Fiscal Policy Design in Collateral-Constraint Economies: the Role of Commitment

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Abstract

I study the optimal design of fiscal policy, with and without commitment, in collateral-constraint models where the households' borrowing capacity is linked to the economy's real exchange rate. When the collateral constraint is binding, increasing public spending raises the real exchange rate and stabilizes private consumption. However, by making potential crises less costly, higher spending also makes borrowing more attractive. I show that the Ramsey-optimal policy entails a commitment to restrict fiscal stimulus during crisis periods, aimed at deterring excessive debt accumulation. In a quantitative application to Argentina, I show that, despite the potential for substantial ex-post gains from stabilizing the real exchange rate, significant fiscal expansions are not optimal because of the borrowing inefficiency.

Keywords: Fiscal policy, inefficient borrowing, collateral constraints, financial crises, macroprudential policies.

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1 Introduction

Pro-cyclical fiscal policy is a pervasive feature of emerging-market economies, with governments often reducing spending during downturns. This empirical fact contrasts sharply with the view that fiscal stimulus is an effective tool to address macroeconomic and financial instability. The existing literature has documented large fiscal multipliers during crisis times, raising the question of why developing countries do not more frequently adopt a counter-cyclical fiscal stance.

To explore this idea, I study a standard incomplete-markets small-open economy model with tradable and nontradable goods. Following Mendoza (2002) and Bianchi (2011), I consider a setting where households can borrow up to a fraction of their income's value, which depends on the equilibrium real exchange rate. A standard pecuniary externality makes this economy constrained-inefficient. Private agents do not internalize that higher debt levels depress future collateral values, leading to higher borrowing than socially optimal.

I extend the standard framework by allowing the government to supply a share of nontradables as public consumption. Fiscal policy serves two key roles. First, increasing government spending raises the relative price of nontradables, leading to a real exchange rate appreciation. When the collateral constraint binds, this appreciation boosts the value of income and relaxes the constraint. Second, fiscal policy influences households' borrowing incentives by altering the relative attractiveness of tradable versus nontradable consumption, as well as the relative attractiveness of current versus future total consumption. These two roles of fiscal policy give rise to an interesting trade-off for the government. Ex-post, during a crisis, fiscal stimulus is beneficial as it relaxes borrowing constraints. However, from an ex-ante perspective, the anticipation of a fiscal easing can make the economy more vulnerable by encouraging households to increase debt issuance prior to a potential crisis. Therefore, the optimal fiscal policy must strike a balance between stabilizing the economy during crises and avoiding the buildup of vulnerabilities that could lead to future instability.

To formalize this trade-off, I study the optimal design of fiscal policy by a benevolent government that maximizes welfare subject to a set of implementability conditions, which includes the collateral constraint and the households' Euler equation. Because the Euler equation is a forward-looking constraint, the Ramsey-optimal policy is time-inconsistent. Therefore, I characterize the second-best allocations both with and without commitment. As a benchmark, I consider the optimal policy in the absence of collateral constraints, which coincides with the classic Samuelson rule. According to this rule, the government should set public spending to equalize the marginal utilities of private and public consumption. I show that in the presence of collateral constraints this unconstrained benchmark is no longer optimal.

In the period before the crisis, fiscal policy takes up a prudential role, with the government optimally deviating from the Samuelson level to deter households' excessive borrowing. Depending on the model parameters, optimal spending may be higher or lower than in the frictionless benchmark. Under commitment, it is ambiguous whether the optimal policy is expansionary or contractionary, as this depends on whether the government has stronger incentives to influence borrowing in the current period versus the previous one. By contrast, in the absence of commitment, I show that if the elasticity of substitution between tradable and nontradable goods exceeds the inter-temporal elasticity of substitution, then the optimal policy is contractionary, with the government setting public consumption below the Samuelson level.[1]

To understand the intuition behind this result, consider the effects of a fiscal tightening. A decrease in public consumption makes nontradables more abundant, which in equilibrium leads to an increase in private nontradable consumption. Whether this translates into higher or lower borrowing depends on how the increase in nontradable consumption affects the marginal utility of tradable consumption. If the intra-temporal elasticity is higher than the inter-temporal one, an increase in nontradable consumption reduces the marginal utility of tradable consumption and lowers borrowing. Therefore, under this condition on the elasticities, reducing government spending helps mitigate the overborrowing problem, steering private borrowing toward the socially efficient level.

The condition on the intra- and inter-temporal elasticities is closely related to those discussed in Coulibaly (2023) and Bianchi and Coulibaly (2024), both of which study optimal monetary

[1] This finding is consistent with the view that a counter-cyclical fiscal policy can be effective in limiting the build up of leverage and in making the economy less susceptible to a crisis.

policy in economies affected by borrowing inefficiencies. In a model with collateral externalities, Coulibaly (2023) shows that the effectiveness of monetary policy in mitigating overborrowing depends on whether the ratio of the intra- and inter-temporal elasticities is greater than, equal to, or less than one. In a model with aggregate demand externalities, Bianchi and Coulibaly (2024) show that whether monetary policy leans with or against the wind depends on the relative values of the elasticities of substitution.

When the collateral constraint is binding, the optimal policy also deviates from the Samuelson rule. If the government lacks commitment the optimal policy is more expansionary than the frictionless benchmark; higher spending increases the real exchange rate, improves collateral values and boosts private consumption. Under commitment, by contrast, the optimal policy can be higher or lower than the Samuelson level, as the government faces an additional trade-off. While fiscal stimulus is beneficial during a crisis, it unintentionally leads households to increase borrowing ex-ante, making the economy more vulnerable to financial instability. I show that the Ramsey-optimal policy incorporates a forward-looking "Prudential" motive; the government promises to limit fiscal easing when the constraint binds, despite the substantial ex-post benefits of stabilizing the real exchange rate.

To quantify these forces, I calibrate the model to match key moments of the Argentinean economy between 1969 and 2007. I characterize the optimal policy with and without commitment, and compare aggregate dynamics under these alternative policy regimes. Prior to a crisis fiscal policy behaves similarly. The Ramsey government closely tracks the Samuelson level, while the time-inconsistent government only deviates slightly to discourage private borrowing. By contrast, during a crisis, the two models diverge significantly. In the absence of commitment, the government substantially increases spending, with a 14 percentage point increase relative to the ergodic mean when the collateral constraint starts to bind. In contrast, under commitment, fiscal expansions are significantly more limited, with government spending remaining below trend throughout the typical crisis episode. The average deviation from the Samuelson level is positive under both policy regimes, indicating an expansionary policy, but is smaller with commitment than without commitment. In addition, I find that the Ramsey government sometimes reduces spending below the Samuelson benchmark, despite the binding collateral constraint. The quantitative results suggest that the prudential motive is quantitatively important and that the ex-ante borrowing incentives of households may significantly limit the desirability of fiscal stimulus during financial crises, providing a rationale for a more pro-cyclical fiscal policy.

Finally, I discuss whether the availability of capital controls matters for welfare. I show that optimal debt taxes significantly reduce the probability of a crisis. However, resulting welfare gains are smaller than those found in related papers, such as Bianchi (2011) and Ottonello et al. (2022). This is because fiscal stimulus alone significantly mitigates the costs of financial crises, despite its unintended effects on private borrowing incentives.

Relation to the literature. This paper is primarily related to a recent literature, pioneered by Lorenzoni (2008) and Bianchi (2011), studying policy interventions in economies with endogenous collateral constraints.[2] Ottonello (2021) and Coulibaly (2023) extend the workhorse small-open-economy model by introducing nominal rigidities. They show that the optimal monetary policy departs from the traditional stabilization policy to address the borrowing inefficiency. Ottonello (2021) studies optimal exchange-rate policy under commitment, while Coulibaly (2023) characterizes the optimal policy without commitment. Fiscal policy plays a similar role in my model, by providing a way to manipulate the real exchange rate and alter borrowing incentives by households. I show that the Ramsey-optimal policy entails a prudential motive that constrains fiscal expansions during crises episodes. By providing a numerical characterization of the optimal policy with and without commitment, I show that the prudential motive is quantitatively important, providing a novel rationale for adopting a

[2]A related literature, starting from Bianchi and Mendoza (2018), introduces capital and assumes that the collateral is a stock instead of a flow. Devereux et al. (2019) depart from the current-valued collateral of Bianchi and Mendoza (2018), and analyze a model with a borrowing constraint that depends on expected future (resale) prices. Other papers looking at optimal macroprudential policies include Benigno et al. (2013), Benigno et al. (2016) and Benigno et al. (2023), who consider a working capital constraint similar in nature to that in Bianchi (2011). Ottonello et al. (2022) consider a specification in which future prices instead of current ones enter the collateral constraint. They show that in this case the competitive equilibrium is in fact constrained-efficient.

conservative fiscal stance in the presence of financial frictions.[3]

In addition to the literature on borrowing inefficiencies, this paper contributes to research on optimal fiscal policy in small open economies. Much of the existing work has focused on the role of government spending as a stabilization tool in the presence of nominal rigidities. Examples include Galí and Monacelli (2008), Werning (2011), and Farhi and Werning (2016). Bianchi et al. (2023) introduce the possibility of sovereign default in a model with downward wage rigidity. They show that the combination of default risk and limited fiscal capacity may prevent the government from implementing counter-cyclical fiscal policies. In contrast, my paper examines the interaction between government spending and private borrowing in international credit markets. I show that, due to borrowing inefficiencies, a counter-cyclical fiscal policy may backfire, exacerbating the economy's vulnerability to negative shocks.

Finally, this paper speaks to theoretical and empirical work on fiscal multipliers.[4] The closest papers, in this regard, are Liu (2022) and Liu et al. (2024) who introduce fiscal policy in a two-sector open-economy model with stock collateral constraint à la Bianchi and Mendoza (2018). Their model rationalizes the empirical finding that fiscal multipliers increase during sudden stops.[5] In contrast to these papers, I provide a quantitative characterization of the optimal fiscal policy in an infinite-horizon setting both with and without commitment. The quantitative application to Argentina yields the novel result that large fiscal expansions are not optimal, while forward guidance is very effective in mitigating the overborrowing inefficiency. In addition, I show that commitment is critical for the model to reproduce the conditional counter-cyclicality of fiscal policy observed empirically during sudden stops.

[3] The approach I follow in this paper is also similar to Jeanne and Korinek (2020), Bianchi (2016) and Benigno et al. (2016), who provide a joint analysis of ex-ante and ex-post policy interventions in a model of financial crises. In contrast, I consider here a single policy instrument, fiscal policy, and show how this tool helps foster financial stability both ex-ante, in the run-up to a crisis, and ex-post, when a crisis hits the economy. Recently, Bengui and Bianchi (2022) consider a similar setting where the planner is only able to enforce capital controls on a subset of agents. They show that even in the presence of leakages macroprudential policy is desirable and improves welfare.

[4] Empirical studies, which include Nakamura and Steinsson (2014), have estimated a wide set of fiscal multipliers. Other papers focusing on the effect of financial frictions on fiscal multipliers include Fernández-Villaverde (2010), Eggertsson and Krugman (2012) and Carrillo and Poilly (2013)

[5] Woodford (2011) illustrates the stabilization capacity of fiscal policy with nominal rigidities via simple examples for which fiscal multipliers can be analytically characterized. Farhi and Werning (2017) study a different dimension of fiscal policy in the presence of nominal rigidities, focusing on cross-country transfers and the design of fiscal unions.

Layout. The remainder of the paper is organized as follows: Section 2 presents the model and defines the competitive equilibrium. Section 3 characterizes the main trade-offs in the optimal design of fiscal policy with and without commitment. Section 4 considers a quantitative application to Argentina, compares aggregate dynamics under different policy regimes, and discusses welfare gains from commitment and from optimal capital controls.

2 Model

I consider an infinite-horizon, small open economy with two types of goods, tradables and nontradables, and no production. The economy is populated by a unit-continuum of identical, infinitely-lived households, whose preferences are given by

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(c_t) + v(g_t^N)\right] \tag{1}$$

where c_t denotes private consumption, g_t^N nontradable public consumption and $\beta < 1$ the agent's discount factor.

I assume that households have CRRA preferences for private and public consumption with the same elasticity of substitution, i.e.

$$u(c_t) = (1-\theta)\frac{c_t^{1-\sigma}}{1-\sigma} \tag{2}$$

$$v(g_t^N) = \theta \frac{{g_t^N}^{1-\sigma}}{1-\sigma} \tag{3}$$

with $\sigma > 0$ and $\theta \in (0,1)$. The consumption basket is given by a composite of tradable and non-tradable goods according to a standard CES aggregator

$$c_t = A(c_t^T, c_t^N) = \left[a(c_t^T)^{1-\frac{1}{\xi}} + (1-a)(c_t^N)^{1-\frac{1}{\xi}}\right]^{\frac{1}{1-\frac{1}{\xi}}} \tag{4}$$

with $\xi > 0$ and $a \in (0,1)$.[6]

Households receive an exogenous and stochastic endowment stream, $\{y_t^T, y_t^N\}$, and borrow from international creditors through a one-period, non-contingent bond denominated in foreign currency. The budget constraint is given by

$$c_t^T + p_t^N c_t^N + b_t = y_t^T + p_t^N y_t^N + \frac{b_{t+1}}{R} - T_t \tag{5}$$

where b_t denotes the amount of debt that must be repaid at the beginning of period t, b_{t+1} the amount of debt issued at t and due at $t+1$, R the world risk-free interest rate, p_t^N the relative price of the nontradable good, and T_t lump-sum taxes levied by the government.

When issuing debt, households face a collateral constraint that limits the maximum amount of borrowing to a fraction κ of the value of current income:[7]

$$\frac{b_{t+1}}{R} \leq \kappa(y_t^T + p_t^N y_t^N) \tag{6}$$

Households take public consumption and the relative price as given and choose private consumption and next-period borrowing to solve

$$\max_{c_t^T, c_t^N, b_{t+1}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u\left(A\left(c_t^T, c_t^N\right)\right) + v\left(g_t^N\right)\right] \tag{7}$$

s.t.

$$c_t^T + p_t^N c_t^N + b_t = y_t^T + p_t^N y_t^N + \frac{b_{t+1}}{R} - T_t$$
$$\frac{b_{t+1}}{R} \leq \kappa(y_t^T + p_t^N y_t^N)$$

To close the model, I assume that the government provides public consumption, g_t^N, in units

[6] The assumptions on the utility functions and on the consumption aggregator simplify the analysis. However, similar results hold as long as u and v are differentiable, increasing and concave functions and the aggregator A is a differentiable function, increasing in both arguments, and homogeneous of degree one.

[7] Ottonello et al. (2022) have shown that the specific form of collateral used in debt contracts matters for policy. Here I focus on a formulation where the value of collateral depends on the current price of nontradables. This type of borrowing constraint has been used frequently in the literature to rationalize patterns of emerging-markets business cycles (see Mendoza (2002), Mendoza (2010) and Bianchi and Mendoza (2020)).

of nontradable goods, using the proceeds from lump-sum taxes, T_t, to maintain a balanced budget:

$$p_t^N g_t^N = T_t \tag{8}$$

2.1 Equilibrium

Let $\mu_t \geq 0$ denote the Lagrange multipliers associated to the collateral constraint. The first-order conditions of the household's problem are given by

$$u_T(c_t^T, c_t^N) = \beta R \mathbb{E} u_T(c_{t+1}^T, c_{t+1}^N) + \mu_t \tag{9}$$

$$p_t^N = \mathcal{P}(c_t^T, c_t^N) \equiv \frac{A_N(c_t^T, c_t^N)}{A_T(c_t^T, c_t^N)} \tag{10}$$

along with the complementary slackness condition

$$\mu_t \left[\kappa(y_t^T + p_t^N y_t^N) - \frac{b_{t+1}}{R_t} \right] = 0 \tag{11}$$

where $u_X(c_t^T, c_t^N) \equiv \frac{\partial u\left(A\left(c_t^T, c_t^N\right)\right)}{\partial c_t^X}$ and $A_X(c_t^T, c_t^N) \equiv \frac{\partial A\left(c_t^T, c_t^N\right)}{\partial c_t^X}$ for $X \in \{T, N\}$.

An equilibrium of this economy is defined as follows:

Definition 1. *Given a sequence of exogenous process* $\{y_t^T, y_t^N\}_{t=0}^{\infty}$*, a sequence of public consumption* $\{g_t^N\}_{t=0}^{\infty}$ *and initial debt* b_0*, a competitive equilibrium consists of allocations and prices* $\{c_t^T, c_t^N, c_t, b_{t+1}, \mu_t, p_t^N\}_{t=0}^{\infty}$ *such that*

1. *allocations solve the household's problem given prices, and*

2. *the market for nontradable goods clears*

$$c_t^N + g_t^N = y_t^N \tag{12}$$

Combing the market clearing condition with the household's budget constraint we obtain

$$c_t^T = y_t^T + \frac{b_{t+1}}{R_t} - b_t \tag{13}$$

Hence, given $\{y_t^T, y_t^N, g_t^N\}_{t=0}^{\infty}$ and initial condition b_0, a competitive equilibrium is characterized by equations (6), (9), (10), (11) and (13).

When the collateral constraint binds, tradable consumption is the solution to the following equation

$$c_t^T = y_t^T + \kappa \left(y_t^T + \mathcal{P}(c_t^T, y_t^N - g_t^N) y_t^N \right) - b_t \tag{14}$$

which implicitly defines tradable consumption as a function $\overline{\mathcal{C}_t^T}(b_t, g_t^N)$ of debt and public consumption. Assuming that the slope of the borrowing limit is less than one, i.e. $\frac{\partial \kappa \left(y_t^T + \mathcal{P}(c_t^T, y_t^N - g_t^N) y_t^N \right)}{\partial c_t^T}$ $= \kappa \mathcal{P}_T(c_t^T, y_t^N - g_t^N) y_t^N < 1$ such function is increasing in g_t^N

$$\frac{\partial \overline{\mathcal{C}_t^T}(b_t, g_t^N)}{\partial g_t^N} = \frac{\kappa \mathcal{P}_N(\overline{\mathcal{C}_t^T}(b_t, g_t^N), y_t^N - g_t^N) y_t^N}{1 - \kappa \mathcal{P}_T(\overline{\mathcal{C}_t^T}(b_t, g_t^N), y_t^N - g_t^N) y_t^N} > 0 \tag{15}$$

where $\mathcal{P}_X(c_t^T, c_t^N) \equiv \frac{\partial \mathcal{P}\left(c_t^T, c_t^N\right)}{\partial c_t^X}$ for $X \in \{T, N\}$.

