Gains from Commitment: The Case for Pegging the Exchange Rate*

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Abstract

This paper argues that the exchange rate regime matters for inflation and economic activity, with substantial benefits arising from a currency peg. At the heart of these benefits lies an increase in credibility that reduces the inflationary bias once central banks commit to peg their currency to a credible anchor. Using an open economy model, we provide a credibility estimate for 170 economies for 1950-2019 which aligns with other central bank independence measures. We document that committing to a peg persistently lowers inflation and its volatility while increasing real growth. Less credible countries benefit more from fixing the exchange rate.

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1 Introduction

Should countries peg their currency or aim for a flexible exchange rate regime? This classical question in international economics is still an open debate. One argument in favor of fixing the exchange rate is that such a regime keeps inflation low and stable. On the other hand, a strand of literature advocates flexible exchange rates to counteract shocks. Recent research emphasizes the disconnect of the exchange rate regime to macroeconomic fundamentals (Itskhoki and Muhkin, 2019) and questions the ability of the exchange rate regime to insulate from economic shocks (Corsetti et al., 2021).

This paper stresses that fixing the exchange rate can have positive effects on the economy, as it helps to reduce inflation and its volatility persistently. We spell out conditions under which fixing the exchange rate does have effects and when it does not. We also provide evidence for the quantitative magnitude of lower inflation when pegging and which countries in particular can benefit from such a regime shift.

In essence, we highlight and quantify the "credibility channel" in which a central bank gains credibility when committing to peg the exchange rate. Countries with non-credible central banks suffer an inflationary bias that has its origins in discretionary monetary policy. We provide a theory in which some countries are able to diversify away temptation shocks more efficiently than others, resulting in more credible institutions, less discretion, and lower inflation rates. We derive several testable implications in an estimated quantitative model when a country pegs to a more credible anchor: First, inflation and its volatility should go down permanently. Furthermore, GDP growth goes up in the short-run as the costs of high inflation go down. Last, we emphasize that those effects are stronger the less credible the pegging country is. Using this model, we provide an estimate of credibility for 170 countries between 1950 and 2019.

In our empirical analysis, we start by documenting that our proposed measure of a country's credibility is aligned with other measures of central bank independence, inflation expectations' anchoring, and central bank governors' average tenure. We then provide evidence for the implications of the model: When a country pegs its currency, inflation goes down on average by 2.6% per year, the standard deviation of inflation is reduced by around 0.9% and real GDP goes up temporarily by around 1% per year. The less credibility a country has, the larger the effects are.

Contribution: We use an open economy model, based on Chari et al. (2020) that features different monetary regimes and the possibility of an inflationary bias and focus on a multiple region version of this model. An inflationary bias arises when a central bank acts under discretion and uses time-inconsistent inflationary policies to stimulate economic activity. The degree of this inflationary bias is determined by temptation shocks. The larger and more volatile these shocks are, the more erratic monetary policy will be, resulting in higher and more volatile inflation.

Our analysis emphasizes how well countries can diversify away temptation shocks. Credible countries enjoy a larger diversification of shocks, leading to lower and less volatile inflation.

In such a setup, pegging the exchange rate to a credible and stable anchor can help to reduce inflation and its volatility. The client country gives up monetary autonomy and completely adopts the monetary stance of its anchor country, thereby inheriting its credibility. The magnitude of the reduction in inflation crucially depends on the initial credibility of the country and the credibility of its anchor. If inflation is costly to the economy, a long-term reduction also leads to a short-term increase in economic growth.

Taking the client's and the anchor's credibility into account, we derive several testable implications about the level of inflation, its volatility and economic growth, if a country changes its monetary regime. Inflation and volatility should go permanently down when a country pegs to a more credible anchor, while GDP growth should go up in the short-run. We then estimate the time-varying credibility parameter in a model calibrated for Italy (pegging country) and Germany (anchor country) and demonstrate that the evolution of inflation and its volatility in the data can be well matched. We extend our measure of credibility for 170 countries between 1950 and 2019 using our model. We document that our proposed measure correlates with other measures of central bank independence, inflation expectations' anchoring, and central bank governors' average tenure duration.

In our empirical exercises, we use the most comprehensive dataset available at the country level, with information on 170 economies over the last 70 years, corresponding to approximately 8,000 country-year observations including 282 pegging episodes identified following Ilzetzki et al. (2022). We start by providing 3 stylized facts on the differences between countries in float and fixed exchange rate regimes that are in line with the seminal contributions by Bordo and Schwartz (1999) and Calvo and Reinhart (2002): 1) inflation is higher and more volatile in floats than in pegs; 2) real GDP growth is higher in pegs; 3) interest rates are higher and more volatile in floats than in pegs. In addition, in the spirit of Eichengreen and Rose (2012), we also perform an event study analysis around changes in exchange rate regimes and confirm that following a pegging episode countries display lower inflation and interest rates and higher economic growth.

Then, to causally test the implications of our model, and after acknowledging that not all changes in the exchange rate regime are unexpected or unrelated to the business cycle of each economy, we use an inverse probability weighting methodology to estimate the impact of a change in the exchange rate regime. In the first step, we use our estimated credibility parameter, lagged inflation, and real GDP growth rates to predict pegs in the exchange rate regime. We find that higher inflation and lower real GDP growth in the previous period together with a low level of credibility predict changes in the exchange rate regime. In the second step, we estimate local projections using as regression weights the inverse of the estimated probability for each episode in the first step.

On average, we estimate a 2.6% persistent reduction in annual inflation and a 4.8% increase in real GDP cumulative growth over 5 years following a pegging episode. We also provide evidence that the effect depends on how credible a country is. If a country is more credible (that is the probability of acting under commitment is higher), the effect of pegging the exchange rate to a stable anchor is reinforced with lower inflation and higher growth.

Literature Review: By revisiting the classical question of whether and how the exchange rate regime matters for countries' economic performance, this paper aims to contribute to two strands of literature. On the empirical side, we contribute to the literature that studies the differences between exchange rate regimes and the effect of pegging and floating episodes. In his seminal work, Mussa (1986) showed that the decision to let the exchange rate regime float freely after the Bretton Woods breakdown not only had an impact on the nominal exchange rate but also on the *real* exchange rate.

In recent work, Itskhoki and Mukhin (2019) reconfirm this finding but emphasize that changes in the exchange rate regime fail to show up in other real macroeconomic variables such as GDP or consumption. Using a sample of the G7 countries excluding Canada plus Spain, they also argue that there is no systematic change of cyclical properties in inflation after a shift of the exchange rate regime.[1] This paper redirects the focus from the cyclical (short-run) properties and the Bretton Woods breakdown episode towards long-run level shifts of macroeconomic variables after different pegging episodes over the last 70 years for 170 countries. We show that inflation and economic growth are persistently affected for non-credible countries after an exchange rate regime change. Harms and Knaze (2021) introduce a new measure of *effective* exchange rate regime classification to assess whether there are effects on inflation. As in our paper, they find that inflation indeed goes down when countries enter a more pegged regime. In line with findings from Levy-Yeyati and Sturzenegger (2003); De Grauwe and Schnabl (2008); Ghosh et al. (2014); Harms and Knaze (2021), we find a negative long-run response of inflation and a positive short-run response of economic growth following a pegging episode.

On the theoretical side, the paper relates to the open economy literature that examines the relationship between exchange rate regimes, credibility, and the economy. We use an estimated multiple-region version of the Chari et al. (2020) model. They set up an open economy model and link it to discretionary monetary policy in the Barro and Gordon (1983) tradition. Models in that tradition point to the signaling content of the regime choice. Governments and monetary authorities that suffer from a credibility deficit can signal their commitment to tough policies by appropriately choosing the exchange rate regime (Giavazzi and Pagano, 1988). Indeed, Obstfeld et al. (2010) show that countries inherit the monetary stance of their corresponding anchor. Such a shift in credibility, as in Schaumburg and Tambalotti (2007) or Debortoli and Lakdawala (2016) is able to mitigate the inflation bias arising from a discretionary monetary authority. In these papers, the shift between non-credible and credible central banks exogenously happens with a certain probability. Our paper takes one step back and asks what determines the probability of discretionary monetary policy in the first place.

Then, we emphasize the gains from commitment for a country by moving towards a pegged exchange rate regime with a credible country. Other papers that discuss the stability of those

[1] They document a significant increase in volatility of inflation after the floating events of Bretton Woods for those countries (Italy, UK) that we classify as non-credible. This is in line with our results, as other credible countries (Germany, Japan) in their dataset do not experience this increase.

exchange rate arrangements focus on trade gains or invoicing complementarities, see Arvai (2021) and Muhkin (2021). The literature that highlights the disconnect between exchange rate regimes and macro fundamentals (originally Meese and Rogoff (1983), Itskhoki and Mukhin (2019) and Corsetti et al. (2021) more recently) focus on short-term real macro fundamentals. Our finding stresses the permanent effect on the level of inflation and the corresponding impact on real variables stemming from such a permanent shift in inflation. This is in line with Froot and Ramadorai (2005) who find that short-term movements of the exchange rate are often disconnected with macro fundamentals while long-term movements indeed show a relationship to fundamentals.

Historically, the global economy's oscillation between pegged and floating exchange rate regimes reflects strategic shifts and credibility challenges. Before the 1971 Bretton Woods collapse, fixed regimes dominated, buoyed by their stability in international trade and monetary policy, a period marked by notable economic growth, especially in OECD countries (Obstfeld, 2020). The post-Bretton Woods era of floating rates highlighted the difficulties in maintaining monetary credibility without a fixed peg, as Rose (2007) discusses regarding inflation targeting as a modern stabilizer. Such transitions underscore the enduring challenge of achieving and maintaining credibility, central to understanding the impacts of exchange rate regimes on economic stability and growth and talk about the importance of looking at both developed and developing economies.

The remainder of this paper is structured as follows. Section 2 introduces the model and derives 3 implications about the economic behavior of countries that move towards a fixed exchange rate regime. Section 3 presents our calibration strategy and the quantitative exercise. Section 4 describes the empirical strategy and presents its results. Section 5 concludes.

2 Model

The model follows closely Chari et al. (2020). Our point of departure is that a central bank acts under discretion and reacts to volatile temptation shocks. These temptation shocks originate from a regional granular level. A country with many regions reacts to the average temptation shock of the country. The degree of diversification of the shocks determines the overall volatility of the country-wide temptation shock. The lower the correlation between temptation shocks, the larger the diversification effect. This means that monetary policy becomes less erratic. We provide country-specific and time-varying estimates of this correlation as a proxy for the credibility of monetary policy.

2.1 Setup

The economy consists of a continuum of regions. Each region produces traded and non-traded goods. Several regions can constitute one country. The traded goods sector is assumed to be perfectly competitive while the non-traded goods sector has imperfect competition and sticky prices. There are two different sources of shocks that hit the non-traded sector on a regional level: A markup (or temptation) shock and a productivity shock. Temptation shocks have a certain correlation structure between regions and occur first. Then non-traded good firms set their prices, afterward productivity is realized, then monetary policy reacts and last the rest of the economy takes place. The timing implies that a discretionary monetary authority has an incentive to use surprise inflation to inflate away inefficient markups. Firms anticipate the attempt of the central bank to inflate and raise their prices for non-traded goods before. In equilibrium, the economy ends up with an inflationary bias. Depending on how well the temptation shock is diversified away on the country level, firms expect a relatively erratic monetary policy if the correlation of shocks is high, or a predictable policy if the correlation is low. The shock correlation between regions can be different, which we interpret as a proxy for the central bank's effective credibility. We first consider how the economy works for one single region and then look how monetary policy operates for country blocks.

2.1.1 Production

Firms are owned by households. Production of traded goods given history s^t is given by

$$Y_T(s^t) = L_T(s^t).$$

Production is linear in labor input $L_T(s^t)$. Traded good firms maximize their profits $P_T\left(s^t\right) L_T\left(s^t\right) - W\left(s^t\right) L_T\left(s^t\right)$. Firms optimally set the price of traded goods $P_T\left(s^t\right)$ equal to the wage $W\left(s^t\right)$. $W(s^t)$ can therefore be replaced by $P_T\left(s^t\right)$.

Production of non-traded goods is subject to two frictions, namely monopolistic markets and rigid prices. This gives rise to markups that increase prices of non-traded goods. A microfoundation for markups can be given by following the setup of Smets and Wouters (2007) which is also described in the Appendix of Chari et al. (2020). The non-traded good is produced by a competitive final producer who uses differentiated inputs $y_N(j, s^t)$ from input firms of mass $j \in [0, 1]$ to produce the final good $Y_N(s^t)$:

$$Y_N\left(s^t\right) = \left[\int y_N\left(j, s^t\right)^{\theta(s_t)} dj\right]^{1/\theta(s_t)}$$

where $\theta\left(s_t\right)$ is the time-varying substitution parameter between the inputs in state s_t. $\theta\left(s_t\right) > 0$ implies that demand for inputs is elastic. If $\theta\left(s_t\right)$ is very close to 1 goods are almost perfect substitutes and firms are not able to use any monopolistic power. The closer $\theta\left(s_t\right)$ is to 0, the more monopolistic power a firm has. In a multiple region version of the model, markup shocks are correlated to each other via the parameter ρ. The final good firm maximizes profits which gives demand for intermediate goods. Intermediate goods are produced by monopolistic firms who use a linear production function: $y_N(j, s^t) = A(s_t)L_N(j, s^t)$. Intermediate good firms choose their prices one period in advance $P = P(j, s^{t-1}, s_{1t})$ to maximize their expected profits. s_{1t} indicates the state when the markup shock has realized for period t, but productivity is still not known. Optimally, intermediate good producer j sets the price on non-traded goods as a time-varying markup over a weighted average of marginal costs. The price equation is not a function of j such that the price is the same for all intermediate firms. Plugging in $W(s^t) = P_T(s^t)$ gives the pricing equation of non-traded goods as a function of prices for traded goods:

$$P_N\left(s^{t-1}, s_{1t}\right) = \frac{1}{\theta\left(s_{1t}\right)} \sum_{s_t} \left(\frac{Q\left(s^t\right) Y_N\left(s^t\right)}{\sum_{\tilde{s}_{2t}} Q\left(\tilde{s}^t\right) Y_N\left(\tilde{s}^t\right)} \right) \frac{P_T\left(s^t\right)}{A\left(s_t\right)}. \tag{1}$$

where $Q(s^t)$ is the discount factor, the price of a state-contingent claim to local currency units at s^t in units of local currency in s^{t-1} and $\frac{1}{\theta(s_{1t})}$ is the markup. This implies that all intermediate firms hire the same amount of labor and their production function is then given by

$$Y_N(s^t) = A(s_t)L_N(s^t).$$

2.1.2 Households

Households derive utility from consumption of traded goods $C_T(s^t)$ and from consumption of non-traded goods $C_N(s^t)$. In addition, they experience disutility from labor $L(s^t)$:

$\sum_{t=0}^{\infty} \sum_{s^t} \beta^t h_t\left(s^t\right) U\left(C_T\left(s^t\right), C_N\left(s^t\right), L\left(s^t\right)\right)$. As in Chari et al. (2020), we specialize preferences as

$$U\left(C_T, C_N, L\right) = \alpha \log C_T + (1-\alpha) \log C_N - \psi L.$$

This specification entails several simplifying assumptions, first, it assumes that the elasticity of substitution between traded and non-traded goods is 1. Second, log-utility in consumption means that the inter-temporal elasticity of substitution is 1 as well. Those assumptions imply that households do not have incentives to borrow or save across countries, as the willingness to substitute goods across time is exactly offset by the willingness to substitute traded goods with non-traded goods. α reflects the weight of traded goods in the overall consumption basket, large values imply that the countries in the economy have a very high degree of trade openness. Finally, the preferences are quasi-linear in labor, which simplifies aggregation results[2]. The budget constraint of households is given by

$$\begin{aligned} &P_T\left(s^t\right)C_T\left(s^t\right) + P_N\left(s^{t-1}, s_{1t}\right)C_N\left(s^t\right) + M_H\left(s^t\right) + B\left(s^t\right) \\ &= P_T\left(s^t\right)L\left(s^t\right) + M_H\left(s^{t-1}\right) + R\left(s^t\right)B\left(s^{t-1}\right) + T\left(s^t\right) + \Pi\left(s^t\right) \end{aligned} \tag{2}$$

where $T(s^t)$ are nominal transfers. $\Pi\left(s^t\right) = P_N(s^{t-1}, s_{1t})Y_N(s^t) - P_T(s^t)L_N(s^t)$ are profits from the traded-goods sectors. As households own the firms in their corresponding country, these profits go to the households. Firms themselves are not traded on international markets. $R(s^t)$ is the interest rate paid on the non-contingent one-period nominal bond in the domestic currency and $B(s^t)$ are the nominal government bonds[3]

[2]Quasi-linear utility eliminates any wealth effects in the demand for money, which makes all agents choose the same amount of money. See Ricardo and Wright (2005)

[3]Compared to Chari et al. (2020), we replaced the price that is paid to buy new bonds with interest rates that are paid on existing bonds.

There is also a cash-in-advance constraint for consumers, that requires domestic money brought from period $t-1$ to be used to purchase traded goods:

$$P_T\left(s^t\right) C_T\left(s^t\right) \leq M_H\left(s^{t-1}\right)$$

Under flexible exchange rates, consumers use their local currency $M_H\left(s^{t-1}\right)$ to pay for these goods. The superscript H denotes the individual holding of money. Domestic money is only held by domestic households. Even though money is dominated by bonds as they pay interest on the existing stock, households need money to buy traded goods. The assumption of cash-in-advance makes surprise inflation costly, as they can only use cash from the last period. In addition, the assumption that only traded goods are affected by this is for simplicity. This assumption can also be interpreted as a trade friction that requires committing a certain amount of cash beforehand when internationally traded goods are bought from a foreign country. Note that current money injection that increases the nominal price of traded goods cannot be used for the cash-in-advance constraint.

The Euler equation can be obtained by combining the home bonds' first order condition with the consumption first order condition. It governs the household's intertemporal decision:

$$\frac{1}{C_N(s^t)} = \beta \mathbb{E}_t\left[\frac{1}{C_N(s^{t+1})}\frac{P_N(s^t)}{P_N(s^{t+1})}R(s^{t+1})\right] \tag{3}$$

The nominal stochastic discount factor is defined as

$$Q\left(s^{t+1}\right) = \beta h\left(s^{t+1} \mid s^t\right) U_N\left(s^{t+1}\right) P_N\left(s^{t-1}, s_{1t}\right) / \left(P_N\left(s^t, s_{1t+1}\right) U_N\left(s^t\right)\right).$$

This discount factor is also used by firms to discount their profits.

2.1.3 Government

The government budget constraint for each country under flexible exchange rates is given by

$$B\left(s^t\right) = R\left(s^t\right) B\left(s^{t-1}\right) + T\left(s^t\right) - \left(M(s^t) - M(s^{t-1})\right),$$

where $M(s^t)$ denotes the money supply in the economy. The last term is seignorage income from the growth in money supply. The initial money supply for each consumer in each country is set to M_{-1} and the initial bond holding B_{-1} is zero. The central bank specifies nominal interest rates, the quantity of debt, and taxes for each country, satisfying the budget constraint. Note that there are no externalities for the central banks. This ensures that monetary policy does not have any incentive to set monetary policy in a non-cooperative way and to use its monopoly on its currency to manipulate the terms of trade.

