Financing Covid-19 Deficits in Fiscally Dominant Economies
Is the Monetarist Arithmetic Unpleasant?

Martín Uribe
Columbia University and NBER

December 21, 2020

Motivation

- The coronavirus pandemic of 2019-20 confronts fiscally dominant economies with the question of whether the large deficits caused by the health crisis should be monetized or financed by issuing debt.

- In "Some Unpleasant Monetarist Arithmetic," Sargent and Wallace (1981) warned that in fiscally dominant regimes 'tighter money now can mean higher inflation eventually.'

- Why revisit this issue 40 years later?

Because, in spite of the qualifier 'unpleasant,' the monetarist arithmetic is purely positive in nature, and therefore provides no normative prediction as to under what circumstances it pays for governments in fiscally dominant regimes to delay inflation by financing deficits through debt issuance.

This Paper

- Addresses the question: When is it optimal in a welfare sense for a government in a fiscally dominant regime to delay inflation by financing part of the fiscal deficit through debt issuance?

- The analysis is conducted in the context of a model in which the monetarist arithmetic holds, in the sense that if the government finds it optimal to delay inflation, it does so knowing that it will result in higher inflation in the future.

- The central result of the paper is that delaying inflation is optimal when the fiscal deficit is expected to decline over time—as appears to be the case with the Covid-19 deficits.

What Is A Fiscally Dominant Regime?

In this paper, a fiscally dominant regime is defined as a fiscal regime in which the **primary fiscal deficit** is exogenous.

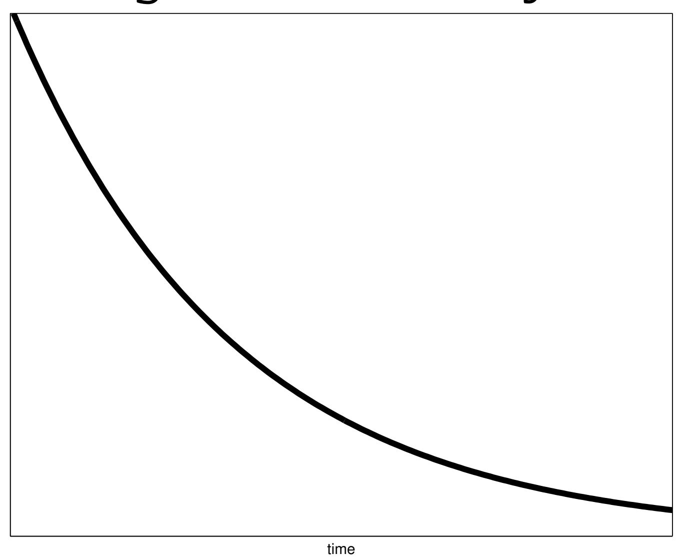
The primary fiscal deficit is defined as government expenditure (excluding interest payments on the public debt) minus tax revenue.

Nontechnical Presentation

Fiscal Policy

Suppose that the real primary fiscal deficit is exogenous and follows a declining trajectory as shown in figure 1.

Figure 1: Exogenous Primary Fiscal Deficit



The Central Bank in a Fiscally Dominant Regime

Government solvency requires that the present discounted value of fiscal deficits equal the present discounted value of seignorage revenue (money printing).

$\Rightarrow$ in a fiscally dominant regime, the central bank cannot control the overall magnitude of the inflation tax.

However, the central bank does have control over the *timing* of inflation, because there are an infinite number of inflation trajectories compatible with financing a given stream of fiscal deficits.

