Fiscal Dominance: Implications for Bond Markets and Central Banking*

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Abstract

Fiscal dominance refers to situations in which monetary policy is constrained by the public sector's budget constraint. Large shifts in the dynamics of sovereign debts, surpluses, and central banks' balance sheets since the Great Financial Crisis have created the perception of a heightened risk of such fiscal dominance in major jurisdictions. This paper reviews the theoretical and empirical literature on fiscal dominance. We offer a simple theory in which fiscal dominance arises as the outcome of strategic interactions between the government and the central bank.

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1 Introduction

Public finances in most major economies have experienced a regime shift since the Great Financial Crisis. Sustained periods of large deficits have led to sovereign debt levels that are unprecedented in peacetime. In 2020, public debt as a percentage of GDP reached 98% in the United States and 97% in the euro area. A large fraction of this debt has been purchased by central banks,[1] together with private securities, leading them to increase the size of their balance sheets by nearly an order of magnitude.

These developments have been responses to unprecedented shocks, and so whether they have been optimal remains a subject of debate. Yet, no matter the answer to this question, these developments have challenged the traditional assumption that price stability and monetary policy could be analyzed in academia and implemented in practice independently of the other dimensions of public finance.

Many observers in particular argue that the recent high inflation rates —which peaked at 7.2% in the United States and 10.6% in the euro area—are manifestations of fiscal dominance, defined as a situation in which monetary policy is constrained by fiscal decisions and the need to satisfy the public sector's budget constraint.

The goal of this paper is to summarize the literature on fiscal dominance that followed the seminal contribution of Sargent & Wallace (1981), as well as to provide new insights that may be useful to finance scholars. *Our main argument is that fiscal dominance emerges from strategic interactions between the government and the central bank—even when the latter is formally independent—in which both authorities can take actions to try to impose their priorities on the other, and in which bond markets play a critical role by providing incentives.* We focus particularly on the implications of fiscal dominance for bond markets and central banking. As detailed below, the forays of the finance literature into the study of fiscal dominance have primarly adopted an asset-pricing perspective, focusing on understanding the relationship between government surpluses, inflation, and bond prices. Here we adopt an approach that is more familiar to corporate-finance and banking theorists, in which we seek to use microeconomic theory to qualitatively understand the conditions under which fiscal policy plays an important role in determining inflation.

Such an approach yields a rich set of implications for central banking and bond mar-

[1] In 2020, Federal Reserve Banks (the Eurosystem) held 17% (21% respectively) of public debt.

kets. Regarding central banking, as expected, prudent asset management by the central bank that maintains a sufficiently low balance-sheet size and adequate net worth reduces the risk of fiscal dominance. When fiscal dominance is unavoidable, the central bank can still mitigate the costs of inflation by adjusting its timing and frontloading it —a strategy we deem "preemptive inflation". Regarding the bond market, we stress that current market conditions and, in particular, the current real rate at which the government can borrow are not sufficient to predict fiscal dominance. The anticipated responses of bond markets to potential attempts by fiscal authorities to influence monetary policy are key determinants of fiscal-monetary interactions. Finally, we provide an interpretation of the 2022 UK "mini-budget" episode as an instance in which the fiscal authority painfully discovered that the bond market stood ready to make fiscal dominance very costly. We underline that the limited intervention of the central bank was key in the final outcome of this episode.

The paper is organized as follows. Section 2 surveys the theoretical and empirical literature on fiscal dominance. Section 3 develops our formal analysis of the conditions under which fiscal dominance prevails. Section 4 draws some implications for central banking and elaborates on the role of bond markets. Section 5 concludes.

2 Fiscal dominance in the models and in the data

This section summarizes our view of the main messages conveyed by the academic literature that addresses fiscal dominance. We do not aim at an exhaustive description of this large literature. We seek instead to highlight the body of papers that particularly influenced and motivated our theoretical development in Section 3.[2] We first offer a summary of the theories that aim at formalizing fiscal dominance. We then survey the literature that empirically documents episodes of fiscal dominance.

2.1 The theoretical underpinnings of fiscal dominance

At the core of fiscal dominance is the simple point that the budget constraint of the public sector implies that monetary and fiscal policies are interdependent because they

[2]See also the reviews of the literature on fiscal-monetary interactions in, among others, Leeper & Leith (2016), Bassetto & Sargent (2020), Kehoe & Nicolini (2021), Cochrane (2023), Bassetto, Benzoni & Hall (2024) or, for facts and policy implications for the euro area, Checherita-Westphal et al. (2024).

both affect the value of *all* public liabilities no matter which specific branch of government issues them. As Bassetto & Sargent (2020) put it: *"(...) institutional arrangements that delegate decisions about bonds and money to people who work in different agencies are details. Central bank independence is a convention or a fiction."* It is a thought-provoking way of stating that the budget constraint of the public sector implies that taking fiscal policy as given imposes restrictions on feasible monetary policies, and vice versa. Sargent & Wallace (1981) first formalized this idea. Leeper (1991) imported it in workhorse macroeconomic models, introducing the concept of active and passive rules. This section summarizes these two seminal theories of fiscal (or monetary) dominance.

"Unpleasant monetarist arithmetic" The pioneering model of Sargent & Wallace (1981) can be summarized as follows. In a perfect-foresight endowment economy, at each date t, the government collects the real proceeds b_t from issuing one-period real bonds, and runs a real surplus s_t. Monetary policy is described by the path for money supply M_t, and P_t denotes the price level at date t. To fix ideas, suppose that money demand stems from a cash-in-advance constraint, whereby the private sector must use money to purchase the goods that it consumes, so that in equilibrium

$$M_t = P_t e_t \tag{1}$$

where e_t is the aggregate endowment. Denoting r_t as the real interest rate on public debt between t and $t+1$, the date-t consolidated budget constraint of the government reads:

$$P_t r_{t-1} b_{t-1} + M_{t-1} = P_t b_t + P_t s_t + M_t.$$

Iterating this equation forward, imposing a transversality condition, and using the demand for money (1) yields:[3]

$$b_{t-1} = \sum_{j=0}^{\infty} \left(\Pi_{k=-1}^{j-1} r_{t+k}\right)^{-1} \left(s_{t+j} + e_{t+j} - e_{t+j-1}\frac{P_{t+j-1}}{P_{t+j}}\right). \tag{2}$$

[3]See the discussion by Jiang et al. (2023), among others, on the conditions under which this transversality condition holds.