We show in the Appendix B.1 that the price of bonds in Chari et al. (2020) is simply the inverse of interest rates used here. The model abstracts from international capital markets, as households do not have an incentive to borrow or lend across countries, given the considered preferences.

2.2 Market Clearing and Equilibrium

Labor markets clear, which means that the demand for non-traded goods labor and traded goods labor equals overall labor supply

$$L_N\left(s^t\right) + L_T\left(s^t\right) = L\left(s^t\right).$$

Good markets clear for traded and non-traded goods.

$$C_T\left(s^t\right) = Y_T\left(s^t\right), \quad C_N\left(s^t\right) = A\left(s^t\right) Y_N\left(s^t\right).$$

GDP in this model is defined as the sum of consumption of traded and non-traded goods. Money demand from households $M_H(s^t)$ is met by money supply of the central bank

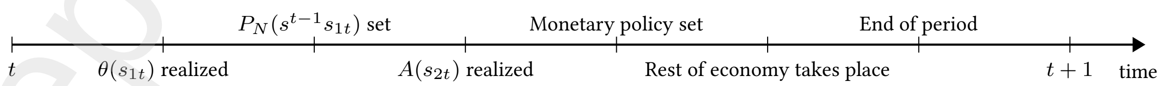
$$M_H\left(s^t\right) = M\left(s^t\right).$$

An equilibrium under flexible exchange rates is defined as an allocation in which 1) consumers behave optimally, 2) firms behave optimally, 3) the government's budget constraint holds, and 4) markets clear.

As the law of one price holds in this model, the bilateral exchange rate can be defined as the price of traded goods in the considered country relative to the price of traded goods in the other country. The nominal exchange rate is fixed for all states in a peg: $e\left(s^t\right) = 1$ and consequently, the price of traded goods is the same everywhere. This means that only aggregate shocks can change the price of traded goods in a peg.

2.3 Monetary Regimes

This subsection discusses monetary policy for a country that consists of $i = \{1, ..., I\}$ regions. For multiple regions, there is a shock correlation structure ρ that determines how much temptation shocks move together. This parameter determines how erratic and credible monetary policy will be. We consider two monetary regimes under discretion: One with independent monetary policy, implying a flexible exchange rate, and another one in which it pegs a currency to an anchor country. The benchmark of monetary policy under commitment can be found in the Appendix B.4. The timing of events is depicted in this chart:



Importantly, discretionary monetary policy moves after firms have chosen their prices. The central bank has an incentive to inflate away inefficient markups.

2.3.1 Float

The central bank acts under discretion and chooses the price of traded goods to maximize an equally weighted average of all regions in the country. The central bank chooses a traded good price for the country taking the non-traded good prices as given and does not commit to pre-announced plans.

The best response of the monetary authority [4] is to set the price of traded goods as a function of productivity realizations A^i and prices of non-traded goods $p_N^i(\rho)$:

$$p_T\left(\left\{A^i, p_N^i\left(\theta^i(\rho)\right)\right\}_i^I\right) = \frac{(1-2\alpha) + \sqrt{(1-2\alpha)^2 + 4\sum_i^I \frac{1}{I}\frac{(1-\alpha)}{A^i}\frac{\psi}{p_N^i(\theta^i(\rho))}}}{\sum_i^I \frac{1}{I}\frac{2(1-\alpha)}{A^i}\frac{1}{p_N^i(\theta^i(\rho))}}, \tag{4}$$

where the denominator captures the willingness of the central bank to put the marginal rate of transformation equal to the average marginal rate of substitution and the numerator captures the costs from surprise inflation. If the average p_N increases by one, p_T increases less than one-to-one. In the following we assume as in Chari et al. (2020) that $\frac{1}{\theta(\rho)} < \frac{1-\alpha}{1-2\alpha}$ so that there is a point where marginal costs of surprise inflation equal their marginal benefits. This simply bounds markups from above, meaning that it is not possible that reducing markup distortions always exceeds the costs of reducing trade goods consumption.

For policy under discretion, it is also important to consider the firms. They take into account that the central bank will try to inflate away their markups. Optimally firms still set prices of traded goods as in (1). Remember that firms observe the markup shock and then set their price taking their expectation for future productivity into account. Overall, the price of traded goods in the equilibrium solves the fixed-point problem of equaling the optimal price firms would set and what the central bank wants to implement. In equilibrium, any attempt of the central bank to inflate away the markup is frustrated, as firms anticipate the central bank's move and set their prices accordingly. The only thing the central bank achieves is an inflationary bias with higher volatility of prices and consumption.

As the central bank reacts to the average price of the non-traded good in the country, the more regions there are and the lower the correlation of markup shocks, the more certain – from an *ex-ante* perspective – monetary policy will be. This means firms have less uncertainty about monetary policy in large countries, or countries with lower shock correlation when setting their prices.

2.3.2 Peg

In a peg, a client country fixes the exchange rate to an anchor country. The monetary stance of the client is therefore exactly the same as in the anchor. An anchor consisting of I^* regions and with shock correlation ρ^* maximizes the average utility of its country. If it focuses

[4] For a derivation, see Appendix B.4.

only on its own citizens, it ends up with a monetary rule, that considers domestic shocks only:

$$p_T\left(\left\{A^{i*}, p_N^{i*}\left(\theta^i(\rho)\right)\right\}_{i^*}^{I^*}\right) = \frac{(1-2\alpha^*) + \sqrt{(1-2\alpha^*)^2 + 4\sum_{i^*}^{I^*} \frac{1}{I^*} \frac{(1-\alpha^*)}{A^{*i}} \frac{\psi^*}{p_N^{i*}(\theta^{i*}(\rho^*))}}}{\sum_{i^*}^{I*} \frac{1}{I^*} \frac{2(1-\alpha^*)}{A^{i*}} \frac{1}{p_N^{i*}(\theta^{i*}(\rho^*))}}, \tag{5}$$

The anchor central bank sets the price for traded goods for the client country as well, without considering its shocks. In a float, both could set their local price of traded goods and let the exchange rate adjust freely.

In the model class considered here, the law of one price for traded goods holds and the only shocks relevant to the welfare of the anchor country originate in the anchor country as well. In an environment, in which the anchor country also consumes goods that are subject to shocks from the client country, a peg could induce the anchor's central bank to react to shock in the client country as well. One way to have such a feature in this model setup is to consider a currency union with country weights λ.

2.3.3 Zero Lower Bound

We also add a Zero Lower Bound to the model which prevents both interest rates from falling below zero and excessive deflation when markups are low.

$$R(s^t) \geq 1$$

This is an important practical limitation for central banks around the world. The implication of a zero lower bound in terms of average inflation is also motivated by the data as large deflation is rarer than large inflation. Theorem 1, 3, and 4 in the next subsection hold independently of the ZLB, but their quantitative implications are re-enforced: As less credible countries have more volatile and erratic monetary policies, the addition of the zero lower bound increases average inflation as the strong deflationary periods are now bounded below. In contrast, more credible central banks hit the ZLB less frequently in the first place, which means that their average inflation rates are not affected. This will be helpful for the quantitative part that estimates a central bank's credibility by matching its inflation rates and the chosen exchange rate regime.

2.4 Overview

This section summarizes key real and nominal variables given the policy rules under different monetary regimes. We derive four implications about the behavior of inflation and economic activity if countries switch their exchange rate regime. In particular, we focus on a situation in which a client country of size I and with shock characteristics ρ switch from a float to an anchor of size I^* and characteristic ρ^*.

For simplicity, we focus on a model solution with productivity such that the cash-in-advance constraint is exactly binding in discretion. First, turn to the nominal variables of the model. Table 1 shows inflation of traded goods:[5]

Table 1: Inflation rate under different regimes for country with correlation ρ

Regime	π_T
Float	$\frac{\beta\alpha}{\alpha-(1-\alpha)(1-\sum_i \frac{1}{I}\theta^i(\rho))}\Theta(\rho')$
Peg	$\frac{\beta\alpha^*}{\alpha^*-(1-\alpha^*)(1-\sum_i \frac{1}{I^*}\theta^{i*}(\rho^*))}\Theta^*(\rho^{*'})$

Notes: Inflation of traded goods (π_T) under all regimes. Client country has size I while the anchor country has I^* regions. Correlation of shocks between regions is given by ρ, values in the next period are indicated by $'$

where $\Theta(\rho') = \frac{\frac{\alpha}{\psi}-\frac{1-\alpha}{\psi}(1-\sum_i \frac{1}{I}\theta^i(\rho))}{\frac{\alpha}{\psi}-\frac{1-\alpha}{\psi}(1-\sum_i \frac{1}{I}\theta^i(\rho'))}$.

The central bank trades off costs of inflation in the form of a binding cash-in-advance constraint with reduced markups. Firms anticipate this attempt and simply raise their prices. In equilibrium, the economy ends up with higher inflation. The size of the inflationary bias depends on $\frac{\alpha}{\alpha-(1-\alpha)(1-\sum 1/I\theta(\rho))}$. Values of that term close to one imply no inflationary bias. This means that larger markups (small θ) correspond to a larger inflationary bias. The larger the trade openness (large α) the lower the inflationary bias is. If there is no markup inflation would be negative and equal to β and the central bank would follow the Friedman (1969) rule. In the presence of markups, however, the central bank is careful not to induce too much inflation that lowers the consumption of internationally traded goods, as those are also important to households. The central bank achieves higher inflation by inducing a positive growth rate for the money supply. The Euler equation then dictates that nominal interest rates have to be higher as well. The first theorem summarizes the implication for the average level of inflation and interest rates when a client country pegs to a more credible anchor country country.

Theorem 1 *If a client country pegs its currency to an equally large anchor country with $I^* = I$ and $\rho > \rho^*$, the average inflation and interest rates fall permanently in the client country.*

The proof uses the fact that inflation is a convex function of markups. The average inflation of a more dispersed markup process is higher than with less dispersion. As the anchor has a lower correlation of shocks, diversification emerges more quickly and the markup process is less dispersed.

Next, we consider how output compares across regimes:

Table 2: Output under different regimes for state s

Regime	Y_T	Y_N
Float	$\left(\frac{\alpha}{\psi}-\frac{1-\alpha}{\psi}\left(1-\sum_i \frac{1}{I}\left(\theta^i(\rho)\right)\right)\right)$	$\frac{1-\alpha}{\psi}\theta(\rho)\left(\sum_i \frac{1}{I}(1/A^i)\right)^{-1}$
Peg	$\left(\frac{\alpha^*}{\psi^*}-\frac{1-\alpha^*}{\psi^*}\left(1-\sum_i \frac{1}{I^*}\left(\theta^{i*}(\rho^*)\right)\right)\right)$	$\frac{1-\alpha}{\psi}\theta(\rho)\left(\sum_i \frac{1}{I^*}(1/A^{i*})\right)^{-1}$

Notes: Output of traded goods (Y_T) and non-traded goods (Y_N) under all regimes.

[5] For a derivation see the Appendix B.4.

In general, the output of traded goods is larger the larger the trade openness α. Large values of disutility from work $\psi > 0$ lower output. Under discretion, Y_T is lower than $\frac{\alpha}{\psi}$, as the central bank follows an inflationary policy. With high inflation, the household's cash in advance constraint is binding such that traded good consumption is lower, implying lower output. Larger markups increase the inflationary bias and hence decrease the amount of traded goods output under discretion. That is, if θ is relatively small. If a country follows a unilateral peg to a more credible anchor, average output will be higher. The following proposition summarizes a testable implication for output under different regimes:

Theorem 2 *If a country pegs its currency to a more credible country, then output volatility of traded and non-traded goods goes down and the average output of traded goods goes up.*

The proof uses the fact that the volatility of $\sum \frac{1}{I}\theta^i(\rho)$ goes down for lower ρ and that average inflation is lower for more credible countries.

Next, we discuss the behavior of inflation volatility. Consider for this the role of $\Theta(s)$ that impacts inflation under discretion: This term adds more volatility in the inflation process. If the markup goes up in the future, inflation of this good increases by a larger amount. If markups are lower than usual, then inflation decreases more than in a setup without this term. It is an amplifier. Together with the higher money growth rate, inflation rates *are higher on average and more volatile* the less stable the aggregate markup process. A peg can ensure that Θ is more stable over time. Region-specific markup shocks vary more than the average of all markup shocks. Therefore, larger countries with lower shock correlation are able to reduce the volatility of inflation because monetary policy is less erratic. For the anchor country, this can matter too if it reacts to shocks of the client country as well. This leads to the third theorem that we can test with the data:

Theorem 3 *If a country pegs its currency to a more credible anchor country, the volatility of inflation goes down.*

Last, we emphasize the relevance of credibility differences between anchor and client in a theorem. This will help us to distinguish the reaction of non-credible countries pegging their exchange rate versus credible countries who peg their exchange rates.

Theorem 4 *The less credible a client country is, the larger the reaction in inflation and output if it pegs to a credible anchor.*

This theorem directly follows from Theorem 1 and 2. The next chapter calibrates the shock process in more detail.

3 Calibration and Results

We use the simulated method of moments to calibrate the time-varying credibility parameter, matching inflation moments of Italy and Germany. How well the estimated model matches the data of these two countries is discussed in the second part of this section. As a last step, we extend our credibility measure to a larger set of countries.

3.1 Calibration Strategy

The model seeks to highlight the effects of fixing the exchange rate. Toward that aim, we focus on Germany and Italy between 1950 to today. During this time horizon, both countries went through different exchange rate regimes. Germany is the stable anchor of the European monetary architecture in the North, with relatively low inflation rates. Italy, in contrast, is the largest country of the European southern block that experienced large increases in inflation during the mid-1970s and 1980s. One period in the model corresponds to one year. The calibration proceeds in two steps. First, we calibrate parameters based on long-run moments in the data and the outside literature. Thereafter, taking these as given, we calibrate the process for markup shocks and the correlation of shocks that we interpret as the credibility parameter to match key stylized facts on the properties of inflation for Germany and Italy.

The time discount factor is chosen to replicate a real interest rate of around 2% per year, in line with estimates for European countries by Brand et al. (2018). Next, we choose α, a measure of trade openness, to be 35 % in line with imports over GDP for Germany in 2015. We also consider the impact of smaller values of trade openness in Figure B.1. The trade elasticity and intertemporal elasticity are already chosen to be 1 in the specification of preferences.

Next, we turn to the heart of the calibration, which aims to match cyclical inflation movements in Europe with the evolution of markups and the credibility parameter in the model. We will consider a model under a floating exchange regime and compute its moment. This way, we can assess whether the estimated evolution of credibility is consistent with credibility in the model under different regimes, e.g. whether Italy's credibility indeed approached the German level, when it decided to peg its currency.

The markup process of a single region i fluctuates around a constant mean $\bar{\theta}$, with shocks uniformly distributed with mean zero, while the country-wide average markup is the equally weighted sum of markups with time-varying correlation $\rho(s^t)$:

$$\theta^i(s_t) = \bar{\theta} + C \cdot \epsilon^i(s_t), \quad \theta^I(s_t) = \bar{\theta} + C \cdot \sum_i^I \epsilon^i(\rho_t), \quad \epsilon \sim Uni(-0.5, 0.5), \text{ corr } \rho_t$$

C is a constant that scales up the bounds of the uniforms and affects the maximum and minimum value for markups. Calibrating the parameter ρ_t is crucial, as it determines how well temptation shocks can be diversified away. This impacts average inflation and its volatility over a considered time horizon. The credibility parameter is country-specific and time-varying. We do not focus on the country size I as the main difference between countries, as some small countries are able to have low inflation rates as well. Arvai and Coimbra (2023) show how an increasing number of summed processes is similar to consider different values of shock correlation. Next to the correlation, the average level of markups $\bar{\theta}$ and the volatility governed by C are important too. We calibrate both of these parameters such that the most credible central bank in our model with $\rho = 0$ ends up with an inflation of 2%. For this, we chose an average markup of 1.3%. For reference, most papers estimate markups that are larger, see De Loecker and Warzynski (2012), Christopoulou and Vermeulen (2012), Kuester (2010), and Midrigan (2011). Notwithstanding, the range of estimations varies widely. In our model, relatively low markups already lead to very high inflation values under discretion, see Figure B.1. Therefore, to avoid unreasonably high inflation rates, we aim for a macro-markup of 1.3% for both countries which is lower than what the literature usually chooses. For example, if markups are 0% inflation is -2%, as the Friedman (1969) rule demands. Given the volatility of the shock process, markups can be very low which would imply, absent the ZLB, negative inflation and negative interest rates. A reduced aggregate volatility therefore reduces the likelihood of hitting the lower bound. We also assume shocks to be i.i.d. over time. Central banks with higher correlation experience a lower diversification effect, implying more erratic markups which means higher average inflation rates.

We also impose that the model assumption $\theta > 1-\alpha/(1-2\alpha)$ still holds and also consider country-specific proxies for TFP growth for each country at each point in time, as those impact inflation as well. The simulated method of moments then chooses for every country at each point in time t the appropriate value ρ_t so that the model inflation rate closely matches the realized inflation rate. For further details on how SMM works, see Appendix B.6.1

3.2 Quantitative results for Germany and Italy

Table 3 summarizes the mean estimation, the moments of the data and the moments of the model for Italy and Germany. Temptation shocks for Germany feature a lower correlation implying that the central bank acts less erratic and achieves a lower inflation rate. The credibility of monetary policy (defined as 1 minus the correlation ρ in %) is close to the maximum value of 100%. For Italy, higher average inflation implies lower credibility and a higher correlation of temptation shocks.

Table 3: SMM Calibration

	Italy	**Germany**	**Description**
Parameters			
$1-\rho$	78.89%	95.94%	Mean credibility
$\bar{\theta}$	1.3%	1.3%	Mean markup
C	0.5	0.5	Volatility markup
Moments			
$\mu(\pi)$ data	5.49%	2.52%	Av. inflation 1950-end
$\mu(\pi)$ model	5.59%	2.94%	Av. inflation in the model

Notes: Calibration for Germany and Italy. Data from IMF IFS database.

We zoom into the three main monetary regimes of these countries. The time of floating exchange rates after the Bretton Woods collapse from 1972-1985, the following pegs from 1986-

Table 4: Inflation under all regimes, model and data

		Float (1972-1985)	Peg (1986-1999)	EMU-Peg (2000-end)
		mean	mean	mean
Italy	π data	14.5%	4.5%	1.8%
	π model	14.4%	4.9%	2.3%
	credibility	19.29%	84.69%	98.84%
Germany	π data	4.6%	2.1%	1.4%
	π model	4.8%	2.6%	2.1%
	credibility	85.27%	96.98%	99.82%

Notes: Credibility is defined as 1-ρ, with 100% indicating maximum credibility. Data from IMF IFS database.

1998, and the creation of the Eurozone from 1999 until the end. Table 4 reports the moments of inflation in the model under the three regimes for Italy and Germany. The empirical analog to this table for all countries can be found in the summary statistics Table 5.