This inequality shows that a fiscal expansion boosts tradable consumption when households are at the borrowing limit. Intuitively, an increase in public consumption raises the relative price of nontradables, relaxing the collateral constraint and allowing households to borrow and consume more. Because the value of collateral depends on the relative price of nontradables there is a standard pecuniary externality. Private agents do not internalize that a larger debt burden depresses the value of income, and hence borrow more than the socially optimal level.

Before moving to the optimal policy analysis, it is worth clarifying that in this economy, fiscal multipliers, defined as the increase in total consumption due to a marginal increase in government spending, can be either positive or negative. While an increase in g_t^N always reduces private non-tradable consumption one-to-one, its effect on total consumption depends on whether the increase in public spending crowds out or crowds in private tradable consumption. As we will see in the next section, this hinges on the relative values of the inter-temporal and intra-temporal elasticities and, when the collateral constraint is binding, also on the effect of g_t^N on collateral values. Nevertheless, while the fiscal multiplier can be positive or negative, it is in any case below one under standard calibrations.

3 Fiscal Policy Design

Having characterized the competitive equilibrium, I now study the optimal design of fiscal policy, under different assumptions on the government's ability to commit to its promised policies. I adopt the perspective of a benevolent planner that maximizes households' lifetime utility, subject to implementability constraints.

3.1 The Samuelson Benchmark

As a benchmark, I consider the optimal policy in the absence of collateral constraints, which aligns with the classic Samuelson principle. According to this principle, it is optimal to equalize the marginal utilities of public and private nontradable consumption. Following Bianchi et al. (2023), I refer to the level of public consumption that achieves this equality as the Samuelson level:

Definition 2. *Given tradable consumption, c_t^T, and nontradable income, y_t^N, define the associated Samuelson level, denoted by $g^*(c_t^T, y_t^N)$, as the level of government spending that equalizes the marginal utilities of public and private nontradable consumption, i.e.*

$$v_N(g^*(c_t^T, y_t^N)) = u_N(c_t^T, y_t^N - g^*(c_t^T, y_t^N)) \tag{16}$$

When public consumption exceeds the Samuelson level, I consider fiscal policy to be expansionary. Conversely, when public consumption falls below the Samuelson level, I consider fiscal policy to be contractionary. Next, I will study whether the presence of collateral constraints gives the government incentives to deviate from the Samuelson benchmark and whether the resulting optimal policy is expansionary or contractionary.

3.2 Optimal Policy with Commitment

First, I study the optimal allocation when the government has commitment. The Ramsey-optimal policy is defined as follows:

Definition 3. *The optimal fiscal policy with commitment is the process* $\{g_t(s^t)\}_{t=0}^{\infty}$ *that maximizes the household's lifetime utility (1) subject to the implementability conditions given by (6), (9), (10), (11) and (13).*

The problem of the government is to choose state-contingent sequences for tradable consumption, public consumption and next-period borrowing, and a state-contingent sequence of non-negative multipliers, $\{\mu_t(s^t)\}$, to solve the following optimization problem

$$\max_{\left\{c_t^T(s^t), g_t^N(s^t), b_{t+1}(s^t), \mu_t(s^t)\right\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(A(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))) + v(g_t^N(s^t))\right] \tag{CO}$$

s.t.

$$c_t^T(s^t) = y_t^T(s^t) + \frac{b_{t+1}(s^t)}{R} - b_t(s^{t-1}) \qquad \lambda_t(s^t)$$

$$\frac{b_{t+1}(s^t)}{R} \leq \kappa(y_t^T(s^t) + \mathcal{P}(s^t) y_t^N(s^t)) \qquad \mu_t^{\text{sp}}(s^t)$$

$$\mathcal{P}(s^t) = \frac{A_N(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))}{A_T(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))} \qquad \eta_t(s^t)$$

$$u_T(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t)) - \beta R \mathbb{E}_t[u_T(c_{t+1}^T(s^{t+1}), y_{t+1}^N(s^{t+1}) - g_{t+1}^N(s^{t+1}))] = \mu_t(s^t) \qquad \phi_t(s^t)$$

$$\mu_t(s^t) \geq 0 \qquad \delta_t(s^t)$$

$$\mu_t(s^t)\left[\kappa(y_t^T(s^t) + \mathcal{P}(s^t) y_t^N(s^t)) - \frac{b_{t+1}(s^t)}{R}\right] = 0 \qquad \zeta_t(s^t)$$

given an initial condition b_0.

The set of constraints includes, in order: the resource constraint, the collateral constraint, the expression for the relative price, the household's Euler equation, the non-negativity condition for the household's multiplier on the collateral constraint and the complementary slackness condition.

After some manipulation, the first-order conditions with respect to $c_t^T(s^t)$, $g_t^N(s^t)$, $b_{t+1}(s^t)$

and $\mu_t(s^t)$ are given by

$$u_T(s^t) - \lambda_t(s^t) + \phi_t(s^t)u_{TT}(s^t) - \phi_{t-1}(s^{t-1})\beta R\pi(s^t|s^{t-1})u_{TT}(s^t) \\ + \kappa\left[\mu_t^{\text{sp}}(s^t) + \mu_t(s^t)\zeta_t(s^t)\right] y_t^N(s^t)\mathcal{P}_T(s^t) = 0 \quad (17)$$

$$- u_N(s^t) + v_N(s^t) - \phi_t(s^t)u_{TN,t}(s^t) + \phi_{t-1}(s^{t-1})\beta R\pi(s^t|s^{t-1})u_{TN}(s^t) \\ - \kappa\left[\mu_t^{\text{sp}}(s^t) + \mu_t(s^t)\zeta_t(s^t)\right] y_t^N(s^t)\mathcal{P}_N(s^t) = 0 \quad (18)$$

$$\lambda_t(s^t) - \beta R\mathbb{E}_t\lambda_{t+1}(s^{t+1}) - \left[\mu_t^{\text{sp}}(s^t) + \mu_t(s^t)\zeta_t(s^t)\right] = 0 \quad (19)$$

$$-\phi_t(s^t) + \zeta_t(s^t)\left[\kappa\left(y_t^T(s^t) + \mathcal{P}(s^t)y_t^N(s^t)\right) - \frac{b_{t+1}(s^t)}{R}\right] + \delta_t = 0 \quad (20)$$

where

$$\begin{aligned} u_X(s^t) &\equiv \frac{\partial u\left(A\left(c_t^T, c_t^N\right)\right)}{\partial c_t^X}, && \text{for } X \in \{T, N\}; \\ u_{XY}(s^t) &\equiv \frac{\partial^2 u\left(A\left(c_t^T, c_t^N\right)\right)}{\partial c_t^X \partial c_t^Y}, && \text{for } X, Y \in \{T, N\}; \\ \mathcal{P}_X(s^t) &\equiv \frac{\partial \mathcal{P}\left(c_t^T, c_t^N\right)}{\partial c_t^X}, && \text{for } X \in \{T, N\}. \end{aligned}$$

Slack collateral constraint. To gain some insight, consider first the case where the collateral constraint is not binding under the Ramsey-optimal policy, i.e. $\mu_t^{\text{sp}}(s^t) = \mu_t(s^t) = 0$. In this case, the first-order condition with respect to $g_t^N(s^t)$ becomes

$$\underbrace{-u_N(s^t) + v_N(s^t)}_{\text{Samuelson}} \underbrace{- \left[\phi_t(s^t) - \phi_{t-1}(s^{t-1})\beta R\pi(s^t|s^{t-1})\right] u_{TN}(s^t)}_{\text{Prudential}} = 0 \quad (21)$$

This expression consists of two terms. The "Samuelson" term is simply the difference between the marginal utilities of public and private nontradable consumption. While these marginal values are equalized at the Samuelson level in a frictionless setting, this is not necessarily the case in the presence of collateral constraints.

The other term is linked to the multipliers, $\phi_t(s^t)$ and $\phi_{t-1}(s^{t-1})$, associated with the household's Euler equation. Because of the borrowing inefficiency, these multipliers can be non-zero. Households do not internalize that higher borrowing depresses collateral values during crisis periods, leading to a situation where the social cost of borrowing is higher than the private one. To see this, suppose that the household's Euler equation was never a binding constraint, i.e. $\phi_t(s^t) = 0$ for all t. Then, the government's optimality condition for next-period debt would be: $u_T(s^t) - \beta R\mathbb{E}_t[u_T(s^{t+1})] = \beta R\mathbb{E}_t\mu^{\text{sp}}_{t+1}(s^{t+1})\kappa\mathcal{P}_T(s^{t+1})y^N_{t+1}(s^{t+1})$. If the collateral constraint binds with positive probability at time $t+1$, this condition is incompatible with the household's Euler equation, violating one of the constraints in the planner's problem. Intuitively, the Euler equation restricts the set of implementable allocations to those where the marginal benefit of borrowing matches its private cost, $\beta R\mathbb{E}_t[u_T(s^{t+1})]$, rather than its social cost, $\beta R\mathbb{E}_t[u_T(s^{t+1})] + \beta R\mathbb{E}_t\mu^{\text{sp}}_{t+1}(s^{t+1})\kappa\mathcal{P}_T(s^{t+1})y^N_{t+1}(s^{t+1})$.

If the "Prudential" term is non-zero, it is optimal for the government to deviate from the Samuelson level. These deviations help steer private borrowing closer to the socially efficient level without violating the household's optimality conditions. To understand this term more precisely, note that by adjusting $g^N_t(s^t)$, the government changes the marginal utility of time-t tradable consumption, $u_T(c^T_t(s^t), y^N_t(s^t) - g^N_t(s^t))$. Importantly, this change affects the household's borrowing decision not only at time t, but also at time $t-1$, and in opposite directions. Specifically, a decrease in $u_T(c^T_t(s^t), y^N_t(s^t) - g^N_t(s^t))$ reduces the choice of $b_{t+1}(s^t)$ in the current period, but increases the choice of $b_t(s^{t-1})$ made in the previous period. Under commitment, the government internalizes both effects. This is why the "Prudential" term ultimately depends on the relative magnitudes of $\phi_t(s^t)$ and $\phi_{t-1}(s^{t-1})$; $\phi_t(s^t)$ captures the government's incentive to influence the time-t borrowing decision, while $\phi_{t-1}(s^{t-1})$ reflects the commitment made in the previous period, which in turn captures the incentive to influence the time-$(t-1)$ borrowing decision.

Formally, equation (21) shows that the sign of the "Prudential" term depends on those of $u_{TN}(s^t)$ and $[\phi_t(s^t) - \phi_{t-1}(s^{t-1})\beta R\pi(s^t|s^{t-1})]$. The cross-derivative, $u_{TN}(s^t)$, captures the effect of government spending on the marginal utility of tradable consumption and, consequently, on the household's incentives to borrow. Given the CRRA and CES functional forms, the sign of the cross-derivative depends on the relative magnitudes of the elasticity parameters, σ and ξ:

If $\sigma\xi < 1$, $\quad u_{TN}(s^t) > 0 \Rightarrow$ increasing $g_t^N(s^t)$ leads to lower borrowing;

If $\sigma\xi > 1$, $\quad u_{TN}(s^t) < 0 \Rightarrow$ increasing $g_t^N(s^t)$ leads to higher borrowing;

If $\sigma\xi = 1$, $\quad u_{TN}(s^t) = 0 \Rightarrow$ borrowing is independent of $g_t^N(s^t)$.

To understand the intuition behind this condition on the elasticity parameters, consider the effects of a fiscal tightening. Lower public consumption makes nontradables more abundant, which in equilibrium leads to an increase in private nontradable consumption. Whether this translates into higher or lower borrowing depends on how the increase in nontradable consumption affects the marginal utility of tradable consumption. If $\sigma\xi > 1$, higher nontradable consumption reduces the marginal utility of tradable consumption, leading to lower borrowing. If $\sigma\xi < 1$, higher nontradable consumption raises the marginal utility of tradable consumption, leading to higher borrowing. Finally, if $\sigma\xi = 1$, the marginal utility of tradable consumption is independent of the level of nontradable consumption. In this case, the "Prudential" term in Equation 21 drops out, implying that optimal public consumption coincides with the Samuelson level.[8]

While $u_{NT}(s^t)$ captures the effect of $g_t^N(s^t)$ on borrowing, the multiplier $\phi_t(s^t)$ reflects whether households are engaging in overborrowing or underborrowing relative to the efficient allocation. As shown in Equation (20), $\phi_t(s^t)$ is related to the multiplier, $\zeta_t(s^t)$, associated with the complementary slackness condition and to the multiplier, $\delta_t(s^t)$, associated with the non-negativity condition for $\mu_t(s^t)$. Suppose the government could choose private borrowing freely, without being constrained by the households' optimality conditions. If $u_T(s^t) - \beta R \mathbb{E}_t[u_T(s^{t+1})] > 0$ the government would prefer households to borrow less than their privately optimal level. In the constrained problem, this corresponds to a situation where $\delta_t(s^t) = 0$ and $\zeta_t(s^t) < 0$, implying that $\phi_t(s^t) < 0$. Conversely, if $u_T(s^t) - \beta R \mathbb{E}_t[u_T(s^{t+1})] < 0$,

[8] Guerrieri et al. (2022) provide the same conditions on the elasticities for the existence of a "Keynesian supply shock" in a two-sector economy, i.e. a negative shock to one sector of the economy that drives down demand also in the other sector and hence depresses aggregate output.

the government would prefer households to borrow more their privately optimal level. This corresponds to a scenario where $\delta_t(s^t) \geq 0$ and $\zeta_t(s^t) \geq 0$ with at least one strict inequality, implying that $\phi_t(s^t) > 0$.

Due to previous commitments, unless $\sigma\phi = 1$, it is challenging to determine whether the optimal level of spending should be above or below the Samuelson benchmark. This is due to the fact that $[\phi_t(s^t) - \phi_{t-1}(s^{t-1})\beta R\pi(s^t|s^{t-1})]$ in equation 21 can be positive or negative, so that households can underborrow or overborrow relative to the government. Whether the optimal policy is expansionary or contractionary is therefore a quantitative question.

Binding collateral constraint. Assume now that the collateral constraint is binding, i.e. $\mu_t^{\text{sp}}(s^t) > 0$ and $\mu_t(s^t) > 0$. In this case, the non-negativity condition for the multiplier $\mu_t(s^t)$ and the complementary slackness are no longer binding in the government's optimization problem. As a result, $\phi_t(s^t) = 0$. This allows me to derive the following expression, highlighting the key trade-offs in fiscal policy when the collateral constraint is binding:

$$\begin{aligned}\underbrace{-u_N(s^t) + v_N(s^t)}_{\text{Samuelson}} & \underbrace{- \left[u_T(s^t) - \beta R \mathbb{E}_t \lambda_{t+1}(s^{t+1})\right] \frac{\kappa \mathcal{P}_N(s^t) y_t^N(s^t)}{1 - \kappa \mathcal{P}_T(s^t) y_t^N(s^t)}}_{\text{Collateral}} \\ & \underbrace{- \phi_{t-1}(s^{t-1}) \beta R \pi(s^t|s^{t-1}) \left[u_{TN}(s^t) - u_{TT}(s^t) \frac{\kappa \mathcal{P}_N(s^t) y_t^N(s^t)}{1 - \kappa \mathcal{P}_T(s^t) y_t^N(s^t)}\right]}_{\text{Prudential}} = 0 \quad (22)\end{aligned}$$

This equation includes the familiar "Samuelson" term, along with two additional components. The "Collateral" term, which is negative, pushes public consumption above the Samuelson level. This term reflects the added benefit of fiscal stimulus when the collateral constraint is binding: higher public spending raises the relative price of non-tradables, increasing collateral values and expanding the economy's borrowing capacity.[9]

The "Prudential" term captures the commitment made in the previous period to influence the borrowing behavior of households. It reflects the government's ability to affect debt levels

[9]This effect is also highlighted in Liu (2022) and Liu et al. (2024), who show that government spending can help relax collateral constraints when the borrowing limit depends on the value of income, as in this paper, or on the value of capital as in Bianchi and Mendoza (2018). They show that the relaxation of debt constraints generates state-dependent fiscal multipliers, consistent with empirical evidence.

at time $t-1$ by altering consumption at time t. Unlike in equation 21, where it only depends on the cross-derivative, this term now includes an additional component. The intuition is as follows: when the collateral constraint is slack, the government can only indirectly influence the level of tradable consumption by altering its marginal utility. In contrast, when the collateral constraint is binding, the government gains an additional lever: by manipulating the value of collateral, it can directly affect tradable consumption, either tightening or loosening the borrowing constraint.

Equation 22 captures the key trade-off faced by the government during a financial crisis. While a significant fiscal expansion can improve consumption prospects by stabilizing the real exchange rate, it also unintentionally encourages households to increase borrowing before the crisis. This incentive for households to borrow more ex-ante provides the government with a reason to limit fiscal stimulus when the collateral constraint is binding. By offering households less favorable consumption prospects, a more conservative fiscal policy discourages excessive borrowing, even though it may depress collateral values and exacerbate the severity of the crisis ex-post.

Since the "Collateral" and "Prudential" terms may have opposite signs, the optimal deviation from the Samuelson' level cannot be signed analytically. Intuitively, government expenditures exceed the Samuelson' level only if the benefit of sustaining collateral values ex-post is larger than the cost of inducing inefficient private borrowing ex-ante.

Optimal policy in the initial period. It is worth emphasizing that in the initial period there are no initial commitments. If the constraint is slack in period 0, then the first-order condition with respect to $g_0^N(s^0)$ simplifies to: $-u_N(s^0) + v_N(s^0) - \phi_0(s^0)u_{TN}(s^0) = 0$. While it is analytically difficult to prove, it can be verified numerically that $\phi_0(s^0) > 0$, indicating that households overborrow relative to the social planner. This implies that if the collateral constraint is slack in the initial period but expected to bind in the future, and if $\sigma\xi > 1$, then the government prudentially sets public consumption below the Samuelson level. In contrast, when the constraint binds for the planner in period 0, only the "Collateral" effect remains in Equation 22. In this case, optimal public consumption exceeds the Samuelson level, as the planner internalizes that increasing spending relaxes the binding borrowing constraint.

3.3 Optimal Policy without Commitment

Since the Euler equation is a forward-looking constraint, the Ramsey-optimal plan is time-inconsistent. In this section I consider an alternative policy regime where the government chooses allocations sequentially and without commitment, taking future policies as given.