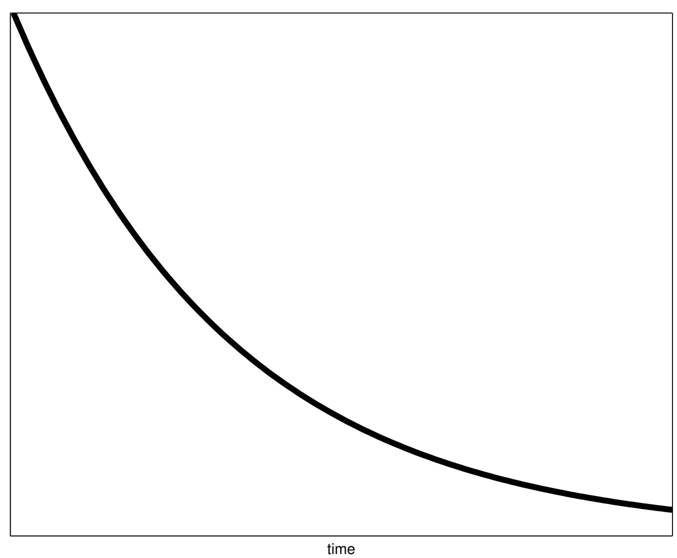
Consider two alternative monetary policies: (1) full monetization of deficits; and (2) partial monetization of deficits.

Full Monetization

Suppose the central bank prints enough money to finance the deficit each period so that the treasury does not have to issue interest-bearing debt.

If the fiscal deficit is expected to decline over time, full monetization requires relatively high money growth rates at the beginning and relatively low money growth rates later, generating a declining path of inflation, as shown in the figure:

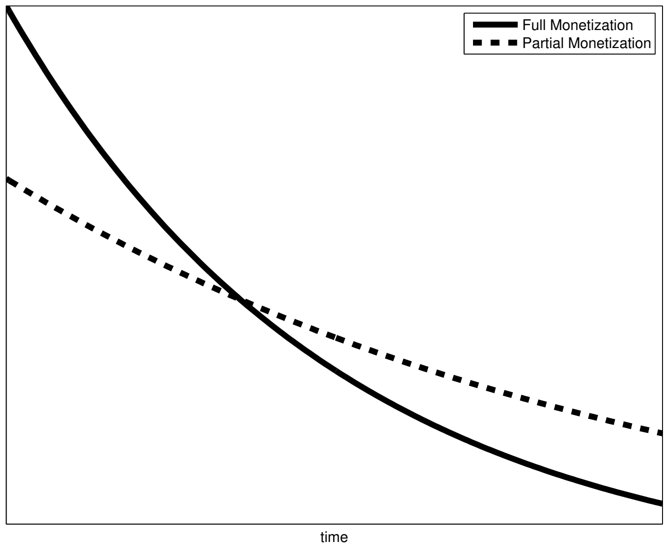
Figure 2: The Inflation Rate Under Full Monetization



Partial Monetization

- The central bank finances part of the fiscal deficit by printing money and part by issuing public debt.
- Under partial monetization, initially the money growth rate and inflation are lower than under full monetization.
- As time goes by, the central bank must pay not only for the declining deficits but also for the interest on the rising debt so at some point money printing and inflation become higher under partial monetization than under full monetization, as shown in the figure:

Figure 3: Inflation Rate Under Partial and Full Monetization



The figure illustrates the unpleasant monetarist arithmetic: 'tighter money now means higher inflation eventually.'

Objective of a Benevolent Government

• A benevolent government will pick the path of inflation that maximizes the welfare of households subject to being consistent with intertemporal government solvency.

What determines the best monetary policy?

• In virtually all existing monetary models, inflation is a distortion.

• A general principle of dynamic public finance is that it is optimal for the government to smooth distortions over time.

Which Monetary Policy Is Better?

• Partial monetization gives rise to a smoother path of inflation than full monetization.

