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 find that significant fiscal expansions are not optimal due to the borrowing inefficiency, despite the potential for considerable ex-post gains from stabilizing the real exchange rate.

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.[1] I contribute to this debate by studying the optimal design of fiscal policy in a small-open-economy model with financial constraints. I find that large fiscal expansions may backfire, as their anticipation can increase borrowing incentives, making the economy more susceptible to financial instability.

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.[2]

I extend the standard framework by allowing the government to supply a share of non-tradables 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,

[1] See Freedman et al. (2010), Eggertsson and Krugman (2012), Corsetti et al. (2014), Chian Koh (2016), Bernardini et al. (2020), Liu (2022) and Siming et al. (2024)

[2] Korinek and Mendoza (2014) provide a comprehensive review of the inefficiencies arising when agents' borrowing capacity depends on equilibrium prices. Since households do not internalize the impact of borrowing decisions on collateral values, there is a wedge between private and social marginal utilities of wealth, resulting in overborrowing or underborrowing relative to the constrained efficient benchmark.

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 household's excessive borrowing. Depending on the model parameters, optimal spending may be higher or lower than in the frictionless benchmark. Under commitment, due to the government's past promises, it is not possible to derive general conditions for whether the optimal policy is expansionary or contractionary. 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.[3] To understand the intuition behind this result consider the effects of a fiscal tightening. A decrease in public consumption makes nontradables relatively more abundant for private consumption, triggering two opposing effects; on the one hand, the increases availability of nontradables shifts spending away from the tradable sector, discouraging borrowing; on the other hand, it makes current total con-

[3]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.

sumption relatively more appealing than future consumption, encouraging borrowing. For a fiscal tightening to effectively curb debt accumulation, the substitution channel must dominate. Under this condition, reducing government spending helps mitigate the overborrowing problem, steering private borrowing towards the socially efficient level.

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 Guidance" 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 10 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 forward guidance 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 are successful in driving the probability of a crisis virtually to zero. 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 where endogenous collateral constraints.[4] 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. 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. While Coulibaly (2023) characterizes the optimal policy without commitment, I consider different assumptions about the government's ability to commit. I show that the Ramsey-optimal policy entails a forward guidance motive that constraints fiscal expansions during crises episodes. By providing a numerical characterization of the optimal policy with and without commitment, I show that the forward guidance motive is quantitatively important, providing a novel rationale for adopting a conservative fiscal stance in the presence of financial frictions.[5]

[4] 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 time-consistent macroprudential policies include Benigno and Fornaro (2012), 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 where future prices instead of current ones enter the collateral constraint. They show that in this case the competitive equilibrium is in fact constrained-efficient.

[5] The approach I follow in this paper is also similar to Jeanne and Korinek (2020), who provide a joint analysis of ex-ante and ex-post policy interventions in a model of financial crises.[6] In contrast, I consider

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), Farhi and Werning (2017). 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.[7] The closest papers, in this regard, are Liu (2022) and Siming et al. (2024) who introduces 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.[8] 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.

Layout. The remainder of the paper is organized as follows: Section 2 lays out the

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.

[7] Empirical studies, which include Farhi and Werning (2016) and Nakamura and Steinsson (2014), have estimated a wide set of fiscal multipliers. Other papers focusing on the effect of financial frictions on fiscal multipiers include Fernández-Villaverde (2010), Eggertsson and Krugman (2012) and Carrillo and Poilly (2013)

[8] Woodford (2011) illustrates the stabilization capacity of fiscal policy with nominal rigidities via simple examples for which fiscal multipliers can be analytically characterized.

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 Argentina, compares aggregate dynamics under different policy regimes, and discusses welfare gains from commitment and from optimal capital controls.

2 Model

I consider a 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 $a \in (0,1)$.[9]

[9]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, concave, and homogeneous of degree one.

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:[10]

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

Households take public consumption and the relative price as given and chooses 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 of nontradable goods, using the proceedings from lump-sum taxes, T_t, to maintain a

[10] Ottonello et al. (2022) have shown that the specific form of collateral used in debt contracts matters for policy. To focus on the interaction between fiscal policy and borrowing inefficiencies, 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) and Mendoza (2010)).

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, such function is increasing in g_t^N

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

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 rises 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.

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.[11]

[11] 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.

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

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

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

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

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

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

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

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

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

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

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

where

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

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

$$\underbrace{-u_N(s^t) + v_N(s^t)}_{\text{Samuleson}} \underbrace{-\phi_t(s^t)u_{TN}(s^t)}_{\text{Prudential}} \underbrace{+\phi_{t-1}(s^t)\beta R \pi_{t|t-1} u_{TN}(s^t)}_{\text{Forward Guidance}} = 0 \tag{21}$$

This expression consists of three 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 two terms are linked to the multipliers, $\phi_t(s^t)$ and $\phi_{t-1}(s^t)$, associated with the household's Euler equation. Because of the borrowing inefficiency, these multipliers can be non-zero.[12] 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 given by

$$u_T(s^t) - \beta R \mathbb{E}_t[u_T(s^{t+1})] = \beta R \mathbb{E}_t \mu_{t+1}^{\text{sp}}(s^{t+1})\kappa \mathcal{P}_T(s^{t+1}) y_{t+1}^N(s^{t+1}) \tag{22}$$

If the collateral constraint binds with positive probability at time $t+1$, this condition is in-

[12] 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.

compatible 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, $\beta R\mathbb{E}_t[u_T(s^{t+1})] + \beta R\mathbb{E}_t\mu^{\text{sp}}_{t+1}(s^{t+1})\kappa\mathcal{P}_T(s^{t+1})y^N_{t+1}(s^{t+1})$.

The "Prudential" and "Forward Guidance" terms show that it is optimal for the government to deviate from the Samuelson level when $\phi_t(s^t)$ or $\phi_{t-1}(s^t)$ are non-zero. These deviations allow the government to steer private borrowing closer to the socially efficient level without violating the household's optimality conditions. The two terms reflect different ways in which the government can influence private borrowing behavior: first, by altering the marginal utility of present consumption - captured by the "Prudential" term -, and second, by altering the marginal utility of future consumption through a commitment to change public spending in the next period - captured by the "Forward Guidance" term.

Equation (21) shows that the signs of the "Prudential" and "Forward Guidance" terms depend on those of $u_{TN}(s^t)$, $\phi_t(s^t)$ and $\phi_{t-1}(s^{t-1})$. 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 $\sigma\xi < 1$, $u_{TN}(s^t)$ is positive, so increasing $g^N_t(s^t)$ leads to higher borrowing;
- if $\sigma\xi > 1$, $u_{TN}(s^t)$ is negative, so increasing $g^N_t(s^t)$ leads to lower borrowing;
- if $\sigma\xi = 1$, $u_{TN}(s^t)$ is equal to zero, so borrowing is independent of $g^N_t(s^t)$.

if $\sigma\xi = 1$, both "Prudential" and "Forward Guidance" terms drop out of Equation 21, implying that optimal public consumption is exactly at the Samuelson level.[13]

The condition on the elasticity parameters reflects two opposite effects: a substitution effect and a consumption-smoothing effect. To illustrate, suppose the government reduces

[13] Deviating from Samuelson does not help addressing the inefficiency when the households' optimal level of borrowing is unaffected by changes in $g^N_t(s^t)$.

expenditures. Lower public consumption increases the share of nontradables available for private consumption, triggering two distinct forces

- Substitution effect: As nontradables become more available, tradable goods become relatively scarcer. This encourages households to substitute away from tradables and increase their consumption of nontradables.