I focus on the notion of Markov Perfect Equilibrium and set up the government problem recursively. The aggregate state is given by $\mathbf{S} = (b, \mathbf{y})$, where $\mathbf{y} = \{y^T, y^N\}$. Let $\mathcal{C}^T(b, \mathbf{y})$ and $\mathcal{G}^N(b, \mathbf{y})$ denote the decision rules for tradable consumption and public consumption that are taken as given by the current government. Then, I can write the planner's optimization problem as follows

$$V(b, \mathbf{y}) = \max_{c^T, b', g^N, \mu} u(A(c^T, y^N - g^N)) + v(g^N) + \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} V(b', \mathbf{y}') \tag{NC}$$

s.t.

$$\begin{aligned}
c^T &= y^T + \frac{b'}{R} - b && \lambda \\
\frac{b'}{R} &\leq \kappa \left(y^T + \mathcal{P}(c^T, y^N - g^N) y^N \right) && \mu^{\mathrm{sp}} \\
\mathcal{P}(c^T, y^N - g^N) &= \frac{A_N(c_t^T, y_t^N - g_t^N)}{A_T(c_t^T, y_t^N - g_t^N)} && \eta \\
u_T(c^T, y^N - g^N) - \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \big[\beta R u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \big] &= \mu && \phi \\
\mu &\geq 0 && \delta \\
\mu \left[\kappa (y^T + \mathcal{P}(c^T, y^N - g^N) y^N) - \frac{b'}{R} \right] &= 0 && \zeta
\end{aligned}$$

Similarly to the problem under commitment, the set of constraints includes, in order: the resource constraint, the collateral constraint, the expression for the relative price on nontradables, the household's Euler equation, the non-negativity condition for the household's multiplier, and the associated complementary slackness condition.

The Markov-Perfect Equilibrium is then defined as follows

Definition 4. *A Markov-Perfect Equilibrium consists of a value function, $V(b,\boldsymbol{y})$, policy functions $\{b'(b,\boldsymbol{y}), g^N(b,\boldsymbol{y}), c^T(b,\boldsymbol{y}), \mu(b,\boldsymbol{y})\}$ and conjectured future policy rules $\{\mathcal{C}^T(b,\boldsymbol{y}),$ $\mathcal{G}^N(b,\boldsymbol{y})\}$ such that*

1. *Given the conjectured rules, the value function and the associated policy functions solve the Bellman equation defined in problem (NC).*

2. *The conjectured future policy rules are consistent with the current planner's policies.*

$$\mathcal{C}^T(b,\boldsymbol{y}) = c^T(b,\boldsymbol{y})$$
$$\mathcal{G}^N(b,\boldsymbol{y}) = g^N(b,\boldsymbol{y})$$

The first-order conditions of problem (NC) with respect to c^T, g^N and b' are respectively given by

$$-u_N + v' - [\mu^{\text{sp}} + \zeta\mu]\,\kappa\mathcal{P}_N y^N - \phi u_{TN} = 0 \tag{23}$$
$$u_T - \lambda + \phi u_{TT} + [\mu^{\text{sp}} + \zeta\mu]\,\kappa\mathcal{P}_T y^N = 0 \tag{24}$$
$$\frac{\lambda}{R} - \beta\mathbb{E}_{\mathbf{y}'|\mathbf{y}}\lambda' - \frac{[\mu^{\text{sp}} + \zeta\mu]}{R} - \phi\frac{\beta R\partial\mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[u_T(\mathcal{C}^T(b',\mathbf{y}'), y^N - \mathcal{G}^N(b',\mathbf{y}'))\right]}{\partial b'} = 0 \tag{25}$$

Using these equations, in Appendix A I establish the following result:

Proposition 1. *In a Markov Perfect Equilibrium*

1. *if the collateral constraint is binding in state $(b,\boldsymbol{y})$, i.e. $\mu^{sp}(b,\boldsymbol{y}) > 0$, then the government sets public consumption, $g^N(b,\boldsymbol{y})$, above the Samuelson level.*

2. *if the collateral constraint is not binding in state $(b,\boldsymbol{y})$, i.e. $\mu^{sp}(b,\boldsymbol{y}) = 0$, but binds with positive probability in following periods, then*

   (a) *if $\mu(b,\boldsymbol{y}) = 0$ the government sets public consumption, $g^N(b,\boldsymbol{y})$, below (above) the Samuelson level if and only if $\sigma\xi > 1$ (< 1). If $\sigma\xi = 1$, the government sets spending at Samuelson level.*

(b) *if* $\mu(b, \boldsymbol{y}) > 0$ *the government sets public consumption,* $g^N(b, \boldsymbol{y})$*, below the Samuelson level*

Part 1. of the proposition states that public consumption always exceeds the Samuelson benchmark when the collateral constraint is binding. Lacking commitment, the government fails to recognize that fiscal expansions exacerbate overborrowing from an ex-ante perspective, and consequently finds it optimal to increase spending.

Part 2.(a) focus on the case where the collateral constraint is slack, for both the government and the households, but is likely to bind in future periods. In this scenario, fiscal policy takes up a prudential role, aiming to reduce private borrowing toward the efficient level. Whether government consumption is above or below the Samuelson level depends on the relative magnitude of the elasticity parameters; the optimal policy is contractionary if $\sigma\xi > 1$, expansionary if $\sigma\xi < 1$ and exactly at the Samuelson level if $\sigma\xi = 1$.

As explained in the previous section, if $\sigma\xi > 1$, higher nontradable consumption reduces the marginal utility of tradable consumption, which lowers borrowing. In this case, the government optimally sets g^N below the Samuelson level to mitigate overborrowing. By contrast, if $\sigma\xi < 1$, higher nontradable consumption raises the marginal utility of tradable consumption, which increases borrowing. In this case, the government sets g^N above the Samuelson level. When $\sigma\xi = 1$, the marginal utility of tradables is independent of nontradable consumption, and optimal public spending coincides with the Samuelson benchmark.

Finally, Part 2.(b) considers the case where the collateral constraint is slack for the government, that is $\mu^{\text{sp}}(b, \mathbf{y}) = 0$, but binding for the households, that is $\mu(b, \mathbf{y}) > 0$. This corresponds to a situation where the planner's Lagrange multiplier $\mu^{\text{sp}}(b, \mathbf{y})$ is zero, even though the borrowing constraint holds with equality. In this scenario, optimal public consumption lies below the Samuelson benchmark. Fiscal policy again takes up a prudential role, with the government further tightening the collateral constraint to steer private debt closer to the efficient benchmark.[10]

4 Quantitative Analysis

In this section, I conduct a quantitative application of the model to the Argentinean economy. Section 4.1 illustrates the calibration strategy. Section 4.3 describes crisis dynamics under the optimal fiscal policy with and without commitment. Section 4.4 introduces capital controls. Finally, Section 4.5 evaluates welfare gains across policy regimes.

4.1 Calibration

I calibrate the model at an annual frequency to match key moments in Argentinean data from 1965 to 2007. The calibration assumes that the government has commitment and is chosen so that under the Ramsey-optimal policy the model-implied moments closely align with their empirical counterparts.[11] The model parameters are divided into three subsets. The first subset is kept fixed according to the values reported in Table 1, which directly follow Bianchi (2011). The risk aversion coefficient is set to $\sigma = 2$, the world interest rate to $R = 4\%$ and the intra-temporal elasticity of substitution to $\xi = 0.83$.

The second subset consists of those parameters that govern the law of motion of the exogenous state. Following the literature, I model endowment shocks as a first-order bivariate autoregressive process: $\log y_t = \rho \log y_{t-1} + \epsilon_t$ where $y = [y^T y^N]'$, $\rho = \begin{bmatrix} \rho_T & \rho_{TN} \\ \rho_{NT} & \rho_N \end{bmatrix}$ is a 2x2 matrix of autocorrelation coefficients, and $\epsilon_t = [\epsilon_t^T \epsilon_t^N]'$ follows a bivariate normal distribution with zero mean and contemporaneous variance-covariance matrix $V = \begin{bmatrix} \sigma_T^2 & \sigma_{TN} \\ \sigma_{TN} & \sigma_N^2 \end{bmatrix}$. The estimates

[10] This scenario can also arise under the Ramsey-optimal policy. In both policy regimes - with and without commitment - there may be states where households are financially constrained, even though the socially optimal level of debt is below their borrowing limit. In such cases, fiscal policy acts as a quantity-based macroprudential intervention, where the government optimally tightens the collateral constraint to enforce a lower level of borrowing. Conversely, when households are not financially constrained, fiscal policy functions more like a price-based macroprudential tool, reducing borrowing by adjusting the relative price of current versus future consumption.

[11] The results remain largely unchanged if I consider separate calibrations for economies with and without commitment.

Table 1: Calibration

Parameter	Description	Value	Source/Target
(a) Fixed Parameters			
R	Interest rate	1.04	Standard value DSGE-SOE
σ	Coefficient of risk aversion	2	Standard value DSGE-SOE
ξ	Intratemporal elasticity of subst.	0.83	Bianchi (2011)
(b) Calibrated Parameters			
β	Discount rate	0.94	Average NFA/GDP
a	Weight on tradables in CES	0.35	Share of tradable output
θ	Weight of govt. good in utility	0.02	Average govt. spending/GDP
κ	Credit regime	0.33	Frequency of crisis

Notes : This table reports values for two subsets of parameters. The upper part shows the parameters that are kept fixed, while the lower part reports the parameters that are calibrated to match key moments of Argentinean data.

Table 2: Endowment process

Parameter	Description	Value
σ_{T}	Standard deviation shocks to tradable endowment	0.216
σ_{N}	Standard deviation shocks to non-tradable endowment	0.203
σ_{TN}	Covariance shocks to tradable and nontradable endowment	0.842
ρ_{T}	Autocorrelation of tradable endowment	0.901
ρ_{N}	Autocorrelation of non-tradable endowment	0.225
ρ_{TN}	Cross-correlation of tradable endowment	−0.453
ρ_{NT}	Cross-correlation of non-tradable endowment	0.495

Notes : This table shows the estimated values for the parameters that characterize the exogenous endowment process.

for ρ and V, obtained from data on sectoral value added, are reported in Table 2.

The remaining subset of parameters is chosen to match relevant moments of the Argentinean economy. The empirical targets, together with their model counterparts, are reported in Table 3. The first moment is the share of tradable output in GDP (32% in Argentinean data), which identifies the preference parameter in the CES aggregator, a. The next empirical target is the average ratio of government expenditures to GDP (11% in Argentinean data), which is used to calibrate the weight of public consumption in the household's utility function, θ.

The last two moments, which are mostly governed by κ and β, are the average net foreign asset (NFA) position (-29% in Argentinean data) and the frequency of financial crisis (5.5%, as in Bianchi (2011)). Following Bianchi (2011), I define a crisis as the first period in which the collateral constraint becomes binding and the current account increases by more than one standard deviation.

Table 3 shows that the calibrated economy, both with and without commitment, closely approximates the empirical targets.[12] The fact that financial crises occur more frequently under the Ramsey-optimal policy than under the optimal time-consistent one may appear puzzling at first. However, it is important to note that the probability of the collateral constraint being binding is higher in the time-consistent equilibrium. These results arise because, without commitment, the government increases spending significantly when the constraint binds. This, in turn, reduces the likelihood that such episodes are accompanied by an increase in the current account large enough to meet the crisis criterion, defined as a change exceeding one standard deviation. The model also performs well in terms of untargeted moments, as presented in Table 4. The predictions for the volatility of consumption and government spending are in line with the data. Moreover, the model captures the countercyclical nature of the trade balance and current account, a key feature of emerging-market business cycles.

Notably, the model generates procyclical government spending consistent with the Argentinean data. This result is closely tied to the calibration, where the intratemporal elasticity of substitution, ξ, exceeds the intertemporal elasticity, $1/\sigma$. A high degree of substitutability between sectors implies that the consumption of nontradables becomes particularly valuable to households during economic downturns, when the tradable endowment is scarce. Consequently, in response to a negative shock, the government typically finds it optimal to reduce public spending, making nontradables more available for private consumption. While this procyclicality holds unconditionally in both models - with and without commitment - I will next show that the behavior of fiscal policy differs significantly when conditioned on a financial crisis episode.

[12]To compute the Ramsey-optimal allocation, I use the method of Marcet and Marimon (2019) as detailed in Appendix B.1. The values of calibrated parameters are reported in Table 1.

Table 3: Targeted Moments

Moment	Description	Data	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent
$\mathbb{E}[y_T/y]$	Share of tradable output	0.32	0.31	0.31
$\mathbb{E}[p_N g/y]$	Average govt. spending/output	0.12	0.12	0.12
$\mathbb{E}[b/y]$	Average NFA/output	-0.29	-0.30	-0.30
	Frequency of crisis	0.06	0.07	0.04
	Prob($\mu > 0$)		0.18	0.27

Notes : The table reports the model-implied counterparts of four targeted moments, along with the probability of the constraint being binding, under both the Ramsey-optimal policy and the optimal time-consistent policy. The set of targeted moments includes the average net financial asset position, the share of tradable output, the government-spending-to-GDP ratio and the frequency of crisis as defined in the main text.

Table 4: Untargeted Moments

Moment	Data	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent
Standard Deviations			
$\sigma(c)/\sigma(GDP)$	1.11	1.04	1.09
$\sigma(p_N g)/\sigma(y)$	1.06	1.09	1.02
$\sigma(RER)$	8.20	4.04	2.70
Correlations with GDP			
$\text{corr}(c, GDP)$	0.88	0.98	0.98
$\text{corr}(g, GDP)$	0.37	0.88	0.40
$\text{corr}(RER, y)$	0.41	0.31	0.30
$\text{corr}(\text{current account}, y)$	-0.63	-0.19	-0.03
$\text{corr}(\text{trade balance}, y)$	-0.84	-0.33	-0.28

Notes : This table shows the model counterparts for a set of untargeted moments. It reports the values implied by the model under the Ramsey-optimal policy and those implied under the optimal time-consistent policy. In the table, y denotes output at current prices while GDP denotes output at constant prices. The real exchange rate (RER) is defined as the inverse of the relative price of nontradables

4.2 Policy Functions

Figure 1 compares the policy functions for public consumption and next-period debt under the Ramsey-optimal policy (solid blue line) and the optimal time-consistent policy (dashed red line). Both panels also show the level of public spending and next-period debt consistent with the Samuelson rule (dotted green line).[13] The optimal policy under commitment is shown for a strictly positive value of the Lagrange multiplier, ϕ, associated with the Euler equation, which is a state variable in the planner's problem. I do not display the policy functions in the absence of prior commitments, i.e. evaluated at $\phi = 0$, because they are numerically very close to the optimal time-consistent ones. It is important to note that all policy functions exhibit discontinuities. To gain some intuition for this, notice that the government chooses between two strategies to address the borrowing inefficiencies. First, it can reduce borrowing below the Samuelson level but keep it high enough that the collateral constraint is not binding. Second, it can reduce government spending more significantly, ensuring that the borrowing constraint is binding. The discontinuities in the policy functions reflect the point at which it becomes optimal for the government to adopt the second strategy, tightening the collateral constraint to prevent overborrowing.

Under the baseline calibration, both with and without commitment, the policy function for public consumption closely tracks the Samuelson level when the collateral constraint is slack. As debt increases and the probability of a crisis rises, the policies begin to deviate from the Samuelson benchmark. To the left of the discontinuity point, the optimal time-consistent policy initially lies below the Ramsey-optimal one, due to the fact that past commitments tend to increase optimal spending. To the right of the discontinuity, where the collateral constraint holds with equality, the optimal policy initially remains below the Samuelson level, as the planner deliberately tightens the constraint to mitigate overborrowing. As debt continues to rise, the policies eventually rise above the Samuelson level, with the planner using fiscal policy as an ex-post stabilization tool. In this region, the policy function under commitment lies

[13] Optimal public spending and next-period debt under Samuelson are obtained by solving a competitive equilibrium in which, in every state, g^N is chosen to satisfy Equation 16. A competitive equilibrium under the Samuelson rule is formally defined in Appendix B.2.

below the time-consistent one, capturing the presence of a prudential motive, which is absent when the government lacks commitment. As a result, the debt policy function also lies below its time-consistent counterpart and exhibits a sharp decline at high debt levels, reflecting the planner's commitment to limit fiscal stimulus during a crisis episode.

Appendix C.1 contains additional plots related to the policy functions for debt, public consumption, and deviations from the Samuelson rule. A particularly relevant one is Figure C.2, which shows the public consumption policy function under commitment for different values of ϕ. When the collateral constraint is binding, higher values of ϕ correspond to lower levels of government spending, reflecting a stronger commitment to limiting fiscal expansion for prudential reasons. By contrast, when the constraint is slack, higher ϕ is associated with slightly higher government spending. This suggests that past commitments partially offset current prudential motives. This occurs because, when households are unconstrained in the current period, borrowing can be reduced either by lowering current government spending or by committing to increase future spending if the collateral constraint remains slack in the next period as well.

