



# On the optimal quantity of liquid bonds<sup>☆</sup>



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## ABSTRACT

We develop a dynamic general equilibrium model to analyze the optimal quantity of liquid bonds by investigating the following three questions: under what conditions is it socially desirable to contract the bond supply, what incentive problems are mitigated by doing this, and how large are the effects? We show that reducing the bond supply induces agents to increase their demand for money, which can enhance welfare by improving the allocation of the medium of exchange. However, this effect fails for high inflation rates, because agents hold so little money in the first place that manipulating the bond supply is not enough to correct the misallocation.

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## 1. Introduction

Governments generally issue two intrinsically useless objects: money and bonds. While money is perfectly liquid, divisible, and widely accepted as a medium of exchange, bonds are “intentionally handicapped (hence discounted)” due to “physical or legal characteristics that render them less liquid than money” (Andolfatto, 2011, p. 133). By conducting monetary policy, central banks have a major control over the composition of these issued objects.

In this paper, we take a closer look at optimal quantity of liquid bonds. That is, we analyze under what conditions it can be desirable to contract the bond supply, what incentive problems this mitigates, and how large these effects are.

For this purpose, we construct a microfounded monetary model, where trading in financial markets is essential; i.e., trading improves the allocation of the medium of exchange. In our model, agents face idiosyncratic liquidity shocks, and

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they hold a portfolio composed of money and government bonds. Money can be directly used to purchase goods and thus serves as a medium of exchange. In contrast, government bonds cannot be used as a medium of exchange, but are a superior store of value.<sup>1</sup> The idiosyncratic liquidity shocks generate an ex-post inefficient allocation of the medium of exchange: some agents will hold money, but have no current need for it, while other agents will hold insufficient amounts of money to satisfy their liquidity needs. A secondary financial market allows agents to trade money for bonds and so improves the allocation of the medium of exchange. The secondary financial market is an over-the-counter market, that embeds the recent advances in search theory. We assume that the monetary authority directly controls the bond-to-money ratio and thereby the supply of liquid government bonds.

We derive our results in the monetary steady state equilibrium; i.e., there are no aggregate shocks. Furthermore, we focus on the optimal bond supply in an economy, where the efficient allocation is not attainable; i.e., on an economy with inflation rates above the Friedman rule. Our main finding is that contracting the bond supply mitigates a pecuniary externality and so improves the allocation and welfare. The existence of this externality causes the equilibrium to be inefficient, such that government interventions can be welfare-improving.<sup>2</sup> In our model, the secondary financial market reduces the incentive to self-insure against liquidity shocks, and agents attempt to benefit from money held by other market participants. As a result, the aggregate demand for money is too low, and contracting the bond supply can mitigate this externality. This is because contracting the supply makes bonds scarce and increases their price above their fundamental value. In turn, agents increase their demand for money, which marginally increases the value of money and so improves the insurance for all market participants.

We show that the optimal supply of bonds critically depends on the over-the-counter structure of the secondary bond market. If the market features high bargaining frictions, the optimal bond supply is large, whereas if the market is very competitive, the opposite is true. For a fully competitive market, it is even optimal to reduce the bond supply to zero. We also show that contracting the bond supply is only socially beneficial for low inflation rates. The reason is that for higher inflation rates, the demand for money is so low that contracting the bond supply is not sufficient to improve the allocation.

## 2. Literature

Our paper is in the field of the “New Monetarist Economics,” a branch of literature that builds on [Kiyotaki and Wright \(1989\)](#) and especially [Lagos and Wright \(2005\)](#).<sup>3</sup> In our model, agent-types are alternating, which generates an ex-post inefficient allocation of money and generates an endogenous role for a financial market, where agents can adjust their portfolios. In this sense, our paper is related to [Berentsen et al. \(2007\)](#) and [Berentsen and Waller \(2011\)](#). In contrast to these studies, we do not assume competitive pricing in the secondary financial market and model the exchange process in more detail. Concretely, we assume over-the-counter trading with search and bargaining frictions in the spirit of [Duffie et al. \(2005\)](#).<sup>4</sup>