- Consumption-smoothing effect: As nontradables become more available, current total consumption becomes more attractive, encouraging households to increase their overall consumption basket, including tradables.

In response to lower public expenditures, the substitution effect tends to discourage borrowing, while the consumption-smoothing effect tends to encourage it. The prevailing effect will ultimately determine how changes in public consumption impact the level of private debt.[14]

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 $u_T(s^t) - \beta R \mathbb{E}_t[u_T(s^{t+1})] < 0$, 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

[14] Interestingly, Guerrieri et al. (2022) provide the same conditions on the elasticises 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.

to the fact that the multiplier $\phi_t(s^t)$ can be positive or negative.[15] Whether the optimal policy is expansionary of 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:

$$\underbrace{-u_N(s^t) + v_N(s^t)}_{\text{Samuleson}} \underbrace{- \left[u_T(s^t) - \beta R \mathbb{E}_t \lambda_{t+1}(s^{t+1})\right] \frac{\kappa \mathcal{P}_N(s^t) y_t^N(s^t)}{1 - \kappa \mathcal{P}_T(s^t) y_t^N(s^t)}}_{\text{Collateral}}$$
$$\underbrace{-\phi_{t-1}(s^{t-1}) \beta R \pi(s^t|s^{t-1}) \left[u_{TN}(s^t) - u_{TT}(s^t) \frac{\kappa \mathcal{P}_N(s^t) y_t^N(s^t)}{1 - \kappa \mathcal{P}_T(s^t) y_t^N(s^t)}\right]}_{\text{Forward Guidance}} = 0 \quad (23)$$

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.

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

[15] The fact that the multipliers $\phi_t(s^t)$ can be positive or negative means that households can underborrow or overborrow relative to the government.

Equation 23 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.

Numerically, I find that the "Collateral" and "Forward Guidance" generally have opposite signs so the optimal deviation from the Samuelson' level cannot be signed analytically. Intuitively, government expenditures exceeds 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.

3.3 Optimal Policy without Commitment

Since the Euler equation is a forward-looking constraint, the Ramsey-optimal plan is time-inconsistent.[16] 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.

[16] Quantitatively, I find that the government has a particularly strong incentive to renege on past commitments during crisis periods, engaging in significantly larger fiscal expansion than promised ahead of the crisis.

$$c^T = y^T + \frac{b'}{R} - b \qquad \lambda$$

$$\frac{b'}{R} \leq \kappa\Big(y^T + \mathcal{P}(c^T, y^N - g^N)y^N\Big) \qquad \mu^{\text{sp}}$$

$$\mathcal{P}(c^T, y^N - g^N) = \frac{A_N(c_t^T, y_t^N - g_t^N)}{A_T(c_t^T, y_t^N - g_t^N)} \qquad \eta$$

$$u_T(c^T, y^N - g^N) - \mathbb{E}_{\mathbf{y}'|\mathbf{y}}\big[\beta R u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}'))\big] = \mu \qquad \phi$$

$$\mu \geq 0 \qquad \delta$$

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

Similarly to the problem under commitment, the set of constraints include, in order: the resource constraint, the collateral constraint, the expression for the relative price on non-tradables, 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

$$-u_N + v' - [\mu^{\text{sp}} + \zeta\mu]\, \kappa \mathcal{P}_N y^N - \phi u_{TN} = 0 \tag{24}$$

$$u_T - \lambda + \phi u_{TT} + [\mu^{\text{sp}} + \zeta\mu]\, \kappa \mathcal{P}_T y^N = 0 \tag{25}$$

$$\frac{\lambda}{R} - \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \frac{[\mu^{\text{sp}} + \zeta\mu]}{R} - \phi \frac{\beta R \partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \right]}{\partial b'} = 0 \tag{26}$$

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 governments set 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 the 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 expansionary if $\sigma\xi > 1$, contractionary if $\sigma\xi < 1$ and exactly at the Samuelson level if $\sigma\xi = 1$.

Using the terminology from the previous section, if $\sigma\xi > 1$ the substitution effect prevails. In this case, to reduce debt towards the efficient level, the government lowers g^N below the Samuelson' level, making nontradable goods relatively more abundant and shifting consumption away from the tradable sector. Conversely, If $\sigma\xi < 1$ the consumption-smoothing effect prevails, leading the government to increase g^N above the "Samuelson" benchmark, discouraging borrowing by making overall private consumption less attractive.

Finally, Part 2.(b) considers the case where the collateral constraint is slack for the government but binding for the households. 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.[17]

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 4.2 describes crisis dynamics under the optimal fiscal policy with and without commitment. Section 4.3 introduces capital controls. Finally Section 4.4 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.[18] The model parameters are divided into three subsets.

[17] 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.

[18] 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	Interes 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 report 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.

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 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

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.

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%, in Bianchi and Mendoza (2020) for a sample of emerging economies).

Table 3 shows that the calibrated economy, both with and without commitment, closely approximates the empirical targets.[19] 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.[20]This result is closely tied to the calibration, where the intratemporal elasticity of substitution, ξ, exceeds the intertemporal elasticity, σ. A high degree of substitutability

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

[20]In Appendix C.1 I plot policy functions for debt, public consumption and deviations from Samuelson for both the Ramsey-optimal policy and the time-consistent equilibrium. It is important to note that all policy functions exhibit discontinuities. To gain some intuition for this, consider the case where $\sigma\xi = 1$. In this situation, the only way for the government to reduce private borrowing is by ensuring that the borrowing constraint is binding. However, for the constraint to bind, the reduction in government spending—relative to the Samuelson level—must be sufficiently large. The discontinuities in the policy functions reflect the discrete downward jump in government spending required to trigger the binding constraint and drive down debt when households overborrow.

Table 3: Targeted Moments

Moment	Description	Data	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent
$\mathbb{E}[y_T/y]$	Share of tradable output	32%	31.23%	31.22%
$\mathbb{E}[p_N g/y]$	Average govt. spending/output	12%	11.55%	11.61%
$\mathbb{E}[b/y]$	Average NFA/output	−29%	−29.67%	−30.15%
	Frequency of crisis	5%	4.90%	4.37%

Notes : This table shows the model counterparts of four targeted moments. It reports the values implied by the model under the Ramsey-optimal policy and those implied under 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.

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.

