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Essays in Financial Integration, Distributive Conflict, and Effective Demand

By

Nicolás M. Burotto

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Abstract

This thesis comprises three self-contained essays on macroeconomic topics. In the first essay, I develop a model that identifies two key vulnerabilities that prevent emerging economies from fully integrating into global markets: high financial integration costs and their low position in the international monetary hierarchy. These vulnerabilities make these economies susceptible to financial traps, jeopardize debt sustainability, and increase their macroeconomic 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. In the second essay, I model the inflationary inertia that results from distributional conflict by using aspiration gaps in a simple discrete-time Keynesian macroeconomic framework. I show that high bargaining power combined with unfulfilled aspirations between firms and workers leads to inflationary inertia, which becomes a self-sustaining and persistent phenomenon. This inertia promotes systemic instability and hinders the achievement of the Keynesian effective demand equilibrium point. In particular, an equilibrium real wage does not guarantee a distributional equilibrium, so the economy needs a "social consensus" that reduces conflict. The third essay addresses a key question in the conflict theory of inflation: How can an "inflation-free" equilibrium real wage be achieved in the midst of distributional conflict between firms and workers? I present two continuous-time models to answer this question. The first model examines the canonical conflicting-claims framework and shows that closing the aspiration gap is counterproductive for either group so the economy only leads to high or hyperinflation. A viable way to fulfill social aspirations without triggering inflation is to include "market equilibrium." The second model examines how pro-labor, pro-capital, and pro-conflict institutional contexts respond to autonomous demand shocks and influence the success of wage- and profit-led growth strategies. Finally, the study emphasises the Keynesian principle of effective demand as central to reducing conflict and promoting economic stability.

Keywords: external debt sustainability; currency hierarchy; subordinated integration; distributional conflict; inflation; effective demand.

Contents

Introduction

Economic systems are inherently subject to shocks that systematically push them away from equilibrium. This dissertation examines how these disturbances affect macroeconomic stability, income distribution, and economic growth. A common thread running through all chapters is the examination of the mechanisms that restore equilibrium, both in the economy's interaction with global markets and within internal dynamics.

Chapter 1 looks at the vulnerabilities of small, open emerging economies integrating into global markets. In particular, it examines the dual challenges posed by the high costs of financial integration and their low position in the international monetary hierarchy. These structural disadvantages amplify the risks of unsustainable external debt and financial traps, highlighting the limited ability of (domestic) monetary policy to stabilize such systems. In this chapter, I develop a dynamic model in which the balance of payments is the main constraint to examine these issues. It emphasizes how external financial shocks, such as sudden changes in international capital flows or shifts in debt, propagate through the interaction between real and financial factors. While the analysis is tailored to emerging markets, the results have broader implications for understanding systemic vulnerabilities in open economies.

The second and third chapters focus on closed economies to analyze the internal dynamics of inflation persistence and distributional conflict. In these chapters, I deliberately leave financial factors aside in order to isolate the core phenomenon under examination: how, in a context of distributional conflict, both price and wage inflation along with income distribution can achieve stability. Chapter 2 develops a Keynesian framework to examine how aspiration gaps between workers and firms, combined with high bargaining power, generate inflationary inertia. This inertia, in turn, exacerbates systemic instability as the economy struggles to achieve either distributional equilibrium or, as discussed in more detail in this chapter, effective demand equilibrium. Chapter 3 extends and generalizes this analysis by examining how conflicting claims of labor and capital affect the possibility of achieving an inflation-free equilibrium real wage. Using continuous-time models, I challenge the prevailing notion that "more power is better" for either side, and then analyze the institutional contexts—pro-labor, pro-capital, and pro-conflict—and their effects on the distributional stability of wage- and profit-led growth strategies.

In addition to the common goal of macroeconomic stabilization in all chapters, there are also conceptual connections. In particular, the element of distributional conflict can be seen not only in the antagonistic adjustment between firms and workers vying for a larger share of income, but also in the structure of the international monetary hierarchy. The hierarchical structure of the international monetary system can be seen as a space of constant conflict between currencies. Those at the bottom are subordinate to those at the top. This reflects constraints on monetary sovereignty, leading to financial vulnerabilities and exposing economies to external shocks beyond their control. Chapter 1 takes a closer look at this dynamic. On the other hand, effective demand plays a crucial role not only in open economies—where export demand as an autonomous variable is crucial for sustainability—but also in shaping distributional conflict. I show that autonomous demand shocks are not neutral. They can trigger wage-price spirals that fuel instability and potentially lead to output declines and higher unemployment. Chapters 2 and 3 examine these dynamics in more detail.

Ultimately, the closed and open economy approaches discussed here complement each other. From a broader perspective, the topics examined in this dissertation are linked within a unified macroeconomic framework. The main objective is to deepen our understanding of these dynamics in order to promote more resilient economic systems.

Chapter 1

A Model of External Debt Sustainability and Monetary Hierarchy

1.1 Introduction

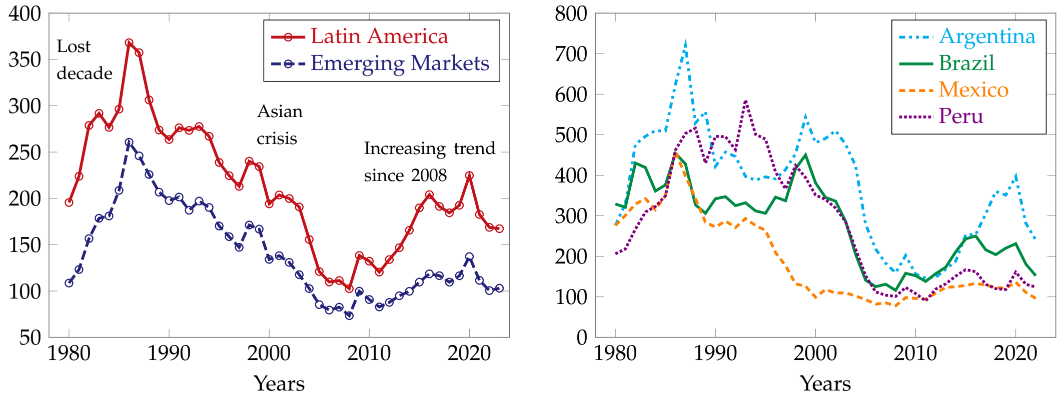
In recent years, emerging economies, particularly in Latin America, have seen a rising trend in external debt to export ratios reminiscent of those observed during the Asian crisis in the late 1990s (see Figure 1.1).[1] The past has shown that the path of increasing integration of these economies into global markets has been cyclical and has led to severe financial and external debt crises. Despite all the benefits that globalization may bring, this process has therefore evolved into a form of subordinated (or segmented) integration that poses significant economic policy challenges. What dangers does the recent increase in the external debt-to-export ratio entail? Can the integration path be sustainable? What role should the monetary authority play in this situation?

This chapter shows two structural vulnerabilities that characterize emerging markets to address these questions.[2] The first one is the high cost of integration into international markets, which is related to risk premiums, expectations and exchange rate fluctuations (e.g. Eatwell and Taylor, 2000; Palma, 2003; Frenkel, 2008; Ocampo, 2016). The second, which theoretically dates back to Keynes (1936), relates to the low position in the international currency hierarchy, which leads to higher domestic interest rates and limited policy space for monetary authorities (e.g. Mehrling, 2012; Paula, Fritz, and Prates, 2017; Bonizzi, Kaltenbrunner, and Ramos, 2021; Paula, Leal, and Ferreira, 2024). Although the second weakness influences the first, I analyze them

[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] Among many others, I focus here on those related to macroeconomics, particularly the monetary dimension and the balance of payments.

Figure 1.1: 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. The data was collected by the IMF and the World Bank.

separately here. The presence of both disadvantages leads to a vicious circle that exacerbates the boom-bust cycle and increases the likelihood of falling into a financial trap (Frenkel, 2008), thereby promoting financial and macroeconomic instability.

I develop a dynamic model for a small, open economy to formally illustrate how these vulnerabilities (or disadvantages) lead to subordinate integration. The main constraint in the model is the balance of payments, as this allows me to study how financial imbalances require compensation on the "real" side and vice versa. First, I investigate the long-term sustainability of external debt by examining the path of external debt relative to exports. In doing so, I follow McCombie and Thirlwall (1994) by considering the foreign sector as the sole contributor to the sustainability of this ratio. Note that this ratio is not a predictor of crises *per se*; it must be examined in conjunction with the phase of the economic cycle. The economy is subject to boom and bust cycles (from the perspective of Minsky, 2008).[3] During an economic boom, the economy grows positively while accumulating a trade deficit and foreign currency debt. In general, the advanced stage of the boom leads to a fragile state in which a shock in international integration costs can

[3] I adopt the Minskyan perspective for emerging markets as described by Frenkel and Rapetti (2009). According to this view, the factors that trigger the boom phase are exogenous and typically linked to macroeconomic deregulation policies and not intrinsic to the financial system as in advanced economies.

trigger a turning point and plunge the system into a bust.[4] I consider these costs as financial costs structured by interest rates in domestic and foreign currency. In response, I construct a "rule" to protect the system and prevent it from falling into a financial trap. The model then integrates the role of the monetary authority in its stabilizing function as a reaction to debt shocks and net capital flows in boom and bust periods. The extent to which the economy deviates from equilibrium due to these shocks depends on its position in the monetary hierarchy and the interest rate elasticity of net capital flows. That is, the higher the hierarchical position combined with a high interest rate elasticity of capital inflows, the better the country can avoid mimicking (or importing) the monetary policy of the rest of the world, and the less likely it is to end up in a bust. This is an indication of monetary policy independence as described in Rey (2015)'s *dilemma*.[5]

Building on this framework, this chapter offers three contributions. First, the standard literature dealing with the sustainability of (public or external) debt focuses on the discrepancy between the interest paid on the stock of debt and the growth rate of output.[6] I contend that this gap is inadequate for analyzing the external debt sustainability of an emerging small open economy. I show that the appropriate gap is determined by the financial integration costs into international markets C and the export growth rate x.[7] The cost curve C arises from the imperfect substitutability of assets in the financial market, which leads to frictions and the appearance of risks and premiums that are not adequately captured by the interest rate on foreign debt. I assume that this financial imbalance influences the development of the nominal exchange rate. It is the task of the monetary authority to eventually bring the exchange rate to its long-term equilibrium and fulfill the condition of non-arbitrage. However, the response of the exchange rate is incomplete, as it is assumed that the capital account is not fully open, leading to a "disconnect" of the exchange rate in the face of financial imbalances.[8] This decoupling also contributes to the fact that the interest rate on external debt does not capture the factors of financial frictions mentioned above. That is, a scenario in which the interest rate on foreign debt is lower than the growth rate of exports does not accurately reflect the robustness of the economy, since it can happen at the same time that $C > x$. I show that shocks in the cost dC, inherent in emerging markets, can even-

[4] 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.

[5] In this chapter, I will examine how the monetary authority can manage shocks to capital inflows and foreign debt within the limits of the policy space, leaving aside considerations such as global risk appetite and foreign asset prices, among others.

[6] Known as the "$r - g$" differential. r is the interest rate paid on the stock of public or external debt, and g stands for the growth rate of output or exports, depending on the type of debt and the specific ratio analyzed. See, for example, Simonsen (1985) and Taylor (2009) on the problem of foreign debt, and Pasinetti (1997) and Blanchard (2019) on the problem of public debt.

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

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

tually lead to turning points that push the economy from boom to bust. I argue that emerging markets are more susceptible to financial traps than developed economies precisely because of their higher C, which makes them more vulnerable to turning points. I discuss this in more detail in sections 1.2 and 1.3.

The second contribution concerns the development of a rule for the sustainability of foreign debt, which I call the $\mathcal{S}$-curve and which is explained in more detail in Section 1.4. I apply the criterion used by Simonsen (1985) and Frenkel (2005) to determine the maximum threshold for external debt that prevents unsustainability and explosiveness. In contrast to much of the existing literature, which focuses on the point of stable debt, this rule clearly relies on the *unstable equilibrium* point of the ratio of external debt to exports, precisely where $C > x$ holds. This criterion protects the system from falling into the financial trap due to turning points by creating the initial conditions between external debt and exports that are necessary to pay external obligations and avoid default. The critical point that separates sustainability from explosiveness can be understood as Minsky's *survival constraint for an open economy*.[9] It refers to the point of maximum credibility at which the system can secure enough revenue (through trade or credit) to cover debt payments and other financial obligations and reduce them over time. I show that beyond the initial conditions, any measure that can lower the cost curve C, such as a tax on financial rentiers, facilitates financial sustainability.

The third contribution examines how monetary policy deals with external debt in an economy with a low position in the monetary hierarchy and how it stabilizes the system when net capital inflows and external debt shocks occur. Although the literature on monetary hierarchy has a precise conceptualization, it fails to integrate this concept into a general formal framework (see e.g. Bonizzi, Kaltenbrunner, and Ramos, 2021). For a didactic comparison, I assume two economies, whereby the one with a lower relative position reflects a higher equilibrium interest rate r^*. My focus here is on the systemic examination of the economy's long-term equilibrium. To this end, I divide the cycle into boom and bust phases (see the BB standard). In this framework, I specifically examine the factors that mitigate the boom (to avoid the bust), considering two types of economic shocks: foreign debt and net capital flows. I analyze these shocks under the assumptions of positive and zero elasticity of net capital flows to the interest rate. So how does the authority react to these shocks in equilibrium? The model shows that, firstly, the lower the hierarchical position, the higher the volatility of the interest rate in the boom and therefore the likelihood of entering the bust. And secondly, the lower the interest rate elasticity of net capital flows, the less policy space the monetary authority has to adjust to such financial shocks. Taking these two factors into account, I examine the extent of the authority's independence in stabilizing the economy.

[9]This formalization represents an interesting contribution to the Minskyan literature, as the survival constraint remains a relatively understudied concept, especially in the context of open economies. A notable exception is Kapadia (2024), who offers a narrative analysis of the survival constraint in open economies and makes a connection to the international monetary hierarchy.

I am referring to independence (or autonomy) in relation to shocks from net capital inflows and not to the traditional concept of state (government) autonomy. Low independence means that the authority is more inclined to mimic or import external monetary policy. Conversely, high independence allows the authority to respond more effectively to domestic economic conditions without being forced to imitate global policy. In other words, a low hierarchical position and low interest rate elasticity of capital flows contribute to subordinate integration. First, they increase integration costs ($\uparrow C$). Second, they lead to the implementation of monetary policy measures that are not justified by domestic economic conditions. For example, a decline in the global interest rate may lead to excessive capital inflows if the local authority maintains interest rates higher than the equilibrium rate ($r > r^*$) due to excessive downward rigidity. Conversely, a global tightening may lead to capital outflows and force the country to raise its interest rates even if domestic economic conditions do not justify it, making local interest rate decisions depend on global conditions. I show that macroprudential measures to control capital flows can improve independence and reduce adjustment volatility.

I conclude that during the boom phase, a shock from net capital inflows is preferable to a debt shock as long as the interest rate elasticity of capital flows provides sufficient independence to allow the necessary monetary policy space to stabilize these shocks. A foreign liquidity shock stabilizes at a long-term equilibrium interest rate that is lower than the initial interest rate, as the domestic currency is strengthened by the inflow of foreign capital. Consequently, managing the transition from boom to bust after a liquidity shock is more favorable than after a foreign debt shock, as the system can manage this transition with a lower interest rate and increased international reserves.

Finally, I discuss some implications and extensions of the model in the context of balance of payments-constrained growth theory (McCombie and Thirlwall, 1994 and Thirlwall, 2011). My contribution is to analyze this theory from the perspective of Minsky's business cycle. I show that the *level* of production compatible with a balance of payments equilibrium always falls with an increase in costs C and is always higher with an increase in x. However, if we consider the *growth rate* of output consistent with a balance of payments equilibrium with capital movements, the result becomes less intuitive. The relationship between x and output growth is not monotonically increasing, as suggested by Thirlwall (2011), but rather cyclical. During an economic boom, an increase in x reduces the growth rate of production only if it leads to an increase in the trade deficit, which increases financial fragility and raises the risk of a crisis. Conversely, an increase in x only boosts output growth if it leads to a trade surplus. The mechanism for maintaining balance of payments equilibrium is therefore inherently countercyclical. Section 1.7 discusses this third contribution, including the proposed extension.

Related literature

This chapter is part of a literature that emphasizes the subordinate integration of emerging economies into international markets, particularly in terms of external debt, since the onset of financial globalization in the 1970s. For early contributions, see 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). See Eatwell and Taylor (2000), Palma (2003), Frenkel (2008), Akyuz (2011), Mehrling (2012), Bresser-Pereira, Oreiro, and Marconi (2014), Paula, Fritz, and Prates (2017), Fritz, Paula, and Prates (2018), Bonizzi, Kaltenbrunner, and Ramos (2021), and Paula, Fritz, and Prates (2024a) for recent developments.

This model extends and complements formulations of the business cycle in emerging markets from various perspectives, including Minskyan (Taylor and O'Connell, 1985; Gatti, Gallegati, and Minsky, 1994; Foley, 2003; Taylor, 2005; Botta, 2017; Kohler, 2019), risk-based (Frenkel, 2005), international monetary hierarchies (Fritz, Paula, and Prates, 2018) and Thirlwall's law (Bhering, Serrano, and Freitas, 2019).

The *dominance* approach proposed by Ocampo (2016) is consistent with this chapter, claiming that the business cycle of a small, open economy is strongly influenced by shocks transmitted through the balance of payments. Building on the Minskyan perspectives of Foley (2003) and Lima and Meirelles (2006), this chapter concurs with Ocampo (2016) in highlighting financial stability as an overriding objective given the negative impact of financial destabilization on the real economy side. However, countercyclical monetary policy actions in an open economy are inherently complex as they can induce procyclical responses in other variables such as capital flows and exchange rates. This chapter examines the strategies available to the monetary authority to ensure financial stability, both with respect to specific financial markets and the balance of payments as a whole.

Following Frenkel (1980)'s seminal work, I assume a law of motion for the interest rate that responds to excess net supply for foreign credit. Several studies have examined variations of this assumption. For example, Gatti, Gallegati, and Minsky (1994) developed an adjustment rule based on corporate debt, Foley (2003) formulated a rule linked to the capital accumulation rate, and Lima and Meirelles (2006) proposed a rule based on the bank markup and capacity utilization.

In contrast to studies that analyze debt and economic fluctuations from a macroeconomic perspective using Minsky's taxonomy of firm behavior (hedge, speculative, and Ponzi), such as Foley (2003), Lima and Meirelles (2006) and Nishi (2012), or from a micro-macro perspective, such as Guilmi and Carvalho (2017), Davis, Souza, and Hernandez (2019), Nishi (2018), Pedrosa (2019) and Reissl (2020) I generalize the cycle by dividing it into boom and bust phases. Simplifying the cycle to just two states of nature helps in the analysis. A hedge structure is indeed included in the formalized boom, even if it is only a small part: it involves a stable course of the ratio of foreign debt to exports, $C < x$, with a trade surplus.[10] However, such a combination is atypical for the ratio and was only observed in the Latin American region in the early 2000s.

This model incorporates exchange rate dynamics and builds on the studies by Taylor (2009), Kohler (2019) and Kohler and Stockhammer (2022).[11] However, in contrast to these studies, which anchor exchange rate dynamics in the financial account and foreign trade, my model is based on Harvey (2009)'s framework. I simplify the law of motion of the nominal exchange rate to deviations from the no-arbitrage condition in interest rates, since financial factors act faster than elements of the trade balance. The foreign exchange accumulated through international trade is seen as positive for the system as it represents an increase in international reserves. Thus, exchange rate movements reflect the dynamics of the financial markets. Given the financialization of commodity markets (Cheng and Xiong, 2014), changes in the terms of trade also affect the exchange rate through the financial channel.

1.2 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.[12] 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

$$CA\left(t\right) \equiv \mathrm{nx}\left(t\right) - \eta \cdot D\left(t\right) \qquad \text{and} \qquad FA\left(t\right) \equiv \mathrm{ci}\left(t\right). \tag{1.1}$$

[10]This state can be seen as the initial phase of the boom. As we will examine later, any policy here is sustainable because it represents an ideal state, which makes its study somewhat trivial.

[11]In contrast to Foley (2003) and Frenkel (2005), who examine open emerging markets, this model incorporates two fundamental variables that were overlooked in their analyzes: the influence of the exchange rate and the accumulation of international reserves on the business cycle.

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

The current account comprises the net exports of goods and services $\text{nx}(t)$ 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, weighted by α (which I consider a constant and set to 0.5), of the nominal interest rate on domestic currency bonds r, and on foreign currency bonds S. I assume that the economy's accounts are denominated in domestic currency; therefore, the foreign currency bond is adjusted by multiplying it by the rate of change of the nominal exchange rate, $\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}$.[13][14] 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, $\text{ci}(t)$ corresponds to the net capital inflows (financing requirements minus capital outflows), where $\text{ci}(t) = \dot{D}(t)$.[15] Since the balance of payments of an economy is always in equilibrium, it can be expressed as

$$CA(t) + FA(t) - \dot{R}(t) \;=\; \text{nx}(t) - \eta \cdot D(t) + \text{ci}(t) - \dot{R}(t) \;\equiv\; 0. \tag{1.2}$$

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 $S = \tilde{r} + k(\text{nx}, \phi, \ldots)$. 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 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

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

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

[15] 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, which is presented more clearly in Section 1.7.

liquidity premium that is added to the domestic interest rate. From these two interest rates it can be deduced that

$$r = \tilde{r} + \mathcal{K}, \tag{1.3}$$

which is the condition of non-arbitrage (i.e. equilibrium) in the financial market. Here $\mathcal{K} = k(\cdot) + \mathbb{E}[\mathcal{E}] + \varepsilon + \ell = \mathcal{K}(\text{nx}, \phi, \mathbb{E}[\mathcal{E}], \varepsilon, \ell, \ldots)$ has a negative functional relationship with nx and ϕ, but is positive with respect to exchange rate expectations and liquidity premia. Equation (1.3) 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 (1.3) 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 (1.3) as a long-term equilibrium goal. I examine this in detail in Section 1.7.

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 $\chi \equiv \frac{\text{nx}(t)}{X(t)}$, $\delta \equiv \frac{D(t)}{X(t)}$, and $\varphi \equiv \frac{\text{ci}(t)}{X(t)}$, the fundamental balance of payments identity (1.2) is

$$\chi - \eta \cdot \delta + \varphi \equiv 0. \tag{1.4}$$

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

The costs of integration

Exchange rate. Assuming imperfect substitutability between financial assets, the condition (1.3) 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 given and drawing on the approaches of Harvey (2009), Libman (2017), and Basu et al. (2018)—specifically, the Brainard-Tobin condition for imperfect substitutability of assets—I propose the following adjustment law to analyze the effects of changes in $\mathcal{E}(t)$

$$\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)} = v\xi. \tag{1.5}$$

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 1. 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 ξ 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 (1.3) 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 (1.4) and (1.5). This leads to the following definition, which I will use throughout this chapter.

Definition 1 (Integration costs curve). Assuming that $\xi \neq 0$ and $S \in (0, 1)$, 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

$$C = \tfrac{1}{2}\Big\{S\big(\tilde{r} + \mathcal{K}(\cdot)\big) + (1 - S)\, r\Big\}. \tag{1.6}$$

The cost 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 term. 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, Shleifer, and Vishny (2015) refers to as "neglected risks," which can arise from myopia, excessive optimism, or policy decisions. These risks and their implications are analyzed in more detail in Section 1.7.

Thus, C represents the trade-off between bonds valued in domestic and foreign currency, which is simplified here as an equal split ($\alpha = 0.5$). 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 $(1 - S)\, r$.[16] 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 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.

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 $\dot{\chi}(t) = \zeta\chi(t)$.

The growth rate of exports, x, remains constant and depends on exogenous foreign income, as suggested by McCombie and Thirlwall (1994), and thus represents the effective demand element of the model and ensures its stability. In addition, ζ is the growth rate of the trade balance (or net exports), which is also assumed to be constant. This implies that trade adjustment is primarily determined by output, as this directly influences the level of imports. The components of the model are completed in Section 1.3.

The fundamental equation of the external debt-to-export ratio. The combination of equations (1.4) and (1.5) yields the well-known fundamental equation for the ratio of foreign debt to exports, denoted

$$\frac{\dot{\delta}(t)}{\delta(t)} = \gamma - \frac{1}{\delta(t)}\chi(t). \tag{1.7}$$

[16] In the extreme cases not considered here, when $S = 1$, all bonds are denominated in foreign currency, and the cost curve simplifies to $\frac{1}{2}\big(\tilde{r} + \mathcal{K}(\cdot)\big)$, 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.

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 (1.7) 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 dimension.

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 $\delta(t)\left(x + \chi(t)\right) > 0$, can trap the system. Conversely, even with initially balanced trade $\chi(0) = 0$, a minimal increase in γ (> 0) can drive the system into the same trap.

Solution and the maximum criterion. The general solution of equation (1.7) is

$$\delta(t) = \delta(0)\, e^{\gamma t} - \chi(0)\, \frac{1}{\gamma - \zeta}\left(e^{\gamma t} - e^{\zeta t}\right), \tag{1.8}$$

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 (1.8) to ensure sustainability. So I get

$$\frac{1}{\gamma - \zeta} \cdot \epsilon \geq \frac{\delta(0)}{\chi(0)}, \tag{1.9}$$

where $\epsilon \equiv \left(1 - \left(\frac{\zeta}{\gamma}\right)^2 e^{-(\gamma - \zeta)t}\right) \approx 1$. 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 1.4.

1.3 The Cost-Output-Trade Balance Relationship

This section defines the short-run static equilibrium response of the economy in the face of a cost shock. In subsequent sections, I will examine how these effects affect long-run dynamic stability. The cost curve plays a decisive 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 $m = m \circ y(C) = \mu(C)$ and $\mu'(C) < 0$.

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.

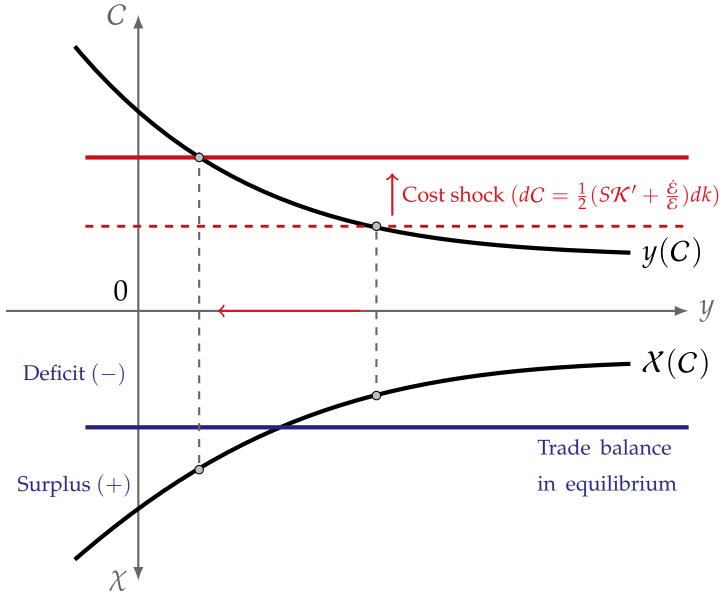
Definition 3 (Trade balance). With an exogenous growth rate of exports, the trade balance ultimately depends on the development of output (via imports) and thus on the integration costs $\chi = \chi \circ \mu(C) = \mathcal{X}(C)$ whose relationship is clearly positive $\mathcal{X}'(C) > 0$ (see footnote 17).

Higher integration costs therefore lead to slower growth in both output and imports. This must be the equilibrium response of the system, as it simultaneously increases the net factor payments to be financed abroad. Imports can fall through two channels: first, the exchange rate channel reduces the real income (measured in foreign currency) available for direct purchases of goods and services abroad;[17] second, higher costs can reduce the foreign funds available to support spending, such as the trade deficit.

Note that the effect of r on $\mathcal{X}(C)$ and the current account in this framework is ambiguous. An increase in r directly increases C, but at the same time appreciates $\mathcal{E}(t)$, leading to higher imports and a trade deficit. However, it also reduces the domestic cost of servicing external debt (via the

[17] In other words, the income effect dominates the substitution effect, since I implicitly assume that the factor $\tilde{r} + \mathcal{K}(\cdot)$ has a greater influence on the exchange rate than the domestic interest rate. This assumption is relaxed in Section 1.7, where the roles of the monetary authority, capital flows, and the accumulation of international reserves take center stage. However, for our present purpose of highlighting the first weakness that distinguishes an emerging economy from an advanced one (the difference in C), this assumption is sufficient.

Figure 1.2: The effects of C's shock on trade balance



balance sheet channel), which can lead to a current account surplus. The final effect depends on which channel prevails. To illustrate the role of r, I assign it a central role in the adjustment and stabilization of $\delta(t)$ in Section 1.7.

According to Minsky (2008)'s financial instability hypothesis, agents take riskier positions in the boom phase, total consumption increases and the system becomes weaker. To illustrate the cycle of an emerging economy, I characterize the boom as a period of low integration costs (more precisely, lower than the growth rate of exports, $\gamma < 0$), high economic growth, a current account deficit and the accumulation of international reserves. The bust, on the other hand, is characterized by the opposite conditions. The increasing vulnerability during the boom is reflected in a gradual increase in integration costs, which causes the intertemporal equilibrium δ^* to rise systematically over time. A more detailed formalization of these cycles is presented in Section 1.7.

When the economic system is in an advanced boom phase, a cost shock can trigger a turning point that leads to a collapse and sets off a downward spiral. This means that the turning point occurs when the system transitions from boom to bust. This transition between the phases of the cycle can be attributed to various factors. In this model, such a shock can originate from the elements contained in $\tilde{r} + \mathcal{K}(\cdot)$ and r. It is important to note that a shock in C does not always cause a turning point; it depends on the relative position of C with respect to x during the boom phase.

Suppose the cost curve experiences a positive shock, given by $dC = \frac{1}{2}\left(S\mathcal{K}'(\cdot) + \frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}\right)dk$, due to a sudden increase in country risk premium factors, such as a systematic growth in the current account deficit. Exchange rate fluctuations also contribute to rising costs. Figure 1.2 illustrates this phenomenon graphically, reflecting the economic intuition behind the mechanism and showing that there is a growth rate $y(C)$ that equalizes the trade balance. Although at this static stage of analysis it cannot be determined whether dC represents a turning point, the recessive effect of the shock (which corresponds to the equilibrium response of the system) intensifies as the elasticity of output growth $y'(C)$ or net exports $\mathcal{X}'(C)$ increases relative to the cost curve. The long-term dynamic stability of this mechanism is examined below.

