Capital Controls on Outflows: New Evidence and a Theoretical Framework*

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Abstract

We study capital controls on outflows (CCOs) in situations of macroeconomic and financial distress. We present novel empirical evidence indicating that CCO implementation is associated with crises and declines in GDP growth. We then develop a theoretical framework that is consistent with such empirical findings and also yields policy and welfare lessons. The theory features costly coordination failures by foreign investors which can sometimes be avoided by suitably tailored CCOs. The benefits of CCOs as coordination devices can make them optimal even if CCOs entail deadweight losses; if the latter are large, however, CCOs are detrimental for welfare. We show that optimal CCOs can suffer from time inconsistency, and also how political opportunism may limit CCO policy. Hence government credibility and reputation building emerge as critical for the successful implementation of CCOs.

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1 Introduction

In recent years, academics and policymakers have proposed to reconsider controls on cross-border capital flows as a potentially useful stabilization device. By and large, developments in this direction reflect shifting views about capital inflows and research findings indicating that, under some circumstances, it may be socially beneficial to impose controls to curb excessive foreign borrowing. A theoretical rationale is provided by macroeconomic models with pecuniary and aggregate demand externalities, where prudential inflow controls can sometimes correct for the associated distortions and improve welfare.[1] On the policy front, the International Monetary Fund (IMF)'s first release of its Institutional View on the Liberalization and Management of Capital Flows (IV) explicitly endorsed the use of capital flow management (CFM) policies on inflows during episodes of inflow surges (IMF 2012a). More recently, the IMF further revised the IV to endorse also the prudential use of inflow CFMs in the absence of inflow surges, provided stock vulnerabilities exist.

In contrast, efforts to reconsider controls on capital *outflows* (CCOs) have been virtually absent. This is a surprising asymmetry which probably reflects the widespread belief that CCOs are either expropriatory measures imposed by corrupt policymakers or last gasp maneuvres of sinking governments.[2] Such a belief (whose precise origins are unclear), rather than being questioned, is in fact taken as a given in theoretical studies. Thus, in an influential contribution, Bartolini and Drazen (1997) modeled CCOs as signals of bad government behavior in the future.

Of course, the fact that CCOs are sometimes a reflection of corruption or financial despair does not rule out the possibility that, under other circumstances, CCOs can be socially useful and effective as a stabilization tool. But whether CCOs can be justified to forestall a financial panic remains an open question. This is perhaps best exemplified in the debate between Krugman's (1999) and Dornbusch (2001) regarding the desirability of Malaysia's CCOs in the midst of the Asian Financial Crisis.

The debate therefore remains largely unsettled, making it hard to identify useful policy prescriptions. In that regard, the IMF's IV says that *"in crisis situations, or when a crisis may be imminent, there could be a temporary role for the introduction of CFMs on outflows"* (IMF 2012a) but also stresses that *"CFMs on outflows, (...) often entail greater costs (...) including through, for example, more adverse effects on investor confidence"* (IMF 2022).

Several significant challenges for research thus emerge. Some are empirical: How are CCOs used in practice? Is there evidence that they are used systematically during crises? Others are theoretical: What kind of model is useful to think about the costs and benefits of CCOs? In particular, can CCOs be viewed as

[1] See literature review in the next section.
[2] See Ghosh et al. (2020)

corrective policies to distortions or externalities and, if so, which ones? What normative implications can we draw? And, how are these implications related to some operational challenges traditionally attached to the use of CCOs (i.e. time consistency, reputation and stigma)?

This paper addresses these and other questions related to CCOs, from both an empirical perspective and a theory viewpoint. On the empirical front, we assemble new evidence on the use of CCOs for the largest panel of countries available. From our data we identify episodes of strong CCO tightening, which we then relate to macroeconomic aggregates and measures of economic and financial stress. This exercise indicates that episodes of CCO implementation coincide with macroeconomic and financial stress, characterized by a steep fall in GDP growth, and indicators of banking and currency crises that begin to rise before the episodes unfold. Other macroeconomic symptoms reminiscent of crises, such as falling capital flows, current account reversals and large depreciations of the currency, also coincide with the deployment of CCOs.

Our empirical results indicate that CCOs are usually deployed in response to crises and declining growth, a stylized fact that inspires our theoretical approach. We develop a model of a small open economy in which CCOs can have benefits as well as costs. Motivated by ongoing policy discussions, the model allows for the possibility of multiple equilibria and coordination failures by foreign investors, resulting in financial panics and capital flight episodes. Under such conditions, the application of CCOs can serve to eliminate undesired equilibria. In other words, CCOs work in our model not as expropriatory measures but, rather, as devices to ensure the coordination of market expectations towards a desirable, no-capital-flight equilibrium. For that reason, the anticipation that CCOs will be applied when circumstances warrant them, can improve ex ante expected returns and attract more foreign investment.

Modeling CCOs as coordination devices at times of financial stress is related to the venerable tradition of models of banking and financial panics descending from Diamond and Dybvig (1983). This approach attempts to formalize the view that CCOs are justified ”in crisis situations, or when a crisis may be imminent”.

Our resulting theoretical framework can be extended in many interesting directions, some of which we develop in this paper. A first one recognizes that CCOs may involve a variety of costs which must be evaluated against the benefits of CCOs to come up with normative prescriptions. Hence, in our model, we allow for the existence of deadweight losses associated with the application of CCOs. Such losses can capture adverse effects on investors confidence from the use of CCOs, but can be related more broadly to other distortions, including *”promoting rent-seeking behavior and corruption, facilitating repression of the financial sector, impeding financial development and distorting the allocation of capital”* (IMF 2012a). Large enough deadweight losses can render the use of CCOs unadvisable. This is not too surprising, but our analysis identifies what ”large enough” means in precise terms. In particular, we find that CCOs can still be beneficial if the probability of a financial crisis would be large in their absence. Our analysis therefore calls for caution but, at the same time,

identifies the relevant variables for the evaluation of CCOs in episodes of stress.

We also discuss other practical obstacles to the successful use of CCOs. An important challenge is that an optimal CCO policy under commitment can be time inconsistent, as we show in our model. This occurs because, as mentioned earlier, while optimal CCOs enhance ex ante returns to investment, the ex post incentives for a government to impose CCOs (or not) can shift once initial investments are in place. The result that CCOs can be time inconsistent underscores the difficulties of appropriate CCO implementation. It implies that the welfare enhancing properties of CCOs may be available only if a government enjoys sufficient credibility.

Finally, we examine implications for our analysis of the view that CCOs are sometimes imposed by governments for reasons other than social benefit. For our discussion, we analyze the policy problem of an honest, benevolent government, when market participants may believe that the government can be, instead, an opportunistic one that always imposes capital controls. Our analysis yields two noteworthy results. First, we find that the benefits from CCO policy are increasing on the government's reputation, as given by the investors' probability belief that the government is benevolent. Second, we show that the implementation of CCOs may have adverse effects on the honest government's reputation. An implication, in a dynamic setting, is that the honest government may refrain from imposing CCOs in situations where they would be called for if not for reputation building. This finding is clearly reminiscent of Bartolini and Drazen (1997), a key difference being that, in our model, low reputation may prevent taking advantage of CCO policies that could otherwise deliver substantial social gains. Clayton et al. (2022) also study the role of of CCOs in reputation building in the case for China. In contrast to these authors, we observe that it is the belief of an *unwarranted* use of CCOs that hurts reputation building, and not the use of the tool per se.

That CCOs may serve as coordination devices to stabilize expectations has been recognized in previous literature, although not developed as thoroughly as we do here. For instance, Schmitt-Grohé and Uribe (2021), who emphasize multiple equilibria in open economy models with collateral constraints, observe that the same type of models often used to justify capital controls on inflows are prone to self-fulfilling crises which can be appropriately addressed by "the mere threat (...) of capital control taxes in the event of capital flight".[3] Likewise, Fornaro (2022) highlights that controls on outflows can be used to eliminate capital flight equilibria in the context of monetary unions. In our paper we investigate several implications and extensions of this observation, which yields many novel findings. For example, we show that, even if CCOs are useful as a coordination tool, it is not always optimal to implement them. We also highlight time inconsistency, deadweight losses, and reputation building as forces that complicate the decision to implement CCOs.

The rest of the paper proceeds as follows. Section 2 extends the discussion about how our paper relates to existing literature. Section 3 reviews new evidence on capital controls on outflows and presents stylized

[3] See Schmitt-Grohé and Uribe (2021, p.995)

facts on the behavior of aggregate variables during episodes of CCO tightening. Section 4 describes our basic theoretical framework under laissez faire. Section 5 introduces CCOs with and without deadweight costs, and discusses their implications. Section 6 examines the time inconsistency problem of optimal CCO policy. Implications of political opportunism for the analysis of CCO policy are studied in section 7. Section 8 examines how dynamic reputation building can become an important constraint to CCO policy. Final comments and remarks are given in Section 9. An empirical and a theory appendices expand on technical details.

2 Literature Review

Our work contributes to three branches of the literature on capital controls. First, we propose a modeling approach that complements recent theoretical studies that justify the use of controls. Second, we present fresh empirical evidence on the relation between capital controls and macroeconomic performance. Finally, our study delivers an analytical framework to study policy prescriptions on the use of capital controls coming from the IMF and other international institutions. We discuss each of these connections in turn.

2.1 Theory

While the optimal use of capital controls has long been a subject of debate in academia and policy circles, in recent years the discussion has been dominated by a relatively new theoretical literature. This literature, developed since the Global Financial Crisis, has justified the use of capital controls as second-best policies in economies with pervasive externalities.

Two kinds of externalities have been stressed. One is pecuniary, and often present in models with financial constraints that depend on some relative price such as the real exchange rate or the price of land. Typically, a fall in the relative price tightens the financial constraint, for example, by increasing the real value of foreign debts. Because this effect is not taken into account by individual agents when deciding their financial position, there is an externality that can be corrected by policy. Capital controls thus emerge as one policy that can correct for the externality, by making individuals face socially appropriate financial returns (Lorenzoni 2008; Korinek 2010; Jeanne and Korinek 2010; Bianchi 2011; Benigno et al. 2013).

A second type of externality appears in models of insufficient aggregate demand, including models with nominal rigidities and sub-optimal monetary or exchange rate policies. In such models, there is an externality because agents do not internalize the fact that increasing their individual demands has a positive welfare impact. Since the severity of such aggregate demand externalities may depend on individual wealth positions, it can

be mitigated by appropriate taxes or subsidies to financial wealth accumulation. Capital controls can then be justified as a special case (Schmitt-Grohé and Uribe 2016; Farhi and Werning 2014, 2016).[4]

These insights have provided a fertile ground for new and richer setups that consider the use of capital controls in conjunction with other policies. In particular, ongoing research at the IMF (Basu et al. 2020; Adrian et al. 2021) has explored the joint inclusion of pecuniary and aggregate demand externalities in what has been called the integrated policy framework, with an eye towards investigating conventional and unconventional central bank policies together with other policies, including capital controls.

Our theoretical approach contributes to this growing literature by exploring coordination failures –a different type of externality– as a possible rationale for the use of capital controls, and particularly of CCOs in times of financial stress. Our modeling choice is motivated by the view that financial crises are sometimes characterized as episodes of capital flight driven by foreign investors in a panic amid macroeconomic and financial stress. We believe that such a view is hardly controversial, but its implications for the analysis of capital controls have been relatively ignored. In particular, approaches that rely on pecuniary and aggregate demand externalities often direct focus to the benefits of capital controls in a *prudential* manner (Bianchi and Lorenzoni 2022).[5] In contrast, our approach underlines that capital controls on outflows can be beneficial when applied *ex post*: in the model we propose below, financial crises are triggered by the lack of coordination by agents who overreact amid financial stress, and CCOs can act as devices to coordinate expectations and ensure outcomes that correspond to fundamentals.[6]

Our emphasis on coordination failures is a natural extension of ideas from the literature on banking and financial crises applied to the study of capital controls. As some readers will recognize, our theoretical model adapts elements from Diamond and Dybvig (1983) and Holmström and Tirole (2001). Moreover, in the international finance literature, Bocola and Lorenzoni (2020) and Schmitt-Grohé and Uribe (2021) study models of small open economies where multiplicity of equilibria is possible. The former argue that ex-post government transfers can eliminate unwanted capital flight while the latter explicitly shows that CCOs can be used for the same purpose. In this sense, our finding that CCOs can eliminate *"bad"* equilibria is not new in the literature. However, we go beyond previous work by allowing for and investigating practical difficulties for the implementation of CCOs, specifically the challenges posed to governments by *deadweight losses*, *imperfect credibility* and *lack of commitment* and show that CCOs even if they can prevent a self-fulfilling crisis, they are not necessarily

[4]More recently, Bianchi and Coulibaly (2022) argue that whether taxes are set on inflows or on outflows depends on the relative magnitude of current and expected labor wedges

[5]Specifically, Bianchi and Lorenzoni (2022), in terms of CCOs, argue that even though outright prohibition on capital outflows can be welfare improving, it could impose reputation costs and raise inconsistency issues which they leave for future research. We address these issues in this paper.

[6]More precisely, policies announcing the future and contingent use of CCOs in case of a crisis are optimal in our model, but their ex ante use, unrelated to macro-financial stress, is welfare detrimental as this would reduce the initial amount of investment. See Li et al. (2023) for a model of optimal preemptive use of CCOs.

optimal.

In this paper we show that optimal CCOs can be time inconsistent. This result belongs, of course, to the influential body of research on the time consistency of optimal policy pioneered by Kydland and Prescott (1977) and Calvo (1978). Time inconsistency shows up often in dynamic policy models. For example, Bianchi and Mendoza (2018) find that macroprudential policy can be time-inconsistent when forward looking prices are part of the constraint, while Fornaro (2022) finds that becoming part of a monetary union solves the time inconsistency problem of a government that can appropriate a share of foreign investors return by devaluating its exchange rate. To the best of our knowledge, however, our finding of time inconsistency is new in the context of CCO policy analysis.

Finally, our treatment of the importance of reputational constraints and reputation building is related to political economy models of capital account restrictions. In an early contribution, Alesina and Tabellini (1989) proposed a model in which left-wing governments might be more prone to restricting capital outflows than right-wing ones, thereby emphasizing the role of political risk. In turn, Bartolini and Drazen's (1997) developed the idea that controls on outflows can signal future "bad policies" to market participants, with the implication that "good" governments may choose capital market liberalization in order to avoid sending such a signal. Along those lines, Ghosh et al. (2020) model inflow controls as "damned by guilt of association" to CCOs, in turn "associated with autocratic and repressive regimes". Similarly, Clayton et al. (2022) construct a dynamic reputation model to rationalize China's strategy for the internationalization of the Renminbi. In their model, the government builds credibility as an international currency issuer by *not* implementing CCOs.

The theoretical framework that we build has some similarities with the work just mentioned, but also important differences. The basic similarity is that our treatment of reputation is based on the assumption that there may be different "types" of government. The key difference, on the other hand, is that we build our model on the assumption that CCOs can be socially beneficial, so that a benevolent government would impose them under the right circumstances. This implies that we can use our analysis to discuss policy prescriptions for an "honest" government. In contrast, the models mentioned in the previous paragraph deliver positive connotations but hardly normative prescriptions. For instance, we argue that reputation deteriorates due to misuse of CCOs, and not because of its use. Additionally, we find that concerns about reputation building prevent governments from implementing CCOs even when it would be optimal to do so. Our model, thus, can help rationalize the findings in Acosta-Henao et al. (2020) where governments appear to be reluctant to actively use capital controls, hence their remarkable stickiness in the data.

2.2 Empirics

In presenting new evidence on the links between CCOs and macroeconomic variables, our paper contributes to empirical studies that have measured capital controls and their link with the macroeconomy.

Because of the complexity and intricacies of real-world capital controls, quantifying *de jure* controls has proven to be a challenge. In one of the earliest attempts, Quinn (1997) produced a composite measure of financial regulation and openness (subsequently revised and updated in Quinn and Toyoda (2008)), based upon a subjective coding of the narrative contained in the current account and capital account transactions of the IMF's Annual Reports on Exchange Rate Arrangement and Exchange Restrictions (IMF 2021). An influential alternative was proposed by Chinn and Ito (2002, 2006) as the first principal component of the four IMF binary variables from the AREAERs that capture the existence of multiple exchange rates; restrictions on the current account and capital account transactions; and the requirement of the surrender of export proceeds.

Both the Quinn and the Chinn-Ito indices have been popular in applied work. For our purposes, however, their usefulness is limited by the fact that neither disaggregates controls by direction of flows, which is critical for our work since we focus on outflow restrictions. Schindler (2009) is among the first to differentiate controls by the direction of the capital flow, through a much more granular approach, benefiting from the increased richness in the AREAERs from 1995 onwards. This structure allows for the construction of various subindices, including those for individual asset categories, for inflows vs. outflows, and for residents vs. nonresidents. Klein (2012) and Fernández et al. (2015) extended the dataset in Schindler (2009).

These works were subsequently consolidated in Fernandez et al. (2016), further extending the set of countries, asset categories and years. Recent work by Binici and Das (2021) draws on the IMF's new Taxonomy of Capital Flow Management Measures to capture monthly changes to capital account policies, on inflows and outflows separately, for a pool of advanced and emerging markets. Acosta-Henao et al. (2020) further studies the dynamics of capital controls by analyzing a new dataset on the intensive and extensive margins of capital controls.[7] Our work contributes to this literature by making use of the dataset in Fernandez et al. (2016) and Binici and Das (2021) to systematically characterize the use of outflow controls. It also extends the analysis in Acosta-Henao et al. (2020) by documenting the persistence of CCOs.

These *de jure* measures of capital controls have often been used to examine the effectiveness of controls,

[7] Other works that have used the categorical information in the AREAERs are Tamirisa and Johnston (1998), Ostry et al. (2012), Eichengreen and Rose (2014) and Brune and Guisinger (2014). Pasricha et al. (2018) refine an approach that was first introduced in Pasricha (2012) and developed in Aizenman and Pasricha (2013) using data on policy changes, rather than levels of capital controls, from AREAER, supplementing it with information on policy changes from central bank websites and news sources, and classifying them as easing or tightening of inflows or outflows, and further decomposing them by types. The works by Bruno et al. (2017), leveraging on the dataset in Chantapacdepong and Shim (2015) using the AREAER info, together with national sources, document capital controls in East Asian economies. Using information from local press releases and news bulletins, Ahmed and Zlate (2014) constructed a balanced, quarterly panel dataset that covers controls for 12 EMEs from emerging Asia and Latin America. Gupta and Masetti (2018) analyze the use of capital flow measures over business cycle frequencies, for which they construct a quarterly database of quantitative or price-based capital controls for 47 emerging market economies between 1999 and 2016 for different kinds and direction of capital flows.

resulting in a voluminous empirical literature recently surveyed in Erten et al. (2021) and Rebucci and Ma (2020). As argued in those surveys, however, empirical studies on the implications of controls on outflows are few. Magud et al. (2018) find mixed results in terms of the effectiveness of outflow controls. They point to episodes in Malaysia, Spain and Thailand as cases that were relatively effective in reducing volumes of outflows and making monetary policy more independent. Less systematic evidence is found in support of them switching capital flows toward longer maturities.

The capital outflow controls deployed in Malaysia in 1998-99 have been a prominent case, perhaps because some observers, particularly Paul Krugman, argued that they were effective (Krugman 1999)[8]. However, Dornbusch (2001) argued against their efficacy, while others have claimed that, instead, the Malaysian controls provided a screen behind which politically favored firms could be supported (Johnson and Mitton 2003). An additional skeptical view from a cross-country dimension was provided by Forbes and Klein (2015), studying episodes of increased capital outflow controls during two periods marked by crises (1997-2001 and 2007-11). They conclude that controls failed to yield significant improvements in growth, unemployment, and inflation. If anything, Forbes and Klein argue, they may have instead caused a significant decline in GDP growth.

More recent studies, some using more granular data, have continued to yield mixed results about the effectiveness of capital outflow controls. Using measures disaggregated by asset class, Binici et al. (2010) find that both debt and equity controls can substantially reduce outflows, but that only high-income countries appear able to impose debt outflow controls. Ben Zeev (2017) finds that capital outflow controls have no significant shock-absorbing capacity in the wake of large external shocks, as opposed to inflow controls. Saborowski et al. (2014) examines whether a tightening of outflow restrictions helps reduce net capital outflows, finding that such tightening is effective if it is supported by strong macroeconomic fundamentals or good institutions, or if existing restrictions are already fairly comprehensive. If these conditions are not met, such measures are found to provoke a sizable decline in gross inflows, mainly driven by foreign investors. Bhargava et al. (2023) documents how blunt tools such as bans and limits on outflows have been imposed during crises, yet it fails to find systemic evidence that they curbed resident or non-resident outflows and may have further triggered further downgrades in sovereign debt ratings.

While our work does not empirically assess the effectiveness of capital outflow controls, the model we build can rationalize the mixed results of the empirical literature. For the model allows to jointly consider the benefits and costs associated to these policy tools. Furthermore, it can also provide a theory backing the findings that certain institutional features matter for the effectiveness of these policy measures. Lastly, our conceptual framework could provide guidance for empirical analysis of the effectiveness of capital controls, including elements of credibility, commitment and investors' coordination failures.

[8] See also Hood (2001)

2.3 Policy

Finally, our paper should be useful to the policy work of multilateral organizations toward the development of a framework to manage capital flows. This effort includes the IMFs Institutional View on the Liberalization and Management of Capital Flows (IV), first published in 2012 (IMF 2012a), together with its background policy paper on outflow controls (IMF 2012b), among others.[9].

Motivated by the observation that capital flows offer potential benefits but also pose policy challenges because of their size and volatility, the IMF's IV proposes a "comprehensive, flexible, and balanced approach for the management of capital flows". An important aspect of the proposal is the view that some rapid capital outflows can be disruptive, creating policy challenges, insofar as they can increase macro and financial stability risks. Under some conditions, then, the IV postulates that capital flow management (CFM) policies on outflows can be useful.[10] It takes the position that, while outflows should usually be handled primarily with macroeconomic, structural, and financial policies, CFMs on outflows could play a temporary role in crisis situations, or when a crisis may be imminent. Importantly, the IV underscores that such policy actions should not substitute for warranted macroeconomic adjustment and that introducing outflow CFMs should always be part of a broader policy package that also includes macroeconomic, financial sector, and structural adjustment to address the fundamental causes of the crisis.

Following a recommendation from the 2020 evaluation report by the IMF's Independent Evaluation Office on IMF advice on capital flows IEO-IMF (2020), the IV was revised in 2022 (IMF (2022)). As already noted, the influence of the analytical agenda on the Integrated Policy Framework was reflected in the identification of CFMs on inflows as potentially useful to reduce financial stability risks preemptively (i.e., in the absence of a capital inflow surge). The review did not propose changes to other existing elements of the IV, including those on outflow CFMs. The IMF Executive Board, however, noted that the use of outflow CFMs required further research and hence could not be addressed in that review.

This postponement did not go unnoticed by some observers, including Stiglitz and Ostry (2022) and Ostry (2022), who called for the need to rethink the IV advice on outflow CFMs. Ostry (2022), in particular, wrote that the "value added of a fresh look at Fund policy on outflows would seem potentially huge."

In this regard, our work contributes an analytical framework that can be useful to identify situations in which

[9] See also (IMF 2015). Other important policy work include the G20's Coherent Conclusions for the Management of Capital Flows, first adopted in 2011, as well as the OECD's Code of Liberalization of Capital Movements, and the EU's Treaty on the functioning of the European Union. While the G20's policy work allowed to reach a consensus on broad principles, the OECD's Code and EU's Treaty formalized bilateral and multilateral agreements establishing norms and rules applicable to their signatories with respect to capital flows and their management.

[10] The IV introduced the concept of CFM which partially overlaps with that of capital controls. For the IV's terminology, the latter are residency-based CFMs, which encompass a variety of measures (including taxes and regulations) affecting cross-border financial activity that discriminate on the basis of residency. Other CFMs, which do not discriminate on the basis of residency, can also be designed to limit capital flows.

the application of outflow CFMs is warranted. The model we build provides guidance on the analysis of benefits and costs of CCOs, and sheds light on practical difficulties for optimal policy, in particular credibility and reputational constraints that can be useful for policy advice.

3 Capital Controls on Outflows and Aggregate Variables: Evidence

This section presents fresh empirical evidence on the linkages between capital controls on outflows (CCOs) and the macroeconomy. We identify episodes of CCO tightening and document their systematic relationship with key macroeconomic variables. Our main finding is that such episodes are associated with macroeconomic and financial stress: they coincide with a steep fall in GDP growth and the occurrence of banking and currency crises. This stylized fact will be incorporated as a key building block of the model developed in later sections.

3.1 Methodology and Data

We identify episodes of forceful use of CCOs using information from three complementary sources. First, we include episodes already identified in the IMF study on managing capital outflows (IMF 2012b) which identified cases of ”significant tightening of outflow controls” in both emerging and advanced economies between 1998 to 2009. The additional two sources of information used are the CCO data in Fernandez et al. (2016) and the information on outflow CFMs in the IMF’s Taxonomy of Capital Flow Management Measures, as captured in Binici and Das (2021). The former covers 100 countries from 1995 to 2019, and is built by coding the capital account regulation on the IMF’s AREAER over 10 asset categories, distinguishing controls by direction of the flow and by residency. The latter covers the monthly changes for all episodes when CFMs have been officially identified by the IMF since 2012.[11]

The criterion we employ to identify forceful CCO episodes is purely statistical and does not take into account any ex-ante or ex-post prudential behavior nor any interaction between CCOs and other macro-financial variables. More concretely, an episode is identified in these two dataset as a positive change in the index of CCOs (i.e. a tightening) that is greater than or equal to two and a half standard deviations, computed over the entire distribution of positive changes across countries and time. The information from the three sources yields

[11] This allows us to capture all publicly available measures of CCOs. The combination of the measures in IMF (2012b) and the IMF’s Taxonomy allows us to capture all measures that have been officially identified by the IMF as macro-critical tightenings of CCOs. The granular information in Fernandez et al. (2016) complements this data by providing information on restrictions of a wider cross section of assets that may not be contained in the IMF Taxonomy. The Empirical Appendix presents results focusing on each of these three sources of information. As mentioned in the literature review, other well known measures of capital controls such as those in Chinn and Ito (2006) and Quinn (1997) are not useful for our purpose because they do not differentiate between inflow and outflow controls.

a total of 31 separate CCO episodes over 26 countries.[12;13] They are somewhat uniformly spread out between 1998 and 2020. Furthermore, of the 31 episodes, 8 are from high income countries, 9 from upper-middle, 9 from lower-middle and 5 from low income. Lastly, using the work by Ilzetzki et al. (2021), we classify the CCO episodes by exchange rate regime: no legal tender, pegs and crawling pegs are the exchange rate regimes most prevalent, with 11, 8 and 6 of the CCO episodes displaying these regimes, respectively. The detailed list of episodes and their distributions across time, exchange rate regime and income level can be found in Table A.1 and Figs. A.5-A.7, respectively, of the Empirical Appendix.