For Italy, inflation after the collapse of Bretton Woods was very high, both in the model and in the data. This coincided with a very low credibility level. After Italy pegs its currency to Germany, its central bank becomes more credible, in fact as credible as the German central bank was after the collapse of Bretton Woods. Its inflation rates are also similar on average to the rates of Germany during the time of the float. For Germany in contrast, the time after Italy pegged its currency is characterized by even lower inflation rates, which the model achieves by assigning Germany a substantially more credible central bank for that time period. The creation of the currency union then leads to a substantial reduction in inflation again.

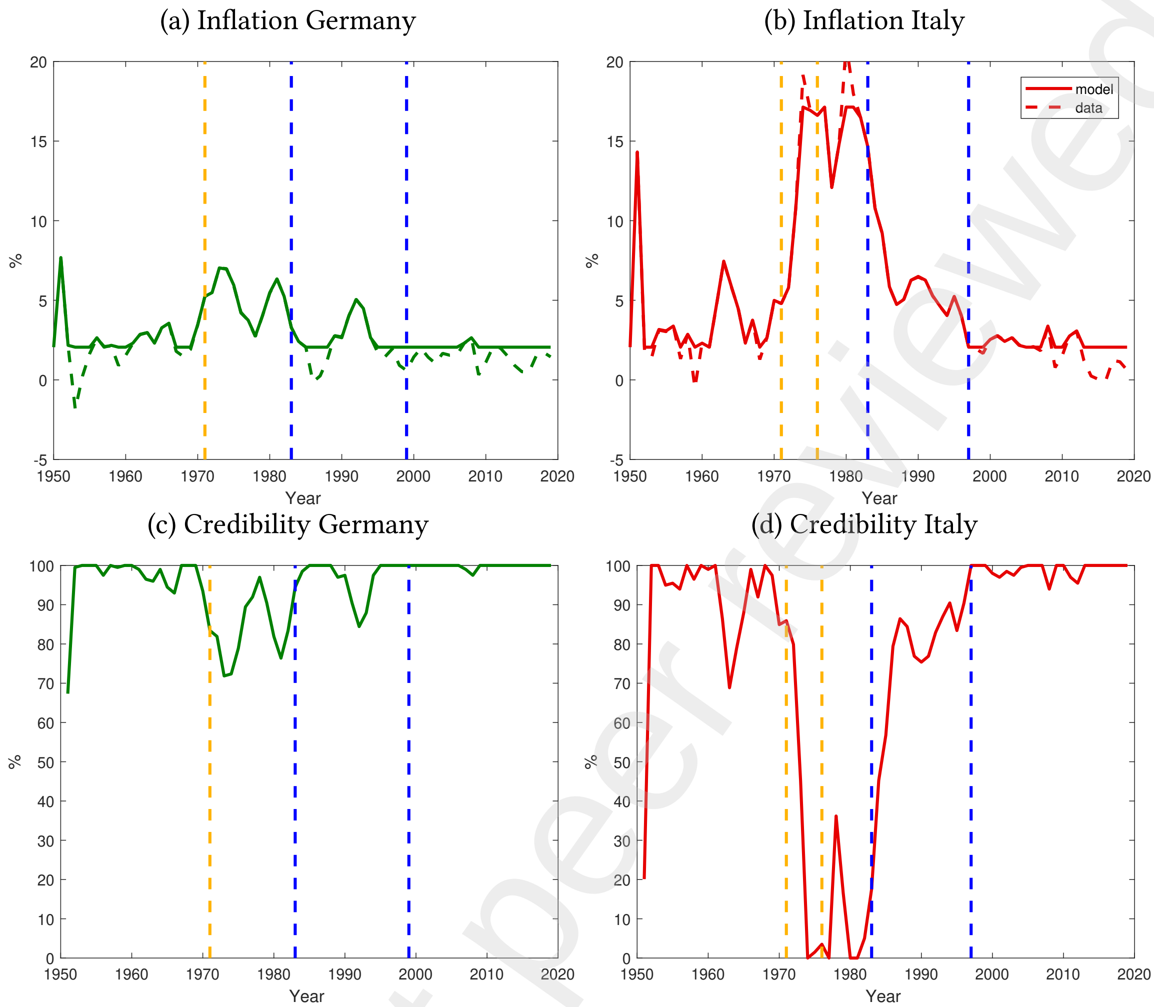
The estimated model suggests that Italy managed to increase its credibility substantially over time. This coincided with moving towards a more fixed exchange rate regime with Germany. The same is however true for Germany, the original anchor. Its monetary authority got more credible as well over time.

Next, Figure 1 displays how the model replicates the evolution of inflation between 1950 and 2019, given the time-varying parameters of credibility for Germany and Italy.

Inflation is well-tracked throughout the sample. Changes in the exchange rate regime precede persistent changes in credibility. When Italy pegs its currency to Germany, its monetary policy becomes more credible and in fact as credible as the one of Germany. The estimated path of ρ_t suggests that this is true. This implies that, whenever we see in the data non-credible countries pegging their currency to a stable anchor, their inflation rates should drop in line with the work from Levy-Yeyati and Sturzenegger (2010). The estimated values for credibility also suggest that even Germany gets more credible when Italy pegs its currency. The model is not able to explain this phenomenon in a unilateral peg where Germany still does monetary policy only for itself.[6] It can however explain a rise in measured credibility when the welfare of the other country is considered. A central bank that is as credible as the German central bank will conduct monetary policy for the average of both countries, which makes the policy less erratic as the central bank only reacts to average shock and not country-specific shocks. In

[6]There are only shocks to the non-traded goods sector. The German central bank does not care about non-traded goods in Italy, as it does not enter the consumption basket.

Figure 1: Inflation and Credibility in the model



Notes: Evolution of inflation (π_N and of credibility $(1-\rho)$ in the data (dashed lines) and in the model (solid line) in panel (a) and (b). The dotted vertical lines indicate floating events (orange) and pegging events (blue).

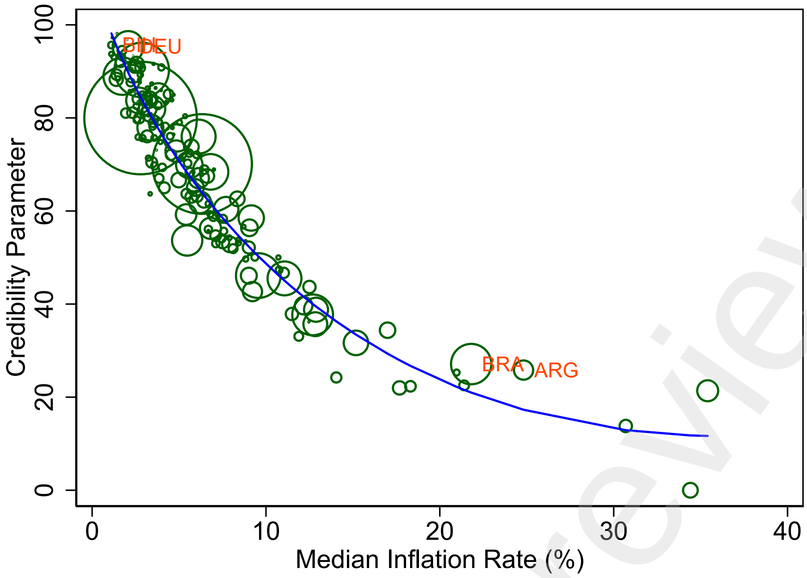
the data, this would mean that inflation is overall less volatile and also a bit lower on average, which is reflected in higher measured credibility.

3.3 Assessing the external validity of the credibility measure

We extend our credibility measure to our dataset covering more than 170 economies between 1950 and 2019. Since our approach aims to match inflation rates well by choosing the appropriate time-varying value for credibility, the measure is strongly correlated with average inflation rates. Figure 2 displays the relationship between our credibility measure and median inflation rates across the countries in our sample.

In general, the model assigns countries with low and stable inflation rates a high credibility score, while assigning lower credibility to high-inflation countries. Large economies such as the United Kingdom are relatively credible on average, though not as credible as low-inflation anchors like Germany or Japan. The model also succeeds in identifying small, credible countries that do not function as anchor currencies, such as Singapore and Switzerland. This credibility measure will help us distinguish the degree of credibility for countries that peg

Figure 2: Relation between credibility measure and median inflation in our sample



Notes: This figure plots the average credibility parameter $(1 - \bar{\rho}_i) \cdot 100$ against the median inflation rate in our historical sample for each country i. The size of the circles represents the population size which is not a predictor of credibility. Our measure of credibility displays a non-linear negative relationship with median inflation in our cross-section. Table A.4 displays the data coverage for each individual country.

their currency to a stable anchor in our empirical analysis.

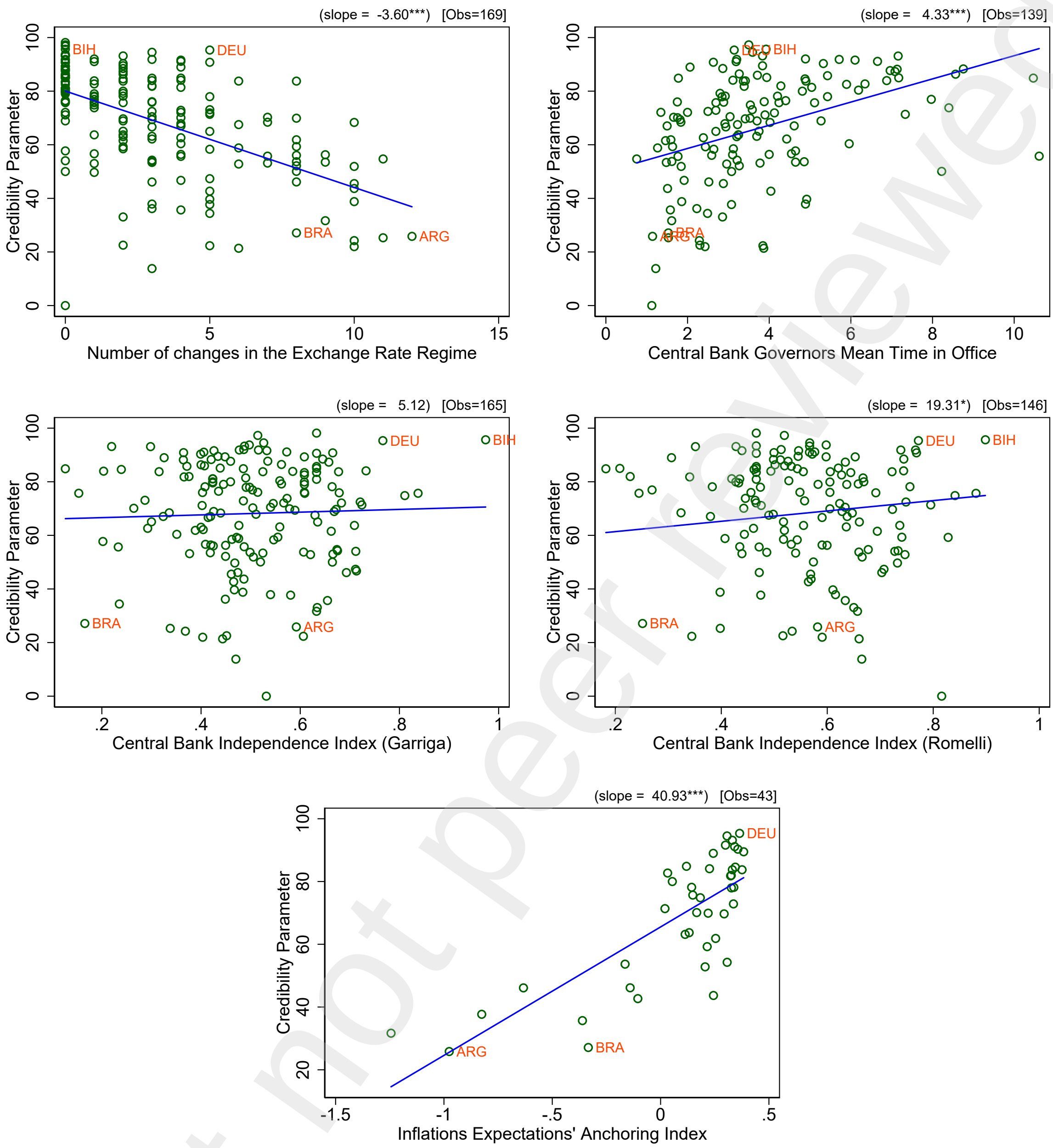
Figure 2 displays the central tradeoff in our analysis: On the one hand, our estimate of credibility correlates with the country's inflation rate, but because of that, on the other hand, we can construct a coherent measure for more countries and a longer time-span. The latter allows us to maximize the number of pegging episodes we study and thus explore more variation compared to a setting where we would use an already established credibility index. It is thus crucial to validate our measure against others used in the literature.

To validate our credibility measure, we compare it against several external indicators that also reflect central bank credibility. Figure 3 shows the relationship between our credibility parameter and various measures including: 1) the number of changes in the exchange rate regime, 2) the mean tenure of central bank governors (Dreher et al., 2008, 2010) 3) central bank independence indices from Garriga (2016) and Romelli (2022), and 4) an inflation expectations anchoring index from Bems et al. (2021). Our credibility measure exhibits the predicted correlations with these external proxies, adding external validity support.

The top-left panel indicates countries with more frequent exchange rate regime shifts tend to have lower credibility scores, as regime instability can undermine policy credibility. The top-right panel shows countries with longer-tenured central bank governors, signaling institutional stability, have higher credibility on average. The middle panels demonstrate our measure aligns with established *de jure* central bank independence indices. Finally, the bottom panel reveals our credibility measure positively correlates with the anchoring of inflation expectations, a key indicator of policy credibility.

The empirical patterns in Figure 3 provide validating evidence that our model-based credibility measure accurately captures the degree of credibility and commitment to low inflation

Figure 3: Validating our credibility measure



Notes: We keep observations that have information for both measures being analyzed in each panel, thus this exercise's goal is not to compare the relative position of each country on the credibility scale but rather whether the credibility measure tracks with external measures. We highlight 4 countries: ARG - Argentina; BIH - Bosnia and Herzegovina; BRA: Brazil; DEU - Germany.

for central banks across our broad country sample. To quantitatively evaluate the quality of our credibility measure, we also examine how it correlates with established external proxies for central bank credibility over time. The results are reported in Appendix Table A.5.

Overall, the consistent patterns of correlations with these five established proxies for central bank credibility and policy commitment provide validating evidence that our model-based credibility measure accurately captures both the cross-sectional and time-varying credibility of monetary authorities. The results bolster confidence in using this measure for the subsequent empirical analysis.

4 Empirical analysis

This section begins by describing the comprehensive global dataset we compiled for our analysis. In addition to presenting the data sources, we provide descriptive statistics and an event study examining the dynamics of inflation, GDP, and interest rates before and after episodes of pegging exchange rates. To test the implications of our model, we augment the dataset with our credibility measure and present reduced-form evidence. We then conduct an econometric analysis using an inverse probability weighted (IPW) estimator to address potential endogeneity concerns, as not all exchange rate regime changes are unexpected or exogenous to the business cycle.

We test the four theorems outlined in the model section. In Section 4.2.1, we investigate the impact of fixing the exchange rate on inflation (Theorem 1) and real GDP growth (Theorem 2). Section 4.2.2 provides the key robustness check to our main analysis where we implement a Local Projections Difference-in-Differences approach to test the first two theorems. Subsequently, in Section 4.3, we assess the impact of a regime change on inflation volatility (Theorem 3) and how a country's credibility affects the response of all three variables to a regime shift (Theorem 4).

4.1 Data

Our analysis is based on an unbalanced annual panel dataset covering 170 economies, including both advanced and emerging market economies, over the past 70 years from 1950 to 2019. The primary data sources are the IMF's International Financial Statistics (IFS) database and the Penn World Table version 10.01 (Feenstra et al., 2015). We supplement these with data from the Macrohistory Database (Jordà et al., 2017) and the macro-financial dataset from Monnet and Puy (2021). The assembled dataset includes variables such as consumer price index, short- and long-term interest rates, real GDP growth, government spending, imports, and exports.[7]

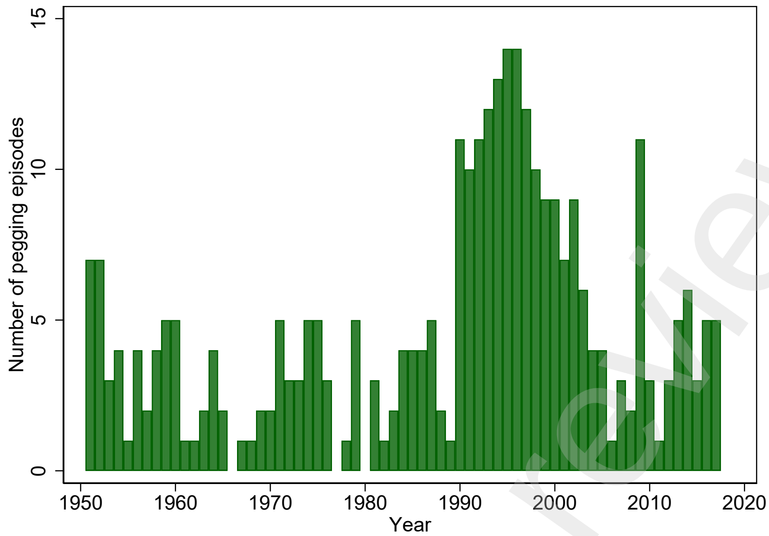
Crucially, we incorporate the exchange rate regime classification from Ilzetzki et al. (2019) subsequently extended to 2019 by Ilzetzki et al. (2022). Their classification identifies the exchange rate regime for each country-year based on both *de jure* and *de facto* criteria at the monthly level. Throughout the study, we rely on their coarse episode classification which arguably identifies significant changes in the regime. We aggregate their monthly level data to annual level data by taking the mode.

To identify exchange rate regime changes, we depart from the annual *de facto* exchange rate arrangement classification. We code a pegging episode when the change was towards a more fixed exchange rate regime from one year to the following, including changes towards a currency union or when there was no separate legal tender. Figure A.1 summarizes the 15 different regimes identified by (Ilzetzki et al., 2019) and how we define the pegging episodes. Figure 4 illustrates when and how many times countries moved towards a more pegged regime

[7]Additional details on variable definitions and sources are provided in Appendix, Table A.1.

over time. We observe a total of 282 pegging episodes.

Figure 4: Frequency of exchange regime changes towards a more fixed regime



Notes: Number of the changes of the exchange rate regime classification from Ilzetzki et al. (2022). Reporting moves towards a peg regime, including a currency union or a no separate legal tender ($N = 282$). Figure A.2 in the Appendix further decomposes this graph between advanced and developing economies.

There is one big wave of pegging episodes during the 1990s explained both by the Euro creation and the dollarization of emerging economies. Nevertheless, there are pegging events almost every year in our sample and such variation is important to motivate our analysis. For consistency, we restrict the empirical analysis to country-year observations with available data on the exchange rate regime, CPI inflation, and real GDP growth, resulting in about 8,000 country-year observations between 1950 and 2019.[8]

4.1.1 Descriptive Statistics

The summary statistics in Table 5 highlight some well-established stylized facts: 1) inflation is higher and more volatile under floating regimes compared to pegs; 2) real GDP growth exhibits similar patterns; 3) interest rates (both short- and long-term) tend to be higher and more volatile under floating regimes.