1.4 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, which in this model are amplified 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.

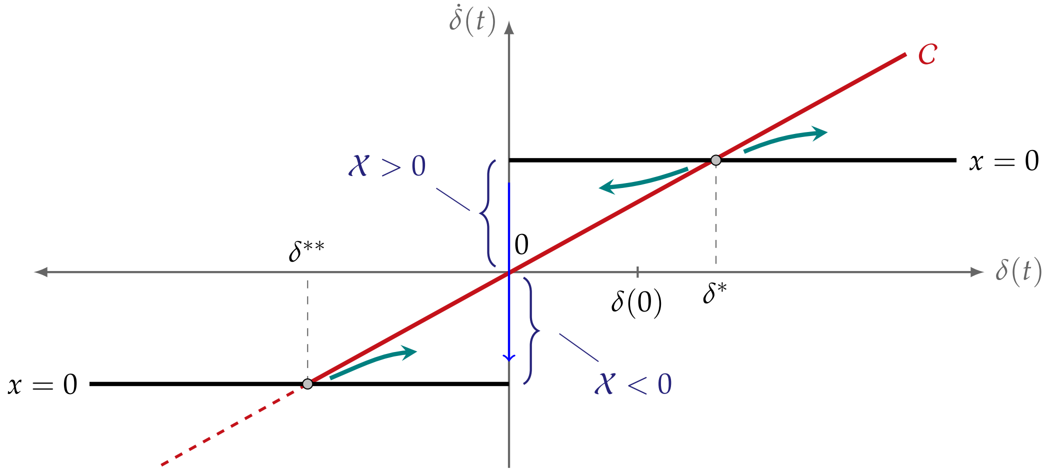
Equilibrium. If the ratio of foreign debt to exports experiences balanced growth, where $\dot{\delta}(t) = 0$, then

$$\underbrace{C\delta(C)}_{\text{Financial}} = \underbrace{x\delta(C) + \mathcal{X}(C)}_{\text{Real}}. \tag{1.10}$$

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. Stability refers to the tendency of the debt ratio to converge to its long-term equilibrium, δ^*. 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 at the same time, as neglecting either aspect can be detrimental. These issues are discussed next.

Figure 1.3: Top-down adjustment: a standard balance of payments crisis



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 1.3). 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.[18]

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.[19] 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, which initially worsens the recession by causing $dy = y'(C)\,dC < 0$ and thus $dm = \mu'(C)\,dC < 0$. Assuming that the response of the 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

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

[19]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.

$\mu(C)$ 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.

Bottom-up adjustment

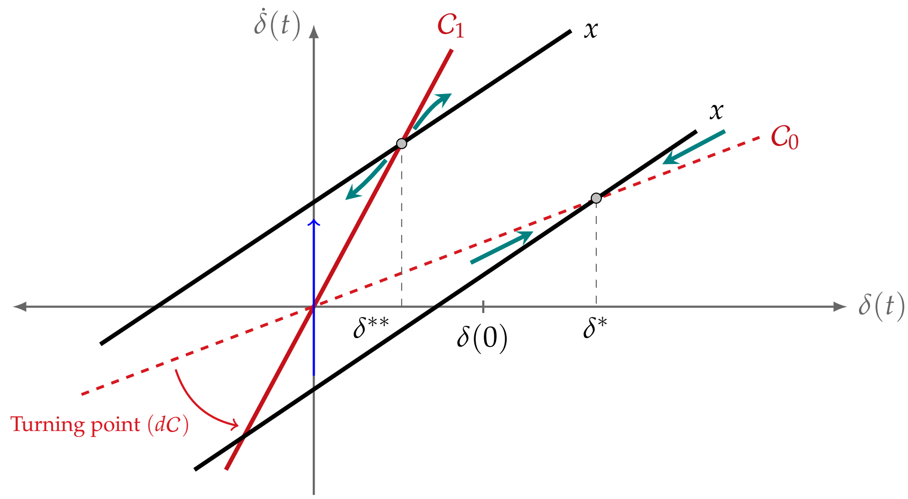
If we consider the economy under the same initial conditions as in the previous example $\delta(0)$, we now observe a positive export rate that exceeds the integration cost curve $\gamma < 0$. In Minskyan's terms, this stable scenario corresponds to the boom phase: increased confidence encourages excessive 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 1.4. 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 1.2 suddenly occurs so that $dC = \frac{1}{2}\Big(S\mathcal{K}'(\cdot) + \frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)}\Big)dk$, 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 to the point $\delta^{**} > 0$, where it accumulates a trade surplus ($\mathcal{X}(C) > 0$) 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 1.4 it is shown on the left, but could also be on the right).[20] 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 but with a larger trade

[20]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.

Figure 1.4: Bottom-up adjustment: a Minskyan crisis



deficit and/or a 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.[21] 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 1.4).*

This result may seem counterintuitive and will be examined in more detail in Section 1.5. 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.

Some strategies to escape the trap

Strategy #1: taxes. The above result suggests that economic policy should primarily, but not exclusively, work towards 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

[21] 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, Serrano, and Freitas (2019), a certain caution can be observed with regard to high δ^*; however, they continue to associate stability with sustainability.

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

$$\mathcal{X} - \eta\left(\tau_r, \tau_S\right) \cdot \delta + \varphi \;=\; 0, \tag{1.11}$$

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

$$C_\tau \;=\; \tfrac{1}{2}\Big\{\left(S - \tau_S\right)\left(\tilde{r} + \mathcal{K}\left(\cdot\right)\right) + \left(1 - \left(S - \tau_S\right)\right)\left(r - \tau_r\right)\Big\}. \tag{1.12}$$

Note that the decline in domestic currency returns mitigates what Paula, Fritz, and Prates (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.[22] 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

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

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

[22] For further details on different measurement approaches and empirical data, see Das, Gopinath, and Kalemli-Ozcan (2022).

cost curve given by

$$C_\tau = \tfrac{1}{2}\Big\{v\left(S-\tau_S\right)\left(\tilde{r}+\mathcal{K}\left(\cdot\right)\right)+\left(1-v\left(S-\tau_S\right)\right)\left(r-\tau_r\right)\Big\}. \tag{1.13}$$

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, ceteris paribus, help the economy to get 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 $\mathcal{K}\left(\cdot\right)$, it is only beneficial if the economy has a trade surplus, similar to the previous two measures; otherwise the trap gets bigger.

1.5 How to *Avoid* the Financial Trap

What is the best strategy for the economy to avoid falling into a trap after a cost curve shock? That is, to prevent this 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. This is achieved by applying the maximum criterion (1.9). First, I define the left-hand side of the inequality as a function $\mathcal{S}\left(C\right)$ at an unstable equilibrium point where $\gamma > 0$, as described in Proposition 1. That is

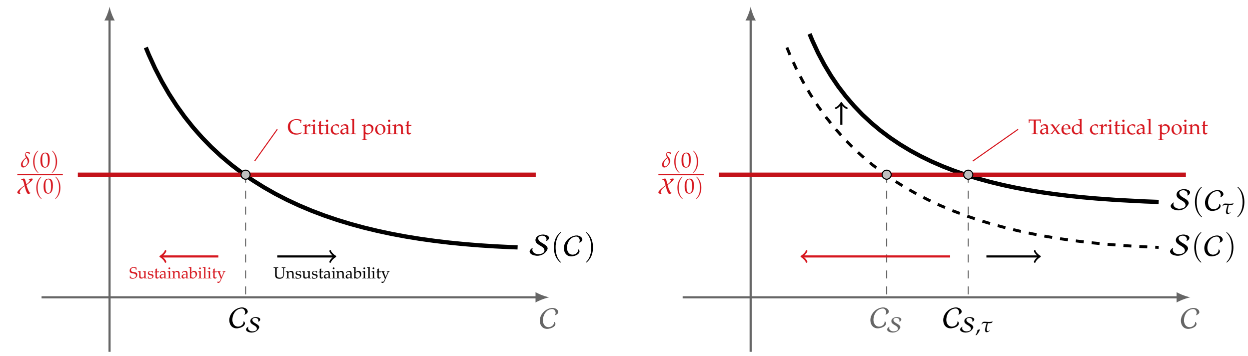
$$\mathcal{S}\left(C\right) = \frac{1}{\gamma\left(C\right)-\zeta\left(C\right)}\cdot\epsilon, \tag{1.14}$$

where I take $\epsilon \approx 1$ as a constant. First, it is possible that $\gamma\left(C\right)$ is greater or less than $\zeta\left(C\right)$. However, the slope of $\mathcal{S}\left(C\right)$ depends on whether $\zeta'\left(C\right) < 1$ or $\zeta'\left(C\right) > 1$, with $\gamma'\left(C\right) = 1$.[23] Second, the right-hand side of (1.9) specifies the initial conditions $\frac{\delta(0)}{X(0)}$ as the minimum "lower bound" that the function $\mathcal{S}\left(C\right)$ must not fall below in order to maintain sustainability. I call the intersection of these two curves as the critical point of sustainability. In Figure 1.5 you will find an example of an $\mathcal{S}\left(C\right)$ with a negative slope. In the case of an $\mathcal{S}\left(C\right)$ with a positive slope, the same principle applies, but the sustainability region would shift to the right of the critical point. This point can be seen as *Minsky's survival constraint for an open economy* and serves as a link between the "real" side of the economy and the integration costs, which includes elements beyond productivity. This concept is further clarified in the next result.

Proposition 2 (Sustainability rule). *The relationship between foreign debt and exports remains*

[23] I exclude the scenario where $\zeta'\left(C\right) = 1$, as this would eliminate both the critical point and the ratio equilibrium δ^*.

Figure 1.5: External-debt sustainability curve



(a) Debt sustainability and the critical point

(b) The effects of a taxed curve at the critical point

sustainable in the face of a turning point only if the system fulfills

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

Conversely, if

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

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 1.4. If the initial conditions act as a "lower bound," an alternative approach from the perspective of δ^{**} is to determine the maximum "upper bound" given by

$$\delta^{**} = \delta_{\max} \leq \frac{\mathcal{X}\left(C\right)}{\gamma\left(C\right)}, \tag{1.15}$$

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 $\delta\left(0\right) \in \left[0, \delta^{**}\right]$, 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 deviate from $\delta_{\max}$ after a turning point, as indicated by

$$\delta(t) = -\text{ sust. rule } \times e^{\gamma t} + \delta_{\max} < 0. \tag{1.16}$$

One way to widen the sustainability range $\int_0^{C_S} \mathcal{S}(C)\, dC$ is to lower the initial conditions "floor" curve. The other is to lower the integration costs and shift the $\mathcal{S}(C)$-curve upwards. For example, as shown in Figure 1.5b, 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 stricter 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.

1.6 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 1.4.

Impulse response. I introduce in equation (1.8) a transient shock of the form $dC\Delta(t-s)$, 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 (1.8) is now expressed as

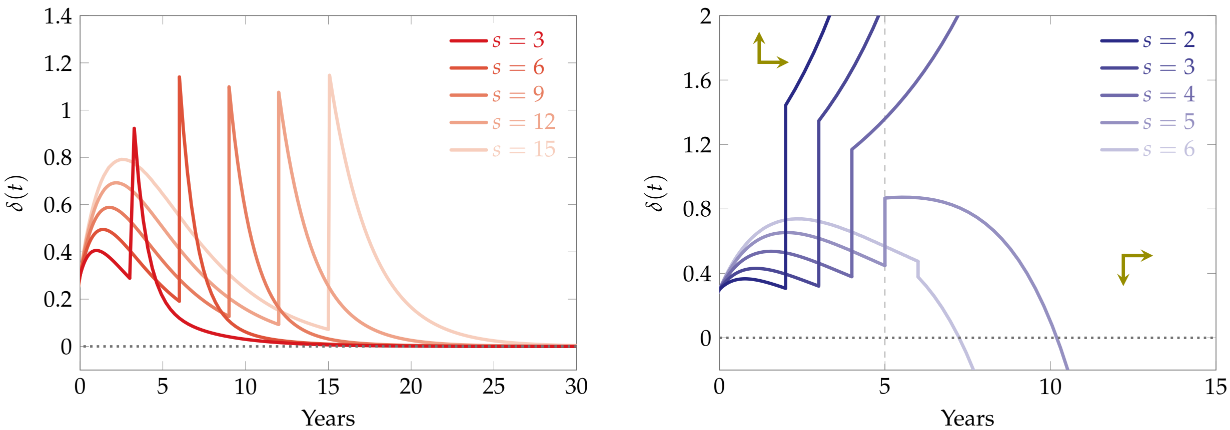
$$\delta(t) = \delta(0)\, e^{\gamma t} - \chi(0)\, \frac{1}{\gamma - \zeta} \left(e^{\gamma t} - e^{\zeta t} \right) + dC u_s(t)\, e^{\gamma(t-s)}, \tag{1.17}$$

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

Figure 1.6: Impulse response to an integration cost curve



(a) Stable equilibrium

(b) Unstable equilibrium

exogenous in the two types of equilibrium studied below. In Appendix A.1 I present a step-by-step proof for the derivation of expression (1.17).

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 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 $\big(\delta(t), \mathcal{X}(t)\big)$-plane. Figure 1.6a shows the response of $\delta(t)$ to cost shocks. The shocks occur every 3 years, and the first impact (in the third year, $s = 3$) quickly converges to equilibrium and resumes the original trajectory around the 5th year. However, as γ decreases due to a systematic increase in C and persistent shocks,[24] the convergence of the debt-export ratio slows down.[25] 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

[24]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.

[25]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.

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 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 1.6b 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 onwards position the economy in a sustainable region. Moreover, the shock from the sixth year onwards, *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.

1.7 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 $(\delta(t), r(t))$ 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.

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, Gopinath, and Kalemli-Ozcan, 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.[26]

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

$$\dot{r}(t) = c\Big(\varphi_T - \varphi(r)\Big), \qquad \text{where} \qquad \varphi'(r) = \begin{cases} > 0 & \text{if Independent,} \\ = 0 & \text{if Non-independent,} \end{cases} \tag{1.18}$$

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 (1.18) shows that the interest rate responds to excess net capital inflows $\varphi(r)$ relative to a target φ_T set by the monetary authority. The disequilibrium expressed in this financial equation can be understood from a Minskyan perspective. The literature on Minsky cycles in emerging markets (e.g. Foley, 2003; Frenkel, 2008; Kohler, 2019; Paula, Leal, and Ferreira, 2024) recognizes that the initial conditions of the boom start with high interest rates that induce an oversupply of capital inflows, which subsequently causes a decline in interest rates. In the later stages of the boom, the interest rate rises again due to high debt levels and increased risk perceptions until the turning point pushes the system into the crisis phase. In the following sections, I will examine the system's response to these behaviors at each stage of the cycle.

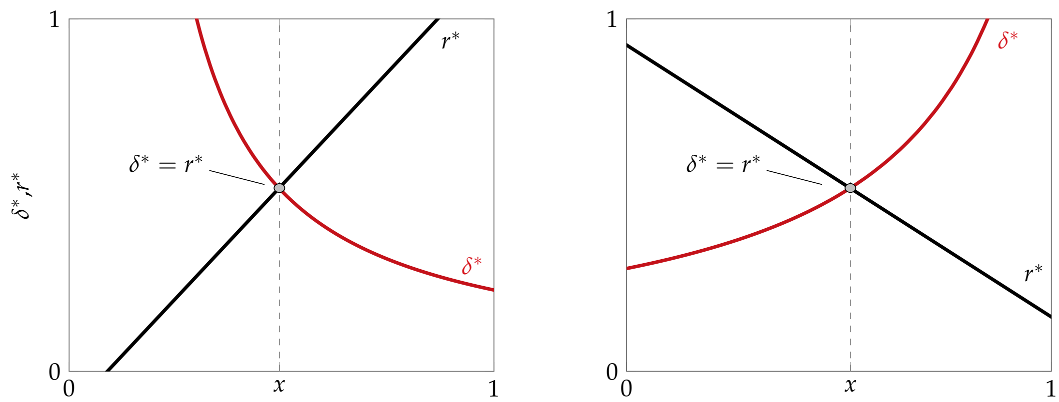
In order to achieve a positive and sustainable net capital inflow from abroad, I assume that the authority relies on two conditions: first, a nominal exchange rate that remains stable, i.e. in equilibrium; and second, I assume that this equilibrium corresponds to the rate that balances international trade.[27] This will ensure positive financing where both the real and financial dimensions (the no-arbitrage condition) are balanced. Thus, if $\frac{\dot{\mathcal{E}}(t)}{\mathcal{E}(t)} = 0$ and $\mathcal{X}(r)$[28] are in equilibrium, from (1.4) 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. 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

[26]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.

[27]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.

[28]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.

Figure 1.7: Fixed point in boom and bust



(a) Boom

(b) Bust

the stabilization of the business cycle. I then use a basic rule of motion given by

$$\frac{\dot{R}(t)}{R(t)} = \theta(r), \qquad \text{where} \qquad \theta'(r) = \begin{cases} > 0 & \text{if Boom,} \\ < 0 & \text{if Bust,} \end{cases} \tag{1.19}$$

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 (1.18) is therefore reformulated as

$$\frac{\dot{r}(t)}{r(t)} = c\frac{1}{2}\delta(t) + c\frac{1}{r(t)}\Big(R(t)\,\theta(r) - \varphi(r)\Big). \tag{1.20}$$

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

$$\frac{\dot{\delta}(t)}{\delta(t)} = \gamma(r) - \frac{1}{\delta(t)}\Big(\mathcal{X}(r) - R(t)\,\theta(r)\Big), \qquad \text{where} \qquad \mathcal{X}'(r) = \begin{cases} < 0 & \text{if Boom,} \\ > 0 & \text{if Bust.} \end{cases} \tag{1.21}$$

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 (1.21). During the boom, an increase in r makes yields on domestic currency assets more attractive,[29] 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, ceteris paribus, to an increase in the trade deficit. Conversely, an increase in r during a crisis is

[29] 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.

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, both of which lead to a decline in $\mathcal{K}(r)$. At this point, I draw on the "neglected risks" theory of Gennaioli, Shleifer, and Vishny (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[30]

$$\gamma'(r) = \tfrac{1}{2}\Big(S\mathcal{K}'(r) + 1 - S\Big) = \begin{cases} < 0 & \text{if Boom,} \\ > 0 & \text{if Bust.} \end{cases} \tag{1.22}$$

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 (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 (1.3), $r^* = \tilde{r} + \mathcal{K}(r^*)$, is satisfied;
- The cost curve simplifies to $C = \eta = \frac{1}{2}r^*$;

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

- In the long run, the system converges to the values

$$\delta^* = -\frac{R(t)\,\theta(r^*)}{\gamma(r^*)} \qquad \text{and} \qquad r^* = \left(1 - \frac{\varphi(r^*)}{R(t)\,\theta(r^*)}\right) 2\gamma(r^*)\,; \tag{1.23}$$

- 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 1.7 shows that the steady state is a unique and positive point of intersection.[31] In addition to the specifications in footnote (31), 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

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

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 1.8 illustrates the BB standard. The (solid black) curve delimiting both regimes implies that[32]

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

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, $\theta(r)$, 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

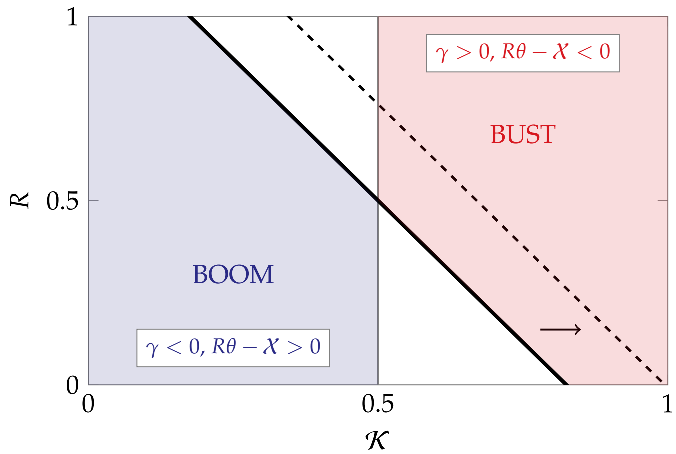
[31] Here I claim the existence of a positive equilibrium under the condition

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

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.

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

Figure 1.8: BB standard (in the boom)



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

$$\frac{\theta'(r)}{\theta(r)} > \frac{\gamma'(r)}{\gamma(r)}. \tag{1.24}$$

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. 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 A.2.

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 A.3. 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 $\theta(r - \tau_r)$ shifts the curve to the right and reduces the likelihood of entering the bust phase. This confirms the application of the strategies discussed above.

Stability analysis

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

Analytical framework. Using equations (1.21) and (1.20) I can express the dynamic system in terms of the state variables

$$\dot{\delta}(t) = \mathcal{D}\Big(\delta(t), r(t)\Big) \tag{1.25}$$

$$\dot{r}(t) = \mathcal{R}\Big(\delta(t), r(t)\Big). \tag{1.26}$$

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 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 $\big(\delta(0), r(0)\big) \in \big(\delta^* - \varepsilon, \delta^* + \varepsilon\big) \times \big(r^* - \varepsilon, r^* + \varepsilon\big)$ 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 1.8)

$$\mathcal{D}_{\delta^*} = \gamma(r). \tag{1.27}$$

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

$$\mathcal{D}_{r^*} = \delta^* \gamma'(r) + R(t)\,\theta'(r) - \mathcal{X}'(r). \tag{1.28}$$

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

$$\left.\frac{\partial r^*}{\partial \delta^*}\right|_{\dot{\delta}=0} = -\frac{\gamma(r)}{\delta^* \gamma'(r) + R(t)\,\theta'(r) - \mathcal{X}'(r)}. \tag{1.29}$$

The effect of a change in the ratio of external debt to exports on the trajectory of the interest rate,[33] is given by

$$\mathcal{R}_{\delta^*} = \frac{1}{2}r^*. \tag{1.30}$$

The strength of the relationship depends on the level of the equilibrium interest rate. The higher r^* is, the more strongly the system reacts to changes in the level of the foreign debt ratio. To represent an economy with a low position in the international currency hierarchy, I assume a structurally high r^*. Compared to a currency at the top of the hierarchy with negligible or almost negligible ℓ, $\mathcal{K}(r)$ is burdened with a larger 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

$$\mathcal{R}_{r^*} = \frac{1}{2}\delta^* + R(t)\,\theta'(r) - \varphi'(r). \tag{1.31}$$

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 δ^* through the costs associated with financial integration and the debt burden, thus affecting the future sustainability of foreign debt relative to exports. 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. 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 (δ^*, r^*) that achieves balanced growth on the schedule $\dot{r}(t) = 0$ is determined by

$$\left.\frac{\partial r^*}{\partial \delta^*}\right|_{\dot{r}=0} = -\frac{\frac{1}{2}r^*}{\frac{1}{2}\delta^* + R(t)\,\theta'(r) - \varphi'(r)}. \tag{1.32}$$

For a given difference between the interest rate elasticity of the growth rate of reserves and net capital flows, the slope of equation (1.32) 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

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

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 A.4.

Boom

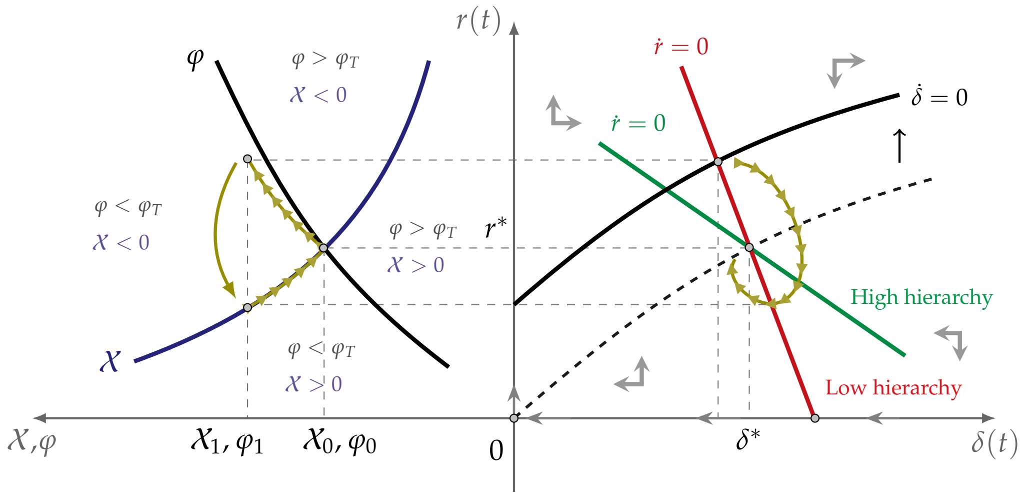
The investigation of this phase is crucial because it underpins the conditions for the collapse of the system. It is therefore important to examine what measures the monetary authority can take to stabilize the economy in the event of external shocks. Although the model does not provide a mechanism that 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 (1.9) 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, Paula, and Prates, 2018 and Paula, Fritz, and Prates, 2017; Paula, Fritz, and Prates, 2024a), while the flatter curve (solid green) represents a higher position. In other words, according to equation (1.32), 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.

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

Figure 1.9: Debt shock no. 1, $\varphi'(r) > 0$



(1.21). 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 1.9 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 (1.20) 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 1.9, 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 target φ_T and deliberately overshoot the interest rate downwards. 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 elasticity $\varphi'(r)$ at a given shock, the more fragile the structure becomes and the higher the risk of systemic collapse.

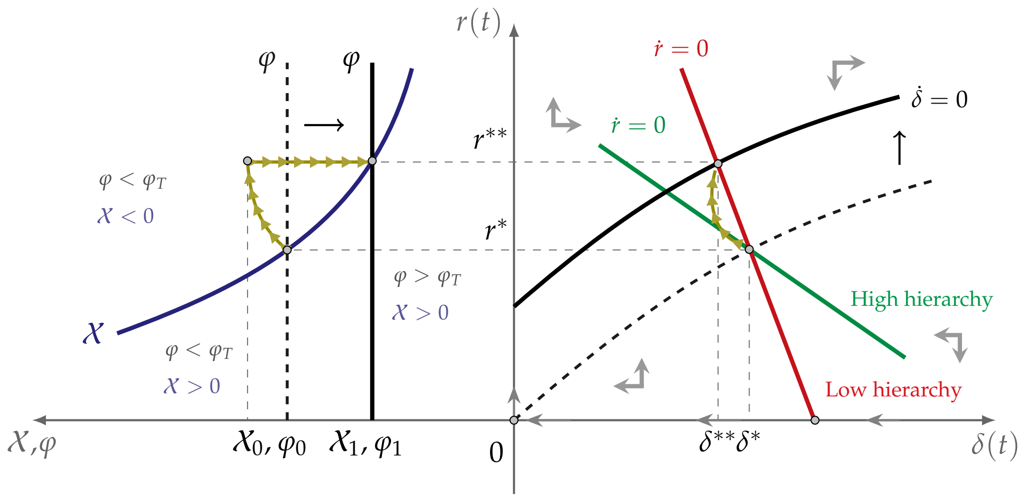
External debt shock #2. Let us now consider the same foreign debt shock in an economy with a very low or negligible interest rate elasticity of net capital flows, $\varphi'(r) = 0$. This does not change the stability properties of the critical points but causes the net capital flow curve to be vertical 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 $\tilde{r}$. This is illustrated in Figure 1.10. 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 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

Figure 1.10: Debt shock no. 2, $\varphi'(r) = 0$



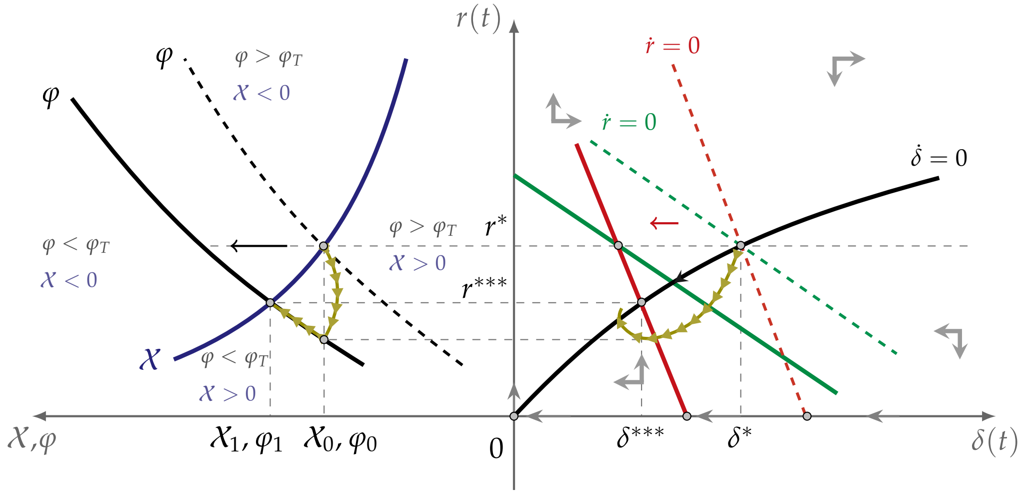
to net liquidity inflows from abroad $\uparrow\varphi(r)$.[34] This shock shifts the $\varphi(r)$ curve and the locus $\dot{r}(t) = 0$ to the left, as shown in Figure 1.11, and brings the economy to a region where capital inflows exceed the target $\varphi(r) > \varphi_T$, at the point $\mathcal{X}_0, \varphi_0$. 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 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-exports 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 allows the system to stabilize at a lower interest rate, since lower liquidity premia reduce $\mathcal{K}(r)$ (for a given $\tilde{r}$) and thus satisfy the non-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

[34] 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 $\tilde{r}$.

Figure 1.11: Foreign liquidity shock



not desirable as it leads to greater volatility,[35] 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 $(\delta(t), r(t))$ plane of Figure 1.11). 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 system protect itself from or avert a financial trap? First, by ensuring that the slope of the $\dot{r}(t) = 0$ curve in the bust phase is steeper than that of the $\dot{\delta}(t) = 0$ curve (both positive). Although the situation remains unstable, there will be at most one trajectory that allows the authority to guide the system to the point (δ^*, r^*). Second, the application of the "ceiling rule" (1.15), which targets an unstable δ^{**} and not the stable $\delta^*$of the boom. This is achieved by a higher international reserve volume ($R_1(t) > R_0(t)$) for a 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:*

[35]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.