Having identified CCO episodes, we now document the comovement of these episodes with key macroeconomic variables via event study plots capturing averages across episodes, as well as more systematically through regression analysis. Our main focus of analysis is the systematic relationship between CCO episodes, real GDP, and macro-financial crises indicators. Real GDP data come from WEO (IMF 2022). To isolate country-specific trends in real GDP, we calculate the average growth for each country and de-mean the series. We borrow the indices of banking and currency crises from Laeven and Valencia (2018).[14]

We also look at the behavior of other macro variables around CCO episodes such as aggregate consumption and investment; capital flows; current account balance; exchange rates, and inflation. The sources of these variables are standard (WEO and WDI). For the sake of space, results for these variables are reported in the Empirical Appendix (see Figs. A.8-A.9).

3.2 Stylized Facts

Figure 1 depicts the dynamics of (de-meaned) GDP growth in the ten years around the 31 CCO episodes identified, in both simple means and medians ($t = 0$ is the year of the episode).[15] A first stylized fact readily emerges upon inspecting the figure: episodes of CCO tightening coincide with steep falls in GDP growth of about 4 percentage points on average (3 percent in medians). In the year preceding a CCO episode, average (median) GDP growth is above trend growth by about (slightly below) 1 percentage, but falls steeply to -3 percent on average (-2 percent in medians) in the year of a CCO episode. The recovery is somewhat protracted, with average (median) growth rising above trend only two years after the CCO episode.

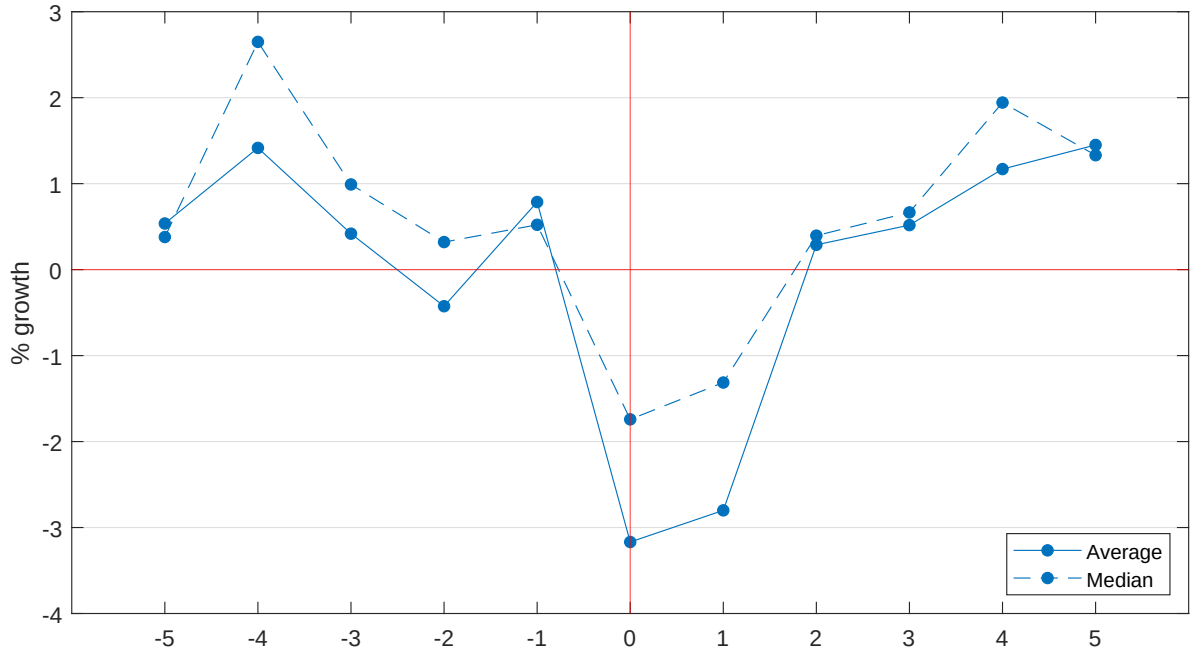
Figure 2 further illustrates the macro dynamics around the CCO episodes identified by documenting the

[12] An important caveat to bear in mind with our methodology is that our proxy for CCO tightenings captures only the extensive margin of capital controls, not the intensive margin. Thus, our estimates might be underestimating the true extent of the tightening in this policy variable. Unfortunately, to the best of our knowledge, there are no publicly available systematic measures of the intensive margin of capital controls for a sufficiently large pool of countries. Acosta-Henao et al. (2020) study the intensive margin but only for a small subset of countries.

[13] We cannot separate all CCOs episodes by residency, i.e whether they have been applied to residents or non-residents. Robustness tests presented at the end of this Section discuss the available information from a subset of episodes for which we can conduct such analysis. Results gathered in the Empirical Appendix indicate that CCOs on non-residents are present in the majority of the cases (see Table A.6).

[14] Additional results in the Empirical Appendix (Figure A.1) consider also sovereign debt crises as third indicator from Laeven and Valencia

Figure 1: GDP Growth Around Episodes of CCO Tightening



Note: The figure depicts the average (median) dynamics of GDP growth (demeaned) in the ten years around the 31 episodes of forceful CCO tightening identified. $t = 0$ is the year of the episode. See main text for details of the methodology and sources used to identify the episodes. Further details, including the list of episodes, can be found in the Empirical Appendix.

behavior of crises indicators. In particular, the figure depicts the average banking and currency crises dummy indicators, as measured by Laeven and Valencia (2018). A second related stylized fact is apparent from this figure: CCO episodes coincide with spikes in both crises indicators. While the banking crisis indicator spikes at 30%, that of currency crisis peaks at 25%. Importantly, both crises indicators start increasing one year *before* the CCO episode materializes in $t = 0$. Figures A.2-A.4 in the Empirical Appendix present results that document how the same patterns in Figures 1 and 2 are reproduced when we focus in each of the three separate sources that we use. Overall, this indicates that CCOs are implemented when crises have already began unfolding.

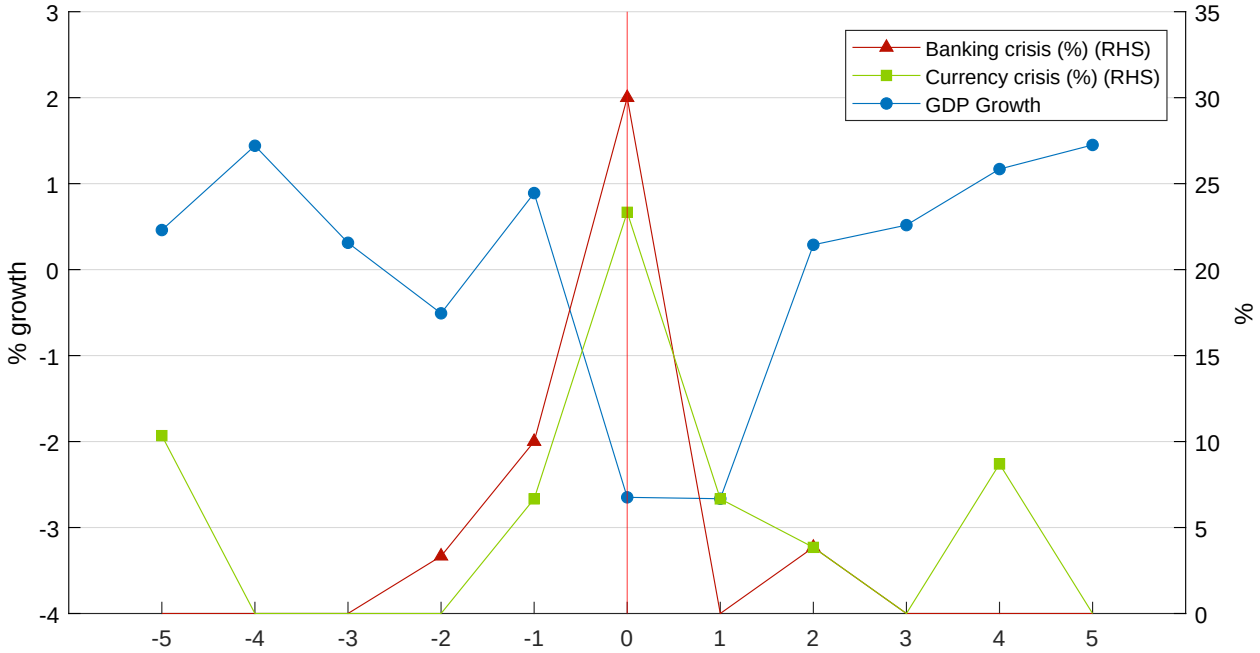
Further results in the Empirical Appendix document the dynamics of other variables of interest around CCO episodes (see Figs. A.8-A.9). On average, CCO episodes also coincide with falling net and gross capital inflows, particularly in FDI. Gross outflows slow down, particularly in portfolio and FDI. They also coincide with large reversals in the current account balance, stagnant consumption and investment, depreciating currencies, and inflation spikes. In sum, these findings further corroborate the fact that large CCO tightenings are coincident with periods of macro-financial stress.

To further explore the relationship between GDP dynamics and CCO episodes, we estimate linear regres-

(2018).

[15] While some of the episodes are identified at a higher frequency, i.e. those coming from the IMF Taxonomy, the analysis is done with annual data as the financial crises data is reported in this frequency.

Figure 2: CCO Episodes and Macro-Financial Crises



Note: The figure depicts the average dynamics of GDP growth (demeaned) in the ten years around the 30 episodes of forceful CCO tightening identified for which crisis indicators of banking and currency crisis exist in Laeven and Valencia (2018). $t = 0$ is the year of the episode. Averages of the dummy variables for these two crises indicators are plotted on the right scale. Out of the 31 episodes in CCO identified, only one does not have data from Laeven and Valencia (2018) which is why the GDP growth dynamics slightly differ between Figures 1 and 2. See main text for details of the methodology and sources used to identify the episodes. Further details, including the list of episodes, can be found in the Empirical Appendix.

sions of the form

$$Y_{i,t} = \beta GDPgr_{i,t} + \alpha X_{i,t-1} + \epsilon_{it},$$

where $Y_{i,t}$ takes the value of 1 if country i experienced a CCO episode in year t and 0 otherwise, $GDPgr_{i,t}$ is the de-meaned real growth rate of income, and $X_{i,t-1}$ is an array of (lagged) macro country-specific controls. The latter include country fixed effects and time trends, as well as the exchange rate regime, inflation, the CA balance, gross and net capital flows, consumption and investment growth. In one specification, the Laeven and Valencia (2018) crisis indicators are also added as controls (not lagged).

Results are summarized in Table 1. The first row depicts the estimated β coefficients associated to GDP growth across 5 alternative specifications that gradually enrich the set of controls used, albeit at the cost of fewer observations/countries available. While column 1 has no controls, columns 2 through 4 sequentially add country fixed effects, time trends (linear and quadratic), and the aforementioned lagged macro controls, respectively. The last column, additionally controls for the two crisis indicators. Table A.2 in the Appendix presents the full set of estimated coefficients.

Table 1: CCO Episodes and the Macroeconomy: Regression Analysis

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP growth	-0.000621***	-0.000636***	-0.000690***	-0.00223***	-0.00172***
Banking Crisis					0.140***
Currency Crisis					0.120***
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	5014	5014	2877	2494
Countries	193	193	193	143	143
Episodes	31	31	31	22	22
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017
Adjusted R^2	0.002	0.008	0.008	0.020	0.097

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports OLS results from the regression analysis of the occurrence of CCO episodes on GDP growth. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth. See the Empirical Appendix for the full table of estimated coefficients.

The key takeaway from the table is that GDP growth systematically correlates negatively with CCO episodes, which is consistent with Figure 1, and the estimated negative β coefficient is statistically significant at 1%, even after controlling for several other macro variables. In fact, adding macro controls increases the absolute value of the estimated β. Importantly, the negative link between growth and CCO episodes remains even after controlling for banking and currency crises (column 5) which, in turn, are positively correlated with CCO episodes, in line with Figure 2.

Estimated marginal effects from a probit analysis presented in the Empirical Appendix help gain additional intuition (see Table A.3). They imply that a 1% decrease in GDP growth would coincide with an increase in the probability of having a CCO episode by 1.1%. This is not only statistically significant but also economically relevant, for the unconditional probability of such an episode is 6.7%, therefore implying an increase of around 16.4% (1.1/6.7).

So far, our discussion has emphasized correlations, without taking a stance on causation. Figures 1 and 2 suggest, however, a natural timing of events: indicators of crises worsen first, and are followed by declines in GDP growth and CCO tightenings in response to worsening macroeconomic and financial conditions.[16] One might conjecture, however, that causality could run in a reverse direction, i.e. that a fall in GDP growth and a spike in crises indicators could be *caused* by the use of CCOs. While a formal analysis of causality is beyond the scope of this work, we nonetheless explore this alternative hypothesis in the Appendix, by performing a counterfactual analysis using a 2-stage procedure (see Figure A.22). First, we recover CCO shocks by removing the systematic component in CCO indices that is associated to lagged macroeconomic activity. A

[16] This timing is consistent with what Edwards (1999) refers to as curative capital controls on outflows.

second stage then uses these CCO shocks as regressors of contemporary GDP growth. The counterfactual is obtained through the fitted GDP growth series assuming that only CCO shocks are turned on. The analysis shows that the simulated GDP growth barely moves in CCO episodes, indicating that the CCO shocks have negligible a impact on the deep fall in GDP growth documented in Figure 1.

The Empirical Appendix contains further results as well as additional robustness tests. First, results with alternative less stringent thresholds for identifying CCO episodes are presented (see Figure A.20). In particular, we consider thresholds of 2 and 1.5 standard deviations, which deliver similar results in terms of the fall in GDP that is coincident with such episodes. Second, it documents the dynamics of CCO indices in the episodes identified, presenting evidence of a strong persistence in the use of these tools in the subsequent periods after the tightening episodes materialize (Figure A.21).[17] Third, we document how results are robust to using time fixed effects, controlling for the level of development, and adding Driscoll and Kraay standard errors (see Tables A.4, A.5, A.7-A.9). Lastly, the Appendix documents the extent to which a subset of 21 CCO episodes identified are characterized by measures that restrict outflows from non-residents (see Table A.6).[18] Results indicate that 12 of the 21 cases CCOs are characterized by tightening of outflows from non-residents. In 16 episodes CCO episodes there is a tightening in CCO to residents.

Overall, the evidence examined here suggests that crises trigger both a fall in economic activity and the deployment of CCOs. We incorporate these facts as the main building blocks in our theoretical work, to which we turn next.

4 A Theoretical Framework

In this section we lay out a basic framework for the analysis of capital controls on outflows. A key building block of the model is the empirical finding documented in the previous section that CCOs are often a response to financial stress and deteriorating macroeconomic conditions. The framework rationalizes the view that capital controls on outflows can be called for in certain circumstances, in particular creditor panics amid macroeconomic and financial stress (IMF, 2012). Hence the model below incorporates the possibility of a *coordination failure* which can be avoided by the imposition of capital controls.

We begin this section by considering a setting without policy intervention. Capital controls are introduced in the next section.

[17] The persistence in CCOs echoes the broader stickiness in capital controls in both extensive and intensive margins documented in Acosta-Henao et al. (2020)

[18] The analysis is done only on the subset of cases where an index from Fernandez et al. (2016) exists as this is the only source that can disaggregate controls by residency.

4.1 A Basic Scenario

Consider a small open economy that lives for three periods, indexed by *t* = 0, 1, 2. In each period there is a single good which, for convenience, we refer to as *dollars*.

For now, we assume that the economy's population is represented by a benevolent government. At *t* = 0 the economy is endowed with an initial amount of dollars $A > 0$. In addition, the economy has the opportunity to invest in a project of variable size. We denote the project size at t by I_t.

The initial size of the project can be larger than *A* because the economy can borrow from foreign investors. Foreign investors are risk neutral. Without loss of generality, they have an alternative safe investment opportunity that yields a net interest rate equal to zero. We also assume that foreign investors are small and identical, and normalize their number to one. Denoting by *i* the average contribution of each investor to the project, the initial size of the project will then be $I_0 = A + i$.

At $t = 2$, the project returns RI_2 dollars, where $0 < R < 1$. We assume that the economy can credibly commit the whole of RI_2 to the repayment of outside investors. In the parlance of Holmstrom and Tirole, RI_2 is the *pledgeable* income from the project. Note it depends on the final size of the project, I_2, which can be less than I_0, as we will see.

In addition to the pledgeable income, we assume that the project yields other, non-pledgeable benefits to the country. The total non-pledgeable benefits are BI_2, where $B > 0$. The existence of non-pledgeable benefits can be motivated in a number of ways, for example that foreign investment brings to the country positive externalities that could be modeled more extensively. Alternatively, as noted by Holmstrom and Tirole, it can reflect moral hazard which, in the context of our model, guarantees that the domestic economy is allocated a minimum share of the project's return.

In this setting, and in the absence of other considerations, it is easy to see that it is optimal for the economy to borrow as much as it can to maximize the size of the project. Indeed, the economy would be able to invest in a project of size $I_0 > A$ by offering investors a payoff RI_0 at *t*= 2 in exchange for an initial contribution of $i = I_0 - A$ from foreign investors at *t*=0. For foreign investors to participate, they expect to be paid the opportunity cost of their funds, which entails $RI_0 \geq i = I_0 - A$. This constraint with equality then gives the project size:

$$I_0 = \frac{1}{1-R}A \tag{1}$$

The size of the project is then a multiple of the country's initial dollar endowment, where the *leverage ratio* $1/(1-R)$ is greater than one. The interpretation is simple. By our assumptions, the country would like to invest in a project as large as possible. But a project of size I_0 can only attract RI_0 dollars from outside investors.

Hence the difference, $I_0 - RI_0$, must be covered with the country's initial funds.

4.2 Financial Fragility and Capital Flight

Now we introduce a substantial complication. At *t* = 1 each foreign investor is given the chance to pull out from the project, obtaining a payoff that depends on the *state of nature* that is revealed at that time. This may reflect that, at *t* = 1, investors find alternative uses for their funds.

For concreteness, we assume that at *t* = 1 the economy can find itself in either a "normal" state or a "fragile" state, with probabilities $1 - q$ and q respectively. In the normal state, no change effectively occurs. Hence foreign investors don't have any incentives to deviate from their original investment plans and choose not to exit the project. But in the fragile state, an investor that has contributed *i* dollars to the project at *t* = 0 can exit the project and obtain an alternative return of ωi, where ω is a positive constant.

In the fragile state, also, the return of the project depends on the *collective* decisions of foreign investors to stay or exit. To model this aspect of the economy in the simplest fashion, we assume that the size of the project at the end of the last period (I_2) is equal to $g(\lambda)I_0$ where λ is the measure of investors that do not exit the project, and $g(\lambda)$ is a continuous and increasing function with $g(1) = 1$ and $g(0) = 0$.

It follows that an investor's payoff of not exiting is also a measure of what *other* investors choose. More precisely, at $t = 2$, each investor that stays can expect to be paid a rate of return equal to $f(\lambda)$ where

$$f(\lambda) \equiv \frac{g(\lambda)}{\lambda} R \frac{I_0}{i}$$

for $\lambda > 0$. We also assume that $g(\lambda)$ is such that $f(\lambda)$ is increasing and continuous, and that $f(0) = 0$.[19]

These assumptions capture that a particular investor's rate of return from staying is higher as more investors choose to stay. This requires $g(\lambda)/\lambda$ to be increasing in λ, and is more restrictive than the assumption that $g(\lambda)$ is increasing. This reflects that if more investors decide to stay the size of the project gets bigger but, at the same time, the project's payoff has to be divided between more people.[20]

More generally, our assumptions about the function $g(\lambda)$ are a short cut for strategic complementarities that may emerge in a more detailed model.[21] For example, one could assume a Diamond-Dybvig situation where the return to a typical bank depositor in the absence of a bank run is high, while the depositor's return if there is a run (i.e. if all other depositors leave the bank) falls to zero.

Lastly, it should be noted that the assumption that the project's return is not affected by the fragile state at

[19] For example, in models a la Diamond-Dybvig, there is some $0 < \lambda* < 1$ such that $g(\lambda) = 0$ for $\lambda \leq \lambda*$.

[20] Imposing convexity on g is a sufficient condition

[21] Fornaro (2022) refers to these strategic complementaries as investment complementarities while Farhi and Tirole (2012) find that costly and untargeted ex-post liquidity policies can generate such complementarity between agents decisions.

$t = 1$ when $\lambda = 1$ is not essential, and could be relaxed at little cost to enhance realism. One could instead assume that the project return falls if the state turns out to be fragile. This assumption would only make our notation more cumbersome, but our analysis would essentially remain (as long as the fall in the project return were not too large).

4.3 Equilibrium Under Laissez Faire

Equilibria in our model are given by strategies for individual investors and an aggregate outcome such that, given the aggregate outcome, the strategies are optimal for each individual investor and, in turn, the aggregate outcome is induced by the strategies together with our maintained assumptions. For exposition and intuition, in this subsection we present and discuss only the key aspects of equilibria. Formal details and proofs are delayed to Appendix B.2.

As we will see below, p denotes the exogenous probability of a capital flight during a fragile state at $t = 1$. With this definition, the main result in this subsection is then:

Proposition 1 (Equilibrium under Laissez Faire)

Assume $\omega < 1$. Then, under laissez faire, for any given p such that $0 \leq p \leq 1$ there is an equilibrium in which capital flight occurs with probability pq.

For the intuition behind the proposition, we start by examining the continuation of the model from *t* = 1 on, and then go backwards. At *t* = 1, the initial size of the project I_0 and the initial contribution of investors $i = I_0 - A$ are given by previous decisions. At that point, if the state turns out to be normal, there are effectively no further changes in the project, so that at *t*=2 the project has size I_0 and each foreign investor is paid RI_0.

If the state turns out to be fragile, however, there are at least two possible continuation outcomes in equilibrium:

- If all investors believe that the others will exit ($\lambda = 0$), the individual payoff from staying is $f(0)i$ = 0 which is less than ωi since $\omega > 0$. Hence it is an equilibrium outcome for all investors to exit the investment in the fragile state.

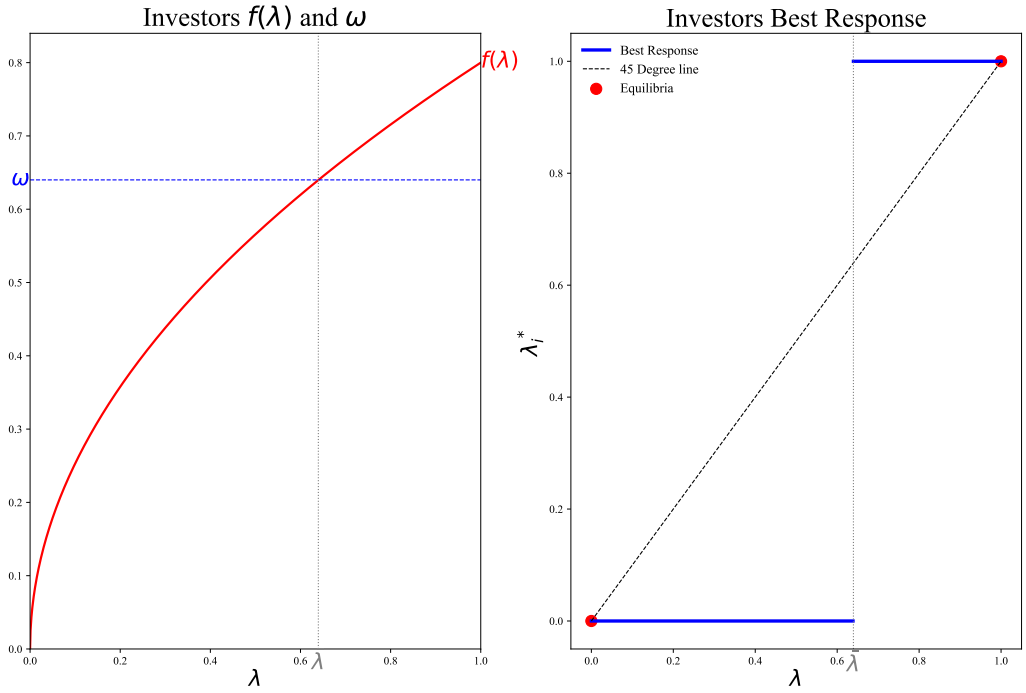
- If all investors stay with the project, an individual investor that also stays with the project receives as payoff $f(1)i$. This investor chooses to stay as long as $R\frac{I_0}{i}$ is greater than the payoff ω from exit. Hence it is also an equilibrium continuation for all investors to stay when $f(1) > \omega$.

Assuming, for the moment, that $f(1) > \omega$ holds, the situation is illustrated in Figure 3.[22] In the figure, a

[22] We set the numerical example such that the first best of the expected payoff is equal to one. More precisely, R is equal to 0.8, B equal to one, and A equal to $1 - R$. We set ω equal to 80% of R, the probability of a fragile state to be 0.2, and we consider $g(\lambda) = R\lambda^{1.5}$. For Figure 3 specifically, we set p equal to 0.3

threshold value of λ , $\bar{\lambda}$, is defined by $f(\bar{\lambda}) = \omega$.[23] The left panel then shows that for λ less than $\bar{\lambda}$, ω is greater than $f(\lambda)$ for any positive i. In contrast, when λ is greater or equal to $\bar{\lambda}$, $f(\lambda)$ is at least as much as ω. The right panel of the figure shows that an investor's best response is to liquidate investment when $\lambda < \bar{\lambda}$, and to stay otherwise.