Fiscal and monetary dominance Suppose for the sake of the discussion that, as assumed in Sargent & Wallace (1981), the rates r_t do not depend on policy.[4] Then, given a path for surpluses s_t, this equation imposes restrictions on the feasible paths of future inflation rates P_{t+j}/P_{t+j-1}. In particular, tighter monetary policy in the short run, leading to a lower current price level P_t, has to be compensated with higher inflation in the future. Thus if the fiscal authority "moves first" and imposes a path of surpluses, monetary policy is constrained by fiscal policy. This is the essence of fiscal dominance. If, conversely, monetary policy moves first and sets the current and future price levels, the budget constraint of the government dictates the present value of future real surpluses. This corresponds to a situation of monetary dominance.

In Sargent & Wallace (1981), government bonds are real. This is at odds with the prevailing situation in advanced economies in which most sovereign bonds are denominated in the country's legal currency. Accordingly, the literature on fiscal and monetary interactions has since introduced nominal debt, as in Leeper (1991) described below, Sims (1994), or Woodford (1994). Nominal debt creates another channel for fiscal and monetary interdependence. To see this, suppose that the government issues nominal bonds B_t, so that B_{t-1}/P_t replaces b_{t-1} in the above intertemporal budget constraint. In this case, accommodative monetary policy reduces the need for fiscal surpluses both by generating seigniorage income and by eroding the real value of sovereign debt.

Active and passive monetary and fiscal policies Leeper (1991) formulates these general concepts of fiscal or monetary dominance in a context, commonly used in monetary macroeconomics, in which fiscal and monetary policies follow rules. More precisely, Leeper (1991) studies a simple economy similar to the one described above in which a policy consists of paths of money supply and issuances of one-period nominal debt. Policy also features a monetary rule—a mapping from realized inflation π_t into a nominal rate between t and $t+1$ equal to $R_t = \alpha_0 + \alpha\pi_t$. Finally, the (real) primary surplus is given by the fiscal rule $s_t = \gamma_0 + \gamma b_{t-1}$ with b_{t-1} the value of real debt. Uncertainty in this economy stems from additional random shocks added to each of these rules.

Leeper (1991) offers a characterization of the set of parameters for the monetary and

[4]This can be the case in equilibrium if we consider a small open economy subject to the world interest rate. It also holds if the public sector does not consume, and rebates taxes and proceeds from money issuance lump-sum to the private sector.

fiscal rules for which the economy admits a unique equilibrium. Such an equilibrium exists in two situations. The first one is that in which monetary policy is "active" ($|\alpha\beta| > 1$, with β the representative agent's discount factor) and fiscal policy is "passive" ($|\beta^{-1} - \gamma| < 1$). Along the equilibrium path, primary surpluses react positively to the level of debt whereas inflation only depends on monetary-policy parameters, which corresponds to the general notion of monetary dominance introduced above. The second situation in which an equilibrium exists is when monetary policy is passive ($|\alpha\beta| < 1$) and fiscal policy is active ($|\beta^{-1} - \gamma| > 1$). In this case, inflation is linked to fiscal variables and reacts positively to the level of debt, whereas primary surpluses only modestly respond to the level of debt, "preventing deficit shocks from being financed entirely with future taxes". This is akin to fiscal dominance, whereby the fiscal authority "moves first" and monetary policy accommodates.

Extensions These seminal contributions by Sargent & Wallace (1981) and Leeper (1991) have paved the road for a number of important extensions that we briefly describe here.

Maturity structure The bulk of the analysis of fiscal dominance is conducted with one-period government bonds. Notice that equation (2) is only valid for short-term debt. Cochrane (2001) shows that the maturity structure of debt matters for the dynamics of inflation under fiscal dominance. In particular, the management of the term structure of government debt, holding primary surpluses fixed, can shift inflation over time.

Monetary unions In a monetary union, the multiplicity of fiscal authorities and sovereign issuers leads to a more complex environment. In particular, Bassetto & Caracciolo (2021) investigate the consolidation of budget constraints in such a monetary union. Mackowiak & Schmidt (forthcoming) extend the analysis of fiscal dominance following Leeper (1991) to monetary unions, and study different configurations of fiscal policies within the union.

When no authority chickens out In the unpleasant arithmetic of Sargent and Wallace, if fiscal and monetary policies are such that there exists no path of the price level P_t that satisfies (2), there is no equilibrium associated with these policies. Similarly, Leeper (1991) shows that no equilibrium exists when both monetary and fiscal policies are active.

Yet it seems plausible in practice that, at least for some time, both the fiscal and the monetary authority refuse to chicken out and accommodate the other. The monetary authority may remain focused on controlling inflation while the fiscal authority does not adjust surpluses to stabilize debt. There are several ways to predict the outcome in such situations. A way to allow for equilibria with such active policies is to assume that such episodes are almost surely of finite duration because policies Markov-switch from active to passive (Bianchi & Ilut, 2017). An alternative approach is to relax the Walrasian equilibrium concept. Barthélemy, Mengus & Plantin (2024b) develop a strategic model of price-level determination in which they can derive the predictable outcomes associated with such policies that do not generate a Walrasian equilibrium. They find that this gives rise to trade at unofficial prices in black markets. They also obtain equilibria with sovereign default.

Fiscal theory of the price level Even though fiscal dominance and the fiscal theory of the price level are often put in the same bucket, Cochrane (2005) clearly explains that they are of a different nature.[5] The fiscal theory of the price level can be summarized as follows. In the economy in which we presented the unpleasant arithmetic, suppose now that the government only issues nominal bonds and raises real surpluses. In other words, it is a frictionlessÂ economy where money is not needed for transacting nor has a fixed relation with expenditures. It is still the case that condition (2) pins down the price level using only fiscal variables:

$$\frac{B_{t-1}}{P_t} = \sum_{j=0}^{\infty} \left(\Pi_{k=-1}^{j-1} r_{t+k}\right)^{-1} s_{t+j}. \tag{3}$$

The idea that fiscal policy alone can determine the price level in principle, although formally correct, has generated a heated debate. Buiter (2002) and Niepelt (2004) argue that two ingredients are spurious in this theory: (i) It relies on the private sector holding initial legacy debt that has not been explicitly priced in a rational-expectations equilibrium, (ii) Fiscal policy is allowed to be "non-Ricardian", that is, it can be inconsistent with equation (2) in some contingencies. This latter argument is carefully handled in Bassetto (2002), who shows that in order to properly study price-level determination, one needs to depart from Walrasian environments and rely on strategic models in which

[5]See also Sims (1994), Woodford (1994), McCallum (2001), and Cochrane (2001) among others.

policies are well defined for all (in and out of equilibrium) feasible actions of the private sector. Bassetto (2002) constructs a set of (in and out-of-equilibrium) fiscal and monetary actions that lead to the equilibrium outcome described by the fiscal theory of the price level. Barthélemy, Mengus & Plantin (2024b) show in a more general model of strategic exchange that the fiscal theory of the price level corresponds to an extreme form of fiscal dominance whereby the monetary authority stands ready to monetize all or part of public debt, and to adjust the price level so as to keep the real spending of the government constant no matter the actions of the private sector. Such actions are absent from the equilibrium path however.