4.2 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.[21]

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

Table 4: Untargeted Moments

Moment	Data	Optimal Policy w/ Commitment	Optimal Policy Time-Consistent
Standard Deviations			
$\sigma(c)/\sigma(GDP)$	1.11	1.05	1.09
$\sigma(p_N g)/\sigma(y)$	1.06	1.06	1.02
$\sigma(RER)$	8.20	3.90	2.67
Correlations with GDP			
$\text{corr}(c, GDP)$	0.88	0.98	0.98
$\text{corr}(g, GDP)$	0.37	0.82	0.40
$\text{corr}(RER, y)$	0.41	0.31	0.30
$\text{corr}(\text{current account}, y)$	-0.63	-0.17	-0.03
$\text{corr}(\text{trade balance}, y)$	-0.84	-0.31	-0.27

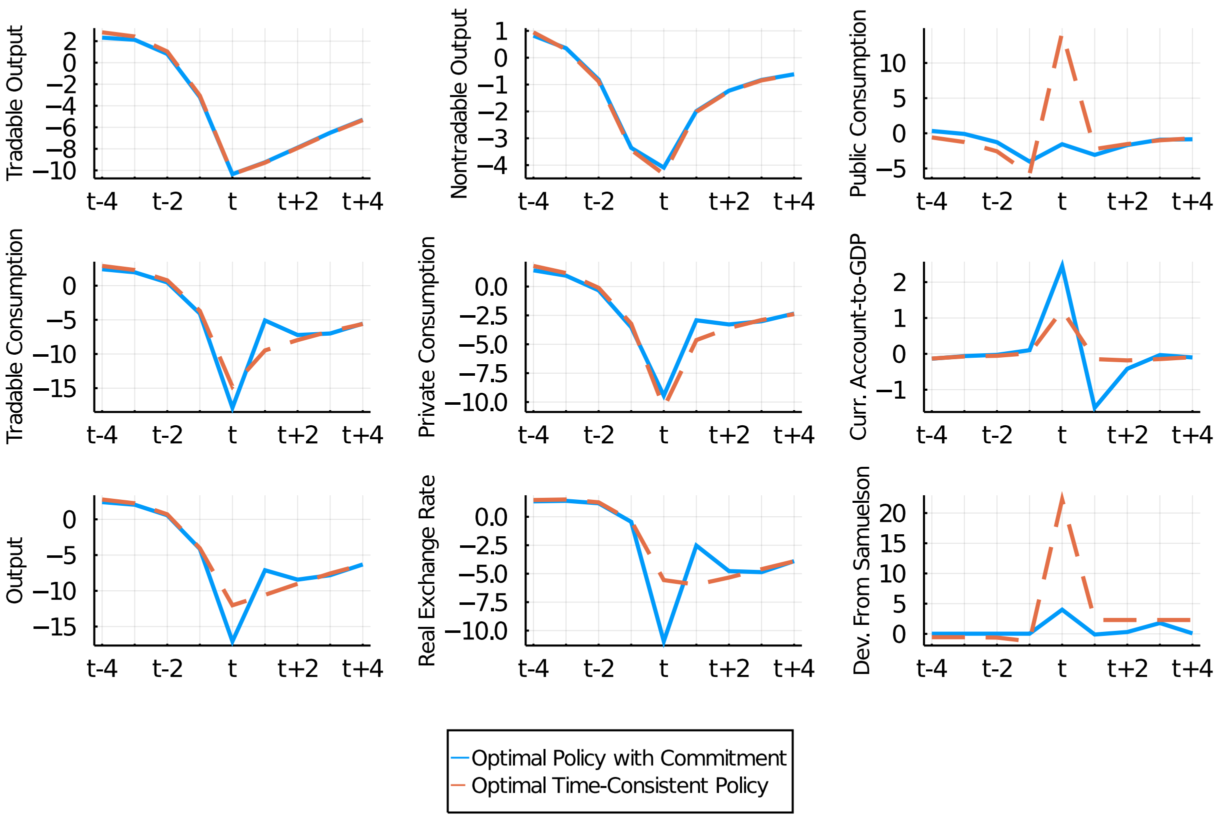
Notes : This table shows the model counterparts for a set of untargeted moments. It reports the values implied by the model under the Ramsey-optimal policy and those implied under the optimal time-consistent policy. In the table, y denotes output at current prices while GDP denotes output at constant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

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 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 behave similarly. The Ramsey government essentially tracks the Samuelson level, while the time-inconsistent government slightly deviates downward from that benchmark to deter private borrowing.[22]

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,

[22]Without commitment, deviations from the Samuelson level are negative prior to the crisis, consistent with Proposition 1 and given a calibration such that $\sigma\phi > 1$

Figure 1: Typical Financial Crisis



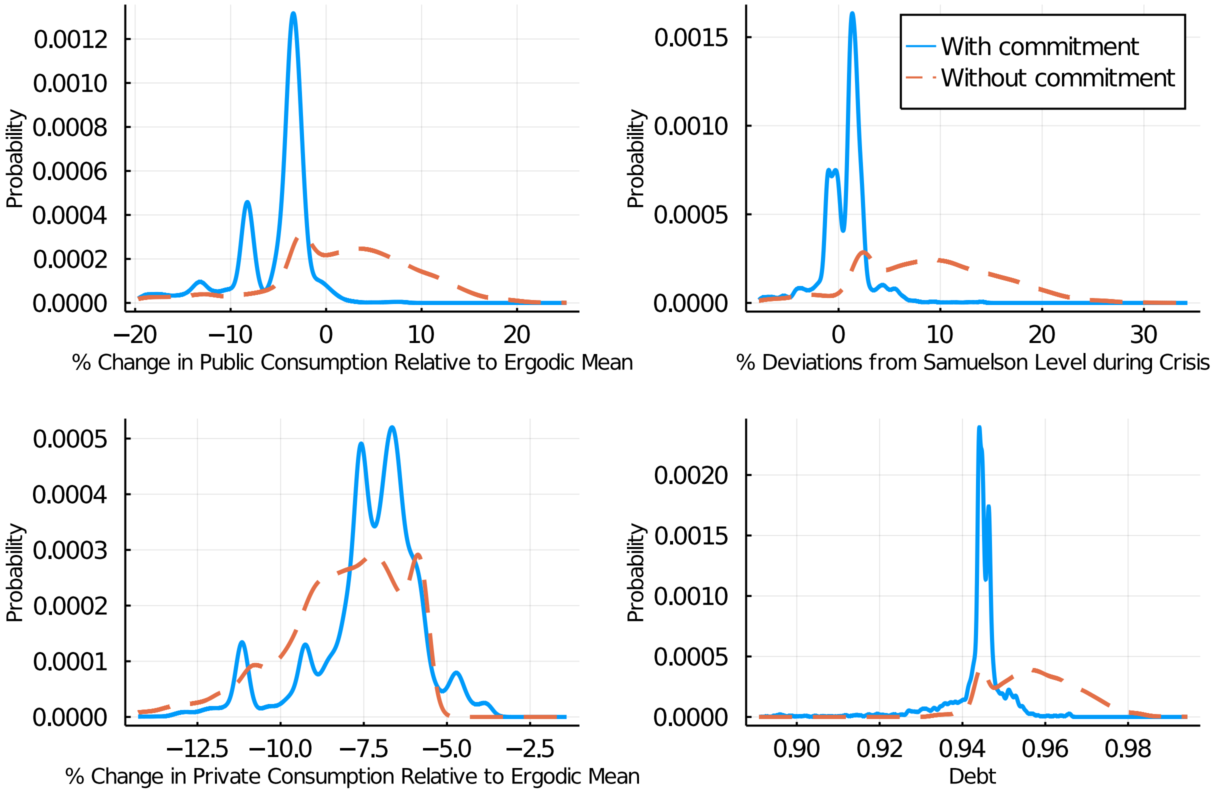
Notes : This figure plots aggregate dynamics during the typical financial crisis. A crisis episode is defined as the first period where the collateral constraint is binding and the current account increases by more than one standard deviation. The figure compares model-implied dynamics under the Ramsey-optimal 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.