Unlike the above-mentioned studies, our main focus is on the optimal quantity of bonds and its implications for the allocation of money and welfare. More closely related to what we do are the studies by [Williamson \(2012, 2015, 2016\)](#). While we assume that only money can be used as a medium of exchange, Williamson assumes that also claims to bonds are acceptable in some meetings. That is, Williamson assumes that agents do not directly trade money for bonds, but rather that banks collateralize their deposits with bonds and that agents can trade these claims for goods in monitored meetings.<sup>5</sup> In the exchange process, Williamson assumes take-it-or-leave-it offers, while we assume over-the-counter trading with search and bargaining frictions. This differentiation has interesting implications regarding the quantity of bonds, which are not present under the assumption of take-it-or-leave-it offers. Williamson models some features in more detail than we do, such as financial intermediation and the issuance of private debt, while we focus more explicitly on other issues. That is, we show under what conditions central banks succeed in controlling short-term interest rates by contracting the bond supply and when such a policy measure is socially beneficial. To do this, we do not solely focus on equilibria where bonds are scarce and exhibit a liquidity premium, but also focus on equilibria where bonds are plentiful, which allows us to obtain interesting insights.<sup>6</sup> For instance, we find that in equilibria where bonds and money are plentiful, welfare can always be improved by

<sup>1</sup> It is socially beneficial that government bonds cannot be used as a medium of exchange. Otherwise, bonds would be perfect substitutes for money and thus be redundant. See [Kocherlakota \(2003\)](#), [Andolfatto \(2011\)](#), [Berentsen and Waller \(2011\)](#), and [Berentsen et al. \(2014\)](#) for a more detailed discussion.

<sup>2</sup> See [Greenwald and Stiglitz \(1986\)](#) and [Berentsen et al. \(2016\)](#) for a more detailed discussion.

<sup>3</sup> A detailed overview of major contributions to this field can be found in [Williamson and Wright \(2010\)](#), [Nosal and Rocheteau \(2011\)](#), and [Lagos et al. \(2015\)](#).

<sup>4</sup> There is a rapidly growing literature which builds on the seminal contribution of [Duffie et al. \(2005\)](#). See, for instance, [Ashcraft and Duffie \(2007\)](#), [Duffie et al. \(2008\)](#), [Lagos and Rocheteau \(2009\)](#), [Lagos et al. \(2011\)](#), [Rocheteau and Wright \(2013\)](#), [Lagos and Zhang \(2015\)](#), [Berentsen et al. \(2016\)](#), [Mattesini and Nosal \(2016\)](#), [Trejos and Wright \(2016\)](#), and [Geromichalos and Herrenbrueck \(2016a, 2016b\)](#).

<sup>5</sup> A more detailed discussion about the acceptability of illiquid assets can be found in [Shi \(2008\)](#), [Lagos and Rocheteau \(2008\)](#), [Lester et al. \(2012\)](#), [Hu and Rocheteau \(2013\)](#), and [Rocheteau et al. \(2015\)](#). Collateralization is discussed in [Ferraris and Watanabe \(2008\)](#), [He et al. \(2015\)](#), [Li and Li \(2012\)](#), [Gu et al. \(2013\)](#), [Bethune et al. \(2015\)](#), [Andolfatto et al. \(2015\)](#), and [Rocheteau et al. \(2015\)](#).

<sup>6</sup> The existence of liquidity premia is discussed in [Geromichalos et al. \(2007\)](#), [Lagos and Rocheteau \(2008\)](#), [Lagos \(2010a\)](#), [Lagos \(2010b\)](#), [Lagos \(2011\)](#), [Jacquet and Tan \(2012\)](#), [Lester et al. \(2012\)](#), [Nosal and Rocheteau \(2013\)](#), [Lagos and Zhang \(2015\)](#), [Berentsen et al. \(2014\)](#), [Berentsen et al. \(2016\)](#), and [Dominguez and Gomis-Porqueras \(2016\)](#).

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