Figure 3: Laissez Faire - Continuation at $t = 1$



Which outcome occurs in the fragile state depends then on the beliefs of investors. This is a delicate problem that we circumvent by simply assuming that, in the presence of the above mentioned two equilibrium continuations, the "run" continuation occurs with probability *p*. In our analysis, we take *p* as exogenous, but we note that it may depend on history, institutions, or other aspects of the environment that we do not model explicitly but can be significant in practice.[24]

We turn now to the determination of initial investment. Seen from $t = 0$, the expected payoff to an investor to contribute to the project in a laissez-faire (LF) economy is

$$\Pi^{LF} = pq\omega i + (1 - pq)RI_0$$

To interpret this expression, recall that at $t = 1$ the state of the economy is fragile with probability q, and that in such state all investors will exit the project with probability p. Hence, from the viewpoint of $t = 0$, there

[23] Since f is a continuous and increasing function, and $f(0) < \omega < f(1)$, then $\bar{\lambda}$ exists and it is strictly between zero and one.

[24] For instance, one can interpret part of p being determined by the effectiveness of other policies that can be used to address capital outflows and their destabilizing effects, such as regulatory forbearance, monetary policy, foreign exchange intervention, etc.

is probability pq that the investment will end with exit and a corresponding payoff ωi. In all other cases, which occur with probability $1 - pq$, the project will be carried to completion, and each investor will receive RI_0.

For investors to initially join the project, the expected return Π^{LF} must be at least as large as the opportunity cost of their funds, which is simply i. In fact, Π^{LF} must be exactly equal to i, because it is optimal for the country to choose the project size as large as possible. And using $i = I_0 - A$ we obtain the crucial condition:

$$pq\omega(I_0 - A) + (1 - pq)RI_0 = I_0 - A$$

i.e. $I_0 = LA$, where the leverage coefficient L is given by

$$L = \frac{1 - pq\omega}{1 - pq\omega - (1 - pq)R}$$

Note that $L > 1$ provided that pq is sufficiently small, which we assume. Under the same condition, more importantly, $L < 1/(1 - R)$, that is, initial investment is smaller than in the previous subsection.

These results mean that the possibility of capital flight at $t = 1$ affects the economy's investment problem in an important and interesting way. Investors realize that, if they participate in a project of size I_0, they will receive a payoff $\omega(I_0 - A)$ in the case of a capital flight episode, which occurs with probability pq. With probability $1 - pq$, there is no capital flight, and investors receive a payoff RI_0. Under these conditions, the most that the country can raise at $t = 0$ is $pq\omega(I_0 - A) + (1 - pq)RI_0$. This is less than I_0, the difference being covered with the country's initial equity A.

Importantly, because $\omega(I_0 - A) = \omega i < RI_0$, the leverage ratio L falls with pq, i.e. with the probability of a capital flight crisis. Effectively, the possibility of a capital flight episode reduces the pledgeable income from the project, which in turn reduces the amount that the country can borrow initially and the size of the project.

To complete the analysis, consider the payoff to the country. We assumed that the country's payoff is the expected value of BI_2, where I_2 is the final size of the project. Under our maintained assumptions, $I_2 = 0$ if there is capital flight and $I_2 = I_0$ otherwise. Hence the expected payoff to the country is

$$\begin{aligned} E(BI_2) &= B(1 - pq)I_0 \\ &= B(1 - pq)LA \end{aligned} \tag{2}$$

The possibility of a capital flight crisis reduces the economy's payoff in two ways: the initial project size is smaller if the probability of capital flight is higher; and, with probability pq, a capital flight episode wipes out the project and, hence, its benefits to the country.

Finally, as stated by Proposition 1, the existence of an equilibrium with capital flight rests on the condition that $f(1) > \omega$ is satisfied. But this condition must hold in equilibrium for any pq, provided $\omega < 1$. To see this, from the definition of f and that $\Pi^{LF} = i$, it follows that $f(1)$ is equal to $\frac{1-qp\omega}{1-qp}$ in equilibrium. This fraction is strictly greater than one, and hence also greater than ω, if ω is less than one.

5 Capital Controls on Outflows

We have seen that, in the economy under study, the possibility of coordination failure leading to capital outflows is welfare decreasing. The question then emerges of whether government intervention can correct for such failure. To discuss, in this section we endow the government with the power to enact *capital control* policies that can deter such outflows.

It will become apparent that, in our model, capital controls on outflows can be beneficial as coordination devices, eliminating a capital flight equilibrium in the fragile state of nature. Because investors choose to stay in the project in the fragile state, capital controls are not binding in equilibrium. This implies that capital controls are unambiguously beneficial in the absence of other considerations. In practice, however, as mentioned in the Introduction, the imposition of capital controls may involve costs that can more than offset their potential benefits. Accordingly, in this section we expand on the consequences of allowing for such deadweight costs of CCOs. Our analysis casts light on the importance of specific details of the economy, such as the "technology" of capital controls, as well as the need to balance the costs and benefits of imposing controls when governments are considering their use.

5.1 Costless Capital Controls

To begin, suppose that, in period $t = 1$ and if the state turns out to be fragile, the government can take an action that reduces the exit payoff from ωi to $(1 - \tau)\omega i$. The obvious interpretation is an exit tax of rate τ. But one can also see τ as capturing any government measure that reduces the payoff from exit. For example, if $\tau = 1$, the policy can be represented as an outright prohibition on exit. Alternatively, if one assumes that capital controls take the form of increased bureaucratic obstacles to capital outflows, $\tau\omega i$ can be seen as the cost to investors from dealing with such obstacles.

Will such controls eliminate equilibrium capital flight? A moment's thought reveals that the crucial condition is that

$$(1 - \tau)\omega \leq f(0)$$

The interpretation is straightforward. If the state turns out to be fragile at $t = 1$, consider the decision of an

investor that conjectures that all other investors will be exiting the project. That investor will not join the run if his payoff from exiting is less than or equal that his payoff from staying. This is the condition above.

On the other hand, if τ is chosen to satisfy the preceding condition, it must also satisfy $(1-\tau)\omega \leq f(1)$. Hence it is optimal for each investor to stay if she anticipates that all others will stay, i.e. the continuation equilibrium without capital flight must survive. In short, the imposition of capital controls on outflows eliminates capital flight in the fragile state as long as $(1-\tau)\omega \leq f(0)$ holds.

Importantly, CCOs serve as a "coordination device": they can work by reassuring individual investors that the other investors will not leave. Hence their imposition only serves to eliminate unwanted equilibrium capital flight in the fragile state. One implication is that no investor loses $\tau\omega i$, since there is no exit in the fragile state.

This analysis suggests that there may be flexibility in designing CCOs appropriately, depending on available fiscal tools. For instance, if $f(0) = 0$ then the only feasible value of τ that ensures the above requirement is $\tau = 1$. That is, if the payoff from staying to an investor when all others are exiting is zero, the only way to prevent capital flight may be to impose a total ban on exit.

This may not be necessary, however, if the government has an adequate tax-transfer technology. Suppose that the imposition of capital controls means that the government collects a levy of $\tau\omega i$ from any exiting investor, and redistributes the corresponding revenue to staying investors. Then, recalling that λ denotes the measure of staying investors, the total revenue collected is $(1-\lambda)\tau\omega i$, so that each staying investor will receive $(1-\lambda)\tau\omega i/\lambda$. Therefore the above condition changes to $(1-\tau)\omega \leq f(0) + (1-\lambda)\tau\omega/\lambda$, i.e.

$$\lambda(1-\tau)\omega \leq \lambda f(0) + (1-\lambda)\tau\omega$$

In this case, any strictly positive value of τ is sufficient to deter capital flight, even in the case $f(0) = 0$.

In practice, the technology of capital controls may be somewhere in the middle, which means that capital flight will sometimes be prevented by policies less draconian than a strict prohibition of capital flows. Our analysis is worth paying attention to, however, in the sense that it illustrates the importance of policy technology and institutions.

Now, assuming that sufficiently stringent capital controls are imposed in the fragile state, the capital flight equilibrium disappears. This means that the only possible outcome of the model is that the final size of the project will equal its initial size, i.e. $I_2 = I_0$ with probability one.

Recall that this leads to the best possible outcome for this economy, i.e. the outcome of subsection 4.1. In this sense, we have arrived at a model in which capital controls on outflows are socially optimal.

5.2 Costly Capital Controls

In the analysis of the previous subsection, the fact that CCOs act as a coordination device implies that CCOs can be implemented without cost. For example, if CCOs are interpreted as a tax on capital outflows, nobody pays the tax in equilibrium. That analysis, however, may be too optimistic. In practice, the imposition of capital controls can entail several costs, from the adverse effects on investor confidence (IMF 2022), to broader distortions induced by rent-seeking behavior and corruption, financial repression, and capital misallocation (IMF 2012a).

To deal with this issue, in this subsection we allow for such costs, and examine the resulting trade-off between the costs of capital controls and their beneficial impact as a coordination device.

As a first pass at the issue, we assume that capital controls cause a deadweight loss proportional to the size of the project: if capital controls are imposed, the size of the project shrinks from I_0 to $(1-\phi)I_0$, where $\phi > 0$ is a measure of the loss associated with capital controls.[25]

In this scenario, *when* exactly capital controls can be applied makes a difference. In this subsection we consider the case in which capital controls are imposed after the state of nature is realized at $t = 1$ but, if the state is fragile, before investors have chosen whether to stay with the project or exit. The definition of equilibrium is then amended in the natural way (see Appendix B.2 for details).

Proposition 2 (Controls Can Eliminate Capital Flight)

For a given τ, there is no equilibrium with capital flight if

$$(1-\tau)\omega \leq (1-\phi)f(0)$$

Proposition 2 establishes conditions under which capital controls eliminate equilibria with capital flight. The proof is simple. If the state is fragile and λ investors stay with the project, an individual investor will also stay if

$$(1-\phi)f(\lambda)i \geq \omega i(1-\tau)$$

Under the condition of the proposition, the preceding inequality holds even if $\lambda = 0$, that is, even if all investors pull out in the fragile state. It is then individually optimal for investors to stay with the project in the fragile state regardless of λ, and hence no capital flight can occur in equilibrium.

Since $f(0) = 0$, the proposition implies that equilibria with capital flight can always be eliminated if τ can be set to 1. (The way we have stated the proposition, however, suggests that less restrictive CCOs may eliminate capital flight equilibria if our assumptions were relaxed so that $f(0) > 0$.)

[25] We assume that deadweight losses reduce both the return of the project for investors and the domestic economy payoffs, despite that CCOs are only imposed on foreign investors. Thus, we make the implicit assumption that CCO distortions or capital flight incentives move across sectors. For instance, Forbes (2007) and Andreasen et al. (2024), among others, provide empirical evidence of capital controls having a broader impact on the economy.

While the proposition is remarkably simple, it underscores that, even if CCOs entail deadweight losses, they can still be effective as coordination devices to avoid capital flight. On the other hand, the final size of the project falls to $I_2 = (1-\phi)I_0$ in the fragile state, reducing final payoffs in that state.

There is an additional, more subtle cost. The anticipation of CCOs and their implied losses will affect, in turn, the initial size of the project. To see this, notice that if controls rule out capital flight in the fragile state, the expected payoff to investors is given by

$$\Pi^{CC} = [q(1-\phi) + (1-q)]RI_0$$

since the imposition of capital controls, which occurs with probability q, reduces the final payoff by the factor ϕ. Using again the fact that $\Pi^{CC} = i = I_0 - A$ now gives the initial project size under capital controls:

$$I_0 = \frac{1}{1-(1-q\phi)R}A \tag{3}$$

Comparing with (1), this expression shows that the possibility of costly capital controls effectively reduces pledgeable income from RI_0 to $(1-q\phi)RI_0$. This is because the controls are applied in the fragile state, which has probability q, and cause a proportional loss ϕ of pledgeable income from the project. For that reason, the leverage ratio and the initial size of the project decrease with the product $q\phi$.

In turn, the country's expected welfare is

$$\begin{aligned} BE(I_2) &= B[(1-q) + q(1-\phi)]I_0 \\ &= B(1-q\phi)\left[\frac{1}{1-(1-q\phi)R}\right]A \end{aligned} \tag{4}$$

Hence, under costly capital controls, an increase in $q\phi$ reduces expected welfare in two ways: it directly increases the expected loss, given the initial size of the project I_0; and it also reduces the project size. In fact, capital controls can result in lower expected welfare than in laissez faire. This would reflect that the elimination of capital flight is not worth the direct and indirect costs of CCOs.

Finally, it is important to show not only that CCOs can eliminate capital flight, but also that they do so leaving room for equilibria without capital flight. This is the subject of the next proposition, whose proof is given in the appendix:

Proposition 3 (Equilibrium without Capital Flight)

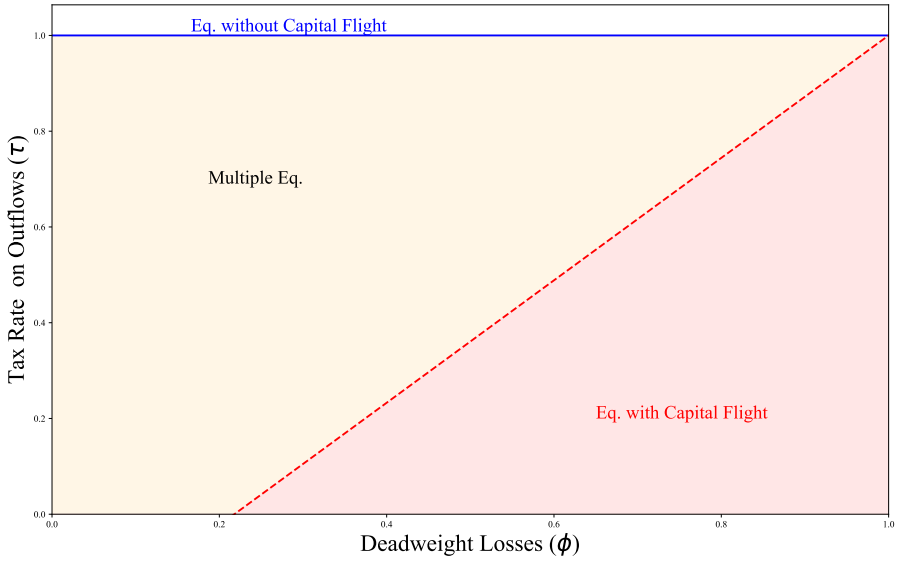
For a given τ, an equilibrium without capital flight exists as long as

$$(1-\tau)\omega \leq \frac{1-\phi}{1-q\phi}$$

The main intuition of the proposition involves ensuring that it is individually optimal for investors to stay in the fragile state if all other investors stay. This would not be the case if $(1-\phi)f(1) < \omega(1-\tau)$. Under such condition, CCOs are not strong enough to prevent liquidation, but their deadweight costs have such a negative impact on project returns that each investor decides to leave the country regardless of what the other investors do. The condition is ruled out by the inequality in Proposition 3

Figure 4 illustrates how the nature of equilibria depends on the relative values of τ and ϕ. The figure shows that, if ϕ is relatively small, a sufficiently large τ rules out capital flight as a best response and, as a result, there is only one continuation equilibrium in which investors stay.[26] If τ is not large enough, however, investors may decide to exit in the fragile state (multiplicity) even if they have to pay the exit cost τ. The figure also says that, if ϕ is large and τ is small, the only equilibrium continuation involves investors exiting (liquidation). In that case, the imposition of capital controls is so detrimental to the project return that investors exit: capital controls backfire.

Figure 4: τ and ϕ - Equilibria with CCO policy



The analysis of this subsection underscores that, if CCOs imply deadweight losses, they may or may not be socially desirable. This is the case even if CCOs rule out speculative capital flight, i.e. if $(1-\phi)f(0) \geq \omega(1-\tau)$. The intuition is that capital controls entail costs in the fragile state even if investors expectations had coordinated

[26] Since $f(0) = 0$, in the case of our numerical example, this only holds for $\tau \geq 1$

in the no exit equilibrium. Whether or not capital controls are optimal may depend on the value of p, the probability of capital flight in the fragile state, as well as the deadweight loss parameter ϕ .

It may be worth noting that the way we model capital controls and deadweight losses does not capture all operational challenges that governments might face when implementing CCOs. For instance, our model assumes that there is complete information about p and ϕ while, in practice, governments make policy decisions based on estimates;[27] it ignores potential constraints and challenges imposed by *"sequential"* flight, that is, a scenario where investors decide to leave, or stay, in some order;[28] and we capture abstract any heterogeneous multi-sectorial impact of CCOs and capital flight incentives through a single parameter ϕ. Despite not fully capturing operational challenges, our following analysis underscores that, even in scenarios where a government can implement CCOs effectively,[29] it is not always optimal to do so.

6 Optimal Versus Time Consistent CCO Policy

The previous section focused on how the cost-benefit analysis of CCO policy depends on an economy's parameters. It also turns out that the implications of capital controls depend on whether the government can *commit* in advance to impose (or not) capital controls under certain circumstances. In other words, the optimal capital controls policy may not be *time consistent,* as we will see.

6.1 Optimal Policy with Commitment

To begin, suppose that the government can, at $t = 0$ choose whether or not impose costly capital controls in the fragile state, as in the previous subsection, and that the choice is credible, i.e the government enjoys sufficient commitment power.[30] The correct choice then depends on the comparison between the country's expected payoff under laissez faire, given by (2), and the expected payoff under costly capital controls, given by (4).[31]

For concreteness, we assume that a capital controls policy satisfies the conditions of Propositions 2 and 3. Hence capital controls eliminate capital flight, and are superior to laissez faire if

$$(1 - q\phi)\left[\frac{1}{1 - (1 - q\phi)R}\right] > (1 - pq)\frac{1 - pq\omega}{1 - pq\omega - (1 - pq)R} \tag{5}$$

[27] As shown by Bennett et al. (2023), potential misspecification by policymakers reduces policy welfare gains. Our setup highlights that, additionally, misspecification can lead a government to a poor policy design where CCOs coordinate foreign investors under capital flight.

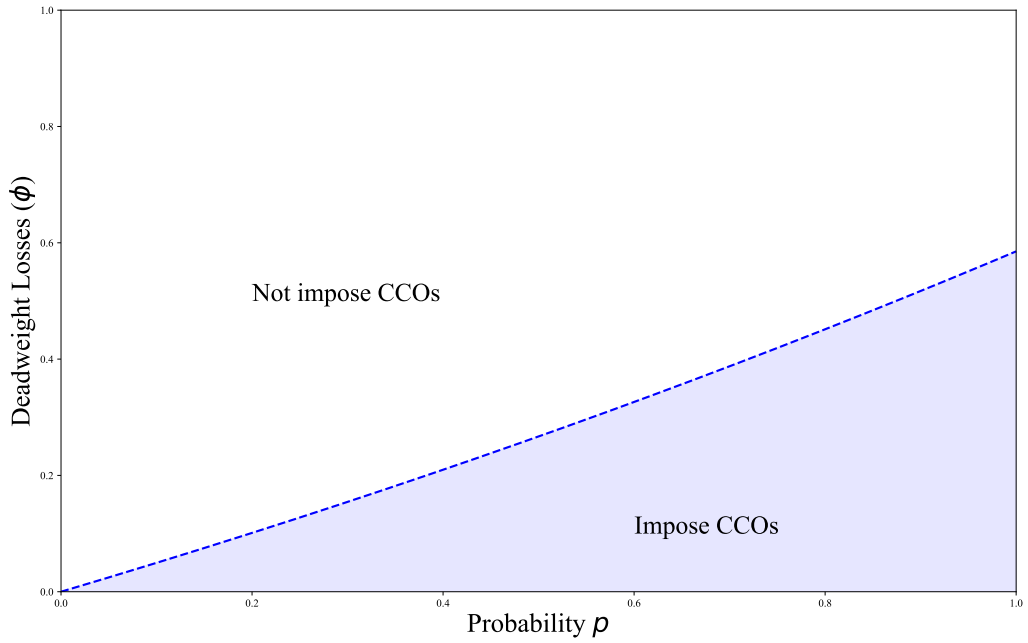
[28] See Wallace (1988) for policy challenges that arise due to a sequential service constraint in the context of a Diamond and Dyvbig framework. In the context of mutual funds, Cipriani et al. (2014) and Li et al. (2021) show that the possibility of *"gates"*, policy akin to CCOs, can drive agents to preemptively run.

[29] In the sense that this tool is effective in coordinating investors under no capital flight

[30] See Appendix B.3 for the formal introduction of a committed government in the anonymous sequential game.

[31] Hereafter, we denote with ($\pi = LF$) a policy where $(\tau, \phi) = (0, 0)$ and ($\pi = CCO$) a policy where $(\tau, \phi) = (1, > 0)$

Figure 5: Committed Government - Optimal Strategy as function of $\{\phi, p\}$



In the opposite case, capital controls deliver less welfare than laissez faire.

To interpret, the blue line in Figure 5 presents the combination of $\{\phi, p\}$ such that (5) holds with equality. We denote as $\bar{\phi}$ and $\bar{p}$, both in $(0, 1)$ every combination of these parameters that satisfy this condition.

Thus, Figure 5 illustrates the optimal strategy for a committed government. For small p relative to ϕ (i.e. for $\{\phi, p\}$ to the left of the blue line) a committed government would prefer laissez faire. In contrast, for a small ϕ relative to p, a committed government imposes capital controls following a fragile state.

The result is intuitive. A policy of capital controls in the fragile state has the benefit of eliminating the capital flight equilibrium. That effect is more important the higher p, the probability of capital flight in the fragile state. On the other hand, capital controls result in a deadweight loss ϕ. If ϕ is large, the economy is better off by not imposing capital controls and taking its chances of capital flight in the fragile state.

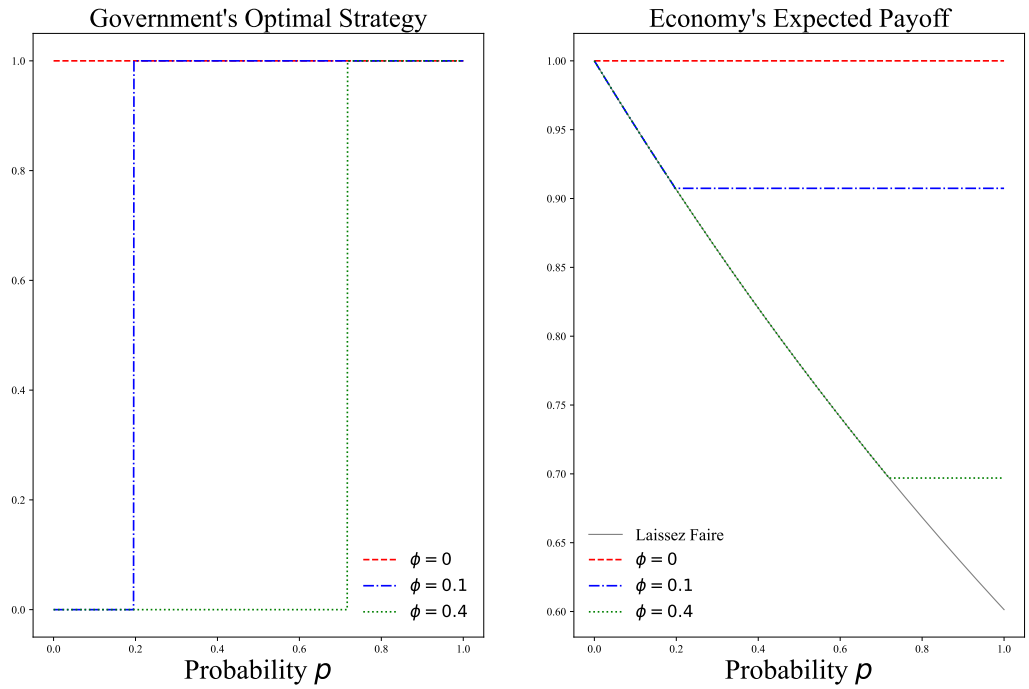
Figure 6 summarizes the committed government's optimal policy as a function of *p*, for three different values of the deadweight loss parameter ϕ. The left panel presents the government's optimal strategy and the right panel the corresponding expected payoff for the economy.

First, consider the case when ϕ is zero. Then capital controls involve no deadweight losses, only benefits. A government would impose CCOs for all possible values of p. As discussed before, this policy would move the economy to it's first best.

For positive values of ϕ, the left panel shows that if *p* is small (that is, less than the $\bar{p}$ corresponding to $\bar{\phi}$ equal to that value of ϕ) the government prefers to commit to laissez faire in spite of the risk of capital flight.

For such values of *p*, the country's expected payoff falls with *p*, as the probability of investor exit goes up, as shown in the right panel. For $p > \bar{p}$, in contrast, the left panel shows that government imposes capital controls in the fragile state. This eliminates the risk of capital flight (at a cost), which means that the country's payoff is then independent of *p*, as we see in the right panel.

Figure 6: Committed Government Equilibrium



Summarizing, if the government chooses at the beginning of the model to impose or not capital controls in the fragile state, the optimal choice depends on parameter values as discussed above, and in particular it will choose capital controls if p is relatively large and ϕ relatively small.

6.2 Discretionary CCO policy

As seen in previous sections, the initial investment I_0 and the expected benefits $BE(I_2)$ both depend on the expectations at $t = 0$ that capital controls will or will not be imposed in the fragile state. This indicates that the optimal policy under commitment may not be *time consistent.*

To examine the time consistency problem, consider the situation at $t = 1$, if the fragile state has occurred. At that time, the initial size of the project is already given by previous decisions. Suppose that the government has the opportunity to reconsider its stance on capital controls. Will capital controls be beneficial at that juncture?

To answer this question, we restrict attention to the government's choice between laissez faire and CCO policies that eliminate capital flight. With the obvious notation, we say that the government chooses a *laissez*

faire policy $\pi = LF$ or a *capital controls policy* $\pi = CCO$. A *discretionary equilibrium* is then defined by a policy π, a set of investor strategies, and an aggregate outcome λ such that, in addition to the conditions stated in Section 5.2, but also, policy π is optimal for the government in the fragile state at $t = 1$. (See Appendix B.4 for more details.)

Proposition 4 (CCO Policy in a Discretionary Equilibrium)
A discretionary government chooses $\pi = CCO$ *in equilibrium only when the probability of a capital flight is greater than deadweight losses, i.e.* $p > \phi$.

Given our previous analysis, the proof is quite simple. Not imposing capital controls means that capital flight occurs with probability p, and hence the *expected* final size of the project becomes $EI_2 = (1-p)I_0$. By imposing capital controls, on the other hand, the possibility of capital flight is eliminated, but the final size of the project falls to $I_2 = (1 - \phi)I_0$. Implementing CCOs, then, is optimal when

$$p > \phi \tag{6}$$

and not optimal in the opposite case.

Comparing (5) and (6) it becomes obvious that, in general, the government will have an incentive to deviate at $t = 1$, if the fragile state has occurred, from the optimal policy under commitment. In other words,

Corollary The optimal commitment policy can be time inconsistent.