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 interventions when the constraint binds leads to excessive borrowing by households. Therefore, under commitment, public spending during crises is much more restrained. Figure 1 shows that during the typical crisis public consumption under commitment lies below the average level, even though the collateral constraint is binding.[23]

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

[23]Figure C.9 in Appendix C.2 shows that the model-implied dynamics are in line with the data.

Figure 2: 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. The bottom-right panel plots the unconditional ergodic distribution of debt under the Ramsey-optimal policy and under the optimal time consistent policy.

expansionary policy, they are significantly smaller under commitment. For further insight, the upper-right panel of Figure 2 illustrates the distribution of deviations from Samuelson during crises. 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. 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 are in fact quite similar.

4.3 Optimal Policy With Capital Controls

In this section, I study the optimal fiscal policy in a setting where the government has 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. Since none of these constraints are forward-looking, the planner's problem is time-consistent.

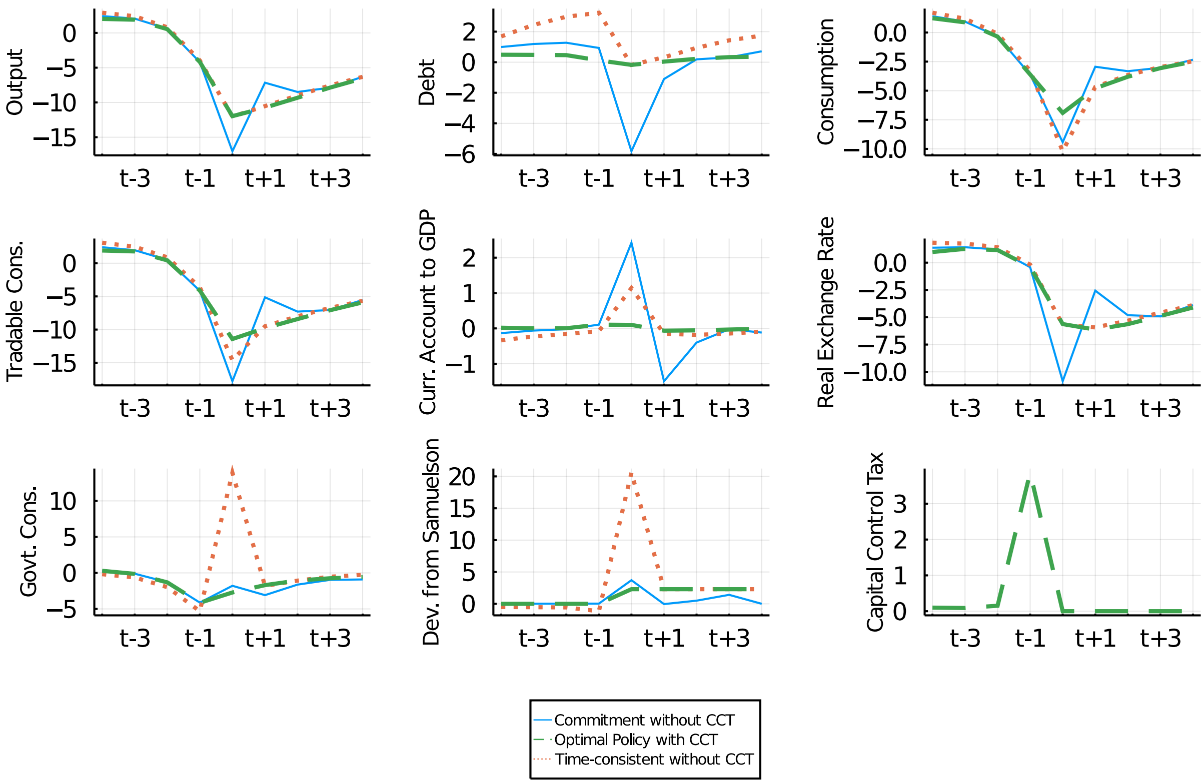
The first-order condition with respect to $g_t^N(s^t)$ is the following

$$-u_N(s^t) + v_N(s^t) - \mu^{\text{sp}}(s^t) \kappa \mathcal{P}_N(s^t) y_t^N(s^t) = 0 \tag{27}$$

This equation shows the planner optimally deviates from the Samuelson level when the collateral constraint is binding. By increasing spending, the government relaxes the collateral constraint, boosting 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 overborrowing inefficiency.

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

Figure 3: 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 variable are skewed to the right.

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.

The results, presented in Figure 3, 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,

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	2.42%	1.14%	0.10%
Private consumption	−9.43%	−10.2%	−6.91%
Public consumption	−1.79%	13.91%	−2.72%
Deviation from Samuelson	5.02%	21.24%	3.07%

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.

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 constraints become 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 of 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 (2.42% vs 1.14%), and is essentially zero if debt taxes are employed. While private consumption behave similarly across policy regimes, government consumption exhibits the largest variation, rising substantially under the time-consistent policy (13.91%) while staying below its ergodic average in the other two cases (-1.79% with commitment and-2.72% 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 (21.24% vs 5.02% with commitment and 3.07% with capital controls).

4.4 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 computed through the following equation:

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

$$(1 + \gamma(b, \mathbf{y}))^{1-\sigma} V^{\text{tax}}(b, \mathbf{y}) = V^{\text{no tax, nc}}(b, \mathbf{y}) \tag{29}$$

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.[24]

Table 6 shows that the average welfare gain from accessing a commitment technology is small, at just 0.002%. The negative correlation with output reflects the macroprudential nature of fiscal commitments, which promise to restrict future spending as income start 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%, but smaller than those found in related papers, such as Bianchi (2011) and Ottonello et al. (2022). The modest welfare gains are particularly noteworthy, given that debt taxes effectively reduce

[24] 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.

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	0.002%	0.019%
Standard deviation	0.002	0.007
Correlation with output	−0.325%	−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.

the probability of a crisis to nearly zero. The underlying intuition is that fiscal stimulus alone reduces the costs of crises, meaning that addressing the borrowing inefficiency through debt taxes results in only modest improvements.

5 Conclusions

In this paper I study the optimal design of fiscal policy in economies that are subject to borrowing constraints. The main finding is that while fiscal stimulus can be beneficial during crises by relaxing collateral constraints, its anticipation can lead to increased borrowing and heightened vulnerability to future financial instability.

I characterize and compare the optimal policies with a without commitment, finding 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 instead implements large fiscal expansions during crises.

The quantitative results, based on the model calibrated to the Argentinean economy, highlights the importance of forward guidance in shaping optimal fiscal policy. The government's commitment to limiting fiscal easing during crises can significantly reduce the likelihood of prolonged financial instability. My findings challenges 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.