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.

Some implications of these results

Distributive conflict. The macroeconomic impact of shocks on inflation, particularly in the context of exchange rate depreciation, has not been discussed as this is beyond the scope of this chapter. However, this phenomenon should not be overlooked, especially in open emerging markets. As Rowthorn (1977) noted, inflationary dynamics can lead to price-wage spirals in which firms and workers adjust prices according to their bargaining power in order to maintain their share of the income distribution. This could represent *another significant vulnerability* for an emerging economy seeking international market integration. In chapters 2 and 3, I analyze in detail inflation arising from distributional conflict.

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 $v(r) \equiv 1 - \delta_{\max} \cdot \gamma(r) - R(t)\,\theta(r)$ using the "ceiling rule" (1.15). This makes it possible to achieve a level of production that is compatible with the balance of payments constraint

$$Y_{\mathrm{BoP}} = v(r)\,\frac{1}{m}X. \tag{1.33}$$

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 (1.13), the taxes τ_r and τ_S reduce C, which leads to a more negative value of $\gamma(r)$ and ensures that $v(r;\tau_r,\tau_S) > v(r)$. 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 1.4). 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*

$$y_{\text{BoP}} = \frac{x}{\pi}\left(1 + \delta_{\max}\right), \tag{1.34}$$

where $\pi = \frac{dM/M}{dY/Y}$ *denotes the income elasticity of imports. Under the parametric constraint of the BB standard, (1.34) 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 (1.34), 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 (1.4) 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, (1.34) yields

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

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 (1.34) 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* $\delta_{\max}$.

Essentially, this result shows that the two disadvantages faced by a typical emerging economy, which were previously examined from a Minskyan perspective of the business cycle, also apply in the context of balance of payments-constrained growth theory.

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.

1.8 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, to name a few. 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; (b) the formalization of debt sustainability through the $\mathcal{S}(C)$-curve, which in other words is the Minskyan "survival constraint" for a small open economy.

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 that an emerging economy faces in integrating into international markets in a globalized world and show how a dynamic balance of payments analysis can clarify this asymmetry.

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Chapter 2

Inflationary Inertia as a Result of Unfulfilled Aspirations

2.1 Introduction

Inflationary inertia (or persistence) has been studied for more than half a century and remains the subject of heated debate today.[1] Within the framework of the conflict theory of inflation, some researchers attribute inflationary inertia primarily to wage indexation and contractual rigidities.[2] This effect was particularly pronounced in emerging markets in the 1970s and 1980s, where inflation rose as adjustment intervals shortened. However, the relationship between inflation inertia and aspiration gaps remains relatively underexplored compared to more traditional conflict-based approaches. Although the aspiration gap is a well-established concept within conflict inflation theory, dating back to Rowthorn (1977)'s seminal work, few studies have directly linked it to inflation inertia.

How might this aspirational channel contribute to inflation persistence in the absence of contractual indexation, even after economic gaps have closed and macroeconomic equilibrium has been reached? Could aspiration-based inflation inertia be more pronounced in certain institutional or economic contexts? In this chapter, I develop a model to investigate this channel and answer these critical questions.

To analyze the effects of aspiration gaps and their contribution to inflationary inertia, I rely on Keynes (1936)'s macroeconomic aggregates—the so-called D/Z model—as my analytical frame-

[1] For an analysis of the Argentinian special case, see Reinhart (2019); for a global outlook, see Goodhart and Pradhan (2020). Following the inflationary surge caused by the pandemic, Cevik (2022) examines eurozone (UZ) economies, Pill (2023) focuses on the United Kingdom, Schwartzman (2023) on the United States (US), and Afrouzi et al. (2024) offer insights at the global level. Hilscher, Raviv, and Reis (2024) show that inflation expectations have become unanchored in both the US and the EZ, with "inflationary disasters" expected in the coming years, especially in the EZ.

[2] See, for example, Bacha (1988), Carvalho (1993), and Heymann and Leijonhufvud (1995).

work (see Hartwig, 2007). In the context of a closed economy, I apply Davidson (2011)'s simple "farm" economy to illustrate the trial-and-error process first without and then with conflict. This forms the base scenario for my analysis. The iterative process between firms and workers reacts to deviations between expected and actual demand, which are assumed to be due to autonomous demand shocks. In response, firms adjust their production by changing the demand for labor, renegotiating wages, and setting new prices. Employment adapts to these changes, which remain sticky within each market round and are only corrected in subsequent rounds. Over time, this iterative process between firms and workers continues until aggregate demand and aggregate supply reach equilibrium, known as the point of effective demand.

The trial-and-error process leaves the distribution of income unchanged, as prices and wages adjust evenly in response to the autonomous demand shock. This simplifies the convergence process. Equilibrium is reached as soon as the deviation between expected and actual demand has disappeared. However, convergence is made considerably more difficult by an iterative, conflict-ridden process. Firms and employees not only adjust their prices in response to deviations in demand, but also to their desired pay targets. These adjustments are made to varying degrees depending on the bargaining power of each group, which leads to shifts in income distribution. Significant bargaining power within a group can lead to autonomous inflationary inertia that is difficult to eliminate. This inertia can persist even when supply and demand have reached overall equilibrium and aspirational gaps have temporarily closed.

The aspirational dimension runs parallel to the expectational dimension, suggesting that convergence to the point of effective demand equilibrium does not necessarily stabilize the system, as aspirations may remain unfulfilled. For those who assume that an effective demand equilibrium involves both expectations and aspirations (as posited by Millar, 1972, and Hartwig, 2007), the realization of such an equilibrium is clearly hindered by conflict. For those who adhere to the traditional view that the equilibrium of effective demand is simply where expected and realized demand coincide (ignoring aspirations), the introduction of conflict means that this intersection no longer contains "all information" about prices, wages, and employment for the next period of production. In both cases, distributional conflict tends to pull the economy away from the equilibrium of effective demand.

To integrate conflict into this simple economy, I introduce several important adjustments that represent the contributions of this model to the literature. First, following Olivera (1991), I consider, on the one hand, the aspiration gaps[3] of both groups as the social equilibrium of the economy that is achieved when these gaps are closed. These gaps reflect the difference between the actual real wage and the payments aspired to by each group. On the other hand, I assume that market equilibrium is the point of effective demand, with the market gap occurring when an au-

[3]Originally conceptualized by Rowthorn (1977) and later popularized by Dutt (1987) in such a way that this model exists in a standard form widely recognized in contemporary conflicting-inflation literature.

tonomous demand shock exceeds autonomous supply movements. As a starting point, I equate each aspiration gap with the market gap to examine the system's response to autonomous demand shocks. This framework integrates market logic into antagonistic price adjustments between firms and workers.[4] I first define this equilibrium in a "pure" form that excludes the influence of bargaining power. This serves as a starting point for the analysis of distributional conflict. I then show how the introduction of bargaining power disturbs this original equilibrium and pushes the social equilibrium towards an inertial dynamic, especially when the power to adjust is strong.

Second, I define conflict-based price and wage setting as weighted averages of the current real wage and aspirations.[5] In contrast to the traditional approach, which makes a linear and proportional adjustment to the size of the gap (e.g. Blecker and Setterfield, 2019, in their canonical textbook model), this function captures the *relative* influence of the actual real wage and aspirations in the adjustment process. This function indicates that changes in actual real wages and aspirations are not simply additive. The influence of the individual variables depends on their relative importance in price and wage setting, which is determined by the size of the aspiration gap. The supraindices, which measure the openness of the aspiration gaps, give the model a clear mechanism to track how far economic agents' aspirations deviate from actual outcomes. Quantifying the size of the gap between each group is advantageous as it increases flexibility and allows the simulation of multiple scenarios (see e.g. Section 2.5). This means that the actual real wage shared by both groups can affect price and wage adjustments differently depending on the size of the aspiration gap between them. This is true even without considering bargaining power, which, when taken into account, clearly exerts additional pressure. Moreover, this weighted adjustment is more realistic as it allows for gradual changes in prices and wages over time rather than abrupt shifts. This aspect, together with the first contribution, is discussed in Section 2.3.

Third, I summarize the actual real wage in a single equation that results from separate subequations for firms and workers. This wage exhibits cyclical (oscillatory) behavior that is partly consistent with the sawtooth pattern associated with contractual indexation (e.g., Carvalho, 1993), although in this model it is mainly associated with the business cycle. In particular, the autoregressive coefficient of this equation serves as a composite elasticity reflecting the bargaining power of firms and workers. This dual structure of the coefficient leads to a decoupling that enables one of the two groups to trigger an inflationary inertial episode (if it has high bargaining power) even with a stable actual real wage. This is a crucial feature because it allows the social equilibrium to deviate from the market one, which destabilizes the system and ultimately pushes the economy away from the equilibrium point of effective demand. Under certain conditions, the

[4] Antagonistic adjustments, in which the gains of one party directly correspond to the losses of the other, resemble zero-sum games. For a more detailed explanation, see Kolaja (1968).

[5] A similar approach to price and wage setting is discussed in chapter 2 of Taylor (2009) and Martin (2023).

resulting inertia becomes a force that is difficult to eliminate, even when the system is in equilibrium, because it is self-sustaining (i.e. autonomous). I conclude that additional non-market mechanisms are needed to curb this inflation. This leads to what I call a "consensus-led regime." I show that this is the only context that ensures long-term stability and convergence to an effective demand equilibrium in a conflictual environment. I address this point in Section 2.4 and conclude in Section 2.5 by presenting numerical examples for the cases studied, which show the flexibility in simulation already mentioned.

Related literature

This chapter integrates and extends several strands of the conflicting inflation literature. First, it joins a long-standing economic tradition that assumes that distributional conflict between firms and workers—independent of monetary factors or expectation dynamics—influences price and wage adjustments through bargaining power. In this view, inflationary episodes arise as a result of these distributional struggles. The seminal contributions of Kalecki (1943), Robinson (1962), Sylos-Labini (1974), Scitovsky (1978), Rowthorn (1980) and Skott (1989), to name a few, have provided important perspectives on distributional conflict. Recent studies by Hein (2024), Lavoie (2024), Rowthorn (2024), Sawyer (2024), and Skott (2024) have revitalized this tradition, renewing the discussion and providing new insights into its implications.

Second, this chapter addresses a branch of the literature that uses the distributional conflict hypothesis to shed light on the origins of inflationary inertia, particularly within Latin American structuralist economics. Notable contributions include the work of Simonsen (1983), Frenkel (1986), Bresser-Pereira and Nakano (1987), Bacha (1988), Ros (1989), Ros (1993), Carvalho (1993), and Heymann and Leijonhufvud (1995), among others.[6] These works argue that wage contracts are indexed with a time lag, which leads to a loss of purchasing power that must be made up in ever shorter periods. This dynamic leads to the autonomous persistence of inflation, independent of macroeconomic fundamentals. Studies by Taylor (2009), Serrano (2010), Vera (2013), Hein (2023), and Serrano, Summa, and Morlin (2024) contribute to a contemporary discussion of the inertial phenomenon, which is rooted in distributional conflict.

Third, this chapter uses the mechanism of aspiration gaps to formally represent the conflict through the antagonistic adjustment of prices and wages that these gaps illustrate. This mechanism has been studied in a broad strand of the literature, starting with Rowthorn (1977)'s seminal work and later extended by Marglin (1984), Dutt (1987), Olivera (1991), Sen and Dutt (1995), and Hein and Stockhammer (2009) for closed economies, as well as Blecker (2011) and Wildauer et al. (2023) for open economies. Setterfield (2023) also applies this framework to explain the recent

[6] Also noteworthy is the important work of Blanchard (1986), who models inertia through expectations and nominal rigidities rather than contractual causes. Lorenzoni and Werning (2023) build on this expectation-based approach and incorporate the aspiration gap mechanism.

COVID-19 crisis. This mechanism has gained considerable traction in the recent literature and has become a canonical model found in many textbooks and recognized as a standard framework in the field (e.g. Blecker and Setterfield, 2019; Lavoie, 2022; Hein, 2023). This chapter attempts to reinforce the link between aspirations and inertia by showing that inflation can persist as a consequence of unfulfilled aspirations. It is emphasized that such dissatisfaction results from social equilibrium. The distinction between social equilibrium and market equilibrium is crucial, as an exclusive focus on the market and its path to (effective demand) equilibrium overlooks the broader social dynamics that can generate general equilibrium effects—in particular, dissatisfaction with aspirations.

Finally, this chapter addresses a strand of Keynesian literature that emphasizes the failure of Keynes and traditional Keynesian economics to address distributional conflict. Notable contributions include Skidelsky (2013), Palley (2023), Palley (2024), Heise (2024), and Heise (2024a). Building on this critique, I aim to incorporate a more explicit recognition of social conflict into the macroeconomic aggregates discussed in Keynes' *General Theory* in a clear and formal way.

2.2 A D/Z Keynesian Model

Basic framework

This economic system contains the basic macroeconomic aggregates from Keynes (1936) and adopts the "farm economy" framework of Davidson (2011) and the corresponding "Keynesian" chapters in Mitchell, Wray, and Watts (2019). It models a closed economy operating in discrete time, with periods indexed by $t \geq 0$. The economy consists of two groups: firms, which produce tomatoes as their only output Y_t, and workers, who consume tomatoes and provide (effective) labor N_t as their only input. Thus, production follows a simple structure and can be represented linearly as $Y_t = N_t$. The production lifespan of tomatoes is limited to a single period as they spoil at the end of each cycle. This simplification prevents the accumulation of inventories and simplifies the model by ensuring that the production cycle is reset every period without carryover.

On the one hand, the aggregate supply function, denoted by $Z_t = \Phi\big(N_t, t\big)$, captures the relationship between the expected future revenues of entrepreneurs (farmers) and the current employment level N_t required to produce tomatoes that meet these expectations. On the other hand, the aggregate demand function $D_t = D\big(N_t, t\big)$ describes how high the expected demand in the economy will be at different employment levels N_t and (implicit) income levels. I assume that the money supply is endogenous and adapts to individuals' demand for transactions in each period. While there is no explicit money market, this assumption ensures a consistent and balanced response to the demand for money.

I introduce the discrete-time sequence to illustrate in a comprehensible way the trial-and-error process that leads the economy to an effective demand equilibrium. It captures the lagged responses and gradual adjustments to exogenous shocks and their impact on production and decision making on a period-by-period basis. This framework simplifies the inclusion of lag effects and makes the emergence of inertia more intuitive (which I will explore in the next Section 2.3). This approach addresses Keynes' omission of temporal dynamics in the General Theory. Kregel (1976) and Possas (1986) explicitly point out the negative effects of this omission on Keynes' analytical abilities.[7]

Employment. I adopt a Keynesian perspective in which workers establish only the nominal wage W_t and not the real wage.[8] However, this does not mean that fluctuations in real wages are ignored. As for the price level, I assume that prices are set according to a fixed real markup m on labor costs, so that

$$P_t \;=\; \big(1+m\big)W_t, \tag{2.1}$$

where (average) labor productivity is constant and normalized to one.

In this economy, the supply of labor exceeds the quantity demanded, indicating that involuntary unemployment can coexist. Consequently, the quantity of labor demanded determines the current effective number of employed workers N_t. Note that despite the excess supply of labor in this straightforward setting of tomato farming, workers are able to set wages because firms want to attract and retain skilled labor (e.g., those with more experience in harvesting) to ensure uninterrupted production.

The demand for labor reflects firms' decisions about how much labor they need to generate the expected sales and profitability associated with the expected prices for tomatoes and the expected demand for them. For the sake of tractability, from the point of view of firms I assume that the expected prices correspond to the current price P_t and that the expected demand for goods is primarily related to the autonomous component. While money wages reflect demand dependent on income, they also represent a cost. The demand for labor is therefore a function $N\big(P_t, W_t\big)$, and the effective employment level in tomato production is given by

$$N_t \;=\; N\big(P_t, W_t\big). \tag{2.2}$$

All other things being equal, an increase in prices (i.e. revenues) stimulates production $\frac{\Delta N_t}{\Delta P_t} > 0$, while an increase in production costs reduces it $\frac{\Delta N_t}{\Delta W_t} < 0$. Moreover, changes in prices and wages are influenced by *unexpected* shifts in autonomous demand, so it is impossible to determine

[7] According to Possas (1986), Keynes deliberately refrains from a dynamic analysis from period to period in order to explain in the simplest possible way that involuntary unemployment is not an imbalance. To support this explanation, Keynes assumes that firms' short-term sales expectations are always fulfilled.

[8] As far as wages are concerned, I will use the terms "money wage" and "nominal wage" interchangeably throughout this chapter.

a priori whether the change in N_t will be positive or negative; this depends on the elasticities of price and wage with respect to employment. These results can be summarized in the following proposition:

Proposition 1 (Effective demand equilibrium: price and wage adjustments). *The rate of change of equilibrium prices $\hat{P}_t$ and money wages $\hat{W}_t$ can be expressed as a function of the difference between the unexpected autonomous expansion of aggregate demand δ and aggregate supply ς. This rate is divided by the product of two factors:*

1. *The difference between price and money wage elasticities of employment volume, $\varrho - \omega$, and*
2. *The difference between aggregate supply and aggregate demand elasticities of employment volume, $\sigma - \varepsilon$.*

While the production process, which is based on expected demand, constantly adjusts to actual market demand, I assume that firms eventually reach a point where they effectively adjust production to actual demand through a process of trial and error. This effective demand equilibrium is defined as

$$D\Big(N\left(P_t, W_t\right), t\Big) - \Phi\Big(N\left(P_t, W_t\right), t\Big) \;=\; 0. \tag{2.3}$$

This term should not be interpreted as general equilibrium in Walras's sense,[9] since at this stage not all resources are necessarily fully exhausted. Instead, it should simply be understood as the point at which entrepreneurs' expectations align.

To track the changes in equilibrium position over time, I fully differentiate the expression (2.3) with respect to time and assume that $Z_t = D_t$ is true for a period t. After further algebraic manipulations, the result is

$$\big(\varrho \Delta P_t / P_t - \omega \Delta W_t / W_t\big)\big(\sigma - \varepsilon\big) \;=\; \big(\delta - \varsigma\big)\Delta t. \tag{2.4}$$

Equation (2.1) implies that equilibrium prices and money wages adjust at the same rate.[10] From this follows directly the formulation in Proposition 1, which yields

$$\hat{W}_t \;=\; \hat{P}_t = \frac{\delta - \varsigma}{\big(\varrho - \omega\big)\big(\sigma - \varepsilon\big)} \;=\; \big(\delta - \varsigma\big)\Lambda, \tag{2.5}$$

where $\Lambda \equiv \frac{1}{\left(\varrho-\omega\right)\left(\sigma-\varepsilon\right)} = 1$ is treated as a constant. Proposition 1 is thus proven.

This result is essential because it shows that an (unexpected) autonomous expansion of demand relative to supply[11] can lead to a positive shift in price and money wage levels over time

[9] That is, a point at which all markets are *cleared*.

[10] The hat ˆ above each variable indicates the proportional rate of change relative to its level.

[11] I assume that δ represents the unexpected component of the autonomous shock (which is defined as the uninduced

($n = 1, 2, \ldots$), represented by

$$P_{t+n} \;=\; \left(1 + \delta - \varsigma\right)^n P_0, \tag{2.6}$$

and also

$$W_{t+n} \;=\; \left(1 + \delta - \varsigma\right)^n W_0. \tag{2.7}$$

Trial and error adjustment process. Consider the tomato market in equilibrium at $t < 0$. Immediately after its opening at $t = 0$, it faces an autonomous demand shock (over supply) $\delta > \varsigma$. This excess demand exceeds the sales expectations of the entrepreneurs and exhausts the market earlier than expected. The early exhaustion of the market causes firms to hire additional labor to produce a quantity equal to the expected revenue and sales in the period $t = 1$. In response to this additional demand for labor, producers must agree with workers on wages worth $W_{t+1} = (1 + \delta - \varsigma) W_0$ and therefore expect to sell tomato production in the next period at $P_{t+1} = (1 + \delta - \varsigma) P_0 = (1 + m) W_{t+1}$. For practical reasons, I assume that the price elasticity of employment is greater in absolute value than that of wages $\varrho > \omega$. Consequently, the volume of hired labor will increase from N_t to N_{t+1} (at the rate indicated in (2.8)) in anticipation of the upcoming market round.

If the market gap remains open and entrepreneurs continue to underestimate sales at $t = 1$, they must adjust production, prices, and wages at $t = 2$ and continue this process over time until sales expectations match actual market demand. This iterative trial-and-error process continues until equilibrium is reached. Figure 2.1 shows the time sequence of these adjustments.

The adjustment of prices and wages then depends on the discrepancy between demand and supply shocks, unless a subsequent opposite shock neutralizes the original impulse. This process shows that autonomous demand shocks lead to imbalances, which in turn reshape expectations and influence production and employment. However, this shock has *no effect on the income distribution* between workers and entrepreneurs. Both groups adjust at the same rate, $\hat{W}_t = \hat{P}_t$, maintaining the existing distribution and keeping the real wage in constant equilibrium. This synchronous change in prices and wages ensures a balanced adjustment of labor given by

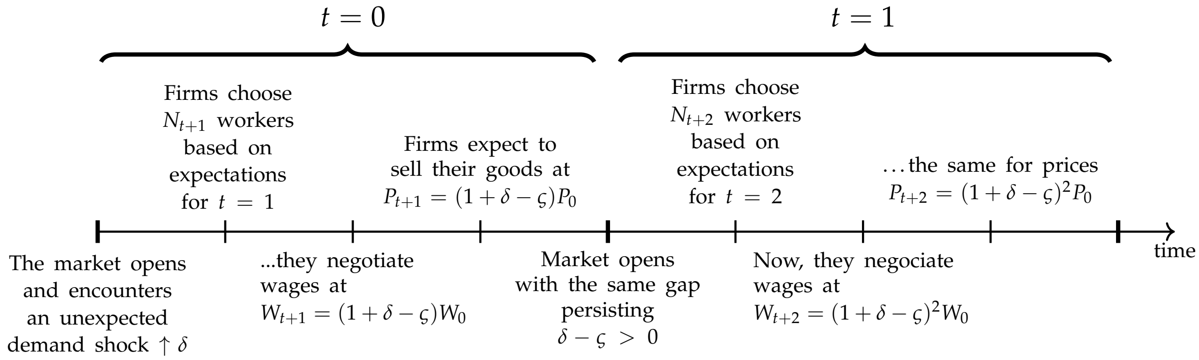
$$\hat{N}_t(\hat{P}_t, \hat{W}_t) \;=\; (\varrho - \omega)\,\hat{W}_t \;=\; \frac{\delta - \varsigma}{\sigma - \varepsilon}. \tag{2.8}$$

If the gap between autonomous demand and supply remains positive over a long period of time, full employment can theoretically be achieved, as Keynes predicted. Here, however, I focus exclusively on the inflation dynamics driving this adjustment, leaving aside further analysis of the labor market.

As soon as the market gap closes, prices, wages and employment stabilize at their last adjust-

part of aggregate demand), while the expected component is contained in firms' *ex-ante* production decisions. Positive changes in prices and wages can also result from a negative supply shock compared to demand. From now on, I will refer to δ as an autonomous demand shock, which already contains the unexpected component in its status.

Figure 2.1: Trial-and-error timeline



ment level, so that the economy can quickly return to effective demand equilibrium (expressed in levels).[12] This path to equilibrium appears straightforward and smooth, as it relies exclusively on market forces with no distributional conflict. How would the adjustment in this naïve-farm economy change if a distributional conflict were introduced? In the next section, I examine how the bargaining power of both groups affects economic outcomes, focusing on the distributional effects of an autonomous demand shock.

2.3 A Conflicting-Claims Model

I assume here that the trial-and-error process discussed earlier, by which nominal wages and prices adjust to equilibrium, is conflict-driven. I introduce the concept of "aspiration gaps" (Rowthorn, 1977; Dutt, 1987) to explain this dynamic. Firms and employees adjust prices antagonistically with the aim of reducing the income share of the other group. The aspirational motivations and their respective adjustments are first examined independently for each group, followed by a general analysis in Section 2.4. The results show how the inertial inflationary pressure of one or both groups interrupts the path to the equilibrium point of effective demand and leads to an undesirable destabilization of the system.

Workers

The aspiration gap of employees is based on the assumption that they have an aspirational real wage, denoted as $s_{W,t}$, which they want to achieve.[13] In contrast, the actual real wage, denoted by w_t, is the result effectively determined in each period. I assume that the actual real wage only enters the system via its ratio, as it represents an *ex-post* outcome. The workers' aspiration gap,

[12] In this model, I assume a rapid transition to equality of levels when the autonomous shock dissipates, so that the market gap expressed in autonomous shocks can be treated interchangeably with the gap in levels.

[13] This ideal wage is supported by a cultural framework that varies across societies; however, it will not be examined in detail here, as this is not the purpose of the model.

defined as $s_{W,t} - w_t$, serves as a benchmark for increasing their compensation by setting wages towards their aspirations. Following Olivera (1991), I argue that the aspiration gap belongs to the dimension of social equilibrium that is achieved when this gap is closed. From the workers' point of view, this social equilibrium is partial, and the influence of firms is through the actual real wage. I will later define the remaining component of this partial equilibrium from the firms' point of view.

Within the social equilibrium, the adjustment of prices and wages reflects the relative "power" of each group to increase its share of income distribution. In contrast, the adjustment of prices and wages in market equilibrium, as explained in the previous section, reflects the relative scarcity of goods or, in Keynesian terms, a discrepancy between expectations. In other words market equilibrium is the point of effective demand at which the aggregate demand curve intersects the supply curve. Although market and social equilibrium are linked, they are not identical. The price set that secures one equilibrium may differ significantly from the price set that sustains the other. Distributional conflict exacerbates this distinction.

I assume persistent dissatisfaction among workers leads to increasing aspirations over time. This assumption is based on the observation that as societies mature within a capitalist framework, material progress continually raises the basis for workers' aspirations. The inherent dynamics of capitalism—such as constant innovation and growing consumption opportunities—create a social environment in which standards are constantly being raised. This process encourages a steady upward adjustment of aspirations, leading to a kind of downward rigidity (i.e., $\hat{s}_{W,t} \geq 0$). In this single-good model, material progress can manifest itself as a desire for greater quantities or higher quality tomatoes and/or even intangible improvements. Whether these desires translate into an actual increase in real wages depends on the bargaining power of workers: the greater the bargaining power, the wider the gap between the two equilibria. This distinction begins with the following proposition:

Definition 1 (Partial equilibrium of workers). In the *absence* of bargaining power, aspirations and the market gap adjust in tandem so that

$$\hat{s}_{W,t} - \hat{w}_t \ = \ \delta - \varsigma. \tag{2.9}$$

Without external pressures—such as workers' bargaining power—that would otherwise widen the gap between aspirations and market outcomes, this alignment implies that when the market equilibrium is reached (i.e. $\delta - \varsigma = 0$), by definition the workers' social equilibrium is reached simultaneously, $\hat{s}_{W,t} - \hat{w}_t = 0$. This formulation emphasizes the close interdependence between these partial equilibria in a context where neither aspirations nor the real wage are actively influenced by workers.

The assumption of an initial match between social and market equilibrium reflects a steady-state scenario in which distributional tensions (captured by the aspiration gap) and macroeconomic conditions (captured by demand and supply shocks) are in equilibrium without external disturbances. Even if real economies do not always exhibit such perfect alignment, this assumption provides a reasonable starting point for the study of disequilibrium dynamics. On the other hand, while the literature on distributional conflict inflation has extensively analyzed wage bargaining, inflation expectations, and conflict-driven price dynamics, it usually treats social aspirations and macroeconomic imbalances as separate forces. My approach contributes by integrating these elements into a unified framework and explicitly linking the aspiration gap mechanism to macroeconomic fluctuations. This perspective helps to explain how inflationary pressures result from both distributional conflicts and the aggregate supply and demand situation.

To address dynamic shocks in autonomous supply and demand, the aspiration gap is expressed in terms of rates of change. This adaptation allows a coherent and continuous analysis of its evolution over time by reconciling changes in aggregate demand and aggregate supply with the aspiration gap. To integrate these concepts into the real economy, in particular this "farm economy," and to include bargaining power in this framework, I assume that tomato consumption c_t is a positive function of workers' aspiration level, $c_t = f(s_{W,t-1})$, where $f'(s_{W,t-1}) > 0$. The target level $s_{W,t}$ is an exogenous variable[14] that is influenced by factors such as cultural norms, institutional practices and historical contexts. For simplicity, given the lengthy nature of this process, I assume that changes in aspirations do not affect consumption immediately, but only take effect after a period. At the same time, and all other things being equal, higher consumption implies a higher actual real wage, $w_t = g(c_t)$, where $g'(c_t) > 0$. This is due to excess demand and the additional labor input required to meet it. For tractability, I assume that the adjustment takes place within the same period, without a delay between changes in consumption and the actual real wage.[15]

From this information, it can be deduced that an increase in social aspirations would lead to a positive shift in tomato consumption. This would have a positive effect on the actual real wage of workers, which is thus represented as

$$\hat{c}_t = \mathrm{A} \cdot \hat{s}_{W,t-1} \qquad \text{and} \qquad \hat{w}_t = \Gamma \cdot \hat{c}_t,$$

where $\mathrm{A} \equiv \frac{\Delta c_t / c_t}{\Delta s_{W,t-1} / s_{W,t-1}}$ and $\Gamma \equiv \frac{\Delta w_t / w_t}{\Delta c_t / c_t}$ denote the aspirations elasticity of consumption and the consumption elasticity of the actual real wage, respectively. On the basis of (2.9) I can now derive two equations:

[14] Although it can be fully endogenized, for the sake of tractability in this model, I will assume it as given.

[15] If I had assumed that real wage changes follow a one-period lagged consumption adjustment, the result in Section 2.4 would have remained largely unchanged. Therefore, this simplification is adopted without loss of generality.

$$\hat{s}_{W,t+1} = \delta - \varsigma + \mathcal{W}\hat{s}_{W,t} \tag{2.10}$$

$$\hat{w}_{t+1} = \left(\delta - \varsigma + \hat{w}_t\right)\mathcal{W}. \tag{2.11}$$

These expressions are the *fundamental equations* for workers' aspirations and the actual real wage adjustments. I interpret $\mathcal{W} \equiv \Gamma A$ as the bargaining power that workers exercise to adjust their aspirations and real wage changes over time. $\mathcal{W}$ captures the compound elasticity by which a change in aspirations leads to higher consumption, which ultimately leads to an increase in the actual real wage.