Finally, Bassetto & Cui (2018) show that when the real rate of interest is sufficiently low, the budget constraint of the government does not pin down a unique equilibrium price level given debt and primary surpluses, as many Ponzi-schemes levels are sustainable and thus multiple price levels. Still, it does provide a lower bound on prices.

Remarks on sovereign default The seminal contributions of Sargent & Wallace (1981) and Leeper (1991) feature only risk-free public debt. Sovereign default is more generally assumed away in the literature on monetary and fiscal interactions. Such an assumption is in fact at the center of criticism of the fiscal theory of the price level (see Buiter, 1999, for example). Cochrane (2023) notices that an unexpected partial default, by reducing the legacy debt B_{t-1} in equation (3), can mitigate the price-level jump typically predicted by the fiscal theory of the price level following a negative surplus shock. By explicitly modelling the game of chicken, Barthélemy, Mengus & Plantin (2024c) demonstrate that default —when incorporating it in the utility functions of fiscal and monetary authorities— plays a pivotal role in shaping the equilibrium, even if it never occurs along the equilibrium path. The cost of default directly influences each authority's incentive to ensure debt sustainability, whether through higher fiscal surpluses or increased inflation.

2.2 Alternative approaches to fiscal-monetary interactions

Before reviewing the empirical literature on fiscal dominance, we offer, for the sake of completeness, a brief summary of the analyses of fiscal and monetary interactions which differ from that in Sargent & Wallace (1981) and Leeper (1991) on which we have focused thus far.

Optimal joint monetary and fiscal policies First, a large macroeconomic literature studies optimal public financial policy as a whole when a government with a single objective controls both its fiscal and monetary components. Following Lucas & Stokey (1983), this literature has emphasized that the public sector may optimally use unexpected inflation to deal with budgetary shocks (see Bohn, 1988; Chari, Christiano & Kehoe, 1991; Calvo & Guidotti, 1993, among others). Subsequent research has investigated how this result quantitatively depends on the costs of inflation, e.g., due to sticky prices (see Siu, 2004; Schmitt-Grohé & Uribe, 2004; Teles & Tristani, 2024, among others), or on the level and the maturity structure of public debt (see Lustig, Sleet & Şevin Yeltekin, 2008; Faraglia, Marcet, Oikonomou & Scott, 2013; Leeper & Zhou, 2021, among others).

On the other hand, Lucas & Stokey (1983) note that nominal liabilities also make the optimal fiscal and monetary policy time-inconsistent, a problem analyzed by Alvarez, Kehoe & Neumeyer (2004) and Persson, Persson & Svensson (2006).

As a result, the public sector may have to choose between state contingent inflation as a buffer against negative shocks to finance deficits and the time-consistency of its policy: by delegating its monetary policy to an independent central bank with a price stability mandate, the public sector opts for the latter at the expense of the former. Such a delegation creates room for strategic interactions that are not studied by this literature.[6]

Strategic interactions The time-inconsistency of monetary policy and its delegation to an independent authority has been intensively explored following Barro & Gordon (1983) and Rogoff (1985). In particular, a literature has identified tax distortions as the fiscal origins of such time inconsistency (see Alesina & Tabellini, 1987, among others). Dixit & Lambertini (2003) study how the nature of the game between the Treasury and the central bank affects their joint ability to handle such distortions in equilibrium. Gnocchi (2013) and Camous & Matveev (2022) study the best response to fiscal policy by monetary authorities with commitment power.

Interestingly, this rich literature on strategic fiscal and monetary interactions does not study the "game of chicken" induced by the intertemporal budget constraint of the government, which is the focus of Sargent & Wallace (1981) and Leeper (1991). Tabellini

[6]The central bank can also have a mandate with state-contingent inflation, with the objective to implement optimal inflation. This would make, however, the game even simpler and would not necessarily solve the time-consistency problem of the government: the government may issue debt that would lead the central bank to generate inflation following its mandate.

(1986) is an exception. He considers a reduced-form model in which the government issues debt to finance deficits and the central bank issues money that helps to reduce government debt in circulation.

2.3 Fiscal dominance in the data

We survey the literature that seeks to build evidence of fiscal dominance. We hope to showcase the impressive diversity of approaches that this literature encompasses.

Fiscal dominance helps understand recent dynamics in US sovereign bond markets A sequence of papers analyzes the valuation of US public debt through the lens of the budget constraint of the government, identifying conditions on fiscal policy under which this debt is risky or safe in real terms (See Jiang et al., 2024). In particular, Jiang et al. (2024) interpret bonds as claims on government surpluses. They stress that surpluses are procyclical in the case of the US. Building on this work, Gomez-Cram et al. (2024) show that, with nominal default-free debt, fiscal shocks are absorbed by fiscal surpluses under monetary dominance, while they are absorbed through inflation and, thus, real-debt fluctuations under fiscal dominance. From a policy perspective, Gomez-Cram et al. (2024) argue that bond markets have recently shifted from a regime of monetary dominance with safe real debt to one of fiscal dominance with risky real debt. In this latter regime, bond markets require a corresponding risk premium on public debt. Yields react to news about future government surpluses, as shown in Corhay et al. (2023), and bond yields are positively correlated with stock returns. In contrast, Hilscher, Raviv & Reis (2022) argue that inflation can only have limited effects on the real value of US public debt due to short maturities and the low expected persistence of inflation.

Historical and international examples suggestive of fiscal dominance Sargent (1982) provide historical examples of periods of persistently large inflation associated with fiscal deficits. Sargent & Velde (1995) describe how unpleasant fiscal arithmetic explains public finances before and during the French Revolution. Antipa (2016) shows the connection between fiscal policy and the price level in the UK during the period of suspension of the convertibility of the pound into gold between 1797 and 1821 associated with Napoleonic wars. Kehoe & Nicolini (2021) provide evidence of fiscal dominance for a large set of Latin

America countries over multiple decades. For the inter-war period, Barthélemy, Bignon & Ding (2024a) find support for fiscal dominance in France by studying the impact of bad news on German war reparations.