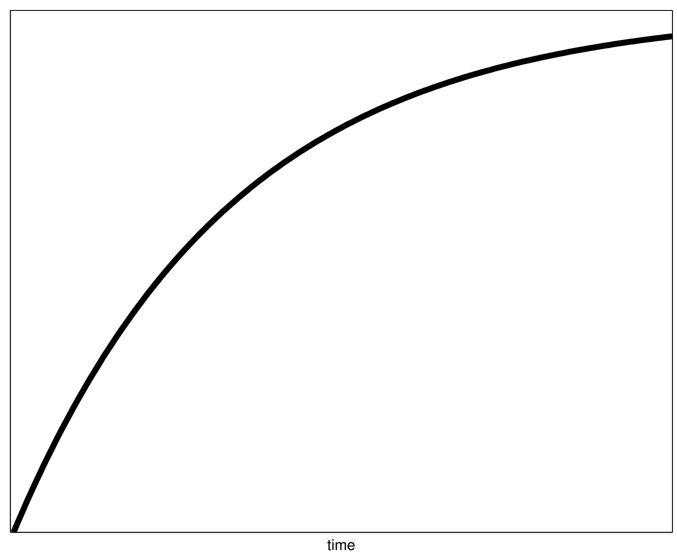
• Taken together, the above observations lead to the intuition that partial monetization can be preferred to full monetization.

• The optimal plan calls for delaying inflation even though the monetarist arithmetic is at work, that is, even though failing to fully monetize the deficit implies that in the future the rate of inflation will be higher than if the government had chosen to print money to finance the entire deficit period by period.

Implications for Public Debt

• Under the optimal policy, the government issues debt to finance part of the fiscal deficits. As a result, public debt builds up, and converges to a higher long-run level, as shown in figure 4:

Figure 4: Public Debt Under the Optimal Monetary/Fiscal Policy



Formal Analysis

The Model

The main elements of the economic environment are:

- Infinite horizon

- Money in the utility function

- Flexible prices.

- Fiscal dominance, taking the form of an exogenous path for the primary fiscal deficit.

- Benevolent central bank

Households

Households choose paths for consumption, c_t, money holdings, M_t, and bond holdings, B_t, to maximize

$$\int_0^\infty e^{-\rho t}[u(c_t) + v(M_t/P_t)]dt,$$

subject to

$$c_t + \frac{\dot{M}_t + \dot{B}_t}{P_t} = y + \tau_t + i_t \frac{B_t}{P_t},$$

$$\lim_{t \to \infty} e^{-R_t} \frac{M_t + B_t l}{P_t} \geq 0.$$

where $\rho > 0$ is the subjective discount factor; $u(\cdot)$ and $v(\cdot)$ are increasing and concave functions; y is a constant endowment; τ_t is a real government transfer; P_t is the price level; i_t is the nominal interest rate; $R_t \equiv \int_0^t r_s ds$ is the market discount factor; $r_t \equiv i_t - \pi_t$ is the real interest rate; and $\pi_t \equiv \dot{P}_t/P_t$ is the inflation rate.

Optimality Conditions

$$\frac{\dot{c}_t}{c_t} = \left[\frac{-u'(c_t)}{u''(c_t)c_t}\right](r_t - \rho)$$

This is an Euler equation, stating that consumption grows when the real interest rate exceeds the subjective discount factor.

$$\frac{v'(m_t)}{u'(c_t)} = i_t,$$

This expression gives rise to a money demand function of the type

$$m_t = L(\underset{-}{i_t}, \underset{+}{c_t}),$$

where $m_t \equiv M_t/P_t$ denotes real money balances. I assume that $i_t L(i_t, c_t)$ is increasing in i. Finally, the following transversality condition must hold:

$$\lim_{t\to\infty} e^{-R_t}(m_t + b_t) = 0,$$

where $b_t \equiv B_t/P_t$ denotes real bond holdings.

The Government

The government generates an exogenous flow of real primary fiscal deficits, τ_t. It finances the (secondary) fiscal deficit, $\tau_t + i_t B_t/P_t$, by a combination of money creation, $\dot{M}_t$. and debt issuance, $\dot{B}_t$. Its flow budget constraint is

$$\frac{\dot{M}_t + \dot{B}_t}{P_t} = \tau_t + i_t \frac{B_t}{P_t}.$$

Market Clearing

In equilibrium, the product market must clear, that is,

$$c_t = y.$$

This expression and the consumer Euler equation imply that in equilibrium the real interest rate equals the subjective discount factor

$$r_t = \rho.$$

and $R_t = \rho t$.