Assumption 1. The bargaining power $\mathcal{W}$ is treated as a single unit, regardless of the individual values of Γ and A. In a similar manner, the bargaining power of firms will be viewed as a single measure abstracted from its individual components.

The introduction of bargaining power in partial equilibrium (2.9) can alter this proportional relationship. A higher $\mathcal{W}$ may prolong the changes in aspirations and the actual real wage and thus widen the gap between the social equilibrium of workers and the market equilibrium.

How does money wage adjust in this context? Building on the wage-setting framework of Taylor (2009) and Martin (2023)—which intuitively is very similar to the canonical linear adjustment—I assume that wages at time t are determined as a geometrically weighted average of aspirations and the actual real wage, given by

$$W_t\left(s_{W,t}, w_t\right) = \left(s_{W,t}\right)^{\alpha}\left(w_t\right)^{1-\alpha}. \tag{2.12}$$

Expressed in terms of rates of change, this equation shows wage adjustment, i.e. wage inflation $\hat{\pi}_t^W$, which is the phenomenon I want to study, with

$$\hat{\pi}_t^W\left(\hat{s}_{W,t}, \hat{w}_t\right) = \alpha\hat{s}_{W,t} + \left(1 - \alpha\right)\hat{w}_t. \tag{2.13}$$

The parameter α regulates the reaction of the wage determination process to the aspiration gap. It increases with the size of the gap—i.e. the greater the difference between aspirations and the actual real wage, the higher the value of α. In the extreme case, when the gap is maximum $\alpha = 1$, individuals adjust the nominal wage according to $\hat{s}_{W,t}$ in order to "catch up" with their aspirations. At the other extreme, when the gap is completely closed $\alpha = 0$, the money wage adjusts to the actual real wage, as it already reflects the (real) aspirational wage. However, I exclude these extremes and assume a parameter that fluctuates within the limits $\alpha \in (0,1)$. In this case, the wage setting process reflects a positive aspiration gap that gradually adjusts toward the target over time. The main interest is to examine how bargaining power at a given gap (and thus a given α) alters the process of partial attainment of the target in each period, in parallel with the trial-and-error dynamics of the tomato market. Next, I analyze how wage adjustments respond to the four possible values that workers' bargaining power can take.

Case 1, $\mathcal{W} = 0$. In this scenario, workers lack bargaining power, which prevents them from adjusting the actual real wage. Only aspirations can adjust, but they are constrained by market equilibrium. The solutions to equations (2.10) and (2.11) can be summarized as follows:

$$\hat{s}_{W,t} = \delta - \varsigma \qquad \text{and} \qquad \hat{w}_t = 0. \tag{2.14}$$

In this context, wage inflation sets a constant minimum floor, which is determined solely by the supply and demand pressure of the market, expressed as $\hat{\pi}_t^W(\cdot) = \alpha\big(\delta - \varsigma\big)$. This wage adjustment remains in place until the aggregate imbalance between supply and demand is corrected $\delta - \varsigma = 0$, which also eliminates the rate of change of the aspiration gap as defined in Definition 1. However, this is a disadvantage because the market equilibrium dictates the necessary adjustments to the workers' social equilibrium and hinders the ability of them to keep pace with aspirational changes.

Case 2, $\mathcal{W} \in \big(0, 1\big)$. In this intermediate case, the adjustments of aspirations and actual real wages converge to their intertemporal equilibrium in the long run, which is represented by

$$\hat{s}_{W,t} = \big(\delta - \varsigma\big)\frac{1}{1 - \mathcal{W}} = \hat{s}_W^* \qquad \text{and} \qquad \hat{w}_t = \big(\delta - \varsigma\big)\frac{1}{1 - \mathcal{W}}\mathcal{W} = \hat{w}^*. \tag{2.15}$$

Although wage inflation is higher than in the previous case, where $\hat{\pi}_t^W(\cdot) = \frac{1}{1-\mathcal{W}}\big(\delta - \varsigma\big)\Big(\mathcal{W} + \alpha\big(1 - \mathcal{W}\big)\Big)$ (since bargaining power acts as a wage-adjusting multiplier, $1 + \mathcal{W} + \mathcal{W}^2 + \ldots$), the aspirational gap adjustment will also cease as soon as the gap between supply and demand closes. That is, adjustments are still subject to market forces. The influence of bargaining power on wage inflation becomes clear, with the effectiveness of aspirations and real wage adjustments depending on whether $\mathcal{W} \gtrless 0.5$, even for small values of α. This effect leads to rigidities in the adjustment of the aspiration gap, which feed directly into the trial-and-error process and thus influence the expectations and production decisions of entrepreneurs.

Case 3, $\mathcal{W} = 1$. This context is characterized by strong bargaining power,[16] where workers' aspirations and the evolution of actual real wages depend on market equilibrium, which is reinforced by temporal factors and initial conditions that constitute the inertial (i.e. autonomous) component of the system.[17] The general solutions for both variables show a dynamic equilibrium

[16]Which means nothing other than that an aspirational change today will lead to a proportional adjustment of actual real wages tomorrow, $\hat{w}_{t+1} = \mathcal{W} \cdot \hat{s}_{W,t} = 1 \cdot \hat{s}_{W,t}$.

[17]The inertial component works autonomously, i.e. it becomes a force that is independent of external factors such as the business cycle or shifts in expectations.

over time, which ultimately simplifies to

$$\hat{s}_{W,t} \;=\; \left(\delta - \varsigma\right) t + \hat{s}_{W,0} \qquad \text{and} \qquad \hat{w}_t \;=\; \left(\delta - \varsigma\right) t + \hat{w}_0. \tag{2.16}$$

The multiplicative component $\mathcal{W} = 1$ prevents the gap from converging to $\hat{s}_W^*$ and $\hat{w}^*$, leading to a persistent inflationary deviation from dynamic equilibrium over time, $\hat{\pi}_t^W(\cdot) = \left(\delta - \varsigma\right) t + \alpha \hat{s}_{W,0} + \left(1 - \alpha\right) \hat{w}_0$.[18] Even after the imbalance between supply and demand is corrected, the inflationary process remains constant driven by the weighted (inertial) initial conditions $\alpha \hat{s}_{W,0} + \left(1 - \alpha\right) \hat{w}_0$. In other words, inertial factors lead to an adjustment of the aspirational gap, which moves further away from market equilibrium from period to period. This shows that a balanced market is unable to resolve wage inflation against a background of unfulfilled aspirations and strong bargaining power.[19]

Case 4, $\mathcal{W} > 1$. The adjustment is very sensitive in this context, which indicates a strong bargaining power of the employees. This leads to an unstable trajectory in which both the actual real wage and the real target experience a rapid, unbounded growth as $t \to \infty$. As a result, wage inflation is represented by

$$\hat{\pi}_t^W\left(\hat{s}_{W,t}, \hat{w}_t\right) \;=\; \underbrace{\Big(\alpha\left(\hat{s}_{W,0} - \hat{s}_W^*\right) + \left(1 - \alpha\right)\left(\hat{w}_0 - \hat{w}^*\right)\Big)\mathcal{W}^t}_{\text{Inertia}} + \underbrace{\alpha \hat{s}_W^* + \left(1 - \alpha\right) \hat{w}^*}_{\text{Convergence}}. \tag{2.17}$$

This expression shows that wage inflation is a weighted average of inertial and stable components. After the gap between supply and demand has closed, the inertial component of the wage inflation rate grows *explosively* at $\Big(\alpha \hat{s}_{W,0} + \left(1 - \alpha\right) \hat{w}_0\Big)\mathcal{W}^t$, which illustrates the increasing deviation of the workers' social equilibrium from the market equilibrium over time. This highly unstable scenario can lead to macroeconomic problems such as a distorted income distribution and systemic risks due to excessive nominal wage increases adding volatility. It is not desirable for this economy to remain in this situation. The negative consequences will be illustrated later with examples (see Section 2.5).

Firms

The firm's aspiration gap is defined by a "targeted" real wage $s_{F,t}$, which is conceived as the reciprocal of an ideal profit rate, and the actual real wage w_t. Since the firm's aspirational wage is always less than or equal to the actual real wage, the aspiration gap is expressed as $w_t - s_{F,t}$. This reflects social equilibrium from the firm's point of view. Similar to workers, I assume that $s_{F,t}$ has

[18] Note that although inflation increases over time, its acceleration remains constant and reaches a maximum upper limit at $\frac{\Delta \hat{s}_{W,t}}{\Delta t} = \frac{\Delta \hat{w}_t}{\Delta t} = \delta - \varsigma$.

[19] Even if the gap were completely closed, so that $\alpha = 0$, the inertial component would remain due to $\hat{w}_0$.

a downward tendency (without going towards zero), reflecting upward rigidity. This dynamic is the origin of the antagonistic adjustment between the two groups, as firms try to lower w_t until it converges with $s_{F,t}$.

Thus, the partial equilibrium of firms, which includes their social equilibrium and market equilibrium without taking bargaining power into account, is similar to Definition 1. Expressed in terms of rates of change, it follows that:

Definition 2 (Partial equilibrium of firms). When there is no bargaining power, the market and firms' aspiration gaps adjust in unison so that

$$\hat{w}_t - \hat{s}_{F,t} = \delta - \varsigma. \tag{2.18}$$

This relationship mirrors Definition 1 and emphasizes the co-movement of the gaps under equilibrium conditions.

To relate these concepts to the farm economy, I consider that firms' target wage is a negative function of the installed capacity of the economy u_t, expressed as $s_{F,t} = f(u_t)$, where $f'(u_t) < 0$.[20] This negative relationship arises from the assumption that firms rely on the business cycle to facilitate target cuts and price adjustments (see Lima, 2009 and Brochier, 2020). In particular, they use economic booms to raise their prices and lower their targets, while the opposite is true during downturns. This adjustment takes place within the same time period and is determined by firms' ability to make price decisions. Furthermore, I assume that capacity utilization is a positive function of the actual real wage, $u_t = g(w_{t-1})$, where $g'(w_{t-1}) > 0$ (see Blecker, 2016). An increase in the real wage, spurred by higher tomato consumption and the associated increase in employment, requires greater installed capacity to meet excess demand. Since the adjustment of installed capacity is a gradual, time-consuming process, I assume that the change will take place with a delay of one period.

To clearly outline the sequence of events, suppose that the economy suffers an exogenous workers' aspirational shock that leads to an increase in tomato consumption. This in turn gives rise to actual real wages as production must expand to meet this excess demand, leading to an enlargement in capacity to produce more tomatoes. Firms will use this boom phase to adjust their targets, formally expressed as

$$\hat{u}_t = \Pi \cdot \hat{w}_{t-1} \qquad \text{and} \qquad \hat{s}_{F,t} = -\mathrm{H} \cdot \hat{u}_t.$$

Here $\Pi \equiv \frac{\Delta u_t / u_t}{\Delta w_{t-1} / w_{t-1}}$ and $\mathrm{H} \equiv \frac{\Delta s_{F,t} / s_{F,t}}{\Delta u_t / u_t}$ denote the actual real wages elasticity of capacity utilization and capacity utilization elasticity of firms' wage aspirations, respectively. Using the

[20] Wildauer et al. (2023) uses the same causal link, but in a positive direction, focusing on mark-up targets instead of real wage targets.

same procedure as before, I derive via (2.18) the firms' *fundamental equations* as

$$\hat{w}_{t+1} = \delta - \varsigma - \mathcal{F}\hat{w}_t \tag{2.19}$$

$$\hat{s}_{F,t+1} = -\left(\delta - \varsigma + \hat{s}_{F,t}\right)\mathcal{F}, \tag{2.20}$$

where $\mathcal{F} \equiv \Pi\mathrm{H}$ represents firms' bargaining power to adjust target and actual real wages. Note that in this context, an increase in the bargaining power of firms *will lower* both actual real wages and wage aspirations, since both are measured in real terms. This will become clearer in the cases discussed below. Similar to workers, the pricing strategy is a weighted average of firms' aspirations and the actual real wage, where the constant parameter $\beta \in \left(0, 1\right)$ fulfills the same function as in (2.13), excluding marginal cases. However, expressing the firms' gap in real terms will slightly affect the structure of the price-setting function. The price adjustment must be inversely related to both target and actual real wages so that

$$P_t\left(w_t, s_{F,t}\right) = \left(w_t\right)^{-\beta}\left(s_{F,t}\right)^{-(1-\beta)}. \tag{2.21}$$

Thus, if the gap is considerably large (with β close to one), price adjustments will tend to follow the real wage and aim to lower it in order to "catch up" with firms' aspirations. Consequently, price inflation $\hat{\pi}_t^F$ is determined by

$$\hat{\pi}_t^F\left(\hat{w}_t, \hat{s}_{F,t}\right) = -\beta\hat{w}_t - \left(1-\beta\right)\hat{s}_{F,t}. \tag{2.22}$$

This framework introduces four additional adjustment scenarios based on the different bargaining power of firms. Since the objectives of firms are directly opposed to those of workers, price adjustments will move in the opposite direction. Later we will examine how this antagonistic adjustment leads to fundamental economic imbalances.

Case 5, $\mathcal{F} = 0$. As firms have no bargaining power, they cannot adjust their targets, so actual real wage adjustments are solely determined by market forces. Equations (2.19) and (2.20) have the following solutions

$$\hat{w}_t = \delta - \varsigma \qquad \text{and} \qquad \hat{s}_{F,t} = 0. \tag{2.23}$$

The actual real wage reacts positively to a demand-supply gap. However, companies are not in a position to counteract this shift. In the absence of bargaining power, the market works "against" firms, with price inflation remaining negative and minimal, $\hat{\pi}_t^F = -\beta\left(\delta - \varsigma\right)$, until the market gap closes.

Case 6, $\mathcal{F} \in \left(0, 1\right)$. In this intermediate case, aspirations and real wages exhibit limited adaptability and gradually converge to the long-run equilibrium rate of change defined by

$$\hat{w}_t = \left(\delta - \varsigma\right) \frac{1}{1+\mathcal{F}} = \hat{w}^* \qquad \text{and} \qquad \hat{s}_{F,t} = -\left(\delta - \varsigma\right) \frac{1}{1+\mathcal{F}} \mathcal{F} = \hat{s}_F^*. \tag{2.24}$$

Note that the firms' defense mechanism is twofold: the adjustment of the actual real wage proves ineffective and leads to a price decline, while the aspirational channel is more efficient as shifts in aspirations cause positive price adjustments. Whether price inflation is positive depends on $\mathcal{F} > \frac{\beta}{1-\beta}$, as given by $\hat{\pi}_t^F(\cdot) = \frac{1}{1+\mathcal{F}}\left(\delta - \varsigma\right)\Big(\left(1-\beta\right)\mathcal{F} - \beta\Big)$. That is, for firms to raise prices—assuming the market gap remains open—the aspiration gap must be relatively small, such that $\beta < 0.5$, and firms must have sufficient bargaining power to satisfy such inequality. Otherwise, if $\mathcal{F} \leq \frac{\beta}{1-\beta}$, firms are unable to counteract the positive shift in the actual real wage, leading to negative inflation.

Case 7, $\mathcal{F} = 1$. In this context, characterized by the strong bargaining power of firms, prices do not converge to a moving equilibrium due to *inertia*. The solutions to the fundamental equations are represented by

$$\hat{w}_t = -\hat{w}_0 + \left(\delta - \varsigma\right) \qquad \text{and} \qquad \hat{s}_{F,t} = -\hat{s}_{F,0} - \left(\delta - \varsigma\right). \tag{2.25}$$

The inertial component reflects the autonomous change in actual real wages and aspirations, shaped by their initial conditions. In solution (2.25), the positive market gap[21] prevents upward price adjustments via the real wage channel. Nevertheless, overall price inflation remains positive, as indicated by $\hat{\pi}_t^F(\cdot) = \beta\hat{w}_0 + \left(1-\beta\right)\hat{s}_{F,0} + \left(1-2\beta\right)\left(\delta - \varsigma\right)$. The positive effect is amplified as long as the market gap remains open and $\beta < 0.5$, which indicates a relatively small aspiration gap. As soon as the market gap closes, inflation will continue to grow inertially at a constant rate. This situation can only be reversed by a market shock in the opposite direction, i.e. by an autonomous negative demand or positive supply shock.

Case 8, $\mathcal{F} > 1$. This scenario is similar to Case 4 of the workers. The (explosive) price inflation rate is thus represented by

$$\hat{\pi}_t^F\left(\hat{w}_t, \hat{s}_{F,t}\right) = \underbrace{\Big(\beta\left(\hat{w}_0 - \hat{w}^*\right) + \left(1-\beta\right)\left(\hat{s}_{F,0} - \hat{s}_F^*\right)\Big)\mathcal{F}^t}_{\text{Inertia}} + \underbrace{\beta\hat{w}^* + \left(1-\beta\right)\hat{s}_F^*}_{\text{Convergence}}. \tag{2.26}$$

This clearly leads to a highly unstable and undesirable macroeconomic environment, with inertia playing a key role in the instability of the system. The model illustrates throughout the chapter that, in a context devoid of conflict or characterized by low (or negligible) bargaining power, an autonomous demand shock temporarily interrupts the trial-and-error adjustment process. It is

[21] Note that the market gap here is not reinforced by the temporal variable, as observed in Case 3 for the workers.

in this sense that inflationary inertia poses a major challenge, as it transforms a temporary shock into a *permanent deviation* from the system's path towards an effective demand equilibrium.[22]

The novelty of this result lies in the model's departure from the traditional link between the aspiration gap and bargaining power found in the canonical model (e.g. Blecker and Setterfield, 2019; Lavoie, 2022). Instead, bargaining power determines the extent to which changes in aspirations and actual real wages today affect the next period (tomorrow) and propagate over time. This suggests that the inertia component, once established, is difficult to eliminate due to the independence of adjustments. This result is formally stated in Proposition 2 and Corollary 1. Nevertheless, another problem needs to be addressed first. So far, the actual real wage has only been partially formulated, with each group adjusting its own fundamental equation. But, since both groups look at the same variable from different angles, the model only needs a *single*, general equation to capture its evolution over time.

In the next section, I will derive a general expression for the actual real wage and integrate it into the framework of distributional conflict. This step clarifies and simplifies the analysis.

2.4 A General Actual Real Wage Into the Conflict

Using the two partial equilibrium real wages (2.11) and (2.19), I derive a general fundamental equation that describes the behavior of the actual real wage, given by

$$\hat{w}_{t+2} = \big(1 - \mathscr{C}\big)\big(\delta - \varsigma\big) - \mathscr{C}\hat{w}_t. \tag{2.27}$$

The structure of this expression provides valuable insights into the possible course of distributional conflict. For simplicity, I define $\mathscr{C} \equiv \mathcal{F}\mathcal{W} = \Pi\mathrm{H}\Gamma\mathrm{A}$, which represents the composite elasticity of bargaining power of both groups.

Assumption 2. Henceforth, the fundamental actual real wage equation (2.27) will be observed by both groups simultaneously and used for the formation of their aspiration gaps.

Solution and Equilibrium. The roots of equation (2.27), denoted by $\pm i\sqrt{\mathscr{C}}$, are purely complex and represent the underlying *sources* (the *root*) of the conflict. Therefore, the general solution of equation (2.27) is given by

$$\hat{w}_{G,t} = \mathrm{C}_1 \mathscr{C}^{\frac{t}{2}} \cos\left(\frac{\pi}{2}t + \mathrm{C}_2\right) + \hat{w}^*_G, \tag{2.28}$$

where $\frac{\pi}{2}$ indicates the amplitude of actual real wage fluctuations and C_1 and C_2 are arbitrary

[22] I refer to this phenomenon of persistent inflationary dynamics as inertia because it reflects long-lasting adjustments over time, even if certain forms of it produce hysteresis-like effects.

constants. In terms of intertemporal equilibrium, the expression

$$\hat{w}_G^* = (\delta - \varsigma)\frac{1-\mathscr{C}}{1+\mathscr{C}}, \tag{2.29}$$

represents the rate of change at which the general real wage fluctuates and converges over time. Oscillating behavior is represented by the sequence $\{\cos(\frac{\pi}{2}t + C_2)\}$, which reflects what is referred to in structuralist literature as the "Simonsen (1964) curve"[23] (Bresser-Pereira and Nakano, 1987; Carvalho, 1993), which was originally based on contractual delays between firms and workers. In this model, however, the oscillation is not due to contractual aspects (since indexation is excluded), but to the business cycle, which is determined by the interaction between consumption c_t and capacity utilization u_t in the economy.

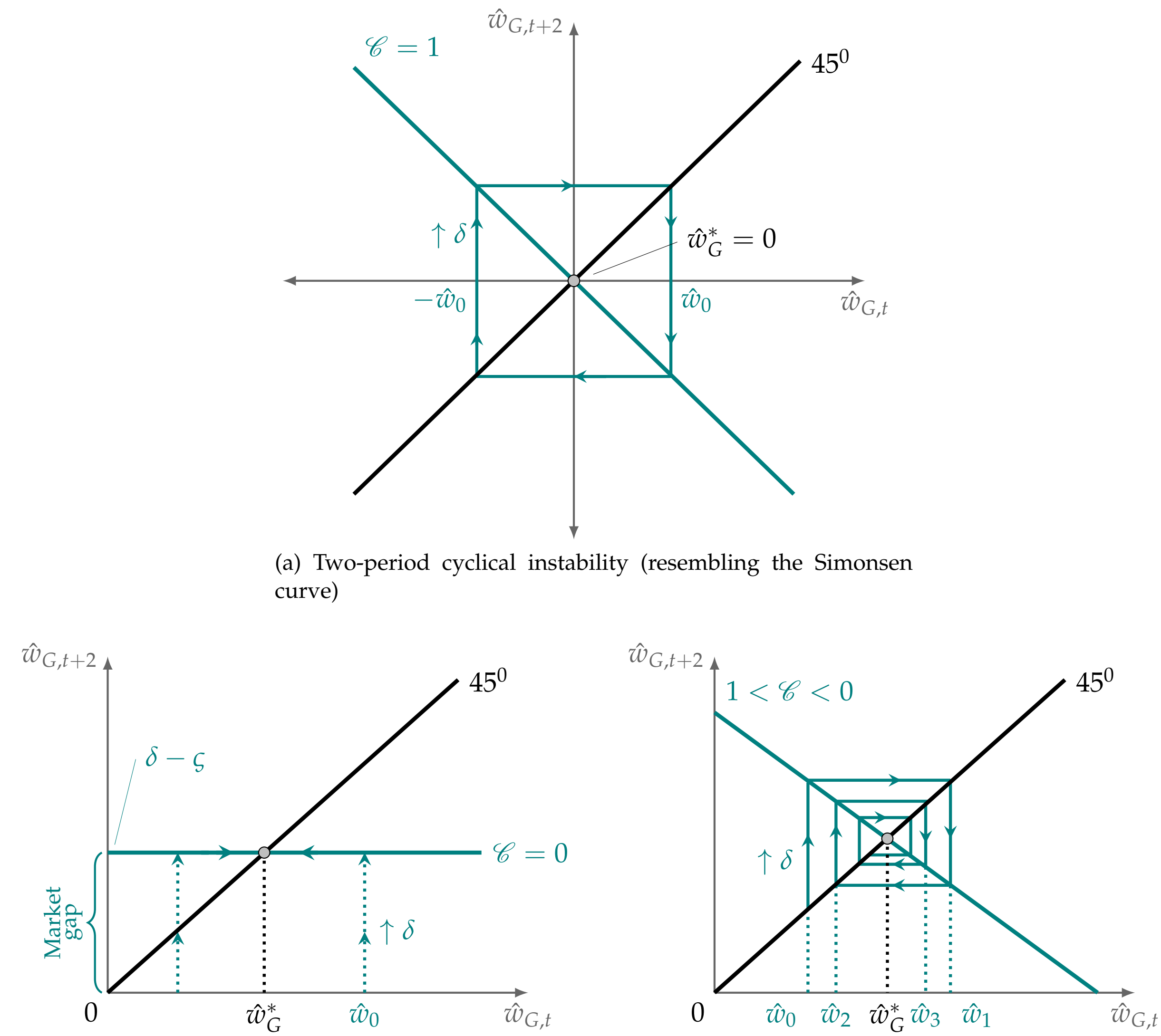
The key insight from equation (2.28) and the dual structure of $\mathscr{C}$ is that reaching an equilibrium real wage $\hat{w}_G^*$ does not necessarily lead to an equilibrium distribution, as happens in the canonical model with continuous time (see e.g. Blecker and Setterfield, 2019, chapter 5 or chapter 3 of this dissertation). The instantaneous adjustment of the real wage in continuous time makes it an attractor that *stabilizes the distribution* of conflict in an inflationary context. Interestingly, this convergence occurs at values of $\mathcal{W}, \mathcal{F} \in (0, \infty)$. However, the actual real wage pattern in this discrete-time model is oscillating and *does not* serve as an attractor. The distinction between market and social equilibrium in conjunction with the structure of $\mathscr{C}$ implies that bargaining power here can destabilize distribution over time. The actual real wage can reach equilibrium but still leave the distribution problem unsolved due to inflationary inertia. As I will show, this inertia can persist in any established equilibrium, be it in the market or in a social equilibrium.

Stability. The actual real wage can achieve intertemporal convergence in two ways. First, one can assume that $\mathscr{C} = 0$. Due to significant constraints on price or wage adjustments imposed on entrepreneurs, workers, or both the actual real wage undergoes a correction based solely on imbalances between market supply and demand. This trajectory follows a monotonic (non-oscillating) pattern and ends as soon as the market gap is closed. This is illustrated in Figure 2.2b.

Second, if $\mathscr{C} \in (0, 1)$, the actual real wage will oscillate towards the steady state $\hat{w}_G^*$. As shown in Figure 2.2c, these oscillations are damped in response to an autonomous demand shock and gradually decrease starting from the initial condition $\hat{w}_{G,0}$ (in $t = 0$, without specifying the initial conditions in $t = 1$). As long as there is a positive structural gap between demand and supply curves, the general real wage converges to $\hat{w}_G^*$. Once the market gap closes, the oscillation centers around the origin $\hat{w}_G^* = 0$. This is formulated in the following proposition from which a key result emerges.

[23]This in turn goes back to the sawtooth pattern of real wages by Kaldor (1955).

Figure 2.2: Several actual real wage convergence paths



(a) Two-period cyclical instability (resembling the Simonsen curve)

(b) Monotonic convergence

(c) Cobweb-like stability

Proposition 2 (Real wage stability and bargaining power decoupling). *For the general actual real wage to remain stable, it is necessary and sufficient that $\mathscr{C} \in [0, 1)$, implying*

$$\mathcal{W} < \frac{1}{\mathcal{F}} \quad \text{or} \quad \mathcal{F} < \frac{1}{\mathcal{W}}.$$

This indicates that the stability condition holds independently of the specific partial equilibrium outcomes resulting from the different cases of each group, decoupling the dynamics of general real wage stability from the individual bargaining scenarios.

This result is central to the analysis, as it separates the dynamics of the actual real wage from the bargaining power of each group. The implications, explored through examples in Section 2.5, suggest that achieving overall system stability requires far-reaching social agreements beyond market mechanisms—whether in terms of the market gap or the actual real wage—that focus on the aspirations sought by each group.

If $\mathscr{C} > 1$, on the other hand, the adjustment path for the actual real wage becomes explosive.[24] This result is the inverse of Proposition 2, with the inequalities reversed.

What happens when $\mathscr{C} = 1$? This is a singular and unstable case in which the actual real wage constantly fluctuates by $\hat{w}_G^*$ over time. This inertial case closely resembles the Simonsen curve presented by structuralist economists in the 1980s,[25] although it has an oscillating cycle (and not specifically a sawtooth shape). Even after the market gap is eliminated in the long run, the real wage continues to fluctuate constantly, but is now around zero, since $\hat{w}_G^* = 0$. Figure 2.2a illustrates this two-period cycle case in the long run, oscillating alternately between positive and negative values, as indicated by the equation

$$\hat{w}_{G,t} \;=\; C_1 \cos\left(\frac{\pi}{2}t + C_2\right).$$

On the basis of the information presented so far, in particular the result derived from Proposition 2, the following corollary can be formulated, which shows that inflationary inertia is a more complex phenomenon than it first appears.

Corollary 1 (The enduring impact of inflationary inertia). *Inflationary inertia may exerts a persistent influence not only after the closure of the market imbalances, but also after the closure of the two aspiration gaps. That is, even when the economy reaches full market and social balance, inflationary (inertial) pressure remains.*

This surprising result can be illustrated with a simple example. Consider an economy in which workers have intermediate bargaining power (Case 2) and firms have unitary bargaining power (Case 7) such that $\mathscr{C} \in (0,1)$ is true satisfying the inequality $\mathcal{W} < \frac{1}{\mathcal{F}}$ set up in Proposition 2. Assume that the market gap has rebalanced (after a previous demand shock), and for the sake of this hypothetical exercise both aspiration gaps have also closed. Wage inflation will be $\hat{\pi}_t^W(\cdot) = 0$, since $\hat{w}_G^* = 0$; but price inflation will be $\hat{\pi}_t^F(\cdot) = \hat{s}_{F,0} > 0$ (note that β disappears as the aspiration gap closes). There is no mechanism to stop this process, so the change remains constant and—assuming all else is equal—continues indefinitely. Of course, this is a theoretical exercise as such a scenario is unrealistic in the real economy as there are natural limits to inflation.[26]

[24] This scenario is not shown in Figure 2.2, but it is similar to 2.2c, except that the oscillation deviates from equilibrium and moves away from $\hat{w}_G^*$, which is in the *third quadrant* of the plane.

[25] In many theoretical formulations developed by these economists, a unitary $\mathscr{C}$ was implicitly assumed to represent a proportional adjustment of the real wage; this ultimately led to the emergence of inertia.

[26] In reality, price inflation cannot continue indefinitely without a corresponding wage adjustment. Otherwise, real wages and consumption would eventually fall to zero, which is unsustainable.