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

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

$$u_T - \lambda + \phi u_{TT} + [\mu^{\text{sp}} + \zeta \mu] \kappa \mathcal{P}_T y^N = 0 \tag{30}$$

$$-u_N + v_N - [\mu^{\text{sp}} + \zeta \mu] \kappa \mathcal{P}_N y^N - \phi u_{TN} = 0 \tag{31}$$

$$\frac{\lambda}{R} - \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \frac{[\mu^{\text{sp}} + \zeta \mu]}{R} - \phi \frac{\beta R \partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \big[u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \big]}{\partial b'} = 0 \tag{32}$$

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

along with the complementary slackness conditions

$$\mu^{\text{sp}} \Big[\kappa (y^T + \mathcal{P}(c^T, y^N - g^N) y^N) - \frac{b'}{R} \Big] = 0 \tag{34}$$

$$\delta \mu = 0 \tag{35}$$

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

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

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

3. $\mu^{sp} = 0$ 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 $\mu^{sp} > 0$ and $\mu = 0$ cannot both hold. To do so, suppose by contradiction that $\mu^{sp} > 0$ and $\mu = 0$. The government's complementary slackness condition implies that

$$\kappa(y^T + \mathcal{P}(c^T, y^N - g^N)y^N) - \frac{b'}{R} = 0 \tag{36}$$

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

$$u_T = \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' \tag{37}$$

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

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

This in turn implies

$$u_T - \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \neq 0 \tag{39}$$

where the last implication follows from the assumed properties of the solution to the government's problem. Because $\mu = 0$, (39) 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. $\mu^{sp} = \mu = 0$. In this case, the complementary slackness condition implies that the non-negativity constraint on the multiplier is satisfied. Therefore, $\delta = 0$. Combining equations (30) and (32) yields

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

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

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

Simple algebra then yields

$$\left[1 - \frac{R}{u_{TT}} \frac{\partial \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\beta R U_T (\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) \right]}{\partial b'} \right] u_{TT} \phi = \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{42}$$

In sequential form, this expression can be rewritten as follows

$$\left[1 - \frac{R}{u_{TT,t}} \frac{\partial \beta R \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} u_{T,t}}{\partial b_{t+1}}\right] u_{TT,t}\phi_t = \beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \left[\phi_{t+1} u_{TT,t+1} + \tilde{\mu}_{t+1}\kappa \mathcal{P}_{T,t+1} y^N_{t+1}\right] \tag{43}$$

Define

$$\Theta_t = \left[1 - \frac{R}{u_{TT,t}} \frac{\partial \beta R \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} u_{T,t}}{\partial b_{t+1}}\right] > 1 \tag{44}$$

$$\tilde{\phi}_t = u_{TT,t}\phi_t \tag{45}$$

Then, equation (43) becomes

$$\tilde{\phi}_t = \frac{\beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \tilde{\mu}_{t+1}\kappa \mathcal{P}_{T,t+1} y^N_{t+1}}{\Theta_t} + \frac{\beta \mathbb{E}_{\mathbf{y}_{t+1}|\mathbf{y}_t} \tilde{\phi}_{t+1}}{\Theta_t} \tag{46}$$

Iterating forward and using the transversality condition we get

$$\tilde{\phi}_t = \mathbb{E} \sum_{s=1}^{\infty} \frac{\beta^s}{\prod_{j=0}^{t-1} \Theta_{t+j}} \tilde{\mu}_{t+s}\kappa \mathcal{P}_{T,t+s} y^N_{t+s} \tag{47}$$

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

$$\zeta = \frac{\phi}{\left[\kappa\left(y^T + \mathcal{P}(c^T, y^N - g^N) y^N) y^N\right) - \frac{b'}{R}\right]} < 0 \tag{48}$$

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

$$\mu = u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T \tag{49}$$

It is enough to show that $\mu > 0$. Using equation (32) I get

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \mu^{\text{sp}} = 0 \tag{50}$$

Using the expression fro λ' yields

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[u'_T + \phi' u'_{TT} + \tilde{\mu}'\kappa \mathcal{P}'_T y'^N\right] - \mu^{\text{sp}} = 0 \tag{51}$$

Therefore

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

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

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

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

$$\mu = \frac{\mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right]}{1 - \zeta \left[1 - \kappa \mathcal{P}_T y^N \right]} > 0 \tag{54}$$

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

$$\mu = \zeta \mu \left[1 - \kappa \mathcal{P}_T y^N \right] + \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{55}$$

As result, the following two equations both hold

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \mu \tag{56}$$

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \zeta \mu \left[1 - \kappa \mathcal{P}_T y^N \right] + \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{57}$$

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

$$u_T + \zeta \mu \kappa \mathcal{P}_T y^N - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \lambda' - \zeta \mu = 0 \tag{58}$$

Substituting for λ' we get

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

Finally some algebra yields

$$u_T - \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u'_T = \zeta \mu \left[1 - \kappa \mathcal{P}_T y^N \right] + \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi' u'_{TT} + \tilde{\mu}' \kappa \mathcal{P}'_T y'^N \right] \tag{60}$$

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

$$-u_N + v_N = 0 \tag{61}$$

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

$$\begin{aligned} & u_T \left(y^T + \frac{b'}{R} - b, g^* \left(y^T + \frac{b'}{R} - b, \mathbf{y} \right) \right) - \beta R \beta \mathbb{E}_{\mathbf{y}'|\mathbf{y}} u_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) = \\ & \beta R \mathbb{E}_{\mathbf{y}'|\mathbf{y}} \left[\phi(b', \mathbf{y}') u_{TT}(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) + \tilde{\mu}(b', \mathbf{y}') \kappa \mathcal{P}_T(\mathcal{C}^T(b', \mathbf{y}'), y^N - \mathcal{G}^N(b', \mathbf{y}')) y'^N \right] = 0 \end{aligned} \tag{62}$$

$$\frac{b'}{R} - \kappa\left(y^T + \mathcal{P}\left(y^T + \frac{b'}{R} - b, y^N - g^*\left(y^T + \frac{b'}{R} - b, \mathbf{y}\right)\right) y^N\right) = 0 \tag{63}$$

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 $\mu^{\mathrm{sp}} = \mu = 0$. The first-order condition with respect to g^N is

$$-u_N + v_N - \phi u_{TN} = 0 \tag{64}$$

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

$$u_{TN} = \theta a(1-a)\frac{1-\sigma\phi}{\phi} c^{T-\frac{1}{\phi}}(y^N - g^N)^{-\frac{1}{\phi}} c^{\frac{1-\sigma\phi}{\phi}-\left(1-\frac{1}{\phi}\right)} \tag{65}$$

This implies that

$$u_{TN}\begin{cases} > 0 & \text{if } \sigma\phi < 1 \\ = 0 & \text{if } \sigma\phi = 1 \\ < 0 & \text{if } \sigma\phi > 1 \end{cases} \tag{66}$$

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 governments set spending at Samuelson level.

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

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

Since $\mu^{\mathrm{sp}}\kappa\mathcal{P}_N y^N > 0$, 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. $\mu^{\mathrm{sp}} = 0$ but $\mu > 0$.The first-order condition with respect to g^N is

$$-u_N + v_N - \zeta\mu\kappa\mathcal{P}_N y^N = 0 \tag{68}$$

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 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

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

s.t.

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

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

$$H(c_t^T, g_t^N, \mu_t, \phi_t, \tilde{\phi}_t, \mathbf{y}_t) = u(A(c_t^T, y_t^N - g_t^N)) + v(g_t^N) - u_T(c_t^T, y_t^N - g_t^N) \left(\frac{\phi_t}{R} - \tilde{\phi}_t\right) + \phi_t \mu_t \tag{69}$$

Then rewrite problem CO as

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

s.t.

