle after the 2008 crisis (see Harvey 2009; Kohler and Stockhammer 2021). This approach implies that the trade balance is ultimately determined by the cost curve. This results in the following definition.

Definition 3 (trade balance). With an exogenous growth rate of exports, the trade balance ultimately depends on the development of output (via imports) and thus on the integration costs, $\chi = \chi \circ \mu(C) = \mathcal{X}(C)$, whose relationship is clearly positive $\mathcal{X}'(C) > 0$.

Figure 2: The effects of C's shock on trade balance



To capture the macroeconomic effect of financial integration constraints, I assume that the growth rate of output is a decreasing function of the integration cost parameter C, as stated in Definition 2. The underlying idea is that tight access to external finance increases the cost of capital and lowers the potential growth rate of output. Since import growth is positively related to output growth, this means that rising costs reduce imports and thus improve the trade balance when exports are constant. This inverse relationship is summarized in Definition 3.

Figure 2 shows a stylized, static representation of these relationships. The horizontal axis denotes the output growth rate, while the vertical axis displays both the integration costs C and the trade balance. The output growth curve is downward sloping and concave, reflecting the idea that growth is increasingly sensitive to cost shocks (dC) at higher growth rates. The pattern is similar to the trade balance curve: reduced import demand has diminishing marginal effects at lower output levels. These elasticity patterns reflect the stylized facts observed in financially constrained economies.

This static framework serves as a conceptual prelude to the dynamic mechanisms developed in the next section. In particular, it motivates the cost-growth-trade balance relationship that underlies the external sustainability rule and the conditions under which financial fragility can emerge.

3. STABILITY AND SUSTAINABILITY THROUGHOUT THE CYCLE

From this point on, I focus on long-term adjustments, setting aside short-term considerations. One question naturally arises: how does the interaction between real and financial components mitigate the effects of cyclical fluctuations (amplified in this model by shocks to the cost curve)? I examine how the system reacts in two scenarios. To understand the mechanism of the model, I begin by analyzing the system under the assumption of fixed costs and zero export growth, which is referred to here as "top-down adjustment." This scenario corresponds to traditional balance-of-payments crises triggered by current account deficits. I then present the general case of an economic crisis, focusing on the effects of a turning point, which I call "bottom-up adjustment." This adjustment is related to a Minsky-type crisis triggered by financial shocks to C.

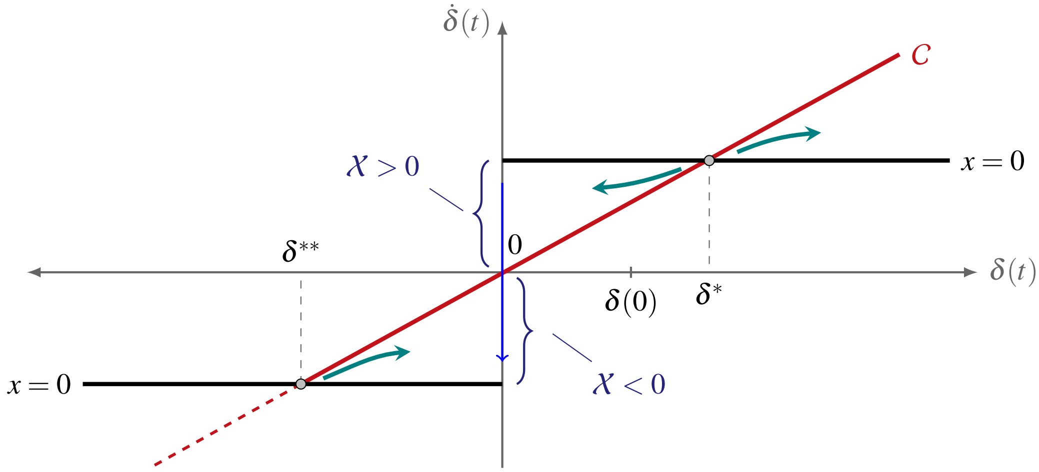
Equilibrium. If the ratio of foreign debt to exports experiences balanced growth, where $\dot{\delta}(t) = 0$, then

$$\underbrace{C\delta(C)}_{\text{Financial}} = \underbrace{x\delta(C) + \mathcal{X}(C)}_{\text{Real}}. \tag{10}$$

The linear nature of this equation suggests a single equilibrium point, namely $\delta^* = \frac{\mathcal{X}(C)}{\gamma(C)}$, which is the intersection of the curve on the real side and the curve on the financial side. The slope of the real dimension is represented by the export growth rate x, while the slope of the financial side is represented by C. The vertical axis represents the trade balance, an important indicator of economic activity that is essential for ensuring balance-of-payments equilibrium.

Before we continue, it is worth briefly explaining the difference between debt sustainability and debt stability. Debt stability refers to the tendency of the debt ratio to converge to its long-term equilibrium, δ^*. Debt sustainability, on the other hand, refers to the long-term ability of the system to meet its financial obligations. These two concepts are not interchangeable, even though they are often mistakenly used as such. A stable debt path can create the illusion of sustainability, but this is not necessarily true; a stable equilibrium **does not inherently protect the economy from turning points**. In this context, it is important to consider both sustainability and stability concurrently, as neglecting either aspect can be detrimental. These issues are discussed next.

Figure 3: Top-down adjustment: a standard balance of payments crisis



3.1 Top-Down Adjustment

Consider an economy in the initial situation, $\delta(0)$, with positive economic growth and a positive trade balance, but zero growth rates for exports and positive costs, where $\gamma = C > 0$ (see Figure 3). This situation initially makes it possible to meet external obligations and gives the impression of sustainability, as it is accompanied by a current account surplus and sufficient reserves to meet obligations. In the long term, however, this is not sustained. With zero (or negative) export growth, positive integration costs, and production, the economy will inevitably run a trade deficit. The transition manifests itself along the vertical axis and leads to a deterioration of the trade balance, $\mathcal{X}(C) < 0$, accompanied by a change in the $\mathcal{X}$-intercept, resulting in a downward shift of the x-curve. This circumstance leads to the economy being trapped on a long-term path characterized by escalating debt: $\frac{\dot{\delta}(t)}{\delta(t)} = C - \frac{1}{\delta(t)}\mathcal{X}(C) > 0$. This situation would persist even if costs were to fall over time, as the trade deficit would more than offset this potential decline.[13]

The trivial solution to escape the financial trap is to increase effective demand from the rest of the world, which raises x above the integration cost curve.[14] Alternatively, the trade balance can be improved by reducing imports and thus production. However, this option is not necessarily intuitive, as the model implies that such a move must be triggered by a positive shock on the cost curve, initially worsening the recession by causing $dy = y'(C)\,dC < 0$ and thus $dm = \mu'(C)\,dC < 0$. Assuming that the response of the

[13]Here, I assume that the trade deficit escalates faster than the initial deleveraging, due to the contractual nature of debt maturity agreements.

[14]McCombie and Thirlwall (1994) have examined the nature of this development in detail. Small, open economies that are unable to produce international money always face external constraints. The most important constraint is the demand for domestic export goods from abroad.

exchange rate is, to some extent, disconnected (i.e. that rigidities are present), lowering the cost curve through a monetary policy rate cut in the context of a trade deficit is impractical. Such a move would exacerbate the trap zone by increasing $\mu(C)$ and $y(C)$ while shifting the δ^{**} equilibrium point to the left.

In light of the above, it is important to emphasize that improving the trade balance by reducing production (assuming no additional external financing) is generally considered undesirable. This approach has a negative impact on the domestic economy and leads to a decline in output and employment rates below their full potential.

Within the framework of this model, I have shown that low export growth harms the economy—a result that is well-established in the literature. But is robust export growth sufficient to meet long-term foreign obligations? Does a positive export growth rate ensure systemic stability and a successful exit from the financial trap? These questions are addressed below.

3.2 Bottom-up adjustment

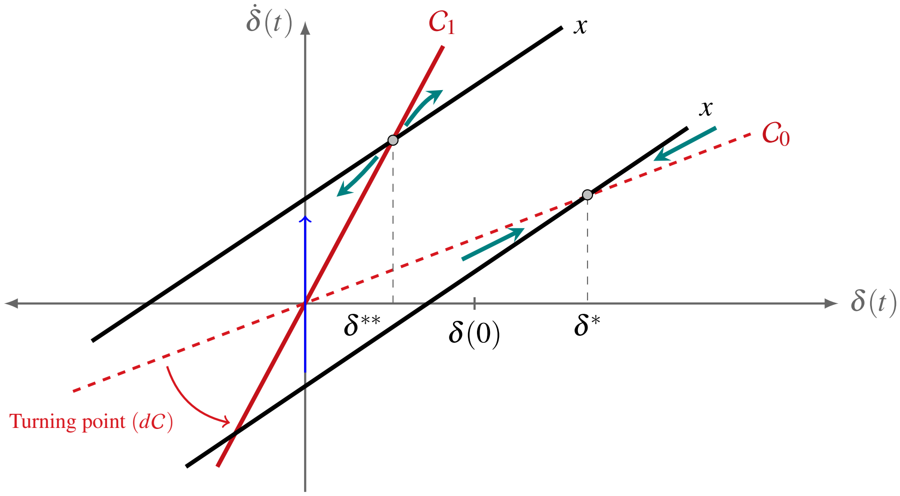
If we consider the economy under the same initial conditions as in the previous example $\delta(0)$, we now observe a positive export rate that exceeds the integration cost curve $\gamma < 0$. In Minskyan terms, this stable scenario corresponds to the boom phase: increased confidence encourages excessive spending and consumption. A trade deficit arises which leads to a sustained increase in the debt ratio $\delta(t) \to \delta^* > 0$ that weakens the economy. This development is consistent with the hypothesis of financial instability for emerging markets as shown in Figure 4. However, given the imperfections of the financial market (see Proposition 1), the increase in fragility captured in $\mathcal{K}(\cdot)$ does not necessarily lead to an increase in the domestic interest rate r (and thus η in the current account). Therefore, the appropriate threshold for x to accurately assess the robustness of the debt path in this context is not the traditional interest rate on external debt (i.e., η), but C.

Suppose the same cost shock as in Figure 2 suddenly occurs so that

$$dC = \frac{1}{2}\left(S\mathcal{K}'(\cdot) + \frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}\right) dk,$$

which is now effectively a *turning point* with $\gamma > 0$. This illustrates the *asymmetric integration between developing and developed economies*. In the initial phase, this shock traps the economy in a cycle of rising debt, low growth and increased vulnerability. Subsequently, the equilibrium response leads the economy

Figure 4: Bottom-up adjustment: a Minskyan crisis



to the point $\delta^{**} > 0$, where it accumulates a trade surplus ($X(C) > 0$) to meet its external obligations. The adjustment of the trade balance now moves "from bottom to top" along the vertical axis. The larger the trade-balance adjustment, the more likely foreign obligations will be met, regardless of the relative position of δ^{**} to δ^{*} (in Figure 4 it is shown on the left, but could also be on the right).[15] This adjustment is usually associated with economic recession, currency crises, inflation, and capital withdrawals.

