



Bonds with transactions service and optimal Ramsey policy

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ABSTRACT

We introduce a model of government bonds with transactions services into a standard dynamic stochastic general equilibrium sticky-price monetary economy. This additional feature results in an endogenous interest-rate spread and affects equilibrium allocations and inflation by altering the Ramsey planner's sequence of implementability and sticky-price constraints. Qualitatively, the trade-off confronting a planner in sticky-price models shown in recent literature, between using inflation surprise and labor-income tax, is eliminated by the liquid bond channel. We find that the more sticky prices become, the more the optimal fiscal–monetary policy stabilizes prices and also creates less distortionary and less volatile income taxes by taxing the liquidity service of bonds. Quantitatively, we show that the additional tax instrument created by the bond liquidity channel can yield a sizable welfare gain from an economy without this channel.

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1. Introduction

How a government coordinates its macroeconomic policies is an important question and is the subject of ongoing interest in policy circles. In theoretical circles, the benchmark positive framework approaches this issue from the point of view of a Ramsey planner with a consolidated fiscal- and monetary-policy plan. However, recent focus has been on model economies where inflation matters and is costly to society in real terms. In this paper we provide an alternative setup of a sticky-price dynamic stochastic general equilibrium model with Ramsey optimal fiscal and monetary policy where there exists an interest-rate spread between two classes of nominally risk-free bonds (government and private bonds) à la [Canzoneri and Diba, 2005](#). The existence of liquid, interest-bearing government bonds creates a spread between the returns on illiquid private bonds and liquid government bonds that acts as an additional tax instrument.¹ [Canzoneri and Diba \(2005\)](#) provide one real example that, "... [U].S. Treasury bills clearly facilitate transactions in a number of ways: they serve as collateral in many financial markets, banks hold them to manage the liquidity of their portfolios, and individuals hold them in money-market accounts that offer checking services". We investigate how this new feature alters the equilibrium characterization of the Ramsey allocation, and modifies the trade-off between price stability and income tax stability found in recent papers, such as [Schmitt-Grohé and Uribe \(2004a\)](#) and [Siu \(2004\)](#), on Ramsey optimal policy in sticky-price environments.

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¹ The crucial difference between the bonds here is that government bonds provide some liquidity service. Thus, private agents may want to hold assets in the form of government debt in exchange for their liquidity service although they pay a lower return than the private bond. One can envision that the private sector can also issue liquid assets or bonds (e.g., credit cards, commercial paper and etc.). However, for the sake of clarity and exposition, we assume that there only exist a nominally risk-free private bond that is illiquid and the liquid government bond.

We show that government bond dynamics affect the intertemporal allocations of resources via the Ramsey planner's sequence of "implementability constraints". An implementability constraint is a nutshell constraint for the planner which encodes all private optimal decisions in a competitive equilibrium. More precisely, this unexplored effect of government bond liquidity

- (i) creates a wedge between the marginal social value of a current government deficit and private (net) marginal utility of consumption (and thereby how the planner discounts future deficits or surpluses);
- (ii) alters intratemporally the money-bond transactions technology constraint; and
- (iii) affects current inflation via the labor decisions and hence firms' real marginal cost,

and thus influences the sequence of the planner's implementability constraints. This suggests an avenue for fiscal policy, in terms of government debt with liquidity services (via the interest-rate spread), to alter the trade-offs between a limited number of distorting tax instruments faced by a Ramsey planner who wishes to approximate market completion in a world without real state-contingent assets.

We find that the more sticky prices are in our model economy, the more the optimal Ramsey plan favors price stability but the planner can also afford a less distortionary and less volatile income tax scheme. The latter result is opposite to that of existing literature, for example [Schmitt-Grohé and Uribe \(2004a\)](#) and [Siu \(2004\)](#). This is because in our model the dynamics of liquid government bonds affect the government's sequence of implementability (intertemporal solvency) constraints. Thus the planner uses the interest spread channel which alters the dynamics of liquid government bonds, as a means of satisfying the constraints, in designing its optimal tax and monetary policy plan. In doing so, the planner does not have to rely so much on using distortionary income tax or costly inflation to meet its expected intertemporal solvency constraints. Quantitatively, we show that the additional tax instrument created by the bond liquidity channel can yield a sizable welfare gain from an economy without this channel.