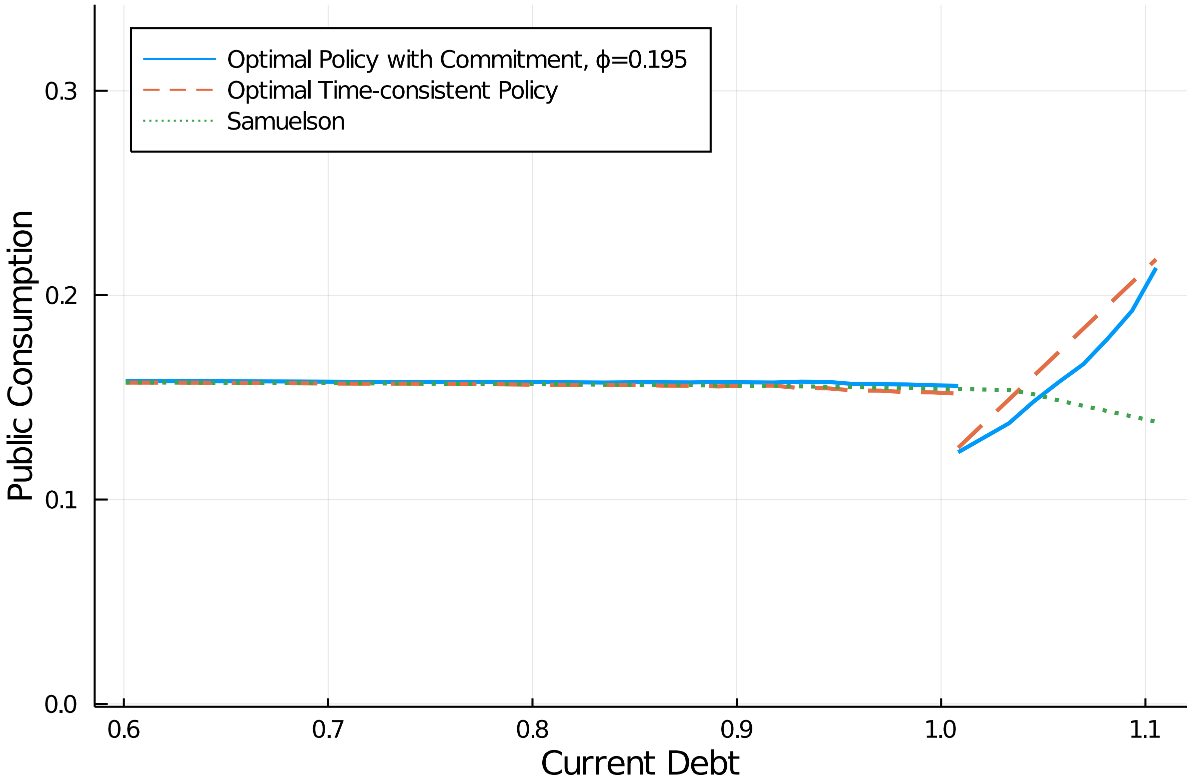
4.3 Crisis Dynamics

In this section, I conduct an event study of model-simulated data, by computing averages across financial crises episodes in a long time-series simulation. The objective is to compare the dynamics of the model when fiscal policy is set optimally with commitment versus without commitment. For each economy, I identify a financial crisis as the first period in which the collateral constraint becomes binding and the current account increases by more than one standard deviation. I then construct a nine-year event window centered on the crisis year and calculate the mean of aggregate variables across these episodes.[14]

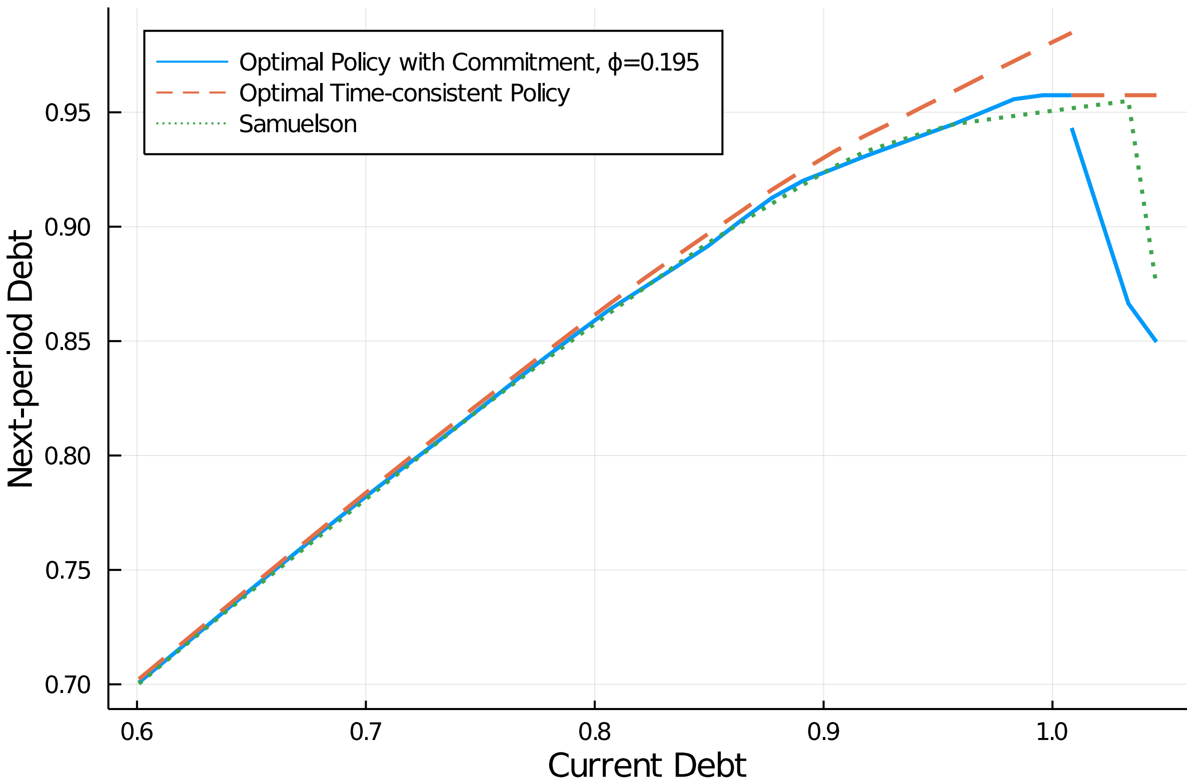
As expected, financial crises typically occur during periods of weak economic fundamentals, triggered by negative shocks to both tradable and nontradable endowments. These crises are characterized by large drops in consumption and output, a depreciation of the real exchange rate and a reversal of the current account. Notably, both the depreciation and the reversal are

[14] I focus on event windows where the constraint is slack for four years preceding the financial crisis.

Figure 1: Policy Functions with and without Commitment

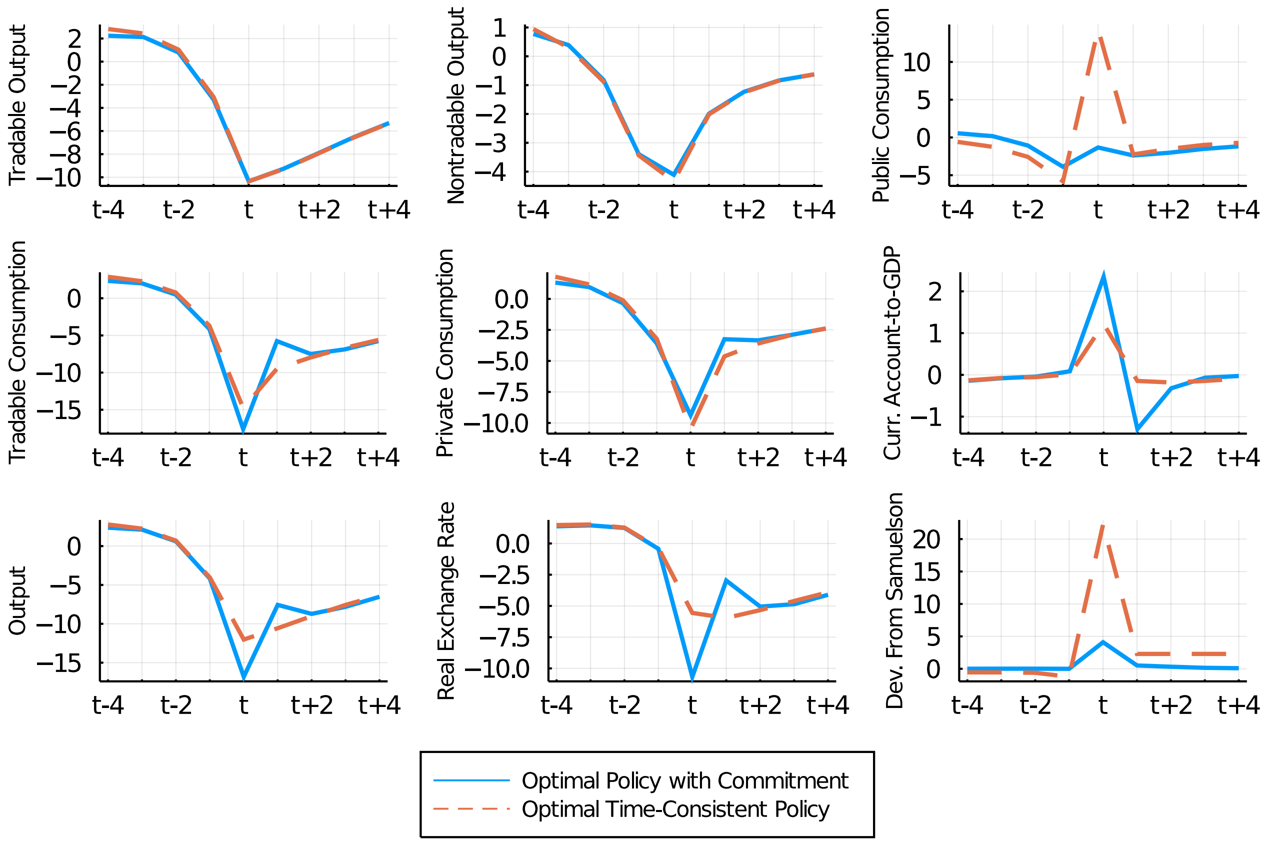


(a) Public Consumption Policy Function



(b) Debt Policy Function

Figure 2: Typical Financial Crisis

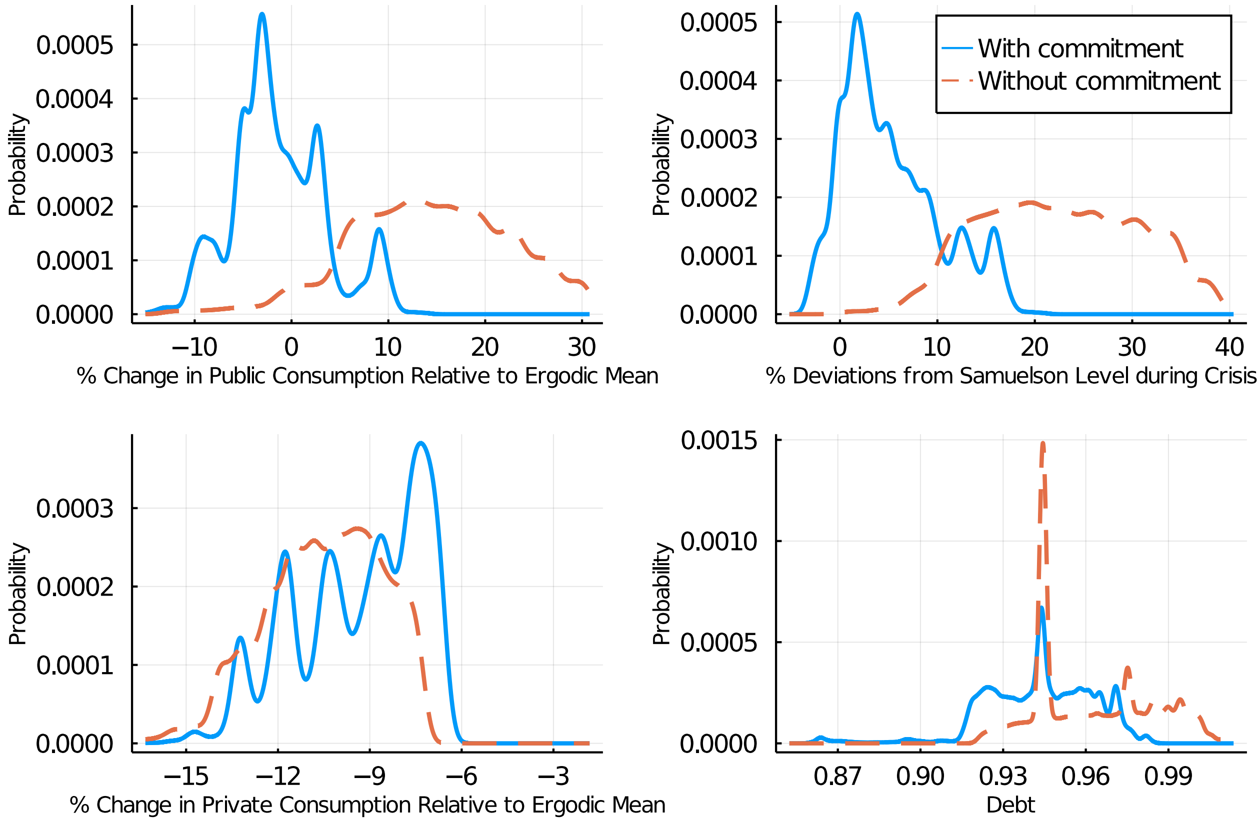


Notes : This figure plots aggregate dynamics during the typical financial crisis. A crisis episode is defined as the first period where the collateral constraint is binding and the current account increases by more than one standard deviation. The figure compares model-implied dynamics under the Ramsey-optimal policy - the solid line - and under the optimal time-consistent policy - the dashed line. All variables are expressed in percentage deviations from their average value in the ergodic distribution. For Dev. from Samuelson I plot the median across event windows, rather than the average, as the ergodic distribution of this variable is skewed to the right.

significantly more pronounced under the Ramsey-optimal policy than under the optimal time-consistent policy. This feature stems from the starkly different dynamics of public consumption in the two models. Before the crisis, fiscal policy behaves similarly. The Ramsey government essentially tracks the Samuelson level, while the time-inconsistent government slightly deviates downward from that benchmark to deter private borrowing.

In contrast, during a crisis, the responses of the two models diverge significantly. In the absence of commitment, the government finds it optimal to substantially increase spending, relaxing the collateral constraint. While such spending surges may appear desirable from an ex-post perspective, they are not necessarily optimal ex-ante. The expectation of large government

Figure 3: Distribution of Impact Effect of Financial Crises and Ergodic Debt Distribution



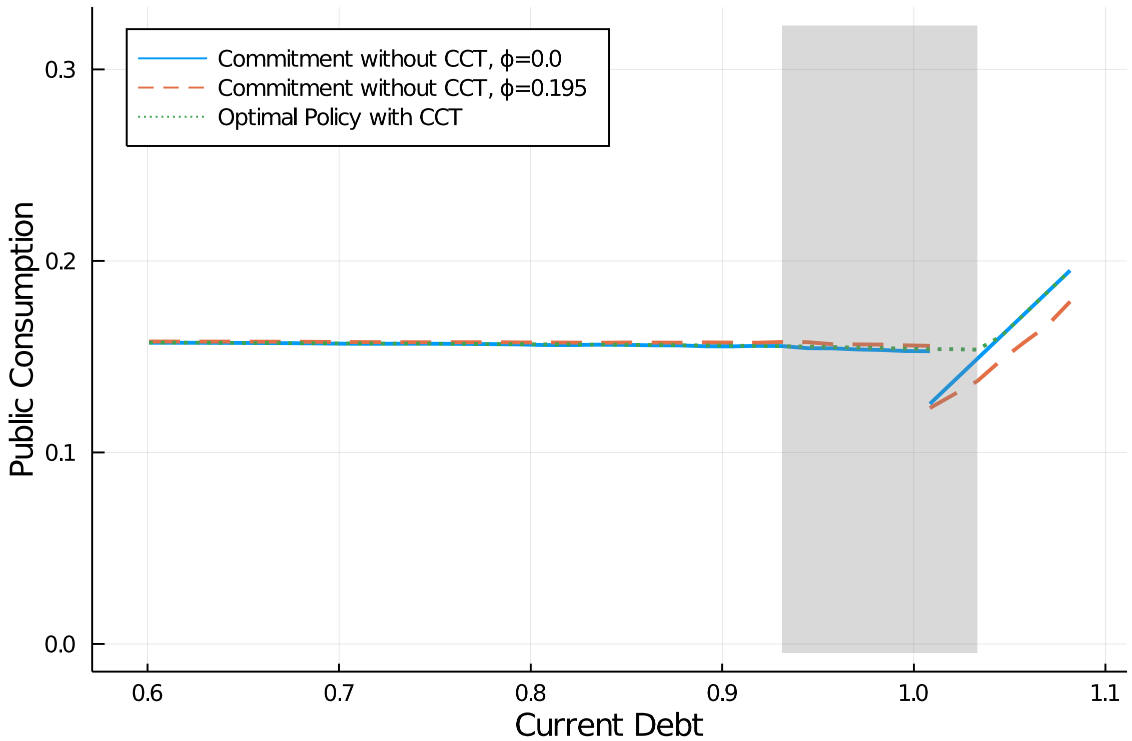
Notes : The top panels and the bottom-left panel plot the conditional distribution of public consumption, deviations from the Samuelson level and private consumption in the first period of financial crises under the Ramsey-optimal policy - the solid line - and under the optimal time consistent policy - the dashed line. Percentage changes are calculated relative to the ergodic distribution associated with each policy regime. The bottom-right panel plots the unconditional ergodic distribution of debt under the Ramsey-optimal policy and under the optimal time consistent policy.

interventions when the constraint binds leads to excessive borrowing by households. Therefore, under commitment, public spending during crises is much more restrained. Figure 2 shows that during the typical crisis public consumption under commitment lies below the average level, even though the collateral constraint is binding.[15]

Another way to understand these dynamics is by examining deviations from the Samuelson level. While these deviations are generally positive under both models, indicating an expansionary policy, they are significantly smaller under commitment. For further insight, the upper-right panel of Figure 3 illustrates the distribution of deviations from Samuelson during crises.

[15]Figure C.11 in Appendix C.2 shows that the model-implied dynamics are in line with the data.

Figure 4: Public Consumption Policy Functions with and without Capital Controls



Although the average deviation is positive, there are instances where the government, under commitment, deviates negatively from the Samuelson level. This behavior enables the government to discourage borrowing ex-ante, ultimately making crises less costly.[16] The lower-right quadrant shows the distribution of debt in the two economies. Private borrowing is significantly lower under the Ramsey-optimal policy, suggesting that commitment is very effective in discouraging excessive borrowing by households. Finally, the left panels show that although public consumption differs significantly between the two economies, the distribution of private consumption changes is in fact quite similar.