Table 2.1: Taxonomy of conflict types and distributive regimes

Power	Inflationary Regime	Distributional Type
$\mathcal{F} = \mathcal{W} = 0$	Led by the market	In favor of workers
$\mathcal{F} \in (0, 1)$ $\mathcal{W} \in (0, 1)$	Led by consensus	In favor of workers
$\mathcal{F} \geq 1$ $\mathcal{W} \geq 1$	Led by chaos (both aspirations)	Alternated (oscillatory)
$\mathcal{F} > 1$ $\mathcal{W} \in [0, 1)$	Led by firms aspirations	In favor of firms
$\mathcal{W} > 1$ $\mathcal{F} \in [0, 1)$	Led by workers aspirations	In favor of workers

Note: It is worth noting that most regimes produce inertia, and I largely dismiss the first market-driven case, as such a scenario is highly unlikely (except perhaps under extreme authoritarian conditions). This underscores the importance of a consensus-led regime, which is plausible but requires agreements beyond market mechanisms to form a sustainable, long-term institutional framework.

The closure of aspiration gaps is only temporary and only lasts for a short time after they have initially been bridged. Firms' inertial adjustments in aspirations lead to shifts in real wages to keep the gap closed, but these shifts reopen the gap for workers, perpetuating the cycle. The key point I want to emphasize in this brief theoretical example is that inertia acts as a force that transcends any established equilibrium. I will explore this in more detail using two more examples in Section 2.5, but first it is necessary to establish a taxonomy of the cases analyzed.

Taxonomy of inflation regimes and distribution types. The decoupling of bargaining power outlined in Proposition 2, together with the earlier cases based on the potential values of these elasticities, leads to several combinations of inflation regimes and distributional types. To clarify these combinations and better illustrate the resulting income distribution, I set up a taxonomy. Table 2.1 summarizes the taxonomy and outlines the potential inflation and distributional outcomes resulting from these interactions. The equations for prices, wages and employment associated with each of these regimes can be found in Appendix B.1.

The prevailing inflation regimes and the corresponding distribution types are determined by the values of $\mathcal{W}$ and $\mathcal{F}$. Remarkably, only in two specific cases is there no inflationary inertia: First, when both bargaining powers are equal to zero. In this case, inflation is driven by the market gap alone, leading to a distribution in favor of workers with positive wage inflation and negative price inflation. Second, in what I call the *consensus regime*, bargaining powers are balanced at intermediate levels. This is the only scenario in which firms can have relatively greater bargaining power while the distribution remains favorable for workers. Consequently, real wages rise[27] within a stable framework, which is contrary to the usual policy recommendations that advocate lowering real wages to eliminate inertia (see e.g. Reinhart, 2019). I refer to this as a consensus regime because the distribution is influenced by non-market factors such as institutional norms, political agreements, and implicit egalitarian arrangements that prevail in conflict-prone societies (see Sawyer, 2024).[28]

These external factors ultimately keep both bargaining positions within moderate limits. The model suggests that distributional conflict, together with inflationary inertia, goes beyond market dynamics and requires a comprehensive stabilization approach that also addresses all forms and sources of inflation outside the market sphere. I draw on Heymann (1986), who argues that to stabilize inflation, existing redistributive mechanisms must be replaced by alternatives that mitigate these pressures. While the model does not deal directly with questions of political economy, it shows that a consensus-based regime can be the necessary long-term alternative to ensure macroeconomic stability. Nevertheless, the implementation of this political dimension can be very difficult and time-consuming, as it comes at the expense of those who have more social and economic power.

Next, I will give two additional examples to illustrate the points discussed.

2.5 Examples

This section presents two examples that illustrate the adverse effects of inflationary inertia on the economy. First, I examine the qualitative effects of inertia on employment and review the timeline of the trial-and-error process, taking distributional conflict into account. Then, I examine a numerical example to quantify some cases discussed earlier.

[27]The origin of this effect lies in the fact that the actual real wage adjusts positively in this context (even from the firms' point of view), which exerts downward pressure on price inflation. See Case 6 and the sign of $\hat{w}^*_G$.

[28]Brazil illustrates a remarkable transition from an inertial regime driven by firms' profit targets, to a consensus regime. During the second half of the 20th century, real wages in Brazil were highly volatile and characterized by a pronounced sawtooth pattern and, especially after the 1960s, by a downward trend. However, after the implementation of the Real Plan in 1994, real wages stabilized considerably, with less volatility and a steady upward trend that continued into the early 21st century. Although this model does not take into account other adjustment variables such as interest rates, Brazil's stabilization experience largely corresponds to the consensus regime. For the real wage series, see http://www.ipeadata.gov.br.

A qualitative example

Employment. To examine how distributional conflict affects employment adjustment, I include price and wage inflation in the equation (2.8)

$$\hat{N}_t\left(\hat{w}_{G,t}, \hat{s}_{F,t}, \hat{s}_{W,t}\right) = \varrho \hat{\pi}_t^F - \omega \hat{\pi}_t^W = -x\hat{w}_{G,t} - y\hat{s}_{F,t} - z\hat{s}_{W,t}, \tag{2.30}$$

which changes implicitly as a function of the aspiration gap and the bargaining power of firms and workers.[29]

Employment adjustment is negatively affected by the aspiration channel of workers and the actual real wage. However, it will benefit from firms' adjustments, especially in a system driven by firms' aspirations. A price increase provides firms with an incentive to expand (tomatoes) production, which leads to increased labor demand, as assumed in equation (2.2). In any case, the result will depend on the values of $\mathcal{W}$ and $\mathcal{F}$. For example, consider a chaotic scenario in which the bargaining power of workers is $\mathcal{W} = 1$ and the power of firms is $\mathcal{F} > 1$, such that $\mathscr{C} > 1$. The adjustment in the volume of employment will take the next form $\hat{N}_t(\cdot) = -xC_1\mathscr{C}^{\frac{t}{2}}\cos\left(\frac{\pi}{2}t + C_2\right) + y\hat{s}_{F,0}\mathcal{F}^t - z\hat{s}_{W,0}$, which is inherently unstable and oscillating over time. This clearly cannot contribute to the convergence of the effective demand equilibrium. If, on the other hand, the economy functioned according to a consensus regime, the volume of employment would converge to an equilibrium point and would no longer adjust once the market gap was closed. The consensus case is illustrated in the quantitative example. I will now focus again on the farm economy to examine how conflict affects the trial-and-error process.

Trial-and-error with conflict. In order to replicate the trial-and-error process in the farm economy taking into account the distributional conflict, I add the inflation rates of prices and wages at their respective levels (2.6) and (2.7) as well as the level of employment and its rate of change (2.30)

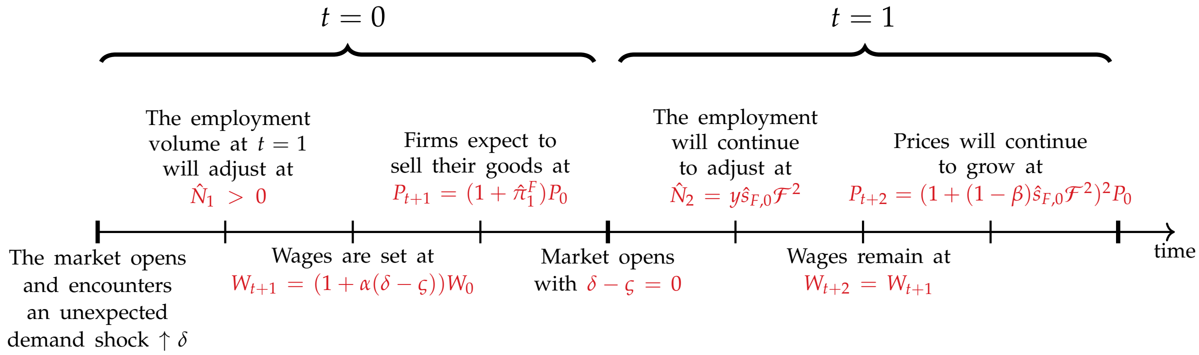
$$P_{t+n} = \left(1 + \hat{\pi}_t^F\right)^n P_0, \quad W_{t+n} = \left(1 + \hat{\pi}_t^W\right)^n W_0 \quad \text{and} \quad N_{t+n} = \left(1 + \hat{N}_t\right)^n N_0. \tag{2.31}$$

Observe how the intertemporal trajectory of prices, money wages, and employment levels has shifted from being driven solely by the market gap (in the conflict-free farm economy) to the inclusion of aspiration gaps and bargaining power. The efforts of both groups to adjust their income shares will now affect decision making and the production process.

To illustrate how the trial-and-error process works under inertia, I will present an extreme case. Imagine a society that is very repressive towards workers but very lenient towards firms' adjustments: $\mathcal{F} > 1$, $\mathcal{W} = 0$ so that $\mathscr{C} = 0$. This farm economy is hence governed by a regime

[29] To simplify the notation, I use $x = \beta\varrho + \omega(1 - \alpha)$, $y = (1 - \beta)\varrho$, and $z = \omega\alpha$.

Figure 2.3: A trial-and-error timeline augmented by a firm's aspiration-led regime



that is guided by the aspirations of firms.

Let the system reopen its market at time $t = 0$ in response to a positive autonomous (and unexpected) demand shock $\delta - \varsigma > 0$. This shock increases tomato consumption at $t = 0$ and induces firms to boost production in anticipation of continued high demand in the following period. Firms need additional labor and negotiate money wages of $W_{t+1} = \Big(1 + \alpha\big(\delta - \varsigma\big)\Big)W_0$, reflecting the zero bargaining power of workers. This wage adjustment is similar to that in a conflict-free farm economy, albeit somewhat smaller, as it is weighted by the size of the aspiration gap α. Taking advantage of this favorable regime, firms plan to sell their tomatoes next period at price level $P_{t+1} = \Big(1 + \hat{\pi}_1^F\Big)P_0$, where $\hat{\pi}_1^F = -\beta\big(\delta - \varsigma\big) + \big(1 - \beta\big)\Big(\hat{s}_F^* + \big(\hat{s}_{F,0} - \hat{s}_F^*\big)\mathcal{F}\Big)$. Consequently, the rate of change in employment from N_0 to N_{t+1} is $\hat{N}_1\left(\cdot\right) = y\big(\hat{s}_{F,0} - \hat{s}_F^*\big)\mathcal{F} + \big(\delta - \varsigma\big)\Big(y\frac{\mathcal{F}}{1+\mathcal{F}} - x - z\Big)$. Employment increases positively (where the second term of $\hat{N}_1\left(\cdot\right)$ is negligible) because additional labor is needed to produce more tomatoes. This is driven by the expectation that the current consumption trend, which is consistent with the market gap, will continue in the following period.

Now suppose the market opens at $t = 1$, but the exceptional consumption trend does not continue, and the market gap closes returning to its original equilibrium $\delta - \varsigma = 0$. In theory, this closure should modify effective demand and consumption expectations, leading firms to anticipate that tomato production will remain unsold during this period. However, firms seem to be overlook these signals. Instead of lowering tomato prices for $t = 2$, firms will continue to raise prices due to the inertia of aspirations in the form $P_{t+2} = \Big(1 + \big(1 - \beta\big)\hat{s}_{F,0}\mathcal{F}^2\Big)^2 P_0$. Workers cannot adjust their wages any further and will therefore maintain the previously set level, $W_{t+2} = W_{t+1}$. In particular, employment will continue to adjust to firms' expectations, $N_{t+2} = \Big(1 + y\hat{s}_{F,0}\mathcal{F}^2\Big)^2 N_0$, following an obviously unstable path. Firms' ambition to adjust prices disproportionately leads to a contradictory and recessive dynamic, as rising prices ultimately drive real wages to zero.[30]

[30] As mentioned in footnote 26, a complete reduction of the actual real wage is obviously not feasible in a real economy, as it would severely restrict both consumption and production capacity. Such a result illustrates the theoretical limits of the model rather than a realistic forecast.

Although the volume of employment increases (already indicating an inconsistency), this drives the economy further away from effective demand equilibrium, making the system volatile and unsustainable, with falling consumption and excess output supply over time. What initially appears to be advantageous for firms ultimately becomes detrimental both for the firms themselves and for the system in general. The timeline of this regime is shown in Figure 2.3.

In the following numerical example, I illustrate how the consensus regime benefits employees in the context of a stable adjustment.

A quantitative example

Before examining quantitatively the cases discussed above, I will first introduce a general price index that captures the interaction between prices and money wages in overall inflation. Using the same approach as before, the index will be represented as a weighted average $G_t(W_t, P_t) = (W_t)^{\gamma}(P_t)^{1-\gamma}$ so that the model can capture how aspiration gaps affect total (general) inflation through their impact on prices and wages. General inflation is therefore given by[31]

$$\hat{\pi}_t^G(\hat{w}_{G,t}, \hat{s}_{F,t}, \hat{s}_{W,t}) = a\hat{w}_{G,t} - b\hat{s}_{F,t} + c\hat{s}_{W,t}. \tag{2.32}$$

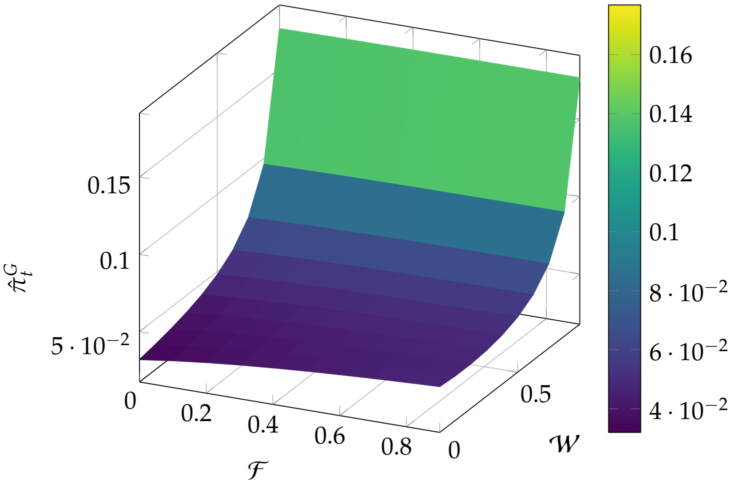
In this simple farm economy developed in this paper, the “tomato” can be seen as the totality of all physical goods produced in an economy. However, money wages provide a purchasing power that goes beyond the mere consumption of physical goods. They are essential for the livelihood of workers and enable their continuous participation in the production process. I will refer to these goods as *health and mental care* and assume that they are intangible. Money wages reflect the pricing of these intangibles in the general price index and serve as a channel through which workers’ aspirations enter this index.[32] Note that general inflation (2.32) gathers three driving forces widely recognized in the economic literature: (a) an excess of aggregate demand over the supply of goods and services, (b) wage costs associated with changes in the actual real wage, and (c) distributional conflict arising from antagonistic adjustments in prices and money wages that crystallize into shifts in aspirational targets.

Consensus-led regime. I will now examine the consensus-led regime through a numerical example to provide a quantitative understanding of how workers benefit in this context. This case is purely illustrative and not intended as a calibration exercise. Wage and price inflation are

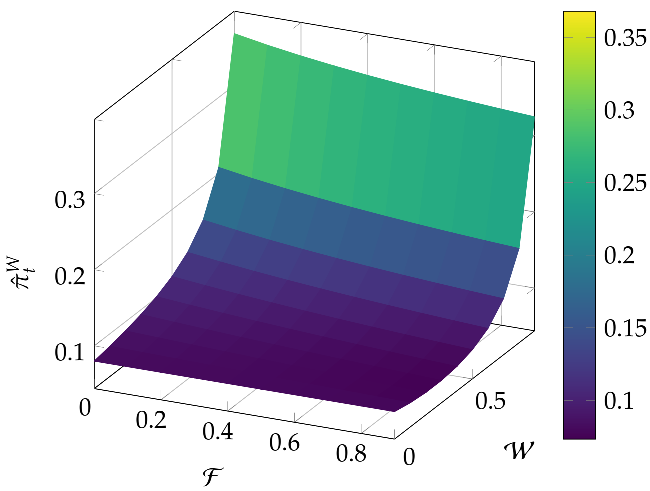
[31] To reduce notational complexity, I use the constants $a = \gamma(1-\alpha) - (1-\gamma)\beta$, $b = (1-\beta)(1-\gamma)$ and $c = \gamma\alpha$.

[32] In addition to the consumption of the physical good “tomato,” money wages enable workers to access intangible goods and services that are important for their health and well-being (with the exception of housing services). These include: (a) mental health services (e.g., therapy, counseling, stress management); (b) access to culture (e.g., art, music, social activities); (c) education (learning and knowledge enhancement); and (d) entertainment (recreational activities such as sports and games), to name a few.

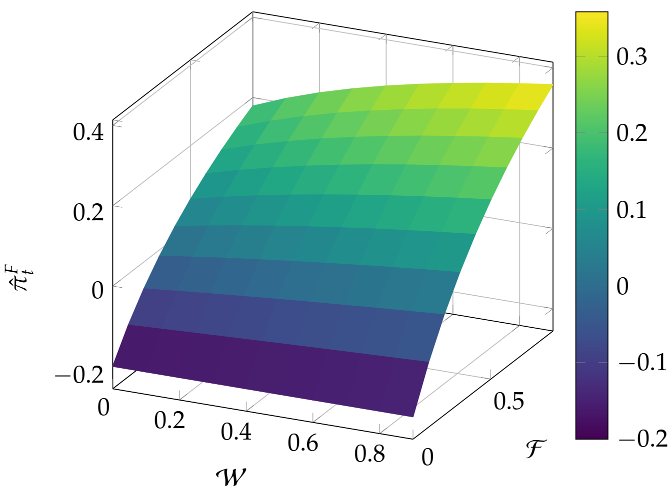
Figure 2.4: A consensus-led regime



(a) General inflation



(b) Wage inflation



(c) Price inflation

represented by

$$\hat{\pi}_t^W = (\delta - \varsigma)\left(\alpha \frac{1}{1-\mathcal{W}} + (1-\alpha)\frac{1-\mathscr{C}}{1+\mathscr{C}}\right) \tag{2.33}$$

$$\hat{\pi}_t^F = (\delta - \varsigma)\left((1-\beta)\frac{\mathcal{F}}{1+\mathcal{F}} - \beta\frac{1-\mathscr{C}}{1+\mathscr{C}}\right). \tag{2.34}$$

Therefore, the "consensus-led" general inflation rate is given by

$$\hat{\pi}_t^G = (\delta - \varsigma)\left(c\frac{1}{1-\mathcal{W}} + b\frac{\mathcal{F}}{1+\mathcal{F}} + a\frac{1-\mathscr{C}}{1+\mathscr{C}}\right). \tag{2.35}$$

Suppose the economy faces an unexpected autonomous demand shock that causes the market

Table 2.2: Consensus-led regime: externally set model parameters

Parameters	Description	Value
$\delta - \varsigma$	Market gap	8%
$\mathcal{F}$	Firms' power	0.6
$\mathcal{W}$	Workers' power	0.3
$\mathscr{C}$	Composite elasticity	0.6
α	Workers' aspiration gap	0.4
β	Firms' aspiration gap	0.2
$\hat{\pi}_t^W$	Wage inflation	7.9%
$\hat{\pi}_t^F$	Price inflation	1.3%
$\hat{\pi}_t^G$	General inflation	4.6%

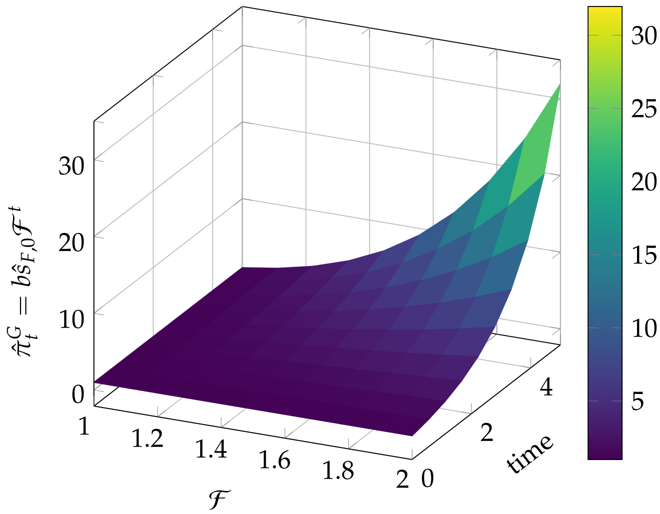
gap $\delta - \varsigma$ to increase by 8 % annualy—the unit of time used in this example. In this economy, firms have greater adjustment power than workers, with values of $\mathcal{F} = 0.60$ and $\mathcal{W} = 0.30$, leading to $\mathscr{C} = 0.18$. I assume that both aspiration gaps are relatively small (i.e. with parameters < 0.5). However, due to the downward rigidity of workers' aspirations, reflecting their "insatiability," the gap is larger for workers than for firms, with $\alpha = 0.40$ and $\beta = 0.20$. This implies that wage setting gives more weight to changes in workers' aspirations than price setting does to firms' aspirations.

Considering that the market gap remains constant over time, the inflation rate for prices will be around 1.3 % over the annual period, while wage inflation will reach 7.9 %. This results in a general inflation rate of 4.6 %, which will remain stable throughout the adjustment period as long as the market gap persists. Any change in the market gap leads to a corresponding adjustment in inflation, as shown in equations (2.33)-(2.35). Once the market gap closes, inflation will fall to zero, allowing the system to position itself at the effective demand equilibrium point without inertial disturbances. How does this scenario affect employment levels? Whether employment rises or falls depends on price (ϱ) and wage (ω) elasticity in relation to employment. Because the price inflation is low in this case, a positive change in employment requires at least a ratio of $\frac{\varrho}{\omega} \geq 3.8$.

The heat maps in Figure 2.4 illustrate each inflationary behavior under the consensus-led regime.[33] Note that the numerical values on the vertical axis are in decimals, not percentages.[34] Wage inflation (Figure 2.4b, corresponding to equation (2.33)) consistently exceeds price inflation (Figure 2.4c, corresponding to equation (2.34)) for each $\mathcal{W}$-$\mathcal{F}$ combination. Wage adjustments remain consistently positive—especially with explosive growth above 0.8—even at low $\mathcal{W}$ values, suggesting that workers are managing to achieve wage increases, albeit at a slower pace. Price

[33] Illustrating inflation patterns through heat maps is more effective for understanding than presenting tables of values for each combination of bargaining powers.
[34] For example, a value of 0.1 stands for 10 %.

Figure 2.5: Firms' aspiration-led regime



adjustments are disadvantageous, as low values of $\mathcal{F}$ can even lead to deflation. This is due to the term $\frac{1-\mathscr{C}}{1+\mathscr{C}}$, which dampens price inflation (as shown in Case 6). Firms cannot take full advantage of their greater bargaining power as the interaction with workers' bargaining power (via $\mathscr{C}$) reduces the inflationary pressure they can exert on prices. The compound elasticity $\mathscr{C}$ provides a balancing effect by limiting firms' ability to raise prices and helping to maintain workers' relative advantage in income distribution. This disadvantage is apparent at first glance, as the concave price adjustment plane in Figure 2.4c contrasts sharply with the convex wage adjustment plane in Figure 2.4b.

Firms' aspiration-led regime. For the purpose of illustrating graphically the inertial factor in the farm economy (in conjunction with the timeline shown in Figure 2.3 for the qualitative example), Figure 2.5 shows the regime that is driven by firms' aspirations. Recall that here $\mathcal{F} > 1$, $\mathcal{W} = 0$ and therefore $\mathscr{C} = 0$. Taking the market gap as already closed for the sake of simplicity, general inflation is primarily determined by the inertial component of firms' aspirations $\hat{\pi}_t^G = b\hat{s}_{F,0}\mathcal{F}^t$. Note that inflationary growth becomes exponential over time. If the value of $\mathcal{F}$ is close to 1, inflation remains moderate for the first four periods. However, as $\mathcal{F}$ approaches 2, it becomes clear that general inflation rises to over 200 % after the fourth period ($t = 4$), which is very likely to lead to a hyperinflationary scenario.

I want to emphasize that this is a theoretical analysis of wage and price inflation dynamics under different combinations of bargaining power, and I am aware of the limitations of the model in relation to real economies. Nevertheless, my aim is to shed light on important analytical aspects of the current inflation debates, in particular the distributional consequences of inflationary inertia in a conflictual context.

2.6 Conclusion

This chapter examines how inflationary inertia due to distributional conflict disrupts the economy's path towards effective demand equilibrium. I address this by incorporating aspiration gaps and the bargaining power of firms and workers into a simple Keynesian D/Z model. An important innovation is the dynamic, discrete-time analysis of the trial-and-error process underlying the model. This feature provides a clear, intuitive and analytical demonstration of how unfulfilled aspirations create inflationary inertia. In addition, the model offers a unique approach to formalizing conflict: Wage and price-setting strategies are not formulated as linear functions of aspiration gaps, but as weighted averages of the actual real wage and these aspirations. This simplification improves the interpretation of price and wage inflation and allows a thorough investigation of the effects arising from the different combinations of bargaining power of both groups, as the decoupling feature in Proposition 2 shows. The inflationary inertia created by these interactions is a formidable force that acquires an autonomous nature, making it challenging to eliminate. Therefore, I conclude that the economic system—embedded in a conflict-driven society—needs a "consensus" to mitigate the price and wage adjustment mechanisms through means that go beyond conventional market logic.

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Chapter 3

Conflict Inflation, Equilibrium Real Wage, and Growth

The inflation debate has returned to the forefront following the pandemic crisis, with increasing recognition that distributional conflict between firms and workers is a key driver (Blanchard, 2022; Lavoie, 2024). Inflation models based on this conflict—most notably Rowthorn (1977)'s seminal work—have gained considerable popularity over the last two decades,[1] offering a social structural view that challenges traditional monetary explanations (see Blecker and Setterfield, 2019, chapter 5; Lavoie, 2022, chapter 8). Despite their explanatory appeal, these models lack mechanisms for resolving inflation or guiding stabilization policy, leaving a critical gap in their practical application.[2] This gap is particularly pressing as the over-reliance on monetary policy tools to fight inflation is often associated with significant social costs, such as an increase in inequality and lower economic growth.

Can inflation be stabilized by mechanisms beyond monetary policy? How do the demand and supply structures of the goods and labor markets influence the dynamics of inflation? Under what institutional conditions can distributional conflict be defused without promoting persistent inflation? How do different institutional arrangements create a balance between inflation stabilization and economic growth? In this chapter, I explore these questions by shifting the focus away from monetary (and fiscal) policy interventions and examining how market structures and institutions can address inflation in the context of distributional conflict.

The first model uses a dynamic version of the canonical conflicting-claims framework and focuses on aspiration gaps between firms and workers. This approach examines the conditions under which a stable, non-inflationary real wage equilibrium can emerge. By incorporating mar-

[1] For recent advances in conflict modeling, see Rowthorn (2024).

[2] A notable exception is Wildauer et al. (2023), who through a distributional conflict model show that windfall taxes can be an effective instrument for reducing inflation.

ket equilibrium into the analysis, the model highlights the interplay between the dynamics of aggregate supply and demand and distributional conflict, ultimately stabilizing the inherent instability of aspiration gaps that generate persistent inflationary pressures. The second model extends the analysis to include institutional regimes, exploring how pro-labor, pro-capital and pro-conflict frameworks influence inflation and income distribution. By integrating Keynesian principles with flexible supply and demand dynamics in goods and labor markets, the model evaluates the responses of wages, prices and employment to autonomous demand shocks[3] under different growth strategies. This broader perspective offers insights into the conditions that stabilize inflation while balancing distributional conflict.

Each model operates within the framework of a closed economy and continuous time, leading to several important insights that constitute the contributions of this chapter, which are summarized in two parts:

Aspirations gap canonical model. The dynamic analysis of this simplified model, which focuses exclusively on the aspiration gap (A. K. Dutt, 1987; A. K. Dutt, 1992), shows that the actual real wage serves as a consistent attractor. Both price and wage growth rates inevitably converge at a common rate over time. The bargaining power of each group determines the extent to which the actual real wage matches their respective aspirations, creating a dynamic interplay of competing interests. This attractor feature defines two possible outcomes within the model: either both aspirations converge and correspond to each other and to the actual real wage, or they diverge and separate from each other as well as from the actual real wage. In particular, it is not possible for the aspirations to diverge while one of the two aspirations corresponds to the actual real wage, thereby closing its gap. I call the first state *compatibility*, while the second is called *conflict*. This proposition is of central importance (see Proposition 1) because it reveals the economic incoherence of the compatibility state. The equilibrium associated with this state is ambiguous (lack of uniqueness) and leads to an infinite set of equilibrium real wages. These values may be rational within the system, but they are economically unsustainable. Consequently, the system inevitably enters a state of conflict characterized by persistent inflation—an outcome consistent with established literature. However, the implications of this result provide a new perspective on the dynamics of such systems that challenges traditional interpretations.

The conflict state within the system highlights a compelling paradox that I call the *oddity of aspirations*. This concept implies that it is *not beneficial* to completely close the aspirational gap for one group while leaving the aspirations of the other group unfulfilled. Such an imbalance inevitably creates the conditions for the disadvantaged group to close its gap—regardless of its bargaining power—and achieve the same goal, which must be the same for both groups. There-

[3] This refers to a sudden increase in *non-induced* demand. In fact, in both models the initial shock comes from autonomous demand. However, its importance is greater in the second model because it includes causal hypotheses, whereas in the first model it is only used as an exogenous shock.

fore, it is best for the advantaged group to maintain a controlled inflationary environment in which adjustments in prices and wages (as the case may be) come as close as possible to the respective targeted levels without reaching them entirely. This perspective challenges the traditional interpretation, as the existing literature on this model generally views the fulfillment of a group's aspirations as a positive outcome. At first glance, such a view seems socially reasonable. The case of only one group fulfilling its aspirations is often treated as a polar (special) scenario and is used as an illustrative example in canonical textbook models (e.g. Lavoie, 2024). However, the paradox shows that complete fulfillment of aspirations may not have the positive effects traditionally attributed to it. This result is peculiar, as I assume an antagonistic dynamic in which both groups aim to reduce each other's share of the income distribution rather than working cooperatively towards common goals. I show that the only non-paradoxical way for a group to close its gap is for workers to experience a money illusion. In this scenario, only myopic workers manage to close their gap—even if only nominally—while firms continuously adjust prices and ultimately drive real wages towards zero.