The Competitive Equilibrium

Combining the flow budget constraints of the household, the flow budget constraints of the government, the market clearing condition, and the transversality condition yields the following intertemporal restriction

$$\frac{B_0 + M_0}{P_0} = \int_0^\infty e^{-\rho t}[i_t L(i_t, y) - \tau_t]dt, \tag{1}$$

It says that the present discounted value of seignorage revenues, $\int_0^\infty e^{-\rho t} i_t L(i_t, y)dt$, must be large enough to pay for the sum of the government's initial liabilities, $(M_0 + B_0)/P_0$, and the present discounted value of primary deficits, $\int_0^\infty e^{-\rho t}\tau_t dt$.

Definition 1 (Competitive Equilibrium) *A competitive equilibrium is an initial price level P_0 and a time path of nominal interest rates $\{i_t\}$ satisfying equation* (1)*, given the initial level of nominal government liabilities $B_0 + M_0$ and the time path of real primary fiscal deficits $\{\tau_t\}$.*

The Ramsey Optimal Equilibrium

The Ramsey planner chooses a path for the nominal interest rate $\{i_t\}_0^\infty$ to maximize the indirect utility function

$$\int_0^\infty e^{-\rho t}[u(y) + v(L(i_t, y))]dt,$$

subject to the restriction that $\{i_t\}_0^\infty$ be consistent with a competitive equilibrium, that is, subject to

$$\frac{B_0 + M_0}{P_0} = \int_0^\infty e^{-\rho t}[i_t L(i_t, y) - \tau_t]dt,$$

Note that: (a) The indirect utility function is decreasing in i_t. (b) The initial price level, P_0, does not enter in the indirect utility function. (c) If $M_0 + B_0 > 0$ and $\int_0^\infty e^{-\rho t}\tau_t dt > 0$, then an increase in P_0 allows for a lower path for i_t. This implies that the benevolent central bank has an incentive to engineer an initial hyperinflation, $P_0 \to \infty$, to inflate away its initial real liabilities, $(M_0 + B_0)/P_0$. For this reason, following the related literature, I assume that the Ramsey planner takes the initial price level, P_0, as given.

The Ramsey Optimal Equilibrium (continued)

So the Ramsey problem is to chooses a path for the nominal interest rate $\{i_t\}_0^\infty$ to maximize

$$\int_0^\infty e^{-\rho t}[u(y) + v(L(i_t, y))]dt,$$

subject to

$$\frac{B_0 + M_0}{P_0} = \int_0^\infty e^{-\rho t}[i_t L(i_t, y) - \tau_t]dt,$$

given $(M_0 + B_0)/P_0$ and $\int_0^\infty e^{-\rho t}\tau_t dt$. Letting η be the Lagrange multiplier, the associated first-order condition is

$$v'(L(i_t, y))L_1(i_t, y) + \eta[L(i_t, y) + i_t L_1(i_t, y)] = 0, \tag{2}$$

This expression implies that the optimal nominal interest rate is constant

$$i_t = i^*.$$

And so is the optimal rate of inflation

$$\pi_t = \pi^* \equiv i^* - \rho.$$

The Optimal Evolution of Public Debt

With $i_t = i^*$ and $\pi_t = \pi^*$, the flow budget constraint of the government becomes

$$\dot{b}_t = \rho b_t + \tau_t - \pi^* L(\pi^* + \rho, y)$$

Integrating forward and using the transversality condition yields

$$b_t = \frac{\pi^* L(\pi^* + \rho, y)}{\rho} - \int_0^\infty e^{-\rho s} \tau_{t+s} ds.$$

The optimal path of debt depends on the expected trajectory of future primary fiscal deficits. Suppose that τ_t follows the declining path $\tau_t = \tau_0 e^{-\delta t}$, with $\tau_0, \delta > 0$. Then, we have that

$$b_t = \frac{\pi^* L(\pi^* + \rho, y)}{\rho} - \frac{\tau_0}{\rho + \delta} e^{-\rho t}.$$

which says that if the primary fiscal deficit is expected to fall over time (as is the case with the Covid-19 deficits), then the central bank will not find it optimal to fully monetize the fiscal deficit. Instead, it will finance part of the deficit by issuing interest-bearing debt.