4.4 Optimal Policy With Capital Controls

In this section, I study the optimal fiscal policy in a setting where the government has

[16] Figure C.10 in Appendix C.2 complements the analysis by displaying the distribution of deviations from the Samuelson level, conditional on periods in which the collateral constraint is slack for the social planner. The figure shows that, during these periods, deviations tend to be more negative under the optimal time-consistent policy than under commitment.

access to capital control taxes. This additional policy tool allows the government to directly regulate private borrowing. Hence, the household's Euler equation is no longer a constraint in the planner's optimization problem:

$$\max_{\{c_t^T(s^t), g_t^N(s^t), b_{t+1}(s^t)\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(A(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))) + v(g_t^N(s^t)) \right] \tag{CC}$$

s.t.

$$\begin{aligned} c_t^T(s^t) &= y_t^T(s^t) + \frac{b_{t+1}(s^t)}{R} - b_t(s^{t-1}) \\ \frac{b_{t+1}(s^t)}{R} &\leq \kappa \left(y_t^T(s^t) + \mathcal{P}(s^t) y_t^N(s^t) \right) \\ \mathcal{P}(s^t) &= \frac{A_N(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))}{A_T(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))} \end{aligned}$$

given an initial condition b_0. The maximization is subject to three implementability conditions: the resource constraint, the collateral constraint, and the equilibrium price function. The first-order condition with respect to $g_t^N(s^t)$ is the following

$$-u_N(s^t) + v_N(s^t) - \mu^{\text{sp}}(s^t) \kappa \mathcal{P}_N(s^t) y_t^N(s^t) = 0 \tag{26}$$

This equation shows the planner optimally deviates from the Samuelson level when the collateral constraint is binding, in order to relax the constraint and boost the economy's borrowing capacity. By contrast, when the collateral constraint is non-binding, the planner maintains spending at the Samuelson level, and instead uses capital control taxes to address the over-borrowing inefficiency.[17] Figure 4 compares the policy function for public consumption under commitment, with and without capital control taxes. The shaded region corresponds to the range of debt levels where the social planner would impose a tax on debt in the constrained-efficient allocation. The policy function with capital controls does not exhibit a discontinuity. By contrast, in the absence of debt taxes, a discontinuity emerges precisely at the debt levels

[17]The expression for the optimal macroprudential tax coincides with the one in Bianchi (2011). In periods where the collateral constraint is slack the optimal tax is given by: $\tau_t^*(s^t) = \frac{\mathbf{E}_t \mu_{t+1}^{sp}(s^{t+1}) \mathcal{P}_T(s^{t+1}) y_t^N(s^{t+1})}{\mathbf{E}_t u_T(s^{t+1})}$

Table 5: Impact Responses during Crises under Different Policy Regimes

	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	2.35%	1.14%	0.1%
Private consumption	−9.38%	−10.21%	−6.92%
Public consumption	−1.35%	14.22%	−2.46%
Deviation from Samuelson	5.19%	21.26%	3.09%

Notes : This table shows the average crisis response on impact for the current account-to-GDP ratio, private consumption, public consumption and deviations from the Samuelson level across policy regimes. All variables are expressed as percentage deviations from their respective ergodic averages.

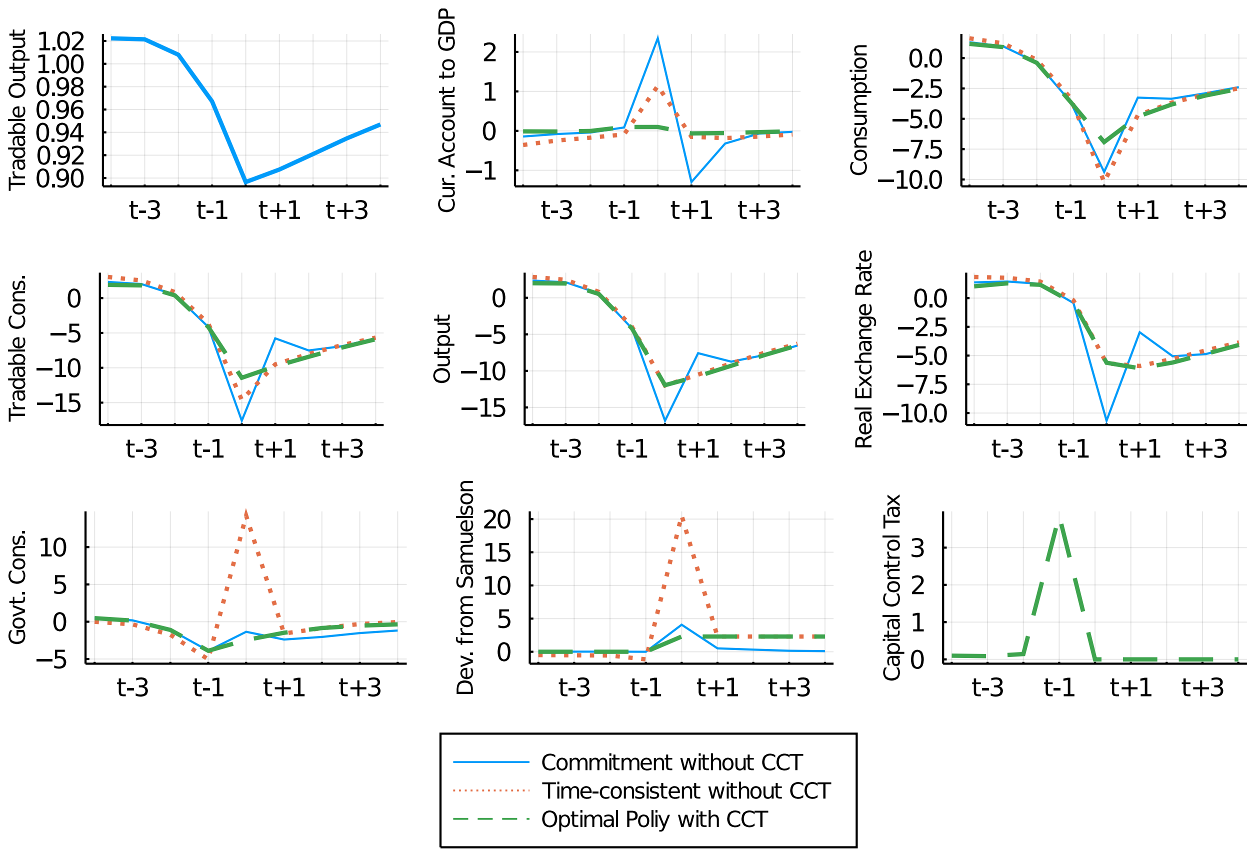
where the government would impose such taxes.

The unconditional average for the capital control tax in the simulated model is 0.92%, which is significantly lower than the value reported in Bianchi (2011). Arce et al. (2025) show that the availability of ex-post interventions can either increase or reduce debt taxes. To investigate whether the lower values in my model are due to a different calibration or the use of optimal fiscal policy, in Appendix B.2 I consider an alternative policy regime in which the government follows the Samuelson rule but chooses capital control taxes optimally. Under this regime, fiscal policy no longer serves as a stabilization tool. Table B.1 shows that the average tax is higher under the Samuelson commitment than under the constrained efficient allocation, suggesting that the use of fiscal policy ex-post reduces the need for ex-ante interventions. Moreover, when I lower the discount factor β to match the value in Bianchi (2011), the model delivers an average debt tax of 3.94% quantitatively in line with their results.[18]

To study how capital control taxes affect model dynamics, I again focus on nine-year crisis windows. I first simulate the economy under the assumption that the government sets fiscal policy with commitment but does not have access to capital controls. Crises are identified following the same procedure as outlined in Section 3. For each event window, I then retrieve the series of exogenous shocks and initial debt positions and pass them through both the policy functions of the equilibrium with capital controls and those of the time-consistent equilibrium.

[18] See Appendix B.2 for additional details on optimal macroprudential policy under the Samuelson rule, as well as a comparison of average taxes across different policy regimes and parameterizations.

Figure 5: Crisis Dynamics under Different Policy Regimes



Notes : This figure compares aggregate dynamics during the typical financial crisis across policy regimes. A crisis episode is defined as the first period where the collateral constraint is binding and the current account increases by more than one standard deviation. The figure plots model-implied dynamics under the Ramsey-optimal policy - the solid line -, under the optimal time-consistent policy - the dashed line - and under the optimal policy with capital control taxes - the dotted line. All variables are expressed in percentage deviations from their average value in the ergodic distribution. For Dev. from Samuelson and Capital Control Tax I plot the median across event windows, rather than the average, as the ergodic distributions of these variables are skewed to the right.

The results, presented in Figure 5, highlight several key findings. Debt levels prior to crisis episodes are lowest when capital controls are available, reflecting the use of high debt taxes in anticipation of a potential crisis. Borrowing is higher without capital controls, particularly under the time-consistent policy, which shows a surge in debt in the years leading up to the crisis. In contrast, with commitment, debt remains relatively stable before a crisis and even decreases slightly in the year prior. This trajectory is the result of the government's promise to limit public spending if the constraint becomes binding, which reduces households' incentives to borrow.

The dynamics of the current account show that implementing capital controls before a crisis effectively stabilizes the economy, resulting in a nearly flat current account. Interestingly, the patterns of public consumption—whether measured as deviations from the ergodic mean or from the Samuelson level—are strikingly similar between the economy with capital controls and the economy with commitment but without capital controls. The use of debt taxes to reduce borrowing avoids the need for large fiscal expansions during crises, requiring only mild deviations from the Samuelson rule when the constraint binds.

Table 5 compares the behavior of macroeconomic aggregates in the first period of a crisis across policy regimes. The current account reversal is larger with commitment than without (2.35% vs 1.14%), and is essentially zero if debt taxes are employed. While private consumption behaves similarly across policy regimes, government consumption exhibits the largest variation, rising substantially under the time-consistent policy (14.22%) while staying below its ergodic average in the other two cases (-1.35% with commitment and-2.46% with capital controls). Lastly, the deviation from the Samuelson level is on average positive under all policy regimes, being by far the highest under the time-consistent policy (21.26% vs 5.19% with commitment and 3.09% with capital controls).[19]

4.5 Welfare Comparison

To conclude the quantitative analysis, I compute the welfare gains from transitioning out of the Markov Perfect Equilibrium - where fiscal policy is chosen optimally but without commitment - to two alternative policy regimes: one where the government has commitment, and another where it has access to capital control taxes. I express welfare gains as consumption equivalent deviations from the time-consistent equilibrium. Formally, I compute the proportional increase in both private and public consumption that would make households indifferent between remaining in the Markov Perfect Equilibrium and transitioning to the alternative policy regime. Due to the homotheticity of the utility function, the welfare gain in each state, $\gamma(b, \mathbf{y})$, can be

[19]In Appendix D, I show that these predictions are robust across different values of the elasticities σ and ξ

Table 6: Welfare Gains from Commitment and Debt Taxes

	Commitment w/o Taxes w.r.t No Commitment w/o Taxes	Optimal Policy w/ Taxes w.r.t. No Commitment w/o Taxes
Average	0.004%	0.019%
Standard deviation	0.002	0.007
Correlation with output	−0.317%	−0.368%

Notes : This table reports welfare gains from transitioning out of the Markov Perfect Equilibrium - where fiscal policy is chosen optimally but without commitment - to two alternative policy regimes: one where the government has commitment, and another where it has access to capital control taxes. Moments are computed based on the ergodic distribution under the optimal time-consistent policy in the economy without capital control taxes.

computed through the following equation:

$$(1+\gamma(b,\mathbf{y}))^{1-\sigma}V^{\text{no tax, c}}(b,\mathbf{y}) = V^{\text{no tax, nc}}(b,\mathbf{y}) \tag{27}$$

$$(1+\gamma(b,\mathbf{y}))^{1-\sigma}V^{\text{tax}}(b,\mathbf{y}) = V^{\text{no tax, nc}}(b,\mathbf{y}) \tag{28}$$

where $V^{\text{no tax, nc}}(b,\mathbf{y})$ denotes the value function under the optimal time-consistent policy, $V^{\text{no tax, c}}(b,\mathbf{y})$ the value function under the Ramsey-optimal policy, and $V^{\text{tax}}(b,\mathbf{y})$ the value function with optimal debt taxes.[20] The value function under the Ramsey-optimal policy is given by $V^{\text{no tax, c}}(b,\mathbf{y}) = W(b,\phi,\mathbf{y})|_{\phi=0}$, where $W(b,\phi,\mathbf{y})$ is defined in Appendix B.1, following the saddle-point formulation of Marcet and Marimon (2019).

Table 6 shows that the average welfare gain from accessing a commitment technology is small, at just 0.004%. The negative correlation with output reflects the macroprudential nature of fiscal commitments, which promise to restrict future spending as income starts to contract and households approach their borrowing limit. Welfare gains from implementing optimal capital controls are an order of magnitude larger, averaging at 0.019%, due to the fact that debt taxes drastically reduce the probability of a crisis. Nevertheless, welfare gains are smaller than those found in related papers, such as Bianchi (2011) and Ottonello et al. (2022). This

[20] I calculate welfare gains for every $(b,\mathbf{y})$-pair, and use the ergodic distribution of the aggregate state under the optimal time-consistent policy to compute the mean, standard deviation and correlation with output. Additionally, in Appendix C.3 I plot welfare gains as a function of current debt, for a given level of income.

is due to two main factors. First, my calibration uses a higher discount factor, $\beta = 0.94$, than those papers. Second, even in the absence of capital controls, fiscal stimulus is available as an ex-post intervention, which mitigates the severity of financial crises. As a result, the benefit of correcting the borrowing inefficiency through debt taxes is smaller relative to settings where ex-post interventions are not available.

5 Conclusions

In this paper I study the optimal design of fiscal policy in economies that are subject to borrowing constraints. While fiscal stimulus can be beneficial during crises by relaxing collateral constraints, its anticipation can increase borrowing and lead to financial instability. I characterize the optimal policies with and without commitment and find the two to be very different. Under commitment, the government adopts a conservative fiscal stance during downturns, which mitigates the overborrowing inefficiency ex-ante. This contrasts with the time-consistent policy, where the government implements large fiscal expansions during crises. A quantitative application to the Argentinean economy shows that commitment to limiting fiscal easing during crises can significantly reduce financial instability. My findings challenge the conventional wisdom that fiscal policy should be highly expansionary during downturns and underscores the need to consider both the ex-ante and ex-post effects of fiscal interventions.

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Appendices

A Proofs

Proof. Recall the government's problem in the Markov Perfect Equilibrium

$$V(b,\mathbf{y}) = \max_{c^T, b', g^N, \mu} u(A(c^T, y^N - g^N)) + v(g^N) + \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} V(b', \mathbf{y}) \tag{NC}$$

s.t.

$$\begin{aligned}
c^T &= y^T + \frac{b'}{R} - b && \lambda \\
\frac{b'}{R} &\leq \kappa \Big(y^T + \mathcal{P}(c^T, y^N - g^N) y^N \Big) && \mu^{\text{sp}} \\
\mathcal{P}(c^T, y^N - g^N) &= \frac{A_2(c_t^T, y_t^N - g_t^N)}{A_1(c_t^T, y_t^N - g_t^N)} && \eta \\
u_T(c^T, y^N - g^N) - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \big[u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \big] &= \mu && \phi \\
\mu &\geq 0 && \delta \\
\mu \left[\kappa (y^T + \mathcal{P}(c^T, y^N - g^N) y^N) - \frac{b'}{R} \right] &= 0 && \zeta
\end{aligned}$$

The first-order conditions of problem (NC) with respect to c^T, g^N, b' and μ are respectively given by

$$u_T - \lambda + \phi u_{TT} + [\mu^{\text{sp}} + \zeta \mu] \kappa \mathcal{P}_T y^N = 0 \tag{29}$$

$$-u_N + v_N - [\mu^{\text{sp}} + \zeta \mu] \kappa \mathcal{P}_N y^N - \phi u_{TN} = 0 \tag{30}$$

$$\frac{\lambda}{R} - \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \frac{[\mu^{\text{sp}} + \zeta \mu]}{R} - \phi \frac{\beta R \partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \big[u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \big]}{\partial b'} = 0 \tag{31}$$

$$-\phi + \zeta \left[\kappa \left(y^T + \mathcal{P}(c^T, y^N - g^N) y^N) y^N \right) - \frac{b'}{R} \right] + \delta = 0 \tag{32}$$

along with the complementary slackness conditions

$$\mu^{\text{sp}} \left[\kappa (y^T + \mathcal{P}(c^T, y^N - g^N) y^N) - \frac{b'}{R} \right] = 0 \tag{33}$$

$$\delta \mu = 0 \tag{34}$$

I conjecture and verify that for each state the solution to problem (NC) falls into one of the following cases:

1. $\mu^{\text{sp}} = \mu = 0$, in which case $\delta = 0$, $\zeta < 0$ and $\phi < 0$;

2. $\mu^{\text{sp}} > 0$ and $\mu > 0$, in which case $\delta = \zeta = \phi = 0$;

3. $\mu^{\text{sp}} = 0$ and $\mu > 0$, in which case $\delta = 0$, $\zeta < 0$ and $\phi = 0$.

I start by showing that in a Markov Perfect Equilibrium satisfying the above properties $\mu^{\text{sp}} > 0$ and $\mu = 0$ cannot both hold. To do so, suppose by contradiction that $\mu^{\text{sp}} > 0$ and $\mu = 0$. The government's complementary slackness condition implies that

$$\kappa(y^T + \mathcal{P}(c^T, y^N - g^N)y^N) - \frac{b'}{R} = 0 \tag{35}$$

which also means that $\zeta = 0$, as the household's complementary slackness condition directly follows from the government's complementary slackness.

Given $\zeta = 0$, the government's first-order conditions imply

$$u_T = \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' \tag{36}$$

Letting $\tilde{\mu} = \mu^{\text{sp}} + \zeta\mu$ and using the expression for λ' we obtain

$$u_T = \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[u'_T + \phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{37}$$

This in turn implies

$$u_T - \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \neq 0 \tag{38}$$

where the last implication follows from the assumed properties of the solution to the government's problem. Because $\mu = 0$, (38) violates the household's Euler equation and the associated complementary slackness condition, yielding a contradiction.

Case 1. Consider now the case where the collateral constraint is not binding, i.e. $\mu^{\text{sp}} = \mu = 0$. In this case, the complementary slackness condition implies that the non-negativity constraint on the multiplier is satisfied. Therefore, $\delta = 0$. Combining equations (29) and (31) yields

$$u_T + \left[u_{TT} - R \frac{\partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\beta R U_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \right]}{\partial b'} \right] \phi = \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' \tag{39}$$

Letting $\tilde{\mu} = \mu^{\text{sp}} + \zeta\mu$ and using the expression for λ' we obtain

$$u_T + \left[u_{TT} - R \frac{\partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\beta R U_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \right]}{\partial b'} \right] \phi = \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[u'_T + \phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{40}$$

Simple algebra then yields

$$\left[1 - \frac{R}{u_{TT}} \frac{\partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\beta R U_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \right]}{\partial b'} \right] u_{TT} \phi = \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{41}$$

In sequential form, this expression can be rewritten as follows

$$\left[1 - \frac{R}{u_{TT,t}} \frac{\partial \beta R \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} u_{T,t}}{\partial b_{t+1}} \right] u_{TT,t} \phi_t = \beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \left[\phi_{t+1} u_{TT,t+1} + \tilde{\mu}_{t+1} \kappa \mathcal{P}_{T,t+1} y^N_{t+1} \right] \tag{42}$$

Define

$$\Theta_t = \left[1 - \frac{R}{u_{TT,t}} \frac{\partial \beta R \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} u_{T,t}}{\partial b_{t+1}}\right] > 1 \tag{43}$$

$$\tilde{\phi}_t = u_{TT,t}\phi_t \tag{44}$$

Then, equation (42) becomes

$$\tilde{\phi}_t = \frac{\beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \tilde{\mu}_{t+1} \kappa \mathcal{P}_{T,t+1} y^N_{t+1}}{\Theta_t} + \frac{\beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \tilde{\phi}_{t+1}}{\Theta_t} \tag{45}$$

Iterating forward and using the transversality condition we get

$$\tilde{\phi}_t = \mathbb{E} \sum_{s=1}^{\infty} \frac{\beta^s}{\prod_{j=0}^{t-1} \Theta_{t+j}} \tilde{\mu}_{t+s} \kappa \mathcal{P}_{T,t+s} y^N_{t+s} \tag{46}$$

This expression implies that if $\mathbb{E}\tilde{\mu}_{t+s} \geq 0$, with strict inequality for some s, then $\tilde{\phi}_t > 0$. Since $u_{TT,t} < 0$, this in turn implies that $\phi_t < 0$. Finally, we have

$$\zeta = \frac{\phi}{\left[\kappa \left(y^T + \mathcal{P}(c^T, y^N - g^N)y^N)y^N\right) - \frac{b'}{R}\right]} < 0 \tag{47}$$

Case 2. Consider next the case where the collateral constraint is binding, i.e. $\mu^{\text{sp}} > 0$. I start by showing that in this case $\phi = \delta = \zeta = 0$. To do that, I conjecture that $\phi = \delta = \zeta = 0$ then verify using the first-order conditions that that the household's Euler equation, the non-negativity condition for the multiplier and the complementary slackness conditions are all satisfied.