The adjustment mechanism of the simple canonical model, which focuses exclusively on the aspiration gap, is consistent with the concept of social equilibrium as described by Olivera (1991). In this framework, shifts in relative prices are determined by the adjustment power of each group resulting from their respective bargaining capacities. However, this is only one dimension of the system and does not take into account market equilibrium. For the sake of analytical clarity, I define the market as the domain in which the aggregate supply and demand curves for goods and services interact under competitive conditions characterized by price and wage flexibility. In this context, equilibrium is represented by the intersection of these curves. The prices and nominal wages that ensure social equilibrium (even if they are not economically coherent) are often different from those required for market equilibrium, and this divergence is probably the norm. The greater the gap between these two groups, the more difficult it becomes to find a real wage that balances both dimensions simultaneously. My approach integrates the market dimension into the social framework and aims to identify the conditions under which the system can reconcile both in a single steady state in which social and market equilibria converge. The development of the system is clearly a dynamic process that is constantly running in states of disequilibrium. My aim is to propose a convergence path that determines a real wage capable of reconciling both dimensions without triggering inflation. Social equilibrium alone is not sufficient for this, as it only reacts to shocks that maintain the imbalance by escalating inflation due to conflict. The detailed model is presented in Section 3.1.

Institutional general equilibrium model. This model examines distributional conflict by formalizing the framework proposed by Lavoie and Stockhammer (2013). It explores how the institutional structure of an economy can influence or "guide" the outcomes of distributional conflict and identifies the market conditions necessary to stabilize both conflict and inflation. By abstracting from aspiration factors and bargaining power, the analysis isolates the institutional determinants of distributional conflict within a simple Keynesian economy and uses net demand functions for goods and labor markets as adapted from Marglin (2017), Marglin (2021), and Hein (2023). In this stylized framework, firms set their pricing and production decisions, while workers adjust their nominal wages and demand for goods, assuming no rigidities. To analyze the equilibrium response of the system, I introduce autonomous demand shocks to prices, nominal wages and employment and evaluate their short-run change and subsequent long-run adjustments. A key factor contributing to long-run stabilization—which I incorporate in response to the concerns highlighted by Colander (2001), Lavoie and Stockhammer (2013), Stockhammer (2022) and Setterfield (2023)—is a flexible supply side that responds to demand fluctuations through technological innovation. This hypothesis contrasts with the traditional view that growth is supply-constrained and is integrated here under the assumption that investment demand in this economy is driven by capital deepening (Marglin, 2017), where capital substitutes for labor. The flexible supply side can be viewed within a Schumpeterian perspective (Aghion and Howitt, 1992), where innovation replaces obsolete technologies to drive growth and productivity. It can also be analyzed through the lens of modern economic growth. Increased capital input typically accelerates automation and displaces labor as capital increasingly takes over tasks previously performed by workers (Acemoglu, 2025).

Building on the framework of Lavoie and Stockhammer (2013) and Stockhammer and Onaran (2022), the institutional and legal structures that govern income distribution are divided into three categories (regimes): *pro-labor,* where the distribution is in favor of workers and adjustments are made through nominal wages and employment; *pro-capital*, where the distribution is in favor of firms and adjustments are made through prices and employment; and a third (new) category I have introduced in this model I call *pro-conflict*, where the shares of labor and capital are given and adjustments are made through prices and nominal wages. This institutional regime is characterized by the fact that it does not inherently favor either party in the distribution process and thus creates fertile ground for the emergence of price-wage spirals. Within each institutional framework, I examine how distributional conflict adapts to profit- and wage-led growth strategies. This represents the Kaleckian aspect of the model.

In a wage-led growth strategy, an increase in real wages drives companies to introduce labor-saving technologies through capital deepening and thus promote technological progress. This process boosts returns and increases long-term productivity. This corresponds to the Kaldor-Verdoorn principle, which is the Kaldorian component of the model. This mechanism sets a virtuous cycle in motion: higher productivity allows firms to maintain their profit margins or lower prices, which in turn stimulates demand and growth. The resulting shifts in the demand

and supply curves reinforce self-sustaining growth and make this strategy more adaptable to different institutional settings.

In a profit-led growth strategy, rising prices (or falling real wages) provide companies with an incentive to introduce labor-saving technological innovations that increase productivity and profits in the long term. In this context, competitiveness depends exclusively on innovations that improve the utilization of capital, and not on growth driven by domestic demand. The Kaldorian effect of increasing returns is therefore less pronounced in this framework, as it does not create a virtuous circle of demand-led expansion.

I conclude that although each growth strategy is compatible with its respective institutional framework (where they exhibit stable behavior respectively), the profit-led strategy is less adaptable to institutional regimes that do not focus exclusively on capital. This lower adaptability results from the lack of a feedback mechanism between demand and productivity. The limited flexibility of the profit-led strategy in other words arises from the fact that only the supply curve experiences positive adjustment.[4] In contrast, the wage-led strategy is generally more effective at overcoming distributional conflict (in a "global" sense, applied to different economies, as Onaran and Galanis (2013) emphasize), as both the demand and supply curves respond positively. These dynamics implies that an autonomous demand shock in a pro-conflict regime leads to a positive price-wage spiral in a profit-led strategy, while it leads to price deflation in a wage-led strategy. These results underpin the Keynesian principle of effective demand, which this model aims to formalize. The integration of these elements leads to what I call the conflict within the "Keynesian-Kaleckian-Kaldorian nexus."

Finally, the versatility and simplicity of this model go beyond the specific problem it addresses and enable its application to broader macroeconomic challenges. Its structure serves as a useful tool for analysing the Keynesian-Kaldorian framework outlined by Palley (2013), in which similar questions about growth, income distribution, and employment are examined by incorporating different theoretical perspectives. Moreover, it provides a simple basis to address the Keynesian-Harrodian problem raised by Palley (2013) and Setterfield (2023), in particular the lack of a mechanism to achieve simultaneous equilibrium in labour and goods markets while avoiding Harrodian instability. This last statement can also be interpreted as an alternative—and simpler—formalization of Hein (2023)'s concept of SIRE (Stable Inflation Rate of Employment), which is treated here as a *global point of attraction*.[5] By integrating different theoretical perspectives, this model not only advances the current debates on income distribution, but also provides a solid basis for interdisciplinary studies of growth and structural dynamics. A detailed analysis of this model is presented in Section 3.3.

[4] This happens because it is assumed that rising prices reduce aggregate demand, as the higher marginal propensity of workers to consume outweighs any potential increase in investment demand.

[5] A further extension of this point is discussed in the appendix of Lavoie (2024).

Related literature

This chapter contributes to the literature on the problem of income distribution by addressing three central strands. First, it joins the studies that interpret inflation as a result of distributional conflict, as summarized in recent works by Basu and Das (2023), Lavoie (2024), and Rowthorn (2024). More specifically, it relies on the conflicting-claims modeling of the antagonistic adjustments of prices and wages based on *aspiration gaps*. Rowthorn (1977)'s seminal work models this concept, which was later popularized by the formulations of A. K. Dutt (1987) and A. K. Dutt (1992), and established itself as the canonical framework for modeling conflict. The textbook presentation of this model can be found in Blecker and Setterfield (2019), Lavoie (2022) and Hein (2023). This mechanism is also applied to various models and broader contexts. For example, Blecker (2011) applies it to open economies; Cassetti (2003) and Nah and Lavoie (2019) integrate it into a neo-Kaleckian framework; Brochier (2020) adapts it for stock-flow consistent models; and Wildauer et al. (2023) link it to energy price shocks, applied to the case of the US.[6] While most of this literature examines the mechanism of aspiration gaps statically,[7] my dynamic approach provides a clearer perspective on steady-state conditions and their stability. This dynamic approach also illustrates the existence of the "oddity of aspirations," a result that cannot be achieved through static analysis.

Second, this chapter builds on the extensive literature on demand-led growth, which distinguishes between wage-led and profit-led strategies. The seminal work was by Bhaduri and Marglin (1990), who developed the benchmark model. Since then, this framework has been significantly extended and applied in different contexts. For example, Bowles and Boyer (1995), Naastepad (2006), Naastepad and Storm (2007), Stockhammer and Ederer (2008) and Hein and Vogel (2008) provide the first empirical estimates for OECD countries. Recent contributions include Storm and Naastepad (2012), Onaran and Galanis (2013), Blecker (2016), Onaran and Obst (2016), Carvalho and Rezai (2016), Skott (2017) and Byrialsen, Valdecantos, and Raza (2024). Although there is no broad consensus on which growth strategy dominates the overall effect of income redistribution in favor of wages—as this depends on factors such as the type of country, the time period, the openness or closedness of the economy, and the relevant macroeconomic variables—Onaran and Galanis (2013) and Stockhammer and Onaran (2013) show that among the 16 largest G20 countries, the wage-led regime generally outweighs the profit-led regime in magnitude. In this chapter, I formally show that the wage-led regime is globally more stable than the profit-led regime because it can adapt more effectively to different institutional contexts.

Third and finally, this chapter deals with the vast literature on institutional distributional

[6] An interesting interpretation of distributional conflict is presented in Martins and Skott (2021). While they do not explicitly use the aspiration gap mechanism, they develop a model of conflict-driven inflation that is related to the informality of labor and the interactions between different sectors of the economy.

[7] An exception is Lorenzoni and Werning (2023).

regimes that are classified as pro-labor and pro-capital. Traditionally, this taxonomy is associated with the political economy literature on party politics, where pro-labor regimes are associated with left-leaning governments and pro-capital regimes with right-leaning governments. Key contributions in this area include Stepan-Norris and Zeitlin (1991), P. Dutt and Mitra (2005), P. Dutt and Mitra (2006), and P. M. Pinto and S. M. Pinto (2008), among many others. Studies linking this taxonomy to growth regimes and macroeconomic applications are relatively rare. In particular, Rodrik (1995) attempts to link these concepts to trade policy, Onaran (2005) links them to employment performance in emerging economies, and Grazini, Guarini, and Porcile (2024) explores them in models examining the green transition. I would particularly like to highlight the contributions by Lavoie and Stockhammer (2013) and Stockhammer and Onaran (2022), as they specifically examine the relationship between wage- and profit-led growth strategies and pro-labor and pro-capital institutional regimes. While these analyses are primarily descriptive, the second model introduces a dynamic formalization of these relationships and includes an additional category that I call *pro-conflict*. Since this regimen does not favor firms or workers a priori, it captures the underlying conditions that lead to a price-wage spiral. I conclude that the wage-led growth strategy is best suited to managing distributional conflict by causing prices and wages to fall, effectively neutralizing the price-wage spiral.

3.1 A Canonical Conflicting-Claims Model

This section examines the equilibrium properties of the canonical aspiration gap model in its simplest form. Here, distributional conflict is restricted to the notion of social equilibrium as formulated by Olivera (1991). The analysis is conducted in a framework in which prices and nominal wages act as state variables, deliberately abstracting from other economic variables to focus exclusively on the conflict. Within this setup, firms and workers set exogenous targets (or aspirational values) for the real profit rate and real wages, respectively. These targets and the relative bargaining power of individual groups influence price and wage setting. Adjustments that favor one group inevitably provoke resistance from the other.

The dynamic analysis of social equilibrium shows that aspirational gaps cannot be completely closed. This is not because the aspirations themselves are "difficult to achieve," but rather because closing both gaps simultaneously leads to an economically incoherent outcome, while closing only one gap produces a paradoxical result.

Basic framework. This is a closed economy in continuous time $t \in [0, \infty)$ in which firms determine the price level $P(t)$, while workers determine their nominal wage $W(t)$ for the labor they offer. The price adjustment rule is defined as[8]

$$\frac{\dot{P}\left(t\right)}{P\left(t\right)} \;=\; \mathcal{F}\Big(\omega\left(t\right)-s_f\Big), \tag{3.1}$$

where $\omega\left(t\right)=\frac{W(t)}{P(t)}$ represents the real wage. The parameter s_f denotes the real target wage that companies want to pay under ideal conditions, which can alternatively be expressed as the real target profit rate. $\mathcal{F}\in\left[0,\infty\right]$ is an inflation adjustment constant, commonly referred to in the literature as the bargaining power of firms, a definition I also use. In the case of employees, they adjust their nominal wages according to the rule

$$\frac{\dot{W}\left(t\right)}{W\left(t\right)} \;=\; \mathcal{W}\Big(s_w-\omega\left(t\right)\Big), \tag{3.2}$$

where s_w represents the real wage set (or targeted) by employees and $\mathcal{W}\in\left[0,\infty\right]$ reflects their bargaining power.[9] In this framework, the targets (or aspirations) of both groups are treated as exogenous parameters shaped by cultural, institutional and historical factors. Although these goals may change over time, their determination is considered external to the model.

The trajectory of the real wage over time is therefore given by

$$\omega\left(t\right) \;=\; \omega^*\left(1-ke^{-\left(\mathcal{W}s_w+\mathcal{F}s_f\right)t}\right)^{-1}, \tag{3.3}$$

where $k=1-\frac{\omega^*}{\omega(0)}<1$ is a constant that can be interpreted as the relative deviation of the real wage at $t=0$ from its equilibrium value. The equilibrium real wage, $\omega^*=\alpha s_w+\left(1-\alpha\right)s_f$, is structured as a linear combination of the targets, with $\alpha=\frac{\mathcal{W}}{\mathcal{W}+\mathcal{F}}$. Consequently, the trajectories of prices and wages from $t=0$ over time are expressed as

$$W\left(t\right) \;=\; W\left(0\right)\left(\frac{e^{\mathcal{F}\left(s_f-s_w\right)t}-ke^{-s_w\left(\mathcal{W}+\mathcal{F}\right)t}}{1-k}\right)^{-\alpha} \tag{3.4}$$

$$P\left(t\right) \;=\; P\left(0\right)\left(\frac{e^{\mathcal{W}\left(s_w-s_f\right)t}-ke^{-s_f\left(\mathcal{W}+\mathcal{F}\right)t}}{1-k}\right)^{1-\alpha}. \tag{3.5}$$

Assumption 1. The economy experiences no price or wage adjustments for $t<0$, the real wage therefore remains constant at $\omega\left(t<0\right)=1$. At $t=0$, however, a positive autonomous demand shock $\delta>0$ disrupts the economy, triggers the conflict and sets in motion the trajectories

[8] Following conventional notation, a dot above a variable indicates its derivative with respect to time t, while an asterisk $*$ indicates its equilibrium value. As far as nominal wages are concerned, I will also refer to them as money wages throughout this chapter.

[9] Infinite bargaining power refers to the ability to align the real wage with the workers' target or, in the case of firms, the profit target with the real wage.

previously discussed for $t \geq 0$.

Social equilibrium. The positive equilibrium real wage $\omega^* > 0$ acts as an attractor for the real wage trajectory (3.3),[10] which is determined by $\exp\Big(-\left(\mathcal{W}s_w + \mathcal{F}s_f\right)t\Big)$. It is noteworthy that this attractor property is independent of the bargaining power or the aspiration level of the two groups. In other words, after the shock δ, the paths of prices and wages inevitably converge to this ω^* point. A natural question that arises here is whether the targets of both groups also converge on the equilibrium real wage. The following definition formalizes this equilibrium.

Definition 1 (Social equilibrium). Given the dynamic system (3.1)-(3.2) and $\omega^* \equiv \frac{W^*}{P^*}$, a steady-state (social) equilibrium occurs if the paths of prices $P(t)$ and money wages $W(t)$ remain constant, such that

$$\frac{W^*}{P^*} = s_w = s_f.$$

In the phase diagram presented in Figure 3.1, ω^* is shown as a solid green line. After the shock δ at $t = 0$, the trajectories of prices and wages inevitably converge towards the equilibrium real wage. From the point of view of inflation analysis, however, it is important to check whether this equilibrium fulfills the conditions of existence and uniqueness. This issue is addressed in the following proposition.

Proposition 1 (Existence and uniqueness of (social) equilibrium). *This economy can only assume two different states:*

a) *Conflict:* $s_w \neq s_f \neq \omega^*$*, or*

b) *Compatibility:* $s_w = s_f = \omega^*$.

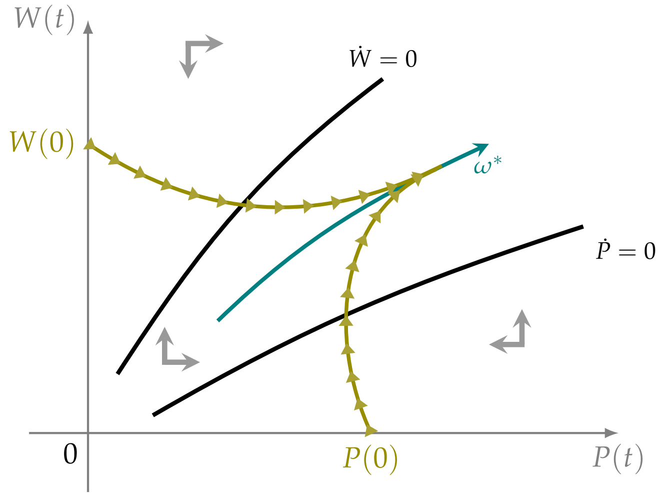
If aspirations do not converge, as in a state of conflict, there is no equilibrium with respect to the state variables (prices and money wages). If aspirations converge, as in the case of compatibility, there is no uniqueness, since the system generates an infinite number of non-isolated steady states.

I will briefly analyze each case separately below.

Compatibility. In this scenario, there is no dynamic behavior or change in the distribution as both variables are initially set to $\omega(0) = \omega^* \equiv \frac{W^*}{P^*}$ and remain fixed at this level. The level at which they finally settle depends on the initial conditions $W(0)$ and $P(0)$, which can be high or low. However, the level is irrelevant since the aspirations are satisfied over a continuum of infinitely many equilibrium points (of the *stable line* type). Along this line, infinitely many proportional combinations of W^* and P^* lead to an equilibrium real wage that allows any set of

[10]Conversely, $\omega^* = 0$ acts as a repellent point and is unstable.

Figure 3.1: Inflationary adjustment of conflict when $s_w > s_f$



Note: The (yellow) curves with arrows illustrate the path that prices and wages can take after an exogenous shock δ. Although other initial conditions are also possible, this is just one example. The decisive factor is that prices and wages converge to the long-term real equilibrium wage ω^* and remain there, provided that there are no aspirational shifts or sufficiently strong shocks that change the course. In the phase diagram, the curve ω^* runs through the middle of the two loci. Depending on the bargaining power of the individual groups, however, it tends towards one locus or the other (but will never be equal). For example, if firms have greater bargaining power than the employees, the curve ω^* will be closer to the locus $\dot{P}(t) = 0$.

nominal values that preserves the specified equilibrium ratio. If an economic shock δ at $t = 0$ causes the real wage to move out of equilibrium, prices and wages will adjust quickly according to

$$\lim_{t\to\infty} P(t) = P(0)(1-k)^{-(1-\alpha)} \quad \text{and} \quad \lim_{t\to\infty} W(t) = W(0)(1-k)^{\alpha}. \tag{3.6}$$

The equilibrium real wage that results here neutralizes the antagonistic conflict. Figure 3.1 would show a single stable line resulting from the superposition of the curves $\dot{W}(t) = 0$, $\dot{P}(t) = 0$, and ω^*. Hence the term "compatibility."

According to Definition 1, social equilibrium coincides with the state of compatibility. However, the lack of uniqueness in this context complicates both the analysis and the economic interpretation of the model. The non-uniqueness of the equilibrium with respect to the state variables leads to indeterminacy in the valuation of W^* and P^* and thus to ambiguity in the value of ω^*. This decouples the model from any sound economic basis. In other words, the arbitrariness with which the initial conditions determine the equilibrium values leads to significant challenges in interpreting the equilibrium real wage. Moreover, this ambiguity complicates the applicability of the model in practice, e.g. the impact on expectations and policy formulation. Therefore, I reject the state of compatibility as a plausible economic context, which leads to the following assumption:

Assumption 2. From now on, this economy is in a state of conflict. For tractability, I assume that $s_w > s_f$.[11]

This assumption immediately rules out a global asymptotic convergence to the stable critical point at the origin where $W^* = 0$ and $P^* = 0$ (which is nonsensical), since convergence to the origin only occurs when $s_w < s_f$.

Conflict. This economic state lacks equilibrium existence and is characterized by persistent wage and price inflation, both of which converge to a common growth rate that defines ω^*. As shown in Figure 3.1, the conflict dynamics unfold within a narrow corridor bounded by the null-clines $\dot{W}(t) = 0$ and $\dot{P}(t) = 0$. This suggests that the real wage in this state represents a *stable disequilibrium*: While the disequilibrium persists with respect to the state variables, the stability results from the dynamics of the *income distribution*. The disequilibrium in prices and wages is reflected in the fact that $P^* = \frac{1}{s_f} W(t)$ and $W^* = s_w P(t)$ remain variable and evolve over time. This is reasonable in this context as the antagonistic resistance between the two groups after shock δ creates persistent inflationary friction. In the framework of system (3.1)-(3.2), the dynamics of price and money wage inflation once they are on ω^* are described by the law of motion

$$\frac{\dot{P}(t)}{P(t)} = \frac{\dot{W}(t)}{W(t)} = \pi, \tag{3.7}$$

whereby $\pi \equiv \alpha \mathcal{F} \left(s_w - s_f\right)$ is assumed for notational simplicity.[12] The deviation in price and wage inflation caused by shocks that shift the real wage from its equilibrium level is described by

$$\frac{\dot{\omega}(t)}{\omega(t)} = \left(\mathcal{W} + \mathcal{F}\right)\Big(\omega^* - \omega(t)\Big). \tag{3.8}$$

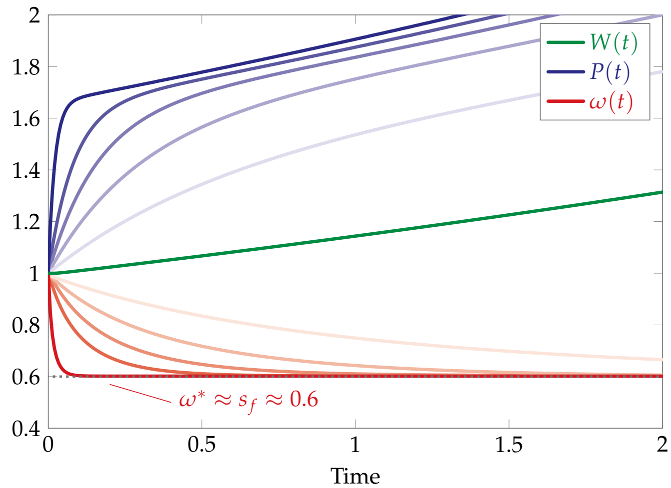
As Lorenzoni and Werning (2023) emphasize, this deviation is temporary and reflects a short-term adjustment that subsides as soon as $\omega(t)$ reaches ω^*. Beyond this point, the distribution stabilizes and maintains positive inflation at the rate π. This result is consistent with the traditional findings of the canonical model, in which the only outcome is a progressive, time-dependent escalation of inflation.

Assuming that the economic system is constantly exposed to shocks—be they autonomous demand shocks affecting prices and wages, shifts in bargaining power, or aspirational shocks—the rate π would increase indefinitely over time without declining. However, this result is not in line with contemporary inflationary experiences across various countries, where persistently high or continuously escalating inflation is a relatively rare phenomenon. Inflation shocks tend to be temporary and usually converge on a stable equilibrium level, which in many cases is almost

[11] Unless explicitly stated otherwise.

[12] The expression $\alpha \mathcal{F}$ is equivalent to $(1-\alpha)\mathcal{W}$ and also to $\alpha(1-\alpha)(\mathcal{W}+\mathcal{F})$.

Figure 3.2: Paradox-free maximum price adjustment



Note: To create an effective visual representation, I set the bargaining power of firms to $\mathcal{F} = 80$ and the power of workers to $\mathcal{W} = 0.7$. The initial conditions start at 1, with $k = 0.4$, and the targets are set to $s_w = 0.8$ and $s_f = 0.6$. These values form the basis for the solid green curve, which represents the trajectory of the money wage $W(t)$, as well as the curves for the real wage $\omega(t)$ and the prices $P(t)$, which are closest to the vertical axis. The other curves with lower slopes decrease as the bargaining power of firms decreases. Note that the real wage quickly converges to the value sought by firms, although it does not fully adjust but approaches $\omega^* \approx 0.6$, allowing prices to continue to adjust as described in equation (3.10). If $\mathcal{F}$ were infinite, the adjustment would be along the vertical axis and instantaneous, leading to the paradox.

negligible. The simple mechanism of the aspiration gap (and any complementary framework that cannot prove the existence of an equilibrium) proves insufficient or incomplete in its explanation power for inflation. Indeed, the inflation that arises in a state of conflict only explains the inflation associated with social equilibrium. However, the economy is not limited to social equilibrium, but also includes a market dimension. This necessity underlines the importance of integrating market equilibrium into the framework, as it ensures the existence of equilibrium and introduces mechanisms for inflationary convergence to counter the multiple shocks to which the economy is regularly exposed. The market equilibrium, which is intended to complement the social equilibrium, is analyzed in detail in Section 3.2. Before that, however, I would like to examine an interesting feature of aspiration gaps that explains why the outcome of social equilibrium inevitably leads to persistent inflation.

An illustrative example, often discussed in textbooks in the context of the simple canonical model (e.g., Blecker and Setterfield, 2019; Lavoie, 2022; as well as Lavoie, 2024), is the response of the model under the assumption that one group succeeds in closing its aspiration gap while the other does not. Although this is a special case rather than a general result, it is often considered a plausible hypothesis. As stated in Proposition 1, such a scenario cannot be realized a priori. However, when considered as a thought experiment, it reveals what I call the "oddity of aspirations." I will analyze this phenomenon next.

Oddity of aspirations. Let us assume that the firms in this economy can close their aspiration gap from $t = 0$ onwards (e.g. due to very high bargaining power, so that $\mathcal{F}$ tends to infinity). As a result, prices no longer adjust and become a constant P^*, since $\dot{P}(t) = 0$, which means $\omega^* = s_f$. Given that workers have not closed their gap, the nominal wage follows an adjustment path of the type $W(t) = W(0) \exp\Big(\mathcal{W}(s_w - s_f)\,t\Big)$, which pushes the real wage further up, since $s_f < s_w$. This result suggests two critical observations that emphasize the peculiarity of this scenario and its probable basis in a flawed hypothesis.

First, the wage trajectory clearly contradicts the finding of a constant P^*, because the price must continue to adjust along the curve

$$P(t) = \frac{1}{\omega(0)\big(1-k\big)} W(t) \qquad \text{which corresponds to} \qquad \omega(t) = \omega(0)\big(1-k\big),$$

in order to keep the real wage constant at s_f due to the upward pressure on money wages.

Second, in analyzing this problem in light of Proposition 1, it is important to examine the real wage solution. Given the attractor property of the real wage, the general solution takes the form

$$\omega(t) = s_w \left(1 - ke^{-\mathcal{W} s_w t}\right)^{-1}, \tag{3.9}$$

when firms, rather than workers, close the gap.[13] In the limiting case, this means that the real wage coincides with employees' aspirations, $\omega^* = s_w$. This result follows from the compatibility condition in Proposition 1, according to which both aspirations must converge to a single value that corresponds to the equilibrium real wage. The convergence in the system seems to result from an implicit, pre-existing alignment between firms and workers that occurs either before or at the initial time $t = 0$, where $s_f = s_w$. This alignment is not the result of an active "expropriation" of workers' aspirations in favor of firms' objectives. Instead, it simply shows that firms (due to their high bargaining power) are more adept at achieving their own goals quickly. Workers' real wages will gradually converge to the level they seek s_w, making this convergence a natural outcome of the *initial conditions* and the dynamic adjustment process, and not a unilateral imposition by firms.

This leads to a paradox: it cannot be advantageous for firms to be the only group to close their gap, as this would force workers to align their pre-existing aspirations with those of firms, *regardless of their bargaining power*. Even with minimal bargaining power, workers can move towards their goals due to the compatibility condition. This happens because firms achieve their

[13]The problem arises analogously in the reverse case, when workers close their aspiration gap instead of firms. In this scenario, the real wage solution is $\omega(t) = s_f \left(1 - ke^{-\mathcal{F} s_f t}\right)^{-1}$.

Table 3.1: Externally set model parameters

		Values	
Parameters	Description	Paradox-free	Money illusion
$\mathcal{F}$	Firms' power	80	0.9
$\mathcal{W}$	Workers' power	0.7	1.3
s_f	Firms' aspirations	0.6	0.5
s_w	Workers' aspirations	0.8	0.8
$P(0)$	Price at $t = 0$	1	1
$W(0)$	Wage at $t = 0$	1	0.47
k	Constant	0.4	-0.69

Note: The values from the "paradox-free" example match the curves closest to the vertical axis, including the (solid green) money wage curve shown in Figure 3.2.

objectives first, thus "paving the way" for workers to achieve the same goal—a goal that is in line with that of firms but which workers have not yet achieved due to their lower bargaining power.[14]

This insight challenges the conventional view of conflict theory of inflation that "more power is always better." The dynamics of social equilibrium show that excessive power can lead to unwanted and undesirable outcomes for the dominant group. In particular, the ability to adjust prices immediately has the paradoxical effect of reducing the obstacles for the weaker group to achieve its goals. In other words, bargaining power is a double-edged sword. While a high degree of power facilitates adjustment, when it becomes so extreme that it closes the aspirational gap, it inadvertently strengthens the opposing group. This dynamic pushes the system into a state of compatibility, which, as noted, leads to ambiguous outcomes. This second point makes it clear that the assumption that only one group closes its gap is neither feasible nor conceptually sound. Within the framework of social equilibrium, the system is in the general state $s_f < \omega^* < s_w$ because settling at the extremes is unreasonable. Here, the aspirations do not serve as goals to be achieved, but rather act as "lure coursing" that keeps driving the dynamics of the system.

Thus, it may be advantageous for companies to adjust prices with a certain rigidity and maintain a state of conflict characterized by persistent inflation and strong (though not absolute) bargaining power. This strategy can bring the target closer to the real wage *without achieving full alignment*. Let us assume that $\mathcal{F}$ is large but finite. For a small gap ϵ, where $\omega(t) = s_f + \epsilon$ or $\omega(t) = s_f - \epsilon$, the maximum (the more favorable) price adjustment rate is

$$\frac{\dot{P}(t)}{P(t)} = \mathcal{F}\,|\epsilon|\,. \tag{3.10}$$

[14]Here I deliberately exclude the scenario in which the firms act as cooperative agents seeking consensus and instead emphasize the inherent conflict between the two groups.