It is noteworthy that **the higher the stable equilibrium level, δ^{*}, the more susceptible the economy is to turning points**. This happens because for a given C, a higher equilibrium, δ^{*}, can be achieved either with a lower export growth rate (x) or by maintaining the same x with a larger trade deficit and/or steeper C. This shows that it is necessary to formulate a general "rule" to protect the system from shocks to C. The main objective of this rule is to prevent the economy from falling into a financial trap under any circumstances, thus ensuring debt sustainability.[16] Ideally, compliance with this rule would occur in a stable framework where $\gamma < 0$. This observation leads to the following result:

Proposition 1 (sustainability of foreign debt). *To ensure the long-term sustainability of external debt relative to exports during turning points, the external debt ceiling should be set at an unstable equilibrium where* $\gamma > 0$ *(as indicated by point* δ^{**} *in Figure 4).*

[15]Moreover, a crisis triggered by $\frac{dC}{dk}$ could even arise under the initial condition of a trade surplus, depending on the magnitudes at play. In this analysis, I focus on the case of a trade deficit to reflect a stylized fact that applies to emerging markets except China and certain Asian economies.

[16]This aspect is usually overlooked in the literature, which tends to emphasize the stability aspect, such as in the seminal model by Foley (2003). In Bhering et al. (2019), a certain caution can be observed with regard to high δ^{*}; however, they continue to associate stability with sustainability.

This result will be examined in more detail in Section 4. It may be counterintuitive, but in other words, the rule should be constructed with the worst-case scenario in mind and applied consistently, regardless of the phase of the economic cycle. However, before formalizing this rule, I will first present three short- to medium-term mechanisms that the system can use to either escape the trap or mitigate its effects when the economy is already there.

3.3. Some strategies to escape the trap

Strategy #1: taxes. The above result suggests that economic policy should primarily, but not exclusively, work toward reducing C. This can be achieved, for example, by mitigating panic risks and limiting financial inflows that exploit carry trade opportunities. One approach might be to impose a tax on foreign creditors to discourage them from buying domestic liabilities by reducing their yield (which means no compensation by further increases in r and S). These liabilities can be denominated in domestic and foreign currencies and subject to taxes of type τ_r and τ_S, respectively. Clearly, these taxes could be levied separately, but I will illustrate their simultaneous application here. The impact of this tax on the balance of payments can be expressed as

$$\mathcal{X} - \eta\left(\tau_r, \tau_S\right) \cdot \delta + \varphi \,=\, 0, \tag{11}$$

where $\eta\left(\tau_r, \tau_S\right) \equiv \frac{1}{2}\left\{\left(r - \tau_r\right) + \frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}\left(S - \tau_S\right)\right\}$. The introduction of such a tax penalizes savers' wealth by lowering their returns to $r - \tau_r$ and $S - \tau_S$, which ultimately leads to a flattening of the integration cost curve:

$$C_\tau \,=\, \frac{1}{2}\Big\{\left(S - \tau_S\right)\left(\tilde{r} + \mathcal{K}\left(\cdot\right)\right) + \big(1 - \left(S - \tau_S\right)\big)\left(r - \tau_r\right)\Big\}. \tag{12}$$

Note that the decline in domestic currency returns mitigates what Paula, Fritz, et al. (2017) and Carstens and Shin (2019) refer to as "original sin redux." In other words, if the creditor is a non-resident, financing the current account deficit with domestic bonds has the same destabilizing effects as financing it with foreign currency bonds. The financial impact of a decline in C is expected to manifest faster than the real effect transmitted through production. In particular, the shift of the intertemporal equilibrium, δ^{**}, to the right (under unstable conditions) is expected to occur before the trade balance deteriorates over time (via output and imports) due to the decline in C, $\frac{dy}{dC_\tau} > \frac{dy}{dC}$. If these measures are taken in the right sequence, they can help to reduce over-dependence on external funding, decrease the vulnerability of the system and provide an alternative to more drastic interventions.

Strategy #2: macroprudential policies. Macroprudential regulations, including systemic risk buffers, help to mitigate arbitrage opportunities between domestic and international assets. Preemptive capital flow management measures can have a similar effect.[17] Coordinated financial regulation reduces the economic vulnerability associated with cost shocks and subsequent instability by dampening a pronounced cycle during the boom phase. In the model, this is represented by a decreasing degree of financial liberalization ($\downarrow v$). Assuming that v is less than one ($v \in (0,1)$), the effect on the cost curve contributes to S decreasing, leading to a situation in which C effectively falls in response to a reduction in r. This leads to

$$C = \tfrac{1}{2}\Big\{Sv\big(\tilde{r}+\mathcal{K}(\cdot)\big)+(1-Sv)\,r\Big\}.$$

The implementation of this strategy mitigates system volatility and ensures continuous access to the international capital markets. Thus, combining the first and second strategies results in a cost curve given by

$$C_\tau = \tfrac{1}{2}\Big\{v\,(S-\tau_S)\,\big(\tilde{r}+\mathcal{K}(\cdot)\big)+\big(1-v\,(S-\tau_S)\big)\,(r-\tau_r)\Big\}. \tag{13}$$

The combination of these two strategies is advantageous in the case of both a trade deficit and a trade surplus. Given the growth rate of exports, reducing integration costs is always beneficial for the system.

Strategy #3: financial aid. Does financial aid such as the IMF rescue package, cet. par., help the economy out of the trap? If this measure does not improve the current account balance, the answer is clearly negative, i.e., it does not help to escape the trap. However, if it helps to reduce country risk and other arguments of $\mathcal{K}(\cdot)$, it is only beneficial if the economy has a trade surplus, similar to the previous two measures; otherwise the trap gets bigger.

Although these strategies are presented in a stylized form, their logic is based on historical experience. For example, Chile's use of unremunerated reserve requirements in the 1990s and Brazil's IOF tax on short-term inflows after the 2008 financial crisis illustrate the effectiveness of capital flow management tools in reducing macro-financial volatility. Similarly, South Korea and Malaysia used macroprudential regulation after the Asian crisis to regain control over interest rate policy and stabilize capital inflows. These experiences support the idea that carefully designed frictions can reduce the effective cost of financial integration and expand the sustainability space—the very mechanisms explored in this model.

[17] For further details on different measurement approaches and empirical data, see Das et al. (2022).

4. HOW TO *AVOID* THE FINANCIAL TRAP

What is the best strategy for the economy to prevent it from falling into a trap after a cost curve shock? That is, how can the system prevent such a shock from becoming a turning point? The challenge is to develop a rule that ensures the sustainability of external debt and protects the system from collapse. To operationalize the maximum criterion inequality (9), I define the left-hand side as a function of the cost curve, denoted $\mathcal{S}(C)$. This function represents the maximum sustainable initial debt-to-export ratio consistent with a stable path for the economy after a shock. Assuming that $\varepsilon \approx 1$ and the growth rate of the trade balance ζ is considered constant, the sustainability rule takes the form

$$\mathcal{S}(C) = \frac{1}{\gamma(C) - \zeta} = \frac{1}{C - x - \zeta}. \tag{14}$$

This simplified formulation preserves the central insight: $\mathcal{S}(C)$ decreases with C, which means that higher integration costs reduce the economy's sustainable external position. While the exact curvature of $\mathcal{S}(C)$ depends on whether $C - x \gtrless \zeta$, its monotonicity—and thus the main policy implication—remains unaffected. The function shown in Figure 5 for $C - x > \zeta$ serves as a reference to assess whether a shock to C leads to a loss of sustainability.

The threshold that separates sustainable from unsustainable regions can be interpreted as a *Minskyan survival constraint for an open economy*. It reflects a binding macro-financial boundary that links the "real" side of the economy to the cost structure of integration, which includes not only productivity but also risk and credibility. This concept is further clarified in the next result:

Proposition 2 (the sustainability rule). *The relationship between foreign debt and exports remains sustainable in the face of a turning point only if the system fulfills*

$$\mathcal{S}(C) - \frac{\delta(0)}{\mathcal{X}(0)} \geq 0.$$

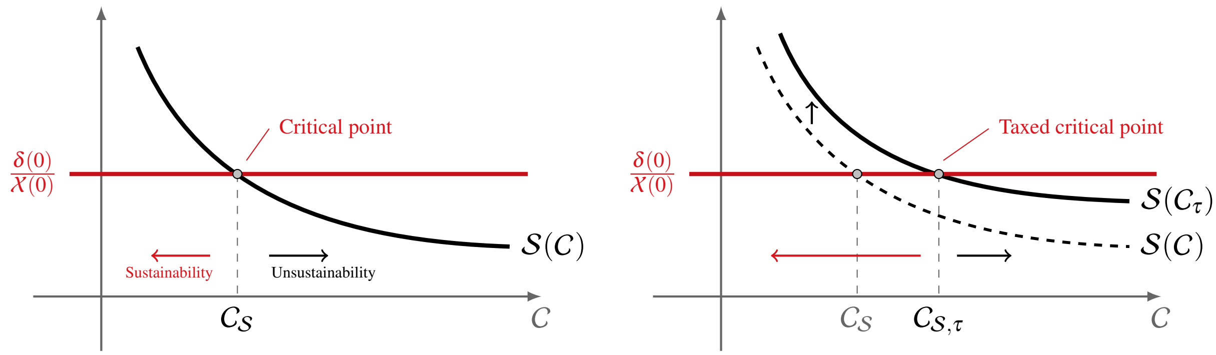
Conversely, if

$$\mathcal{S}(C) - \frac{\delta(0)}{\mathcal{X}(0)} < 0,$$

the debt path becomes unsustainable and leads to a financial trap over time.

The critical point represents the maximum value that the cost curve can assume without violating the sustainability rule. This point corresponds to equilibrium δ^{**} in Figure 4. If the initial conditions act as a

Figure 5: External-debt sustainability curve



(a) Debt sustainability and the critical point **(b) The effects of a taxed curve at the critical point**

"lower bound," an alternative approach from the perspective of δ^{**} is to determine the maximum "upper bound," given by

$$\delta^{**} = \delta_{\max} \leq \frac{\mathcal{X}(C)}{\gamma(C)}, \tag{15}$$

which is equivalent to the value formulated in Proposition 2. Simply put: The economy will not fall into the trap if the cost increase occurs to the left of critical point $C_{\mathcal{S}}$. In the most extreme scenario, in which no external financing is available, the economy must generate a trade surplus to avoid falling into the trap. However, not all surpluses guarantee an escape from the trap; the economy only gets out if $\delta(0) \in [0, \delta^{**}]$, regardless of whether the trade balance is initially in deficit or surplus.

This criterion should serve as a general guideline for policy makers when setting a maximum sustainable debt limit. Although it is based on an unstable equilibrium, it can also be used as a universal threshold in a stable context. If the economy adheres to the sustainability rule, the trajectory of the debt–export relation will be negative as $t \to \infty$, and will deviate from $\delta_{\max}$ after a turning point, as indicated by

$$\delta(t) = -\text{ sust. rule} \times e^{\gamma t} + \delta_{\max} < 0. \tag{16}$$

One way to widen the sustainability range, $\int_0^{C_{\mathcal{S}}} \mathcal{S}(C)\, dC$, is to lower the initial conditions or "floor" curve. The other is to lower the integration costs and shift the $\mathcal{S}$-curve upwards. For example, as shown in Figure 6b, the introduction of a tax on foreign creditors has a positive impact. Here one can observe why certain economies are able to secure financing to meet their obligations despite unfavorable external debt or international trade indicators: they keep their C-curve low (i.e., high level of credibility, institutions, high position in the international monetary hierarchy, etc.) so that they can stay in the sustainable region and avoid financial traps. The more strict the rule that leads to a larger sustainable area, the smaller the trade surplus required after the turning point. This suggests that a stricter rule mitigates the economic recession after the shock. For example, if the expansion of the sustainable area is achieved through improved initial conditions, where $\delta(0) = 0$ at the limit, then achieving a trade surplus after the shock would be unnecessary; maintaining balanced trade at zero would be sufficient.