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

given an initial condition b_0.

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

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

s.t.

$$
\begin{gathered}
c^T = y^T + \frac{b'}{R} - b \\
\frac{b'}{R} \leq \kappa\left(y^T + \frac{A_2(c^T, y^N - G^N)}{A_1(c^T, y^N - G^N)} y^N\right) \\
\mu \geq 0 \\
\mu\left[\kappa\left(y^T + \frac{A_2(c^T, y^N - G^N)}{A_1(c^T, y^N - g^N)} y^N\right) - \frac{b'}{R}\right] = 0
\end{gathered}
$$

C Additional Plots and Tables

C.1 Policy Functions

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

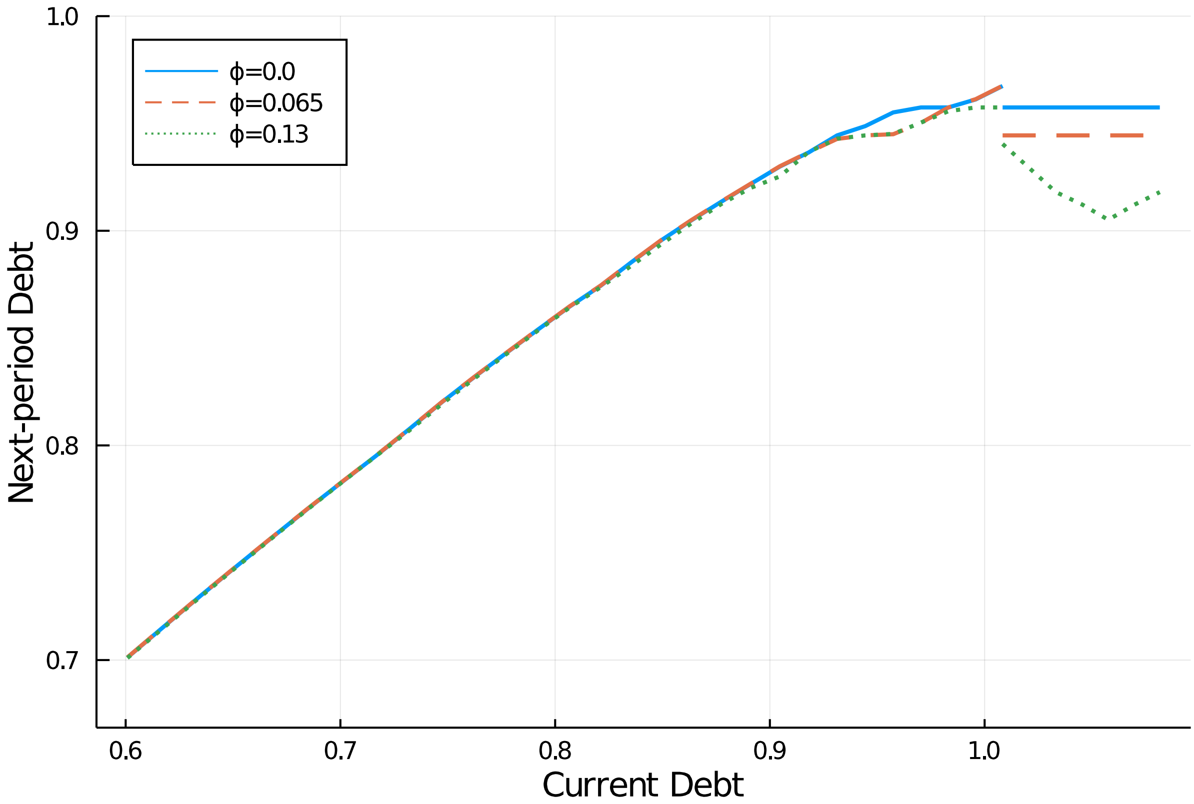


Figure C.2: Public Consumption Policy Function for Different Values of ϕ

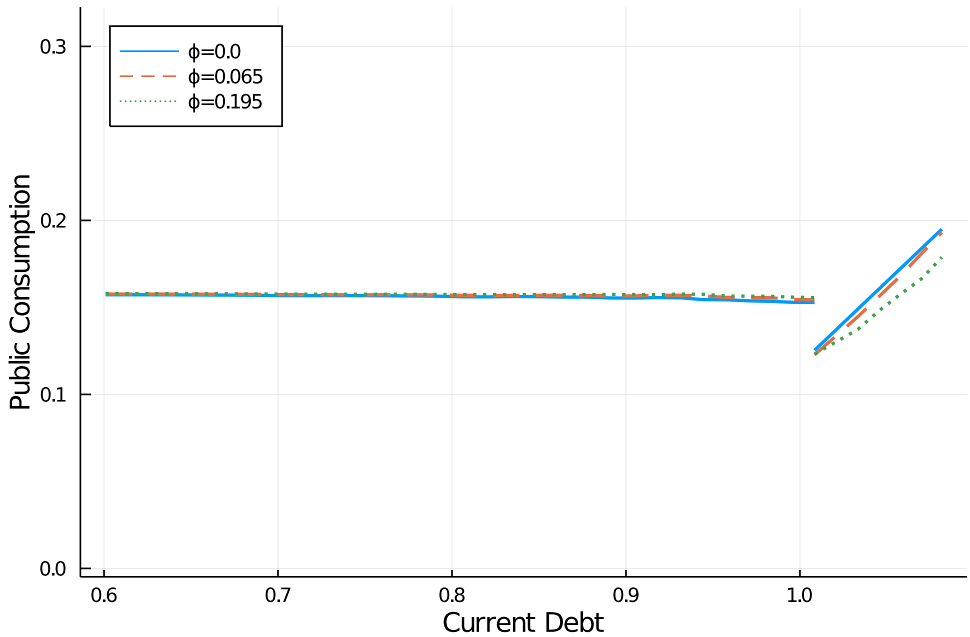


Figure C.3: Optimal Deviation from Samuelson for Different Values of ϕ

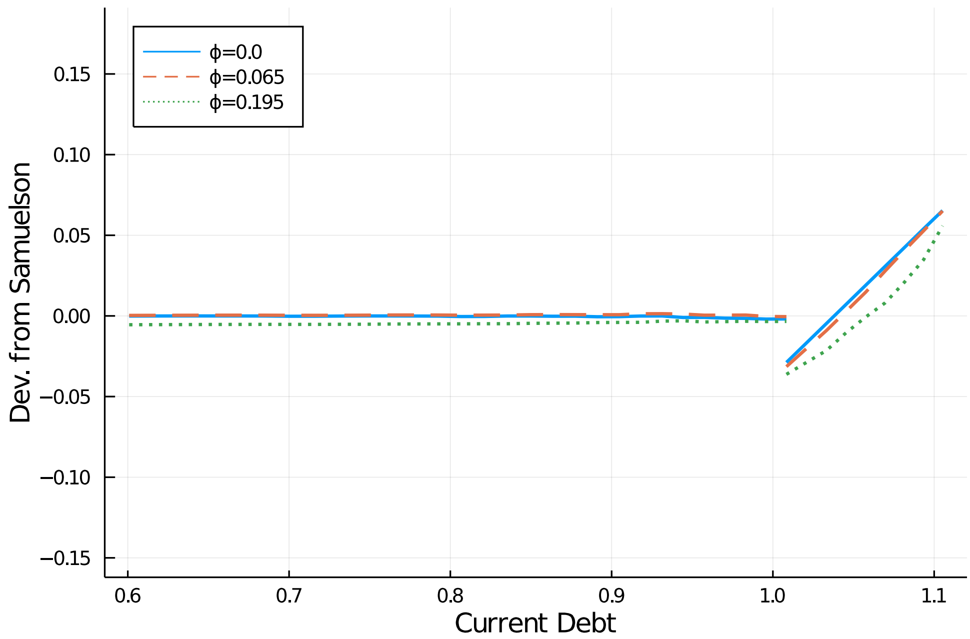
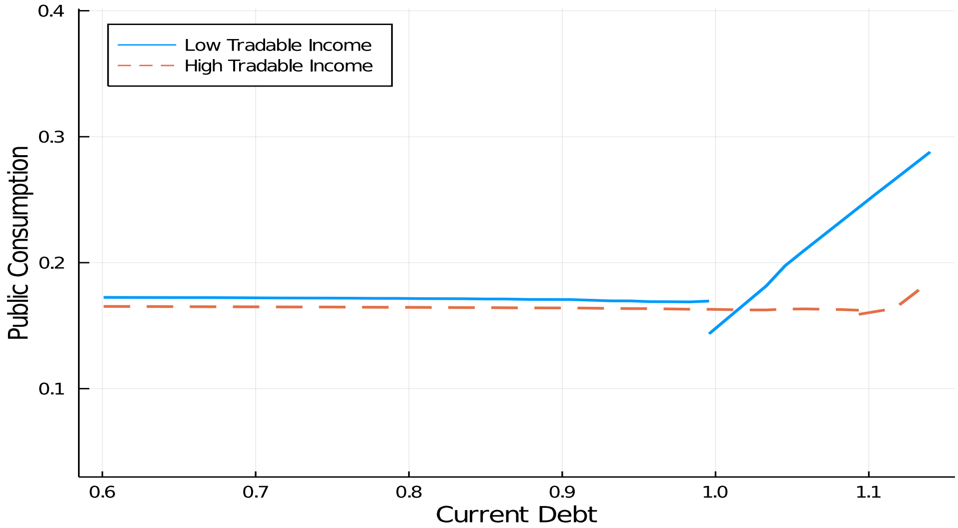
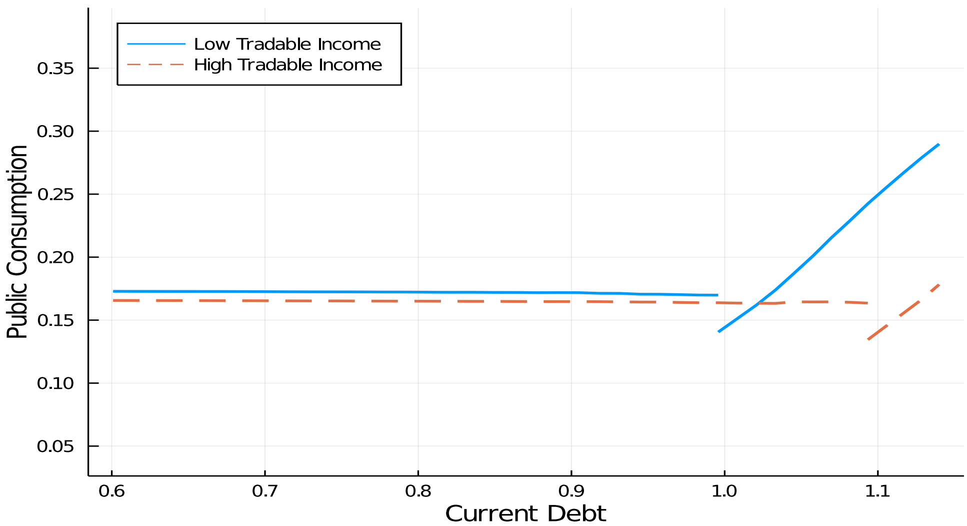