Regarding more recent international experiences, Bolhuis, Koosakul & Shenai (2024) document the fiscal-monetary tensions for a wide set of countries, measured as the difference between the natural interest rate and the "fiscal r-star" —the real interest rate that would stabilize public debt assuming output grows at its potential and inflation is at its target. They find a recent rise in the fiscal-monetary tensions for advanced economies. Using a large panel of countries, Brandao-Marques, Casiraghi, Gelos, Harrison & Kamber (2024) document a link between debt surprises and inflation expectations, especially for emerging countries.

Hall & Sargent (2022) document that the US financed the large expenditures associated with WWI, WWII, and the Covid-19 period mainly by issuing bonds and money. In the case of Covid-19, taxes account for a very small share (3.5% compared with 30.2% for WWII and 20.8% for WWI) and the increase in money supply for a substantial share (18.5% against 10.1% for WWII and 7% for WWI). Ex post, real returns on these assets were negative due to inflation in the case of WWI and WWII. Hall & Sargent (2011) or Acalin & Ball (2023) have analyzed the evolution of post-WWII US public debt. They both show that unexpected inflation accounts for a substantial share of the decline of US public debt.

Direct threats to the independence of central banks A recent literature has explored potential pressure applied by the fiscal authority on the monetary one (Binder, 2021; Romelli, 2022; Drechsel, 2024). Multiple recent papers (Camous & Matveev, 2021, among others) document that tweets by Donald Trump during his first term affected market perceptions of monetary policy. In particular, via a high-frequency approach, Bianchi et al. (2023b) show that these tweets affected the stock market, bond premia and, more generally, the economy.

More generally, the extent to which central banks can emancipate themselves from fiscal influence is the outcome of political-economy forces that are described, e.g., by Silber (2012) in the case of Paul Volcker, or by Mee (2019) in the case of the German Bundesbank.

Fiscal dominance risk helps explain inflation episodes Leeper, Traum & Walker (2017) show the importance of fiscal dominance to estimate fiscal multipliers, Bianchi & Melosi (2017, 2022) show that the expectation of fiscal dominance may explain both the absence of deflation during the Great Recession and post-Covid inflation. Bianchi et al. (2023a) extend Leeper's framework to account for fiscal inflation—inflation resulting from fiscal shocks to which the monetary authority does not respond. They show that such fiscal inflation is key to understanding inflation dynamics and predicting the inflationary effects of fiscal programs such as the 2021 US ARPA. Barro & Bianchi (2023) provide cross-country evidence on the link between government spending and inflation rate during and after Covid. Using a high-frequency approach and inflation forecasts from asset prices, Hazell & Hobler (2024) document that deficits contributed to around 30% of post-Pandemic inflation. Alternative reasons include the rise in commodity prices and constraints on supply chains (see Bernanke & Blanchard, 2023, among others).

Households' perception of fiscal dominance Within the literature on households' inflation expectations, a number of papers investigate the role of fiscal variables. Coibion, Gorodnichenko & Weber (2021) show that information treatments about future rising debt levels lead households to revise their inflation expectations upward. Building on this work, Andrade et al. (2024) provide evidence that at least some households make the connection between fiscal variables and inflation following a fiscal-dominance logic: Information treatments affecting expected debt levels also affect inflation expectations, mainly for households expecting that fiscal capacity cannot be expanded to fully fund the increase in debt.

2.4 Provisional conclusion: "The question is, Which authority moves first, the monetary authority or the fiscal authority? In other words, Who imposes discipline on whom?"

Sargent & Wallace (1981) ask this question at the end of their seminal paper. This literature review suggests that relatively little progress has been made to address it. There is a broad consensus that the intertemporal budget constraint of the government links monetary and fiscal policies, and creates room for a "game of chicken"—in the words of Sargent (1986)—when policies are delegated to two distinct authorities. But which authority has

the upper hand in this game is typically an arbitrary assumption: The literature on fiscal and monetary interactions takes fiscal or monetary dominance as exogenously given. For example, the rule-based approach pioneered by Leeper (1991) typically posits exogenous random switches across regimes. A natural next step in the study of fiscal and monetary interactions is a better understanding of the fundamental determinants of fiscal influence or the lack thereof on monetary policy. Is there an institutional design of the government that enables the monetary authority to "move first" in the game of chicken? Can politicians credibly commit to such a framework? Does the broader state of the economy drive the outcome of the game of chicken? The following section offers an elementary model that aims at scratching the surface on these questions that lie at the intersection of political economy and monetary economics.

3 When does fiscal dominance prevail? A simple theory

This section offers an elementary model that maps the primitive parameters of an economy, including the objectives of the fiscal and monetary authorities, into the prevalence of monetary or fiscal dominance. This adds complementary insights to that of the literature that takes fiscal or monetary dominance, or switches between them, as exogenous.

Overview of the model The public sector in this model is comprised of two agents, a monetary authority M and a fiscal authority F. The public sector issues two types of liabilities, reserves and (real) bonds (see the discussion below for nominal bonds). Reserves are the unit of account of the economy and trade between the monetary authority M and the private sector. F cannot commit to make good on the repayment of its bonds. The central ingredient of the model is a divergence between F and M's objectives. While both authorities incur costs from outright sovereign default, and thus seek to some extent to avert it, they each trade off sovereign solvency with different goals. M also seeks to keep the price level—the price of the (single) consumption good in terms of reserves—at some target. F by contrast balances making good on sovereign debt with maintaining a high level of government spending. F would thus like M to inflate away legacy public liabilities in order to be able to spend more without defaulting, whereas M prefers that the public sector averts default with fiscal consolidation holding inflation on target. Hence

the fiscal and monetary authorities play a game of chicken: They both dread sovereign default but want the other to incur the cost of avoiding it. As F has no ability to commit to future actions (nor does M), it contemplates using current debt issuance as a costly commitment device to gain the upper hand in such a game of chicken played in the future.

In sum, the key features of our model of such a game of chicken are essentially the same as that in Sargent & Wallace (1981), except for one crucial difference. In the seminal paper of Sargent and Wallace, F has full commitment power—both on debt repayment and future deficits—and acts as a Stackelberg leader, constraining monetary policy with credible fiscal plans. By contrast, none of the authorities can commit to policy plans in our setup, and so they use their policy instruments as commitment devices. The model that we present here is a stripped-down version of the richer description of fiscal and monetary interactions studied in Barthélemy, Mengus & Plantin (2024c).[7]

3.1 A two-date model of fiscal-monetary interactions

Consider a two-date economy in which time is indexed by $t \in \{1, 2\}$. There is a single consumption good. The economy features a private sector comprised of a competitive representative agent and a public one that consists of a fiscal authority F and a monetary authority M.