To summarize, the key message of this section is that emerging economies inherently have lower debt sustainability due to higher integration costs. This structural disadvantage remains, even if developed economies have worse "real" indicators than emerging markets.

5. QUANTITATIVE EXPLORATION

After analyzing the impact of the turning point on the economy, I examine two numerical examples to observe the shock dynamics and understand the parametric magnitudes. I focus on the two equilibrium points of bottom-up adjustment shown in Figure 4.

Impulse response. I introduce in equation (8) a transient shock of the form $dC\Delta\left(t-s\right)$, where Δ is the Dirac unit impulse at time s and dC is the magnitude of the change caused by one of the arguments in the cost curve. The general solution of (8) is now expressed as

$$\delta(t) = \delta(0)e^{\gamma t} - \chi(0)\frac{1}{\gamma-\zeta}\left(e^{\gamma t} - e^{\zeta t}\right) + dCu_s(t)e^{\gamma(t-s)}, \tag{17}$$

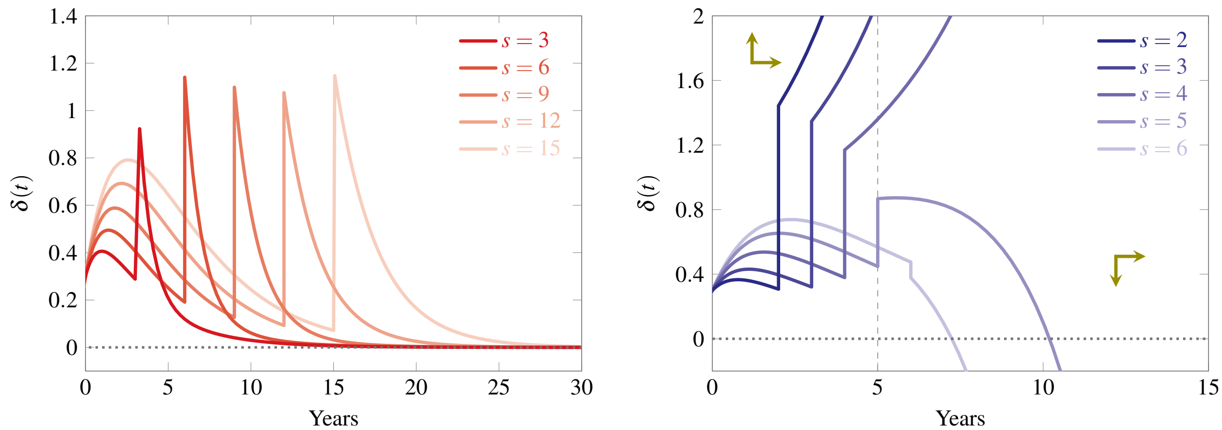
where $u_s(t)$ is the Heaviside function, defined as

$$u_s(t) = \begin{cases} 0 & \text{if } t < s, \\ 1 & \text{if } t \geq s, \end{cases}$$

and $s \geq 0$. At each instant s when the shock occurs, its magnitude is uniform ($dC = 1$) and exogenous in the two types of equilibrium studied below. In Appendix A, I present a step-by-step proof for the derivation of expression (17).

Stable equilibrium. Let us assume that in this context of stability and growth, the shock on the cost curve does not change the sign of $\gamma < 0$. That is, to illustrate this example pedagogically, I assume that this

Figure 6: Impulse response to an integration cost curve



(a) Stable equilibrium **(b) Unstable equilibrium**

segment of the boom phase is sufficiently resilient so that cost shocks do not trigger a turning point. Given discretionary parameters, the initial conditions show an economy with a low debt-to-export ratio of $\delta(0) = 0.3$ and a trade deficit of $\mathcal{X}(0) = -0.6$. Furthermore, the trade balance has a negative growth rate of $\zeta = -0.3$. I also assume that costs escalate over time due to higher country risk, reflecting the fragility of the economy during the boom. As a result, the gap γ decreases over successive periods (i.e., it becomes progressively less negative), which means a positive shift of δ^* in the $\left(\delta(t), \mathcal{X}(t)\right)$-plane. Figure 7a shows the response of $\delta(t)$ to cost shocks. The shocks occur every three years, and the first impact (in the third year, $s = 3$) quickly converges to equilibrium and resumes the original trajectory around the fifth year. However, as γ decreases due to a systematic increase in C and persistent shocks,[18] the convergence of the debt–export ratio slows down.[19] This confirms Proposition 1 and indicates that an economy with a growing steady state, δ^*, is more sensitive to shocks and the probability of a collapse increases. Here, the increased sensitivity is associated with a growing current account deficit.

Unstable equilibrium. Suppose now that the cost shock actually became a turning point that led the economy from a stable to an unstable equilibrium with $\gamma > 0$. This setting is more sensitive to parametric variation; therefore, to capture these effects, the shocks occur annually from the second year onwards. The initial conditions represent an economy identical to the previous one and approaching stability. After the

[18]This rise in costs can occur for various reasons. In this example, negative growth in net exports can lead to higher country risk, increasing C and at the same time increasing negative net payments to the rest of the world. All this leads to a growing current account deficit.

[19]The equilibrium $\delta^* > 0$ is the ratio of two negative values: the trade deficit $\mathcal{X}(C) < 0$ divided by $\gamma < 0$ (since $C < x$). With $\gamma < 0$ as a parameter, an increase in C means that the gap $C - x$ becomes increasingly "less negative," shifting δ^* to the right as C increases. This dynamic increases the fragility of the system.

shock, however, the initial conditions change to $\delta(0) = 0.5$, with a trade surplus of $\mathcal{X}(0) = 0.2$, and positive growth of $\zeta = 0.1$. Over time, this leads to a shift of the equilibrium, δ^{**}, to the right. For the sake of simplicity, $\gamma = 0.4$ is maintained after all shocks. Figure 7b shows that the shocks up to the fourth year have led the economy into a financial trap scenario (to the right of δ^{**}). In contrast, the shocks starting from the fifth year onward position the economy in a sustainable region. Moreover, the shock from the sixth year onward, *accelerates* the decline in $\delta(t)$. In this example, access to the sustainable region results exclusively from the positive growth of the trade balance and the resulting shift of δ^{**} to the right, positioning the economy "to the left" of this point. The ideal application of the sustainability rule, as described in Proposition 2, must produce similar behavior from the beginning at $t = 0$, as happens in the fifth year of this example. As mentioned above, the tighter the rule, the smaller the trade surplus needed to fulfill the commitments, which implies a smaller economic recession after the shock.

6. TOWARD A SYSTEMIC ADJUSTMENT

This section examines the impact of a major disadvantage faced by emerging economies during global integration: their low position within the international monetary hierarchy. In this framework, I assume that this low position translates into a higher equilibrium interest rate, r^*. To this end, and in an attempt to address the low prominence of interest rate policy in the previous sections, I analyze the behavior of monetary policy and its interaction with debt dynamics at the $\left(\delta(t), r(t)\right)$ plane. I formalize both economic booms and busts, focusing in particular on the role of the monetary authority in stabilizing economic booms amid foreign debt and liquidity shocks. In the previous sections, I have shown that during a boom, larger and more persistent debt shocks increase the likelihood of a turning point. Here I show that the higher the hierarchical position and the greater the independence of the monetary authority in responding to shocks, the easier it is to stabilize the system and achieve equilibrium. Conversely, a lower hierarchical position combined with less independence undermines the robustness of the system and makes stabilization efforts more difficult.

6.1 The basic model

This open economy experiences continuous inflows and outflows of capital (Miranda-Agrippino and Rey 2022) which form the basis for a dynamic process of adaptation to persistently unbalanced situations over time. The ability to stabilize the system in response to imbalances reflects the independence of the monetary authority, particularly the way domestic policy adapts to global financial shocks (Leo et al.

2022; Rey 2015). An authority is considered independent if it is able to steer and stabilize the financial cycle with the help of monetary policy without restrictions (i.e., with ample policy space). Conversely, it is considered less independent or not independent if its ability to use monetary policy is limited.[20]

For tractability, I assume that the disequilibrium of capital flows is represented by this differential equation:

$$\dot{r}(t) = c\Big(\varphi_T - \varphi(r)\Big), \qquad \text{where} \qquad \varphi'(r) = \begin{cases} > 0 & \text{if Independent,} \\ = 0 & \text{if Non-independent,} \end{cases} \tag{18}$$

where c is a constant coefficient. Note that $\varphi'(r) \in [0, \infty)$ is not an estimator of independence *per se*, but rather reflects the ability of the authority to control the evolution of the interest rate.

The gap in equation (18) shows that the interest rate responds to excess net capital inflows, $\varphi(r)$, relative to a target, φ_T, set by the monetary authority. This formulation intentionally abstracts from inflation targeting and instead emphasizes the role of capital flows and financial constraints in shaping interest rate dynamics. While the domestic interest rate is treated as a policy instrument under the control of the authority, its evolution is determined by external financing needs and the country's position within the international monetary hierarchy.[21]

This framework can also be interpreted through a Minskyan lens. The literature on financial cycles in emerging markets (e.g. Foley 2003; Frenkel 2008; Kohler 2019; Paula, Leal, et al. 2024) suggests that boom phases often start with high interest rates, which attract capital inflows, leading to downward pressure on interest rates as liquidity increases. In the later phases of the boom, interest rates tend to rise again due to the growing debt burden and rising risk perceptions, until the turning point triggers a crisis phase. The following sections examine how the system reacts to these cyclical behaviors.

To ensure a positive and sustainable flow of foreign capital, I assume that the authority relies on two conditions. First, a nominal exchange rate that remains stable—i.e., is in equilibrium—which, assuming a full pass-through, also implies stable inflation.[22] [23] Second, that this exchange rate corresponds to the

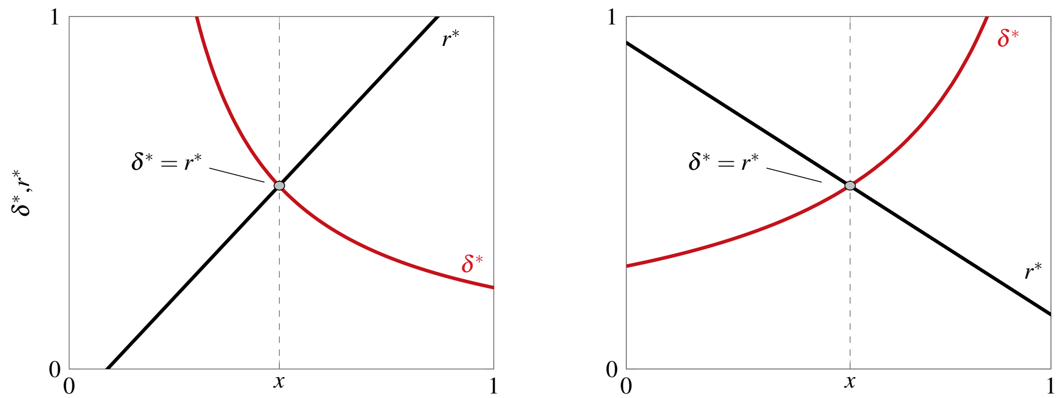
[20] The monetary conditions of the world's major financial centers, especially the US, can affect many countries. Independence allows a country to tailor its monetary policy to its own economic conditions rather than being influenced by global financial cycles.