Figure C.4: Public Consumption Policy Functions



(a) $\phi = 0$



(b) $\phi > 0$

Figure C.5: Deviations from Samuelson

(a) $\phi = 0$

(b) $\phi > 0$

Figure C.6: Debt Policy Function - Time-consistent

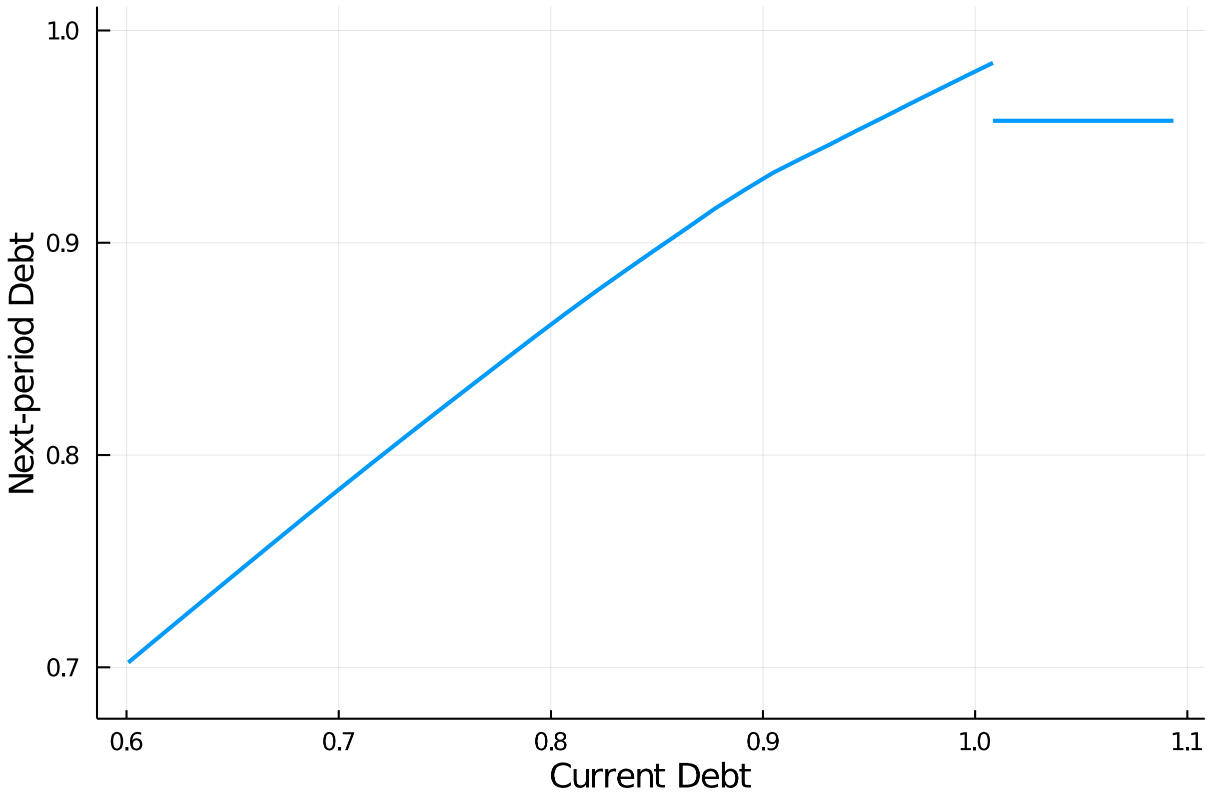


Figure C.7: Public Consumption Policy Function - Time-consistent

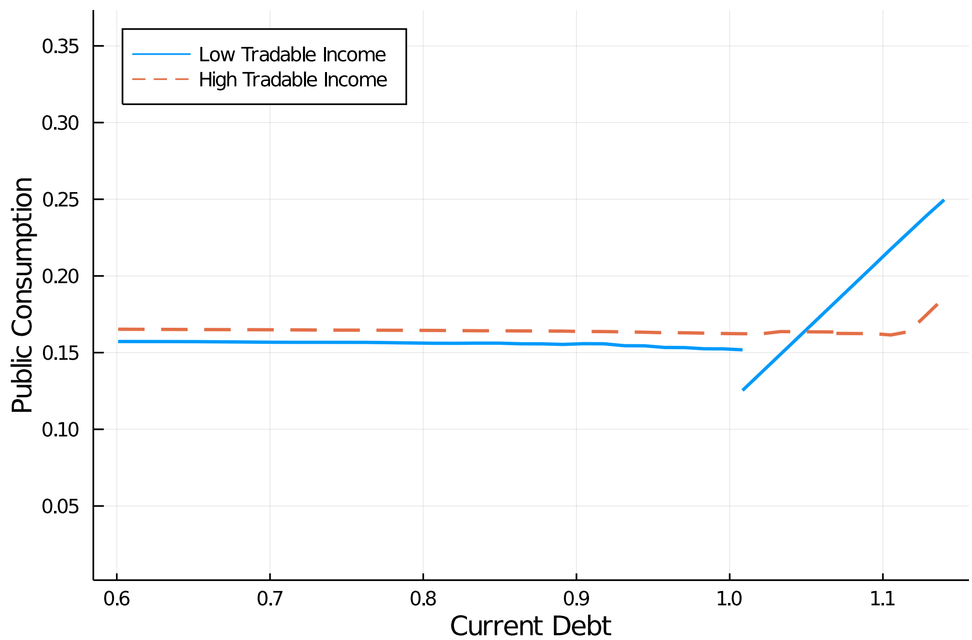
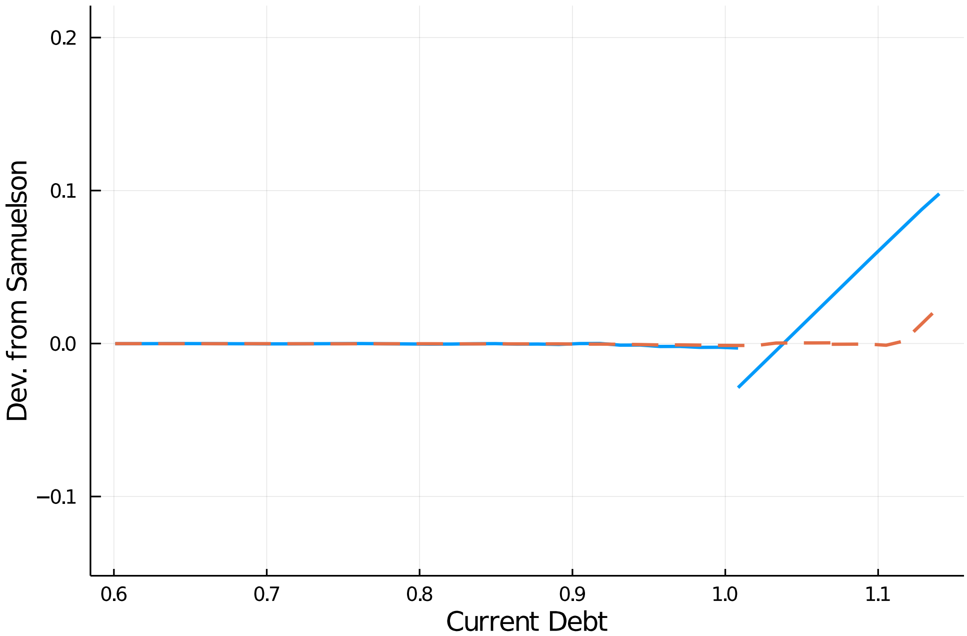
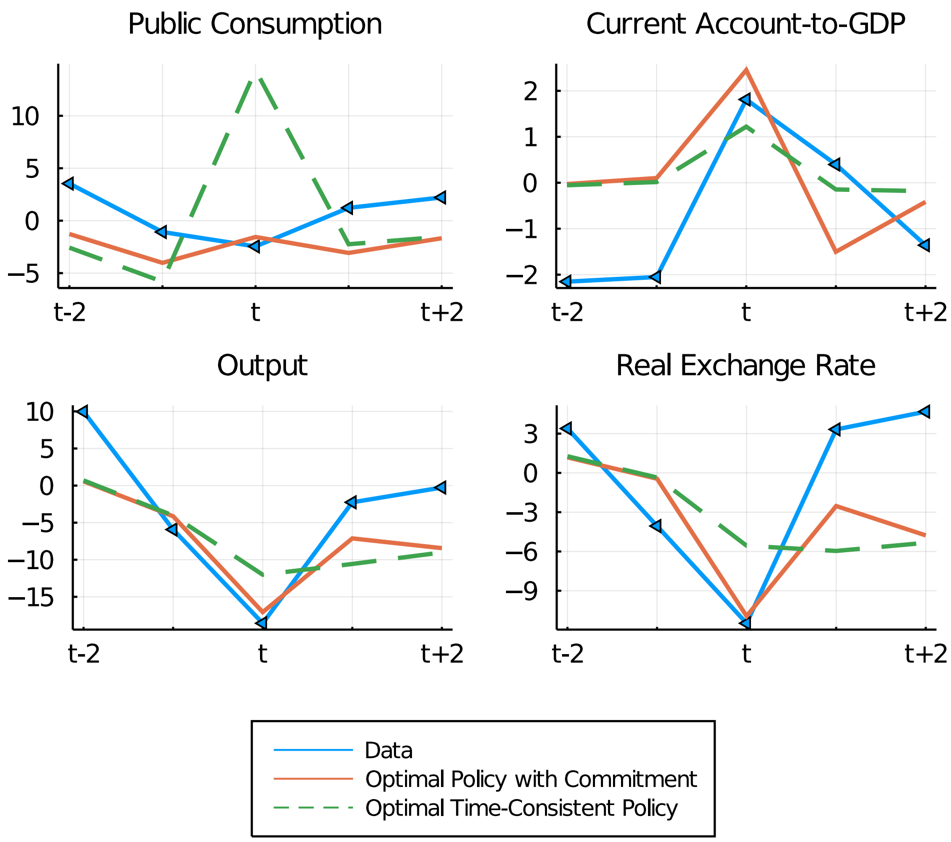


Figure C.8: Optimal Deviation from Samuelson - Time-consistent



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

Figure C.9: 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.