Let

$$\mu = u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T \tag{48}$$

It is enough to show that $\mu > 0$. Using equation (31) I get

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \mu^{\text{sp}} = 0 \tag{49}$$

Using the expression fro λ' yields

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[u'_T + \phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] - \mu^{\text{sp}} = 0 \tag{50}$$

Therefore

$$\mu = \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] + \mu^{\text{sp}} \tag{51}$$

If the collateral constraint is binding in the next period, i.e. $\mu'^{\text{sp}} > 0$ then $\phi' = 0$. If the collateral constraint is not binding in the next period then $\phi' < 0$. Therefore, I conclude that

$$\mu = \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] + \mu^{\text{sp}} > 0 \tag{52}$$

Case 3 Finally, consider the case where the collateral constraint is not binding for the government but is binding for the households, i.e. $\mu^{\text{sp}} = 0$ but $\mu > 0$. I show that there exists a multiplier $\mu > 0$ such that the government's first-order conditions are satisfied for $\phi = 0$ and $\zeta < 0$.

Define a multiplier μ as follows

$$\mu = \frac{\mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right]}{1 - \zeta\left[1 - \kappa \mathcal{P}_T y^N\right]} > 0 \tag{53}$$

where the last inequality assumes that the slope of the borrowing limit is less than one. The multiplier defined above satisfies

$$\mu = \zeta\mu\left[1 - \kappa \mathcal{P}_T y^N\right] + \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] \tag{54}$$

As result, the following two equations both hold

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \mu \tag{55}$$

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \zeta\mu\left[1 - \kappa \mathcal{P}_T y^N\right] + \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] \tag{56}$$

The first equation is the household's Euler equation, while the second is the first-order condition for the planner after substituing $\phi = 0$. To see this use the first-order conditions to derive the following expressions

$$u_T + \zeta\mu\kappa \mathcal{P}_T y^N - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \zeta\mu = 0 \tag{57}$$

Substituting for λ' we get

$$u_T - \zeta\mu\left[1 - \kappa \mathcal{P}_T y^N\right] = \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[u'_T + \phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] \tag{58}$$

Finally some algebra yields

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \zeta\mu\left[1 - \kappa \mathcal{P}_T y^N\right] + \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N\right] \tag{59}$$

It is left to show that generically $\zeta < 0$. Suppose by contradiction that $\zeta = 0$ and denote $g^*(c^T, \mathbf{y})$ the Samuelson level, that is the level of g^N such that

$$-u_N + v_N = 0 \tag{60}$$

Then, next-period debt must solve the two following equations

$$\begin{aligned} & u_T\left(y^T + \frac{b'}{R} - b, g^*\left(y^T + \frac{b'}{R} - b, \mathbf{y}\right)\right) - \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) = \\ & \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\left[\phi(b', \mathbf{y}') u_{TT}(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) + \tilde{\mu}(b', \mathbf{y}') \kappa \mathcal{P}_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) y'^N\right] = 0 \end{aligned} \tag{61}$$

$$\frac{b'}{R} - \kappa\left(y^T + \mathcal{P}\left(y^T + \frac{b'}{R} - b, y^N - g^*\left(y^T + \frac{b'}{R} - b, \mathbf{y}\right)\right) y^N\right) = 0 \tag{62}$$

This is a system of two equations in only one unknown, b', and generically has no solution.

Having established these properties of the time-consistent equilibrium, let me now focus on weather deviations from the Samuelson level are positive or negative.

Case 1. Consider first the case $\mu^{\text{sp}} = \mu = 0$. The first-order condition with respect to g^N is

$$-u_N + v_N - \phi u_{TN} = 0 \tag{63}$$

I have shown that $\phi < 0$. Let me now focus on u_{TN}. Using the functional forms (2) and (4), I obtain

$$u_{TN} = \theta a(1-a)\frac{1-\sigma\phi}{\phi} c^{T-\frac{1}{\phi}} (y^N - g^N)^{-\frac{1}{\phi}} c^{\frac{1-\sigma\phi}{\phi}-\left(1-\frac{1}{\phi}\right)} \tag{64}$$

This implies that

$$u_{TN} \begin{cases} > 0 & \text{if } \sigma\phi < 1 \\ = 0 & \text{if } \sigma\phi = 1 \\ < 0 & \text{if } \sigma\phi > 1 \end{cases} \tag{65}$$

It follows that the government sets public consumption, g^N, below (above) the Samuelson level if and only if $\sigma\xi > 1$ (< 1). If $\sigma\xi = 1$, the government sets spending at Samuelson level.

Case 2. Consider next the case where the collateral constraint is binding, i.e. $\mu^{\text{sp}} > 0$. The first-order condition with respect to g^N is

$$-u_N + v_N - \mu^{\text{sp}}\kappa\mathcal{P}_N y^N = 0 \tag{66}$$

Since $\mu^{\text{sp}}\kappa\mathcal{P}_N y^N > 0$, this equation implies that the government sets public consumption, g^N, above the Samuelson level.

Case 3. Finally, consider the case where the collateral constraint is not binding for the government but is binding for the households, i.e. $\mu^{\text{sp}} = 0$ but $\mu > 0$.The first-order condition with respect to g^N is

$$-u_N + v_N - \zeta\mu\kappa\mathcal{P}_N y^N = 0 \tag{67}$$

Since $\zeta\mu\kappa\mathcal{P}_N y^N < 0$, this equation implies that the government sets public consumption, g^N, below the Samuelson level. ■

B Additional Details on Quantitative Analysis

B.1 Solution Method for Ramsey-Optimal Policy

In this section, I derive a recursive formulation of this problem by following the approach of Marcet and Marimon (2019). This converts the planner's sequential problem into a recursive saddlepoint problem by using the Lagrange multiplier on the household's Euler equation as an additional state variable.

Recall that the Ramsey problem is given by

$$\max_{\{c_t^T, g_t^N, b_{t+1}, \mu_t\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \big[u(A(c_t^T, y_t^N - g_t^N)) + v(g_t^N)\big] \tag{CO}$$

s.t.

$$\begin{aligned}
c_t^T &= y_t^T + \frac{b_{t+1}}{R_t} - b_t && \lambda_t \\
\frac{b_{t+1}}{R} &\leq \kappa(y_t^T + \mathcal{P}(c_t^T, y_t^N - g_t^N) y_t^N) && \mu_t^{\mathrm{sp}} \\
\mathcal{P}(c_t^T, y_t^N - g_t^N) &= \frac{A_N(c_t^T, y_t^N - g_t^N)}{A_T(c_t^T, y_t^N - g_t^N)} && \eta_t \\
u_T(c_t^T, y_t^N - g_t^N) - \beta R \mathbb{E}_t[u_T(c_{t+1}^T, y_{t+1}^N - g_{t+1}^N)] &= \mu_t && \phi_t \\
\mu_t &\geq 0 && \delta_t \\
\mu_t \left[\kappa(y_t^T + p_t^N y_t^N) - \frac{b_{t+1}}{R_t}\right] &= 0 && \zeta_t
\end{aligned}$$

given an initial condition b_0.

Let ϕ_t denote the multiplier associated to the household's Euler equation, which is a forward looking constraint. Let $\tilde{\phi}_{t+1} = \phi_t \mathbb{E}_t u_{T,t}$ and define the following objective function

$$H(c_t^T, g_t^N, \mu_t, \phi_t, \tilde{\phi}_t, \mathbf{y}_t) = u(A(c_t^T, y_t^N - g_t^N)) + v(g_t^N) - u_T(c_t^T, y_t^N - g_t^N)\left(\frac{\phi_t}{R} - \tilde{\phi}_t\right) + \phi_t \mu_t \tag{68}$$

Then rewrite problem CO as

$$\min_{\phi_t} \max_{c_t^T, g_t^N, b_{t+1}, \mu_t} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t H(c_t^T, g_t^N, \mu_t, \phi_t, \tilde{\phi}_t, \mathbf{y}_t) \tag{CO.1}$$

s.t.

$$\tilde{\phi}_{t+1} = \phi_t$$
$$c_t^T = y_t^T + \frac{b_{t+1}}{R_t} - b_t$$
$$\frac{b_{t+1}}{R_t} \le \kappa(y_t^T + \mathcal{P}(c_t^T, y_t^N - g_t^N) y_t^N)$$
$$\mathcal{P}(c_t^T, y_t^N - g_t^N) = \frac{A_2(c_t^T, y_t^N - g_t^N)}{A_1(c_t^T, y_t^N - g_t^N)}$$
$$\mu_t \ge 0$$
$$\mu_t \left[\kappa(y_t^T + p_t^N y_t^N) - \frac{b_{t+1}}{R_t} \right] = 0$$

given an initial condition b_0.

Finally, rewrite the infinite-horizon saddlepoint problem in a recursive form

$$W(b, \tilde{\phi}, \mathbf{y}) = \min_{\tilde{\phi}'} \max_{c^T, g^N, b', \mu} \left[H(c^T, g^N, \mu, \tilde{\phi}', \tilde{\phi}, \mathbf{y}) + \beta \mathbb{E} W(b', \tilde{\phi}', \mathbf{y}') \right] \tag{CO.2}$$

s.t.

$$c^T = y^T + \frac{b'}{R} - b$$
$$\frac{b'}{R} \le \kappa \left(y^T + \frac{A_2(c^T, y^N - g^N)}{A_1(c^T, y^N - g^N)} y^N \right)$$
$$\mu \ge 0$$
$$\mu \left[\kappa \left(y^T + \frac{A_2(c^T, y^N - g^N)}{A_1(c^T, y^N - g^N)} y^N \right) - \frac{b'}{R} \right] = 0$$

I approximate the dynamics under the Ramsey-optimal policy by solving numerically the functional equation CO.2. The algorithm proceeds as follows:

1. Specify an initial guess for the value function, $W_0(b_k, \tilde{\phi}, \mathbf{y})$.
2. For each state $(b_j, \tilde{\phi}_k, \mathbf{y}(s_{X,l}))$ with $j \in \{1, \ldots, nn_b\}$, $k \in \{1, \ldots, nn_\phi\}$, and $l \in \{1, \ldots, nn_s\}$, solve

$$W_{i+1}(b_j, \tilde{\phi}_k, \mathbf{y}(s_{X,l})) = \min_{\tilde{\phi}'} \max_{c^T, g^N, b', \mu} \Bigg\{ H(c^T, g^N, \mu, \tilde{\phi}', \tilde{\phi}, \mathbf{y}) + \beta \sum_{r=1}^{n_s} \text{Prob}(\tilde{s}'_{X,r} \mid s_{X,j}) W_i(b', \tilde{\phi}', \mathbf{y}(\tilde{s}'_{X,r})) \Bigg\} \tag{69}$$

subject to:

$$c^T = y^T(s_{X,l}) + \frac{b'}{R} - b_j$$

$$\frac{b'}{R} \leq \kappa \left(y^T(s_{X,l}) + \frac{A_2(c^T, y^N(s_{X,l}) - g^N)}{A_1(c^T, y^N(s_{X,l}) - g^N)} y^N \right)$$

$$\mu \geq 0$$

$$\mu \left[\kappa \left(y^T(s_{X,l}) + \frac{A_2(c^T, y^N(s_{X,l}) - g^N)}{A_1(c^T, y^N(s_{X,l}) - g^N)} y^N(s_{X,l}) \right) - \frac{b'}{R} \right] = 0$$

3. Compute the distance $\delta_{i+1} \equiv \sup |W_{i+1} - W_i|$. If $\delta_{i+1} \leq \varepsilon_\delta$, the policy functions obtained are a solution to the optimal policy problem. Otherwise, repeat step 2. for $i = 1, 2, \ldots$ until convergence is achieved.

B.2 Equilibrium and Capital-Control Policy under Samuelson Rule

In this section, I consider an alternative policy regime in which the government chooses $g_t^N(s^t)$ so that the Samuelson rule is always satisfied. I analyze both the competitive equilibrium without capital controls and a policy regime in which the government follows the Samuelson rule while optimally choosing debt taxes.

I begin by defining the competitive equilibrium in this context:

Definition 5. *Given a sequence of exogenous processes $\{y_t^T, y_t^N\}_{t=0}^\infty$ and initial condition b_0, a competitive equilibrium under the Samuelson rule consists of allocations and prices $\{c_t^T, c_t^N, c_t, b_{t+1}, g_t^N, \mu_t, p_t^N\}_{t=0}^\infty$ that satisfy equations (6), (9), (10), (11) and (13), together with the condition $v_N(g_t^N) = u_N(c_t^T, y_t^N - g_t^N)$.*

Figure 1 in the main text plots, as green dotted lines, the policy functions for public consumption and next-period debt under the Samuelson rule in the baseline calibration.

I next consider the problem of a planner who follows the Samuelson rule but chooses capital controls optimally. In this case, the planner can directly influence private borrowing decisions through debt taxes. The planner's optimization problem is:

$$\max_{\{c_t^T(s^t), g_t^N(s^t), b_{t+1}(s^t)\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[u(A(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))) + v(g_t^N(s^t)) \right] \tag{SC}$$

s.t.

$$c_t^T(s^t) = y_t^T(s^t) + \frac{b_{t+1}(s^t)}{R} - b_t(s^{t-1})$$

$$\frac{b_{t+1}(s^t)}{R} \leq \kappa \left(y_t^T(s^t) + \mathcal{P}(s^t) y_t^N(s^t) \right)$$

$$\mathcal{P}(s^t) = \frac{A_N(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))}{A_T(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))}$$

$$v_N(g_t^N(s^t)) = u_N(c_t^T(s^t), y_t^N(s^t) - g_t^N(s^t))$$

Table B.1: Average Debt Tax under Different Fiscal Policy Regimes.

	Baseline, $\beta = 0.94$		Low discount factor, $\beta = 0.91$	
	Constrained Efficient	Samuelson w/ Capital Controls	Constrained Efficient	Samuelson w/ Capital Controls
Avg. debt tax	0.92%	1.63%	2.48%	3.94%

Notes : This table reports the average debt tax under different fiscal policy regimes for two discount factors ($\beta = 0.94$ and $\beta = 0.91$). The columns distinguish between the constrained-efficient allocation, where the government sets fiscal policy optimally, and the Samuelson allocation, where the planner adheres to the Samuelson rule but chooses capital controls optimally.

given an initial condition b_0. The maximization is subject to four implementability conditions: the resource constraint, the collateral constraint, the equilibrium price function and the Samuelson rule. The first-order conditions with respect to $c^T(s^t)$, $g_t^N(s^t)$ and $b_{t+1}(s^t)$ are the following

$$\lambda_t(s^t) = u_T(s^t) + \mu_t^{\mathrm{sp}}(s^t)\kappa \mathcal{P}_T(s^t) y_t^N(s^t) - \nu_t(s^t) u_{NT}(s^t) \tag{70}$$

$$\nu_t(s^t)\left[u_{NN}(s^t) + v_{NN}(s^t)\right] = \mu_t^{\mathrm{sp}}(s^t)\kappa \mathcal{P}_N(s^t) y_t^N(s^t) \tag{71}$$

$$\lambda_t(s^t) = \beta R \mathbb{E}_t \lambda_{t+1}(s^{t+1}) + \mu_t^{\mathrm{sp}}(s^t) \tag{72}$$

Combining the first two equations yields

$$\lambda_t(s^t) = u_T(s^t) + \mu_t^{\mathrm{sp}}(s^t)\kappa \left[\mathcal{P}_T(s^t) - \frac{\mathcal{P}_N(s^t) u_{NT}(s^t)}{u_{NN}(s^t) + v_{NN}(s^t)}\right] y_t^N(s^t) \tag{73}$$

Therefore, in periods where the collateral constraint is slack, the planner's Euler equation is

$$u_T(s^t) = \beta R \mathbb{E}_t \left[u_T(s^{t+1}) + \mu_t^{\mathrm{sp}}(s^{t+1})\kappa \left[\mathcal{P}_T(s^{t+1}) - \frac{\mathcal{P}_N(s^{t+1}) u_{NT}(s^{t+1})}{u_{NN}(s^{t+1}) + v_{NN}(s^{t+1})}\right] y_{t+1}^N(s^{t+1})\right] \tag{74}$$

It follows that the optimal debt tax is given by

$$\tau_t^*(s^t) = \frac{\mathbf{E}_t \mu_{t+1}^{sp}(s^{t+1}) \Upsilon_{t+1}(s^{t+1})}{\mathbf{E}_t u_T(s^{t+1})} \tag{75}$$

where

$$\Upsilon_{t+1}(s^{t+1}) = \kappa \left[\mathcal{P}_T(s^{t+1}) - \frac{\mathcal{P}_N(s^{t+1}) u_{NT}(s^{t+1})}{u_{NN}(s^{t+1}) + v_{NN}(s^{t+1})}\right] y_t^N(s^t) \tag{76}$$

Table B.1 reports the average debt tax under different fiscal policy regimes for two values of the discount factor, $\beta = 0.94$ (baseline) and $\beta = 0.91$ (low discount factor). The first and third columns correspond to the constrained-efficient allocation, where the government sets both capital controls and fiscal policy optimally, without necessarily following the Samuelson rule. The second and fourth columns correspond to a planner who follows the Samuelson rule but can choose capital controls optimally.