[21] This model choice reflects the monetary policy behavior observed in financially vulnerable emerging markets—such as Argentina, Turkey or Brazil—in different periods, where interest rate decisions often respond more directly to external financing needs and exchange rate pressures than to domestic inflation targets.

[22] This allows the model to account for inflationary pressures without the need for an explicit Taylor rule or inflation stabilization target.

[23] Tinbergen's principle is not violated here, since the stabilization of the nominal exchange rate is not an independent objective, but a consequence of the fulfillment of the non-arbitrage condition.

Figure 7: Fixed point in boom and bust



(a) Boom **(b) Bust**

level that balances international trade. Together, these conditions help to preserve the non-arbitrage condition and allow for external financing consistent with long-term macroeconomic stability.

Thus, if $\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)} = 0$ and $\mathcal{X}(r)$[24] are in equilibrium, from equation (4) we obtain $\varphi_T = \frac{1}{2} r(t)\,\delta(t) + \dot{R}(t)$, which represents a capital flow that enables the fulfillment of foreign obligations and at the same time allows the accumulation of international reserves, $\dot{R}(t) > 0$. Furthermore, I now consider the accumulation of international reserves independently of a country's net acquisition of assets. This helps me to examine the role that $\dot{R}(t)$ plays during the stabilization of the business cycle. I then use a basic rule of motion, given by

$$\frac{\dot{R}(t)}{R(t)} = \theta(r), \qquad \text{where} \qquad \theta'(r) = \begin{cases} > 0 & \text{if Boom,} \\ < 0 & \text{if Bust,} \end{cases} \tag{19}$$

where $\theta(r)$ is the net reserve rate per volume of reserves per period. A positive accumulation of reserves occurs during a boom when capital inflows exceed the trade deficit.

Taking these elements into account, equation (18) is therefore reformulated as

$$\frac{\dot{r}(t)}{r(t)} = c\frac{1}{2}\delta(t) - c\frac{1}{r(t)}\Big(\varphi(r) - R(t)\,\theta(r)\Big). \tag{20}$$

[24]Since r is a state variable in this system, we have $C(r)$. From now on, all functions of C will be composite functions of r.

Similarly, the development of foreign debt in relation to exports over time is described by the equation

$$\frac{\dot{\delta}(t)}{\delta(t)} = \gamma(r) - \frac{1}{\delta(t)}\Big(\mathcal{X}(r) - R(t)\,\theta(r)\Big), \qquad \text{where} \qquad \mathcal{X}'(r) = \begin{cases} < 0 & \text{if Boom,} \\ > 0 & \text{if Bust.} \end{cases} \tag{21}$$

With respect to the sign of $\mathcal{X}'(r)$, the role of r is unclear since it affects $C(r)$ and the exchange rate simultaneously. In this section, I give priority to the exchange rate channel, which justifies the signs shown in equation (21). During the boom, an increase in r makes yields on domestic currency assets more attractive,[25] leading to higher demand for local currency and causing the (real) exchange rate to appreciate. This appreciation naturally leads to an increase in imports and, cet. par., to an increase in the trade deficit. Conversely, an increase in r during a crisis is interpreted as a signal of economic instability and leads to excessive demand for foreign assets.

After taking these adjustments into account, the country risk premium can be rewritten as a function of the state variable: $k(r) = k\big(\mathcal{X}(r), \phi(r), \ldots\big)$. Consequently, the function $\mathcal{K}$ must also be a function of the interest rate: $\mathcal{K}(r) = \mathcal{K}\big(\mathcal{X}(r), \phi(r), \ell(r), \ldots\big)$. Note that the behavior of r in $\mathcal{K}(r)$ is again ambiguous since, for example, during the boom, an increase in r leads to a trade deficit, which increases $k(r)$. At the same time, however, international reserves accumulate, the domestic currency strengthens, the ratio of reserves to foreign debt $\phi(r)$ rises, and the liquidity premium $\ell(r)$ falls, all of which lead to a decline in $\mathcal{K}(r)$. At this point, I draw on the "neglected risks" theory of Gennaioli et al. (2015) and assume that individuals in the boom phase tend to weigh "good news" against "bad news" until the bad news becomes too obvious to ignore (e.g., an excessive trade deficit). Following this logic, the function $\mathcal{K}(r)$ reacts negatively to the interest rate during the boom ($\mathcal{K}'(r) < 0$) and positively during the bust. Note that this explanation does not contradict the same theory used to explain the non-fulfillment of the no-arbitrage condition, since changes in $\mathcal{K}(r)$ during disequilibrium are still not captured by r *ex-post*.

Consequently, the sign of $\gamma'(r)$ depends on $\frac{\partial C}{\partial r}$, which leads to[26]

$$\gamma'(r) = \tfrac{1}{2}\Big(S\mathcal{K}'(r) + 1 - S\Big) = \begin{cases} < 0 & \text{if Boom,} \\ > 0 & \text{if Bust.} \end{cases} \tag{22}$$

[25]Although the model does not explicitly include the domestic currency and a bond market, these play a crucial role in the underlying mechanism of the argument.

[26]To ensure that the expression is negative during the boom, I assume that $\mathcal{K}'(r) - 1 < \frac{1}{S}$.

Although $\mathcal{K}'(r) < 0$ during the boom contributes to the stability of the equilibrium, a drastic reversal of these beliefs at a later stage makes the equilibrium vulnerable and susceptible to behavioral changes leading to turning points.

Equilibrium. I define equilibrium as follows:

Definition 4 (system equilibrium). A steady state (equilibrium) is one in which the paths of the interest rate $r(t)$, the ratio of external debt to export $\delta(t)$, and the exchange rate $\mathcal{E}(t)$ are all constant, such that:

- r^* is the interest rate that equates capital inflows with the target $\varphi_T = \varphi(r^*)$ pursued by the monetary authority and thus clears the trade balance, $\mathcal{X}(r^*) = 0$;
- The non-arbitrage condition (3), $r^* = \tilde{r} + \mathcal{K}(r^*)$, is satisfied;
- The cost curve simplifies to $C = \eta = \frac{1}{2}r^*$;
- In the long run, the system converges to the values

$$\delta^* = -\frac{R(t)\,\theta(r^*)}{\gamma(r^*)} \qquad \text{and} \qquad r^* = \left(1 - \frac{\varphi(r^*)}{R(t)\,\theta(r^*)}\right) 2\gamma(r^*)\,; \tag{23}$$

- International reserves $R(t) = R(0)\,e^{\theta(r^*)t}$ grow at a rate $\theta(r^*)$ in each period, so that r^* and δ^* remain at a stable level.

Figure 7 shows that the steady state is a unique and positive point of intersection.[27] In addition to the specifications in footnote (27), the steady state is always positive, since I assume that the rate of reserve accumulation is positive during the boom ($\theta(r) > 0$) and negative during the bust ($\theta(r) < 0$). To improve the interpretability of the business cycle, I restrict each phase to only two parametric states, ignoring the combinations in between, which are represented by

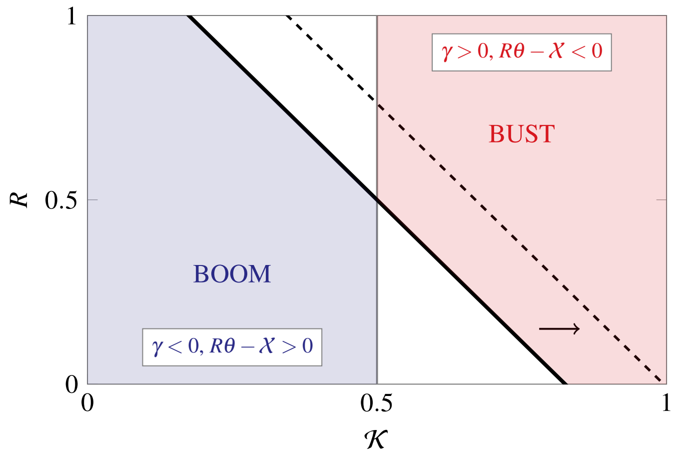
$$\begin{aligned} \text{Boom}: &\quad \gamma(r) < 0 \quad \text{and} \quad R(t)\,\theta(r) - \mathcal{X}(r) > 0, \\ \text{Bust}: &\quad \gamma(r) > 0 \quad \text{and} \quad R(t)\,\theta(r) - \mathcal{X}(r) < 0. \end{aligned} \tag{BB standard}$$

[27] Here I claim the existence of a positive equilibrium under the condition

$$\varphi(r) - R(t)\,\theta(r) > \left(\frac{\mathcal{X}(r) - R(t)\,\theta(r)}{\mathcal{K}(r)}\right)^2 > 0.$$

The assumption is that capital flows during the boom exceed the accumulation of international reserves, as the remainder is used to pay off foreign liabilities.

Figure 8: BB standard (in the boom)



I call this the BB standard, which illustrates Minsky's cycle in emerging markets in a comprehensible way. During a boom, optimism rises, integration costs remain relatively low but positive, international reserves accumulate, and the trade balance deteriorates. This situation continues until a turning point reverses the parametric conditions and the system enters a downturn. The bust is the opposite of the boom.

Figure 8 illustrates the BB standard. The (solid black) curve delimiting both regimes implies that[28]

$$\frac{\partial R}{\partial \mathcal{K}} = -\frac{1}{2\theta\,(r)} < 0.$$

The negative slope of the curve during the boom phase shows that at a reserve level of over 0.5, no value of $\mathcal{K}\,(r)$ can drive the system into the bust phase. Conversely, for reserves below 0.5, a rising $\mathcal{K}\,(r)$ value in line with the slope is necessary to trigger a crisis. This illustrates the resilience of the system when reserves are at low levels. Note that a slight increase in the reserve accumulation rate leads to a decrease in the slope of the curve, which means that an even higher value of $\mathcal{K}\,(r)$ would be required to enter the bust region. This result is obvious and follows directly from the parametric condition of the BB standard. However, the role of the sensitivity of reserve accumulation to the interest rate is less clear. The sustainability rule set out in Proposition 2 changes slightly in this context if reserve accumulation is included. While it is generally recognized that the accumulation of reserves is beneficial to the system, their long-term sustainability must also be ensured.