An Illustration: Fiscal Gradualism in Argentina 2016-19

- The Macri administration, inaugurated in December 2015, inherited a large fiscal deficit.
- The government promised to reduce the deficit gradually.
- The central bank monetized only a fraction of the fiscal deficit.
- The combination of large fiscal deficits and partial monetization gave rise to a significant increase of the public debt.
- The burst of public debt was criticized on the grounds that it will eventually lead to more inflation than the alternative of full monetization.
- Let's introduce some numbers to characterize this environment more precisely and then ascertain what the present model has to say about the optimal path of debt.
- The analysis is conducted from the view point of 2016, when the promise of a gradual elimination of the fiscal deficit was credible.

Calibration of the Argentine Monetary-Fiscal Regime

Symbol	Value	Description
τ_0	0.05	Initial deficit-to-GDP ratio ($y = 1$)
δ	0.3	Decay rate of fiscal deficit,$\tau_t = \tau_0 e^{-\delta t} \Rightarrow \frac{1}{2}$ life 2.3 yrs
$\frac{M_0+B_0}{yP_0}$	0.389	Ratio of Initial gov't liabilities to GDP
A	0.0882	Money demand function $L(i, y) = A\, y\, i^{-\alpha}$
α	0.13	Interest-rate elasticity of money demand
ρ	0.0392	Subjective discount factor
g	0.0198	Growth rate

Note. The time unit is one year.

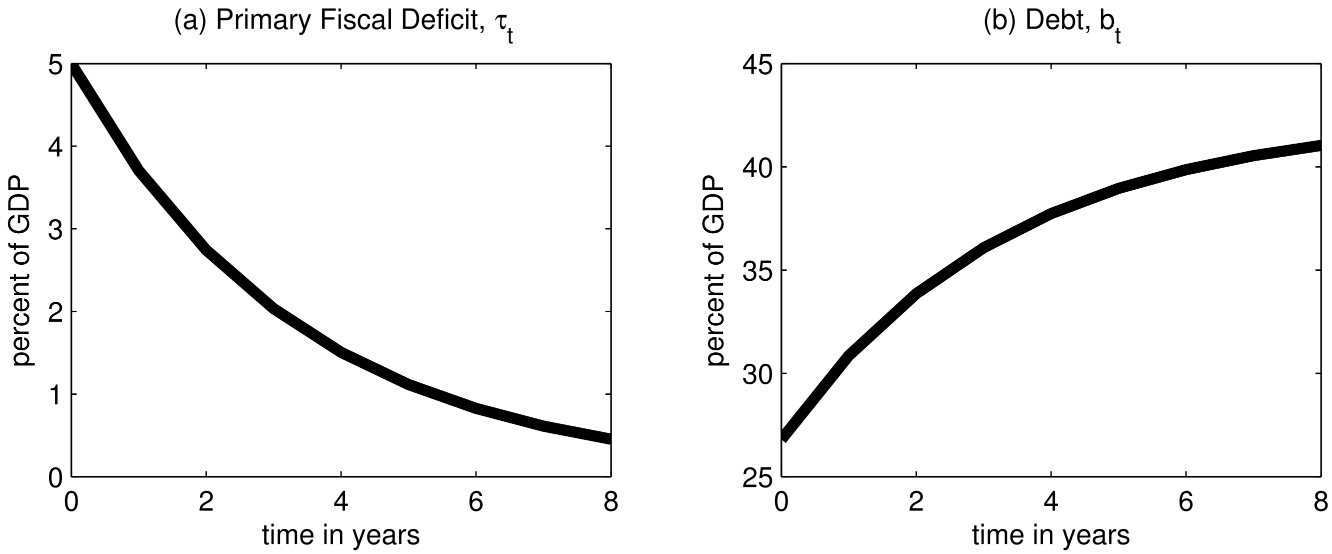
Calibration Details

- The time unit is a year.
- The Macri administration inherited a primary fiscal deficit of about 5% of GDP, so I set $\tau_0 = 0.05$.
- The government promised to reduce the deficit gradually to 1.5% of GDP in four years, which implies a half life of 2.3 years. The resulting law of motion of the primary deficit is