The table shows that the average tax increases as the discount factor declines. Moreover, the average tax is higher under Samuelson commitment because crises are particularly costly when the government lacks ex-post intervention tools. In fact, by adhering to the Samuelson rule under a parametrization with $\sigma\xi > 1$, the government further amplifies the severity of crises. Importantly, under a parametrization close to Bianchi (2011), the model delivers an average debt tax that is quantitatively in line with the values in Bianchi (2011), providing a useful benchmark for the magnitude of such policy interventions in practice.

C Additional Plots and Tables

C.1 Policy Functions

Figure C.1: Debt Policy Function for Different Values of ϕ

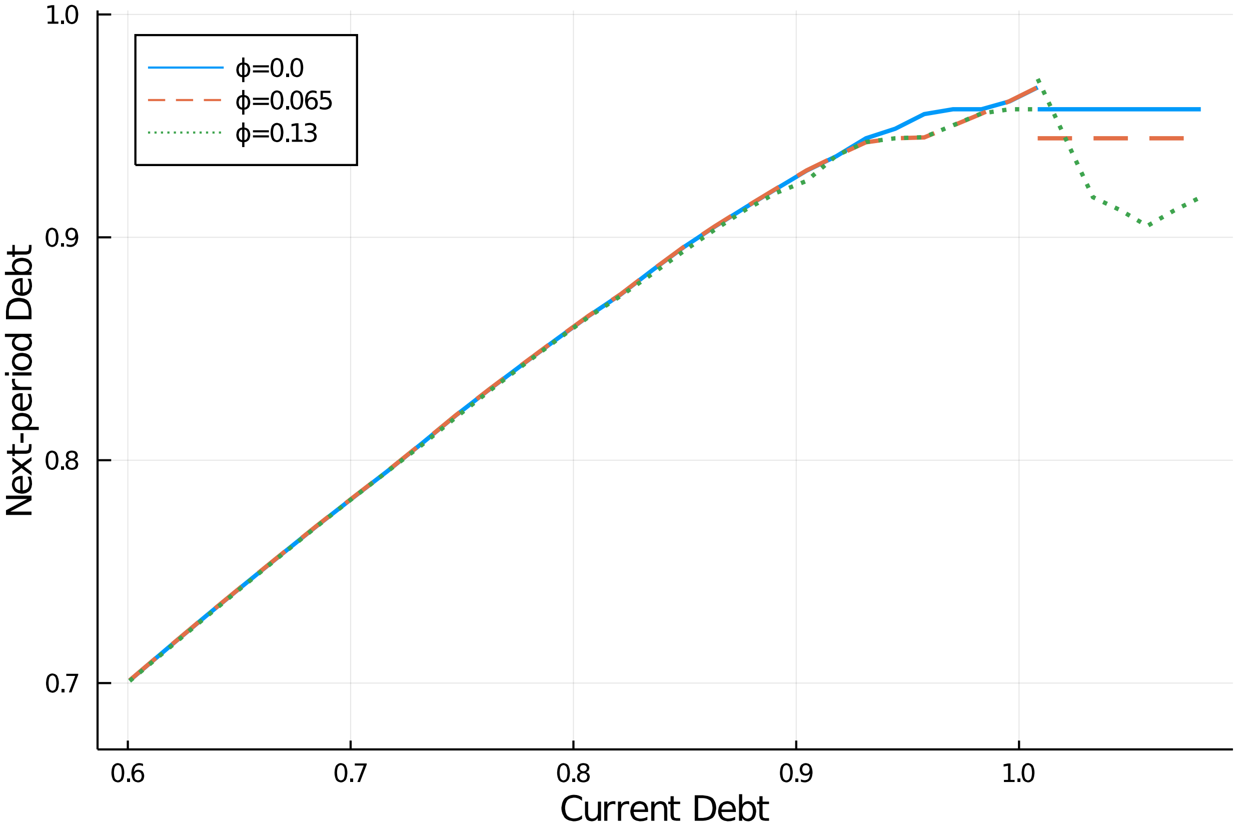


Figure C.2: Public Consumption Policy Function for Different Values of ϕ

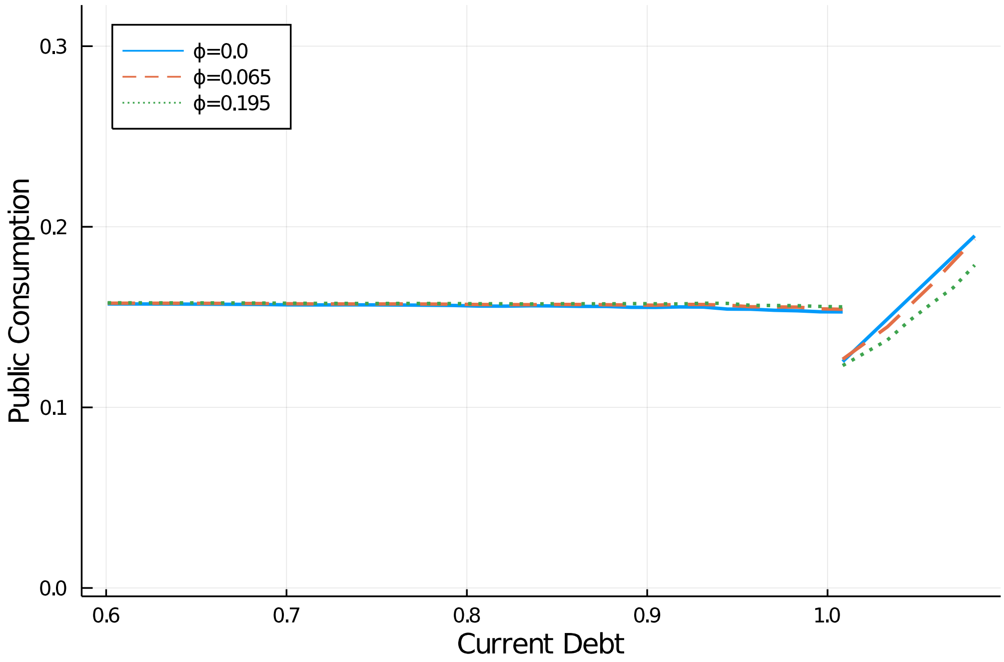


Figure C.3: Optimal Deviation from Samuelson for Different Values of ϕ

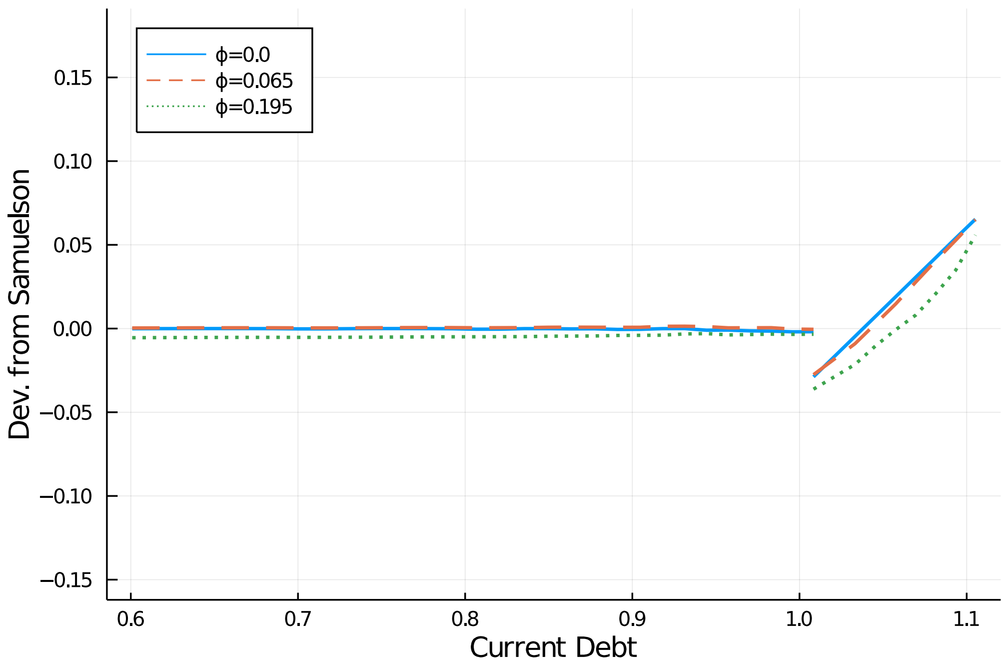
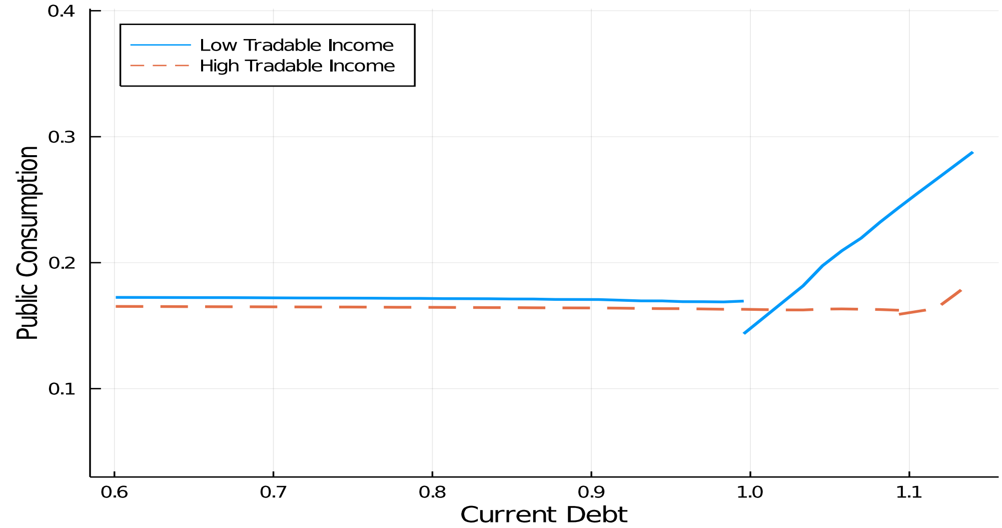


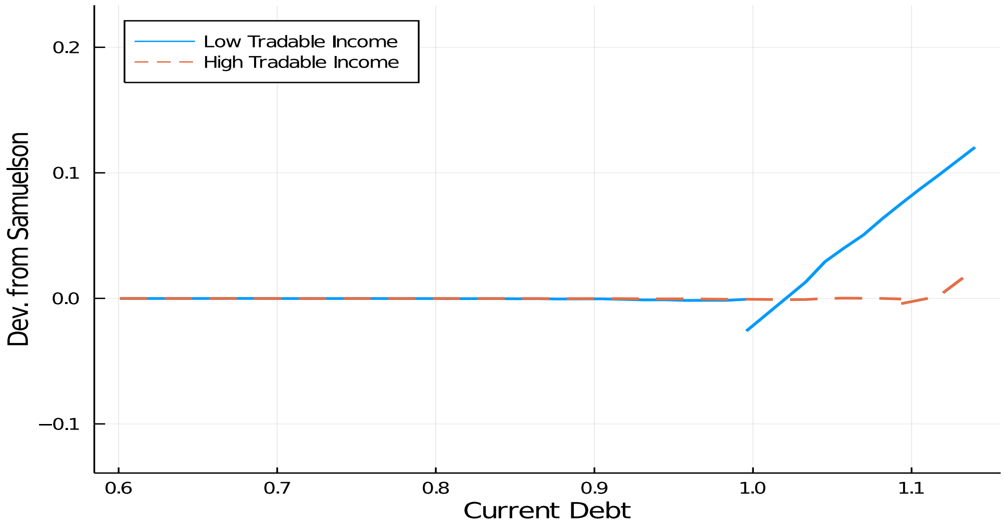
Figure C.4: Public Consumption Policy Functions



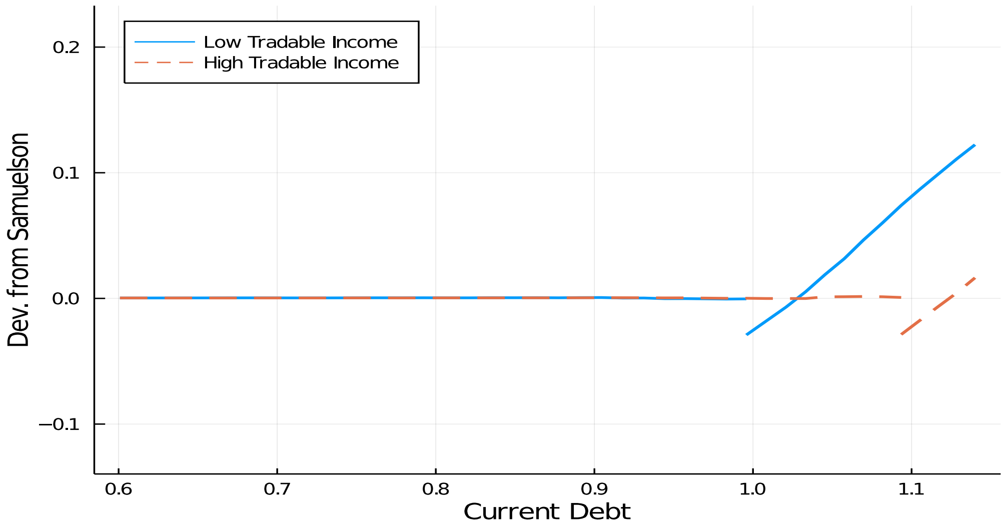
(a) $\phi = 0$

(b) $\phi > 0$

Figure C.5: Deviations from Samuelson

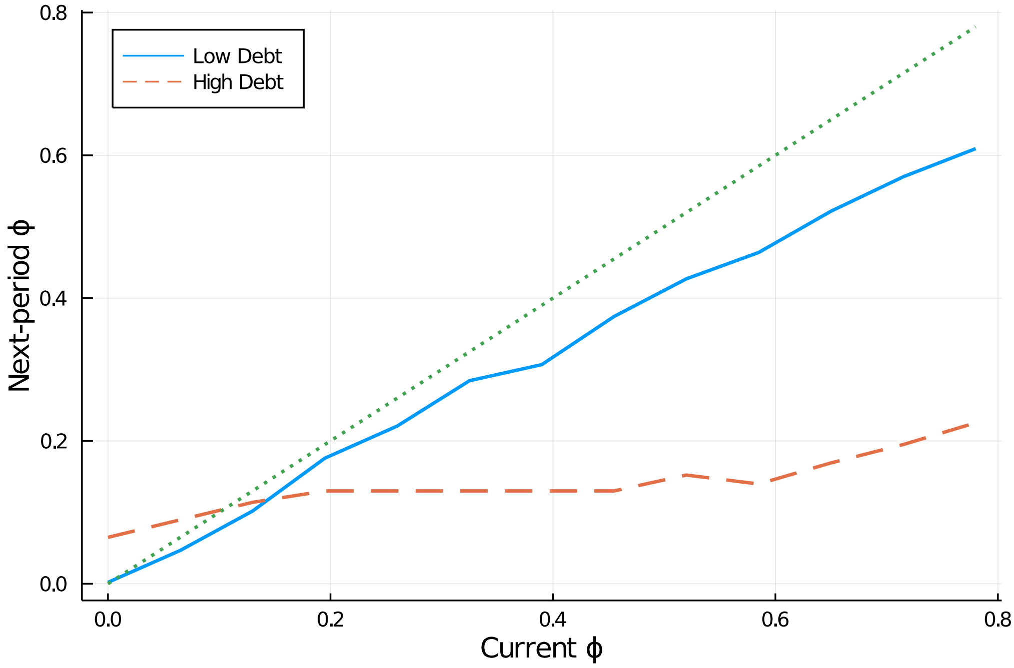


(a) $\phi = 0$



(b) $\phi > 0$

Figure C.6: Law of Motion of ϕ



Notes : The green dotted line represents the 45-degree line.