The rule shows that the area of debt sustainability expands if the interest rate elasticity of reserve

[28] For the sake of illustration, I assume here that $\delta^* \approx 1$, without the result losing its generality.

accumulation exceeds that of the cost curve elasticity only after a **fall in interest rates**:

$$\frac{\theta'(r)}{\theta(r)} > \frac{\gamma'(r)}{\gamma(r)}. \tag{24}$$

If, on the other hand, this inequality applies during a rise in interest rates, the debt sustainability region contracts, which increases the vulnerability of the system.[29] This result is intuitive. Instability occurs when the sensitivity of reserve accumulation to interest rates exceeds that of the stabilizing root of the debt trajectory: an interest rate hike during the boom phase would ultimately trigger a bust. The detailed derivation of this result can be found in Appendix B.

The slope of $\frac{\partial R}{\partial \mathcal{K}}$ during the bust phase is positive, since $\theta(r) < 0$. With reserves $R(t)$ of more than 0.5, the transition back to the boom phase requires that $\mathcal{K}(r)$ remains below 0.5. For lower reserves, $\mathcal{K}(r)$ must decrease in proportion to the slope. This strict condition is consistent with previous results and underlines the crucial role of lowering the C-curve. The analysis of the bust is further detailed in Appendix C. The introduction of a tax on financial income, such as the $r - \tau_r$ studied, would increase the range of the boom regardless of the direction of the slope, since $\theta\left(r - \tau_r\right)$ shifts the curve to the right and reduces the likelihood of entering the bust phase. This confirms the application of the strategies discussed above.

6.2 Stability analysis

With all these elements in hand, we are ready to examine the asymptotic properties of the path $\left\{\delta(t), r(t)\right\}$ and their implications for the business cycle.

Analytical framework. Using equations (21) and (20), I can express the dynamic system in terms of the state variables

$$\dot{\delta}(t) = \mathcal{D}\Big(\delta(t), r(t)\Big) \tag{25}$$

$$\dot{r}(t) = \mathcal{R}\Big(\delta(t), r(t)\Big). \tag{26}$$

If there is a stationary solution, the values $\delta(t) = \delta^*$ and $r(t) = r^*$ result as a function of the respective cycle phase. This analysis focuses exclusively on the local stability of the stationary growth path. To

[29] This observation is in line with more general concerns about the multi-layered impact of interest rate dynamics on systemic financial stability. Galbraith (2023), for example, offers a stark warning about the potential risks that persistently high interest rates pose to the resilience of the US economy. Conversely, Nikiforos (2020) offers a critical nuance by arguing that while low interest rates may be a necessary component in addressing financial fragility, they are often not sufficient on their own, and instead emphasizes that deep structural reforms are essential for a comprehensive and effective reduction of systemic vulnerability.

assess stability, I use the linear approximation of the system and evaluate it locally around each critical point. I formally define stability as follows:

Definition 5 (stability). A steady state with a ratio of external debt to exports δ^* and an interest rate r^* is stable if there exists $\varepsilon > 0$ such that every equilibrium with initial conditions $\delta(0)$ and $r(0)$ within the neighborhood $\left(\delta(0), r(0)\right) \in \left(\delta^* - \varepsilon, \delta^* + \varepsilon\right) \times \left(r^* - \varepsilon, r^* + \varepsilon\right)$ leads to both the ratio of external debt to exports and the interest rate converging back to their steady-state values $\delta(t) \to \delta^*$ and $r(t) \to r^*$. All other steady states are unstable.

Locus's slopes. The influence of an increase in the debt ratio on its own balanced rate of change is determined by the fundamental condition (as shown in equation 8)

$$\mathcal{D}_{\delta^*} = \gamma(r). \tag{27}$$

This condition plays a decisive role in the definition of the cyclical phase. Therefore, the effect of a change in the ratio on its own course depends on whether the economy is in a boom or a bust. The accumulation of reserves, the associated risks and the net export results all affect $\dot{\delta}(t)$, represented by

$$\mathcal{D}_{r^*} = \delta^* \gamma'(r) + R(t)\,\theta'(r) - \mathcal{X}'(r). \tag{28}$$

Consequently, the combination $\left(\delta^*, r^*\right)$ which guarantees a balanced growth of the schedule $\dot{\delta}(t) = 0$ over time, is determined by

$$\left.\frac{\partial r^*}{\partial \delta^*}\right|_{\dot{\delta}=0} = -\frac{\gamma(r)}{\delta^* \gamma'(r) + R(t)\,\theta'(r) - \mathcal{X}'(r)}. \tag{29}$$

The effect of a change in the ratio of external debt to exports on the trajectory of the interest rate,[30] is given by

$$\mathcal{R}_{\delta^*} = \frac{1}{2} r^*. \tag{30}$$

The strength of the relationship depends on the level of the equilibrium interest rate, r^*. The higher r^* is, the more strongly the system reacts to changes in the level of the foreign debt ratio. To model an economy in a low position within the international monetary hierarchy, I assume that its r^* is structurally high. This reflects the idea that less credible or peripheral currencies must offer higher yields to attract foreign capital. In contrast, currencies that are at the top of the hierarchy have to pay no or only a small liquidity

[30] Assuming, for simplicity, that $c = 1$ to reduce notation burden.

premium ℓ, which means that international investors are more willing to hold their assets even at lower yields. The function $\mathcal{K}(r)$ increases with the liquidity premium. Thus, for currencies with a low hierarchy, the costs of integration are higher due to persistently large ℓ. As will be shown below, this hypothesis leads to instability in the bust and increased fragility and volatility in the boom. The challenge is to investigate how the monetary authority can manage this scenario in response to external debt and liquidity shocks.

On the other hand, the influence of the domestic interest rate level on its own growth over time is represented by

$$\mathcal{R}_{r^*} = \frac{1}{2}\delta^* + R(t)\,\theta'(r) - \varphi'(r). \tag{31}$$

First, a rise in the domestic interest rate encourages foreign capital inflows, which contributes through the financial channel to the accumulation of reserves, the appreciation of the exchange rate and the creation of trade deficits. Second, it increases the equilibrium ratio of external debt to exports, δ^*, by raising integration costs and the debt burden. This weakens the long-term sustainability of the foreign debt position. As mentioned above, the ambiguity of the interest rate reappears and is a recurring theme in the Minskyan literature on emerging markets (e.g., Frenkel 1983; Guilmi and Carvalho 2017). This poses a major challenge for the monetary authority.

A further challenge for the authority arises from the interest rate elasticity of net capital flows, $\varphi'(r)$. Elasticity in itself is neither an indicator of monetary policy autonomy nor does it influence the extent of exogenous shocks. However, it does influence the authority's ability to control market imbalances and rebalance the interest rate. If the elasticity is positive $\varphi'(r) > 0$, the higher it is, the easier it is for the authority to set its target and be less affected by liquidity and debt shocks. Conversely, a nil elasticity $\varphi'(r) = 0$ leads to significant rigidities in achieving the target and increased volatility. I will explain this in more detail below.

Consequently, the pair $\left(\delta^*, r^*\right)$ that achieves balanced growth on the schedule $\dot{r}(t) = 0$ is determined by

$$\left.\frac{\partial r^*}{\partial \delta^*}\right|_{\dot{r}=0} = -\frac{\frac{1}{2}r^*}{\frac{1}{2}\delta^* + R(t)\,\theta'(r) - \varphi'(r)}. \tag{32}$$

For a given difference between the interest rate elasticity of the growth rate of reserves and net capital flows, the slope of equation (32) is determined by the value of r^*. As I have already noted, I assume that an economy with a low position in the international currency hierarchy has a high (relative) value of r^*.

The cycle analysis will show how a high r^* value affects the adjustment of the economy. In the following, I will focus on the adjustment in the boom phase because this is when the conditions that lead to the collapse of the system emerge. The stability analysis of the bust phase can be found in Appendix D.

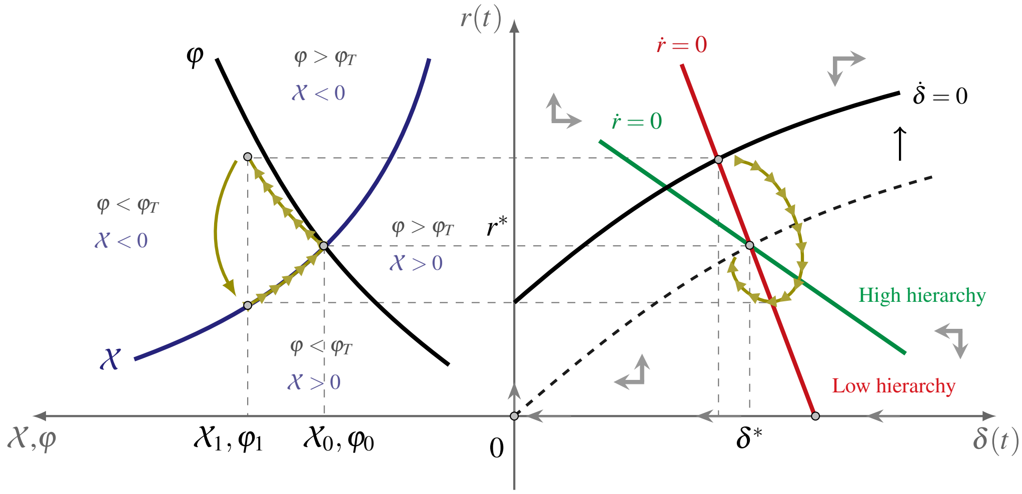
6.3 Boom

The investigation of this phase is crucial because it underpins the conditions for the collapse of the system. It is therefore important to examine what measures the monetary authority can take to stabilize the economy in the event of external shocks. Although the model does not provide a mechanism that automatically brings about the turning point, it can be deduced from the preceding analysis that the accumulation of shocks during the boom causes the cost curve to rise systematically until a final shock reverses the situation. Alternatively, one can say that a series of negative news accumulates (because they were initially ignored) and eventually reaches a point where the beliefs of the individuals change and the sign of $\gamma(r)$ shifts from $\gamma(r) < 0$ to $\gamma(r) > 0$.

In the case that the interest rate elasticity of net capital flows is positive, $\varphi'(r) > 0$, I assume that $R(t)\theta'(r) - \varphi'(r) > 0$ holds. This means that the influence of the interest rate on the rate of accumulation of reserves is greater than the net capital inflow, which indicates that at this stage funds are available for the repayment of part of the foreign obligations. Figure (9) illustrates two $\dot{r}(t) = 0$ schedules. The steeper curve (solid red) represents an economy with a lower position in the international currency hierarchy (see Fritz et al. 2018 and Paula, Fritz, et al. 2017, 2024a), while the flatter curve (solid green) represents a higher position. In other words, according to equation (32), an economy with a lower position in the currency hierarchy has a structurally higher equilibrium interest rate, r^*. Note that the positions of both curves are purely illustrative to show qualitatively how a shock originating from the same point has a stronger effect on an economy with a lower hierarchical position. The following analysis focuses on the economy with the lowest hierarchical position.

The system shows that the critical points, which are evaluated by the linear approximation matrix $\mathcal{J}$ at the origin $\mathcal{J}(0,0)$ and $\mathcal{J}(\delta^*,0)$, are conditionally unstable, which is indicated by the eigenvalues $\lambda_1 = \mathcal{D}_{\delta^*} = \gamma(r) < 0$ and $\lambda_2 = \mathcal{R}_{r^*} = \frac{1}{2}\delta^* + R(t)\theta'(r) - \varphi'(r) > 0$. The critical point evaluated at $\mathcal{J}(\delta^*, r^*)$ has two complex eigenvalues, which makes it a stable focus. In the following, I will thoroughly examine the shocks around the latter critical point.