Endowments The private sector is endowed with a large quantity of the consumption good at each date, and there is a risk-free storage technology with gross real return $\rho > 0$. The private sector also inherits $L > 0$ units of reserves from an unmodelled past at the outset of date 1. M receives a date-2 real endowment $e \geq 0$. This endowment stems from unmodelled past investments in other assets than public debt (e.g., gold, foreign exchange reserves, private assets). It may also stand for an exogenous private demand for central bank reserves.

As is standard in game theory, we first describe the extensive form of agents' interactions, and then their objectives.

[7] We also sketch ideas developed in Barthélemy, Mengus & Plantin (2024b), in which we study more generally the extent to which a government has the capacity to determine the consumption value at which its currency trades without resorting to any trading bans or price controls.

Date 1 At date 1, M decides on a gross nominal rate on reserves $R \geq 0$ between 1 and 2. Then a bond market opens in which F sells to the private sector a promise to repay ρb units of the consumption good at date 2 for current goods, where $b > 0$ is the amount of bonds issued at date 1. F spends the proceeds if any.

Date 2 A market for reserves opens up at date 2 in which M and the private sector participate. We assume that this is a market à la Shapley & Shubik (1977). Participants post reserves or/and goods and the price level—the price of goods in terms of reserves—clears the market. M bids $\sigma \in [0, e]$ goods in it to buy back reserves. After this, simultaneously, F collects an in-kind tax $\tau \geq 0$, and receives a real remittance or dividend $\theta \in [0, e - \sigma]$ from M. It decides to default or make good on its debt and on a spending level g_2.

Objectives M targets a price level $P^* > 0$ at each date. It cannot end up with negative holdings of goods at any date.[8] F values government spending at each date. Spending cannot be negative.[9] Both authorities care about default. Formally, denoting by P_t the date-t price level and g_t government spending at this date, the respective preferences of M and F are:

$$U_M = -|P_1 - P^*| - \beta|P_2 - P^*| - \alpha_M h; \tag{4}$$

$$U_F = g_1 + \beta g_2 - \alpha_F h, \tag{5}$$

where $\beta > 0$ and $h \in \{0, 1\}$ is equal to 0 if and only if the government fully repays its debt. For simplicity, we assume an infinite aversion to default for F ($\alpha_F \to +\infty$) and a finite one for M, $\alpha_M \geq 0$.[10] If M is indifferent between several strategies, we make the tie-breaking assumption that it selects the one that maximizes the utility of F.

The private sector maximizes date-1 consumption.

We now solve for the (unique) predictable outcome of this game, using subgame-perfect Nash as our equilibrium concept. We derive the equilibrium backwards. The

[8] More formally, it derives an arbitrarily small payoff if this is the case, and will thus find it strictly dominant to avoid it.

[9] Idem.

[10] These two costs may have different interpretations. They may arise from the market reactions to expansionary fiscal policy but they may also be interpreted as costs of reversing central bank independence, as we discuss in Barthélemy, Mengus & Plantin (2024c). There, we also analyze the case in which α_F is finite and possibly below α_M.

following section starts with deriving the date-2 outcome taking as given date-1 history.

3.2 Three possible date-2 regimes

We solve backwards for the date-2 outcome, first analyzing the default decision of F given the date-2 reserve-market outcome and then studying optimal date-2 monetary policy.

Default decision Suppose that M has invested $\sigma \in [0, e]$ units of goods in the date-2 reserve market. As M is indifferent between consuming or transferring the remaining resources, it transfers $\theta = e - \sigma$ to F, which also collects taxes τ. Given that F is infinitely averse to defaulting, it does so only when it has no other options, that is when $\tau + \theta < \rho b$, where ρb is the value of its debt. Otherwise, F spends $g_2 = \tau + \theta - \rho b$.

Date-2 money market The private sector starts out at date 2 with the RL units of reserves carried from date 1. The private sector has no use for them at this terminal date, and thus finds it strictly dominant to sell them in the date-2 market for reserves. The date-2 price level P_2 thus satisfies $P_2\sigma = RL$.

M thus controls the date-2 price level $P_2 = RL/\sigma$ by setting the amount of real backing of reserves σ. It can in particular always reach its target ($P_2 = P^*$) provided that $P^* \geq RL/e$, which, we assume for brevity, always holds. But M may not want to do so if this leads to default. We have seen that default occurs when $\tau + \theta - \rho b < 0$. A price level on target is thus incompatible with sovereign solvency if $\tau + e - RL/P^* - \rho b < 0$. In this case, M may prefer to implement a higher price level $P_2 = RL/\sigma$ by spending smaller resources σ in the money market. This frees up resources for a larger transfer $e - \sigma$ to the government in order to avoid default. Conditionally on avoiding default this way, M optimally selects the lowest possible price P_2 such that $\tau + e - RL/P_2 - \rho b \geq 0$, equal to

$$P^F \equiv \frac{RL}{\tau + e - \rho b}. \tag{6}$$

This implies that when $P = P^F$, the government does not spend at all, $g_2 = 0$.

M's decision regarding the date-2 price level boils down to a comparison of the payoffs resulting from its target price level P^* and from P^F. When $P^F \leq P^*$, M implements

P^* and F has enough resources not to default. If $P^F > P^*$, M inflates reserves away to avoid default if and only if the cost $P^F - P^*$ is smaller than the benefits α_M, or $P^F \in (P^*, P^* + \alpha_M]$. When $P^F > P^* + \alpha_M$, M prefers to let F default, and sets the price level at P^*. Figure 1 depicts the resulting optimal monetary policy as a function of public debt b and money in the hands of the private sector RL.