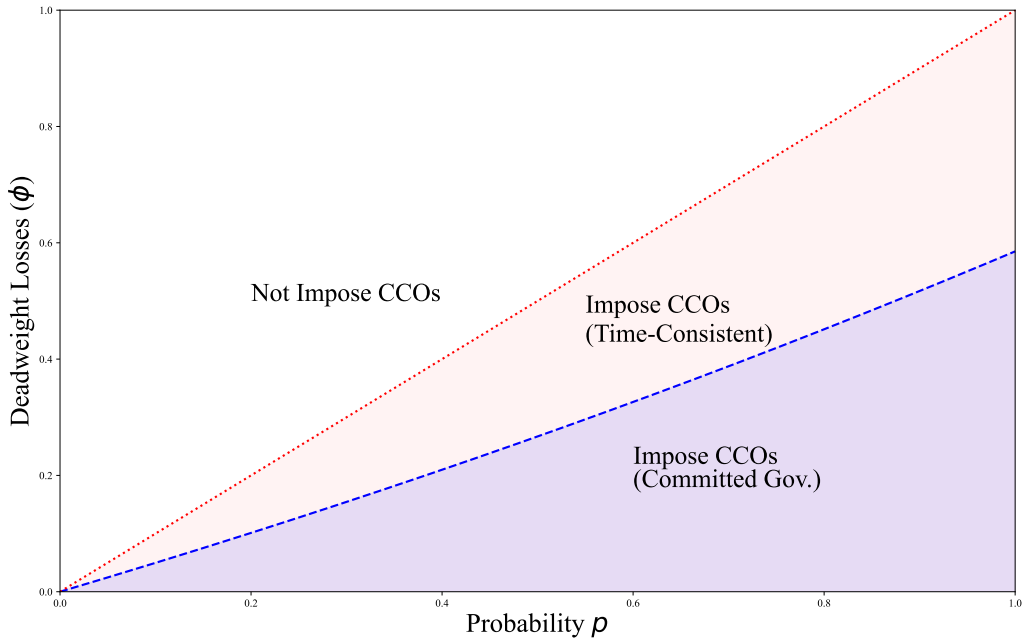
Figure 7 shows that, as a result, capital controls are imposed for a greater combination of $\{\phi, p\}$ when including time-consistent policies to the analysis. In particular, for a fixed ϕ, if $\phi < p < \bar{p}$, (when p is between the red and blue line) the government might want to announce at $t = 0$ that capital controls will not be imposed in the fragile state, but try to renege on that promise if the state at $t = 1$ turns out to indeed fragile.

The source of the time inconsistency problem is clear. Under commitment, capital controls affect the expectation of investors' return from participating in the project. At $t = 1$, however, bygones are bygones, and the government may find that the cost-benefit analysis of capital controls is quite different from the initial one.[32]

If the government does not enjoy enough commitment power, of course, investors will anticipate that policy announcements at $t = 0$ are not credible. Then the outcome of the model will be given by its time consistent equilibria, which is quite easy to characterize here given the model simplicity: in the fragile state, capital controls are imposed if (6) holds, while laissez faire is the outcome in the opposite case. If capital controls are imposed

[32] As in Fornaro (2022), the root of the time inconsistency problem in our model is that the government is only concerned about the welfare of the economy and not of foreign investors.

Figure 7: Government - Optimal Strategy as function of $\{\phi, p\}$



(i.e. if $p > \phi$), the initial size of the project I_0 and the expected payoff to the country $BE(I_2)$ are as in subsection (5.2); in the opposite case, they are as in subsection (4.3).

Figure 8: Time Inconsistency in CCOs

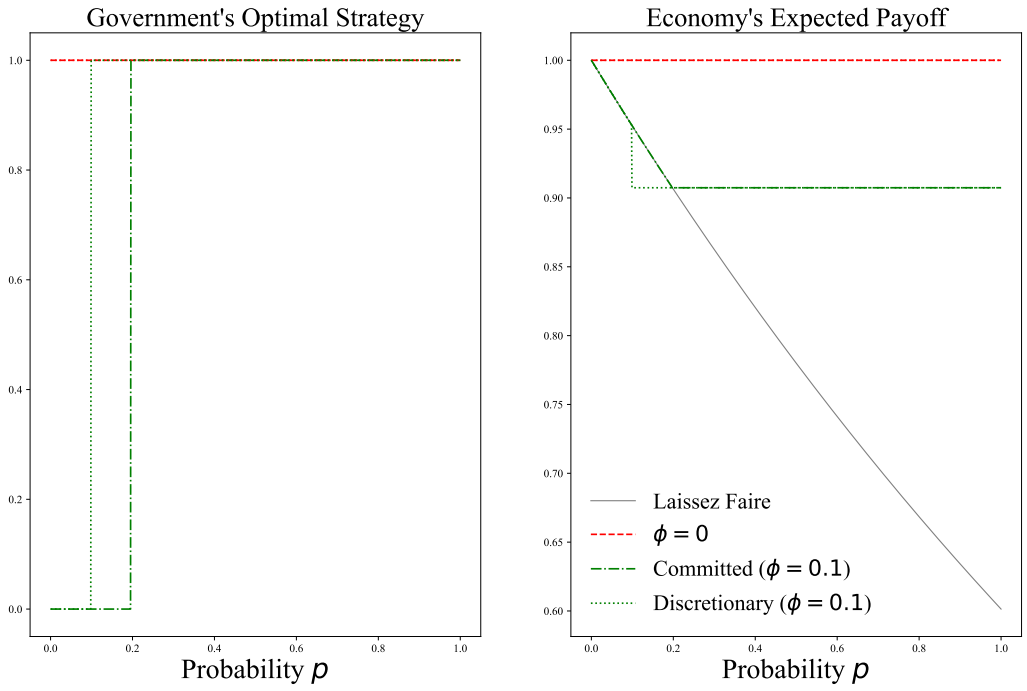


Figure 8 compares the cases with and without commitment emphasizing their dependence on p. When ϕ is

equal to zero, there is no time-inconsistency since the policy is costless for all. In such scenario, a government imposes capital controls independently of p, and it reaches is first best by eliminating the possibility of capital flight.

But if deadweight losses are positive, the left panel of Figure 8 shows that for *p* between ϕ and the corresponding $\bar{p}$ (between 0.1 and 0.2) the discretionary government imposes capital controls in the fragile state, while the committed government would have not. By doing so, the discretionary government prevents the exit of investors in the fragile state, while (for that range of *p* values) the committed government would have refrained from imposing capital controls, thus taking its chances. But the anticipation of capital controls reduces the expected return to investors and, therefore, the initial project size. As a consequence the expected payoff to the country is smaller under discretion than under commitment, as shown in the right panel.

6.3 Discussion

While our model is admittedly rather simple, our analysis reveals that the time inconsistency problem will often be present in models of optimal CCO policy. This is because, as stressed in our discussion, anticipated CCO policy will in general affect ex ante expected returns on investment. As initial investments are sunk, ex post gains from CCO policy will differ from ex ante incentives. This means, in turn, that policy makers will be tempted to break initial promises, at least under some circumstances. This is what occurs in our model, as shown in the preceding subsection, and is a variant of the time inconsistency issue of Kydland and Prescott (1977) and Calvo (1978).

In the context of the debate about CCOs, the analysis and results in this section can be seen as an important difficulty to the position, expressed by Stiglitz and Ostry (2022) and others, that CCOs can be beneficial provided ”the rules of the game are clear and known ahead of time”. In particular, Ostry and Stiglitz’s claim that ”a *pre-announced* policy to tax short-term capital outflows (...) and to impose more extensive controls in the event of the crisis, could ultimately enhance macroeconomic stability and, in that respect, make foreign investment more attractive” may be valid but only under the additional assumption that the pre-announced policy is indeed time consistent.

Naturally, the question emerges of how a government can commit to an optimal CCO policy. Here we can, of course, adapt ideas from an enormous literature on how to solve time inconsistency in general (see, for example, Persson and Tabellini 1991). This is outside the scope of the present paper, but three observations seem particularly pertinent. First, one of the usual proposals to gain credibility in policy is to establish rules or institutions that take away discretion from the policy maker. In this regard, one interesting possibility is that some aspects of international agreements, as well as the IMF’s IV, can be seen as ”rules” in that direction. In

particular, the IV's statement quoted in the introduction, that CCOs may be justified in crisis situations, could be interpreted as a rule to boost the credibility of CCO policy. Second, the model in this section suggests that the main incentive to depart from an optimal CCO policy may be for a government to impose CCOs when they would not be called for under the optimal policy. In this sense, the most important part of a rule might be to specify the circumstances under which CCOs should *not* be used.[33] Third, it should be noted that the temptation to renege on previously announced CCO policy may arise in the absence of "bad" government motives, such as corruption or opportunism. In fact, in our analysis we have assumed that the government is benevolent and maximizes social welfare. The benefits from imposing CCOs, if any, arise solely from the elimination of bad equilibria, and not from any form of expropriation.

7 Capital Controls and Political Opportunism

Theoretical analysis of capital controls are often received with skepticism and criticized for lacking realism. Perhaps the reason for such kind of reaction is that, in practice, capital controls have often been imposed by *opportunist* governments, effectively attempting to expropriate foreign investors, as a relatively easy way to obtain resources to deal with a financial emergency, or just for self serving reasons. Indeed, the possibility of such political opportunism lies behind the claim by Bartolini and Drazen (1997) that capital account liberalization can be seen as a signal of government honesty. Likewise, the claim of Ghosh et al. (2020) that capital controls on inflows have the problem of "guilt by association" with capital controls on outflows presupposes that the latter are not set in a benevolent manner but, rather, by opportunist or incompetent governments.[34] These observations reduce the appeal of CCOs but, in principle, do not completely eliminate the possibility that they can be beneficial under some circumstances. CCOs may still be optimal for *honest* governments even if there exist opportunist governments that impose CCOs when they are not justified from a social perspective. If so, it is important to figure out how the possible presence of political opportunism affects the policy problem of an honest government. In this section we pursue exactly that avenue. We modify the model of the previous section to allow for political opportunism. We show that the existence of political opportunism reduces the welfare benefits of CCOs but may not eliminate them completely. We also show that, if the government's "type" is observed only through its policy choices, the honest government may try to signal its type via the imposition (or not) of CCOs, a result that has the same flavor as Bartolini and Drazen's.

In order to allow for the possibility of political opportunism in the simplest way, we assume that the govern-

[33] For instance, our results suggests that when deadweight losses caused by CCOs are excessive (i.e. if ϕ is greater than $[1-\omega(q+R(1-q))]/[1-\omega(q+qR(1-q))]$), CCOs are welfare decreasing, even if the crisis is imminent ($p=1$). See Figure 8.

[34] One reason to be hesitant about imposing CCOs may be that, for a variety of reasons, they are difficult to remove once their welfare benefits disappear. This would explain the strong peristence in CCOs documented in the Empirical Appendix.

ment can be either *honest* or *opportunist*. Appendix B.5 provides a full description of the anonymous sequential game with two types of government. Below we highlight the relevant aspects for our analysis.

An honest government chooses policy to maximize the country's welfare, which is given by the expectation of BI_2, as in the previous section. An opportunist government, in contrast, always imposes capital controls. This may reflect political aims, corruption, etc. One way to formalize this idea in our model is to interpret ϕI_0 not as a deadweight loss from imposing capital controls, as we did in the previous section, but as an expropriation amount appropriated by the opportunist policymaker. What exactly lies behind the opportunist government is peripheral, however, for our analysis. What is crucial is that the opportunist government always imposes capital controls, and we focus of the implications for the policy problem of the honest government.

A precise definition of equilibrium in this case is given in Appendix B.5. Intuitively, an equilibrium with political opportunism (or *politico economic equilibrium*) consists of a government policy strategy π, a set of investors' strategies, and an aggregate outcome such that the investors' strategies are individually optimal for each investor given the aggregate outcome, the government policy, and initial belief β; the aggregate outcome is induced by the investors' strategies and government policy; and the government policy is optimal for the honest government in the fragile state at $t = 1$, given the aggregate outcome.

Proposition 5 (Optimality of CCOs under political opportunism)
A politico economic equilibrium with $\pi = CCO$ and no capital flight exists as long as the following two conditions are satisfied:

$$p > \phi \quad \textit{and} \quad \omega < \frac{1}{(1-\beta)(1-\phi) + \beta(1-q\phi)}$$

The proof is in Appendix B.5. The proposition states that two conditions are necessary such that CCOs are optimal for the government and effective in eliminating capital flight. To see why consider the continuation of the model from $t = 1$ on. At that time, the initial investment I_0 is given, and continuation outcomes depend on the state of nature and the type of government in place. Clearly, if the government is honest, the equilibrium continuation is just as in previous sections; for concreteness, we focus on the case in which the honest government imposes capital controls if the economic state is fragile which happens when $p > \phi$. In that case, in the normal economic state no capital controls are imposed, and the final project size is $I_2 = I_0$; while in the fragile state capital controls are imposed and the size of the project falls to $I_2 = (1-\phi)I_0$. (For future reference, note that we do not need to assume that investors can observe directly the government type at $t = 1$: if no capital controls are imposed, investors learn that the government is honest, while investors have effectively no decisions to make if capital controls are imposed.)

The main implications of this scenario concern the initial size of the project. We assume that at $t = 0$, investors believe that the government is honest with probability β and opportunist with probability $1 - \beta$. Their

expected payoff from participating in the project is then $\Pi^{CC} = [q(1-\phi)+(1-q)]RI_0$, or $R(1-\phi)I_0$ with probabilities β and $(1-\beta)$ respectively. Recalling now that investors have zero opportunity cost of funds, the expected payoff from participating in the project must equal the size of their initial investment $i = I_0 - A$, and hence

$$\begin{aligned} I_0 - A &= \beta\Pi^{CC} + (1-\beta)R(1-\phi)I_0 \\ &= [\beta(1-\phi q) + (1-\beta)(1-\phi)]RI_0 \end{aligned}$$

Simplifying, we obtain

$$I_0 = \frac{1}{1-[1-(\beta q+(1-\beta))]\phi]R}A$$

Comparison with (3) reveals that the initial project size is smaller than in the previous section, and that the shortfall increases as β falls. In this sense, investor beliefs that the government is opportunist and will impose unjustified capital controls hurts the economy.

The preceding expressions can be, once again, interpreted in terms of the impact of political opportunism on pledgeable income. As in the previous section, pledgeable income falls because of the anticipation of capital controls; the difference in the current setting is that an opportunist government always imposes capital controls. In this case, with probability β the honest government imposes controls in the fragile state only, with probability q. With probability $1-\beta$ there is an opportunist government that always imposes controls. Capital controls, which reduce pledgeable income by ϕ, then occur with probability $\beta q + (1-\beta)$.

Because $\beta q + (1-\beta) = q + (1-\beta)(1-q) > q$, the probability of capital controls is higher than in the absence of political opportunism, and the more so the smaller β. The economy's outcomes then depend on the beliefs of investors about whether the government is honest or opportunist.

Lastly, since β appears as an argument in I_0, it affects an investor's rate of return $f(\lambda)$ of staying at $t = 1$. As discussed in Appendix B.5, the second condition in Proposition 5 is necessary to guarantee that capital flight is possible if the government doesn't impose CCOs.

8 Capital Controls, Credibility, and Reputation Building

In the model of the preceding section, the size of the project and the country's payoff were found to be increasing functions of β, the investors' prior probability that the government is honest. In a dynamic setting, the honest government will then presumably try to convince investors that it is indeed honest, inducing investors to update

their prior and endogenously raise β. This suggests an interesting link between capital controls and reputation building, in the spirit of Bartolini and Drazen (1997).

To see this link, suppose that investors do not observe the government's type directly. To make the analysis interesting, suppose also that they do not observe if the economy falls into the normal state or the fragile state at $t = 1$.[35] On the other hand, they do observe whether capital controls were imposed or not. Investors will then update their beliefs about the government's type after capital controls are imposed (or not).

Indeed, if capital controls are not imposed at $t = 1$, investors can conclude that the government is honest for sure, since the opportunistic government always imposes controls. If capital controls are observed instead, the calculation is a little more involved, but it still straightforward using Bayes' Rule. Recall that, in the case under focus, the honest government imposes controls at $t = 1$ in the fragile state only, while the opportunistic government imposes controls in both the normal state and the fragile state. Bayes Rule then implies that the (posterior) probability that the government is honest after capital controls are observed is[36]

$$1 - \frac{1-\beta}{(1-\beta)+\beta q} = \beta \frac{q}{q+(1-\beta)(1-q)}$$

The posterior probability is strictly less than β, which is intuitive. Upon observing capital controls investors raise their subjective probability that controls were imposed for opportunism rather than for "benevolent" reasons, i.e. to prevent coordination failure.

Because capital controls result in a loss of reputation, the honest government may be more reluctant to impose capital controls even in circumstances where they would be called for in the model studied so far. This would be the case if the government cared about its reputation, for example because of future interactions between the government and investors. In order to shed light on this issue, the next subsection studies a *two stage* model, with each stage given by the (static) model developed up to this point. The only difference between the first stage and the second stage will then be that first stage outcomes affect second stage investors' beliefs about the government's type.

8.1 Repetition and Reputation Building

For the rest of this section we assume that the model of the previous sections is repeated twice. Each repetition is called a "stage". Recalling that each stage has three periods indexed by $t = 0, 1, 2$, we use a "(s)" superscript

[35] A weaker assumption is that, if the government imposes capital controls, investors do not observe whether the state is normal or fragile at $t = 1$. This may be more realistic, under the interpretation that the imposition of capital controls effectively takes away the option to exit from investors.

[36] To be sure: let A be the event that the government is opportunistic and B the event that the government imposes capital controls. Hence $P(B|A) = 1$ and $P(B|A^c) = q$. Also, $P(A) = 1 - \beta$, $P(A^c) = \beta$. Then Bayes Rule says that $P(A|B) = P(A \cap B)/P(B) = 1 - \beta/[\beta q + (1 - \beta)]$. (We use $P(A \cap B) = P(B|A)P(A) = 1 - \beta$ and $P(B) = P(B|A)P(A) + P(B|A^c)P(A^c) = (1 - \beta) + q\beta$.) The probability of honest government after capital controls are observed is then simply $P(A^c|B) = 1 - P(A|B)$.

to denote the stage $s = 1, 2$. For example, $I_0^{(2)}$ denotes the project size at the beginning of the second stage (i.e. at $t = 0$ of $s = 2$).

For concreteness, we focus on the case in which the government has no commitment power. Also, to aid intuition, we focus on the case in which lack of commitment has no adverse implications in the stage model (i.e. in the model of previous sections, the imposition of capital controls in the fragile state is both optimal and time consistent, which requires, in particular, that $p > \phi$). Finally, we assume that the government's total (two-stage) payoff is the sum of the payoffs in the two stages (i.e. there is no discounting between stages).

Since the second stage is just the model of previous sections, its outcomes have already been discussed. The assumption that $p > \phi$ implies that the benevolent government imposes capital controls in the fragile state. Since the opportunistic government always imposes controls, we know from the previous section that the initial project size in the second stage, $I_0^{(2)}$, will be given by:

$$I_0^{(2)} = L(\beta^{(2)})A$$

where $\beta^{(2)}$ denotes the investors' belief probability *at the start of the second stage* that the government is benevolent, and $L(\beta^{(2)})$ is the corresponding leverage ratio:

$$L(\beta^{(2)}) = \frac{1}{1 - \left[1 - (\beta^{(2)}q + (1 - \beta^{(2)}))\phi\right]R}$$

The key observation is that these outcomes depend on the government's reputation at the start of the second stage, as captured by $\beta^{(2)}$, in the natural way. In fact,

$$\frac{dI_0^{(2)}}{d\beta^{(2)}} = (L^{(2)})^2(1 - q)\phi RA > 0$$

The benevolent government's expected payoff in the second stage is

$$\Pi^{(2)}(\beta^{(2)}) = B(1 - q\phi)I_0^{(2)} = B(1 - q\phi)L(\beta^{(2)})A$$

and hence it is also increasing in its reputation $\beta^{(2)}$.

Summarizing, the outcomes of the second stage are given by our previous analysis of the static model. Most importantly, leverage, investment, and expected welfare in the second stage increase with $\beta^{(2)}$, the investors' belief that the government is benevolent.

The crucial fact now is that $\beta^{(2)}$ may depend on what has happened in the first stage, and in particular on whether capital controls have been imposed in the first stage. To see how, consider the honest government's

decision in the first stage, if the state of the economy turns out to be fragile at $t = 1$. From our previous analysis we know that, at that point, imposing capital controls rules out the capital flight equilibrium but imposes a deadweight loss of ϕ, implying an expected payoff $B(1-\phi)I_0^{(1)}$ for the first stage (where $I_0^{(1)}$ denotes the initial project size in the first stage). Because $p > \phi$, we also know that capital controls yields a higher payoff in the first stage than laissez faire. The new and critical aspect of the model in this section is that imposing capital controls will affect the government's reputation, which matters for second stage outcomes and payoffs.

To express this point, let $\beta_{CC}^{(2)}$ denote the (posterior) beliefs about β at the end of the first stage if capital controls are observed. Then the benevolent government's total (two-stage) payoff from imposing capital controls in the first stage if the state is fragile is

$$B(1-\phi)I_0^{(1)} + \Pi^{(2)}(\beta_{CC}^{(2)})$$

In contrast, if the government does not impose capital controls in the fragile state, there is a run equilibrium with probability p, implying that the first stage payoff is $B(1-p)I_0^{(1)}$. In addition, if capital controls are not implemented in the first stage, investors learn that the government is honest, i.e. that $\beta = 1$ with probability one. Hence the continuation payoff for the honest government if it does not impose capital controls is

$$B(1-p)I_0^{(1)} + \Pi^{(2)}(1)$$

It follows that the honest government imposes capital controls in the fragile state of the first stage if

$$p - \phi > \frac{1}{BI_0^{(1)}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC}^{(2)})] \tag{7}$$

and does not impose capital controls in the opposite case.

The preceding condition reveals the key link between capital controls and reputation building. In the static model of previous subsections the benevolent government imposed capital controls in the fragile state if $p > \phi$. In the repeated stage model of this subsection, the condition $p > \phi$ still implies that that imposing capital controls in the fragile state yields a higher first stage payoff than laissez faire. However, capital controls have a disadvantage for the second stage: upon observing capital controls in the first stage, investors increase their subjective belief that the government is opportunistic; in contrast, the absence of controls allows them to conclude that the government is benevolent. This reputational effect means that the imposition of capital controls in the first stage reduces the second stage expected payoff by $\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC}^{(2)})$. Condition (7) then says that imposing capital controls in the first stage, when the state is fragile, is optimal for the honest government if the short term gain (in terms of the first stage payoff) is greater than the long term cost associated

with reputation loss.

To proceed, note that (7) depends on $I_0^{(1)}$, the initial size of the project in the first stage, which presumably depends on the probability of capital controls and, therefore, whether (7) holds or not. Likewise, (7) depends on the posterior probability $\beta_{CC}^{(2)}$, which presumably depends on the honest government policy decision. This means that, to complete our analysis, we need to characterize equilibrium fully.

8.2 Dynamic Equilibria

For purposes of exposition, we discuss equilibria of the two stage model in terms of the initial project size $I_0^{(1)}$, the posterior probability $\beta_{CC}^{(2)}$, and the policy choice $\pi^{(1)}$ for the honest government in the fragile state of the first stage. Equilibrium then requires that (i) given $\pi^{(1)}$, $I_0^{(1)}$ be optimal for investors at $t = 0$ in the first stage; (ii) given $I_0^{(1)}$, $\beta_{CC}^{(2)}$, capital controls be imposed in the fragile state of the first stage if (7) holds, and they not be imposed in the opposite case; and (iii) given the capital controls decision, $\beta_{CC}^{(2)}$ be derived using Bayes Rule.[37]

Depending on parameters, there are two types of equilibrium in the two stage model:

1. Partially Revealing Equilibrium: In the fragile state of the first stage, the benevolent government imposes capital controls. Hence, if capital controls are indeed observed, investors cannot tell for sure if the government is honest or opportunistic (although they update their beliefs).

Equilibrium values of $I_0^{(1)}$ and $\beta_{CC}^{(2)}$ are then as follows: Since the opportunistic government always imposes capital controls, Bayes' Rule implies that, after observing controls, the investors' probability belief that the government is benevolent falls to

$$\beta_{CC}^{(2)} = \beta^{(1)} \frac{q}{q + (1 - \beta^{(1)})(1 - q)} \tag{8}$$

where $\beta^{(1)}$ is the investors' belief at the start of the first stage that the government is benevolent.

Also, in the first stage, the honest government imposes capital controls with probability q, and the opportunistic government does so with probability one. An easy adaptation of our previous analysis then yields the initial project size:

$$I_0^{(1)} = \frac{1}{1 - [\beta^{(1)}(1 - \phi q) + (1 - \beta^{(1)})(1 - \phi)]R} A \tag{9}$$

Finally, for equilibrium, (7) must hold with $I_0^{(1)}$ and $\beta_{CC}^{(2)}$ given by the two preceding expressions. If capital controls are observed at the end of the first stage, $\beta^{(2)} = \beta_{CC}^{(2)}$; if they are not, $\beta^{(2)} = 1$.

In a partially revealing equilibrium, the honest government imposes capital controls in the first stage if the state is fragile. However, since $\beta_{CC}^{(2)} < \beta^{(1)}$, it does so at the cost of losing reputation, which reduces investment

[37] See Appendix B.6 where we present the formal structure of the two stage anonymous sequential game, the complete definition of the dynamic equilibrium (Perfect Bayesian Type), and the complete characterization of partially and fully revealing equilibria.

and payoffs in the second stage.

2. Fully Revealing Equilibrium: In the fragile state of the first stage, the benevolent government does not impose capital controls. As a consequence, if capital controls are indeed observed, investors conclude that the government is opportunistic, i.e.

$$\beta_{CC}^{(2)} = 0$$

In that case, the initial project size in the first stage is

$$I_0^{(1)} = \frac{1}{1 - [\beta^{(1)}(1-pq) + (1-\beta^{(1)})(1-\phi)]R} A \tag{10}$$

Finally, for equilibrium, the inequality in (7) must be reversed at the preceding value of with $I_0^{(1)}$ and $\beta_{CC}^{(2)} = 0$.

In a fully revealing equilibrium, the government refrains from imposing capital controls in the first stage, when the state is fragile, in spite of the fact that capital controls raise the first stage payoff relative to laissez faire. By doing so, the government gains in reputation and, therefore, increases second stage payoffs by more than what it loses in the first stage.