$$\tau_t = 0.05 e^{-0.3\,t}$$

- I set the initial liabilities of the consolidated government to 38.9% of GDP, or $(M_0 + B_0)/P_0 = 0.389\,y$. (Monetary base 10%; central bank interest-bearing debt held by private agents, i.e., Lebacs, 6%; and treasury debt held by private agents 22.9%.)
- I assume a demand for money of the form $L(i, c) = c\,A\,i^{-\alpha}$, with $A = 0.089$ and $\alpha = 0.13$. (The interest-rate elasticity α is based on estimates by Kiguel and Neumeyer, JMCB, 1995; and the value of A ensures a 10% monetary-base-to-GDP ratio when $i = 38\%$ as observed in early 2016.)
- I set the subjective discount factor to 4%, or $\rho = \ln(1.04)$, and the growth rate to 2%, or $g = \ln(1.02)$.

Ramsey Optimal Debt Dynamics



Note. τ_t and b_t are measured in percent of annual GDP.

Observation: The optimal transition to the steady state is characterized by significantly tight monetary conditions, as reflected by the fact that a deficit of 5% of GDP with a half life of 2.3 years is partly financed by an increase in public debt of more than 15 percentage points of GDP.

Full Monetization of Fiscal Deficits

In equilibrium, the evolution of total government liabilities, $w_t \equiv \frac{M_t+B_t}{P_t}$, obeys the law of motion

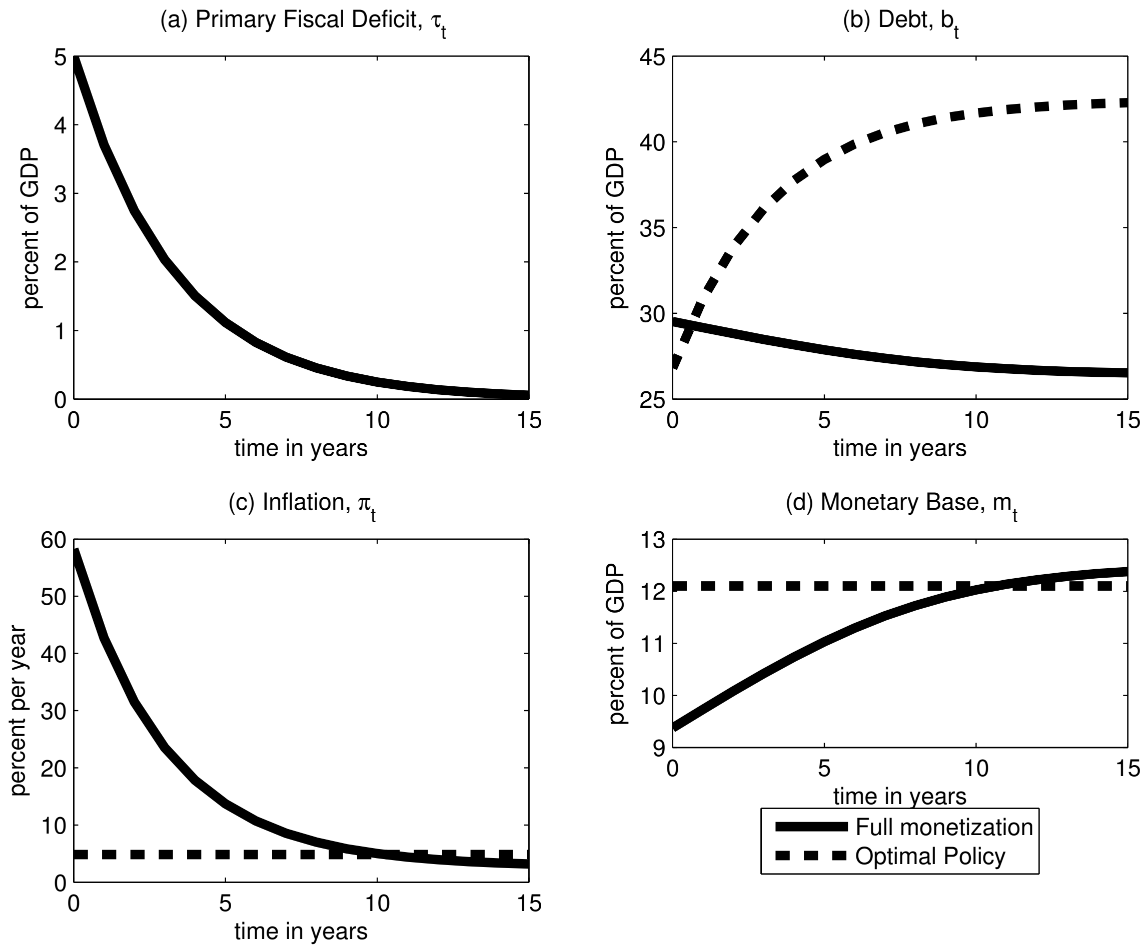
$$\dot{w}_t = \rho w_t + \tau_t - i_t L(i_t, y).$$