In the spirit of Eichengreen and Rose (2012), we now revisit our data and perform a descriptive event study exercise in order to analyze how key economic variables varied before and after a peg, thus formalizing the previous results. Table 6 summarizes the mean and the standard deviation of inflation, real GDP growth, short- and long-term interest rates before and after an episode where countries change their exchange rate regime, for the cross-section of countries in our sample that went through at least one such episode.

Table 6 reveals several notable patterns. First, on average, inflation and interest rates decline after adopting a peg. Second, the volatility (within-country standard deviation) of inflation and short-term interest rates decreases under pegs. Third, real GDP growth tends to be

[8] In Appendix, Table A.4 gives more details about our sample coverage including the number of episodes by country.

Table 5: Summary Statistics (unweighted)

	Float		Peg	
	mean	std. dev.	mean	std. dev.
inflation	11.86	12.43	4.81	6.33
Obs	4058		3797	
gdp	4.09	4.64	4.19	5.30
Obs	4058		3797	
Bills	9.89	7.59	4.75	2.70
Obs	1935		1368	
Bond	8.14	3.32	5.53	2.56
Obs	1259		969	

Notes: This table reports the mean, within standard deviation and number of observations of each variable in our sample divided by exchange rate regime. Inflation, real GDP growth, short- and long-run interest rates are all in percent units. According to Ilzetzki et al. (2019) classification, the **Peg** columns comprise countries with no separate legal tender, in currency union, in either a pre-announced peg or currency board arrangement, a pre-announced horizontal band that is narrower than or equal to +/-2%, or a *de facto* peg. The **Float** column comprises countries in all remaining (floating) exchange rate regimes. Figure A.1 summarizes the classification. We only consider country-year observations for which inflation rates and real GDP growth were below 100%. Table A.2 in the Appendix provides further summary statistics when weighting the importance of a country by its population size.

Table 6: Event Study

	Peg			
	mean		std. dev.	
	pre	post	pre	post
CPI inflation	17.55	10.12	15.30	8.72
Real GDP	3.41	4.73	4.65	3.51
Bills	12.96	10.21	8.65	5.29
Bond	8.96	8.00	2.49	3.10

Notes: This table presents both the mean and the within standard deviation of the four macroeconomics series (inflation, real GDP growth, short-term and long-term interest rates) before and after pegging the exchange rate, according to Ilzetzki et al. (2019) classification. We only consider country-year observations for which inflation rates and real GDP growth were below 100%. For completeness, we present the event study figures for this exercise in Appendix, Figure A.3.

slightly higher and less volatile following the adoption of a peg.

4.2 Testing the Theorems: Effects of Pegging the Exchange Rate

To estimate the impact of pegging the exchange rate, we need to compare two counterfactual scenarios: one where a representative country in our sample changes its exchange rate regime and another where it does not. If the decision to change the regime were random, it would be sufficient to compare the average performance of changers to non-changers. However, most countries do not randomly decide to peg their currency.

Within our dataset's time horizon, two well-studied episodes offer quasi-random variation. First, the United States unilaterally terminated the convertibility of the US dollar to gold on August 15, 1971. This event effectively led to the collapse of the Bretton Woods agreement, forcing countries to change their exchange rate regimes (Bordo and Eichengreen, 2019). While some countries were compelled to immediately float their currency, others decided to peg to another anchor currency, with the German Mark being the preferred choice (Ilzetzki et al., 2019).

The second episode was the creation of the Euro. Eurozone accession was driven primarily by political rather than economic factors (Feldstein, 1997). In fact, many economists believed that countries adopting the Euro would face economic losses due to not satisfying the requirements of an Optimum Currency Area (Jonung et al., 2009). This belief was later corroborated by recent works by Puzzello and Gomis-Porqueras (2018) and Gabriel and Pessoa (2024). Nevertheless, not all events in our sample can be considered as good as random.

We acknowledge that some pegging decisions in our dataset are more endogenous than others. To address this issue, we explicitly model the endogenous decision process and account for it in our estimation. By modeling the pegging episodes, we can reverse-engineer the decision process and re-balance the sample "as if" it were taken at random. To achieve this, we employ the inverse probability weighting methodology.

4.2.1 Inverse Probability Weighting Methodology

Policymakers may choose a fixed exchange rate regime due to current economic circumstances or to achieve specific economic outcomes, such as lower inflation. Such changes in the regime cannot be considered exogenous and are therefore uninformative in inferring the causal effects of adopting a fixed regime. For example, our model suggests that policymakers aiming to maximize their citizens' welfare would opt for a fixed regime if their central bank's credibility is low.

To estimate the causal response, we employ an inverse probability-weighted regression-adjusted (IPWRA) estimator, which gives more weight to events that are difficult to predict based on observable macroeconomic variables and less weight to instances related to those same factors. This estimator re-balances the sample to mimic a setting where the pegging decision is closer to random. Such methods have been applied to study not only the effect of exchange rate regime changes on foreign direct investment (Cushman and De Vita, 2017) but also other macroeconomic topics, such as the economic response to austerity (Jordà and Taylor, 2016), sovereign defaults (Kuvshinov and Zimmermann, 2019), and macroprudential policy changes (Richter et al., 2019). We follow the notation established in the latter work throughout the rest of the empirical section.

Let $d_{i,t}$ be a dummy variable that takes the value 1 if there was a pegging episode and zero otherwise. The estimation proceeds in two stages. In the first stage, we model the decision by estimating a propensity score for each observation in our sample. This score is obtained by a logit model, which estimates the probability of a peg as follows:

$$log\left(\frac{P[d_{i,t}=1|Z_{i,t-1}]}{P[d_{i,t}=0|Z_{i,t-1}]}\right)=c_i+\beta Z_{i,t-1}+\varepsilon_{i,t} \tag{6}$$

where $Z_{i,t-k}$ is a vector of macroeconomic controls at time $t-1$ and $t-2$ to control for business cycle fluctuations. We include the lagged growth rates of real GDP, trade openness, government consumption, and CPI inflation.[9] Instead of country-fixed effects, we include a time-invariant credibility measure $c_i=(1-\bar{\rho}_i)100$, as explained in Section 3.3. Growth rates are computed as log differences to avoid results being driven by extreme values. Moreover, we exclude observations where the lagged absolute value of inflation was above 100%. The probability of pegging the currency is referred to as the propensity score, and its estimate from Equation (6) is denoted by $p_{i,t}$. Appendix Table A.6 presents the results of our first stage. We report results using logit, but using probit yielded very similar results, consistent with the discussion in Caliendo and Kopeinig (2008).

In the second stage, we estimate local projections using regression weights given by the inverse of $p_{i,t}$. The weights are defined as $w_{i,t}=\frac{d_{i,t}}{p_{i,t}}+\frac{1-d_{i,t}}{1-p_{i,t}}$, where $w_{i,t}$ is truncated at 10. Inverse propensity score weighting assigns more weight to observations that were difficult to predict, aiming to re-randomize the treatment. In our application, this implies placing more weight on pegging episodes that were more likely taken as a surprise based on observable macroeconomic variables and less weight on more predictable changes.

For example, when evaluating the impact of pegging a currency, we give more weight to Spain's *de facto* peg to the Deutsche Mark in 1994 and less weight to Ukraine's *de facto* peg to the US dollar in 2000. This reflects the economic crisis experienced by Ukraine during that time, which motivated its peg to the US Dollar, while Spain's decision to peg to the Deutsche Mark was driven more by political considerations to join the Euro than by economic factors. Consequently, we assign lower weights to changes driven by economic goals and higher weights to events not primarily motivated by economic reasoning. A detailed table with the highest weighted events can be found in Table A.7.

Once the sample is re-balanced, the impact of a regime change is measured as its "average treatment effect", which is the average difference in potential outcomes between changers and non-changers across the sample. Potential outcomes are computed using a conditional local

[9]The choice of control variables follows the work of Poirson (2001). To maximize the number of studied episodes and observations, we do not include other important control variables such as short- and long-term interest rates and the standard deviation of the 12-month exchange rate against the US dollar.

projection forecast over a 5-year horizon (Jordà, 2005). To implement the second stage, we run the following specification using weighted least squares:

$$\Delta_h y_{i,t+h} = c_i^h + \gamma_t^h + \Gamma^h d_{i,t} + \phi_h Z_{i,t-k} + \epsilon_{i,t+h}, \quad \forall h \in \{0, ..., 5\} \tag{7}$$

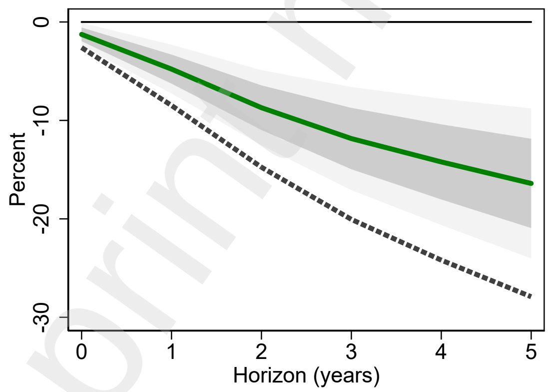
where $\Delta_h y_{i,t+h} = \log(y_{i,t+h}) - \log(y_{i,t-1})$ is the conditional forecast of the cumulative growth in percent of one of the outcome variables (real GDP or the price level) in country i between base year $t-1$ and year $t+h$ over varying prediction horizons $h = 0, 1, ..., 5$ years. $d_{i,t}$ is the treatment dummy variable, taking a value of 1 whenever there is a pegging episode, and thus Γ^h is our coefficient of interest.

We include a rich set of covariates in each specification, including the country-specific credibility parameter c_i^h and time-fixed effects γ_t^h. Moreover, we include $Z_{i,t-k}$, which is a vector consisting of 2 lags of real GDP growth, inflation, trade openness, and government consumption, the same set of controls as in equation (6). Finally, $\epsilon_{i,t+h}$ is the error term, and the standard errors are clustered by country. This procedure assigns a higher weight to the treated observations that were less likely to be treated based on this analysis, i.e., those observations with very low probabilities. Further details on the methodology can be found in Jordà and Taylor (2016). To test Theorems 1 and 2, we estimate equation (7) for the percent change in the price level and real GDP, approximated by taking log differences.

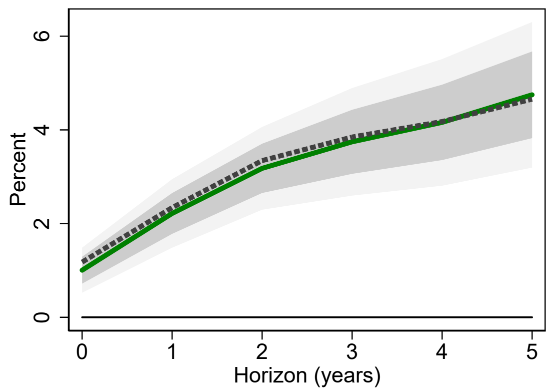
Figure 5 presents the main results and provides evidence in favor of the first two theorems. To put our findings in perspective, we estimate Equation (7) using both weighted least squares (WLS) and ordinary least squares (OLS). This approach allows us to evaluate the correction of the expected bias.

Figure 5: IPWRA Results of a pegging event

(a) Cumulative price level change



(b) Cumulative real GDP change



Notes: The figure shows the impulse response functions for the price level and real GDP growth rates in percent over time, after a pegging episode. The impulse responses compare the cumulative response of the price level and GDP relative to a counterfactual country that did not peg its currency, i.e., the price level after 5 years is around 17.5% lower than for a country that did not peg its currency. Equation (7) has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from specification (6). The (dark) gray shaded areas indicate a confidence interval of (68%) 90%. The black dashed line shows the OLS estimates. Figure A.6 presents the non-cumulative responses.

The estimates in Figure 5 suggest that pegging episodes have significant and persistent effects on both the price level and real GDP. Adopting a fixed exchange rate regime leads to an average 16.4% decline in the price level – about 2.6% per year lower inflation – and a 4.8% increase in real GDP over the 5 years, with the bulk of the GDP growth occurring in the first three years. It is important to note that these measurements are cumulative over a 5-year horizon and both effects are relative to the no-change policy counterfactual. Thus, a decreasing price level does not necessarily imply that a country experienced deflation after a pegging event, but rather that the observed inflation rates are lower than those of the no-change policy counterfactual.

For the price level response, the OLS estimate (dashed black line) displays a stronger reaction than the IPWRA estimate. This suggests that, unsurprisingly and according to our first-stage estimates, countries with large inflationary bias are more likely to peg their exchange rate regime. Our IPWRA approach corrects for such bias by giving more weight to episodes in countries that are more stable but still alter their exchange rate regime.

In the Appendix, Figure A.5 displays the response of the short-run interest rate to each of the studied episodes. The unambiguous responses show an increase (decrease) in short-run interest rates of 200 basis points following a floating (pegging) episode. The interest rate response thus moves in parallel with the inflation rate when the exchange rate regime is altered towards a fixed or floating arrangement, as evident from the non-cumulative price level responses in Figure A.6. This finding aligns with the results of Schmitt-Grohe and Uribe (2021), who observe that interest rates and inflation move in parallel when a permanent monetary policy shock occurs.

In summary, we find supporting evidence for Theorems 1 and 2. We provide empirical evidence of a decrease in inflation and an increase in output following a pegging episode, even when accounting for the non-randomness of exchange regime changes by employing an inverse probability weighted regression-adjusted estimator.

4.2.2 Local Projections Difference-in-Differences

As highlighted by Goodman-Bacon (2021), a two-way fixed effects estimator may not be appropriate when already treated units act as controls, which is likely in our context given the time-varying nature of changing exchange rate regimes. For instance, Ghana and Argentina changed regimes 12 times in our sample. Moreover, recent literature on difference-in-differences (DiD) has shown that even if the parallel trends assumption holds, negative weight bias can arise due to unclean comparisons.

To address these concerns, we employ a local projection difference-in-differences (LP-DiD) approach, recently proposed by Dube et al. (2023). The LP-DiD method estimates dynamic treatment effects by running separate regressions for each time horizon relative to the treatment event, using a "clean control" condition to define appropriate treated and control units. This approach allows for the estimation of the average treatment effect on the treated (ATT) at each time horizon without imposing restrictions on treatment effect dynamics. Formally, we estimate the following LP-DiD specification:

$$\frac{y_{i,t+h} - y_{i,t-1}}{y_{i,t-1}} = \beta^k \mathcal{I}(\Delta D_{i,t}) + \alpha_i^k + \delta_t^k + \epsilon_{i,t}^k \quad \text{for } k \in \{-2, ..., 5\} \tag{8}$$

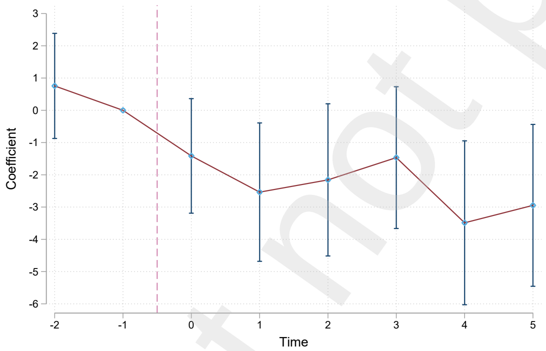
where the dependent variable y is either the price level or the real GDP. $\mathcal{I}(\Delta D_{i,t})$ is an indicator variable taking the value of one if country i adopts a peg regime in year t and zero otherwise. We add both country and year-fixed effects to the estimation, which we run for horizons k between -2 and 5 years after the treatment. We restrict the sample to countries that are either:

$$\begin{cases} \text{newly treated} & \Delta D_{i,t} = 1, \\ \text{or clean control} & \Delta D_{i,t+h} = 0 \quad \text{for } h = \in \{-2, ..., 5\} \end{cases}$$

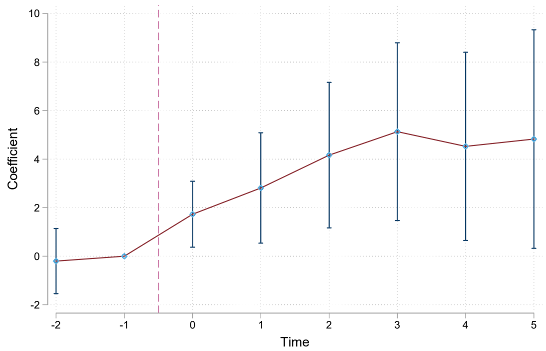
The key assumption is that the trend in the outcome variable for both treatment and control units during the pre-treatment period is similar. In other words, in the absence of treatment, the average change in the response variable would have been the same for both the treatment and control groups. We explicitly test for it by including pre-event years in the estimation horizon k. We moreover ensure a clean control condition by only using as controls countries that did not change their exchange rate regime 2 years before or 5 years after the treatment, toward a more fixed or a more flexible regime. Results follow.

Figure 6: LPDID Results of a pegging event

(a) Cumulative price level change



(b) Cumulative real GDP change



Notes: The figure shows the LP-DID for the price level and real GDP growth rates in percent over time, after a pegging episode and compares the cumulative response of the price level and GDP relative to a counterfactual country that did not peg nor float its currency. Equation (8) has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from (6). Bands indicate a confidence interval of 95%.

The LP-DiD results, presented in Figure 6, provide strong evidence in support of the theoretical predictions regarding the impact of pegging events on price levels and real GDP growth. The cumulative response functions show that adopting a fixed exchange rate regime leads to a significant and persistent decline in the price level and an increase in real GDP relative to a counterfactual scenario without policy intervention. While the price level after is around 2.4% lower real GDP growth is about 3.5% higher, five years after the fixing the exchange rate.

It is important to note that these estimated effects are relative to a counterfactual scenario in which no policy change occurs. The declining price level does not necessarily imply that countries experience outright deflation after pegging, but rather that the inflation rates are lower than they would have been in the absence of the regime change.

The LP-DiD estimates are qualitatively consistent with the first-stage results discussed earlier, which showed that lower credibility is associated with a higher probability of adopting a pegged exchange rate regime. By giving more weight to episodes in countries with greater economic stability and fewer regime changes, the LP-DiD approach helps in correcting the potential selection bias arising from the fact that countries with larger inflationary pressures may be more likely to change their exchange rate regime. The latter is more pronounced in the inflation response as the real GDP response is smaller but closer to our baseline estimates.

The coefficient attenuation on the price level response hints at the credibility channel operating via the gains from commitment. Less credible countries benefit from lower inflation and higher real growth when pegging compared to their more credible peers given more weight in this exercise.

4.3 Gains from Commitment: Testing the Credibility Mechanism

To test Theorem 3, we estimate our baseline Equation (7) with a different dependent variable. We use the difference in the volatility (standard deviation) of inflation in the 5 years preceding the adoption of the new exchange rate regime compared to the 5 years after as our key dependent variable.