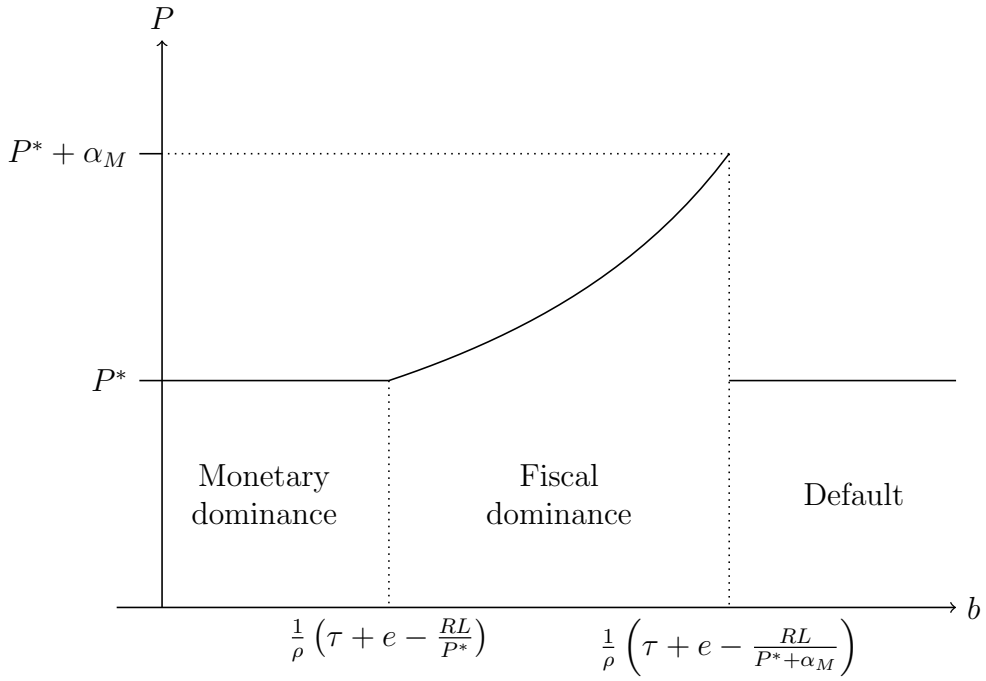

Figure 1: Policy regimes.

Comments on price-level determination Needless to say, our model of price-level determination by M is extremely stylized. It captures very simply the idea that in order to be able to curb inflationary dynamics and keep expectations anchored, the central bank must have sufficient assets to trade for reserves. This way, the central bank can credibly always buy back enough reserves at current market conditions in order to contract the monetary base and keep the price level stable.

Financial repression In the stylized above model, the money market is settled through a specific trading protocol. Agents post quantities of goods and reserves, and an unmodelled auctioneer figures out the market-clearing price. This specific rule is arbitrary, and also at odds with situations in which M sets a fixed price at which it is willing to trade its money, as is for example the case when it defends a currency peg. Suppose thus that M accepts to sell up to σ consumption units at the targeted price P^*. In this case, if $RL > P^*\sigma$,

the private sector is rationed and forced to hold more public liabilities than it would like to—a manifestation of financial repression. In this naive model, financial repression looks like a silver bullet that enables M to control the price level with any arbitrarily small amount of backing σ. Thus financial repression enables M to both control the price level and avert default even when fiscal dominance prevails in our baseline model with market-clearing price ($b > \frac{1}{\rho}\left(\tau + e - \frac{RL}{P^*}\right)$). Where is the catch? In the richer and more realistic model of price-level determination in Barthélemy, Mengus & Plantin (2024b), in which multiple heterogeneous agents are free to create markets to trade with each other, financial repression may give rise to unofficial markets in which the price level is above P^* and, broadly, decreasing in σ. Examples of such unofficial money markets with prices above the official price abound, e.g., foreign exchange unofficial markets during hyperinflations. Thus, financial repression and such black markets can be two sides of the same coin.

The three policy regimes We have shed light on three date-2 policy regimes: monetary dominance, fiscal dominance, and default.

In *monetary dominance*, the date-2 price level is on target $P_2 = P^*$ and F's spending g_2 decreases in response to any change in the debt b:

$$g_2 = \tau + \theta - \rho b, \tag{7}$$

$$= \tau + e - \sigma - \rho b, \tag{8}$$

$$= \tau + e - \frac{RL}{P^*} - \rho b. \tag{9}$$

In *fiscal dominance*, F's spending g_2 is at its minimum equal to zero and the price level P^F adjusts in response to any change in debt b following equation (6) that resembles the fiscal theory of the price level when re-arranged as:

$$\frac{RL}{P^F} = \tau + e - \rho b. \tag{10}$$

In our theory, fiscal dominance can occur only in situations in which F has no choice but defaulting in the absence of inflation as raising primary surpluses is not an option. This absence of any fiscal space prevents the central bank from lowering the price level without triggering a costly default. If this were the case that $g_2 > 0$ and $P_2 > P^*$ simultaneously

along the equilibrium path, M would indeed strictly benefit from increasing its investment σ in the money market to lower the price level and reduce the remittance θ, thereby forcing F to reduce spending g_2 so as to avert default, a contradiction.

Finally, in case of *default*, the price level is on target and $g_2 = \tau + e - \frac{RL}{P^*}$.

3.3 Date-1 bond issuance selects the date-2 policy regime

As is transparent from Figure 1, the critical endogenous variable on which the date-2 policy regime depends is the amount of public debt b. We now study how F optimally selects this debt level in the date-1 bond market. This showcases that bond markets are critical in the determination of the policy regime.

F selects b anticipating date-2 optimal monetary policy as described above. Issuing a debt level leading to default is not desirable as this would be perfectly anticipated by the private sector and thus yield no proceeds. Hence there are two options left for F.

The first option is to select a debt level below $\frac{1}{\rho}(\tau + e - \frac{RL}{P^*})$. In this case, F anticipates a date-2 price level pegged at P^*.

The second option for the government is to select a higher debt level than $\frac{1}{\rho}(\tau + e - \frac{RL}{P^*})$. In this case, F anticipates that M will deviate from its price-level objective and make a larger transfer. More precisely, F anticipates no date-2 consumption ($g_2 = 0$) and a price level $P_2 = P^F$ given by (6). To maximize the transfer from M, the optimal debt level b^F corresponds to the highest possible date-2 price level in the range of fiscal dominance, namely, $P_2 = P^F = P^* + \alpha_M$. This implies $b^F = \frac{1}{\rho}(\tau + e - \frac{RL}{P^* + \alpha_M})$.

In sum, issuing a debt level that induces fiscal dominance comes at the benefit of a larger transfer from M at date 2, but requires that F frontloads its entire consumption to date 1 by borrowing as much as possible at date 1. The cost to F of such frontloading depends on the discount factor β and the real rate ρ. If $\beta\rho \leq 1$, F is better off borrowing as much as possible against its date-2 resources no matter the date-2 price level. Inducing fiscal dominance and the maximum date-2 price level $P_2 = P^* + \alpha_M$ then comes at no cost for F.