Which equilibrium exists turns out to depend on parameter values. This is discussed in the next subsection, which is more technical than the previous ones and can be skipped without much loss of continuity. The main results are that at least one equilibrium must exist, and that equilibria of the two kinds can in fact coexist.

8.3 Existence and Multiplicity of Equilibria

To state our results and notational precision, let I_{CC} and β_{CC} denote the values of $I_0^{(1)}$ and $\beta^{(2)}$ in a partially revealing equilibrium, i.e. the right hand sides of (9) and (8). Likewise, let I_{LF} be the value of $I_0^{(1)}$ in a fully revealing equilibrium, that is, the RHS of (10). Note that, because $p > \phi$, $I_{CC} > I_{LF}$.

Existence of equilibrium. A partially revealing equilibrium exists if (7) is satisfied with $I_0^{(1)} = I_{CC}$ and $\beta^{(2)} = \beta_{CC}$. Suppose that such an equilibrium does not exist. Then (7) must fail at $I_0^{(1)} = I_{CC}$ and $\beta^{(2)} = \beta_{CC}$.

In the latter case, then

$$\begin{aligned} p - \phi &\leq \frac{1}{BI_{CC}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})] \\ &< \frac{1}{BI_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})] \\ &< \frac{1}{BI_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] \end{aligned}$$

where the second inequality follows from $I_{LF} < I_{CC}$, and the third inequality from $\Pi^{(2)}(\beta_{CC}) > \Pi^{(2)}(0)$.

Hence, if (7) fails with $I_0^{(1)} = I_{CC}$ and $\beta^{(2)} = \beta_{CC}$, it fails with $I_0^{(1)} = I_{LF}$ and $\beta_{CC}^{(2)} = 0$ as well. But this means that there is a perfectly revealing equilibrium (with $I_0^{(1)} = I_{LF}$ and $\beta_{CC}^{(2)} = 0$).

We have shown that a fully revealing equilibrium exists if a partially revealing equilibrium does not. Hence at least one equilibrium exists.

Multiplicity of equilibria. It is now apparent that equilibria of both kinds coexist if

$$\frac{1}{BI_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] > p - \phi > \frac{1}{BI_{CC}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})] \tag{11}$$

We claim that

$$\frac{1}{BI_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] > \frac{1}{BI_{CC}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})]$$

and hence the multiplicity condition can be satisfied (for $p - \phi$ in the obvious range).

Consider:

$$\begin{aligned} & \frac{1}{I_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] - \frac{1}{I_{CC}}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})] \\ = \; & \frac{1}{I_{LF}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] - \frac{1}{I_{CC}}[\Pi^{(2)}(1) - \Pi^{(2)}(0)] + \Pi^{(2)}(0) - \Pi^{(2)}(\beta_{CC})] \\ = \; & (\frac{1}{I_{LF}} - \frac{1}{I_{CC}})[\Pi^{(2)}(1) - \Pi^{(2)}(0)] + \frac{1}{I_{CC}}[\Pi^{(2)}(\beta_{CC}) - \Pi^{(2)}(0)] \end{aligned}$$

Since $I_{CC} > I_{LF}$, and $\Pi^{(2)}(\beta^{(2)})$ is increasing in $\beta^{(2)}$, all the terms are positive, proving the claim. We conclude that (11) can indeed hold, and therefore there can be equilibria of the two types.

The main intuition for equilibrium multiplicity is that, if investors expect the honest government to impose capital controls in the fragile state only, they raise their initial investment ($I_0^{(1)}$) because the cost of controls is less than the loss of a run. But a higher $I_0^{(1)}$ raises the importance of the first stage payoff relative to the second stage payoff. In other words, the reputational cost of capital controls becomes relatively less important than the current benefit of controls, which makes the government more inclined to use controls. In contrast, if investors expect the honest government not to impose capital controls when they are called for, they reduce their initial investment. But by doing so they strengthen the reputational incentives against capital controls.

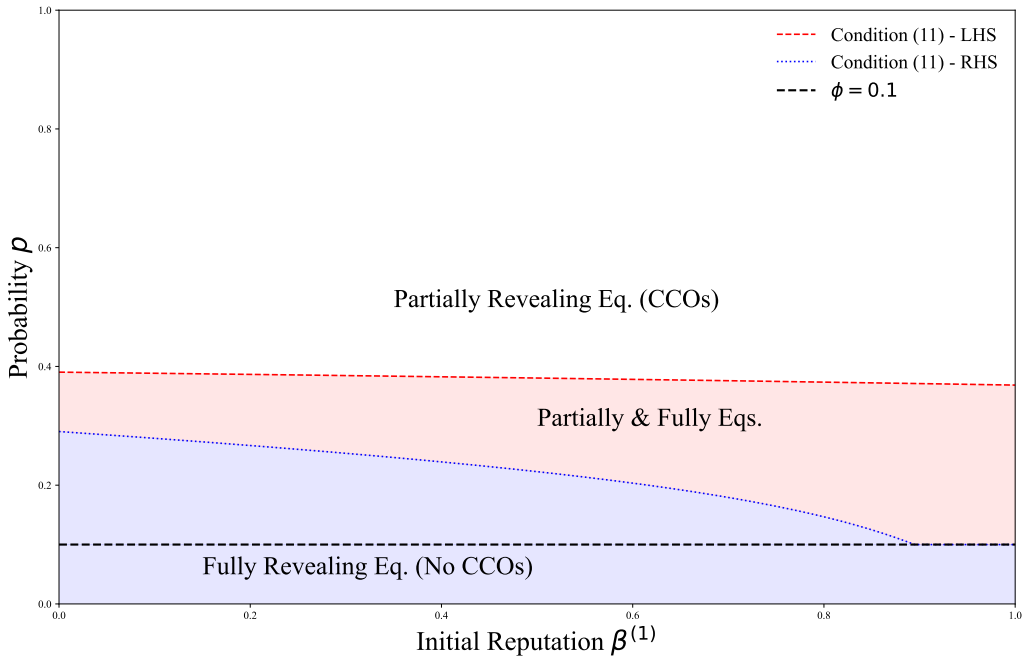
To illustrate further, fix ϕ, and rewrite Condition (11) as follows

$$\frac{\theta\big[1 - R((1-\beta^{(1)})(1-\phi) + \beta^{(1)})\big] + \phi}{1 - qR\beta^{(1)}\theta} > p > \phi + \frac{1}{BI_{CC}}\big[\Pi^{(2)}(1) - \Pi^{(2)}(\beta_{CC})\big] \tag{12}$$

where $\theta = \frac{\left[\Pi^{(2)}(1) - \Pi^{(2)}(0)\right]}{AB}$.

Condition 12 determines bounds on p for the existence of the two types of equilibria. Figure 9 uses this

Figure 9: Two-Stage Equilibria



condition to summarize the equilibrium set for different combinations of β and $p > \phi$.

Note the role of p and ϕ. A larger value of $p - \phi$ (which in Figure 12 refers to a greater p) makes partially revealing equilibria more likely and fully revealing equilibria less so. This is because a larger $p - \phi$ raises the gains from capital controls in the first stage, but it does not change reputational costs.

The figure also shows that when initial reputation, $\beta^{(1)}$, is lower, partially revealing equilibria are less likely, and fully revealing equilibria more likely. This is intuitive: in the case under focus ($p > \phi$), if the state is fragile in the first stage, the honest government would like to impose capital controls to correct for coordination failure. But refraining from imposing capital controls reveals the government to be honest, increasing its reputation for the second stage. The relative gain from reputation building is larger if the honest government's initial reputation is lower.

9 Conclusion

We have presented fresh empirical evidence on the links between capital controls on outflows and macroeconomic variables. A main finding is that CCOs are typically implemented after the onset of crisis conditions, and concurrently with declines in output growth. These empirical features are incorporated in a theoretical model of the costs and benefits of CCOs. In addition to embedding the empirical facts alluded to, the model proposed here formalizes the idea that CCOs may be beneficial to deal with capital flight amid macroeconomic

and financial stress. The model is therefore developed so that multiple equilibria and coordination failures may appear when the economy is in a fragile state. In such a situation, CCOs can serve as devices to coordinate expectations, reassuring investors and preventing capital flight. While the model emphasizes that CCOs can be socially beneficial under some circumstances, we have also made an effort to allow for some potential shortcomings of CCOs. The most direct way is just to assume that CCOs entail deadweight costs. An alternative issue, which is novel in the literature, is that optimal CCO policy can be time inconsistent. Finally, in view of a widespread belief that CCOs can be taken advantage of by corrupt or politically opportunistic governments, we have examined the implications of the possible existence of governments of that kind. In particular, we identify how CCO policy may depend on a government's reputation, which in turn may evolve as the public observes the presence or absence of CCOs.

We have kept the model as simple as possible in order to highlight basic ideas and lessons. Having said this, we see our theoretical framework as a useful start to studying the pertinence of controls on outflows, suggesting extensions and elaborations in many directions.

First, as mentioned previously, we abstract from several operational challenges of implementing CCOs which could be addressed in a more specialized version of the model. For example, in a multi-sectoral version of the model one could explicitly account for how investors leaving one sector affect other sectors of the economy, both in terms of capital flight incentives as well as potential distortions. Another operational challenge lies on whether to restrict CCOs to non-residents or extend them to residents. While the model focuses on CCOs to non-residents, consistent with the empirical evidence in the Appendix, such evidence also points to CCOs to residents being widespread, warranting a more formal analysis on the trade-offs to each of the two kinds of restrictions.

Second, an obvious extension is to develop our arguments in stochastic infinite horizon settings. This is a nontrivial task insofar as models of the Diamond-Dyvbig variety are not easy to extend to infinite horizons. However, some infinite horizon open economy models with pecuniary externalities often admit multiple equilibria, as emphasized by Schmitt-Grohé and Uribe (2021). Such models could be amenable for studying CCOs as coordination devices, as we have done in this paper.

Third, another avenue for future research is to extend our framework to a multi-country version to study international coordination of capital control policies. Despite that by their very nature capital *flows* between countries, international coordination is yet to be fully understood. A potential reason for this omission is that capital controls on outflows are viewed as welfare reducing policies for non-residents. However, we have seen that CCOs can be optimal even for foreign investors under some circumstances. Thus, we believe that a multi-country extension of our framework is well-suited to study this issue.

Lastly, in light of the state of the current literature on capital controls, a crucial extension is to investigate

the prudential use of CCOs and, more generally, the relative impact of CCOs and other macroprudential policies. In this regard, our model is quite suggestive, and in particular the following observations are warranted. Within our setup, policies announcing the future and contingent use of CCOs in case of a crisis are optimal, but imposing them ex ante, unrelated to macro-financial stress, is welfare detrimental. For this would reduce the initial amount of investment (at $t = 0$). Likewise, other macroprudential policies –including the use of capital controls on inflows for prudential purposes–would also negatively impact investment and hence would be undesirable. In the basic version of our model, if CCOs are costless, they can be used to eliminate capital flight, rendering macroprudential policies superfluous in the absence of other types of externalities. If CCOs entail deadweight losses and/or other pecuniary or aggregated demand externalities are present, one could conjecture that macroprudential policies could be superior to CCOs; but a fair comparison would require admitting that macroprudential policies may involve deadweight losses as well. Hence, in environments where coordination failures are present, the evaluation of macroprudential policies versus CCOs will depend on the relative costs of both policies as well as the specific types of externalities considered. The same can be said about the evaluation vis-a-vis CCOs of other policies (i.e. FX intervention, monetary policy) that could, in paper, address capital flight. Exploring this avenue is, however, a subject for future research.

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A Empirical Appendix

This Empirical Appendix gathers additional results. It is structured as follows. Table A.1 lists the 31 episodes of CCO tightening from each of the three sources used, and the related crises indicators from Laeven and Valencia (2018). The subsequent four figures (A.1-A.4) expand Figure 2 from the main text documenting the three crises indicators (A.1) and the robustness if each of the three sources is used independently (A.2-A.4). Figures A.5 through A.7 document the 31 CCO episodes across time, exchange rate regime and income level.

Figures A.8 - A.19 document the dynamics around the CCO episodes of the control macro variables used in the analysis: Capital Flows (Gross Capital Inflows, Gross Capital Outflows, Gross Portfolio Inflows, Gross Portfolio Outflows, Gross FDI Inflows, Gross FDI Outflows and Net Capital Inflows), Current Account Balance, Consumption and Investment growth, Exchange Rate, and Inflation.

Figure A.20 presents robustness results when the threshold used to identify CCO episodes is relaxed. Figure A.21 further documents the persistence of CCO indices around the episodes identified.

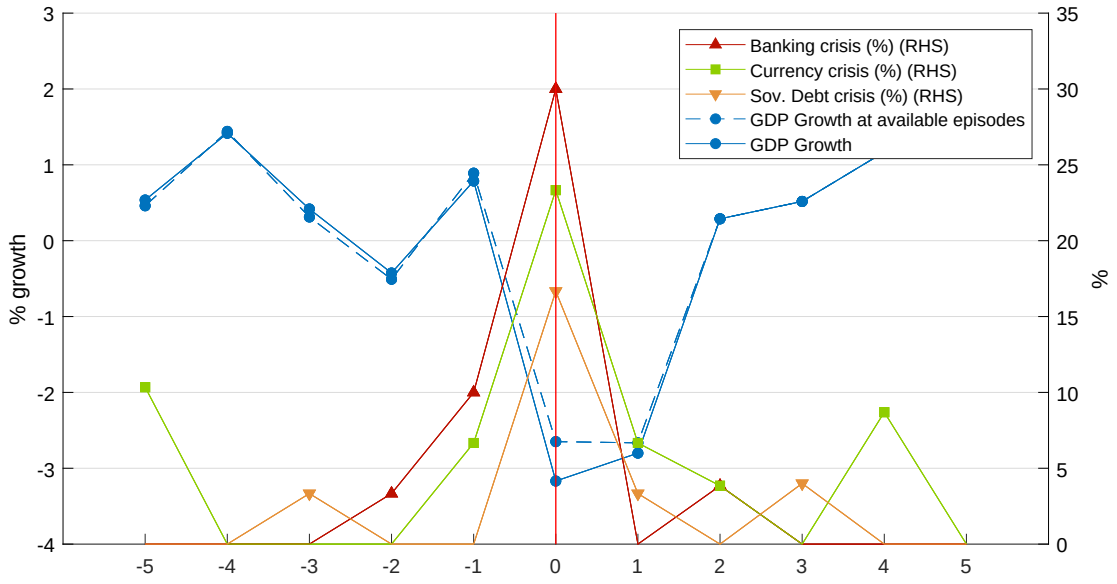
Tables A.2 and A.3 report the full set of results of the OLS regression in the main text (1) and the companion Probit regression from which derive the marginal effects described in the main text. The next two tables A.4 and A.5 report robustness results when controlling for the level of GDP per capita. Table A.6 reports the CCO episodes where residency can be identified. Table A.7 reports the OLS results correcting cross-sectional dependence through Driscoll and Kraay (1998) standard errors. The last two tables A.8 and A.9 use year fixed effects in the regressions instead of time trend.

Finally, the last figure A.22 describes the methodology and results of the counterfactual analysis where CCO shocks are used to account for growth dynamics in the episodes identified.

Country	Year	Banking crisis	Currency crisis	Sov. debt crisis
Bangladesh$^{\mp}$	1996	0	0	0
Cyprus$^{\mp}$	1996	0	0	0
Uzbekistan$^{\mp}$	1996	0	0	0
Bulgaria$^{\mp}$	1997	0	0	0
Vietnam$^{\mp}$	1997	1	0	0
Malaysia $^{\triangle}$	1998	0	1	0
Russia $^{\triangle}$	1998	1	1	1
Ethiopia$^{\mp}$	2000	0	0	0
Argentina $^{\triangle}$	2001/2002	1	0	1
Turkey $^{\triangle}$	2001	0	1	0
Uruguay $^{\triangle}$	2002	1	1	1
Lebanon $^{\mp}$	2005	0	0	0
Sweden$^{\mp}$	2006	0	0	0
Bolivia $^{\mp}$	2007	0	0	0
Ecuador $^{\mp}$	2008	0	0	1
Iceland $^{\mp}$ * $^{\triangle}$	2008/2009	1	1	0
Latvia $^{\triangle}$	2008/2009	1	0	0
Myanmar $^{\mp}$	2008/2009	0	0	0
Russia $^{\triangle}$	2008	1	0	0
Ukraine $^{\triangle}$	2008	1	0	0
Argentina *	2011	0	0	0
Cyprus *	2013	0	0	1
Czech Republic $^{\mp}$	2013	0	0	0
Ghana *	2014	0	1	0
Ukraine *	2014/2015	1	1	0
Greece $^{\mp}$ *	2015	0	0	0
China *	2016	0	0	0
Finland $^{\mp}$	2016	0	0	0
Sweden $^{\mp}$	2016	0	0	0
Zimbabwe *	2016	0	0	0
Fiji *	2020	no data	no data	no data
Total		9	7	5

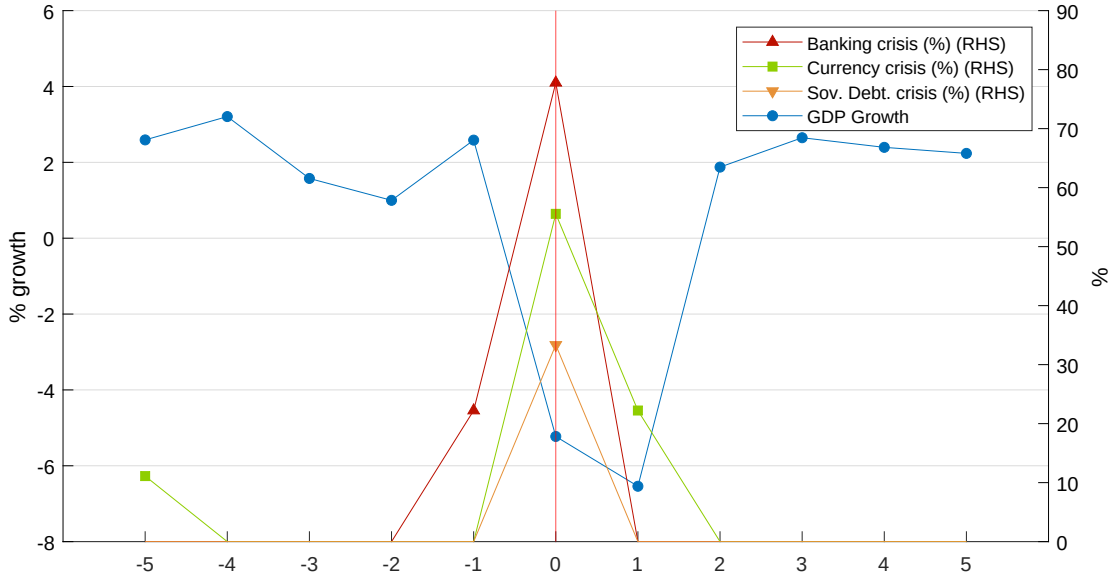
Note: Table reports the 31 CCOs episodes: $\triangle$ are those coming from IMF (2012b), $\star$ those from the IMF's Taxonomy (Binici and Das 2021) and $\mp$ those from Fernandez et al. (2016) index. The table also reports crisis indicators of banking, currency and sov. debt crises from Laeven and Valencia (2018) for the CCO episodes.

Table A.1: CCO Episodes and Macro-Financial Crises



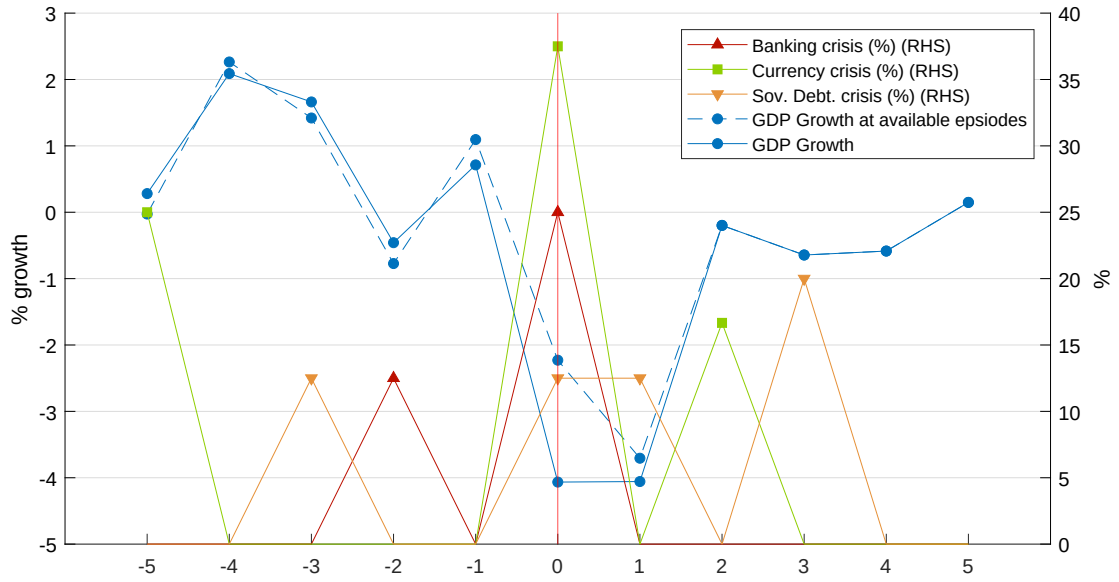
Note: The figure depicts the average dynamics of GDP growth (demeaned) in the ten years around the 30 episodes of forceful CCO tightening identified for which crisis indicators of banking, currency and sov. debt crises exist in Laeven and Valencia (2018). $t = 0$ is the year of the episode. Averages of the dummy variables for these three crises indicators are plotted on the right scale. Out of the 31 episodes in CCO identified, only one does not have data from Laeven and Valencia (2018). GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.1: GDP Growth and Crises around full set of episodes



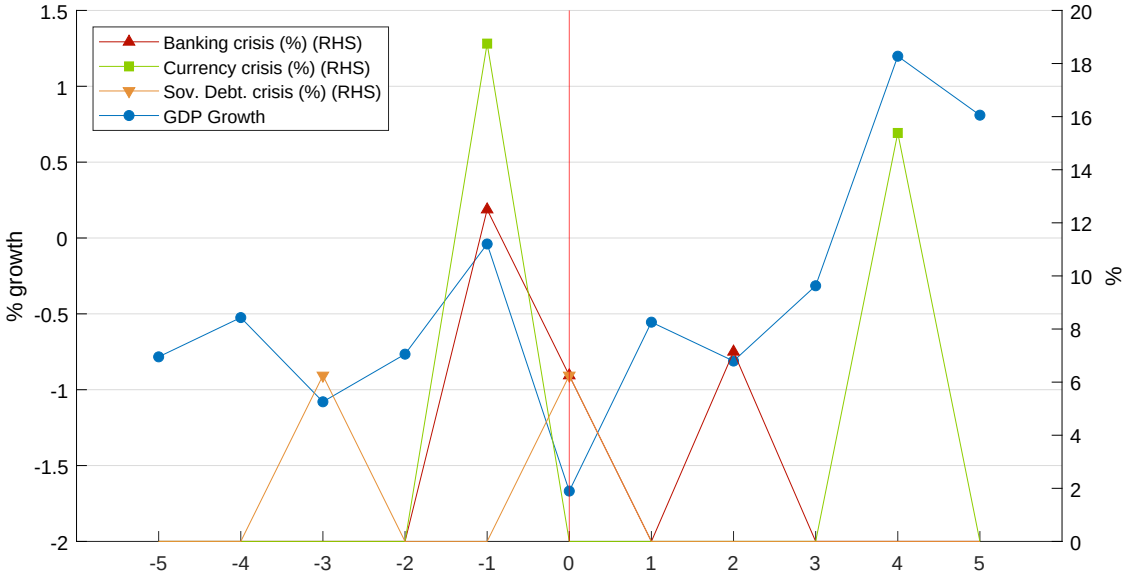
Note: The figure depicts the average dynamics of GDP growth (demeaned) in the ten years around the 9 episodes of forceful CCO tightening identified in IMF (2012b), for which crisis indicators of banking, currency and sov. debt crises exist in Laeven and Valencia (2018). $t = 0$ is the year of the episode. Averages of the dummy variables for these three crises indicators are plotted on the right scale.