To test Theorem 4 – "response of inflation, output, and inflation volatility varies with the degree of credibility" – we add an interaction term between the main variable of interest and the credibility measure derived from our model according to Section 3.3. To ensure consistency across dependent variables, we consider a five-year window and adapt Equation (7). Specifically, we estimate:

$$\Delta y_{i,t+5} = \Gamma d_{i,t} + \Omega d_{i,t} \times c_i + \omega c_i + \phi Z_{i,t-k} + \gamma_t + \epsilon_{i,t} \quad (9)$$

where $\Delta y_{i,t+5} = \log(y_{i,t+5}) - \log(y_{i,t-1})$ is the conditional forecast of the cumulative growth in percent of one of the outcome variables (real GDP or the price level) in country i, or $\Delta y_{i,t+5} = \frac{std(\pi_{i,t+1:t+5}) - std(\pi_{i,t-4:t})}{std(\pi_{i,t-4:t})}$ for the inflation volatility variable. c_i is the average credibility parameter as presented in section 3.3. The coefficient of interest is Ω, which will test Theorem 4 and reveal whether countries with different credibility profiles react differently to a change in the exchange rate regime.

Let us recall the main hypothesis derived from our model: Less credible countries benefit more from pegging to a credible anchor country. By definition, in our sample, all anchor countries are credible countries, or at least more credible than the pegging country. Thus, our hypothesis implies that the Ω coefficient should display the opposite sign of the Γ coefficient. Table 7 presents the key results of this exercise.

Table 7 presents evidence supporting Theorem 4. Columns 1 and 3 reproduce our findings for the 5-year horizon in Figure 5, while column 4 qualitatively supports Theorem 4 from our

Table 7: The Credibility Channel Effects

	Real GDP		Price Level		Inflation Volatility	
	(1)	(2)	(3)	(4)	(5)	(6)
Peg (Γ)	4.75	8.95	-16.40	-69.65	-0.92	-4.28
	(0.93)	(3.62)	(4.54)	(15.78)	(0.39)	(1.66)
Interaction (Ω)		-0.07		0.84		0.05
		(0.05)		(0.20)		(0.02)
Observations	6,650	6,650	6,590	6,590	5,218	5,218

Notes: This table presents the results of estimating Equation (9) for the real GDP and price level growth rates and inflation volatility after a pegging episode. Equation (9) has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from specification (6). Standard errors are clustered at the country level and are reported in parentheses.

model. We find that after a pegging episode, for each additional point in the credibility index, the price level decreases by 0.84% less after 5 years compared to a counterfactual scenario of no policy intervention. These numbers align well with the model presented in Section 2. This implies that the more credible a country is, the smaller the price level response to a pegging event. The main policy implication of this paper stems from this finding: less credible countries benefit the most from committing to a fixed exchange rate regime.

The results in columns 2 and 4 reconcile our findings with those of Itskhoki and Mukhin (2019), who find no macroeconomic effects of changing the exchange rate regime. They focus on the United States (a country with medium credibility according to our dataset) and a composite of countries consisting of Germany and Japan (both credible) as well as Italy and Spain (both less credible). The composite exhibits no substantial effects when changing the regime given their high level of credibility.

Columns 5 and 6 provide empirical evidence supporting Theorem 3. The standard deviation of inflation decreased by 0.92% after a pegging episode. Moreover, the interaction term in column 6 is positive and statistically significant, implying that the less credible a country is, the bigger the reduction in inflation volatility.

5 Conclusion

We provide novel evidence on the potential gains from committing to a fixed exchange rate regime, emphasizing the importance of a country's credibility in realizing these gains. Our findings suggest that adopting a currency peg can be an effective tool for countries grappling with persistently high inflation stemming from a lack of central bank credibility. By anchoring their monetary policy to a more credible currency, these economies can achieve a substantial and lasting reduction in inflation rates. Notably, we estimate that low-credibility countries like Italy and Spain were able to lower their annual inflation by several percentage points after joining fixed exchange rate arrangements, such as the European Monetary Union.

Moreover, we document that this disinflationary impact is accompanied by a temporary boost in real economic growth, as the costs associated with high inflation subside. This result aligns with the predictions of our theoretical model, which highlights how the commitment mechanism of a fixed exchange rate regime can mitigate the inflationary bias arising from discretionary monetary policy. By inheriting the credibility of the anchor country's central bank, the pegging nation can more effectively anchor inflation expectations and reduce the volatility of both inflation and output.

Our findings also contribute to resolving the apparent disconnect between exchange rate regime changes and macroeconomic outcomes documented in previous literature. By distinguishing between countries based on their initial credibility levels, we reconcile the evidence of substantial effects for non-credible countries with the more muted responses observed among their credible counterparts. This heterogeneity underscores the importance of accounting for a country's institutional characteristics when evaluating the potential impact of exchange rate policies.

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Appendix A Data and Empirics

Table A.1: Data Description

Variable Name	Definition	Sources
Bills	Treasury Yields, Percent per annum	IMF, JST
Bond	Long-Term Government Bond Yields, Percent per annum	IMF, JST, MP
CPI	Consumer Price Index of All Commodities	IMF
ERA	Exchange Rate Agreement	Ilzetzki et al. (2022)
Exchange Rate	National Currency to German Mark	Bundesbank
GDP	Real Gross Domestic Product Real	Penn World Table
Gov	Government Consumption	Penn World Table
Trade	Total value of imports and exports	Penn World Table
Population	Number of Inhabitants	IMF, Penn World Table

Notes: This table reports the data sources for our sample. IMF stands for the International Monetary Fund, International Financial Statistics (IFS) database and the Penn World Table corresponds to the version 10.0 (Feenstra et al., 2015). JST stands for the Macrohistory Database (Jordà et al., 2017) while MP for the Macro-financial dataset from Monnet and Puy (2021).

Table A.2: Summary Statistics (weighted by population size)

	Float		Peg	
	mean	std. dev.	mean	std. dev.
inflation	9.91	11.92	4.74	6.37
Obs	4058		3797	
gdp	4.57	3.77	5.15	3.93
Obs	4058		3797	
Bills	8.40	8.15	4.08	3.40
Obs	1935		1368	
Bond	7.52	3.44	5.38	2.71
Obs	1259		969	

Notes: This table reports the mean, within standard deviation and number of observations of each variable for our sample divided by exchange rate regime and weighted by the population size. According to Ilzetzki et al. (2022) classification, **Peg** columns comprise countries in either a pre-announced peg or currency board arrangement, a pre-announced horizontal band that is narrower than or equal to +/-2%, a *de facto* peg and countries with no separate legal tender or in currency union. Finally, the **Float** columns comprise countries in all remaining exchange rate regimes.

Table A.3: Average Duration of Exchange Rate Regimes

	Float	**Peg**
Average Duration (years)	24.2	20.5

Notes: This table reports the average duration of each exchange rate regime in years in our sample, according to the Ilzetzki et al. (2022) classification.

Table A.4: Episodes and Data Coverage

Country	Peg	Float	Begin	End	Country	Peg	Float	Begin	End	Country	Peg	Float	Begin	End	Country	Peg	Float	Begin	End
Albania	4	1	1991	2019	D.R. of the Congo	4	3	1963	2016	Kyrgyzstan	2	0	1995	2019	Russian Federation	3	3	1992	2019
Algeria	1	1	1969	2019	Denmark	2	2	1950	2019	Lao People's DR	3	1	1989	2019	Rwanda	1	1	1966	2019
Angola	2	2	1990	2019	Djibouti	0	0	1979	2019	Latvia	3	2	1991	2019	Saint Kitts and Nevis	0	0	1979	2019
Antigua and Barbuda	0	0	1998	2019	Dominica	0	0	1964	2019	Lebanon	0	0	2008	2019	Saint Lucia	0	0	1965	2019
Argentina	6	6	1950	2019	Dominican Republic	5	5	1950	2019	Lesotho	0	0	1973	2019	Sao Tome and Principe	2	1	1996	2018
Armenia	2	0	1993	2019	Ecuador	6	5	1951	2019	Liberia	1	0	2001	2019	Saudi Arabia	0	0	1963	2019
Australia	0	3	1950	2019	Egypt	1	1	1950	2019	Lithuania	1	0	1991	2019	Senegal	0	0	1968	2019
Austria	3	2	1950	2019	El Salvador	1	2	1950	2019	Luxembourg	0	0	1950	2019	Serbia	2	2	1994	2019
Azerbaijan	2	3	1991	2019	Equatorial Guinea	0	0	1985	2019	Madagascar	3	5	1964	2019	Seychelles	2	3	1970	2019
Bahamas	0	0	1966	2019	Estonia	1	0	1992	2019	Malawi	4	6	1980	2019	Sierra Leone	0	0	2006	2019
Bahrain	0	0	1965	2019	Eswatini	0	0	1965	2019	Malaysia	1	3	1950	2019	Singapore	0	1	1960	2019
Bangladesh	1	0	1986	2019	Ethiopia	2	2	1965	2019	Maldives	1	0	1985	2019	Slovakia	1	1	1991	2019
Barbados	0	0	1966	2019	Fiji	0	1	1969	2019	Mali	0	0	1988	2019	Slovenia	2	1	1980	2019
Belarus	3	2	1992	2019	Finland	2	2	1950	2019	Malta	2	1	1950	2019	South Africa	1	3	1950	2019
Belgium	1	0	1950	2019	France	5	3	1950	2019	Mauritania	1	0	1985	2019	Spain	3	1	1950	2019
Benin	0	0	1992	2019	Gabon	0	0	1962	2019	Mauritius	3	2	1963	2019	Sri Lanka	3	3	1950	2019
Bhutan	0	0	1980	2019	Gambia	4	2	1961	2019	Mexico	3	5	1950	2019	St. Vincent Grenadines	0	0	1974	2019
Bolivia	6	4	1950	2019	Georgia	2	1	1994	2019	Mongolia	1	2	1992	2019	Sudan	3	3	1951	2019
Bosnia and Herzegovina	0	0	2005	2019	Germany	3	2	1950	2019	Montserrat	0	0	2001	2019	Suriname	4	5	1954	2017
Botswana	0	1	1974	2019	Ghana	5	7	1964	2019	Morocco	2	1	1950	2019	Sweden	3	3	1950	2019
Brazil	4	4	1950	2019	Greece	3	2	1950	2019	Mozambique	2	1	2004	2019	Switzerland	1	2	1950	2019
Brunei Darussalam	0	0	1980	2019	Grenada	0	0	1976	2019	Myanmar	5	5	1950	2019	Syrian Arab Republic	1	1	1950	2012
Bulgaria	2	0	1985	2019	Guatemala	2	2	1950	2019	Namibia	0	0	2002	2019	Tajikistan	1	0	2000	2016
Burkina Faso	0	0	1958	2019	Guinea	1	1	2004	2019	Nepal	2	2	1964	2019	Thailand	2	1	1950	2019
Burundi	1	4	1965	2019	Guinea-Bissau	1	1	1987	2019	Netherlands	3	1	1950	2019	Togo	0	0	1966	2019
Cabo Verde	0	0	1983	2019	Guyana	1	0	1994	2019	New Zealand	0	1	1950	2019	Trinidad and Tobago	0	0	1952	2019
Cambodia	2	0	1994	2019	Haiti	2	4	1953	2019	Nicaragua	0	0	1999	2019	Tunisia	0	0	1983	2019
Cameroon	0	0	1968	2019	Honduras	4	3	1950	2019	Niger	0	0	1963	2019	Turkey	5	5	1950	2019
Canada	0	2	1950	2019	Hungary	2	1	1972	2019	Nigeria	5	5	1953	2019	U.R. of Tanzania: Mainland	2	3	1965	2019
Central African Republic	0	0	1980	2019	Iceland	3	4	1950	2019	North Macedonia	2	0	1993	2019	Uganda	1	0	1993	2019
Chad	0	0	1983	2019	India	1	3	1950	2019	Norway	1	1	1950	2019	Ukraine	2	3	1992	2019
Chile	5	5	1950	2019	Indonesia	5	3	1957	2019	Oman	0	0	2000	2019	United Arab Emirates	0	0	2007	2019
China	2	0	1986	2019	Iran	5	5	1950	2019	Pakistan	3	4	1950	2019	United Kingdom	1	2	1950	2019
China, Hong Kong SAR	1	0	1981	2019	Iraq	2	1	1950	2019	Panama	0	0	1950	2019	United States	0	2	1950	2019
China, Macao SAR	0	0	1988	2018	Ireland	1	1	1950	2019	Paraguay	3	5	1950	2019	Uruguay	5	6	1950	2019
Colombia	2	3	1950	2019	Israel	3	5	1951	2019	Peru	4	3	1950	2019	Venezuela	0	0	2009	2016
Comoros	0	0	2000	2013	Italy	3	2	1950	2019	Philippines	4	4	1950	2019	Viet Nam	0	0	1995	2019
Congo	0	0	1985	2019	Jamaica	4	3	1953	2019	Poland	2	1	1970	2019	Yemen	2	1	1990	2014
Costa Rica	5	3	1950	2019	Japan	2	2	1950	2019	Portugal	2	1	1950	2019	Zambia	1	2	1985	2019
Croatia	3	0	1985	2019	Jordan	2	1	1969	2019	Qatar	0	0	1979	2019	Zimbabwe	0	1	2009	2018
Cyprus	1	1	1950	2019	Kazakhstan	2	1	1993	2019	Republic of Korea	4	4	1950	2019	Anguilla	0	0	1990	2019
Czech Republic	2	2	1991	2019	Kenya	2	2	1959	2019	Republic of Moldova	3	2	1991	2019					
Côte d'Ivoire	0	0	1960	2019	Kuwait	1	1	1972	2019	Romania	2	1	1990	2019					

Notes: Number of the changes of the exchange rate regime classification towards a more Peg or Float regime from Ilzetzki et al. (2022). Data coverage for each country, start and end of the sample for which we have information on the exchange rate regime classification and for the consumer price index.

Figure A.1: De Facto Exchange Rate Arrangement Classification (Ilzetzki et al., 2019, 2022)

Coarse	Fine	
1	1	• No separate legal tender or currency union
1	2	• Pre announced peg or currency board arrangement
1	3	• Pre announced horizontal band that is narrower than or equal to +/-2%
1	4	• De facto peg
2	5	• Pre announced crawling peg; de facto moving band narrower than +/- 1%
2	6	• Pre announced crawling band that is narrower than or equal to +/-2%
2	7	• De facto crawling peg
2	8	• De facto crawling band that is narrower than or equal to +/-2%
3	9	• Pre announced crawling band that is wider than or equal to +/-2%
3	10	• De facto crawling band that is narrower than or equal to +/-5%
3	11	• Moving band that is narrower than or equal to +/-2%
3	12	• De facto moving band +/-5%/ Managed floating
4	13	• Freely floating
5	14	• Freely falling
6	15	• Dual market in which parallel market data is missing.

Pegging Episodes

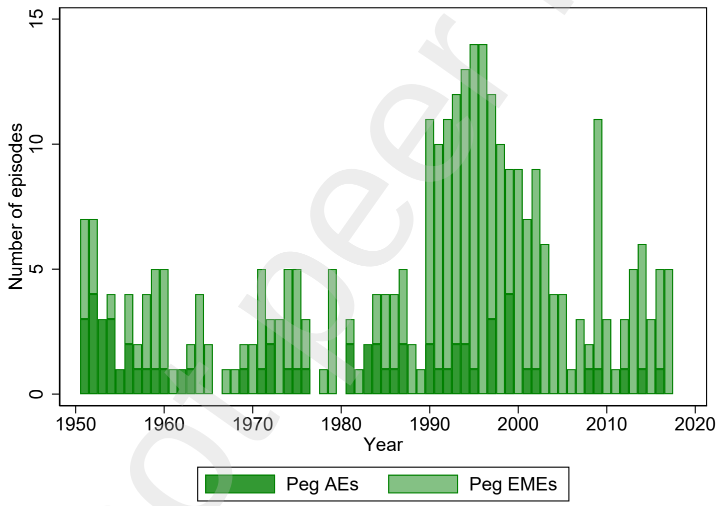
Fine	Coarse
[2:15] -> [1]	[2:6] -> [1]
[5:15] -> [2:4]	[3:6] -> [2]
[9:15] -> [5:8]	[4:6] -> [3]
[13:15] -> [9:12]	

Floating Episodes

Fine	Coarse
[1:4] -> [5:15]	[1] -> [2:6]
[5:8] -> [9:15]	[2] -> [3:6]
[9:12] -> [13:15]	[3] -> [4:6]

Notes: We code a floating episode every time there was a change in the coarse classification towards a more flexible exchange rate regime; a pegging episode when the change was towards a more fixed exchange rate regime.

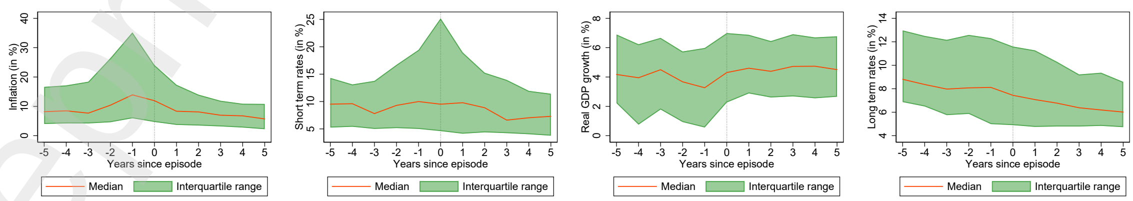
Figure A.2: Frequency of fixed regime changes



Notes: Number of the changes of the exchange rate regime classification from Ilzetzki et al. (2022) where economies move towards a float regime ($N = 282$) decomposed between advanced and developing economies.

Figure A.3: Event study for a pegging episode

(a) Inflation (b) Short interest rate (c) Real GDP growth (d) Long interest rate



Notes: The figure shows the event-study for median inflation and median interest rates in percentage points, and median real GDP growth in percent before and after a pegging episode, when the exchange rate regime becomes more pegged.

A.1 Time-varying credibility measure

To quantitatively evaluate the quality of our credibility measure, we examine how it correlates with established external proxies for central bank credibility over time. We standardize these external proxy variables to range from 0 to 100, similar to our credibility measure. We then regress our credibility measure on each proxy while progressively adding different fixed effects to control for unobserved time-invariant and time-varying factors. The results are reported in Table A.5.

Table A.5: Regression of Credibility

	$\text{Credibility}_{i,t}$		
	(1)	(2)	(3)
ERR change	-0.15***	-0.14***	-0.15***
	(0.01)	(0.01)	(0.02)
# Obs	8,112	8,112	8,112
Avg. Time in Office	0.04***	0.04***	0.04***
	(0.01)	(0.01)	(0.01)
# Obs	5,402	5,402	5,402
CB Independence Index (Garriga)	0.15***	0.15***	0.03**
	(0.02)	(0.02)	(0.02)
# Obs	5,097	5,097	5,097
CB Independence Index (Romelli)	0.17***	0.17***	0.06***
	(0.02)	(0.02)	(0.01)
# Obs	6,267	6,267	6,267
Expectations' Anchoring	0.16***	0.15***	0.14***
	(0.03)	(0.03)	(0.03)
# Obs	877	877	877
Country FE	No	Yes	Yes
Year FE	No	No	Yes

Notes: Columns (1) to (3) show the results from regressing our credibility measure on each proxy of central bank credibility, with the inclusion of different fixed effects. The standard errors are clustered at the country level.

The first proxy variable is the number of changes in the exchange rate regime. Column (1) shows a coefficient of -0.15, indicating that more frequent regime changes are associated with lower credibility scores, likely due to increased policy instability. This negative relationship is highly statistically significant and remains stable around -0.15 even when including country and year fixed effects in columns (2)-(3).