Suppose that the central bank prints enough money to pay for the fiscal deficit and interest on the debt, so that government liabilities stay constant over time, $\dot{w}_t = 0$. I refer to this policy as full monetization of the fiscal deficit. What is the inflation rate associated with this policy? With $\dot{w}_t = 0$, the above expression implies that the inflation rate is given by

$$(\pi_t + \rho)L(\pi_t + \rho, y) = \rho w_0 + \tau_t$$

Under the assumed declining path for the fiscal deficit, $\tau_t = \tau_0 e^{-\rho t}$, inflation is high at the beginning and then falls over time. The figure on the next slide compares the equilibrium dynamics under full monetization and under the Ramsey optimal policy.

Comparing Full Monetization with the Ramsey Optimal Policy



Note. τ_t, b_t, and m_t are measured in percent of annual GDP, and π_t is measured in percent per year.

Observations on the Figure

- The bottom left panel illustrates that the monetarist arithmetic is at work, but is not unpleasant: Under the Ramsey policy inflation is smoother and lower than under full monetizaiton at the beginning but higher in the long run.

- The top right panel sheds light on the unpleasant monetarist arithmetic from a different perspective. Under full monetization, public debt is flat (indeed slightly decreasing) throughout the transition to the steady state. By contrast, under the optimal policy debt increases sharply at the beginning and continues to increase throughout the transition. A naive interpretation of the monetarist arithmetic would interpret the debt dynamics associated with full monetization as more healthy.

Concluding Remarks

• Should fiscally dominant economies finance Covid-19 deficits by printing money or by issuing debt?

• The unpleasant monetarist arithmetic states that under fiscal dominance tight money now implies higher inflation in the future.

• This paper does not quarrel with this dictum, but with the common interpretation—possibly suggested by the qualifier 'unpleasant'—that in a fiscally dominant regime tight monetary policy, understood as financing part of the fiscal deficit by issuing debt, is undesirable.

• In this paper I characterize the welfare maximizing path of inflation and public debt in a fiscally dominant monetary economy.

• The main result derived from this analysis is that in a fiscally dominant regime tight money today may indeed be optimal even if it causes higher inflation later.

• This result obtains when the fiscal deficit is expected to fall over time or is temporarily high, as was the case for many countries during the Covid-19 pandemic.

• Extensions worth pursuing include introducing uncertainty about the future path of deficits, default risk, and nominal rigidity.