Figure A.2: GDP Growth and Crises around Episodes in IMF (2012b)



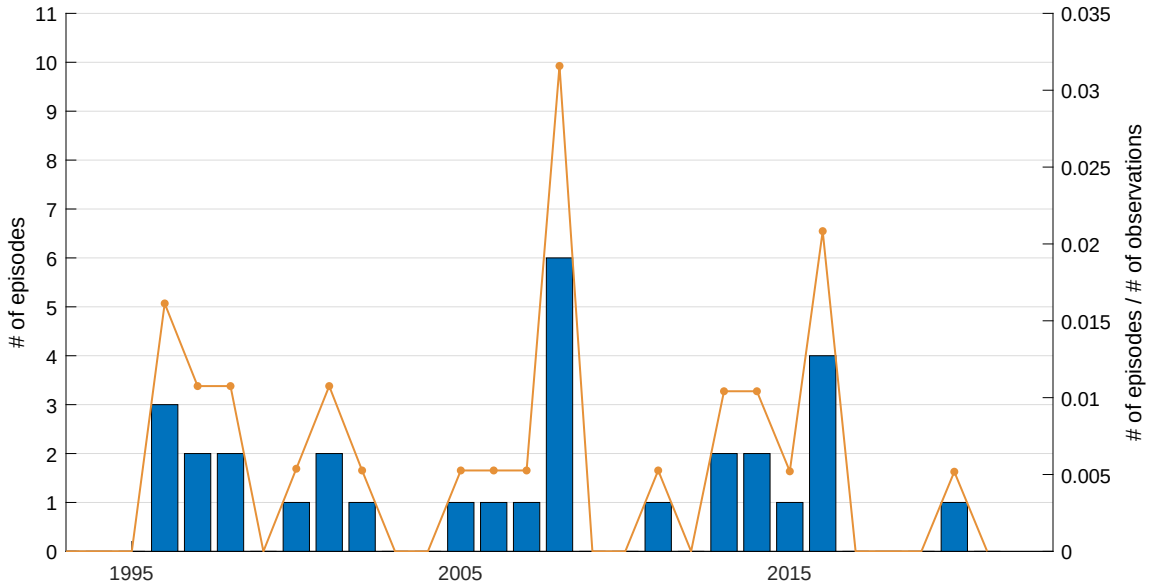
Note: The figure depicts the average dynamics of GDP growth (demeaned) in the ten years around the 9 episodes of forceful CCO tightening identified in the Taxonomy (Binici and Das 2021), for which crisis indicators of banking, currency and sov. debt crises exist in Laeven and Valencia (2018). $t = 0$ is the year of the episode. Averages of the dummy variables for these three crises indicators are plotted on the right scale. Out of the 9 episodes in CCO identified, only one does not have data from Laeven and Valencia (2018). GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.3: GDP Growth and Crises around the IMF Taxonomy episodes



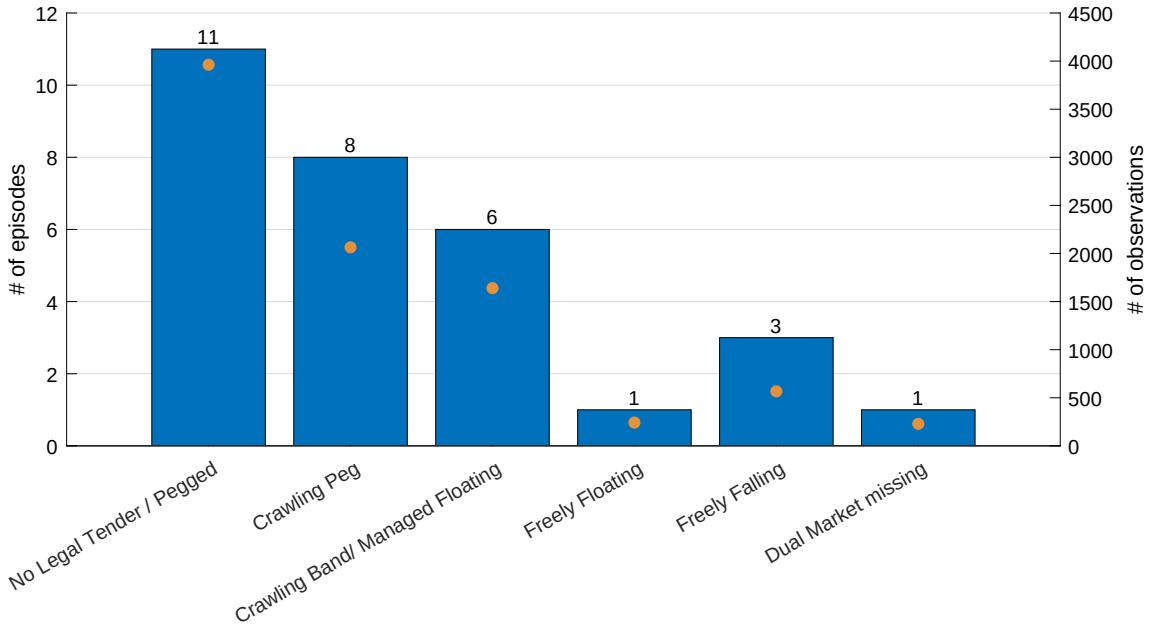
Note: The figure depicts the average dynamics of GDP growth (demeaned) in the ten years around the 16 episodes of forceful CCO tightening identified using the Fernandez et al. (2016) index, for which crisis indicators of banking, currency and sov. crises debt exist in Laeven and Valencia (2018). $t = 0$ is the year of the episode. Averages of the dummy variables for these three crises indicators are plotted on the right scale.

Figure A.4: GDP Growth and Crises around Fernandez et al. (2016) episodes



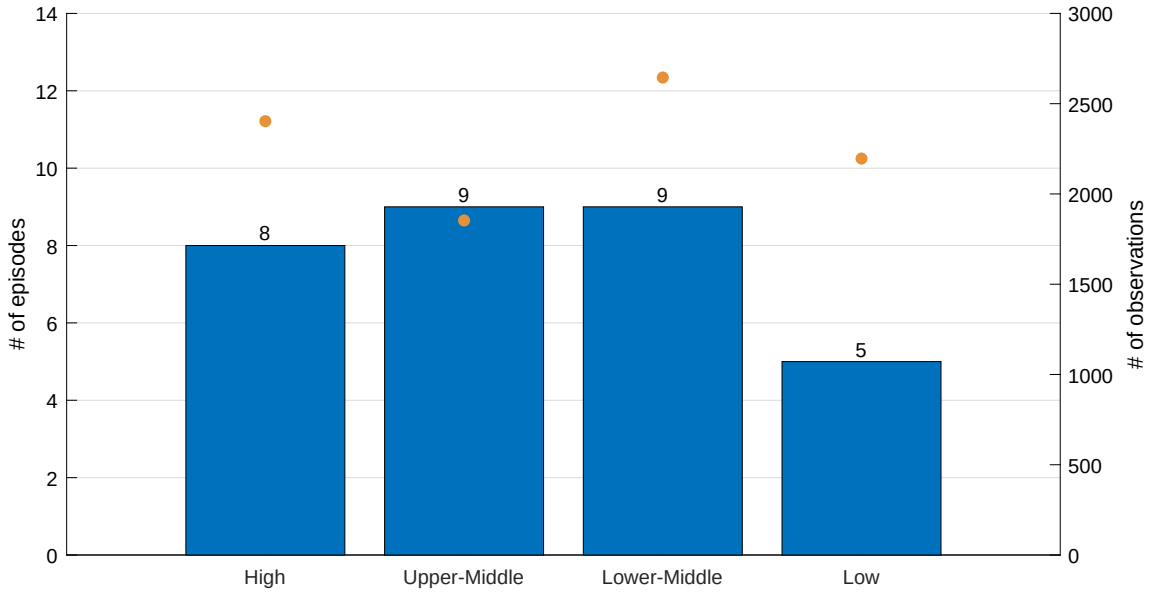
Note: The figure depicts the number of episodes by year. Right scale shows the number of episodes over number of observations, by year, for reference.

Figure A.5: Episodes of CCOs by Year



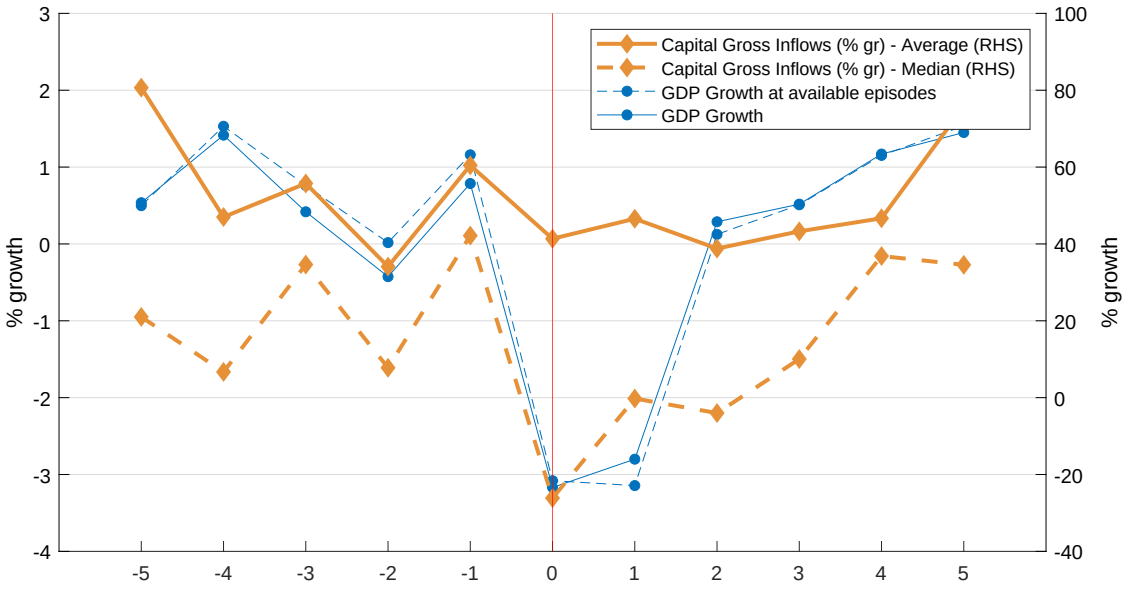
Note: The figure depicts the number of episodes by the exchange rate regime in Ilzetzki et al. (2021). Right scale shows the number of observations, by regime, for reference. 30 episodes can be matched with exchange rate regime data.

Figure A.6: Episodes of CCOs by Exchange Rate Regime



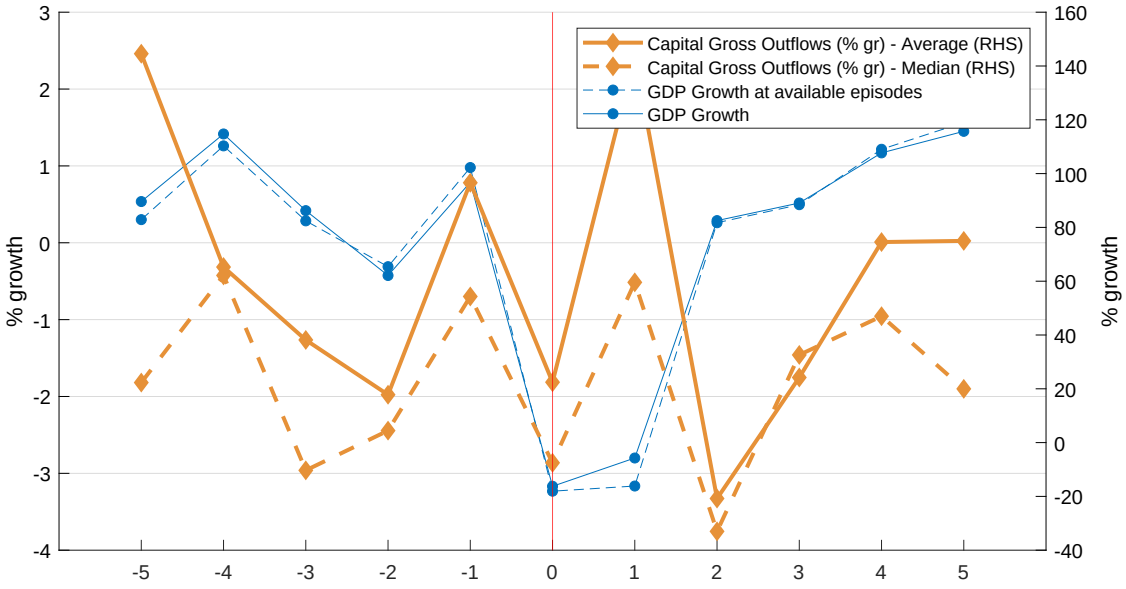
Note: The figure depicts the number of episodes by income level. Right scale shows the number of episodes over number of observations, by year, for reference.

Figure A.7: Episodes of CCOs by Income Level



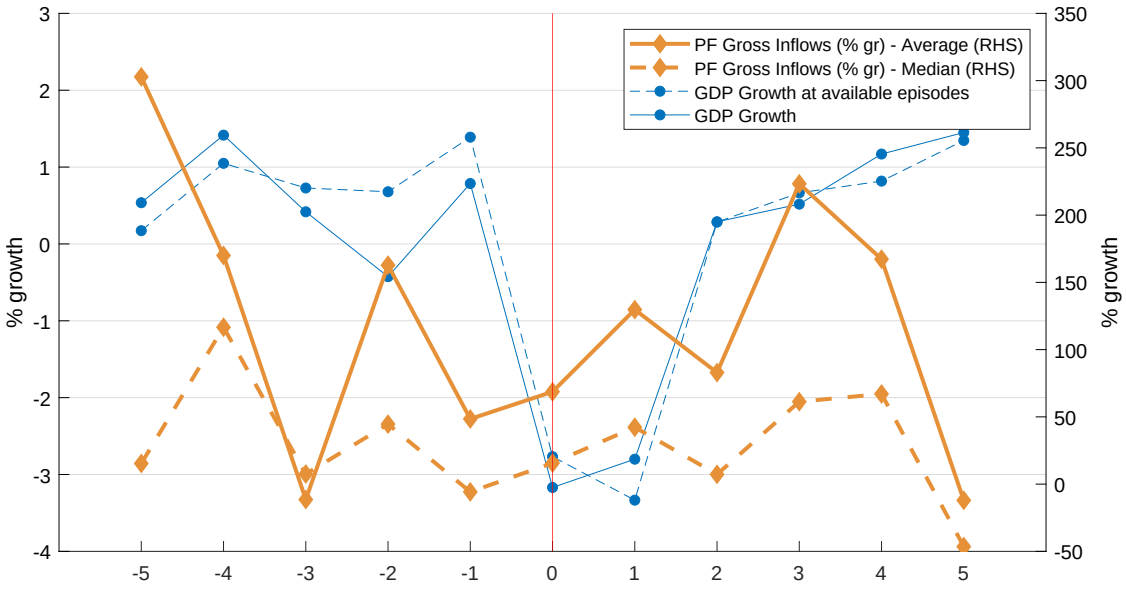
Note: The figure depicts the average and median dynamics of Gross Total Capital Inflows (growth) at the right scale in the ten years around 30 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since one episode does not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.8: Gross Total Capital Inflows growth around Episodes



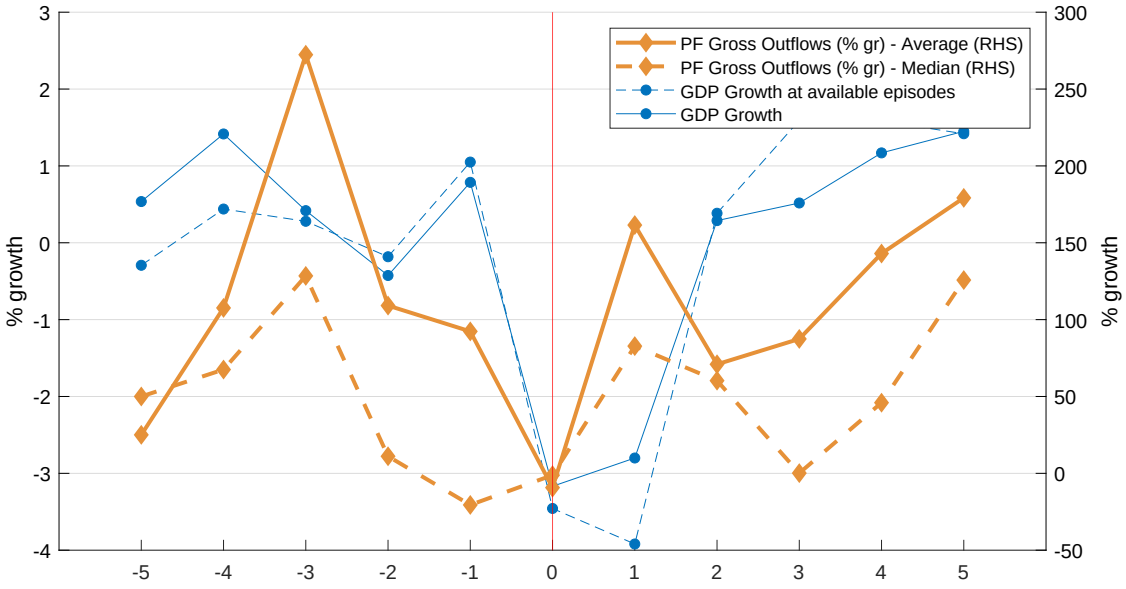
Note: The figure depicts the average and median dynamics of Gross Total Capital Outflows (growth) at the right scale in the ten years around 28 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since three episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.9: Gross Total Capital Outflows growth around Episodes



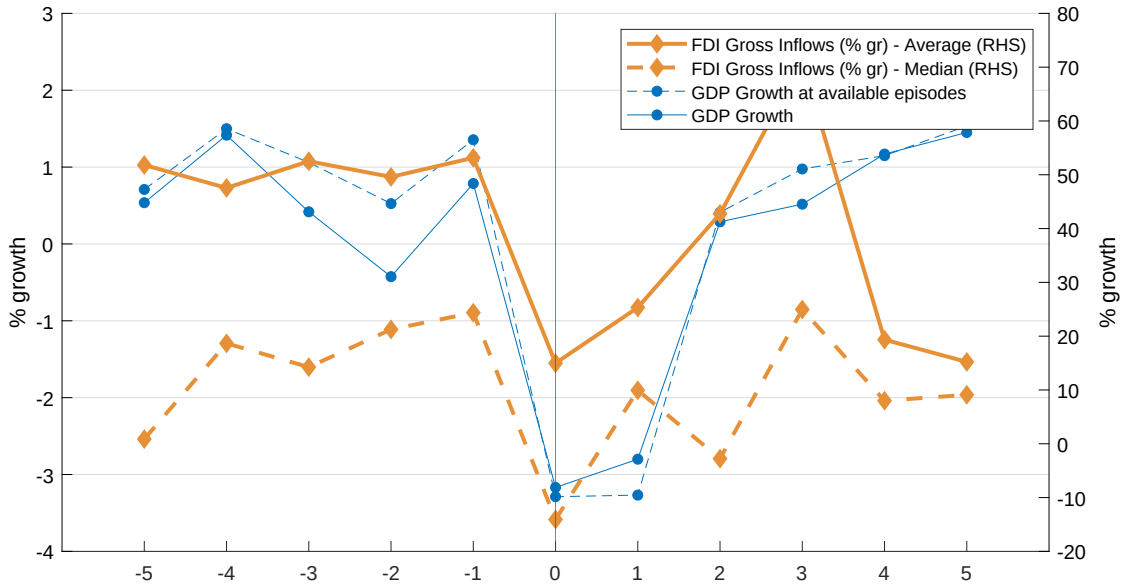
Note: The figure depicts the average and median dynamics of Gross Portfolio Inflows (growth) at the right scale in the ten years around 22 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since nine episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.10: Gross Portfolio Inflows growth around Episodes



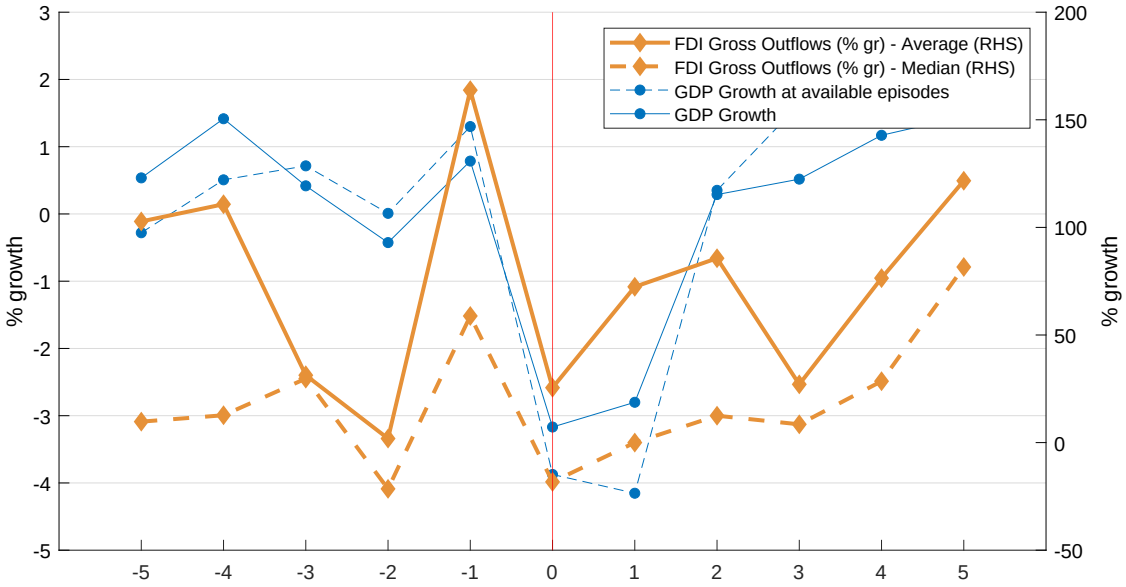
Note: The figure depicts the average and median dynamics of Gross Portfolio Outflows (growth) at the right scale in the ten years around 23 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since eight episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.11: Gross Portfolio Outflows growth around Episodes



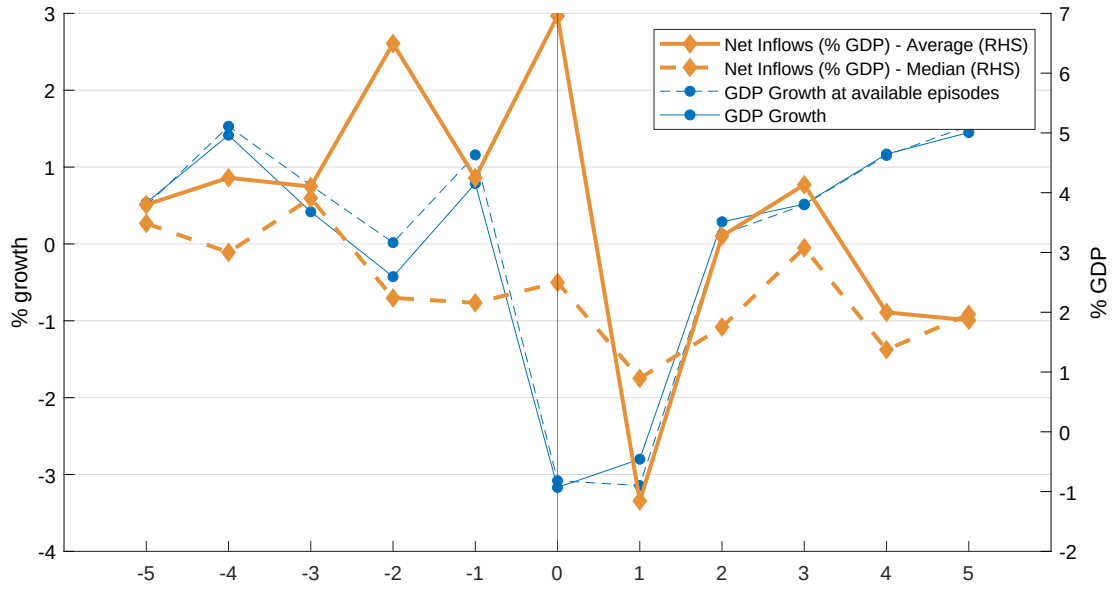
Note: The figure depicts the average and median dynamics of Gross FDI Inflows (growth) at the right scale in the ten years around 28 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since three episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.12: Gross FDI Inflows growth around Episodes



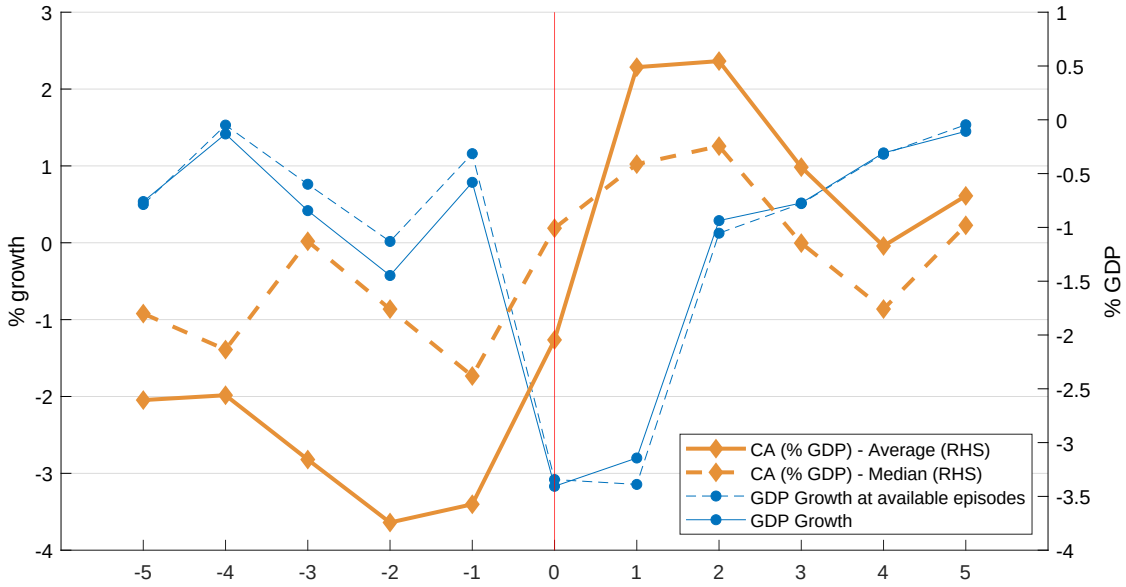
Note: The figure depicts the average and median dynamics of Gross FDI Outflows (growth) at the right scale in the ten years around 22 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since nine episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.13: Gross FDI Outflows growth around Episodes



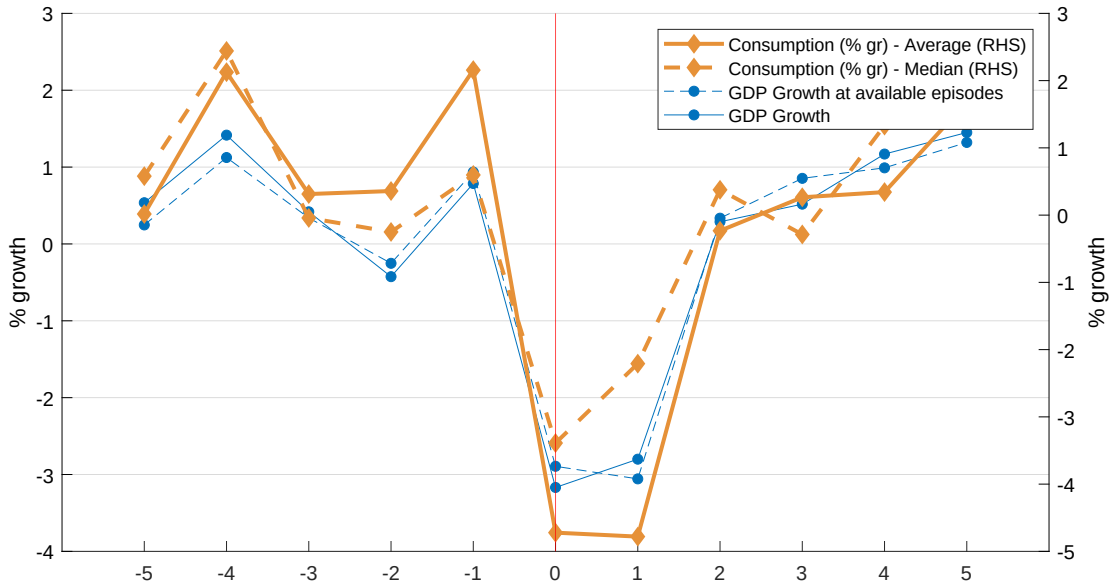
Note: The figure depicts the average and median dynamics of Net Inflows (as % of GDP) at the right scale in the ten years around 30 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since one episode does not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.14: Net Total Capital Inflows (as share of GDP) around Episodes