Figure C.7: Debt Policy Function - Time-consistent

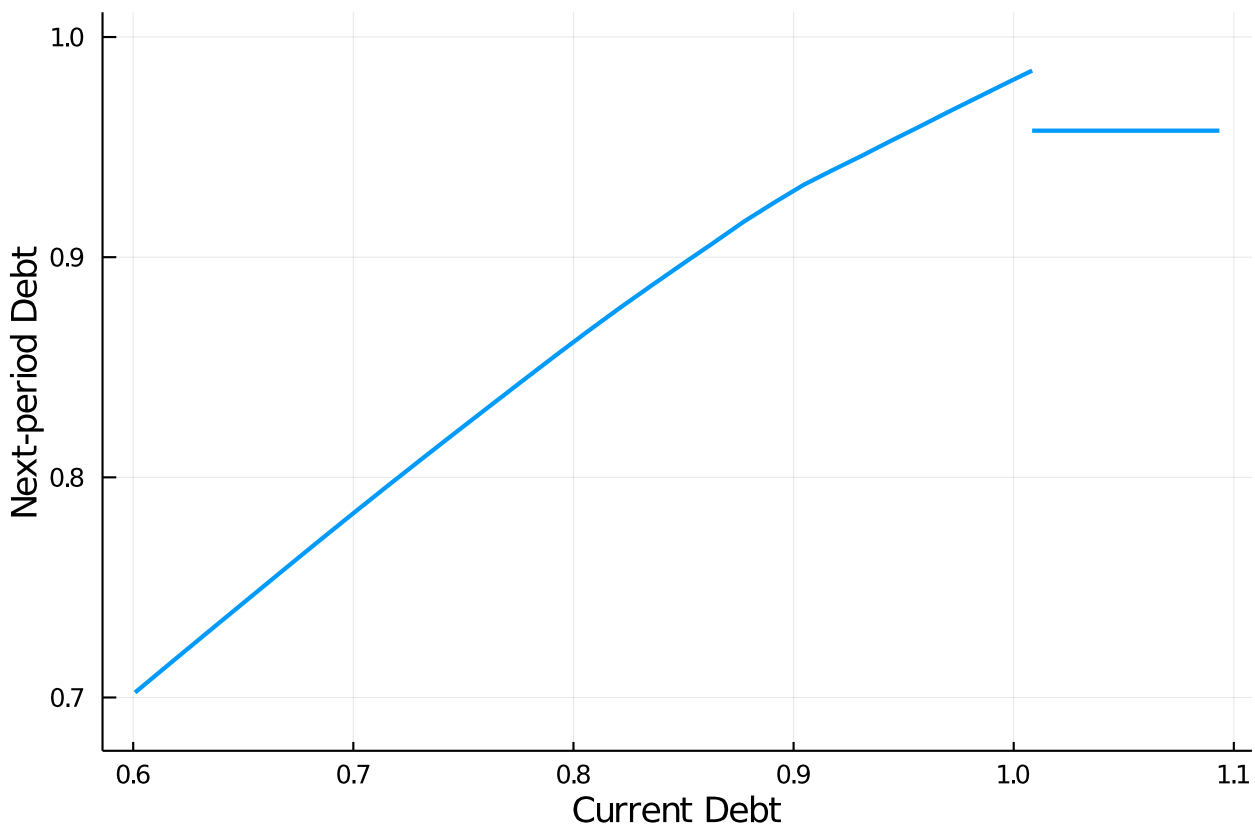


Figure C.8: Public Consumption Policy Function - Time-consistent

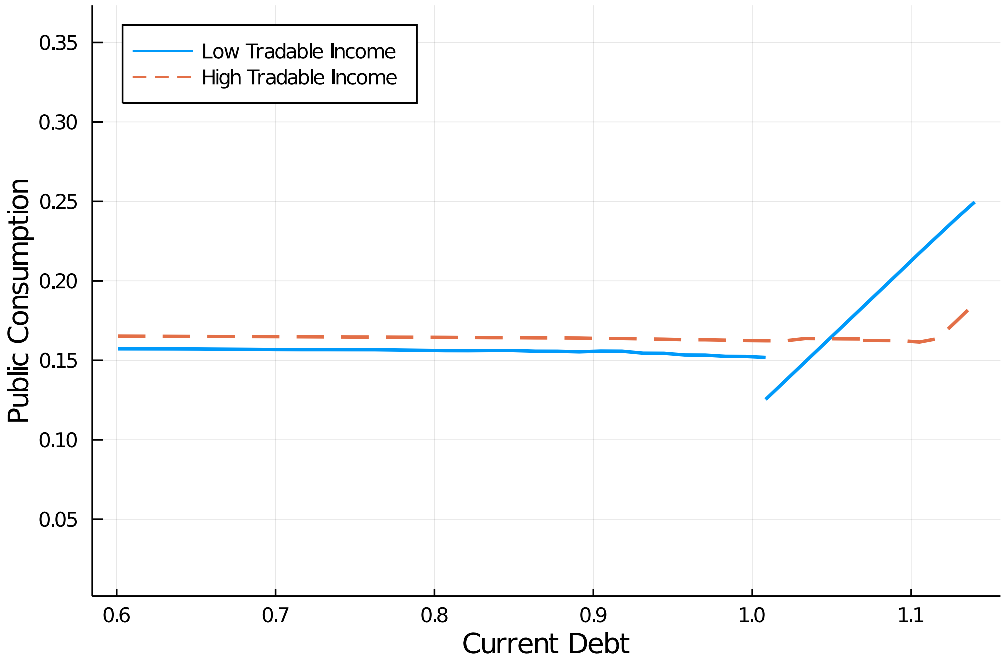
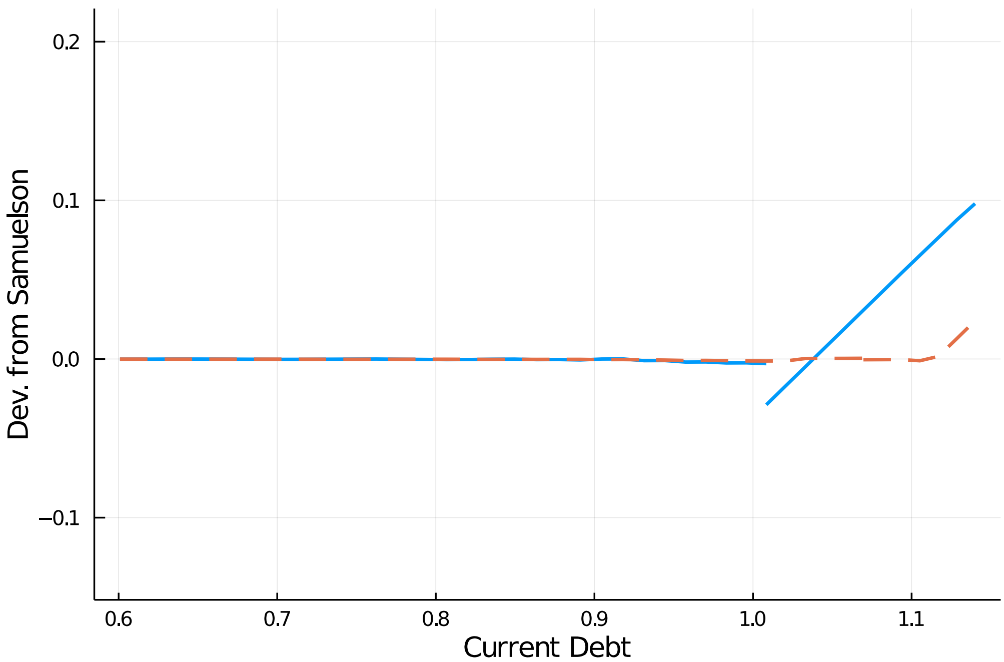
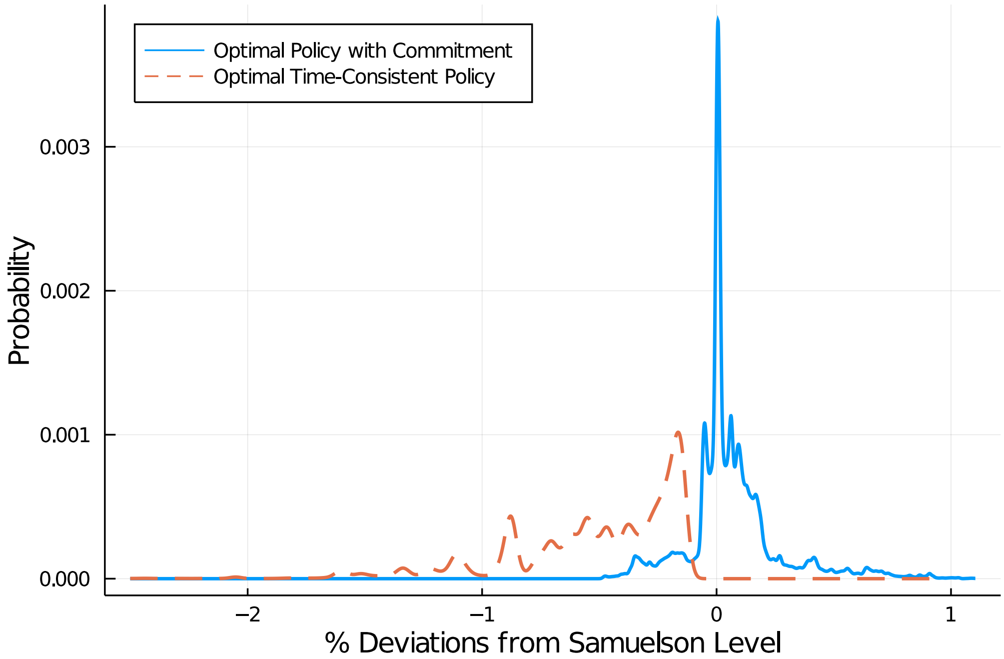


Figure C.9: Optimal Deviation from Samuelson - Time-consistent



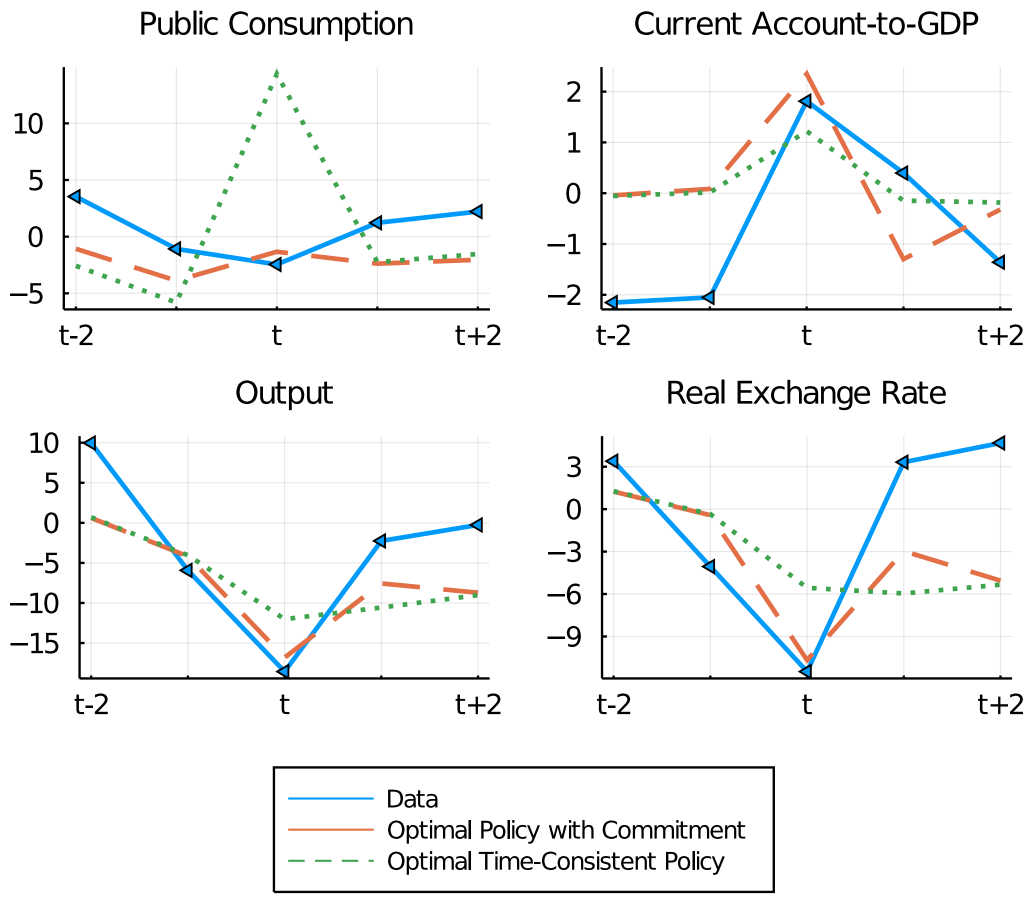
C.2 Crisis Dynamics in the Model and in the Data

Figure C.10: Distribution of Deviations from Samuelson Conditional on Slack Collateral Constraint



Notes : This figure plots the distribution of deviations from the Samuelson level, conditional on the collateral constraint not being binding in the current period for the social planner under the Ramsey-optimal policy - the solid line - and under the optimal time consistent policy - the dashed line.

Figure C.11: Crisis Dynamics: Model vs Data

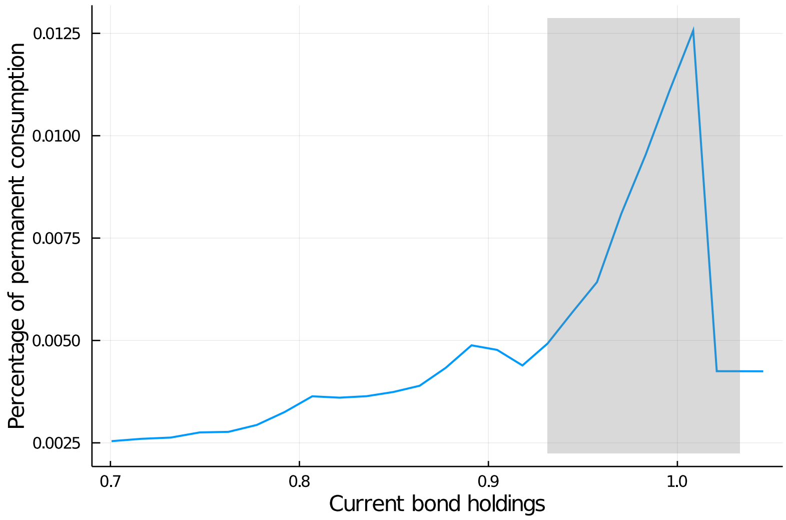


Notes : This figure plots aggregate dynamics during the typical financial crisis. A crisis episode is defined as the first period where the collateral constraint is binding and the current account increases by more than one standard deviation. The figure compares crisis dynamics in the data - the solid blue line - under the Ramsey-optimal policy - the solid red line - and under the optimal time-consistent policy - the dashed line. All variables are expressed in percentage deviations from their average values in the ergodic distribution.

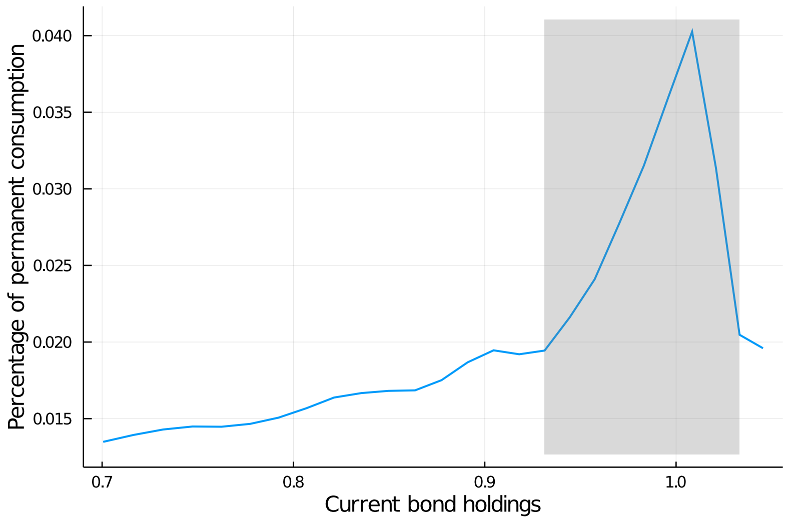
C.3 Welfare Gains

Figure C.12: Welfare Gains from Commitment and Capital Controls

(a) Welfare Gains from Commitment Conditional on Income



(b) Welfare Gains from Capital Controls Conditional on Income



Notes : This figure plots the welfare gains as a function of current debt conditional on income. Panel (a) plots the welfare gains from gaining commitment relative to the optimal time-consistent policy. Panel (b) plots the welfare gains from gaining access to capital control taxes relative to optimal time-consistent policy.

D Sensitivity Analysis

Table D.1: Untargeted Moments for Different Elasticities

		Low Intratemporal Elasticity		High intertemporal Elasticity	
Moment	Baseline	$\xi = 0.77$	$\xi = 0.71$	$\sigma = 2.50$	$\sigma = 2.96$
Standard Deviations					
$\sigma(c)/\sigma(GDP)$	1.04	1.05	1.04	1.00	1.02
$\sigma(p_N g)/\sigma(y)$	1.09	1.12	1.12	1.10	1.13
$\sigma(RER)$	4.04	4.56	4.03	3.67	4.14
Correlations with GDP					
$\text{corr}(c, GDP)$	0.98	0.98	0.98	0.99	0.98
$\text{corr}(g, GDP)$	0.88	0.86	0.75	0.90	0.91
$\text{corr}(RER, y)$	0.31	0.31	0.30	0.29	0.31
$\text{corr}(\text{current account}, y)$	−0.19	−0.22	−0.14	−0.11	−0.14
$\text{corr}(\text{trade balance}, y)$	−0.33	−0.35	−0.32	−0.23	−0.33

Notes : This table reports untargeted moments implied by the model under Ramsey-optimal policy for the baseline model, two models with same parameters but lower ξ, and two models with same parameters but higher σ. y denotes output at current prices, GDP denotes output at constant prices, and the real exchange rate (RER) is defined as the inverse of the relative price of nontradables.

Tables D.1 and D.2 present sensitivity analyses of the model's quantitative predictions with respect to two key parameters: the intratemporal elasticity of substitution, ξ, and the intertemporal elasticity of substitution, σ. Table D.1 reports untargeted moments under Ramsey-optimal policy for the baseline calibration, two parameterizations with same parameters as the baseline but lower ξ, and two parameterizations with same parameters as the baseline but higher σ. The results indicate that the model's fit remains broadly consistent across specifications. The correlation between public consumption and GDP, $\text{corr}(g, GDP)$, decreases when the intratemporal elasticity ξ is lower, as the product $\sigma\xi$ becomes closer to one. This weakens the complementarity between tradable and non-tradable consumption in the utility function, reducing the procyclicality of public spending. Conversely, increasing σ raises $\sigma\xi$ further above one, strengthening complementarity and resulting in a higher correlation between public consumption and GDP.

Table D.2 displays the average impact responses of selected variables during crisis episodes under three policy regimes. Under the optimal policy with commitment, the response of public consumption becomes more expansionary as the intratemporal elasticity ξ is lowered. In contrast, under the time-consistent policy, public consumption becomes less expansionary. When the intertemporal elasticity σ is increased, the optimal policy under commitment becomes slightly more contractionary. Interestingly, the time-consistent policy responds quite differently. Deviations from the Samuelson rule decline significantly as σ rises, and for values of σ close to 3, these deviations under commitment and time-consistency become very close to each other. This convergence suggests that higher intertemporal elasticity mitigates the inefficiencies caused by the lack of policy commitment. Simulations also show that as σ increases, deviations from the Samuelson rule tend to be more negative prior to crises, indicating that the government increasingly relies on prudential fiscal adjustments to improve resilience.

Table D.2: Impact Responses during Crises for Different Elasticities

Baseline			
	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	2.35%	1.14%	0.1%
Private consumption	−9.38%	−10.21%	−6.92%
Public consumption	−1.35%	14.22%	−2.46%
Deviation from Samuelson	5.19%	21.26%	3.09%

Low Intratemporal Elasticity			
$\xi = 0.77$	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	2.17%	0.92%	0.16%
Private consumption	−9.37%	−9.56%	−6.87%
Public consumption	0.16%	11.18%	−3.21%
Deviation from Samuelson	6.38%	17.61%	2.1%
$\xi = 0.71$	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	1.72%	0.74%	0.13%
Private consumption	−8.27%	−8.38%	−6.11%
Public consumption	0.94%	9.4%	−2.82%
Deviation from Samuelson	6.21%	14.82%	1.72%

High Intertemporal Elasticity			
$\sigma = 2.50$	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	1.71%	0.79%	0.03%
Private consumption	−8.83%	−9.28%	−6.64%
Public consumption	−1.54%	6.13%	−3.59%
Deviation from Samuelson	5.05%	12.74%	1.98%
$\sigma = 2.96$	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent	Optimal Policy w/ Capital Controls
Current account-GDP	1.9%	0.29%	−0.01%
Private consumption	−9.44%	−7.91%	−6.61%
Public consumption	−1.98%	−0.79%	−4.88%
Deviation from Samuelson	5.21%	5.52%	0.99%

Notes: This table shows the average impact response during crises across three policy regimes. Results are shown for the baseline model, two models with same parameters but lower ξ, and two models with same parameters but higher σ. All variables are expressed as percentage deviations from their respective ergodic averages.