This prevents the gap from closing completely and the paradox from occurring. Figure 3.2 illustrates the case for $\epsilon > 0$. The strong bargaining power of firms enables rapid price adjustments (solid blue curve), while the wage curve (solid green curve) adjusts gradually. As bargaining power increases, the adjustments converge towards the vertical axis, where in the limit case ($\mathcal{F} \to \infty$) the adjustment is immediate. As a result, for a non-infinite $\mathcal{F}$, the real wage converges to the target s_f but does not fully match it, allowing prices to adjust further over time and avoiding the paradox. Table 3.1 shows the parameter values used in this numerical example to demonstrate paradox-free price adjustment.

The same reasoning can also be applied to money wages, whose ideal adjustment would be $\frac{\dot{W}(t)}{W(t)} = \mathcal{W} |\epsilon|$. This situation leads to the following corollary:

Corollary 1 (Oddity of aspirations). *Under the conditions of Proposition 1, it is impossible to assert simultaneously:*

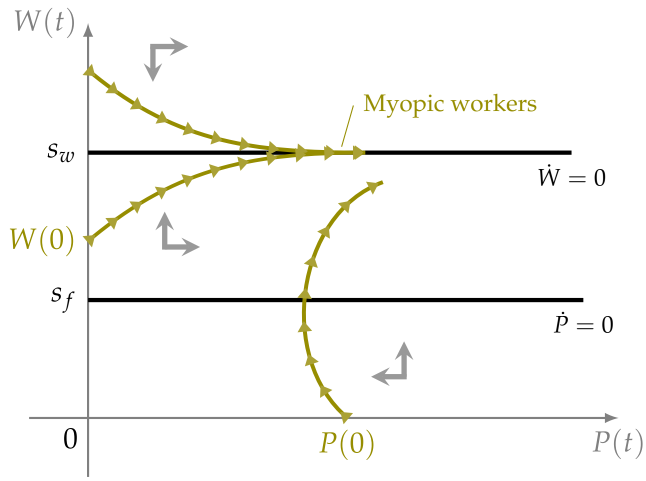
- *Perfect adjustment of prices or money wages ($\dot{P}(t) = 0$ or $\dot{W}(t) = 0$);*
- *$s_f \neq s_w$ (regardless of whether $s_f < s_w$ or $s_f > s_w$);*
- *Prices or money wages remain constant indefinitely.*

This implies that there are only two possible states of nature: either the aspirations s_w and s_f are identical from $t = 0$, leading to a corresponding equilibrium real wage ω^*, or the aspirations differ persistently, leading to the equilibrium real wage adjusting dynamically to reflect these persistent differences. Therefore, Proposition 1 and Corollary 1 show (or suggest) that the system is inherently in a persistent inflationary conflict that *makes it impossible to close the gaps* as long as one wants to maintain economic coherence. While this outcome agrees with the results usually found in textbooks, the underlying rationale differs. Focusing only on social equilibrium, positioning the system at the extremes (in the compatibility state) is neither reasonable nor coherent and makes the fulfillment of aspirations unattainable. Does this mean that aspirations can never be realized? Not at all. This shows another important reason for including market equilibrium: it provides not only an equilibrium, but also a mechanism, or at least a way, to fulfill aspirations.

However, one might wonder whether there is a context in which it is possible for one class to permanently close its gap while the other continues to adapt indefinitely. Is that possible? Yes, it is indeed possible, and one way to accomplish this and "break" the conditions of Proposition 1 is for workers to exhibit money illusion.

Money illusion. One way to show that a gap can close without leading to a paradoxical result is to include a behavioral anomaly, such as workers' myopia. This addition is another way of supporting the argument outlined above, showing that the system cannot achieve coherent gap

Figure 3.3: Dynamics with money illusion



closure without such an illusion. So how does the economy react if we assume that workers have a money illusion? The qualitative features of the system remain unchanged. What changes in response to an autonomous demand shock $\delta > 0$ is the distribution of income, with workers *unaware that they are affected*. Under this hypothesis, the adjustment functions are given by

$$\frac{\dot{P}(t)}{P(t)} = \mathcal{F}\Big(W(t) - s_f\Big) \tag{3.11}$$

$$\frac{\dot{W}(t)}{W(t)} = \mathcal{W}\Big(s_w - W(t)\Big), \tag{3.12}$$

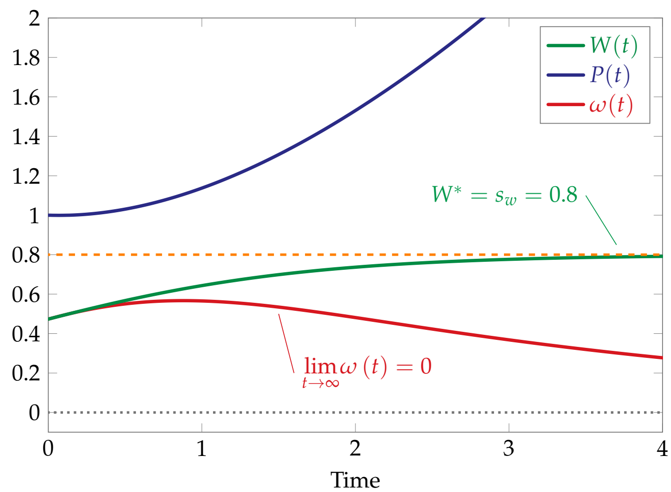
with workers focusing exclusively on the nominal wage (and therefore also firms, due to the antagonistic nature of the conflict) and ignoring price adjustments. The nullclines curves in the phase portrait become straight lines that run perpendicular to the nominal wage axis. Figure 3.3 illustrates how this dynamic is performed. In this context, the general solution for money wages takes the form

$$W(t) = s_w \Big(1 - ke^{-\mathcal{W}s_w t}\Big)^{-1}, \tag{3.13}$$

which is the same as the real wage in the case of "oddity of aspirations" (3.9), with the constant k now expressed as $k = 1 - \frac{s_w}{W(0)} < 1$. This is an interesting case, because the nominal wage seems to behave like the real wage and approach the target. The illusion lies in this trajectory, since workers cannot perceive the real wage. In this situation, workers close their myopic aspiration gap at $W^* = s_w$, leading to a steady state in terms of money wages. However, firms adjust prices over time by following the trajectory

$$P(t) = P(0)\, e^{\mathcal{F}(W(t) - s_f)t},$$

Figure 3.4: Money illusion adjustment



Note: I set the bargaining power of firms at $\mathcal{F} = 0.9$ and that of workers at $\mathcal{W} = 1.3$ intentionally higher to illustrate the point. The initial conditions are $P(0) = 1$ and $W(0) = 0.47$ which leads to $k = -0.69$. The aspiration levels are $s_w = 0.8$ and $s_f = 0.5$. The price curve exhibits a positive exponential adjustment, nominal wages converge to the workers' target value of 0.8, and consequently the real wage quickly converges to zero in the limit.

where $P(t)$ increases indefinitely as $t \to \infty$ and eventually (in the limiting case) drives the real wage to zero $\lim_{t\to\infty} \omega(t) = 0$. Figure 3.4 illustrates this case using numerical parameters. As time progresses, workers mistakenly believe that they have narrowed their real aspiration gap. Of course, this is an analytical representation. In economic terms, there must be a real limit—defined by consumption and production—that counteracts such a decline.

Taking stock. This section concludes with a summary of the main findings. First, the dynamic analysis of the canonical aspiration gap model shows that this framework, which focuses exclusively on social equilibrium, allows for only two possible states: Compatibility and Conflict (see Proposition 1). The system is invariably in a state of conflict, where $s_f < \omega^* < s_w$, not because this reflects typical economic experience, but because alternative scenarios lead to economically incoherent and implausible outcomes. Assuming that the economic system is subject to constant shocks, this state inevitably leads to ever-increasing inflation over time. Second, aspirations are inherently unattainable in the context of social equilibrium; they function merely as "lures" and lead to a paradox when a group tries to achieve them. It can be seen that the simple model of aspiration gaps, which forms the basis of social equilibrium, exhibits very peculiar dynamic behavior. This underlines the need to introduce a market dimension that shows a path to convergence of inflation and allows both firms and workers to realize their aspirations within a stable and coherent economic system.

3.2 Incorporating the Market Into the Model

In this section, I integrate the market dimension into the previously developed model and analyze the conditions that must be met for the system to achieve a real wage equilibrium that stabilizes both price and wage inflation. This implies that a state of compatibility can be associated with a unique steady state, as described in Definition 1. I begin the analysis by characterizing market equilibrium.

Market equilibrium. The market equilibrium concept I use in this chapter is simple: it is the intersection of the aggregate supply and demand curves. I also assume that there is perfect competition with flexible prices and wages and that supply corresponds to potential output. Excess demand over supply will therefore lead to both price and wage inflation.[15] This "defense mechanism" reflects the market's reaction to the relative scarcity of goods. I model this using the excess demand function $\mathcal{D}\big(P(t), W(t)\big)$, which is continuously differentiable and whose normal relationships are expressed as follows:

Assumption 3. $\mathcal{D}'_P < 0$ and $\mathcal{D}'_W > 0$.[16]

For now, I treat the supply curve as an exogenous datum in the system; however, I will relax this assumption in the next section. So, holding everything else constant, an increase in prices will have a negative effect on $\mathcal{D}(\cdot)$ by lowering real wages and consequently aggregate demand. Conversely, an increase in money wages will have a positive effect on $\mathcal{D}(\cdot)$ by inducing excess demand.

The definition of market equilibrium is like in Definition 1:

Definition 2 (Market equilibrium). Given $\mathcal{D}\big(P(t), W(t)\big)$, a steady-state market equilibrium exists if the paths of prices $P(t)$ and money wages $W(t)$ remain constant at P^* and W^* respectively, so that the market clears

$$\mathcal{D}\big(P^*, W^*\big) = 0.$$

General equilibrium. To determine the real wage that stabilizes inflation and reconciles both equilibria, I extend the model by incorporating the market dimension into the previously developed dynamic system of social equilibrium (3.1)-(3.2) through an excess demand function. While the canonical textbook model also incorporates the "market" into the social equilibrium—via the

[15]In other words, these curves represent the overall outcome of competitive forces, with individual agents taking prices and wages as given at any point in time (even if they adjust over time). This disequilibrium context can be interpreted as a continuous-time Keynesian trial-and-error process (see Davidson, 2011) that moves the system towards the intersection of the two curves.

[16]The subscript of the state variables $P(t)$ and $W(t)$ indicates the derivative of the function in relation to the respective variable.

role of installed capacity, which influences the targets of both groups—it fails to stabilize the system (see Blecker and Setterfield, 2019). On the contrary, it *exacerbates* instability.[17] This model pursues a strategy that has the advantage of integrating both sides of the market—demand and supply—into a single framework. By making the market dependent on state variables, stability analysis is facilitated. This framework depicts a trial-and-error process that represents the market adjustment mechanism. In the long run, this interaction establishes a stabilization point for price and wage inflation, resolves the distributional conflict, and shows a way to achieve the targets.

Consequently, the adjustment of prices and wages in disequilibrium is now expressed as

$$\frac{\dot{P}(t)}{P(t)} = \mathcal{F}\Big(\omega(t) - s_f\Big) + \mathcal{D}\Big(P(t), W(t)\Big) \tag{3.14}$$

$$\frac{\dot{W}(t)}{W(t)} = \mathcal{W}\Big(s_w - \omega(t)\Big) + \mathcal{D}\Big(P(t), W(t)\Big). \tag{3.15}$$

These two equilibria are connected, but not inseparable. Social equilibrium implies an infinite number of steady states and establishes a set of prices and wages that guarantee this equilibrium, even if there is a lack of economic rationality; however, it does not necessarily imply a price vector that is compatible with market equilibrium. Conversely, the vector of prices and wages that ensures market equilibrium may be completely different from that which ensures social equilibrium, resulting in a continuous price-wage spiral.

Suppose that after an exogenous shock δ the system converges to a vector of prices and money wages that brings both markets into equilibrium. In this chapter, I refer to this equilibrium as general, meaning that it leads both dimensions to a single steady state. The definition of this equilibrium is similar to the previous two.

Definition 3 (General equilibrium). Given the dynamic system (3.14)-(3.15), a steady-state (general) equilibrium occurs when the paths of prices $P(t)$ and money wages $W(t)$ remain constant at P^* and W^*, respectively, so that *both* equilibria are clear

$$\mathcal{F}\left(\omega^* - s_f\right) + \mathcal{D}\left(P^*, W^*\right) = 0 \quad \text{and} \quad \mathcal{W}\left(s_w - \omega^*\right) + \mathcal{D}\left(P^*, W^*\right) = 0. \tag{3.16}$$

As a result, $\frac{W^*}{P^*} = s_f = s_w$, which satisfies the compatibility state (i.e. the fulfillment of Definition 1) and the uniqueness condition, provided that the determinant of the linear approximation matrix of the system is non-zero. This ensures an equilibrium between price and wage trajectories at a *single* non-inflationary real wage ω^*.

So what are the necessary and sufficient conditions for the system to converge to this point in response to an exogenous shock that disturbs its equilibrium? For the system to be asymptotically

[17] Incidentally, the canonical model does not clearly specify whether the installed capacity influences the demand-side or the supply-side curve.

stable, the following conditions must be fulfilled simultaneously

$$\mathcal{D}'_W W^* + \mathcal{D}'_P P^* \ < \ 0 \quad \text{and} \quad \frac{W^*}{P^*}\mathcal{F} + \mathcal{W} - P^*\big(\mathcal{D}'_P + \mathcal{D}'_W\big) \ > \ 0. \tag{3.17}$$

The conditions for long-term stability are clearly defined and strongly support the Keynesian principle of effective demand. In particular, the combined influence of excess demand elasticities of wages and prices must result in a negative net effect, $\mathcal{D}'_W W^* + \mathcal{D}'_P P^* < 0$. This condition underlines that the stabilizing role of prices must outweigh the destabilizing role of wages in shaping the excess demand function. In other words, stabilizing or lowering prices is far more beneficial for economic activity and the stability of the system as a whole than cutting wages, as excess demand is more sensitive to price changes. Since employees generally have a higher marginal propensity to consume than firms, prioritizing price stabilization over wage adjustments is a more effective strategy for ensuring long-term economic stability. On the other hand, the second condition shows that a higher real wage contributes to system stability. This observation underlines the importance of wage power in stimulating economic activity. In addition, the combined partial derivatives of the excess demand for prices and wages, $\mathcal{D}'_P + \mathcal{D}'_W$, reinforce the positive sign of this relationship to economic stability. The significance of this result lies in the fact that it reaffirms the validity of the principle of effective demand even in the presence of competitive markets. An important limitation of these conditions is that they only guarantee local stability and do not guarantee global stability in the entire state space. This means that a sufficiently large autonomous demand shock could destabilize the system and trigger an uncontrolled wage-price spiral, even though the conditions mentioned in (3.17) are met. In the model presented in the next section, this gap is closed by examining the conditions for global conflict stability. Appendix C presents a detailed analysis of these conditions.

Discussion

This powerful and simple result is in line with current research that argues for alternative ways to stabilize inflation and policy interventions. Gallo and Rochon (2024) and Mastromatteo and Rossi (2024) point out that wage-based stabilization measures are not sufficient to tackle the causes of inflation and instead emphasize the role of sellers' inflation caused by firms' mark-up behavior. These authors argue that price increases are often profit-driven, which exacerbates distributional conflict and increases inflation persistence. The model developed here aligns closely with their results and shows that a price cut has a more stabilizing effect on excess demand and distributional dynamics than a wage cut, which can unintentionally exacerbate inequality without effectively dampening inflation. Similarly, Romaniello and Stirati (2024) emphasize the role of distributional conflict in inflationary processes in which firms raise prices to defend or expand their profit margins in the face of cost shocks. Their analysis also shows that real wage suppression exacerbates inequality without addressing the structural causes of inflation.

The theoretical results presented here complement this perspective by providing a formal framework for understanding why price stabilization measures are more effective at maintaining real wage levels and reducing distributional tensions. These conclusions are also consistent with the findings of I. M. Weber and Wasner (2023) and Nikiforos, Grothe, and J. D. Weber (2024), who emphasize that price stabilization directly targets profit-driven inflation mechanisms and mitigates the role of markups in distributional conflict. Morlin and Pariboni (2023) fit this perspective into a Sraffian supermultiplier framework and argue that higher real wages due to price stabilization can promote demand-led growth while dampening inflationary pressures. These studies are consistent with the theoretical insights developed here and support the case for prioritizing price stabilization over wage cuts to address the conflicting drivers of inflation while promoting equitable economic stability.

3.3 Conflict Through a Keynesian-Kaleckian-Kaldorian Nexus

In this section, the dynamics of conflict and inflation stabilization are formalized through a broader framework, adopting an institutionally driven perspective. The generality of this model allows it to be adapted to different institutional contexts.[18] Deviating from the concept of aspiration gaps, the economy is still modeled as a closed system without a public sector, operating in continuous time with flexible state variables: prices and money wages. However, following the contributions of Palley (2013), Marglin (2017), Skott (2017), and Marglin (2021), I extend the framework by including a labor market. This addition introduces a new state variable: the volume of employment. As a result, the model stabilizes not only the distributional conflict and price-wage inflation, but also the level of employment. This simplified framework provides another way to achieve Hein (2023)'s "Stable Inflation Rate of Employment" (SIRE) and has the added benefit of establishing this point as a *globally* stable equilibrium.

Two important aspects of the labor and goods markets deserve our attention. First, the labor market operates under conditions that imply less than full employment; thus, reaching employment equilibrium does not mean reaching full employment. Second, I assume that long-run productive capacity on the supply side of the goods market is subject to change. This is driven by a process of capital deepening (Marglin, 2017) fueled by productivity-enhancing innovations. In line with current trends in capital accumulation, these innovations are assumed to be labor-saving. In other words, technological progress, which causes long-term shifts in the supply curve, affects both the goods market and the labor market and thus embodies the Kaldorian dimension of the model. At the same time, changes in income distribution and employment, which

[18] In other words, the model based on the aspiration gap mechanism developed above represents a special case (without a labor market) of this more general framework.

drive aggregate demand, capture the Keynesian (via the employment rate channel) and Kaleckian elements. Furthermore, the money market, even if not explicitly modeled, can be assumed to be in constant equilibrium, adjusting the money demand of market participants in response to changes in the goods and labor markets. Consequently, equilibrium on the "real" side of the economy (goods and labor) ensures the general equilibrium of the system.

Institutional regimes and growth strategies. To analyze the stability of distributional conflict within the Keynesian-Kaleckian-Kaldorian nexus, I take the institutional regimes outlined by Lavoie and Stockhammer (2013) and Stockhammer and Onaran (2022) as a broad conceptual framework. These regimes are classified as *pro-labor* and *pro-capital*, with an additional category that I introduce, which I call *pro-conflict*. A pro-labor regime defines the volume of employment and money wages as state variables, while a pro-capital regime defines employment and prices as state variables. The pro-conflict regime, on the other hand, treats the volume of employment as given and only allows wages and prices to be adjusted. This categorization ensures that the system is not underdetermined.

Second, following the taxonomy proposed by Bhaduri and Marglin (1990), I examine how wage- and profit-led growth strategies adapt to this institutional framework. For simplicity, a growth regime is defined here as *wage-led* if an increase in the wage share or real wages has a positive effect on aggregate demand and production, including investment, and thus also influences the goods market supply side. Conversely, a regime is considered *profit-led* if a fall in real wages or an increase in profit share promotes economic growth by stimulating these components. In the cases examined, I assume that in a profit-led strategy, a price increase positively stimulates both demand and supply through investment. However, the increase in investment does not fully offset the larger decrease in consumption,[19] resulting in a net increase in supply. In a wage-led strategy, the aggregate demand and aggregate supply curves shift in the same direction, allowing for several possible outcomes.

Analytical framework. The structure of the model is based on the macroeconomic aggregates outlined by Keynes (1936). First, I use the aggregate supply function $Z(t) = Z\big(N(t)\big)$, which represents the relationship between firms' expected future profits and the current employment level $N(t)$ required to produce the corresponding goods. Second, I consider the aggregate demand function $D(t) = D\big(N(t)\big)$, which describes the relationship between the expected expenditure of all buyers at different levels of $N(t)$. Workers negotiate money wages $W(t)$, while firms set prices $P(t)$. These prices reflect the level at which companies intend to sell their products, assuming that they are in line with current market prices. The real wage is therefore a composite construct. The level of employment $N(t)$ in the economy is determined by the labor demand

[19] The basis for this is the higher marginal propensity to consume of workers, which means that the decline in consumption may not be fully offset by an increase in investment demand.

function $L\big(P(t), W(t)\big)$, which is shaped by effective demand and influenced by money wages and prices (see Mitchell, Wray, and Watts, 2019).

Taking these elements into account, the economic relationships can be expressed as

$$\mathcal{G}\Big(N(t), P(t), W(t)\Big) \tag{3.18}$$

$$\mathcal{L}\Big(N(t), P(t), W(t)\Big), \tag{3.19}$$

where $\mathcal{G}(\cdot)$ denotes the excess demand function on the goods market and $\mathcal{L}(\cdot)$ the excess demand function on the labor market, both of which are continuously differentiable.

Equilibrium and stability. Let us now discuss the equilibrium and stability criteria that I use to evaluate each regime. The definition given is general and serves as a framework for analyzing all subsequent cases.

Definition 4 (Equilibrium and stability). Let us assume that the system has two state variables, denoted $x(t)$ and $y(t)$ (which may represent $N(t)$, $P(t)$ or $W(t)$, depending on the case). Given the dynamic system $\dot{x}(t) = \mathcal{G}\big(x(t), y(t)\big)$ and $\dot{y}(t) = \mathcal{L}\big(x(t), y(t)\big)$, a steady state (general equilibrium) occurs when the paths of $x(t)$ and $y(t)$ are constant, such that both the goods and labor[20] markets clear

$$\mathcal{G}\big(x^*, y^*\big) = 0 \quad \text{and} \quad \mathcal{L}\big(x^*, y^*\big) = 0.$$

It is assumed that this equilibrium is unique. For a general equilibrium, it is sufficient that $\mathcal{G}(\cdot)$ and $\mathcal{L}(\cdot)$ are clear, as the money market is always in equilibrium under the assumption of this model. The equilibrium is stable if there is a positive autonomous demand shock $\delta > 0$, so that for any initial conditions $\big(x(0), y(0)\big)$ in the neighborhood of the equilibrium, namely $\big(x(0), y(0)\big) \in \big(x^* - \delta, x^* + \delta\big) \times \big(y^* - \delta, y^* + \delta\big)$, the trajectories of the system $x(t)$ and $y(t)$ converge back to the equilibrium values x^* and y^* over time. If the system does not return to the point (x^*, y^*), the equilibrium is unstable.

Global stability. While the stability criterion in Definition 4 provides valuable conceptual insight, the analysis often requires examining the behavior of the system near the equilibrium point, especially for nonlinear systems. In this model, this could be done by linearizing the nonlinear system, $\mathcal{G}(\cdot)$ and $\mathcal{L}(\cdot)$, around the equilibrium. One limitation of linearization is that the derived stability conditions only apply in the immediate vicinity of equilibrium. However, Olech's theorem (see Theorem 1 in Ito, 1978) provides a framework for extending the analysis to global

[20] As already emphasized, this clearing does not imply a full employment equilibrium; in other words, unemployment may persist. Moreover, the attractor equilibrium property of this point should not be interpreted as a natural rate of unemployment.

stability and allows an evaluation of the entire state space and not just the local neighborhood. This framework adopts a global perspective, which has the great advantage of ensuring asymptotic convergence and, consequently, stabilization of inflation and employment regardless of the magnitude of autonomous demand shocks. This property increases the overall robustness of the system. The formal conditions supporting this result are listed in Appendix C.

In the following analysis, I examine the responses of prices, wages and employment to short-term autonomous demand shocks under each distributional regime in the context of a defined growth strategy. I then identify the market conditions necessary for the system to converge back to a steady state and eventually reach an "inflation-free" real wage.

Pro-labor regime

The institutional and distributive structure of this economy favors labor. Prices are exogenously given, so that money wages and employment are the unknown variables of the system. On the one hand, I assume that the volume of employment adjusts to excess demand in the goods market, which is consistent with the Keynesian hypothesis. On the other hand, nominal wages react positively to excess demand in the labor market, reflecting the Phillips curve. These adjustment laws are expressed as

$$\dot{N}(t) = \mathcal{G}\Big(N(t), W(t)\Big) \tag{3.20}$$

$$\dot{W}(t) = \mathcal{L}\Big(N(t), W(t)\Big), \tag{3.21}$$

where the changes in variables are represented in a generalized form omitting nonlinearities for simplicity. The main focus is not only on employment dynamics, but also on the absolute change in real wages—i.e. whether they rise or fall in the long run after a shock at $t = 0$. In addition, adjustment coefficients—interpreted as bargaining power—are normalized to one, so that the analysis can focus on institutional dynamics and market response.

Next, I will analyze how each growth strategy behaves within this institutional structure when confronted with shocks that disrupt its equilibrium.

Profit-led. In a profit-led economy, lowering money wages stimulates investment by incentivizing entrepreneurs to engage in technological innovation and labor-saving techniques. These efforts enable companies to maintain or increase their productivity even when wages fall. In the long term, such a dynamic leads to a rightward shift in the supply curve, provided that technological progress continues. From the perspective of net demand functions, this behavior leads to excess supply on both the goods and labor markets. Conversely, an increase in money wages reverses these effects.

As for changes in the effective labor force, an increase in $N(t)$ leads by definition to an excess supply of labor and an excess supply of goods, since this labor-friendly distributional regime favors workers.

These changes lead to the following qualitative properties on both markets:

Assumption 4 (Pro-labor/profit-led). $\mathcal{L}'_N < 0$, $\mathcal{L}'_W > 0$, $\mathcal{G}'_W > 0$, and $\mathcal{G}'_N > 0$.

Let us now examine how the system reacts in the long run to equilibrium shifts caused by a short-term autonomous demand shock. Assume that at $t = 0$ a positive autonomous demand shock ($\uparrow d\delta$) triggers a net demand for goods $\mathcal{G}'_\delta > 0$ with no immediate impact on the labor market $\mathcal{L}'_\delta = 0$. The effects on the net demand for labor arise through other channels. I will maintain these assumptions regarding the autonomous demand shock in all subsequent regimes. The effect of the shock on money wages and employment is therefore represented by a shift vector of type

$$\begin{bmatrix} \dfrac{dN(t)}{d\delta} > 0 \\ \dfrac{dW(t)}{d\delta} > 0 \end{bmatrix}.$$

A positive autonomous demand shock inevitably leads to a short-term increase in money wages and the effective volume of employment. But can this outcome remain stable in the long run? The answer is no, due to a *fundamental structural incompatibility* between the prevailing distributional regime and the growth strategy. Let us analyze this in detail.

The shock leads to an increase in $N(t)$ via the goods market, which increases real wages via the labor market, consistent with a pro-labor regime that promotes redistribution in favor of workers. However, this process is accompanied by a decline in investment, while the short-run increase in $N(t)$ leads to excess supply on the labor market and reduces productivity. As a result, distributional conflict escalates, eventually leading to systemic instability.

Even in the opposite scenario $\mathcal{G}'_W < 0$, the incompatibility remains. In this case, the shock lowers employment and wages $\begin{bmatrix} \frac{dN(t)}{d\delta} < 0 & \frac{dW(t)}{d\delta} < 0 \end{bmatrix}^T$, increases profits and creates net labor demand in the long run, which raises productivity. However, this growth comes at the cost of a redistribution that penalizes workers, undermines the institutional framework and exacerbates conflict. Consequently, net demand for goods falls and the increase in investment cannot compensate for this deficit, so the long-term excess supply of goods is unsustainable.

Wage-led. In this scenario, the effect is exactly the opposite. An increase in money wages raises both the demand for goods and the incentives for the introduction of capital-intensive technologies that increase productivity, which corresponds to the Kaldor-Verdoorn (K-V) principle.

The net effect of a change in the effective volume of labor on the economy retains the same qualitative properties as in the previous example since the institutional regime remains unchanged. However, a change in money wages leads to a slight difference. The labor-saving (or capital-intensive) strategy, triggered by an increase in money wages, now results in excess supply on the labor market. In the case of the goods market, three scenarios may arise. Since this economy is wage-led growth, a change in $W(t)$ affects both the aggregate demand and the supply curve. This creates some ambiguity about the impact of wages on the net demand for goods, which leads me to define the following qualitative properties:

Assumption 5 (Pro-labor/wage-led). $\mathcal{L}'_N < 0$, $\mathcal{L}'_W < 0$, and $\mathcal{G}'_N > 0$. For $\mathcal{G}'_W$, I consider three cases: $\mathcal{G}'_W > 0$, $\mathcal{G}'_W = 0$, and $\mathcal{G}'_W < 0$.

An autonomous demand shock in a context where $\mathcal{G}'_W = 0$ or $\mathcal{G}'_W < 0$, will lead to an increase in employment and a decrease in wages $\left[\frac{dN(t)}{d\delta} > 0 \quad \frac{dW(t)}{d\delta} < 0 \right]^T$. This outcome is unstable in the long run as real wages, investment, and labor productivity fall, leading to a redistribution of income in favor of firms. Such a redistribution is incompatible with the prevailing pro-labor regime and wage-led strategy, thereby exacerbating the distributional conflict.