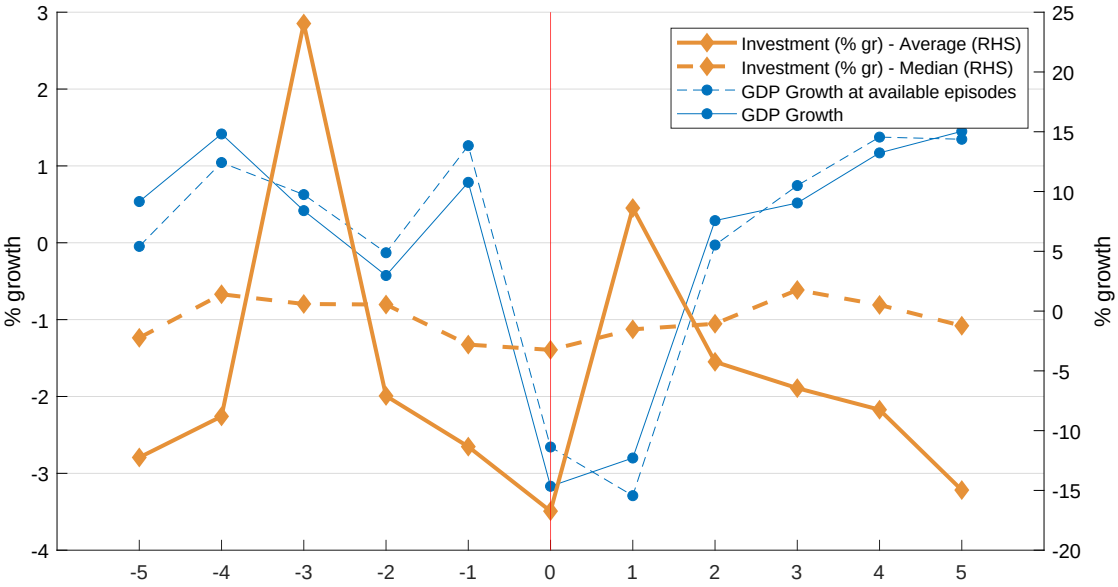
Note: The figure depicts the average and median dynamics of the Current Account Balance (as % of GDP) at the right scale in the ten years around 30 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since one episode does not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.15: Current Account Balance around Episodes



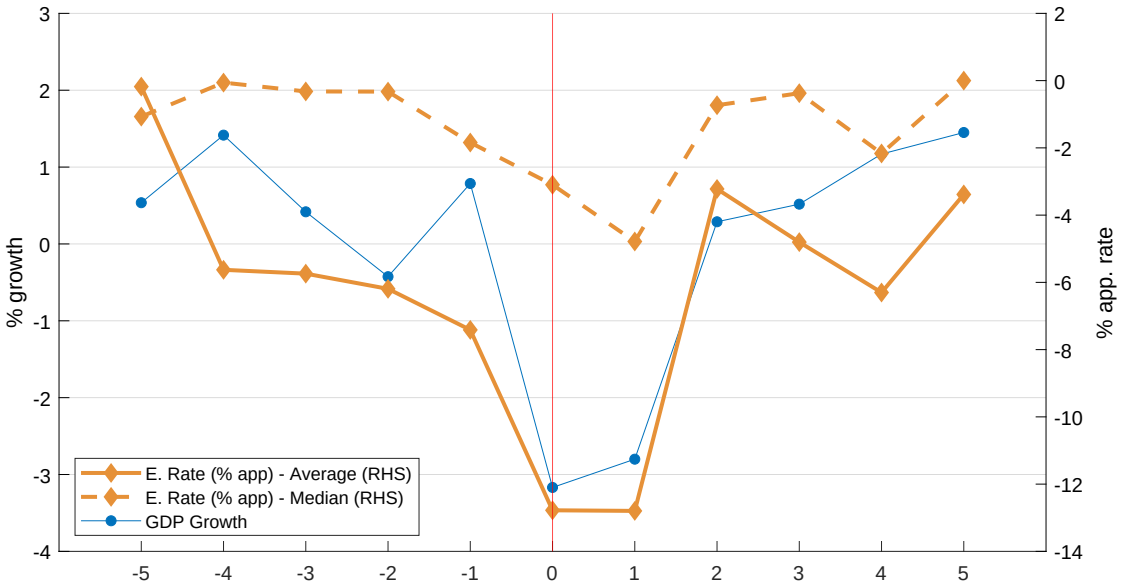
Note: The figure depicts the average and median dynamics of the Consumption growth (demeaned) at the right scale in the ten years around 28 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since three episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.16: Consumption growth around Episodes



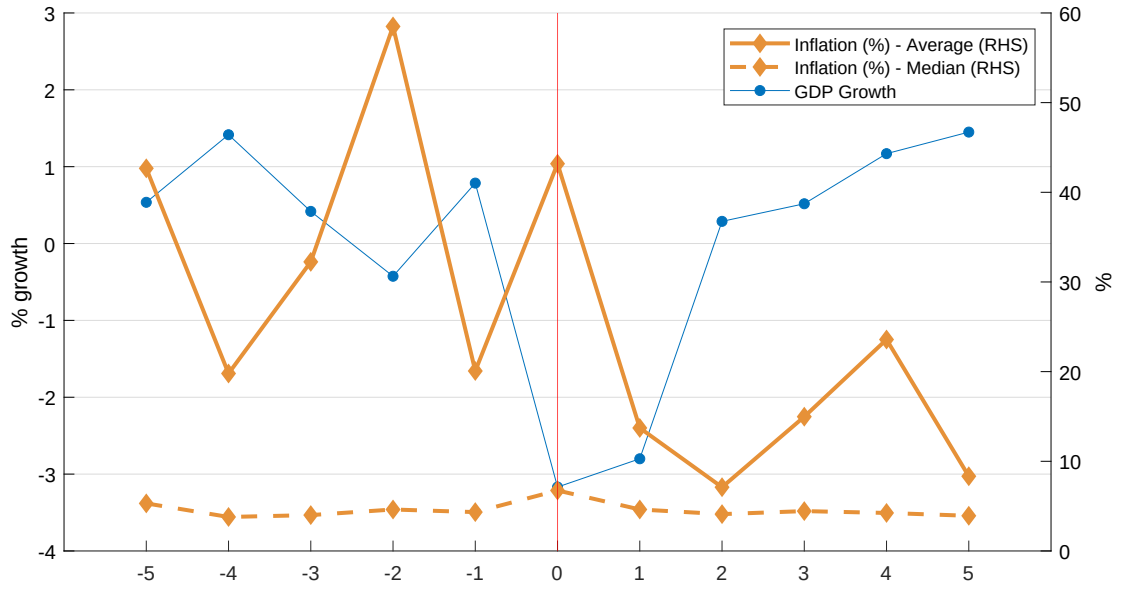
Note: The figure depicts the average and median dynamics of the Investment growth (demeaned) at the right scale in the ten years around 28 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. Since three episodes do not have data for this variable, the GDP Growth and GDP Growth at available episodes are shown for comparison.

Figure A.17: Investment growth around Episodes



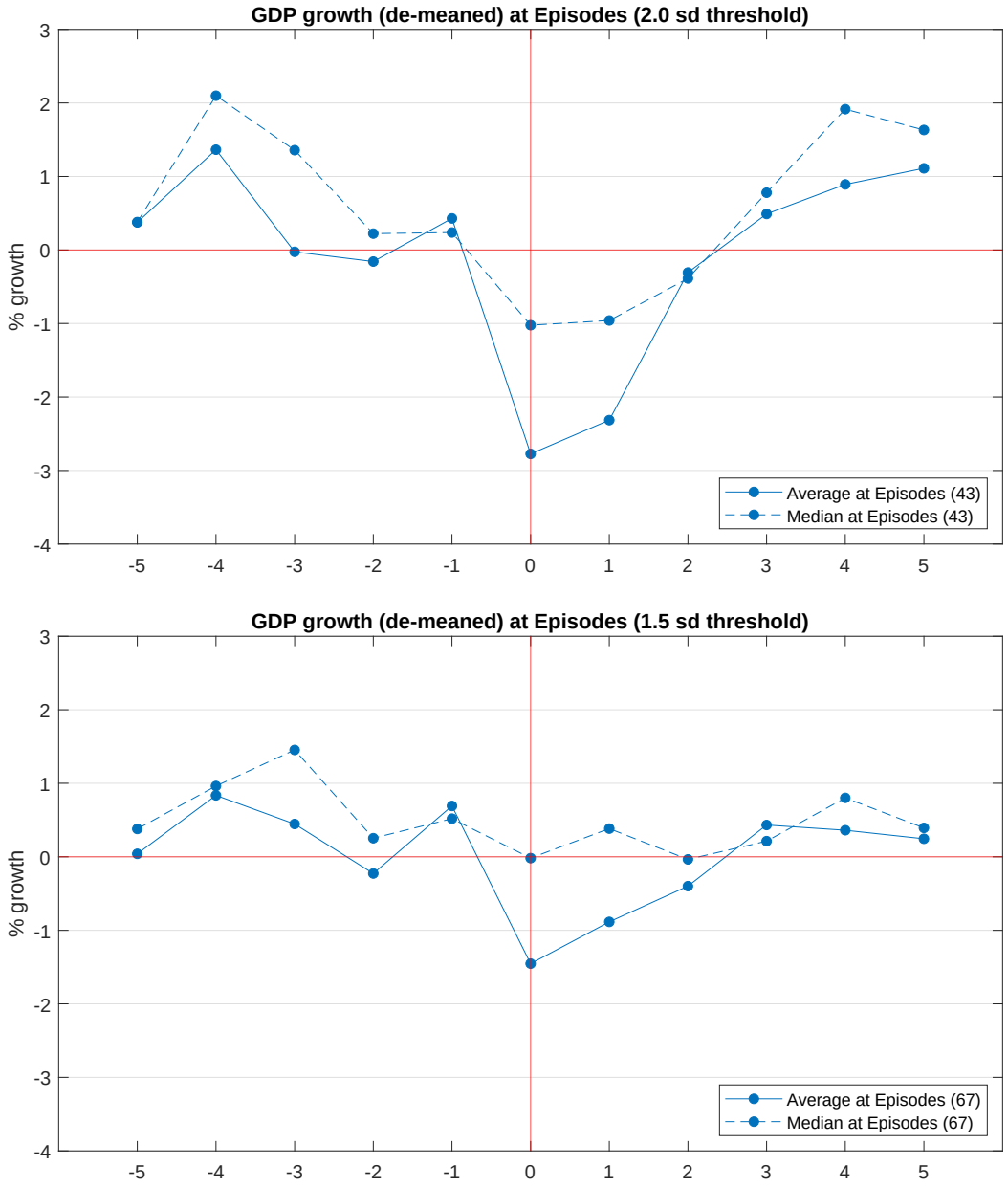
Note: The figure depicts the average and median dynamics of the Exchange Rate appreciation rate at the right scale in the ten years around 31 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. The GDP Growth is shown for comparison.

Figure A.18: Exchange Rate appreciation around Episodes



Note: The figure depicts the average and median dynamics of the Inflation at the right scale in the ten years around 31 episodes of forceful CCO tightening. $t = 0$ is the year of the episode. The GDP Growth is shown for comparison.

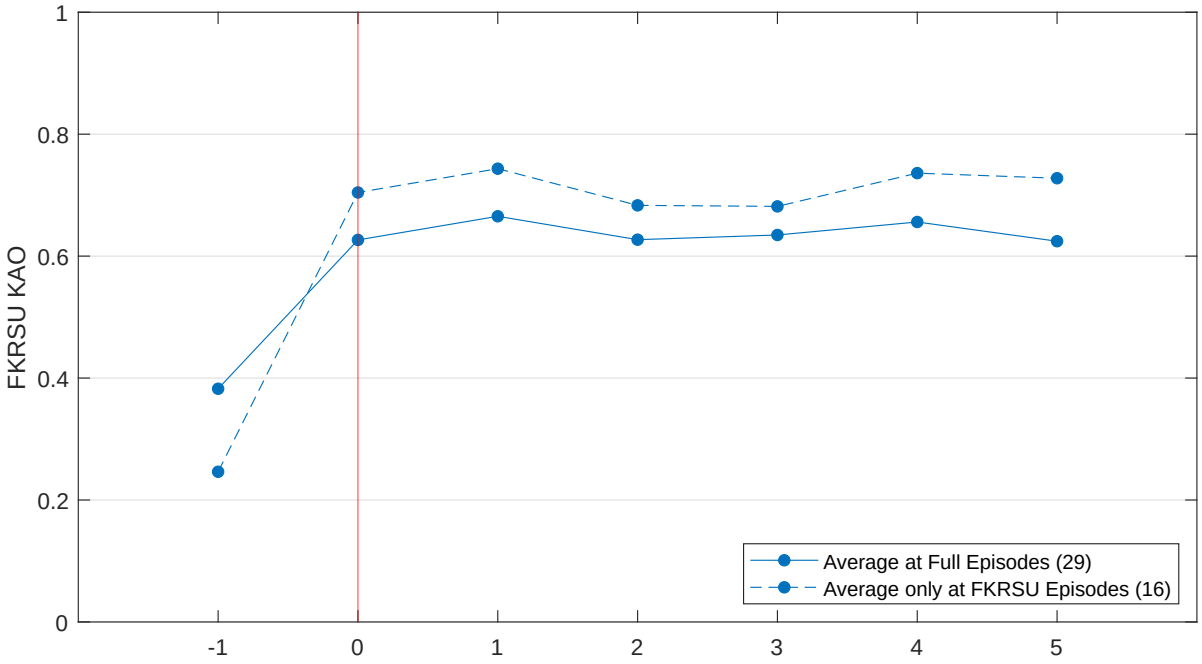
Figure A.19: Inflation around Episodes



No. Episodes	IV	Taxonomy	FKRSU	*Repeated*	Total
2.5 sd threshold	9	9	16	3	31
2.0 sd threshold	9	18	23	7	43
1.5 sd threshold	9	18	47	7	67

Note: Both panels depict the average (median) dynamics of GDP growth (demeaned) in the ten years around the episodes of forceful CCO tightening identified using two different thresholds: 2.0 sd and 1.5 sd. $t = 0$ is the year of the episode. The bottom table lists the number of episodes identified from each of the three complementary sources: IV (significant tightening of outflow controls in IMF (2012b)), Taxonomy (IMF's Taxonomy of CFM, in Binici and Das (2021)) and FKRSU (index by Fernandez et al. (2016)).

Figure A.20: Robustness: GDP Growth Around Episodes of CCO Tightening



Note: The figure depicts the persistence of Fernandez et al. (2016) KAO index (0-1 index, where 1 is a fully restricted capital account) the following 5 years after the episodes are identified. The solid line shows the average for the full list of episodes, except two of them (Zimbabwe 2016 and Fiji 2020) that do not have data on KAO index. The dashed line shows the average only for the episodes identified using Fernandez et al. (2016) KAO index.

Figure A.21: Persistence of Capital Controls

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.000621***	-0.000636***	-0.000690***	-0.00223***	-0.00172***
t			0.00201	0.00684*	0.00180
t^2			-0.0000190	-0.0000614*	-0.0000118
L.ER Regime				-0.00391	-0.00371
L.ER (app. rate)				-0.000128	-0.000213
L.Inflation (%)				-0.00000969	-0.0000106
L.CA Balance (%GDP)				-0.000591	-0.000291
L.Net Inflows (%GDP)				-0.0000303	-0.000250
L.Gross Inflows (% gr)				0.00000928	0.0000139
L.Gross Outflows (% gr)				-0.000000245	-0.000000817
L.Consumption (% gr)				0.00102***	0.00118***
L.Investment (% gr)				-0.0000328	-0.0000156
Banking Crisis					0.140***
Currency Crisis					0.120***
Constant	0.00630***	-0.000116	-0.0514	-0.174	-0.0548
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	5014	5014	2877	2494
Countries	193/195	193/195	193/195	143/195	143/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017
Adjusted R^2	0.002	0.008	0.008	0.020	0.097

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports OLS results from the regression analysis of the occurrence of CCO episodes on GDP growth. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth.

Table A.2: CCO Episodes and the Macroeconomy: Regression Analysis, OLS

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.0342***	-0.0657***	-0.0754***	-0.162***	-0.150***
t			0.320	0.901**	0.547
t^2			-0.00291	-0.00795**	-0.00448
L.ER Regime				0.0690	0.106
L.ER (app. rate)				-0.0594***	-0.0837***
L.Inflation (%)				-0.0578**	-0.0737**
L.CA Balance (%GDP)				-0.0560	-0.000243
L.Net Inflows (%GDP)				-0.0223	-0.0444
L.Gross Inflows (% gr)				0.00157*	0.00168
L.Gross Outflows (% gr)				-0.000569	-0.000802
L.Consumption (% gr)				0.163***	0.214***
L.Investment (% gr)				-0.000423	0.00130
Banking Crisis					2.514***
Currency Crisis					1.714**
Constant	-2.541***	-1.900***	-10.57*	-27.74**	-19.14
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	692	692	373	329
Countries	193/195	26/195	26/195	17/195	17/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports Probit results from the regression analysis of the occurrence of CCO episodes on GDP growth. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth. The marginal effect at the most comprehensive specification implies that if GDP growth would fall a further 1% then the probability of having a CCO episode increases by 1.1%, relative to an unconditional probability of 6.7%, i.e. an increase around 16.4% (1.1/6.7).

Table A.3: CCO Episodes and the Macroeconomy: Regression Analysis, Probit

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.000668***	-0.000682***	-0.000746***	-0.00225***	-0.00172***
GDP per capita (thousand US$)	0.00000117	-0.0000371	0.000241	0.000623	-0.0000232
t			0.00189	0.00647	0.00181
t^2			-0.0000185	-0.0000593*	-0.0000119
L.ER Regime				-0.00393	-0.00371
L.ER (app. rate)				-0.000127	-0.000213
L.Inflation (%)				-0.0000105	-0.0000106
L.CA Balance (%GDP)				-0.000606	-0.000290
L.Net Inflows (%GDP)				-0.0000344	-0.000250
L.Gross Inflows (% gr)				0.00000940	0.0000139
L.Gross Outflows (% gr)				-0.000000219	-0.000000816
L.Consumption (% gr)				0.00101***	0.00118***
L.Investment (% gr)				-0.0000337	-0.0000156
Banking Crisis					0.140***
Currency Crisis					0.120***
Constant	0.00647***	0.00183	-0.0593	-0.192	-0.0543
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	5014	5014	2877	2494
Countries	193/195	193/195	193/195	143/195	143/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017
Adjusted R^2	0.002	0.008	0.008	0.020	0.097

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports OLS results from the regression analysis of the occurrence of CCO episodes on GDP growth. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth.

Table A.4: Robustness: CCO Episodes and the Macroeconomy: GDP per capita, OLS

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.0369***	-0.0658***	-0.0776***	-0.168***	-0.145**
GDP per capita (thousand US$)	0.000791	0.00383	0.0542	0.0562	-0.0401
t			0.283	0.811*	0.631
t^2			-0.00268	-0.00735*	-0.00509
L.ER Regime				0.0575	0.114
L.ER (app. rate)				-0.0618***	-0.0824***
L.Inflation (%)				-0.0612**	-0.0720**
L.CA Balance (%GDP)				-0.0499	-0.00430
L.Net Inflows (%GDP)				-0.0228	-0.0451
L.Gross Inflows (% gr)				0.00167*	0.00163
L.Gross Outflows (% gr)				-0.000577	-0.000793
L.Consumption (% gr)				0.160***	0.218***
L.Investment (% gr)				-0.000329	0.00129
Banking Crisis					2.565***
Currency Crisis					1.771**
Constant	-2.544***	-1.944***	-9.787	-25.08*	-21.60
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	692	692	373	329
Countries	193/195	26/195	26/195	17/195	17/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports Probit results from the regression analysis of the occurrence of CCO episodes on GDP growth. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth. The marginal effect at the most comprehensive specification implies that if GDP growth would fall a further 1% then the probability of having a CCO episode increases by 4.9%, relative to an unconditional probability of 6.7%, i.e. an increase around 73.1% (4.9/6.7).

Table A.5: Robustness: CCO Episodes and the Macroeconomy: GDP per capita, Probit

Country	Year	△ KAO	△ KAO NonResident	△ KAO Resident	△ KAO Undet.
Greece	2015	0.70	0.25 36%	0.15 21%	0.30 43%
Ecuador	2008	0.70	0.30 43%	0.30 43%	0.10 14%
Vietnam	1997	0.51	0.29 56%	0.29 56%	-0.06 -11%
Cyprus	1996	0.50	0.15 31%	-0.10 -19%	0.44 89%
Myanmar	2008	0.47	0.23 50%	0.23 50%	0.00 0%
Czech Republic	2013	0.45	0.05 11%	0.30 67%	0.10 22%
Uzbekistan	1996	0.44	0.28 63%	0.22 50%	-0.06 -13%
Finland	2016	0.40	0.00 0%	0.30 75%	0.10 25%
Sweden	2016	0.40	0.00 0%	0.30 75%	0.10 25%
Bolivia	2007	0.40	0.20 50%	0.20 50%	0.00 0%
Sweden	2006	0.40	0.00 0%	0.30 75%	0.10 25%
Bulgaria	1997	0.36	0.04 12%	0.24 69%	0.07 19%
Lebanon	2005	0.35	0.15 43%	0.00 0%	0.20 57%
Ethiopia	2000	0.33	-0.01 -2%	0.04 14%	0.29 88%
Bangladesh	1996	0.32	0.09 28%	0.16 50%	0.07 22%
Cyprus	2013	0.25	-0.05 -20%	0.20 80%	0.10 40%
China	2016	0.10	0.00 0%	0.00 0%	0.10 100%
Russia	1998	0.05	0.05 100%	0.00 0%	0.00 0%
Latvia	2008	0.05	0.00 0%	0.05 100%	0.00 0%
Argentina	2001	0.05	0.00 0%	0.05 100%	0.00 0%
Mean △		**0.36**	**0.10**	**0.16**	**0.10**
Median △		**0.40**	**0.05**	**0.20**	**0.10**
Mean %		**-**	**25%**	**48%**	**27%**
Median %		**-**	**20%**	**50%**	**22%**

Note: The Table desegregates the △ KAO (0-1 index, from Fernandez et al. (2016), where 1 is a fully restricted capital account) among three different components: those measures directed to outflows by non-resident (△ *KAO NonResident*), by residents (△ *KAO Resident*), and those that cannot be determined (△ *KAO Undet.*). Only episodes with positive △ KAO are analyzed. Each row shows both the absolute variation and the share of each component compared to △ KAO. Bottom rows provide summary measures.

Table A.6: CCO Episodes: Residency Components

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.000621***	-0.000636***	-0.000690***	-0.00223**	-0.00172*
t			0.00201	0.00684	0.00180
t^2			-0.0000190	-0.0000614	-0.0000118
L.ER Regime				-0.00391	-0.00371
L.ER (app. rate)				-0.000128	-0.000213
L.Inflation (%)				-0.00000969	-0.0000106
L.CA Balance (%GDP)				-0.000591***	-0.000291
L.Net Inflows (%GDP)				-0.0000303	-0.000250
L.Gross Inflows (% gr)				0.00000928	0.0000139
L.Gross Outflows (% gr)				-0.000000245	-0.000000817
L.Consumption (% gr)				0.00102**	0.00118**
L.Investment (% gr)				-0.0000328	-0.0000156
Banking Crisis					0.140***
Currency Crisis					0.120***
Constant	0.00630***	-0.000116	-0.0514	-0.174	-0.0548
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✓	✓	✓
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	5014	5014	2877	2494
Countries	193/195	193/195	193/195	143/195	143/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: Table reports OLS results from the regression analysis of the occurrence of CCO episodes on GDP growth, with cross-sectional dependence adjusted standard errors (Driscoll and Kraay 1998). Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth.

Table A.7: Robustness: Regression Analysis, OLS with Driscoll-Kraay Standard Errors

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.000719***	-0.000739***	-0.000739***	-0.00295***	-0.00215***
L.ER Regime				-0.00366	-0.00352
L.ER (app. rate)				0.00000960	-0.000104
L.Inflation (%)				-0.00000498	-0.00000312
L.CA Balance (%GDP)				-0.000509	-0.000323
L.Net Inflows (%GDP)				0.0000360	-0.000176
L.Gross Inflows (% gr)				0.00000809	0.0000135
L.Gross Outflows (% gr)				-0.00000150	-0.00000131
L.Consumption (% gr)				0.000955**	0.00113***
L.Investment (% gr)				-0.0000383	-0.0000195
Banking Crisis					0.137***
Currency Crisis					0.121***
Constant	0.000193	-0.00618	-0.00618	0.0128	0.00143
Year F.E.	✓	✓	✓	✓	✓
Country F.E.	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✗	✗	✗
Macro Controls	✗	✗	✗	✓	✓
Observations	5014	5014	5014	2877	2494
Countries	193/195	193/195	193/195	143/195	143/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017
Adjusted R^2	0.006	0.012	0.012	0.028	0.097

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Note: Table reports OLS results from the regression analysis of the occurrence of CCO episodes on GDP growth, with year fixed-effects. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth.

Table A.8: Robustness: Regression Analysis, OLS with year fixed effects

	(1) episode	(2) episode	(3) episode	(4) episode	(5) episode
GDP (% gr)	-0.0479***	-0.130***	-0.130***	-0.397***	-0.368***
L.ER Regime				0.0427	0.223
L.ER (app. rate)				-0.0673*	-0.101**
L.Inflation (%)				-0.0438	-0.0803
L.CA Balance (%GDP)				-0.0323	-0.0481
L.Net Inflows (%GDP)				-0.0136	-0.0935
L.Gross Inflows (% gr)				0.00225	0.00331*
L.Gross Outflows (% gr)				-0.00213	-0.00317
L.Consumption (% gr)				0.286***	0.325***
L.Investment (% gr)				-0.00116	0.000340
Banking Crisis					2.190**
Currency Crisis					2.447**
Constant	-3.132***	-3.507***	-3.507***	-3.070**	-3.972**
Year F.E.	✓	✓	✓	✓	✓
Country F.E	✗	✓	✓	✓	✓
Trend (linear and Quad.)	✗	✗	✗	✗	✗
Macro Controls	✗	✗	✗	✓	✓
Observations	2963	410	410	176	176
Countries	193/195	26/195	26/195	17/195	17/195
Episodes	31/31	31/31	31/31	22/31	22/31
Years	1995-2021	1995-2021	1995-2021	1995-2020	1995-2017

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: Table reports Probit results from the regression analysis of the occurrence of CCO episodes on GDP growth, with year fixed-effects. Macro controls (all lagged): degree of exchange rate flexibility from Ilzetzki et al. (2021); nominal exchange rate growth; inflation; CA balance; Capital Flows (net and gross); consumption and investment growth. The marginal effect at the most comprehensive specification implies that if GDP growth would fall a further 1% then the probability of having a CCO episode increases by 2.7%, relative to an unconditional probability of 12.5%, i.e. an increase around 21.6% (2.7/12.5).