In the earlier literature on optimal fiscal and monetary policy, the analyses were often carried out using competitive flexible-price monetary models without capital, for example, [Lucas and Stokey \(1983\)](#), [Calvo and Guidotti \(1993\)](#), and [Chari et al. \(1991\)](#). The general conclusion was that optimal fiscal–monetary policy entails a volatile and serially uncorrelated inflation rate while labor income tax is smooth. This is because the planner uses surprise inflation as a lump-sum tax on household financial wealth, while minimizing the distortionary effect of labor income tax. Thus real government bonds act as a shock absorber to maintain a constant path for the labor income tax rate.

In the seminal works of [Schmitt-Grohé and Uribe \(2004a\)](#) and [Siu \(2004\)](#), the authors provide a variation on the results found in the optimal fiscal–monetary policy literature. In such economies, inflation is costly in terms of real resources such that the planner has to trade-off between minimizing tax distortions and minimizing costly inflation volatility. On one hand, in order to minimize tax distortions on private work incentives, the planner would like to use unexpected variations in the price level as a means for taxing household wealth, which leads to greater inflation volatility. This is the same effect found in the earlier class of flexible-price competitive economies. On the other, the existence of price adjustment cost affects household welfare via their feasibility constraint. This discourages the planner from trading off unexpected inflation with labor income tax variations, resulting in lower inflation volatility. [Schmitt-Grohé and Uribe \(2004a\)](#) find that the second effect dominates. In other words, for modest degrees of price stickiness, the tension is resolved in the direction in favor of price stability or low inflation volatility. Furthermore, the tax rate on labor is still reasonably smooth or "near random walk", but this tends to be less so, when there is imperfect competition; or even less when there exist sticky prices. [Siu \(2004\)](#) also has very similar conclusions. [Siu \(2004\)](#) specifically reports that under an optimal Ramsey policy, the volatility of inflation decreases while that of the labor tax rate increases as the degree of price stickiness in the economy rises. He also finds that the tax distortion can be smoothed over time.²

The new addition in our model is a direct adaptation of [Canzoneri and Diba \(2005\)](#) to a more fully specified environment. [Canzoneri and Diba \(2005\)](#) were concerned with the issue of price level determinacy in a deterministic, flexible-price endowment economy with simple monetary- and fiscal-policy rules. In their economy, fiscal policy can provide a nominal anchor, even when monetary policy does not. Their result arises because government bonds can provide liquidity services and this allows bonds to affect the equilibrium process for inflation. They allow for bonds to enter a cash-in-advanced (CIA) constraint and to act as imperfect substitutes for money. We generalize their assumption to a general equilibrium production economy with costly price adjustment, so that there are meaningful short-run monetary policy trade-offs to consider. Furthermore, we consider optimal policy from the point of view of the benchmark Ramsey planner.

The remainder of the paper is organized as follows. We outline the model primitives in Section 2. We show how a decentralized equilibrium, defined in Section 3, can be supported as a Ramsey planning problem in Section 4. We explain the implications of the liquid-bond feature in the model for Ramsey optimal taxation and monetary policy, in Section 4.1. This will be helpful in interpreting the experimental results in the remainder sections. We parameterize the model and perform some numerical experiments to study the behavior of the various Ramsey equilibria in Section 5. First, we consider in Section 5.1 what the optimal Ramsey plan does in various environments – with and without bond liquidity and/or sticky prices – in

² The result in [Siu \(2004\)](#) and [Schmitt-Grohé and Uribe \(2004a\)](#), in terms of a near-unit-root feature of optimal income tax, echoes the outcome in [Aiyagari et al. \(2002\)](#). In [Aiyagari et al. \(2002\)](#), the model is perfectly competitive but features incomplete markets where there is only real non-state-contingent government debt.

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