Now, if the autonomous demand shock (via money wages) triggers excess demand on the goods market $\mathcal{G}'_W > 0$, leading to an equilibrium response vector

$$\begin{bmatrix} \dfrac{dN(t)}{d\delta} < 0 \\ \dfrac{dW(t)}{d\delta} > 0 \end{bmatrix},$$

the system exhibits global stability in the long run. That is, $\mathcal{G}(N^*, W^*) = 0$ and $\mathcal{L}(N^*, W^*) = 0$ are fulfilled. The necessary and sufficient conditions for this result to be true are

$$\underbrace{\frac{\mathcal{L}'_W}{\mathcal{L}'_N}}_{\substack{\dot{W}(t)=0 \\ \text{slope}}} < \underbrace{\frac{\mathcal{G}'_W}{\mathcal{G}'_N}}_{\substack{\dot{N}(t)=0 \\ \text{slope}}} \qquad \text{and} \qquad \mathcal{G}'_N + \mathcal{L}'_W < 0.$$

The model shows that achieving global stability—and thus a general equilibrium—requires that the wage elasticity of net demand for goods exceeds the wage elasticity of net demand for labor. At the same time, the employment elasticity of net demand for goods must be lower than the employment elasticity of net demand for labor. Put simply, under the assumption $\mathcal{G}'_W > 0$, an autonomous demand shock leads to a rise in real wages and must induce long-term net demand for labor, which increases investment and labor productivity.[21]

[21]By and large, albeit with nuances, this agrees with the economic ideal formulated by Lavoie and Stockhammer

In other words, this short-term decline in employment needs to generate long-term net demand for labor such that it offsets the labor-saving strategy driven by the wage increase. This does not mean that a strategy to save labor is harmful per se, since the condition $\mathcal{G}'_N + \mathcal{L}'_W < 0$ must still be met. Rather, investment demand must increase productivity to a level that favors future job creation. Put more simply, the model predicts that increasing real wages and favoring workers in the income distribution would be both unstable and impractical in a fully automated economy where there is an absolute oversupply of labor (i.e., total unemployment).

The following proposition summarizes the results mentioned above:

Proposition 2 (Pro-labor global stability). *Under a pro-labor institutional regime, global stability in response to autonomous demand shocks can only be achieved within the framework of a wage-led growth strategy. This is the only configuration that guarantees a long-term increase in investment, productivity and demand through real wage growth, consistent with the principles of this distributional framework.*

Pro-capital regime

This distributional regime prioritizes firms, enabling the system to adjust prices and employment, while treating money wages as fixed. Consistent with the logic of the previous regime, I adopt the Keynesian hypothesis wherein employment adjusts in response to shifts in the goods market, while price dynamics are driven by excess demand in the labor market, as described by the Phillips curve. The adjustment laws of the system are thus defined by

$$\dot{N}(t) = \mathcal{G}\Big(N(t), P(t)\Big) \tag{3.22}$$

$$\dot{P}(t) = \mathcal{L}\Big(N(t), P(t)\Big). \tag{3.23}$$

I will now analyze the response of the economy to an autonomous demand shock and evaluate the properties of the long-run equilibrium.

Profit-led. As part of this growth strategy, rising firm profits create incentives for investment and technological innovation that increase labor productivity and expand the capacity of the economy through a long-term upward shift in the supply curve.

An increase in prices therefore leads to excess supply on both the goods and the labor market. As far as employment is concerned, an increase in $N(t)$ also leads to excess supply on both markets: on the labor market this happens by definition. And on the goods market this occurs because this distribution regime gives priority to capital, whereby ceteris paribus a higher level of employment is accompanied by a lower demand for goods. The following relationships illustrate these behaviors:

(2013).

Assumption 6 (Pro-capital/profit-led). $\mathcal{L}'_N < 0$, $\mathcal{L}'_P < 0$, $\mathcal{G}'_N < 0$, and $\mathcal{G}'_P < 0$.

The response vector for employment and prices to the autonomous demand shock is represented as

$$\begin{bmatrix} \dfrac{dN(t)}{d\delta} < 0 \\ \dfrac{dP(t)}{d\delta} > 0 \end{bmatrix}.$$

This result, which is consistent with a profit-led regime, shows global asymptotic stability around the (general) equilibrium in the long run, provided that the inequality

$$\underbrace{\frac{\mathcal{G}'_N}{\mathcal{G}'_P}}_{\substack{\dot{N}(t)=0 \\ \text{slope}}} > \underbrace{\frac{\mathcal{L}'_N}{\mathcal{L}'_P}}_{\substack{\dot{P}(t)=0 \\ \text{slope}}},$$

is satisfied so that $\mathcal{G}(N^*, P^*) = 0$ and $\mathcal{L}(N^*, P^*) = 0$ hold.

This result fits seamlessly into the chosen combination of institutional regime and growth strategy. An autonomous demand shock leads to a decline in employment via the goods market and to an increase in prices via the labor market, so that real wages fall, which is reflected in a higher profit share. This process in turn stimulates investment and increases productivity. Long-term stability presupposes that the reduction in employment generates sufficient excess demand for goods ($\mathcal{G}'_N < 0$) to offset the oversupply triggered by rising prices. At the same time, the price increase must lead to an oversupply of labor in order to balance the demand for labor dictated by $\mathcal{L}'_N < 0$—the lower its value, the better for the system. Basically, unemployment is a natural outcome within this pro-capital regime; it serves the system as a "discipline device" to stabilize distributional conflict. Any other scenario—e.g. rising employment combined with falling productivity—would lead to instability, which manifests itself in runaway price inflation and a systematic decline in real wages. From the perspective of the Phillips curve, this dynamic would have a positive slope: Short-term price inflation occurs in parallel with rising unemployment.

This outcome is particularly revealing as it formally illustrates that, from an analytical perspective, a wage-led strategy is not always the optimal approach to managing distributional conflict. The effectiveness of such a strategy depends entirely on the prevailing distribution regime. The competence of policy makers therefore lies in harmonizing these dimensions in order to create a virtuous combination. In this context, profits become the main engine of economic growth, while the (excess) demand for goods is sustained by the segment of the working population that constitutes a highly productive labor base. Nevertheless, the question naturally arises: what happens to the unemployed, especially those who are considered less productive? Although this model lacks the mechanisms to solve this problem, the general approach is to rely on the public sector to absorb these surplus workers or to take long-term measures aimed at improving human capital and thus facilitating the reintegration of these workers into the labor market.

Wage-led. Within this institutional context that favors capital, changes in the level of employment lead to similar results as in the previous case: an increase in $N(t)$ generates excess supply in both markets. In terms of prices, an increase (which implies a decline in real wages) leads to a decrease in investment and induces firms to adopt a labor-intensive strategy, leading to a net demand for labor.

The dynamics of the goods market are ambiguous and lead to three possible outcomes. A price increase reduces both the demand for and the supply of goods. This simultaneous shift in both curves emphasizes the flexibility and benefits of such strategies, as the impact on both demand and supply allows for an easier evaluation of the most beneficial option for the economy. The qualitative properties of the system are as follows:

Assumption 7 (Pro-capital/wage-led). $\mathcal{L}'_N < 0$, $\mathcal{L}'_P > 0$, and $\mathcal{G}'_N < 0$. For $\mathcal{G}'_P$, I consider three cases: $\mathcal{G}'_P > 0$, $\mathcal{G}'_P = 0$, and $\mathcal{G}'_P < 0$.

Given these properties, in cases where $\mathcal{G}'_P = 0$ and $\mathcal{G}'_P < 0$, a positive autonomous demand shock leads to a fall in both employment and the price level $\begin{bmatrix} \frac{dN(t)}{d\delta} < 0 & \frac{dP(t)}{d\delta} < 0 \end{bmatrix}^T$, indicating instability in the system. This outcome arises from the incompatibility between the distributional regime and the growth strategy. A fall in prices leads to an increase in real wages, which stimulates investment but leads to a redistribution of income in favor of workers, undermining the prevailing institutional framework and exacerbating the conflict. At the same time, a short-term decline in $N(t)$ leads to a net demand for labor and goods, which further undermines the institutional framework. To summarize, growth driven by a reduction in profits and a long-term increase in employment is incompatible with a pro-capital regime.

Now, when $\mathcal{G}'_P > 0$, the autonomous demand shock leads to a response vector such that

$$\begin{bmatrix} \dfrac{dN(t)}{d\delta} > 0 \\ \dfrac{dP(t)}{d\delta} > 0 \end{bmatrix},$$

which leads to global stability. However, this stability does not arise for the "right reasons," but is the result of a purely analytical construct. This illustrates the flexibility inherent in a wage-led strategy. The necessary and sufficient conditions for achieving long-term stability are defined by

$$\underbrace{\frac{\mathcal{L}'_N}{\mathcal{L}'_P}}_{\substack{\dot{P}(t)=0\\ \text{slope}}} > \underbrace{\frac{\mathcal{G}'_N}{\mathcal{G}'_P}}_{\substack{\dot{N}(t)=0\\ \text{slope}}} \qquad \text{and} \qquad \mathcal{L}'_P + \mathcal{G}'_N < 0.$$

The shock-induced rise in prices and the resulting excess supply of labor are consistent with the pro-capital distributional regime. However, this outcome is at odds with the growth strategy, as both investment and productivity decline. Stability in this context is achieved through a substantial increase in unemployment (with a higher $\mathcal{L}'_N$ being more favorable to the pro-capital regime) and excess demand for goods that offsets unemployment. Yet, this net demand does not result from an actual increase in demand for goods, as real wages fall, but from a pronounced reduction in investment, which shifts the supply curve below the fall in demand. In essence, inflation and conflict stability are achieved at the cost of a deep economic recession, making this scenario a fertile breeding ground for increased conflict in the future. Therefore, this combination, even if analytically possible, cannot be considered a viable path to stability. The following proposition summarizes these findings:

Proposition 3 (Pro-capital global stability). *In a pro-capital institutional framework, the only consistent and "genuine" general equilibrium response to autonomous demand shocks is a profit-led growth strategy. In contrast, the stability associated with a wage-led strategy is purely analytical and results from an economic recession and a substantial surge in unemployment.*

Pro-conflict regime

I call this regime "pro-conflict" because the system of equations allows for adjustments in prices and money wages, while the level of employment is treated as a datum.[22] Conflict inflation arises from the antagonistic adjustment of variables driven by growth strategies. I assume that prices adjust in response to excess demand in the goods market, while money wages adjust to excess demand in the labor market. As mentioned at the beginning, both groups have the flexibility to set their prices without constraints. Since my aim is to demonstrate the conditions for the global stability of the system (i.e. the existence of an "inflation-free" equilibrium real wage), it is unnecessary to specify the bargaining power of each group. They can be assumed to be equal (e.g. $= 1$) without loss of the generality of the results.

[22] Essentially, this institutional regime guarantees the stability of employment, but it fails to secure the distribution of income for any particular group, leading to a kind of "conflict trilemma"—a topic that would be better dealt with in a separate article.

The resulting adjustment laws are therefore

$$\dot{P}(t) = \mathcal{G}\Big(P(t), W(t)\Big) \tag{3.24}$$

$$\dot{W}(t) = \mathcal{L}\Big(P(t), W(t)\Big). \tag{3.25}$$

While earlier cases of global stability implicitly led to an equilibrium real wage, here the general equilibrium of the system explicitly guarantees the existence of a real wage $\omega^* = \frac{W^*}{P^*}$, such that $P(t) = P^*$ and $W(t) = W^*$. This simultaneously means a clearing on the goods market $\mathcal{G}\big(P^*, W^*\big) = 0$ and the labor market $\mathcal{L}\big(P^*, W^*\big) = 0$.

Profit-led. Under this regime, the analysis becomes simpler because the antagonistic adjustment between nominal wages and prices (the state variables) directly determines a single measure: real wages. An increase in prices generates excess supply in both markets, driven by investment that shifts the supply curve through a labor-saving strategy. Conversely, an increase in wages leads to excess demand in both markets. These features are represented by the following relationships:

Assumption 8 (Pro-conflict/profit-led). $\mathcal{L}'_P < 0$, $\mathcal{L}'_W > 0$, $\mathcal{G}'_P < 0$, and $\mathcal{G}'_W > 0$.

The conflicting interaction of prices and wages means that a positive autonomous demand shock has symmetrical effects on both, producing a response vector given by

$$\begin{bmatrix} \dfrac{dP(t)}{d\delta} > 0 \\ \dfrac{dW(t)}{d\delta} > 0 \end{bmatrix}.$$

The adjustment is positive for both variables, but how to determine which variable takes precedence? In other words, how can we determine whether real wages rise or fall in response to the shock? Since prices are primarily determined by net demand in the goods market (recall the hypothesis $\mathcal{L}'_\delta = 0$), the autonomous demand shock first affects prices. Subsequently, prices affect wages via the labor market and set off a price-wage spiral. The extent and causality of these adjustments are contained in the expressions

$$dP(t) = \mathcal{G}'_\delta \mathcal{G}'_W \frac{1}{\frac{\mathcal{G}'_P}{\mathcal{G}'_W} - \frac{\mathcal{L}'_P}{\mathcal{L}'_W}} d\delta \qquad \text{and} \qquad dW(t) = -\frac{\mathcal{L}'_P}{\mathcal{L}'_W} dP(t). \tag{3.26}$$

The short-run magnitude of the shock to money wages—whether it exceeds, equals, or falls short of the shock to prices—thus depends on whether the ratio $\frac{\mathcal{L}'_P}{\mathcal{L}'_W}$ is greater than, equal to, or less than one. In other words, the response of real wages to an autonomous demand shock is determined by the elasticity ratio of the labor market. This ratio is of central importance as it also determines the criteria for the global stability of the system. These stability conditions are:

$$\underbrace{\frac{\mathcal{L}'_P}{\mathcal{L}'_W}}_{\substack{\dot{W}(t)=0 \\ \text{slope}}} > \underbrace{\frac{\mathcal{G}'_P}{\mathcal{G}'_W}}_{\substack{\dot{P}(t)=0 \\ \text{slope}}} \qquad \text{and} \qquad \mathcal{L}'_W + \mathcal{G}'_P < 0. \tag{3.27}$$

Even though these conditions do not prescribe a specific value for the ratio, to validate this growth strategy I will assume that prices rise faster than wages; that is, the labor market ratio is less than one, $\mathcal{L}'_W > \mathcal{L}'_P$. For the volume of employment to remain constant, the wage elasticity of labor demand must exceed the price elasticity of labor demand. This implies that a reduction in real wages, which stimulates investment and reduces labor demand, must be offset by a corresponding increase in labor demand due to rising wages. Ultimately, the shock leads to a redistribution in favor of firms, resulting in positive inflation in both prices and wages, which eventually stabilizes at a high level.

Wage-led. This strategy demonstrates the opposite dynamic. Here, an increase in real wages creates the necessary incentives for investment and innovation and enables firms to apply labor-saving strategies. Such an increase in real wages can result either from a rise in money wages that exceeds the rise in prices or from a fall in prices that exceeds the fall in wages. As already mentioned, this results in several possible combinations of relative shifts in the supply and demand curves in the goods market. For the sake of brevity and analytical clarity, I will focus exclusively on the conditions that ensure the global stability of the system. The dynamics of the labor market are easy to deduce because they have the opposite sign as in the previous case. The relationships in the goods market have the same signs but are due to opposite mechanisms: A higher propensity to consume on the part of employees compared to firms means that a price rise lowers the demand curve disproportionately compared to the supply curve. A wage increase has the opposite effect. Consequently, the normal relationships underlying this growth strategy are represented by:

Assumption 9 (Pro-conflict/wage-led). $\mathcal{L}'_P > 0$, $\mathcal{L}'_W < 0$, $\mathcal{G}'_P < 0$, and $\mathcal{G}'_W > 0$.

Interestingly, the autonomous demand shock leads to a simultaneous fall in prices and wages

$$\begin{bmatrix} \dfrac{dP(t)}{d\delta} < 0 \\ \dfrac{dW(t)}{d\delta} < 0 \end{bmatrix}.$$

The stability conditions of the system require that $\frac{\mathcal{L}'_P}{\mathcal{L}'_W} > \frac{\mathcal{G}'_P}{\mathcal{G}'_W}$, reflecting the requirements of the previous strategy (3.27). To achieve a larger reduction in prices than in wages, I stick with the assumption that the elasticity ratio of the labor market (represented by the slope of the $\dot{W}(t) = 0$ curve) must be less than one in absolute terms, $\frac{dW(t)}{dP(t)} = \left|\frac{\mathcal{L}'_P}{\mathcal{L}'_W}\right| < 1$. This implies that to maintain the effective level of employment, the net labor demand resulting from a wage reduction must more than offset the excess supply of labor caused by the price decline. What makes this combination particularly remarkable is the fact that the autonomous demand shock triggers deflation, which stabilizes the conflict and inflation at a lower level of prices and wages. This gives it a comparatively more favorable character than the previous case. Here, the price-wage spiral is naturally bound downwards by zero (a threshold that is never reached), which inherently helps to defuse the conflict. In contrast, in the pro-conflict profit-led scenario, the price-wage spiral progresses upwards without a ceiling, leading to a greater propensity towards instability.

Proposition 4 (Pro-conflict global stability). *In a pro-conflict regime, the equilibrium response of prices and money wages to autonomous demand shocks depends on the growth strategy. It is:*

a) *Inflationary in a profit-led, and*

b) *Deflationary in a wage-led.*

Discussion

Several results derived from this model are consistent with and reinforce the findings in the literature on these growth strategies. For example, Lavoie and Stockhammer (2013) and Onaran and Galanis (2013) emphasize that wage-led policies in pro-labor regimes can stabilize the economy by increasing labor's share of income. This promotes equitable growth through higher consumption and at the same time stimulates productivity through demand-driven mechanisms. Based on empirical analysis, Onaran and Galanis (2013) find that many developed and some developing economies operate in wage-led demand systems in which a rising wage share promotes higher and more stable growth—a finding that is also emphasized by Blecker (2016) in the long-term context. Conversely, Cassetti (2003) and Lavoie and Stockhammer (2013) acknowledge that a profit-led growth strategy can be viable in a pro-capital institutional context, but they emphasize the tendency to exacerbate inequality and unemployment, thereby undermining sustainable long-term growth. Blecker (2016) criticizes this approach for relying on a short-term focus that ignores the broader economic implications. Furthermore, Byrialsen, Valdecantos, and Raza (2024) and Blecker (2016) emphasize the role of structural conditions, institutional context and the nature of economic shocks in shaping distributional outcomes, as Skott (2017) also argues. The model presented here complements these findings by explicitly analyzing how institutional regimes mediate and influence these distributional dynamics.

Despite these parallels, this model also introduces new elements into the literature that have either been overlooked or insufficiently analyzed. While it formalizes the verbal discussions of Lavoie and Stockhammer (2013) and Onaran and Galanis (2013) in a coherent framework, its most important contribution lies in the inclusion of the distributive regime that promotes conflict. In doing so, it extends the analytical framework beyond the binary classifications prevalent in the existing literature, offering a perspective in which neither wages nor profits emerge as clearly dominant forces. Cassetti (2003) claims that a Kaleckian framework for modeling conflict generally leads to instability. However, the inclusion of the pro-conflict regime in this analysis shows that both wage-led and profit-led strategies can achieve stability, albeit through different routes. Interestingly, the stabilization of a wage-led strategy in a pro-conflict regime through price cuts is a counterintuitive outcome that departs from conventional wage-led models and introduces a novel mechanism to contain inflationary spirals. Furthermore, the inclusion of an additional institutional level is a response to Skott (2017)'s critique. By including institutional dynamics and labor market interactions and placing growth strategies in these multi-layered contexts, this approach adds depth to the wage-led/profit-led framework. It captures the feedback between growth strategies, prices, wages and employment. Skott (2017) argues that the distributional debates in the literature are oversimplified and rely disproportionately on the binary framework of Bhaduri and Marglin (1990). He argues for moving beyond such dualistic classifications and examining broader structural determinants.

Finally, this model serves as a complement to autonomous demand-led models (e.g. Serrano, 1995), as it takes into account the short-term economic effects of such shocks thereby addressing a gap in the long-term orientation of these frameworks. Moreover, it conceptualizes stability as a condition rather than an assumption. It develops the framework further by examining how autonomous demand shocks reshape the (endogenous) distribution and how these shifts can pave the way for long-term stability.

3.4 Conclusion

This chapter develops two models of distributional conflict to identify the conditions for stabilizing the distribution of income and the inflation of prices and wages in response to autonomous demand shocks. Extending the textbook model of the aspiration gap to a dynamic framework, I show that the aspirations of both firms and workers remain unattainable and serve merely as "lures." In this setup, social equilibrium inevitably leads to escalating inflation. To counteract this constraint, I include market equilibrium conditions that allow for stabilization of income distribution, price and wage inflation, and the fulfillment of both groups' aspirations within a single long-term steady-state.

Subsequently, I extend the conflict model by explicitly including institutional contexts as key determinants of distributional dynamics. I go beyond the traditional duality of pro-labor and pro-capital and introduce a third distributive regime characterized by the absence of inherent dominance in the allocation of income between profits and wages. This integrated framework provides the flexibility to show how institutional configurations influence the effectiveness of wage- and profit-led growth strategies. By presenting distributional conflict as a potentially stable economic regime, these models extend the scope of the existing literature on growth and income distribution.

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Appendix

Appendix A

Appendix of "A Model of External Debt Sustainability and Monetary Hierarchy"

A.1 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 A1. *Assuming that $\gamma \neq \zeta$, the solution of expression (A.1) is*

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

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

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

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

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

which after some algebraic manipulations leads to

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

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 $e^{-zs}\frac{1}{z-\gamma}=e^{-zs}\mathcal{L}\left[e^{\gamma t}\right]=\mathcal{L}\left[u_s\left(t\right)e^{\gamma(t-s)}\right]$. The next step is to determine the inverse transform of $\frac{1}{(z-\gamma)(z-\zeta)}$. Decomposing this expression down into partial fractions yields

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

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

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

Substituting this into equation (A.2) gives

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

and therefore

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

A.2 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

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

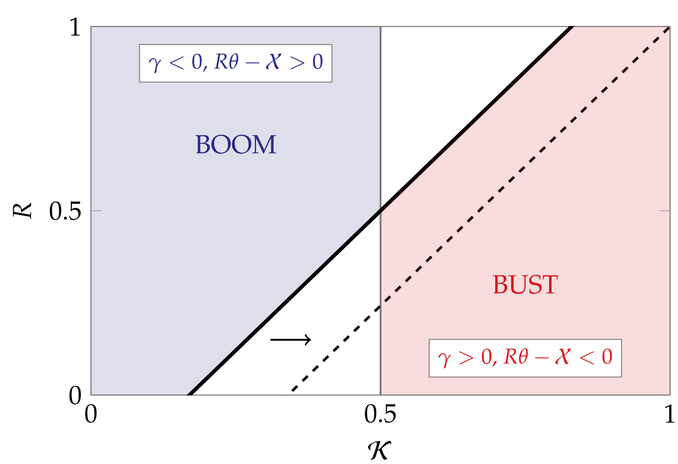
Consequently, the sustainable region can only be expanded by lowering the expression on the right-hand side of the inequality (i.e. reducing the lower section of the $\mathcal{S}$-curve). The prerequisite for this is that the condition

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

is fulfilled only during an interest rate cut.

A.3 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.

A.4 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.

Appendix B

Appendix of "Inflationary Inertia as a Result of Unfulfilled Aspirations"

B.1 Equations for Wages, Prices, and Employment

This appendix describes the intertemporal paths of wages, prices and employment for each inflationary regime shown in Table 2.1.

- Market-led regime, where $\mathcal{F} = \mathcal{W} = 0$ and $\mathscr{C} = 0$:

$$
\begin{aligned}
W_{t+n} &= \Big(1 + \alpha\big(\delta - \varsigma\big)\Big)^n W_0, \\
P_{t+n} &= \Big(1 - \beta\big(\delta - \varsigma\big)\Big)^n P_0, \\
N_{t+n} &= \Big(1 - \big(x + z\big)\big(\delta - \varsigma\big)\Big)^n N_0.
\end{aligned}
$$

- Consensus-led regime, where $\mathcal{F} \in (0,1)$, $\mathcal{W} \in (0,1)$, and $\mathscr{C} \in (0,1)$:

$$
\begin{aligned}
W_{t+n} &= \left(1 + \big(\delta - \varsigma\big)\left(\alpha \frac{1}{1-\mathcal{W}} + \big(1-\alpha\big)\frac{1-\mathscr{C}}{1+\mathscr{C}}\right)\right)^n W_0, \\
P_{t+n} &= \left(1 + \big(\delta - \varsigma\big)\left(\big(1-\beta\big)\frac{\mathcal{F}}{1+\mathcal{F}} - \beta\frac{1-\mathscr{C}}{1+\mathscr{C}}\right)\right)^n P_0, \\
N_{t+n} &= \left(1 + \big(\delta - \varsigma\big)\left(x\frac{1-\mathscr{C}}{1+\mathscr{C}} - y\frac{\mathcal{F}}{1+\mathcal{F}} + z\frac{1}{1-\mathcal{W}}\right)\right)^n N_0.
\end{aligned}
$$

In the following regimes, which are characterized by bargaining powers greater than or equal to one, workers' aspirations are represented by $\hat{s}_{W,t} = \big(\hat{s}_{W,0} - \hat{s}^*_W\big)\mathcal{W}^t + \hat{s}^*_W$, firms' aspirations by $\hat{s}_{F,t} = -\big(\hat{s}_{F,0} - \hat{s}^*_F\big)\mathcal{F}^t - \hat{s}^*_F$, and the actual real wage (with $\mathscr{C}$ greater than one) by $\hat{w}_{G,t} = C_1\mathscr{C}^{\frac{t}{2}}\cos\Big(\frac{\pi}{2}t + C_2\Big) + \hat{w}^*_G$.

- Chaos regime in which I assume that both bargaining powers are greater than one: $\mathcal{F} > 1$, $\mathcal{W} > 1$, and $\mathscr{C} > 1$:

$$\begin{aligned}
W_{t+n} &= \left(1 + \alpha \hat{s}_{W,t} + (1-\alpha)\hat{w}_{G,t}\right)^n W_0, \\
P_{t+n} &= \left(1 - \beta \hat{w}_{G,t} + (1-\beta)\hat{s}_{F,t}\right)^n P_0, \\
N_{t+n} &= \left(1 - x\hat{w}_{G,t} + y\hat{s}_{F,t} - z\hat{s}_{W,t}\right)^n N_0.
\end{aligned}$$

- Firms' aspirations-led regime where $\mathcal{F} > 1$, $\mathcal{W} \in (0,1)$, and $\mathscr{C} \in (0,1)$:

$$\begin{aligned}
W_{t+n} &= \left(1 + (\delta - \varsigma)\left(\alpha\frac{1}{1-\mathcal{W}} + (1-\alpha)\frac{1-\mathscr{C}}{1+\mathscr{C}}\right)\right)^n W_0, \\
P_{t+n} &= \left(1 - \beta(\delta - \varsigma)\frac{1-\mathscr{C}}{1+\mathscr{C}} + (1-\beta)\hat{s}_{F,t}\right)^n P_0, \\
N_{t+n} &= \left(1 - (\delta - \varsigma)\left(x\frac{1-\mathscr{C}}{1+\mathscr{C}} + z\frac{1}{1-\mathcal{W}}\right) + y\hat{s}_{F,t}\right)^n N_0.
\end{aligned}$$

- Workers' aspirations-led regime where $\mathcal{W} > 1$, $\mathcal{F} \in (0,1)$, and $\mathscr{C} \in (0,1)$:

$$\begin{aligned}
W_{t+n} &= \left(1 + \alpha\hat{s}_{W,t} + (1-\alpha)\frac{1-\mathscr{C}}{1+\mathscr{C}}\right)^n W_0, \\
P_{t+n} &= \left(1 + (\delta - \varsigma)\left((1-\beta)\frac{\mathcal{F}}{1+\mathcal{F}} - \beta\frac{1-\mathscr{C}}{1+\mathscr{C}}\right)\right)^n P_0, \\
N_{t+n} &= \left(1 + (\delta - \varsigma)\left(y\frac{\mathcal{F}}{1+\mathcal{F}} - x\frac{1-\mathscr{C}}{1+\mathscr{C}}\right) - z\hat{s}_{W,t}\right)^n N_0.
\end{aligned}$$

Appendix C

Appendix of "Conflict Inflation, Equilibrium Real Wage, and Growth"

C.1 Global Stability Conditions

A system of ordinary differential equations can be approximated as a series of linear differential equations expressed in the form

$$\dot{\mathbf{z}}(t) = \mathcal{J}(x^*, y^*)\mathbf{z}(t), \tag{C.1}$$

by a Taylor series expansion in which higher order terms are ignored. Here, $\mathbf{z}$ is the vector of small deviations from equilibrium, and $\mathcal{J}(\cdot)$ is the Jacobian matrix evaluated at the equilibrium point (x^*, y^*)—using Definition 4 notation. In this framework, $x(t)$ and $y(t)$ can represent any two of the following economic variables: prices, wages, or employment levels. The Jacobian matrix captures the local interactions and feedbacks between these variables, and its entries provide information about the dynamics of the system near equilibrium.

If the economic system initially at rest, $\dot{\mathbf{z}}(t) = 0$, undergoes a sudden positive autonomous demand shock $\delta > 0$, the equilibrium adjustment is given by

$$\underbrace{\begin{bmatrix} \mathcal{G}'_x & \mathcal{G}'_y \\ \mathcal{L}'_x & \mathcal{L}'_y \end{bmatrix}}_{\mathcal{J}} \begin{bmatrix} \frac{dx(t)}{d\delta} \\ \frac{dy(t)}{d\delta} \end{bmatrix} = \begin{bmatrix} \mathcal{G}'_\delta \\ \mathcal{L}'_\delta \end{bmatrix}. \tag{C.2}$$

The resulting dynamics may either stabilize or destabilize the system, depending on its structural characteristics. Although the linear approximation allows a local analysis of stability, Olech's theorem allows a global analysis that goes beyond the neighborhood of the equilibrium point. According to Olech's theorem (see Theorem 1 of Ito, 1978), the equilibrium (x^*, y^*) is globally stable if the following conditions are met:

a) The trace and the determinant of $\mathcal{J}(\cdot)$ satisfy $\text{tr}\,\mathcal{J}(\cdot) < 0 < \det \mathcal{J}(\cdot)$ for all pairs $(x(t), y(t))$, which ensures that the eigenvalues of $\mathcal{J}(\cdot)$ are either real and negative or complex with negative real parts, thus excluding instability, and

b) At least one of the following conditions holds for all pairs $(x(t), y(t))$:

  i) Both entries on the main diagonal of $\mathcal{J}(\cdot)$ are negative, which means that the self-feedback effects of $x(t)$ and $y(t)$ are stabilizing;

  ii) The two entries on the opposite diagonal of $\mathcal{J}(\cdot)$ are non-zero and have opposite signs, implying balancing (complementary adjustment) feedback between $x(t)$ and $y(t)$.

Note that if conditions *i*) and *ii*) are simultaneously satisfied, condition *a*) is automatically fulfilled. As a result, the two conditions mentioned in point *b*) together ensure the global stability of the steady state. However, if the system contains significant nonlinearities—which were intentionally omitted in equation (C.1)—a more detailed analysis may be required to verify the stability in the entire state space.