Table A.9: Robustness: Regression Analysis, Probit with year fixed effects

The counterfactual analysis is made in two stages. In the 1st stage, we have the Fernandez et al. (2016) CCO index as the dependent variable ($CCO_{i,t}$):

$$CCO_{i,t} = \beta_1 CCO_{i,t-1} + \beta_2 GDPgr_{i,t-1} + \alpha_1 X_{i,t-1} + \epsilon_{i,t}$$

Where $X_{i,t-1}$ are lagged covariates (ER regime, ER appreciation rate, inflation, CA Balance, Capital Flows and Banking and Currency crises) and also country F.E. and time trends. Then we get a series of CCO shocks, that can be calculated as:

$$\widetilde{CCO}_{i,t} = CCO_{i,t} - \widehat{CCO}_{i,t}$$

In the 2nd stage we use the CCO shocks as a variable to explain the GDP growth path. To evaluate the effect of a large CCO shock, we will regress only on episodes and their neighborhood (between t-5 and t+5).

$$GDPgr_{i,t} = \gamma \widetilde{CCO}_{i,t} + \varepsilon_{i,t}$$

Finally, we get a fitted series for GDP growth, as explained only by the CCO shocks.

$$\widehat{GDPgr}_{i,t} = \hat{\gamma} \widetilde{CCO}_{i,t}$$

The estimator of γ is not significant, with a magnitude of -0.165. The next figure shows the fitted GDP growth path $\widehat{GDPgr}_{i,t}$ for the 31 episodes:

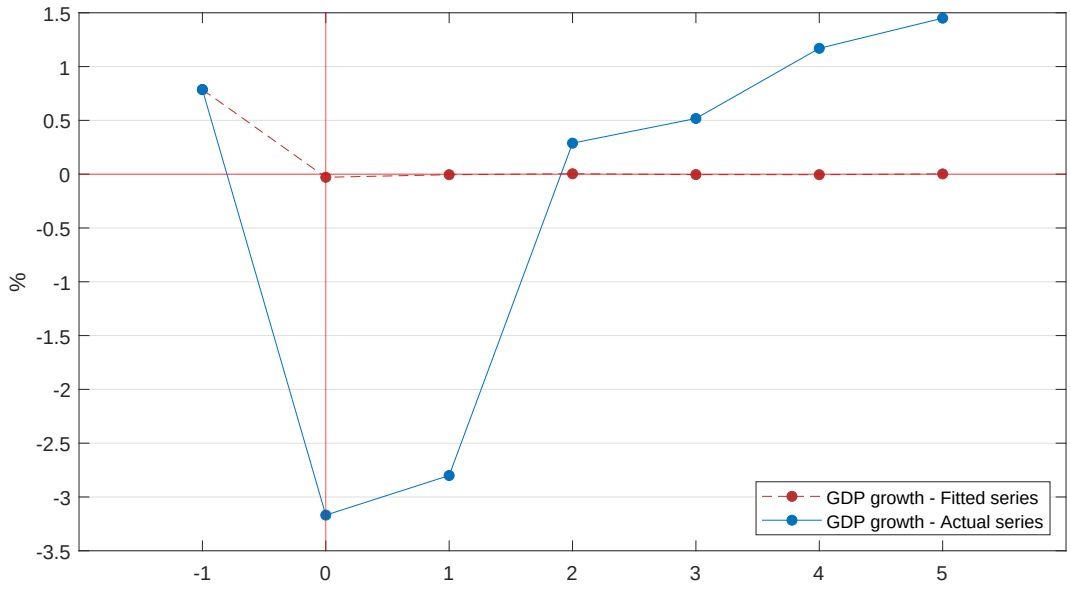


Figure A.22: GDP Growth - Counterfactual Simulation

B Theoretical Appendix

B.1 Further Discussion of Basic Assumptions

For convenience, we restate some assumptions of the model. If a capital controls policy $\pi = (\tau, \phi)$ (with $\phi = 0$ if $\tau = 0$) is applied at $t = 1$, the project size shrinks to $I_1 = (1 - \phi)I_0$. Also, recalling that λ is the fraction of the population of investors that stay if the state is fragile at $t = 1$, a basic assumption is that $I_2 = g(\lambda)I_1 = (1-\phi)g(\lambda)I_0$, where g is a continuous, increasing function with $g(1) = 1, g(0) = 0$ (or some small number). The project's final payoff is then $RI_2 = Rg(\lambda)I_1 = R(1 - \phi)g(\lambda)I_0$.

In the fragile state at $t = 1$, if $\lambda > 0$, each investor that stays can expect to be paid $RI_2/\lambda = R(1-\phi)g(\lambda)I_0/\lambda$ at $t = 2$. So we can define the rate of return at that time by $(1 - \phi)f(\lambda)$, with $f(\lambda) \equiv g(\lambda)RI_0/\lambda i$. (Note that f potentially depends on the policy π only through I_0/i). If $\lambda = 0$, the previous expression is indeterminate, but we adopt the natural assumption that $f(\lambda) = 0$.

For a leading example, consider a typical Diamond and Dybvig framework, where there is an L such that $0 < L < 1$ and $g(\lambda) = 0$ for $\lambda \leq L$. That is, if more than $(1 - \lambda)$ investors leave in the fragile state, the size of the project becomes zero.[38]

B.2 Basic Model With Given CCO Policy

In the spirit of game theory, this appendix discusses our basic model in terms players, decision nodes, moves to each player at the nodes, and payoffs. To define the equilibrium concept, one slight complication is that there is a continuum of players (investors). It is then helpful to add aggregate outcomes to the list of objects to be specified in an equilibrium.[39]

In this section we assume that a capital controls policy (τ, ϕ) (with $\phi = 0$ if $\tau = 0$) is given at the start of the game. The policy is applied at $t = 1$ only if the state turns out to be fragile. Of course, one can imagine other possibilities (e.g. that the policy applies at $t = 1$ regardless of the state).

Players. The government (G) and a continuum of (foreign) investors.

Nodes and Information. An initial time $t = 0$, with $\pi = (\tau, \phi)$ given.

At $t = 1$, there are two possible states, *normal* and *fragile,* with probabilities q and $1-q$. If the state is fragile an exogenous variable is then realized, "sunspots" with probability p and "no sunspots" with probability $(1-p)$.

Hence there are three nodes at $t = 2$: normal (with probability $1 - q$), fragile with sunspot (probability pq, referred to as sunspots, for brevity), and fragile without sunspot (probability $q(1-p)$, referred to as no sunspots).

Moves and Strategies. At $t = 0$ the government proposes an initial contribution i from the typical investor. The investor then accepts or rejects it. To simplify exposition, we will just assume that i is the maximal contribution that is accepted, i.e. i must equal the expected payoff to investors.

The only other nontrivial decision is made by the typical investor in period $t = 1$, if the state is fragile and after observing the sunspots realization. We describe the investor 's *strategy* by two indicator functions: χ_s ($= 1$ if investor leaves if sunspots, $\chi_s = 0$ if not); χ_{ns} ($= 1$ or 0 if investor leaves or stays) if no sunspots. An investor strategy will be denoted by $\chi = (\chi_s, \chi_{ns})$

Aggregate Outcomes and Payoffs. The *aggregate run outcome* $\lambda = (\lambda_s, \lambda_{ns})$ is the number of investors λ_s (λ_{ns}) that stay if sunspots (no sunspots) at $t = 1$. Without loss of generality, we restrict attention to outcomes where λ_s and λ_{ns} are either 0 or 1.

Given the initial project size i and an aggregate run outcome, other aggregate outcomes and payoffs are defined in the natural way. For instance, the project size evolves according to $I_0 = A + i$; if state is normal at $t = 1$, $I_2 = I_1 = I_0$; in the sunspots state, $I_2 = g(\lambda_s)(1 - \phi)I_0 \equiv I_{2s}$; in the no sunspots state, $I_2 = g(\lambda_{ns})(1 - \phi)I_0 \equiv I_{2ns}$. The expected final size of the project is then $E(I_2) = (1 - q)I_0 + q\left[pI_{2s} + (1 - p)I_{2ns}\right]$.

The government's expected payoff is then $BE(I_2)$, and he expected payoff to an investor is $(1 - q)RI_0 + qp[\chi_s\omega(1 - \tau)i + (1 - \chi_s)RI_{2s}] + q(1 - p)[\chi_{ns}\omega(1 - \tau)i + (1 - \chi_{ns})RI_{2ns}] - i$.

[38] One nuance may be that, in Diamond-Dybvig, if $\lambda \leq L$, $L - \lambda$ investors do not get paid i. Then the probability that a running investor gets paid is $1 - L/(1 - \lambda) = 1 - (L - \lambda)/(1 - \lambda)$. For $\lambda = 0$ this becomes $1 - L$. We can amend our formulation with the assumption that leaving investors get expected payoff $h(\lambda)\omega i$, not ωi, where $h(\lambda)$ is the probability of getting paid. Assuming that $h(0) = 1 - L, h(\lambda) = 1$ for $\lambda \geq L$, everything we say will obtain if we replace ω with $(1 - L)\omega$.

[39] In game theoretical terms, our model should be seen as an *anonymous* game.

Equilibrium. An initial proposal i, an investor strategy χ, and aggregate run outcome λ are an (anonymous, symmetric, sequentially perfect) equilibrium if:

1. The aggregate run outcome is consistent with the strategy pair (i.e. $\lambda_s = 1 - \chi_s$ and $\lambda_{ns} = 1 - \chi_{ns}$)
2. The initial proposal i is greater than zero and gives investors a zero expected payoff, given the aggregate outcome
3. The strategy χ is optimal for the typical individual investor, given the aggregate run outcome λ.

Proposition. Assuming that

$$(1-\tau)\omega < \frac{1-\phi}{1-q\phi}$$

there is an equilibrium **with** capital flight given by:

$$\begin{aligned} \chi_s &= 1,\ \lambda_s = 0 \\ \chi_{ns} &= 0, \lambda_{ns} = 1 \\ I_{2s} &= 0,\ I_{2ns} = (1-\phi)I_0 \end{aligned}$$

and

$$I_0 = A + i = LA$$

where the leverage coefficient is

$$L = \frac{1 - qp(1-\tau)\omega}{(1 - qp(1-\tau)\omega) - [q(1-p)(1-\phi) + (1-q)]R}$$

Remarks. In this equilibrium, there is capital flight at $t = 1$ with probability pq. Also, note that in laissez faire the leverage coefficient becomes

$$I_0 = \frac{1 - pq\omega}{1 - pq\omega - (1-pq)R}A$$

which is consistent with the text.

Proof. Equilibrium condition 1 holds by construction. For condition 3, it is necessary in the sunspots state that

$$(1-\tau)\omega i > (1-\phi)f(0)i = 0$$

which holds if $i > 0$. In the no sunspots state, it is necessary that

$$(1-\tau)\omega i < (1-\phi)f(1)i = (1-\phi)RI_0$$

Now, the expected payoff to investors is:

$$q[p(1-\tau)\omega i + (1-p)(1-\phi)RI_0] + (1-q)RI_0 - i = 0$$

which, after simplification and rearranging, gives

$$(1-\phi)RI_0/i = \frac{[1 - qp(1-\tau)\omega]\,(1-\phi)}{q(1-p)(1-\phi) + (1-q)}$$

The necessary condition $(1-\tau)\omega i < (1-\phi)RI_0$ is then satisfied under the condition of the proposition. Finally, since $i = I_0 - A$ we get L and I_0 from

$$q[p(1-\tau)\omega(I_0 - A) + (1-p)(1-\phi)RI_0] + (1-q)RI_0 = I_0 - A$$

This construction ensures that equilibrium condition 2 holds.■

Corollary. If

$$(1-\tau)\omega < (1-\phi)f(0)$$

there cannot be an equilibrium with capital flight.

Proof. From the previous discussion, capital flight in the sunspots state requires $(1-\tau)\omega i > (1-\phi)f(0)i$, which is ruled out by the preceding inequality.■

The consequence is that a policy with $\tau = 1$ can always rule out capital flight.

Proposition. Assuming the same condition as in the previous proposition, there is an equilibrium **without** capital flight given by

$$\begin{aligned} \chi_s &= 0,\ \lambda_s = 1 \\ \chi_{ns} &= 0, \lambda_{ns} = 1 \\ I_{2s} &= I_{2ns} = (1-\phi)I_0 \end{aligned}$$

and

$$I_0 = A + i = \frac{1}{1-(1-q\phi)R}A$$

Proof. Again the proof requires just to check conditions 1-3. For condition 3, with or without sunspots, we need

$$(1-\tau)\omega i < (1-\phi)f(1)i = (1-\phi)RI_0$$

In this case the payoff to investors is given by

$$(1-q\phi)RI_0 - i = 0$$

and hence the preceding inequality becomes

$$(1-\tau)\omega(1-q\phi) < (1-\phi)$$

which is the condition of the proposition.■

B.3 Optimal Policy With Commitment

In subsection 6.1, that G *chooses* a policy $\pi = (\tau, \phi)$ at $t = 0$, together with the proposal i. An *optimal policy with commitment* is then a choice (i, π) such that there is no other (i, τ, ϕ) that results in an equilibrium with a higher $E(I_2)$.

The analysis of the previous section is modified in the obvious way. We can clearly restrict attention to two cases: laissez faire ($(\tau, \phi) = (0, 0)$, denoted by $\pi = LF$ hereon) and binding CCOs ($\tau = 1$ and $\phi > 0$, eliminating capital flight, $\pi = CCO$ from now on). Assuming that the conditions of the Propositions of the previous section hold, capital controls are optimal if

$$(1-q\phi)\left[\frac{1}{1-(1-q\phi)R}\right] > (1-pq)\frac{1-pq\omega}{1-pq\omega-(1-pq)R}$$

and laissez faire is optimal if the inequality is the opposite. This is just the main result of subsection 6.1, where the proof is given.

B.4 Discretionary Case

Assume instead, as in subsection 6.2, that G chooses a policy $\pi = (\tau, \phi)$ at $t = 1$ if the state is fragile, but before the sunspot variable is realized. The original formulation of the model and the definition of equilibrium need to be modified accordingly. In particular, the investor strategy χ as well as the aggregate run outcome can depend on the policy choice π. The investors' strategy is now denoted by $\chi = (\chi_s^\pi, \chi_{ns}^\pi)$, with $\pi = LF, CCO$, and the aggregate run outcome by $\lambda = (\lambda_s^\pi, \lambda_{ns}^\pi)$. In this notation, λ_s is the number of investors that stay in the fragile state under policy π if sunspots are observed, etc.

Equilibrium. A project size i, policy π, investor strategy χ, and aggregate run outcome λ is a *discretionary equilibrium* if:

1. The aggregate run outcome is consistent with the strategy pair
2. The initial proposal i is greater than zero and gives investors a zero expected payoff, given the aggregate outcome λ and policy π.
3. The policy π is optimal for the government at $t = 1$, given $I_0 = A + i$ and the aggregate run outcome λ.
4. The strategy χ is optimal for the typical individual investor, given the aggregate run outcome λ and policy π.

Proposition. There is a discretionary equilibrium with $\pi = CCO$ if

$$p > \phi$$

If the inequality is the opposite, there is a discretionary equilibrium with $\pi = LF$.

Proof. Once more, the proof involves checking 1-4 and left to the reader. In particular, the proof of condition 3 follows subsection 6.2 in the text.■

B.5 Political Opportunism (Single Stage)

Now consider the case with political opportunism described in section 7.

Players. The government G and the continuum of investors.

Nodes, Information, and Moves. At $t = 0$, "nature" chooses the government's *type*: honest or opportunistic. Investors have an initial **belief** $\beta \in [0, 1]$ that the government is honest.

At $t = 1$, if G is opportunistic, the state of the economy is assumed to be fragile (this simplifies the exposition). In that node, the CCO policy $\pi = CCO$ is imposed by the opportunistic G, and $I_1 = (1 - \phi)I_0$.

If G is honest, at $t = 1$ the state can be normal with probability $1-q$ or fragile with probability q. In the normal state investors do not have the opportunity to run, so we assume that the LF policy $\pi = LF$ is imposed, and $I_0 = I_1 = I_2$.

If the state is fragile and G is honest, G can choose either $\pi = LF$ or $\pi = CCO$. (This is the only point in $t = 1$ at which the honest government makes a nontrivial decision).

In the fragile state, investors decide whether to stay or leave after observing the policy π and the realization of the sunspots variable.

The size of the project is adjusted according to whether the state is normal or fragile, the policy π, and the aggregate investment decision. At $t = 2$, investors are then paid and model ends.

Strategies, Aggregate Outcomes, Beliefs. At $t = 0$ both kinds of government propose an initial project size I_0 and contribution $i = I_0 - A$ to the typical investor. To shorten exposition, we impose that the proposal leave investors indifferent between accepting or not. (This is clearly optimal for the honest government, while the opportunistic government must imitate the honest one so as not to reveal its type.)

At $t = 1$, as noted above, the only nontrivial decision for the honest government is to choose a policy $\pi = LF$ or $\pi = CCO$ if the state is fragile.

The investor 's *strategy* χ is given by her choice of staying or leaving in the fragile state, conditional on the observed policy π and sunspots realization. It is again denoted by $\chi = (\chi^\pi_s, \chi^\pi_{ns})$.

The *aggregate run outcome* $\lambda = (\lambda^\pi_s, \lambda^\pi_{ns})$ is the number of investors that stay if policy π is observed and sunspots occur (λ^π_s) or not (λ^π_{ns}).

Clearly, given i, the government's strategy π and the aggregate run outcome χ determine project size at all nodes in the natural manner. Payoffs depend on I_2 as in the basic model.

Equilibrium. An equilibrium in the model with political opportunism is an initial proposal i and project size $I_0 = A + i$, an investors' strategy χ, a government strategy π, and an aggregate run outcome λ, such that:

1. The aggregate run outcome λ is consistent with χ
2. The initial proposal i gives investors an expected zero payoff, given the policy π, the aggregate run outcome, and the initial government reputation β.
3. The strategy χ is optimal for the individual investor at $t = 1$, given I_0, π, and the aggregate run outcome λ.

4. Policy π is optimal for the honest G if the state is fragile in $t = 1$, given I_0 and the aggregate run outcome λ.

Proposition. There is an equilibrium in which $\pi = CCO$, $(\lambda_s^{CCO}, \lambda_{ns}^{CCO}) = (1, 1), (\lambda_s^{LF}, \lambda_{ns}^{LF}) = (0, 1), \chi = 1 - \lambda$, $i = I_0 - A$ with

$$I_0 = \frac{1}{1 - [\beta(1 - \phi q) + (1 - \beta)(1 - \phi)]R} A$$

provided that

$$\omega < \frac{1}{(1 - \beta)(1 - \phi) + \beta(1 - q\phi)}$$

and

$$p > \phi$$

Proof. Equilibrium condition 1 is true by construction. For condition 2, note that the expected initial payoff for investors in equilibrium satisfies

$$(1 - \beta)(1 - \phi)RI_0 + \beta\left[(1 - q)RI_0 + q(1 - \phi)RI_0\right] = i = I_0 - A$$

which yields the equilibrium value of I_0.

At $t = 1$, if $\pi = CCO$ is observed investors stay, by the assumption that $CCOs$ bind. If $\pi = LF$ is observed and the state is fragile (which occurs with probability zero), the equilibrium continuation $(\lambda_s^{LF}, \lambda_{ns}^{LF}) = (0, 1)$ says that probability p and stay with probability $1 - p$. This is individually optimal if $0 < \omega i < RI_0$, which holds because $i > 0$ and $\omega < R(I_0/(I_0 - A)))$ under the conditions of the proposition.

Finally, condition 4 is satisfied if $p > \phi$, as discussed in the text. ■

B.6 Two Stages

We turn to the two stage model of section 8. To simplify matters, here we only expand on the analysis of the first stage, taking advantage of the special assumptions we have imposed, and especially that the payoff to the honest government in the second stage, $\Pi^{(2)}(\beta^{(2)})$, is completely determined its *reputation* $\beta^{(2)}$ entering that stage.

The formal description of the first stage is the same as that of the one stage model, except that one needs to describe the evolution of reputation, and that the honest government cares about two stage payoffs. Hence we omit stage superscripts unless strictly needed.

Players. The government G and the continuum of investors.

Nodes, Information, and Moves. An initial time $t = 0$, "nature" chooses the government's *type*: honest or opportunistic. Investors have an initial **belief** $\beta^{(1)}$ that the government is honest.

At $t = 1$, if G is opportunistic, the state of the economy is assumed to be fragile, the CCO policy $\pi = CCO$ is imposed, and $I_1 = (1 - \phi)I_0$.

If G is honest, at $t = 1$ the state is normal with probability $1 - q$ or fragile with probability q. In the normal state the LF policy $\pi = LF$ is imposed, and $I_0 = I_1 = I_2$.

If the state is fragile and G is honest, G chooses between $\pi = LF$ or $\pi = CCO$..

In the fragile state, investors decide whether to stay or leave after observing the policy π and the realization of the sunspots variable.

The size of the project is adjusted according to whether the state is normal or fragile, the policy π, and the aggregate investment decision. At $t = 2$, investors are then paid and the first stage ends.

Strategies, Aggregate Outcomes, Beliefs. At $t = 0$ both kinds of government propose an initial project size I_0 and contribution $i = I_0 - A$ to the typical investor. The proposal leave investors indifferent between accepting or not.

The honest G's strategy is a choice $\pi = LF$ or CCO. The investor 's *strategy* $\chi = (\chi_s^\pi, \chi_{ns}^\pi)$ is given by her choice of staying or leaving in the fragile state at $t = 1$, having observed the policy π and sunspots realization.

The *aggregate run outcome* is again denoted by $\lambda = (\lambda_s^\pi, \lambda_{ns}^\pi)$ and has the same meaning as in the previous section.

Given i, the government's strategy π and the aggregate run outcome χ determine the evolution of project size. First stage payoffs depend on $I_2 = I_2^{(1)}$ as in the basic model.

Finally, as mentioned, the second stage payoff to the government is $\Pi(\beta^{(2)})$, where $\beta^{(2)}$ depends on first stage outcomes. Let β_{CCO} denote the posterior investors' belief that G is honest if $\pi = CCO$ has been observed. Of course, if $\pi = LF$ has been observed, investors learn that G is honest for sure. So $\beta^{(2)} = \beta^{CCO}$ if the state is fragile and $\pi = CCO$ is observed, and $\beta^{(2)} = 1$ in all other cases.

Dynamic equilibrium. A dynamic equilibrium is an initial proposal i and project size $I_0 = A+i$, an investors' strategy χ, a government strategy π, an aggregate run outcome λ, and a posterior belief β_{CCO} such that:

1. The aggregate run outcome λ is consistent with χ
2. The initial proposal i gives investors an expected zero payoff, given the policy π, the aggregate run outcome, and the initial government reputation $\beta^{(1)}$.
3. The strategy χ is optimal for the individual investor at $t = 1$, given I_0, π, and the aggregate run outcome λ.
4. Policy π is optimal for the honest G if the state is fragile in $t = 1$, given I_0, β_{CCO}, and the aggregate run outcome λ.
5. β_{CCO} is derived from π using Bayes' Rule.

Remark. As mentioned earlier, in condition 4 optimality for the honest G refers to its two stage payoff.

The following propositions describe the two classes of equilibria mentioned in subsections 8-2-8.3 of the text.

Proposition (Partially Revealing Equilibrium). There is an equilibrium in which $\pi = CCO, (\lambda_s^{CCO}, \lambda_{ns}^{CCO}) = (1,1), (\lambda_s^{LF}, \lambda_{ns}^{LF}) = (0,1), \chi = 1-\lambda, i = I_0 - A$ with

$$I_0 = \frac{1}{1-[\beta^{(1)}(1-\phi q)+(1-\beta^{(1)})(1-\phi)]R}A$$

and

$$\beta^{CCO} = \beta^{(1)}\frac{q}{q+(1-\beta^{(1)})(1-q)}$$

provided that

$$\omega < R(I_0/(I_0-A)))$$

and

$$p-\phi > \frac{1}{BI_0}[\Pi^{(2)}(1) - \Pi^{(2)}(\beta^{CCO})]$$

Proof. Equilibrium condition 1 holds by construction.

Note that there is no capital flight in this equilibrium, but CCOs are imposed in the fragile state. So the zero expected payoff condition is:

$$i = RI_0[1-\phi(\beta^{(1)}q + (1-\beta^{(1)}))]$$

Using $I_0 = A + i$ gives the equilibrium I_0. Condition 2 is then satisfied.

If CCOs are imposed, they are binding by assumption, so $(\lambda_s^{CCO}, \lambda_{ns}^{CCO})$ must equal $(1,1)$. If the state is fragile but CCOs are not imposed (which can only happen out of equilibrium), the condition $(\lambda_s^{LF}, \lambda_{ns}^{LF}) = (0,1)$ means that there is capital flight with probability p. Following previous discussion, this is seen to be optimal for individual investors provided $0 < \omega i < RI_0$, which is guaranteed by $\omega < R(I_0/(I_0-A)))$.

Finally, conditions 4 and 5 are proven with the same arguments as in the main text.■

Proposition (Fully Revealing Equilibrium). There is an equilibrium in which $\pi = LF$, $(\lambda_s^{CCO}, \lambda_{ns}^{CCO}) = (1,1), (\lambda_s^{LF}, \lambda_{ns}^{LF}) = (0,1), \chi = 1-\lambda, i = I_0 - A$ with

$$I_0 = \frac{1}{1-[\beta^{(1)}(1-pq)+(1-\beta^{(1)})(1-\phi)]R}A$$

and

$$\beta^{CCO} = 0$$

provided that

$$\omega < R(I_0/(I_0 - A)))$$

and

$$0 < p - \phi < \frac{1}{BI_0}[\Pi^{(2)}(1) - \Pi^{(2)}(0)]$$

The proof is a simple adaptation of previous arguments and the discussion in the text, and left to the interested reader.■