The second variable is the average tenure of central bank governors, which positively correlates with credibility with a coefficient around 0.04 that is highly significant across specifications. Longer gubernatorial tenures signal greater policy consistency and commitment.

The third and fourth variables measure legal central bank independence using indices from Garriga (2016) and Romelli (2022). Higher values on these *de jure* independence metrics are associated with greater credibility, with coefficients ranging from 0.03-0.17 that are statistically significant at the 1% level after controlling for fixed effects.

Finally, the expectations anchoring index from Bems et al. (2021) also exhibits a strong positive relationship with our credibility measure across all specifications, with coefficients around 0.14-0.16.

Overall, the consistent patterns of correlations with these five established proxies for central bank credibility and policy commitment provide validating evidence that our model-based credibility measure accurately captures the time-varying credibility of monetary authorities across countries and time periods.

A.2 Further empirical results

A.2.1 First-Stage IPWRA

Table A.6: First-stage results: Prediction of a change in the Exchange Rate Regime

	Peg		
	GDP	Inflation	Bills
credibility	-0.01***	-0.01***	-0.01
	(0.00)	(0.00)	(0.01)
l1.CPI	5.25***	5.22***	6.21***
	(0.53)	(0.53)	(1.26)
l2.CPI	-5.18***	-5.15***	-6.09***
	(0.52)	(0.53)	(1.22)
l1.rGDP	-3.03**	-3.06**	-3.55
	(1.29)	(1.29)	(2.74)
l2.rGDP	0.17	0.17	3.40
	(1.23)	(1.23)	(3.05)
Pseudo R^2	0.08	0.08	0.06
AUC	0.71	0.71	0.65
	(0.02)	(0.02)	(0.04)
Observations	6,650	6,590	2,624

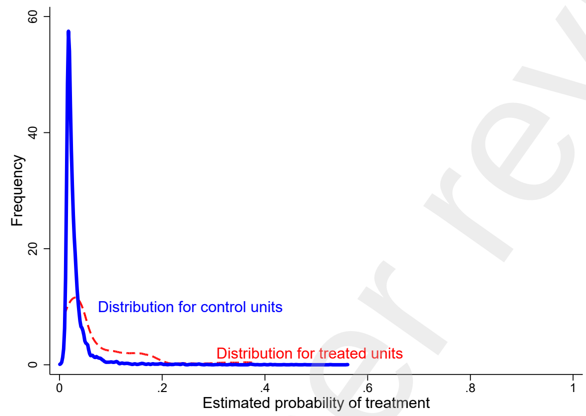
Notes: This table shows logit classification models where the dependent variable is the $d_{i,t}$ dummies for a pegging episode. All controls are lagged growth rates together with the credibility parameter. Clustered (by country) standard errors in parentheses. $^{*}(p < 0.10)$, $^{**}(p < 0.05)$, $^{***}(p < 0.01)$. The difference in coefficients is driven solely by the number of observations for which we have information on each dependent variable, such that it matches the impulse response functions.

Table A.6 presents the results of our first stage. We run logit classification models for the $d_{i,t}$ dummy to account for changes in economic variables relevant to policy making, which could presumably be targeted by a regime change. The results show that higher inflation and lower real GDP growth in the previous period predict a pegging episode. Moreover, we find that less credible countries are more likely to peg their currency, which is reassuring for our approach as our measure of credibility is inversely related to the probability of discretion. Trade openness and government consumption, used as controls, are not found to be good predictors and are thus not reported.

We report the Area Under the Curve (AUC) statistic, which measures a model's ability to correctly sort observations into "episode" and "no episode" bins as combinations of true positive and false positive rates. The AUC provides a summary measure of predictive ability independent of individual cut-off values chosen, taking on a value of 1 for perfect classification and 0.5 for an uninformed classifier or "coin toss" results. Our AUC measures across the models range between 0.65 and 0.71, indicating a significant improvement over a coin toss. For completeness, Figure A.8 plots the estimated probabilities of treatment based on the first stage, differentiating between treated units (red) and control units (blue).

Figure A.4: Treatment propensity score: First-stage results

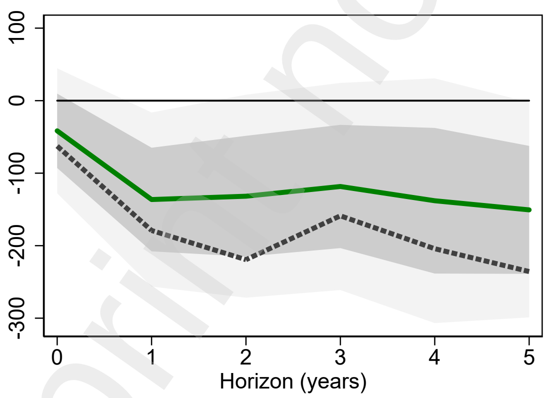
(a) Peg



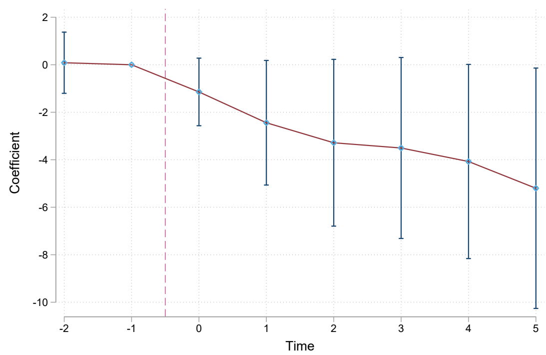
A.2.2 IRFs

Figure A.5: Short-run Interest Rate Responses

(a) IPWRA

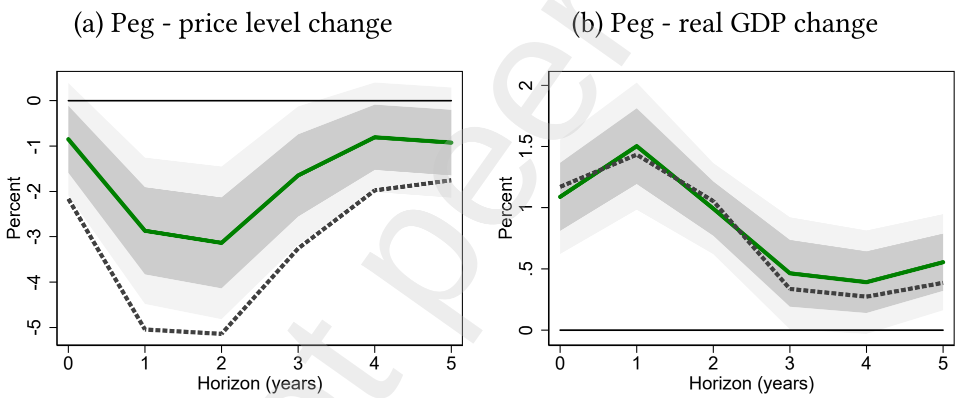


(b) LPDID



Notes: The figure shows the IRFs for the short run interest rate in **basis points** after each of the studied episodes. Equation (7) has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from (6). The (dark) gray shaded areas indicate a confidence interval of (68%) 90%. The black dashed line shows the OLS estimates.

Figure A.6: IPWRA Results for Non-Cumulative Variables



Notes: The figure shows the IRFs for non-cumulative dependent variables after each of the studied episodes. We compute our dependent variables by taking the first differences at each horizon h in equation (7) that has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from (6). The (dark) gray shaded areas indicate a confidence interval of (68%) 90%. The black dashed line shows the OLS estimates.

Table A.7: Highest weighted observation per country

Country	ISO Code	Year	ERA	Anchor
Bangladesh	BGD	2012	1	USD
Belgium	BEL	1954	1	USD
Bolivia (Plurinational State of)	BOL	2009	1	USD
Brazil	BRA	2000	3	USD
Czech Republic	CZE	1997	2	DEM
Denmark	DNK	1999	1	EUR
Ethiopia	ETH	1997	2	USD
Finland	FIN	1958	1	USD
France	FRA	1957	2	USD
Gambia	GMB	1992	2	USD
Germany	DEU	1954	1	USD
Ghana	GHA	2001	2	USD
Guyana	GUY	2009	1	USD
Hungary	HUN	1993	2	DEM
Iraq	IRQ	2009	1	USD
Ireland	IRL	1997	1	DEM
Italy	ITA	1983	2	DEM
Jamaica	JAM	1979	1	USD
Japan	JPN	1959	2	USD
Kenya	KEN	1996	2	USD
Madagascar	MDG	2005	3	USD-EUR
Malawi	MWI	2004	2	USD
Malaysia	MYS	1999	1	USD
Malta	MLT	2001	2	EUR
Mauritius	MUS	2014	1	USD
Mexico	MEX	1992	1	USD
Morocco	MAR	2001	2	EUR
Mozambique	MOZ	2012	2	USD
Nepal	NPL	1982	2	USD
Netherlands	NLD	1953	1	USD
Nigeria	NGA	2004	2	USD
Norway	NOR	1956	1	USD
Philippines	PHL	1996	1	USD
Poland	POL	1995	3	DEM
Portugal	PRT	1981	2	DEM
Seychelles	SYC	2004	1	USD
Slovenia	SVN	2002	1	EUR
South Africa	ZAF	1995	3	USD
Spain	ESP	1960	1	USD
Sweden	SWE	1955	1	USD
Switzerland	CHE	2012	1	EUR
U.R. of Tanzania: Mainland	TZA	1994	2	USD
Yemen	YEM	2002	2	USD
Zambia	ZMB	2002	3	USD

Notes: The table presents the weights used in the estimation of local projections, as defined by the inverse propensity scores from Equation (6). The weights, $w_{i,t} = \frac{d_{i,t}}{p_{i,t}} + \frac{1-d_{i,t}}{1-p_{i,t}}$, are truncated at 10. The highest weighted event per country is detailed in this table. ERA column reports the coarse classification after pegging in Figure A.1 to the anchor reported in the last column.

A.3 Floating Empirics

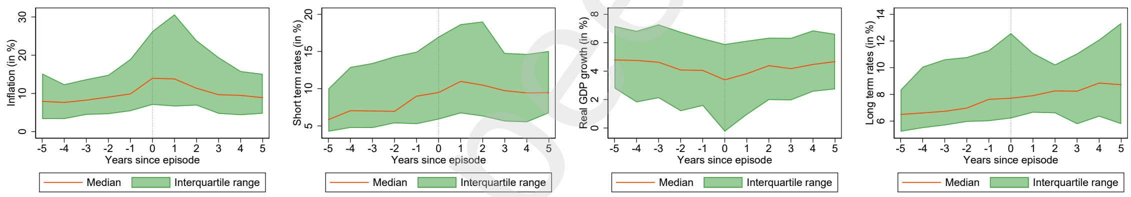
Table A.8: Event Study

	Float			
	mean		std. dev.	
	pre	post	pre	post
inflation	12.08	16.92	9.98	14.89
GDP	4.11	4.11	4.94	4.17
Bills	10.20	12.99	5.29	7.35
Bond	8.30	9.18	2.48	2.68

Notes: This table presents both the mean and the within standard deviation of the four macroeconomics series (inflation, real GDP growth, short-term and long-term interest rates) before and after floating the exchange rate, according to Ilzetzki et al. (2022) classification. We only consider country-year observations for which inflation rates and real GDP growth were below 100%. For completeness, we present the event study figures for this exercise in Appendix, Figure A.7.

Figure A.7: Event study for a floating episode

(a) Inflation (b) Short interest rate (c) Real GDP growth (d) Long interest rate



Notes: The figure shows the event-study for median inflation and median interest rates in percentage points, and median real GDP growth in percent before and after a floating episode, when the exchange rate regime becomes more float.

In contrast and almost symmetrically, a shift towards a more floating regime leads to a strong positive response of the price level and a negative response of real GDP. Figure A.10 shows that adopting a floating exchange rate regime leads to a 20% increase in the price level - about 4% per annum higher inflation than the counterfactual - and to a 1% decrease in real GDP, albeit not statistically significant in the long-run.

Figure A.8: Treatment propensity score: First-stage results

(a) Float

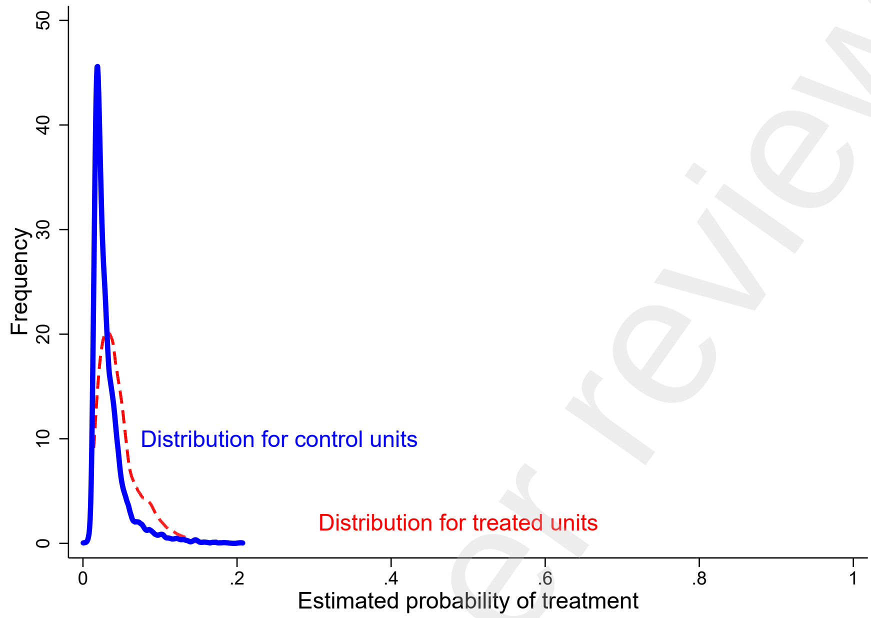
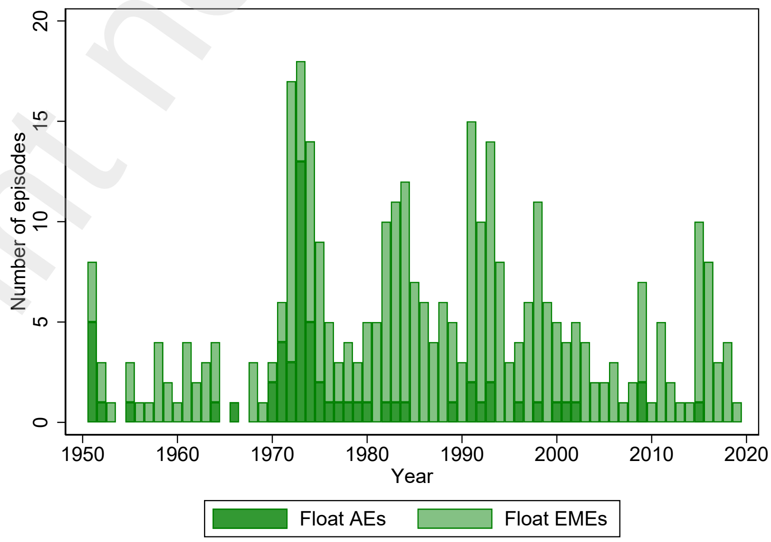


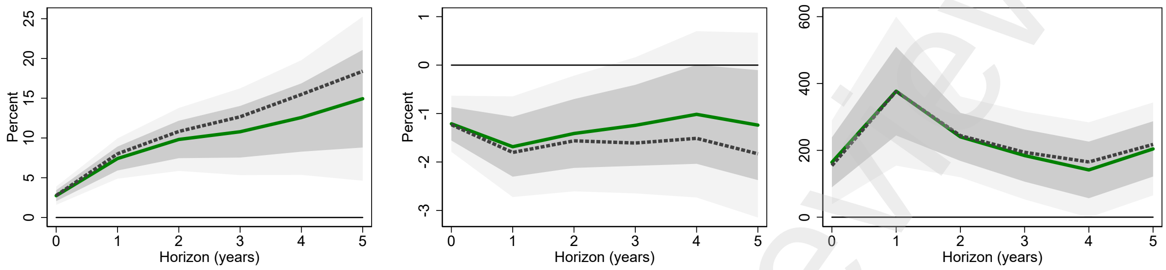
Figure A.9: Frequency of exchange rate regime changes towards a float regime



Notes: Number of the changes of the exchange rate regime classification from Ilzetzki et al. (2022) where economies move towards a float regime ($N = 266$) decomposed between advanced and developing economies.

Figure A.10: IPWRA Cumulative Results of a floating episode

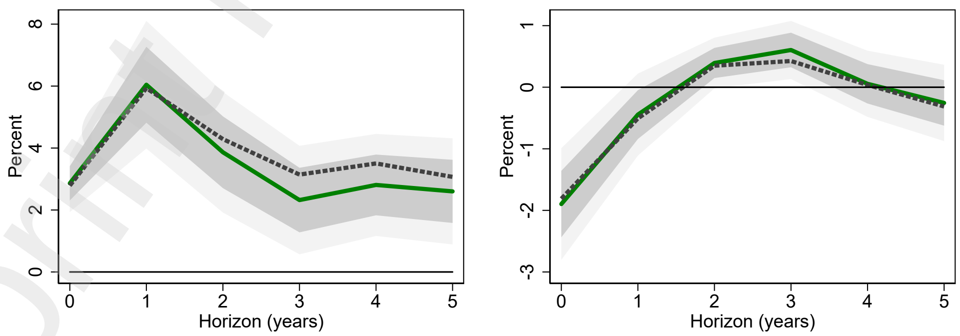
(a) Price level (b) Real GDP (c) Short-run Interest Rate



Notes: The figure shows the impulse response functions for the price level and real GDP growth rates in percent over time, after a floating episode. Equation (7) has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from (6). The (dark) gray shaded areas indicate a confidence interval of (68%) 90%. The black dashed line shows the OLS estimates. Figure A.6 presents the non-cumulative responses.

Figure A.11: IPWRA Results for Non-Cumulative Variables

(a) Float - price level change (b) Float - real GDP change



Notes: The figure shows the IRFs for non-cumulative dependent variables after each of the studied episodes. We compute our dependent variables by taking the first differences at each horizon h in equation (7) that has been estimated with weighted least squares. The weights correspond to the inverse estimated probability of an exchange rate regime change from (6). The (dark) gray shaded areas indicate a confidence interval of (68%) 90%. The black dashed line shows the OLS estimates.