Figure 9: Debt shock no. 1, $\varphi'(r) > 0$



External debt shock #1. Suppose that this economy, characterized by positive output growth and a positive interest rate elasticity of net capital flows $\varphi'(r) > 0$, experiences a positive exogenous external debt shock. Initially, the economy is in equilibrium with its balance of payments at $\mathcal{X}_0, \varphi_0$, which corresponds to the point (δ^*, r^*). After the shock, the economy deviates from its equilibrium, causing the ratio of foreign debt to exports to rise naturally, as described in equation (21). This leads to a higher target value that exceeds the current capital flow, $\varphi_T > \varphi(r)$, which leads to an increase in the interest rate. Figure 9 illustrates the upward shift of the $\dot{\delta}(t) = 0$ locus as a result of the shock.

The rise in the interest rate triggered by (20) has several consequences. First, the nominal exchange rate appreciates, which further increases the real interest rate and the return on domestic assets and leads to a trade deficit that brings the economy into the area where $\mathcal{X}(r) < 0$. Second, it induces an increase in capital inflows and the accumulation of reserves, but still maintains the asymmetry between the target and the current flow, as $\frac{1}{2}\delta^* + R(t)\,\theta'(r) - \varphi'(r) > 0$. Assuming that individuals give more weight to positive news than negative news in this early phase of the cycle, the value of $\mathcal{K}(r)$ decreases with this shock and exacerbates the non-observance of the no-arbitrage condition $\xi \gtrless 0$. Consequently, the system is in disequilibrium at point $\mathcal{X}_1, \varphi_1$ according to Definition 4. At this new point, the economy experiences an overvalued domestic currency, a trade deficit, the non-fulfillment of the no-arbitrage condition and an imbalance in $\delta(t)$ and $r(t)$. As for the change in C, the effect is ambiguous and affects the growth rate of output in a similar way depending on whether the shift in the interest rate or the $\mathcal{K}(r)$ function prevails. As shown in Figure 9, an increase in the interest rate is exacerbated in economies with a low position in the monetary hierarchy, leading to increased volatility and a more difficult adjustment process.

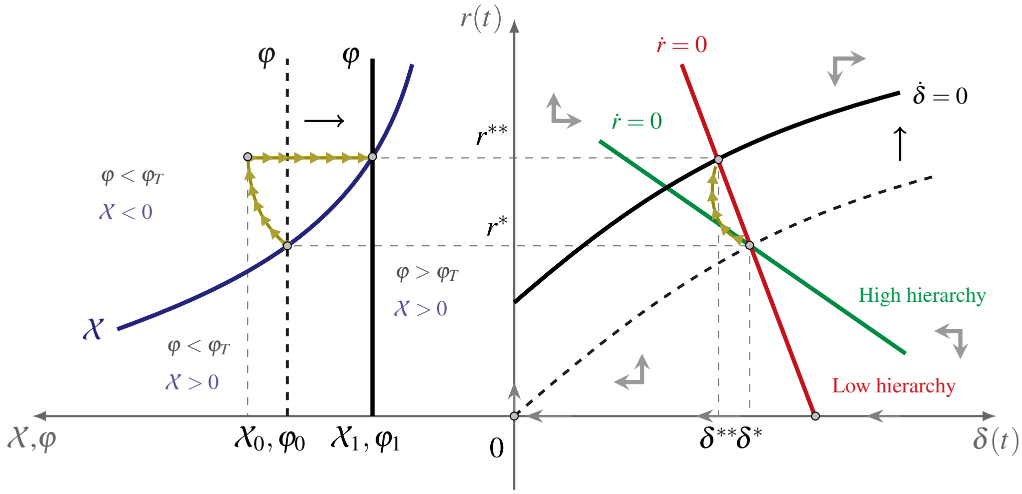
What measures can the monetary authority take to bring the economy back to its original equilibrium after the external debt shock has subsided? To rebalance the system, the authority can exploit the positive elasticity $\varphi'(r) > 0$ by focusing on $\varphi(r)$ while maintaining a fixed capital inflow target φ_T and deliberately overshooting the interest rate downward. This strategy aims to reduce the yield on domestic assets, depreciate the currency and consequently lower the real interest rate, thereby balancing the trade equilibrium. The adjustment sequence shows that the first step is to eliminate the imbalance in international trade in order to prevent the currency reserves used for deficit payments from being depleted. The interest rate can then be gradually raised back to its original long-term equilibrium level $\left(\delta^*, r^*\right)$.

The hypothesis of beliefs where $\mathcal{K}'(r) < 0$, which I am intentionally positing for the purposes of this discussion, contributes to the stability of the system in response to external shocks. However, these beliefs can easily change. If the debt shock is significant (i.e., a large negative event), the relationship could shift to $\mathcal{K}'(r) > 0$ (i.e., $\gamma'(r) > 0$) and lead the system into a financial trap and subsequently into a bust. In other words, the lower the hierarchical monetary position and the interest rate elasticity of net capital flows, the more fragile the financial structure becomes—and the higher the risk of systemic collapse in response to a shock.

External debt shock #2. Let us now consider the same foreign debt shock in an economy with a very low or negligible interest rate elasticity of net capital flows, $\varphi'(r) = 0$. This does not change the stability properties of the critical points but causes the net capital flow curve to be vertical at the balance of payments level.

The external debt shock eventually raises the interest rate, leading to a trade deficit and a discrepancy in capital flows, where $\varphi_T > \varphi(r)$. In this situation, the monetary authority once more tries to balance the payments by lowering the interest rate, which also increases $\mathcal{K}(r)$ and thus reverses the appreciation of the currency. However, due to the lack of interest rate elasticity, this measure only affects the target φ_T, reducing it to φ_1 and shifting the curve until the trade balance is restored again. Zero elasticity clearly prevents the interest rate from overshooting, so that the system stabilizes at an interest rate *higher* than the initial equilibrium, denoted r^{**}. The final result is comparable to a sudden stop caused by an increase in the rest of the world risk-free interest rate, $\tilde{r}$. This is illustrated in Figure 10. At the new equilibrium point, $\mathcal{X}_1, \varphi_1$, Definition 4 is fulfilled but with a higher equilibrium interest rate and a higher debt ratio. This situation makes the system structurally more vulnerable to future shocks. It is (again) evident that an

Figure 10: Debt shock no. 2, $\varphi'(r) = 0$



economy with a lower hierarchical position amplifies the effects of debt shocks, leading to higher adjustment rates compared to a scenario with a stronger hierarchical position.

In summary, the economy can stabilize during the boom phase because the equilibrium is stable, but at a higher price. With a zero interest rate elasticity of net capital flows, the economy becomes more vulnerable to new debt shocks compared to a positive elasticity, as the adjustment requires high interest rates, which are amplified by lower hierarchical positions. These high interest rates can be expected to have a negative impact on output growth, possibly slowing it down.

Foreign liquidity shock. Returning to the assumption that interest rate elasticity of net capital flows is positive, let us assume that the economy initially suffers a sudden positive shock due to net liquidity inflows from abroad $\uparrow\varphi(r)$.[31] This shock shifts the $\varphi(r)$ curve and the locus $\dot{r}(t) = 0$ to the left, as shown in Figure 11, and brings the economy to a region where capital inflows exceed the target $\varphi(r) > \varphi_T$, at the point $\mathcal{X}_0, \varphi_0$. This surplus of foreign money supply enables the accumulation of reserves and leads to an excess demand for domestic currency, which strengthens it.

At this initial point, the monetary authority has two options for action. If efforts to lower the interest rate r encounter rigidities so that the interest rate remains above the $\dot{\delta}(t) = 0$ locus, foreign capital inflows will continue. This leads to an appreciation of the exchange rate and thus to a trade deficit, which in turn increases the ratio of foreign debt to exports. The alternative, which I favor in this analysis, is for the

[31] This shock can also be interpreted as a relative increase in the domestic interest rate compared to the interest rate of the rest of the world $r(t) - \tilde{r}$, i.e., as a decrease in $\tilde{r}$.

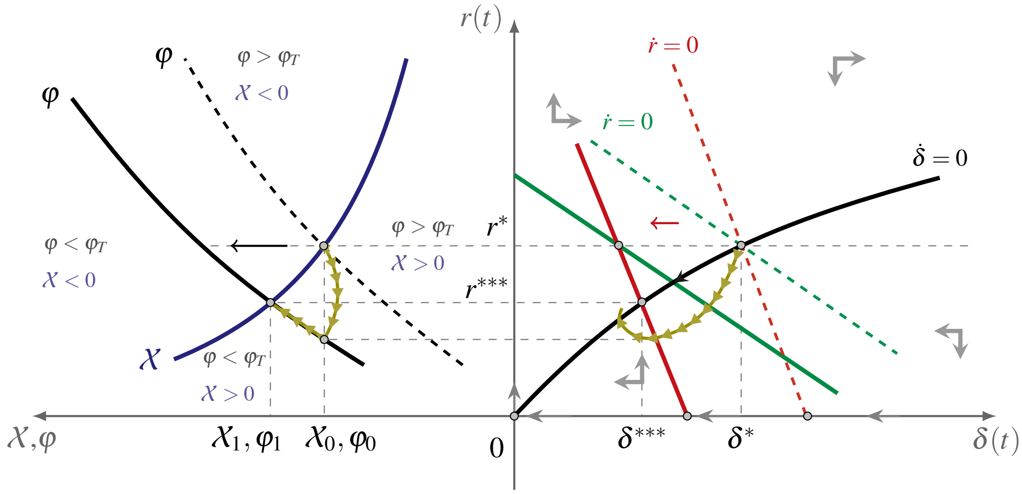
authority to leverage the positive interest rate elasticity, set the target φ_T and overshoot the interest rate downward to generate excess demand for foreign currency and depreciate the exchange rate. This adjustment allows the economy to enter the trade surplus zone $\mathcal{X}(r) > 0$, balancing net capital flows $\varphi_T = \varphi(r)$ and reducing the debt-to-export ratio $\downarrow\delta(t)$. From there, the interest rate can be gradually increased to reach the long-term equilibrium at the point $\mathcal{X}_1, \varphi_1$. At this point, the equilibrium described in Definition 4 is reached, but at an interest rate that is structurally lower than the initial equilibrium, denoted by r^{***}. The relative strengthening of the domestic currency enables the system to stabilize at a lower interest rate. This occurs because a lower liquidity premium reduces $\mathcal{K}(r)$ for a given global risk-free rate $\tilde{r}$, thereby helping to satisfy the no-arbitrage condition.

Note that the more elastic the relation $\varphi'(r)$ is, the more damped the movement of $r(t)$ will be, since the adjustment is made by changes in the amount of $\varphi(r)$ relative to its target. If the $\varphi(r)$-curve is inelastic, all the absorption of the shock will be through changes in $r(t)$. This is not desirable as it leads to greater volatility,[32] regardless of the convergence to a lower interest rate. The situation is similar for a given elasticity $\varphi'(r)$: The better an economy's position in the international monetary hierarchy, the less $r(t)$ moves in response to liquidity shocks (compare the green curve with the red one in the $\left(\delta(t), r(t)\right)$ plane of Figure 11). In terms of monetary policy independence from capital inflow shocks (Rey 2015), a lower elasticity $\varphi'(r)$ and a lower hierarchical position increase the probability that the domestic monetary authority "mimics" foreign policy. This situation is worrisome as it effectively means that monetary policy is imported from abroad, which is tantamount to a loss of monetary sovereignty.