When $\beta\rho > 1$, F faces a tradeoff between fiscal dominance and the cost of frontloading consumption. Under monetary dominance, the optimal debt level is $b = 0$. F chooses fiscal dominance if and only if this leaves it better off than date-2 monetary dominance,

that is, if

$$\frac{1}{\rho}\left(\tau + e - \frac{RL}{P^* + \alpha_M}\right) \geq \beta\left(\tau + e - \frac{RL}{P^*}\right), \tag{11}$$

or

$$(\beta\rho - 1)\left(\tau + e - \frac{RL}{P^*}\right) < \frac{\alpha_M}{P^* + \alpha_M}\frac{RL}{P^*}. \tag{12}$$

The right-hand side of condition (12) are the benefits from inducing date-2 fiscal dominance. It is the product of the ratio $\alpha_M/(P^* + \alpha_M)$, which can be interpreted as a rate of seigniorage, with the real value of the nominal liabilities of the government RL/P^*. The left-hand side are the costs of inducing fiscal dominance. It multiplies a unit cost of frontloading spending $\beta\rho - 1$ with the date-2 aggregate future resources of the government.

Triggers of fiscal dominance From inequality (12), fiscal dominance is more likely when real interest rates ρ are low, F is relatively impatient (low β), M has a high aversion to default α_M/P^*, and outstanding public nominal liabilities are large. Condition (12) is also more likely to hold when fiscal capacity $\tau + e - RL/P^*$ is small. Fiscal capacity encompasses both the resources of M (assets net of reserves: $e - RL/P^*$) and the tax capacity τ of F. Our theory thus offers a microfoundation for models of state-contingent regime switches. It is when the fiscal outlook darkens that the fiscal authority becomes tempted to let unfunded spending grow so as to double down on debt and induce help from the monetary authority.

In extensions of this baseline model, Barthélemy, Mengus & Plantin (2024c) introduce two natural ingredients that make fiscal dominance less palatable to F. First, if F can increase its date-2 taxes at a cost of distortions and faces a large cost of default, it must commit to large future tax distortions in order to induce fiscal dominance and may find it ex-ante undesirable. Second, if the bond market responds to the large increase in public debt required to induce fiscal dominance with an increase in the interest rate, then this may deter fiscal dominance even if the equilibrium interest rate appears to be low.

When F benefits from inducing fiscal dominance F does not derive ex-ante gains from inducing fiscal dominance even when it finds (ex-post) optimal to do so (when (12) holds).

The main reason is that M sets a higher rate R on reserves anticipating fiscal dominance and the higher price level in the future, so that its real remittance is not affected by fiscal dominance. On the other hand, fiscal dominance is ex-ante costly for F when $\beta r > 1$ as it incurs the costs from excessive borrowing. Then, F would be better off availing itself of a commitment device to not induce fiscal dominance, such as a credible fiscal requirement putting an upper bound on the amount of debt it can issue.

This result however holds only because the legacy public liabilities are reserves and thus have a variable rate. Were legacy liabilities fixed-rate debt due at date 2, there would be ex ante gains for F from fiscal dominance as it would contribute to eroding the ex-ante real value of public debt.[11]

Nominal versus real sovereign debt For expositional simplicity, we assume that sovereign debt is real. In contrast, public debts in many advanced countries such as the US or the UK are nominal and some observers consider that this feature would prevent any formal sovereign default. In Barthélemy, Mengus & Plantin (2024c), we show that the results remain unchanged if F issues nominal bonds: The private sector anticipates the date-2 price level and incorporates this expectation into pricing. As a result, fiscal dominance inflates away only legacy reserves (or any legacy public liabilities including long-term government bonds) but does not affect the newly issued nominal debt. Also, through the lens of our model, that nominal debt prevents a formal default through debt monetization can be interpreted as fiscal dominance.

4 Implications for central banking and bond markets

This section draws some implications from the simple model developed in Section 3 for central banking and bond markets.

4.1 Central banking and fiscal dominance

Central bank balance-sheet management The connection between fiscal-dominance risk and the management of central banks' balance sheets is central to many policy discussions (see Jiang et al., 2024, among others). Our model highlights two channels through which

[11] As detailed in Section 4.1, the out-of-equilibrium threat of fiscal dominance can be ex-ante profitable to F even with legacy reserves when M optimally enters into a strategy of preemptive inflation.

this management may affect the risk of fiscal dominance. First, an increase in the net nominal public liabilities in the hands of the private sector raises the gains from fiscal dominance for the fiscal authority. Second, a reduction in the net worth of the central bank diminishes the cost of inducing fiscal dominance by reducing the fiscal space. When a central bank expands its balance sheet by issuing reserves to purchase assets, it increases the exposure of its net worth to the risks borne by its assets. Even if the assets are nominal government bonds, so that the expansion is just a swap of public nominal liabilities, the net worth of the central bank becomes more exposed to an increase in interest rates. Thus a balance sheet expansion unambiguously creates room for future fiscal dominance by increasing the central bank's leverage. Holding the size of its balance sheet and the risk profile of its assets fixed, a central bank still increases the possibility of fiscal dominance when it holds more private securities than nominal government bonds.

Furthermore, central banks' interventions in public bonds markets may contribute to low levels of interest rates, thus giving incentives for the fiscal authority to engage in expansionary fiscal policy. Beyond quantitative easing, other central banks' specific programs may also affect fiscal authorities' incentives to engage in fiscal dominance. This is reminiscent of the discussions surrounding the Transmission Protection Instrument introduced by the ECB in July 2022 and its potential impact on individual countries' debt issuance decisions.

Preemptive inflation A potential way out of fiscal dominance for the central bank is paradoxically to generate moderate inflation. By eroding the real value of outstanding nominal liabilities, this creates fiscal space for the fiscal authority and, thus, diminishes its incentives to induce fiscal dominance.[12] Such *preemptive inflation* may be preferred by the central bank to the extent that it leads to lower levels of inflation than those resulting from fiscal dominance. This echoes the post-covid temporary tolerance for inflation in many jurisdictions that helped governments reduce their debt-to-GDP ratios.

Fiscal policies that may push to fiscal dominance Our game is clearly a stylized representation of fiscal-monetary interactions: We do not argue that governments design fiscal expansions with the explicit goal in mind to force the central bank to deviate from price

[12]In our model, M raises its date-1 price-level target until the real value of RL is sufficiently small that (2) no longer holds.

stability. Instead, we believe that we capture situations of "insidious fiscal dominance" (Leeper, 2023) where the government "kicks the can down the road" by postponing the resolution of policy problems or where the government does not internalize the inflationary consequences of large fiscal expansions, for example, in response to crises or wars.

4.2 Bond markets and fiscal dominance

The risk of fiscal dominance does not depend only on observable factors such as *current* bond-market conditions—like bond prices—and *current and future* fiscal conditions —e.g. fiscal space as usually defined as the distance to the fiscal limit. As mentioned in the previous section, the expected bond market reaction to a potential out-of-equilibrium attempt at forcing fiscal dominance also matters. Low rates per se are not as important for the rise of fiscal dominance as the lack of reaction of rates to fiscal policy, and whether policymakers foresee this lack of reaction. Conversely, fiscal authorities may not seek to impose fiscal dominance if they expect such an attempt to result in a strong deterioration in bond-market conditions. Such bond-market responses to anticipated fiscal expansions are typically referred to as the interventions of "bond vigilantes".