Appendix B Model

B.1 Consumer Optimization

The Lagrangean is

$$\max_{C_T,C_N,L,B,B^*,M_H} \mathcal{L} = \sum_{t=0}^{\infty}\sum_{s^t} \beta^t h_t\left(s^t\right)\Big[\alpha \log C_T\left(s^t\right) + (1-\alpha)\log C_N\left(s^t\right) - \psi L\left(s^t\right) -$$

$$\lambda(s^t)\Big(P_T\left(s^t\right)C_T\left(s^t\right) + P_N\left(s^{t-1}, s_{1t}\right)C_N\left(s^t\right) + M_H\left(s^t\right) + B\left(s^t\right) + e\left(s^t\right)B^*\left(s^t\right) -$$

$$\left(P_T\left(s^t\right)L\left(s^t\right) + M_H\left(s^{t-1}\right) + R\left(s^t\right)B\left(s^{t-1}\right) + e\left(s^t\right)R^*\left(s^t\right)B^*\left(s^{t-1}\right) + T\left(s^t\right) + \Pi\left(s^t\right)\right)\Big)$$

$$-\mu(s^t)\left(P_T(s^t)C_T(s^t) - M_H(s^{t-1})\right)\Big]$$

The first order conditions are

$$\frac{\alpha}{C_T(s^t)} = \lambda(s^t)P_T(s^t) + \mu(s^t)P_T(s^t) \tag{B.1}$$

$$\frac{1-\alpha}{C_N(s^t)} = \lambda(s^t)P_N(s^t) \tag{B.2}$$

$$\psi = \lambda(s^t)P_T(s^t) \tag{B.3}$$

$$\lambda(s^t) = \beta\mathbb{E}_t\left[\lambda(s^{t+1})R(s^{t+1})\right] \tag{B.4}$$

$$\lambda(s^t)e(s^t) = \beta\mathbb{E}_t\left[\lambda(s^{t+1})e(s^{t+1})R^*(s^{t+1})\right] \tag{B.5}$$

$$\lambda(s^t) = \beta\mathbb{E}_t\left[\lambda(s^{t+1})\right] + \beta\mathbb{E}_t\left[\phi(s^{t+1})\right] \tag{B.6}$$

Combining (B.2) and (B.4) gives the Euler equation:

$$\frac{1}{C_N(s^t)} = \beta\mathbb{E}_t\left[\frac{1}{C_N(s^{t+1})}\frac{P_N(s^t)}{P_N(s^{t+1})}R(s^{t+1})\right]$$

Combining (B.4) and(B.5) gives the uncovered interest parity condition:

$$\beta\mathbb{E}_t\left[\lambda(s^{t+1})R(s^{t+1})\right] = \beta\mathbb{E}_t\left[\lambda(s^{t+1})\frac{e(s^{t+1})}{e(s^t)}R^*(s^{t+1})\right]$$

The standardized multiplier on the cash in advance constraint is $\phi(s^t) = \mu(s^t)P_T(s^t)$.

If we use Chari et al. (2020) framework of prices on bonds instead of interest rates, the budget constraint changes to

$$\begin{aligned} P_T\left(s^t\right)C_T\left(s^t\right) + P_N\left(s^{t-1}, s_{1t}\right)C_N\left(s^t\right) + M_H\left(s^t\right) + \bar{Q}(s^t)B\left(s^t\right) + \bar{Q}^*(s^t)e\left(s^t\right)B^*\left(s^t\right) \\ \leq P_T\left(s^t\right)L\left(s^t\right) + M_H\left(s^{t-1}\right) + B\left(s^{t-1}\right) + e\left(s^t\right)B^*\left(s^{t-1}\right) + T\left(s^t\right) + \Pi\left(s^t\right) \end{aligned}$$

The first order condition is then

$$\lambda(s^t) = \beta \mathbb{E}_t \Bigg[\lambda(s^{t+1}) \underbrace{\frac{1}{\bar{Q}(s^t)}}_{R(s^{t+1})} \Bigg]$$

So, using a framework with bond prices instead of interest rates on one period government bonds means that the price of a new bond is the inverse nominal interest rate on bonds that are being hold. $R(s^{t+1})$ is known in t.

B.2 International Capital Markets

The budget constraint is extended to allow households to buy non-domestic bonds as well. These bonds B^* are risk free and denoted in foreign currency:

$$\begin{aligned} P_T\left(s^t\right) C_T\left(s^t\right) + P_N\left(s^{t-1}, s_{1t}\right) C_N\left(s^t\right) + M_H\left(s^t\right) + \bar{Q}\left(s^t\right) B\left(s^t\right) + e(s^t)\bar{Q}^*\left(s^t\right) B^*\left(s^t\right) \\ \leq P_T\left(s^t\right) L\left(s^t\right) + M_H\left(s^{t-1}\right) + B\left(s^{t-1}\right) + e(s^t) B^*\left(s^{t-1}\right) + T\left(s^t\right) + \Pi\left(s^t\right) \end{aligned} \tag{B.7}$$

The exchange rate $e(s^t)$ has to be taken into account. As households can now choose non-domestic bonds, there is a a new first order condition:

$$\bar{Q}^*(s^t)\lambda(s^t)e(s^t) = \beta \mathbb{E}_t \left[\lambda(s^{t+1})e(s^{t+1})\right]$$

Combining it with the old conditions

$$\begin{aligned} \bar{Q}(s^t)\lambda(s^t) &= \beta \mathbb{E}_t \left[\lambda(s^{t+1})\right] \\ \lambda(s^t) &= \frac{\alpha}{P_T(s^t)C(s^t)} \end{aligned}$$

gives the so-called uncovered interest rate parity that relates domestic with foreign interest rates:

$$\frac{\bar{Q}^*(s^t)e(s^t)}{\bar{Q}(s^t)} = \frac{\mathbb{E}_t\left[\lambda(s^{t+1})e(s^{t+1})\right]}{\mathbb{E}_t\left[\lambda(s^{t+1})\right]}$$

with iid shocks we have

$$\mathbb{E}_t\left[Q\left(s^{t+1}\right)R(s^{t+1})\right] = \mathbb{E}_t\left[Q\left(s^{t+1}\right)\frac{e(s^{t+1})}{e(s^t)}R^*(s^{t+1})\right]$$

The nominal interest rate spread is offset by a continuous devaluation of the home currency vis-a-vis to the rest of the world. The rest of the model is not altered by the introduction of international capital markets, as households do not have an incentive to borrow or lend across countries given their current preference structure (log utility and Cobb Douglas consumption aggregator).

B.3 Firm Optimization

A microfoundation for markups can be given by following the setup of Smets and Wouters (2007). The non-traded good is produced by a competitive final producer who uses differentiated inputs $y_N(j, s^t)$ from input firms of mass $j \in [0, 1]$ to produce the final good $Y_N(s^t)$:

$$Y_N\left(s^t\right) = \left[\int y_N\left(j, s^t\right)^{\theta(s_{1t})} dj\right]^{1/\theta(s_{1t})}$$

This firm maximizes

$$P_N\left(s^{t-1}, s_{1t}\right) Y_N\left(s^t\right) - \int P_N\left(j, s^{t-1}, s_{1t}\right) y_N\left(j, s^t\right) dj$$

Demand for intermediate goods is therefore

$$y_N\left(j, s^t\right) = \left(\frac{P_N\left(s^{t-1}, s_{1t}\right)}{P_N\left(j, s^{t-1}, s_{1t}\right)}\right)^{\frac{1}{1-\theta(s_{1t})}} Y_N\left(s^t\right)$$

Intermediate goods are produced by monopolistic firms who use a linear production function: $y_N(j, s^t) = A(s_{2t})L_N(j, s^t)$. Intermediate good firms choose their prices $P = P(j, s^{t-1}, s_{1t})$ to maximize their profits:

$$\max_P \sum_{s_{2t}} Q\left(s^t\right)\left[P - \frac{W\left(s^t\right)}{A\left(s_{2t}\right)}\right]\left(\frac{P_N\left(s^{t-1}, s_{1t}\right)}{P}\right)^{\frac{1}{1-\theta(s_1 t)}} Y_N\left(s^t\right)$$

where $Q(s^t)$ is the discount factor as before. We assume that $\theta(s_{1t})$ is such that there is elastic demand and finite prices. Optimally, intermediate good producer j sets the price in the following way:

$$P_N\left(j, s^{t-1}, s_{1t}\right) = \frac{1}{\theta\left(s_{1t}\right)} \frac{\sum_{s_{2t}} Q\left(s^t\right) Y_N\left(s^t\right) \frac{W\left(s^t\right)}{A(s_t)}}{\sum_{s_{2t}} Q\left(s^t\right) Y_N\left(s^t\right)}$$

Where $\frac{1}{\theta(s_{1t}}$ is the markup that increases prices. Note that the price equation is not a function of j such that the price is the same for all intermediate firms. Plugging in $W(s^t) = P_T(s^t)$ gives the same formula as in equation (1). This implies that all intermediate firms hire the same amount of labor and their production function is then simply $Y_N(s^t) = A(s_{2t}L_N(s^t)$.

B.4 Monetary Policy Optimization

Commitment and Float, 1 region The central bank makes a state-contingent plan for prices of traded and non traded goods to maximize the representative households ex ante utility

$$
\begin{aligned}
\max_{\{P_T(s^t),P_N(s^t)\}_{t=0}^{\infty}} \quad & \mathbb{E}_0\left[\sum_{\tau=t}\beta^t\left(\alpha\log(C_T(s^\tau)+(1-\alpha)\log(C_N(s^\tau))-\psi L(s^\tau)\right)\right] \\
\text{s.t.} \quad & L(s^t)=\frac{C_N(s^t)}{A(s_{2t})}+C_T(s^t) \\
& C_T(s^t)=\frac{\alpha}{\psi} \\
& C_N(s^t)=\frac{1-\alpha}{\psi}\frac{P_T(s^t)}{P_N(s^{t-1},s_{1t})} \\
& \sum_{s_{2t}} h\left(s^t \mid s^{t-1},s_{1t}\right)C_N\left(s^t\right)\left[U_N\left(s^t\right)+\frac{1}{\theta\left(s_{1t}\right)}\frac{U_L\left(s^t\right)}{A\left(s_{2t}\right)}\right]=0
\end{aligned}
$$

Looking at the plugged in firm's first order condition:

$$
\sum_{s_{2t}} h\left(s^t \mid s^{t-1},s_{1t}\right)C_N\left(s^t\right)\left[\frac{1-\alpha}{C_N\left(s^t\right)}-\frac{1}{\theta\left(s_{1t}\right)}\frac{\psi}{A\left(s_{2t}\right)}\right]=0
$$

Plugging in C_N

$$
\sum_{s_{2t}} h\left(s^t \mid s^{t-1},s_{1t}\right)C_N\left(s^t\right)\left[\frac{1-\alpha}{\frac{1-\alpha}{\psi}\frac{P_T(s^t)}{P_N(s^{t-1},s_{1t})}}-\frac{1}{\theta\left(s_{1t}\right)}\frac{\psi}{A\left(s_{2t}\right)}\right]=0
$$

This can only be zero if

$$
\frac{P_T(s^t)}{P_N(s^{t-1},s_{1t})}=A\left(s_{2t}\right)\theta\left(s_{1t}\right)
$$

The best the central bank can do is to ensure that this condition holds. The central bank realizes that it is not possible to reduce markups by manipulating relative prices with inflation. Therefore it focuses to stabilize productivity shocks.

Nominal variables can be computed as well, using the following trick: First normalize all variables with their money supply of the last period, $p_T=\frac{P_T(s^t)}{M(s^{t-1})}$ and $p_N(s^{t-1},s_{1t})=\frac{P_N(s^{t-1},s_{1t})}{M(s^{t-1})}$. Then construct prices in such a way, that the cash in advance constraint is *exactly* binding in the highest possible productivity state[10]. Then use that $p_T(s^t)/p_N(s^{t-1},s_{1t})=A(s_{2t})\theta(s_{1t})$ and $p_T(s^t)=\gamma C_T(s^t)^{-1}$ if the cash in advance constraint binds in the highest state to get:

$$
\begin{aligned}
p_N(s^{t-1},s_{1t}) &= \frac{1}{\theta(s_{1t})}\frac{\psi}{\alpha}\frac{1}{\max\{A(s_{2t})\}} \\
p_T(s^t) &= A(s_{2t})\theta(s_{1t})p_N(s^{t-1},s_{1t}) \\
\frac{M\left(s^t\right)}{M\left(s^{t-1}\right)} &= \beta\sum_{s^{t+1}} h\left(s^{t+1}\mid s^t\right)\frac{A\left(s_{2t}\right)}{A\left(s_{2t+1}\right)}
\end{aligned}
$$

[10]This way, no consumption is lost.

Together with an initial level for $M(s^0)$, the nominal equilibrium is pinned down. The per period money growth rate equals productivity today times the discounted expected inverse productivity in the future. If productivity today is relatively large, money growth will also be relatively large, reflecting expansionary monetary policy and a depreciating exchange rate from the example before. If productivity is not stochastic, money gross growth rate is $\beta < 1$.

The derivation from the money growth rate comes from the consumer's first order condition, that combines the labor and traded goods first order condition with the money first order condition. As $p_T(s^t) = P_T(s^t)/M(s^{t-1})$, we can draw out the money growth rate as follows

$$-\frac{M(s^t)}{M(s^{t-1})}\frac{U_L}{p_T} = \beta \sum_{s'} h\left(s'\right) \frac{U_T\left(b', 1, x'_T, S'_T\right)}{p_T\left(x'_T, S'_T\right)}$$

If you rearrange and plug in, you arrive at

$$\frac{M(s^t)}{M(s^{t-1})} = \beta \sum_{s'} h\left(s'\right) \frac{p_T(s)}{p_T(s')}\frac{\alpha/\psi}{C_T(s')}$$

Plugging in $p_T = A\theta p_N$ with $p_N = \frac{1}{\theta}\frac{\psi}{\alpha}\frac{1}{max(A)}$ at a binding cash in advance constraint with $C_T(s') = \frac{1}{p_T(s')}$ gives the money growth rate as above, only a function of productivity.

Nominal interest rates can then be computed via the Euler equation, see Appendix B.5 for a derivation

$$R\left(s^t\right) = \frac{\max\{A(s_{2t})\}}{\max\{A(s_{2t+1})\}}$$

Interest rates are simply the ratio of the maximum value of productivity today and tomorrow. If productivity stays always the same, then $R(s^t) = 1$ and $M(s^t)/M(s^{t-1}) = \beta < 1$. This means that nominal interest rates are zero and the central bank follows the Friedman rule implying a negative money growth rate. The intuition why zero interest rates are optimal is the following. Nominal bonds dominate money holding as they pay interest on its stock, while money does not. Nevertheless, households need to hold money to buy traded goods. Therefore, the central bank optimally implements zero interest rates to make the necessary money holding as good as the bond holding. Inflation rates of both goods are given by

$$\pi_N(s^t, s_{1t+1}) = \frac{P_N(s^t, s_{1t+1})}{P_N(s^{t-1}, s_{1t})} = \frac{\theta(s_{1t})\max\{A(s_{2t}\}}{\theta(s_{1t+1})\max\{A(s_{2t+1})\}}\frac{M(s^t)}{M(s^{t-1})}$$

$$\pi_T(s^{t+1}) = \frac{P_T(s^{t+1})}{P_T(s^t)} = \frac{A(s^{t+1})\theta(s_{1t+1})P_N(s^t, s_{1t+1})}{A(s^t)\theta(s_{1t})P_N(s^{t-1}, s_{1t})} = \frac{A(s_{2t+1})\max\{A(s_{2t})\}}{A(s_{2t})\max\{A(s_{2t+1}\}}\frac{M(s^t)}{M(s^{t-1})}$$

Markups influence prices of non-traded goods only. The bigger the markup ($1/\theta$ is high) compared to last period, the higher is inflation. Higher productivity of the non-traded good increases prices of traded goods, the relative price adjusts. Higher money growth rates increase both inflation rates. In a world with no stochastic components, inflation is determined by the money growth rate which is then simply $\beta < 1$. This implies deflation. The Friedman rule is a solution for the nominal equilibrium, a continued contraction of the money supply implies deflation which ensures that the cash in advance constraint is never binding.

Discretion and Float, 1 region Chari et al. (2020) show, that there is no intertemporal dimension of the problem for the central bank. The reason is that in equilibrium there is no bond holding and that lump-sum transfers are always available to the government. In addition, households do not derive utility out of money, such that the growth rate of money supply is not intertwined with the static problem. The optimal problem of the central bank can then be thought of as choosing the price of the traded good subject to the first order conditions of households. As the cash in advance constraint optimally binds for the traded good, the primal problem of the central bank is to maximize

$$\max_{P_T(s^t)} \quad \alpha \ln C_T(s^t) + (1-\alpha)\ln C_N(s^t) - \psi(C_T(s^t) + C_N(s^t)/A(s^t))$$

$$\text{s.t.} \quad C_T(s^t) = \frac{M(s^{t-1})}{P_T(s^t)}$$

$$C_N(s^t) = \frac{1-\alpha}{\psi}\frac{P_T(s^t)}{P_N(s^t)}$$

The first order condition is (already divided by $M(s^{t-1})$)

$$-\frac{\alpha}{p_T(s^t)} + \frac{1-\alpha}{p_T(s^t)} - \psi\left(-\frac{1}{p_T(s^t)^2} + \frac{1-\alpha}{\psi}\frac{1}{A(s^t)}\frac{1}{p_N(s^t)}\right) = 0$$

Solving for $p_T(s^t)$ gives the optimal reaction function of the central bank under discretion:

$$p_T(s_t) = p_N(s_{1t})\, A(s_{2t}) \underbrace{\frac{1}{2(1-\alpha)}\left[(1-2\alpha) + \sqrt{(1-2\alpha)^2 + 4(1-\alpha)\frac{1}{A(s_{2t})}\frac{\psi}{p_N(s_{1t})}}\right]}_{F\left(\frac{\gamma}{A(s_{2t})p_N(s_{1t})}\right)}$$

If you consider the firm's price setting equation 1, then you can compute prices:

$$p_N\left(s^{t-1}, s_{1t}\right) = \frac{1}{\theta(s_{1t})}\sum_{s_{2t}}\left(\frac{Q(s^t)\, Y_N(s^t)}{\sum_{\tilde{s}_{2t}} Q(\tilde{s}^t)\, Y_N(\tilde{s}^t)}\right)$$

$$\frac{p_N(s_{1t})\, A(s_{2t})\, \frac{1}{2(1-\alpha)}\left[(1-2\alpha) + \sqrt{(1-2\alpha)^2 + 4(1-\alpha)\frac{1}{A(s_{2t})}\frac{\psi}{p_N(s_{1t})}}\right]}{A(s_t)}$$

If p_N rises, p_T will then in general rise by less than 1 to 1, reflecting the costs of higher inflation.