Turning point. Now suppose that the shock to foreign debt or capital flows (with interest rate rigidities) is significant enough to cause a turning point that leads the system into a bust where $\gamma(r) > 0$. In this systemic context, how can the economy protect itself from falling into a financial trap? First, by ensuring that the slope of the interest rate nullcline $\dot{r}(t) = 0$ is steeper than that of the external debt-to-exports nullcline $\dot{\delta}(t) = 0$ during the bust phase—with both slopes positive. Although the system remains dynamically unstable, this condition ensures that there exists a unique trajectory along which the authority can guide the economy toward a stable equilibrium point $\left(\delta^*, r^*\right)$. Second, the application of the "ceiling rule" (15), which targets an unstable debt-to-export equilibrium δ^{**} and not the stable equilibrium δ^* characteristic of the boom. This is achieved by a higher international reserve volume ($R_1(t) > R_0(t)$) for a

[32] Shocks to foreign liquidity can be both positive and negative. Therefore, the absolute value of $\dot{r}(t)$, which can be interpreted as its variance, would be larger in a context with a zero interest rate elasticity of net capital flows, $\varphi'(r) = 0$, than in a scenario with positive elasticity.

Figure 11: Foreign liquidity shock



given $\gamma(r)$ and $\mathcal{X}(r)$ such that $\delta^{**} = \frac{\mathcal{X}(r) - R_1(t)\theta(r)}{\gamma(r)} < \frac{\mathcal{X}(r) - R_0(t)\theta(r)}{\gamma(r)} = \delta^*$. The following result can be derived from this analysis:

Proposition 3 (external debt and capital inflow shocks during a boom). *In this economy there are three long-run equilibrium interest rates, $r^{***} < r^* < r^{**}$, so that:*

a) A positive (or negative) shock to the ratio of foreign debt to exports with positive $\varphi'(r) > 0$ converges to r^*;

b) A positive (negative) shock to the ratio of foreign debt to exports with zero $\varphi'(r) = 0$ converges to r^{**} (r^{***});

c) A positive (negative) shock to foreign net capital flows converges to r^{***} (r^{**}), regardless of the sign of the elasticity $\varphi'(r)$.

In the case of a positive (negative) shock to foreign debt relative to exports, if the elasticity $\varphi'(r)$ is positive, the monetary authority can make a downward (upward) overshoot of the interest rate, causing the system to converge to its original equilibrium. However, if the elasticity is zero, the monetary policy decision only affects the target φ_T, leading to a structurally higher (lower) convergence. The more positive the elasticity $\varphi'(r)$ associated with a positive or negative net capital inflow shock, the less likely it is that the authority will mimic the monetary policy of the rest of the world. This indicates a certain degree of independence from foreign financial shocks.

This result does not shed light on the position of the economy within the international monetary hierarchy, but focuses on the rate of convergence of the interest rate as a function of the nature of the shock and the influence of $\varphi'(r)$ on this adjustment. The following proposition follows a similar line of reasoning and complements the previous one.

Proposition 4 (monetary hierarchy position and independence). *For a given interest rate elasticity of net capital flows, an economy that is higher in the international currency hierarchy will experience lower interest rate volatility in response to capital flows and external debt shocks. This reflects a certain degree of independence of the authority from these shocks, as a higher hierarchical position reduces the tendency to imitate international monetary policy.*

The following corollary can be drawn from these results:

Corollary 1. *The least detrimental for an economy is a turning point after a positive net capital flows shock or a negative foreign debt shock (when $\varphi'(r) = 0$).*

The reason for this is that both scenarios stabilize the economy at an interest rate that is lower than the original equilibrium value. All other shocks converge to the original or a higher interest rate. It is preferable to experience these shocks in an economy that is relatively better positioned in the international monetary hierarchy, as the authority then has more policy space to manage the adjustment.

6.4 Some implications of these results

Thirlwall's law: output level. The results of the previous sections can be applied to the theory of balance of payments-constrained economic growth from the perspective of McCombie and Thirlwall (1994) and Thirlwall (2011). Assuming that imports account for a share m of national income Y such that $\mathcal{E}M = mY$, one can derive $\upsilon(r) \equiv 1 - \delta_{\max} \cdot \gamma(r) - R(t)\,\theta(r)$ using the "ceiling rule" (15). This makes it possible to achieve a level of production that is compatible with the balance of payments constraint

$$Y_{\text{BoP}} = \upsilon(r)\frac{1}{m}X. \tag{33}$$

For given values of m and X, an increase in C leads to a decrease in the level of Y_{BoP} in both the boom and bust phases. Conversely, an increase in x consistently increases the level of Y_{BoP}. Thus, the balance of payments constraint can be mitigated by introducing a tax on financial income and reducing financial liberalization. As shown in equation (13), the taxes τ_r and τ_S reduce C, which leads to a more negative value of $\gamma(r)$ and ensures that $\upsilon\left(r;\tau_r,\tau_S\right) > \upsilon(r)$. This enables a higher production level.

Let us assume that the economy is in a boom phase in which $\gamma(r) < 0$. A higher $\delta_{\max}$ correlates positively with a higher Y_{BoP}, indicating more room for growth (see Figure 4). However, this level does not take into account the underlying fragility, which I will examine using the growth rate of output. As for the accumulation of reserves $\theta(r)$, the effect is negative when accumulation rate is positive. During a boom with a trade deficit (see the BB standard), reserve growth is driven by financial inflows, which is unsustainable from a balance of payments perspective. Consequently, this is expected to reduce Y_{BoP} in the long run. During a bust, the opposite is the case.

Thirlwall's law: output growth rate. When discussing the growth rate of output constrained by the balance of payments, one can observe effects that are closely linked to the business cycle. This is illustrated by the following result:

Proposition 5 (boom and bust Thirlwall's law). *Taking capital movements into account, the long-run growth rate of output, which is constrained by the balance of payments, is expressed as*

$$y_{\text{BoP}} = \frac{x}{\pi}\left(1+\delta_{\max}\right), \tag{34}$$

where $\pi = \frac{dM/M}{dY/Y}$ *denotes the income elasticity of imports. Under the parametric constraint of the BB standard, (34) has two important implications:*

a) If the export growth rate maintains or increases the trade deficit during a boom, then $\frac{\partial y_{\text{BoP}}}{\partial x} < 0$;

b) If the export growth rate sustains or amplifies the trade surplus during a bust, then $\frac{\partial y_{\text{BoP}}}{\partial x} > 0$.

This result seems counterintuitive and contrasts with Thirlwall (2011), especially in the context of globalization, where an increase in x in a small, very open economy can lead to a simultaneous increase in imports. Nonetheless, it extends Thirlwall's original framework by incorporating the dynamics of the boom-bust cycle, which were overlooked in the original formulation.

To derive the expression (34), I adopt the simplest form of Thirlwall (2011) for the growth rate of output with capital movements, $y_{\text{BoP}} = \frac{x+\varphi}{\pi}$. Assuming $\eta = C$ in the balance of payments (4) and subject to the maximum debt limit $\delta_{\max}$, I substitute the capital flow $\varphi = x \cdot \delta_{\max}$ into y_{BoP} to ensure sustainable output growth. The ratio $\delta_{\max} = \frac{\mathcal{X}(r) - R(t)\theta(r)}{\gamma(r)}$ contains all the cyclical information. Therefore, (34) yields

$$\operatorname{sign} \frac{\partial y_{\text{BoP}}}{\partial x} = \operatorname{sign}\Big(\mathcal{X}(r) - R(t)\,\theta(r)\Big),$$

which proves Proposition 5.

A closer examination shows that the results of Proposition 5 are quite reasonable. The countercyclical response turns out to be the equilibrium mechanism that keeps the system from descending into a financial trap. In other words, since the economy grows during the boom with a trade deficit and a positive accumulation of international reserves (that is, by indebtedness according to the BB standard), an increase in x would cause $\delta_{\max}$ and thus y_{BoP} to fall, signaling a strengthening of the system. Remember that a higher $\delta_{\max}$ in a boom makes the system more vulnerable in the face of potential turning points. In a bust, the opposite is true.

To summarize, expression (34) shows that the relationship between x and y_{BoP} is not monotonically increasing, as suggested by Thirlwall (2011), but depends on the business cycle. The following corollary can be derived from this.

Corollary 2. *According to the BB standard, a lower position in the international monetary hierarchy:*

a) *Reduces the level of output compatible with a balance of payments equilibrium;*

b) *Increases the chances of falling into a bust (or financial trap) by increasing the y_{BoP} rate through an increase in $\delta_{\max}$.*

In essence, this result shows that the two disadvantages faced by a typical emerging economy, previously examined from the Minskyan business cycle perspective, also apply in the context of balance of payments constrained growth theory. While this extension is stylized, it points to a potentially fruitful avenue for further research on how financial frictions affect the dynamics of balance of payments constrained growth in emerging markets.

Finally, it is important to clarify that the preceding formalization is not intended to provide a detailed explanation of the preconditions for the integration of an emerging economy into international markets. Rather, it seeks to address some general aspects of the two vulnerabilities examined, emphasizing their cyclical features. Similarly, this approach is not intended to replace existing formalizations and conclusions on balance of payments-constrained growth models, but to illustrate how such vulnerabilities manifest themselves under different economic conditions. Since each economy has unique production systems, shocks naturally trigger different responses depending on these structural features.

7. CONCLUSION

I examine two inherent weaknesses of emerging economies that hinder their integration into international markets: high integration costs and a low position within the international currency hierarchy. Using a dynamic model centered on the balance of payments as the primary constraint, I show how these weaknesses lead to subordinate integration. Although the hierarchical position influences costs, I analyze both phenomena separately.

The higher cost of financial integration makes emerging markets (compared to developed economies) more vulnerable to financial traps following exogenous shocks, such as sovereign risk and liquidity premia. My first two contributions are: (a) the introduction of the differential $C - x$ into the model, which provides a framework for assessing the (real) vulnerability of the economic system during a boom; and (b) the formalization of debt sustainability through the S-curve, which is the Minskyan "survival constraint" for a small open economy in other words.

I then show that a monetary authority in a low position within the international monetary hierarchy combined with a low-interest-rate elasticity of net capital flows is less independent in steering monetary policy during debt shocks and external capital flow shocks. My third contribution is to formalize that a low level of these factors leads to greater interest rate volatility and a higher propensity to "mimic" the monetary policy of the rest of the world. This vulnerability makes the system more fragile and increases the likelihood of an economic downturn.

Taken together, these contributions show that examining balance-of-payments–constrained growth theory from a boom-bust perspective is enriching because it integrates countercyclical insights that go beyond those of Thirlwall's original formulation.

In summary, these results illustrate the challenges an emerging economy faces when integrating into international markets in a globalized world and how a dynamic balance-of-payments analysis can clarify this asymmetry.