Bond vigilantes The term aims to capture the reactions of debt investors to impose fiscal discipline and/or more action against inflation by raising government borrowing costs. The term was coined by the financial market analyst Ed Yardeni in his weekly commentary on July 27th, 1983 titled "Bond Investors Are the Economy's Bond Vigilantes". He wrote: "So if the fiscal and monetary authorities won't regulate the economy, the bond investors will. The economy will be run by vigilantes in the credit markets." This idea of bond vigilantes was used on multiple occasions, as for example, during the Clinton administration, when fears of expansionary fiscal policy led bond yields to climb in 1993-94. The standard narrative is that this disciplined fiscal policy, ultimately leading to fiscal surpluses (see the column by McKinnon, 2011, in the Wall Street Journal, among others). More recently, bond vigilantes have regained prominence in policy and market-analysis discussions with the rise in long term US yields and the election of Donald Trump in 2024. Similarly, their role is intensively discussed to explain the rise in the spread between the French and the German bond yields in connection with France's persistent deficits and lack of fiscal consolidation.

The key question is then whether central bank's interventions may prevent well-informed bond vigilantes to send signals using prices (see Bassetto & Galli, 2019, for example). This is all the more the case with unconventional policies such as forward guidance or quantitative easing which may contribute to a more significant disconnection of bond yields from fiscal variables. In particular, This question was raised in the US context (see Jiang et al., 2024, among many others) or in the context of the euro area with ECB interventions such as the Outright Monetary Transactions or, more recently, the Transmission Protection Instrument. During the first decade of the euro area, bond yields across the monetary union were hardly different despite heterogenous macroeconomic and fiscal situations, arguably leading to lower market discipline (see Mengus, 2023, for a discussion). Notice that monetary unions have unclear effects on the emergence of fiscal dominance: they may lead individual countries to not fully internalize the effect of fiscal expansions on bond markets but, if the monetary union ultimately shares an aggregate budget constraint (Bassetto & Caracciolo, 2021), an individual country's fiscal expansion is also less likely to push the union to monetize debts.

An application: the UK mini-budget episode The market reactions to fiscal-policy decisions were arguably central in the mini-budget episode in the UK in 2022. We argue that this episode illustrates the dynamic and strategic nature of monetary-fiscal interactions as well as the role of markets as sketched in our model.

On September 6, two days after her appointment, Liz Truss announced the "energy price guarantee" to cap household energy bills. On September 21, the Monetary Policy Committee of the Bank of England confirmed the start of its quantitative tightening a few days later. On the 23rd, the announcement of the mini-budget—often described as a bold unbacked fiscal policy—led to a strong market reaction both on the Forex and on the Gilt market (see Figure 2). On September 28, the Bank of England started to provide support to the gilt market before announcing on October 10 the end of the market intervention on the 14th. On that day, Kwasi Kwarteng, the chancellor of the exchequer, resigned and so did Liz Truss six days later. Bond yields fell shortly after October 14.

Interpreting this episode through the lens of our model, the strong market reactions helped the central bank win the game of chicken. The rise in real bond rates following the mini-budget made apparent for the government that the financial costs of the unbacked

fiscal expansion and the risk of fiscal dominance dominated the potential gains of the tax cuts. In this perspective, the BoE intervention on the gilt market appears to be only transitory to restore market functioning (Pinter, 2023) but not to indefinitely support the mini-budget. In the language of our model, the Bank of England was not forced to chicken out, i.e. could rapidly stop bonds market interventions and did not intervene in the Forex market, because it anticipated the withdrawal or the modification of the mini-budget. The combination of strong reactions by investors leading to higher real rates, limited central bank's interventions on the gilt market and political pressures forced the Truss government to chicken out and resign.

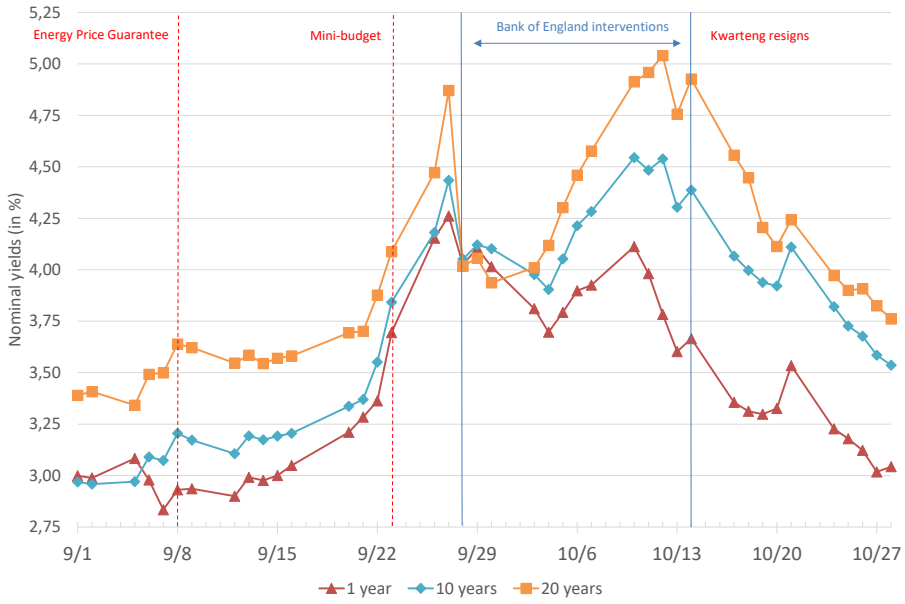

Figure 2: UK Government bond yields – Fall 2022

5 Conclusion

Most economies have experienced large shocks since 2008 that have reshaped the practice and understanding of monetary policy. In particular, the old and simple point that the fiscal and monetary components of public financial policy are interdependent has come to the foreground. From a research agenda perspective, this calls for a deeper integration of monetary economics with adjacent fields such as finance and public finance.

This paper aims to take stock of some of the progress made in this direction by the literature on fiscal and monetary interactions. It also offers suggestions for future research towards a better understanding of the determinants of fiscal dominance.

Another natural research avenue for finance scholars starts from the remark that a third component of public policy, the regulation of the private financial sector, also interacts with fiscal and monetary concerns insofar as it affects the consolidated budget constraint of the government. While the literature on financial stability has recently increasingly taken public-finance concerns into account, further points of contact between these literatures seem necessary.

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