If A is not stochastic the cash in advance constraint never binds (implicit assumption here). We can then write

$$1 = \frac{1}{\theta(s_{1t})}\frac{A(s_{2t})\, \frac{1}{2(1-\alpha)}\left[(1-2\alpha) + \sqrt{(1-2\alpha)^2 + 4(1-\alpha)\frac{1}{A(s_{2t})}\frac{\psi}{p_N(s_{1t})}}\right]}{A(s_t)}$$

Solving for $p_N(s_{1t})$ gives

$$(2(1-\alpha)\theta-(1-2\alpha))^2=(1-2\alpha)^2+4(1-\alpha)\frac{\psi}{A(s_{2t})p_N(s_{1t})}$$

With this we get p_N as in the main text:

$$p_N(s^t)=\frac{1}{\theta(s_{1t})}\frac{1}{A(s_{2t})}\frac{\psi}{\alpha-(1-\alpha)(1-\theta(s_{1t}))}$$
$$p_T(s^t)=\frac{\psi}{\alpha-(1-\alpha)(1-\theta(s_{1t}))}$$

Consumption is then

$$C_T(s^t)=\frac{1}{p_T(s^t)}\quad C_N(s^t)=\frac{1-\alpha}{\psi}\frac{p_T(s^t)}{p_N(s^t)}$$

The money growth rate and inflation rates can be computed as before

$$\frac{M(s^t)}{M(s^{t-1})}=\beta\sum_{s'}h\left(s'\right)\frac{p_T(s)}{p_T(s')}\frac{\alpha/\psi}{C_T(s')}$$
$$\frac{M(s^t)}{M(s^{t-1})}=\beta\sum_{s'}h\left(s'\right)\frac{p_T(s)}{p_T(s')}\frac{\alpha/\psi}{\frac{1}{p_T(s')}}$$
$$\frac{M(s^t)}{M(s^{t-1})}=\beta\sum_{s'}h\left(s'\right)p_T(s)\frac{\alpha}{\psi}$$
$$\frac{M(s^t)}{M(s^{t-1})}=\beta\frac{\alpha}{\psi}\frac{\psi}{\alpha-(1-\alpha)(1-\theta(s^t))}$$

Inflation rates are then

$$\pi_T(s^t)=\frac{P_T(s^{t+1})}{P_T(s^t)}=\frac{M(s^t)}{M(s^{t-1})}\frac{\alpha-(1-\alpha)(1-\theta(s_{1t}))}{\alpha-(1-\alpha)(1-\theta(s_{1t+1}))}$$
$$\pi_N(s^t)=\frac{P_N(s^{t+1})}{P_N(s^t)}=\frac{M(s^t)}{M(s^{t-1})}\frac{A(s^t)\theta(s^t)}{A(s^{t+1})\theta(s^{t+1})}\frac{\alpha-(1-\alpha)(1-\theta(s_{1t}))}{\alpha-(1-\alpha)(1-\theta(s_{1t+1}))}$$

Peg to a Discretionary Anchor Under discretion with a peg prices of traded goods are as prices under discretion for the anchor, for non-traded good prices domestic markups and productivity of the anchor are decisive.

$$p_T=\frac{\psi}{\alpha-(1-\alpha)(1-\theta^{Anch})}$$
$$p_N(s^t)=\frac{1}{\theta(s_{1t})}\frac{1}{A^{Anch}(s_{2t})}\frac{\psi}{\alpha-(1-\alpha)(1-\theta^{Anch}(s_{1t}))}$$

Money growth rate is the one of the anchor and given by

$$\frac{M(s^t)}{M(s^{t-1})} = \beta \frac{\alpha}{\psi} \frac{\psi}{\alpha - (1-\alpha)(1-\theta^{Anch}(s^t))}$$

Inflation in the client country is then given by

$$\pi_T(s^t) = \frac{P_T(s^{t+1})}{P_T(s^t)} = \frac{M^{Anch}(s^t)}{M^{Anch}(s^{t-1})} \frac{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t}))}{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t+1}))}$$

$$\pi_N(s^t) = \frac{P_N(s^{t+1})}{P_N(s^t)} = \frac{M^{Anch}(s^t)}{M^{Anch}(s^{t-1})} \frac{A^{Anch}(s^t)\theta(s^t)}{A^{Anch}(s^{t+1})\theta(s^{t+1})} \frac{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t}))}{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t+1}))}$$

while inflation of non-traded goods in the anchor country is

$$\pi_N^{Anch}(s^t) = \frac{P_N(s^{t+1})}{P_N(s^t)} = \frac{M^{Anch}(s^t)}{M^{Anch}(s^{t-1})} \frac{A^{Anch}(s^t)\theta^{Anch}(s^t)}{A^{Anch}(s^{t+1})\theta^{Anch}(s^{t+1})} \frac{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t}))}{\alpha - (1-\alpha)(1-\theta^{Anch}(s_{1t+1}))}$$

Note that inflation of non-traded good is different. For both countries their own corresponding markup shocks play a role. As the correlation of markups between countries is not perfect, but rather zero in the iid example here, this implies that volatility of non-traded goods for the client country is lower than for the anchor country. This is because if $\frac{\theta^{Anch}(s^t)}{\theta^{Anch}(s^{t+1})}$ is large $\frac{\alpha-(1-\alpha)(1-\theta^{Anch}(s_{1t}))}{\alpha-(1-\alpha)(1-\theta^{Anch}(s_{1t+1}))}$ is large as well. Overall π_N^{Anch} is more volatile than π_N if the underlying markup shock process is the same and uncorrelated to the process in the anchor country.

Discretion and float, multiple regions There is a mass of $\{1, ..., I\}$ regions that constitute a country, each region has a Pareto weight λ^i. The nation-wide central bank chooses a traded good price for all regions taking the non-traded good prices as given. The current state is $s = (z, p_N^i(z, v))$, the primal problem is then

$$\begin{aligned}
&\max_{p_T} \sum_{i=1}^{I} \lambda^i \sum_{v^t} g(v^t) \left[\alpha \log C_T^i(s^t) + (1-\alpha)\log C_N^i(s^t) - \psi\left(L^i(s^t)\right)\right] \\
\text{s.t.} \quad & L^i(s^t) = \frac{C_N^i(s^t)}{A^i(s_{2t})} + C_L^i(s^t) \\
& C_T^i(s^t) = \frac{1}{p_T} \\
& C_N^i(s^t) = \frac{1-\alpha}{\psi} \frac{p_T(s^t)}{p_N^i(s^{t-1}, s_{1t})} \\
& \frac{U_T(s^t)}{U_N(s^t)} = \frac{U_T(\tilde{s}^t)}{U_N(\tilde{s}^t)}
\end{aligned}$$

where $g(v)$ is the average of all regions, given the aggregate state. The first order condition is given by:

$$0 = (1-2\alpha)\frac{1}{p_T} + \psi\frac{1}{p_T^2} - (1-\alpha)\sum_i \lambda^i \sum_v g(v) \frac{1}{p_N^i(z,v)A^i}$$

We can solve the quadratic equation to get the monetary authorities best response:

$$p_T\left(z,\left\{p_N^i\left(z_1,v_1\right)\right\}\right)=\frac{(1-2\alpha)+\sqrt{(1-2\alpha)^2+4\sum_i^I\lambda^i\sum_v g(v)\frac{(1-\alpha)}{A^i(z_2,v_2)}\frac{\psi}{p_N^i(z_1,v_1)}}}{\sum_i\lambda^i\sum_v g(v)\frac{2(1-\alpha)}{A^i(z_2,v_2)}\frac{1}{p_N^i(z_1,v_1)}},$$

As a next step consider again the pricing equation of firms in country i: $p_N^i=\mathbb{E}_v\left(\frac{1}{A^i}\right)\frac{1}{\theta^i}p_T^i$. As with a single country under discretion, we can solve the problem by plugging in the reaction functions into each other, this gives a fixed point problem and can explicitly be solved for p_T. Let $\sum_v g(v)\frac{1}{A^i(z_2,v_2)p_N^i(z_1,v_1)}=\mathbb{E}_v[\frac{1}{A^ip_N^i}\mid z]$. Then

$$p_N^j=\mathbb{E}_v\left(\frac{1}{A^j}\right)\frac{1}{\theta^j}\frac{\psi}{(1-\alpha)p_N^j\sum_i\lambda^i\mathbb{E}_v[\frac{1}{A^ip_N^i}]\theta^jA^j-(1-2\alpha)}$$

For the p_N^i on the right hand side of the equation, plug in $p_N^i=\mathbb{E}\left(\frac{1}{A^i}\right)\frac{p_T}{\theta^i}$

$$p_N^j=\mathbb{E}_v\left(\frac{1}{A^j}\right)\frac{1}{\theta^j}\frac{\psi}{(1-\alpha)\frac{p_T}{A^j\theta^j}\sum_i\lambda^i\mathbb{E}_v[\frac{1}{A^i\frac{p_T}{A^i\theta^i}}\mid z]\theta^jA^j-(1-2\alpha)}$$

$$p_N^j=\mathbb{E}_v\left(\frac{1}{A^j}\right)\frac{1}{\theta^j}\frac{\psi}{(1-\alpha)\sum_i\lambda^i\mathbb{E}_v\left(\theta^i\mid z\right)-(1-2\alpha)}$$

This gives p_T

$$p_T=\frac{\psi}{(1-\alpha)\sum_i\lambda^i\mathbb{E}_v[\theta^i\mid z]-(1-2\alpha)}$$

C_T is then given by:

$$C_T=\frac{1}{p_T}=\frac{\alpha}{\psi}-\frac{1-\alpha}{\psi}\left(1-\sum_i\lambda^i\mathbb{E}_v\left(\theta^i\mid z\right)\right)$$

and C_N

$$C_N^i=\frac{1-\alpha}{\psi}\mathbb{E}_v\left(\frac{1}{A^i}\right)^{-1}\theta^i(s)$$

Money growth rate is

$$\Delta M=\beta\frac{\alpha}{\psi}p_T=\beta\frac{\alpha}{\psi}\frac{\psi}{(1-\alpha)\sum_i\lambda^i\mathbb{E}_v[\theta^i\mid z]-(1-2\alpha)}$$

Inflation for the (former) client are then given by

$$\pi_T(s^t) = \frac{P_T(s^{t+1})}{P_T(s^t)} = \frac{M(s^t)}{M(s^{t-1})} \frac{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}$$

$$\pi_N(s^t) = \frac{P_N(s^{t+1})}{P_N(s^t)} = \frac{M(s^t)}{M(s^{t-1})} \frac{\mathbb{E}_v \left(\frac{1}{A^i(s^t)}\right)^{-1} \theta(s^t)}{\mathbb{E}_v \left(\frac{1}{A^i(s^{t+1})}\right)^{-1} \theta(s^{t+1})} \frac{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}$$

For the former anchor country, inflation of non-traded goods is

$$\pi_N(s^t) = \frac{P_N(s^{t+1})}{P_N(s^t)} = \frac{M(s^t)}{M(s^{t-1})} \frac{\mathbb{E}_v \left(\frac{1}{A^i(s^t)}\right)^{-1} \theta^{Anch}(s^t)}{\mathbb{E}_v \left(\frac{1}{A^i(s^{t+1})}\right)^{-1} \theta^{Anch}(s^{t+1})} \frac{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}{\alpha - (1-\alpha)(1 - \sum_i \lambda^i \mathbb{E}_v[\theta^i \mid z])}$$

Compared to the peg $\frac{\alpha-(1-\alpha)(1-\sum_i \lambda^i \mathbb{E}_v[\theta^i|z])}{\alpha-(1-\alpha)(1-\sum_i \lambda^i \mathbb{E}_v[\theta^i|z])}$ consists now out of the weighted average of markups in the union, and not out of markups of the anchor only. If the union is really large, this term would be constant (1) over time. Volatility of inflation would then only originate from markup variations over time (as money growth rate becomes less erratic as well). In the main text the Pareto weights are equal, $\lambda^i = 1/I$ for all regions

B.5 Computation of Interest Rates

Flexible exchange rates and discretion

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{C_N\left(s^t\right)}{C_N\left(s^{t+1}\right)} \frac{P_N\left(s^{t-1}, s_{1t}\right)}{P_N\left(s^t, s_{1t+1}\right)}$$

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{\frac{1-\alpha}{\psi} A\left(s^t\right) \theta\left(s^t\right)}{\frac{1-\alpha}{\psi} A\left(s^{t+1}\right) \theta\left(s^{t+1}\right)} \frac{p_N\left(s^{t-1}, s_{1t}\right) M(s^{t-1})}{p_N\left(s^t, s_{1t+1}\right) M(s^t)}$$

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{\frac{1-\alpha}{\psi} A\left(s^t\right) \theta\left(s^t\right)}{\frac{1-\alpha}{\psi} A\left(s^{t+1}\right) \theta\left(s^{t+1}\right)} \frac{p_N\left(s^{t-1}, s_{1t}\right)}{p_N\left(s^t, s_{1t+1}\right)} \frac{\psi}{\beta\alpha A(s_{2t})\theta(s_{1t}) p_N(s^{t-1}, s_{1t})}$$

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{1}{A\left(s^{t+1}\right) \theta\left(s^{t+1}\right)} \frac{1}{p_N\left(s^t, s_{1t+1}\right)} \frac{\psi}{\beta\alpha}$$

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{1}{A\left(s^{t+1}\right) \theta\left(s^{t+1}\right)} \frac{1}{\frac{1}{\theta(s_{1t+1})} \frac{1}{A(s_{2t+1})} \frac{\psi}{\alpha-(1-\alpha)(1-\theta(s_{1t+1}))}} \frac{\psi}{\beta\alpha}$$

$$\bar{Q}\left(s^t\right) = \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{\alpha - (1-\alpha)(1-\theta(s_{1t+1}))}{\psi} \frac{\psi}{\beta\alpha} < \beta \sum_{s^{t+1}} h\left(s^{t+1} \mid s^t\right) \frac{\alpha}{\psi} \frac{\psi}{\beta\alpha}$$

$$R(s^{t+1})^{-1} = \mathbb{E}_t\left[\frac{\alpha - (1-\alpha)(1-\theta(s_{1t+1}))}{\alpha}\right]$$

which implies that $\bar{Q}^{disc}(s^t) < \bar{Q}^{Commit}(s^t)$ and therefore $(1+i)^{disc} > (1+i)^{commit}$.

B.6 Model Graphs and Estimation

B.6.1 SMM

Formally, let x be the data and $m(x)$ the moments of the data. The corresponding moments of the model are denoted by $m(\tilde{x}, \upsilon)$ where υ are the parameters of the model. We simulate the model S times, such that there are S simulations of the model data $\tilde{x} = \{\tilde{x}_1, \tilde{x}_2, ..., \tilde{x}_S\}$. The vector of moments in one simulation s of length T consists out of three expressions. The standard deviation and the mean of a country's inflation rate during a discretionary float in simulation s and the average markup

$$std(\pi_s) = \sqrt{\frac{1}{T}\sum_{t}^{T}(\pi_t - \bar{\pi}_s)^2}, \quad \mu(\pi_s) = \frac{1}{T}\sum_{t}^{T}\pi_t, \quad \mu(\theta_s) = \frac{1}{T}\sum_{t}^{T}\frac{1}{\theta_t}$$

The estimated model moments from the simulation are

$$\hat{m}(\tilde{x}, \upsilon) = \frac{1}{S}\sum_{s=1}^{S} m\left(\tilde{x}_s \mid \upsilon\right).$$

The SMM approach estimates the parameter vector $\hat{\upsilon}_{SMM}$ to choose υ in such a way that it minimizes the L^2 norm of the sum of squared errors in moments. We define the moment error function as the percent difference in the vector of simulated model moments from the data moments

$$e(\tilde{x}, x \mid x) = \frac{\hat{m}(\tilde{x} \mid \upsilon) - m(x)}{m(x)}.$$

The SMM estimator is now the following:

$$\hat{\upsilon}_{SMM} = \upsilon : \min_{\upsilon} e(\tilde{x}, x \mid x)^T W e(\tilde{x}, x \mid x)$$

where W is a weighting matrix, in a first step it is the identity matrix, implying equal weights for all moments.

B.6.2 Graphs of the model

The figure shows markups and inflation under discretion given the markups.

Last, we show the average inflation value given the average markup for Italy as a function of the probability of acting under discretion. For each percentage point difference in credibility, average inflation changes by 0.14%. This is in line with the empirical estimate that suggests that for each percentage point difference in credibility, the inflation response is 0.12% (0.6/5) per year when a country decides to peg.

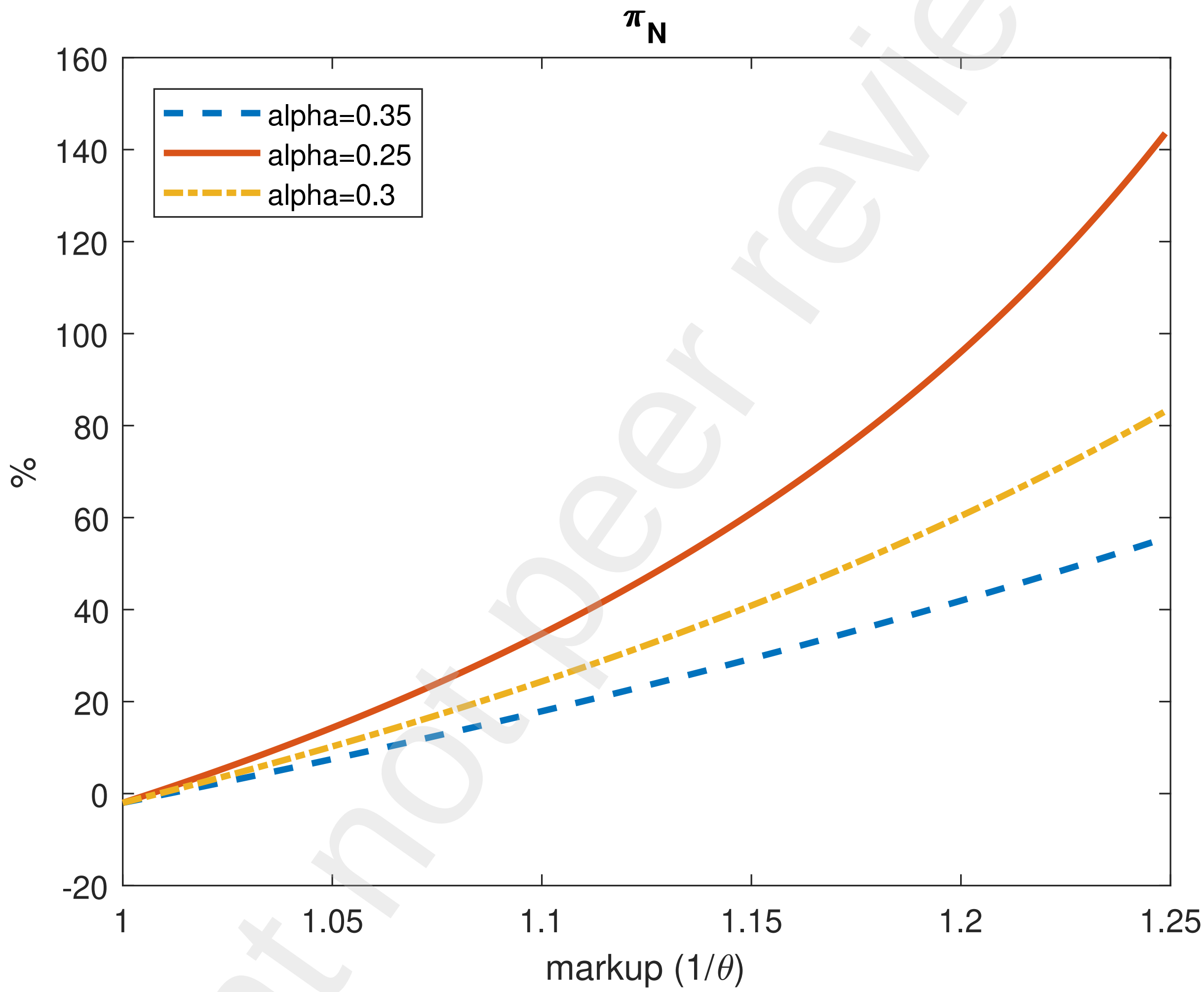


Figure B.1: π_N as a function of the markup in a monetary regime under discretion. The markup is defined as $\frac{1}{\theta}$. High markups correspond to a low elasticity of substitution between intermediate goods, allowing those firms to charge high prices. The dashed blue line corresponds to a trade openness of 35 %, the solid red line of 25% and the dashed yellow line of 30%.