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Appendix

A. IMPULSE RESPONSE OF THE COST CURVE

Consider the differential equation

$$\dot{\delta}(t) - \delta(t)\gamma = -\mathcal{X}(0)e^{\zeta t} + dC\Delta(t-s), \tag{A.1}$$

where $dC\Delta(t-s)$ represents a unitary impulse at time s (a Dirac delta function concentrated at s) and dC is the impact acting on C. The following result can be derived from this equation.

Proposition 6. *Assuming that $\gamma \neq \zeta$, the solution of expression (A.1) is*

$$\delta(t) = \delta(0)e^{\gamma t} - \mathcal{X}(0)\frac{1}{\gamma-\zeta}\left(e^{\gamma t} - e^{\zeta t}\right) + dCu_s(t)e^{\gamma(t-s)},$$

where $u_s(t)$ is the Heaviside function

$$u_s(t) = \begin{cases} 0 & \text{if } t < s, \\ 1 & \text{if } t \geq s, \end{cases}$$

with $s \geqslant 0$.

Proof. Applying the Laplace transform to equation (A.1) and using its linearity, one can obtain

$$\mathcal{L}\left[\dot{\delta}(t)\right] - \gamma\mathcal{L}\left[\delta(t)\right] = -\mathcal{X}(0)\mathcal{L}\left[e^{\zeta t}\right] + dC\mathcal{L}\left[\Delta(t-s)\right],$$

from which the elementary transforms

$$\begin{aligned} \mathcal{L}\left[\dot{\delta}(t)\right] &= z\mathcal{L}\left[\delta(t)\right] - \delta(0) \\ \mathcal{L}\left[e^{\zeta t}\right] &= \frac{1}{z-\zeta}, \text{ where } z > \zeta \\ \mathcal{L}\left[\Delta(t-s)\right] &= e^{-zs}, \end{aligned}$$

are derived. In this context, z is called a "Laplace variable," a complex frequency variable used to shift a function from the time domain to the frequency domain. Consequently, one can then write

$$z\mathcal{L}\left[\delta(t)\right]-\delta(0)-\gamma\mathcal{L}\left[\delta(t)\right] = -\mathcal{X}(0)\frac{1}{z-\zeta}+dCe^{-zs},$$

which after some algebraic manipulations leads to

$$\mathcal{L}\left[\delta(t)\right] = \delta(0)\frac{1}{z-\gamma}-\mathcal{X}(0)\frac{1}{(z-\gamma)(z-\zeta)}+dCe^{-zs}\frac{1}{z-\gamma}. \tag{2}$$

Note that from the above elementary transforms it follows that $\frac{1}{z-\gamma}=\mathcal{L}\left[e^{\gamma t}\right]$, where $z>\gamma$. By applying the time shift theorem to the Laplace transform, one can obtain $e^{-zs}\frac{1}{z-\gamma}=e^{-zs}\mathcal{L}\left[e^{\gamma t}\right]=\mathcal{L}\left[u_s(t)\,e^{\gamma(t-s)}\right]$. The next step is to determine the inverse transform of $\frac{1}{(z-\gamma)(z-\zeta)}$. Decomposing this expression down into partial fractions yields

$$\frac{1}{(z-\gamma)(z-\zeta)} = \frac{A}{z-\gamma}+\frac{B}{z-\zeta} = \frac{Az-A\zeta+Bz-B\gamma}{(z-\gamma)(z-\zeta)}.$$

So, knowing $A=\frac{1}{\gamma-\zeta}$, one can easily find

$$\frac{1}{(z-\gamma)(z-\zeta)} = \frac{1}{\gamma-\zeta}\left(\frac{1}{z-\gamma}-\frac{1}{z-\zeta}\right) = \frac{1}{\gamma-\zeta}\left(\mathcal{L}\left[e^{\gamma t}\right]-\mathcal{L}\left[e^{\zeta t}\right]\right).$$

Substituting this into equation (2) gives

$$\begin{aligned}\mathcal{L}\left[\delta(t)\right] &= \delta(0)\,\mathcal{L}\left[e^{\gamma t}\right]-\mathcal{X}(0)\frac{1}{\gamma-\zeta}\left(\mathcal{L}\left[e^{\gamma t}\right]-\mathcal{L}\left[e^{\zeta t}\right]\right)+dC\mathcal{L}\left[u_s(t)\,e^{\gamma(t-s)}\right]\\ \mathcal{L}\left[\delta(t)\right] &= \mathcal{L}\left[\delta(0)\,e^{\gamma t}-\mathcal{X}(0)\frac{1}{\gamma-\zeta}\left(e^{\gamma t}-e^{\zeta t}\right)+dCu_s(t)\,e^{\gamma(t-s)}\right],\end{aligned}$$

and therefore

$$\delta(t) = \delta(0)\,e^{\gamma t}-\mathcal{X}(0)\frac{1}{\gamma-\zeta}\left(e^{\gamma t}-e^{\zeta t}\right)+dCu_s(t)\,e^{\gamma(t-s)}. \qquad \square$$

B. THE SUSTAINABILITY RULE WITH RESERVE ACCUMULATION

The trajectory of the external debt-to-export ratio, including the accumulation of reserves, is defined as

$$\delta(t) = \delta(0)e^{\gamma(r)t} - \mathcal{X}(0)\frac{1}{\gamma(r)-\zeta(r)}\left(e^{\gamma(r)t} - e^{\zeta(r)t}\right) + R(0)\frac{\theta(r)}{\gamma(r)}\left(e^{\gamma(r)t} - e^{\theta(r)t}\right).$$

Applying the maximum criteria, $\frac{\partial\delta(t)}{\partial t} = 0$ and $\frac{\partial^2\delta(t)}{\partial t^2} < 0$, and following Proposition 2, debt sustainability is guaranteed if

$$\mathcal{S}(r) \geq \frac{\gamma(r)\delta(0) + R(t)\theta(r)}{\gamma(r)\mathcal{X}(0)}.$$

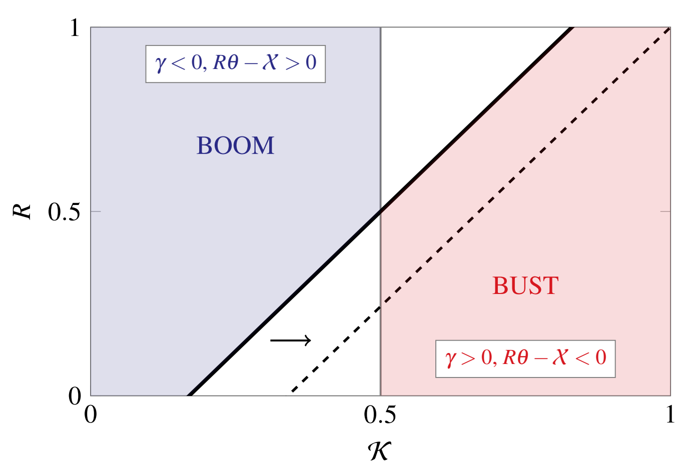
Consequently, the sustainable region can only be expanded by lowering the expression on the right-hand side of the inequality (i.e., reducing the lower section of the $\mathcal{S}$-curve). The prerequisite for this is that the condition

$$\frac{\theta'(r)}{\theta(r)} > \frac{\gamma'(r)}{\gamma(r)}$$

is fulfilled only during an interest rate cut.

C. THE "BB STANDARD" DIAGRAM IN A COLLAPSE

Figure A.1: BB standard (in the bust)



In this scenario the BB standard diagram is analyzed from the bust phase onwards, in which the reserves are exhausted, $\theta(r) < 0$. Consequently, the slope separating the two regimes is positive

$$\frac{\partial R}{\partial \mathcal{K}} = -\frac{1}{2\theta(r)} > 0.$$

The positive slope indicates that the system is in a bust state at $\mathcal{K}(r)$ values above 0.5, in which no reserve level is sufficient to restore the boom phase. Only if $\mathcal{K}(r) \leq 0.5$ and the reserves are at or above 0.5 can the system recover and re-enter the boom phase. For lower reserves, the value of $\mathcal{K}(r)$ must fall further in line with the slope in order to enter the boom phase, which illustrates the system's increased vulnerability to $\mathcal{K}(r)$ with lower reserves. However, the introduction of a tax mitigates these restrictions: With $\mathcal{K}(r) = 0.5$, a lower reserve threshold (below 0.5) is sufficient to re-enter the boom phase.

The ability of the economy to exit the bust phase depends on how effectively the balance between $\mathcal{K}(r)$ and $R(t)$ is managed. As reserves are depleted during the downturn, it is therefore important to accumulate a significant volume of reserves before the downturn—if this is possible through the trade channel. This provides greater policy space for the implementation of stimulus measures.

D. COLLAPSE'S INSTABILITY

It is not necessary to examine this phase of the cycle in detail, as both the model and the theoretical literature point to a highly unstable system. In this phase of the business cycle, each shock accelerates the deviation from the equilibrium convergence path. I will give a brief analysis below.

In this context of economic chaos and instability, I assume that the interest rate elasticity of net capital flows is zero, i.e., $\varphi'(r) = 0$. The system has three critical points, and I analyze the stability at each of these points using the characteristic equation of the linear approximation matrix $\mathcal{J}$. At the first two points, which are evaluated at $\mathcal{J}(0,0)$ and $\mathcal{J}(\delta^*, 0)$, the system has similar eigenvalues. At both critical points, the first eigenvalue is identical and is labeled $\lambda_1 = \mathcal{D}_{\delta^*} = \gamma(r) > 0$. The second eigenvalue at the origin is $\lambda_2 = \mathcal{R}_{r^*} = R(t)\,\theta'(r) < 0$, which classifies it as a saddle point. In the case of positive δ^*, it is inherently unstable, with $\lambda_2 = \mathcal{R}_{r^*} = \frac{1}{2}\delta^* + R(t)\,\theta'(r) > 0$. These two points, where $r^* = 0$, do not seem relevant to the maneuverability of monetary policy; therefore, I discard them analytically. For the critical point evaluated at $\mathcal{J}(\delta^*, r^*)$, the situation becomes somewhat more complicated. A nil elasticity $\theta'(r)$

contributes to the fact that both eigenvalues of $\mathcal{J}$ (assuming they are not complex) are positive

$$\lambda_1, \lambda_2 = \frac{1}{2}\left\{\mathcal{D}_{\delta^*} + \mathcal{R}_{r^*} \pm \sqrt{4\mathcal{R}_{\delta^*}\mathcal{D}_{r^*} + \left(\mathcal{D}_{\delta^*} - \mathcal{R}_{r^*}\right)^2}\right\} > 0,$$

where $\mathcal{R}_{\delta^*} = \frac{1}{2}r^* > 0$ and $\mathcal{D}_{r^*} = \delta^*\gamma'(r) - \mathcal{X}'(r) > 0$ (during the boom phase with the same sign), since I assume that the interest rate has a greater influence on the cost curve than on the trade balance. As a result, the equilibrium point in question becomes an unstable node.

The collapse phase of the cycle poses a major challenge for policy makers. The only possible solution to the model seems to be a positive shock in international trade that causes $\gamma(r) < 0$, or a global financial cycle that lowers the cost curve. Such an event would raise expectations and put output back on a positive growth path.