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journal homepage: [www.elsevier.com/locate/jme](http://www.elsevier.com/locate/jme)Liquidity provision, interest rates, and unemployment<sup>☆</sup>Guillaume Rocheteau<sup>\*</sup>, Antonio Rodriguez-Lopez

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## ABSTRACT

The effective liquidity supply of the economy—the weighted-sum of all assets that serve as media of exchange—matters for interest rates and unemployment. We formalize this idea by adding an over-the-counter market with collateralized trades to the Mortensen–Pissarides model. An increase in public liquidity through a higher supply of real government bonds raises the real interest rate, crowding out private liquidity and increasing unemployment. If unemployment is inefficiently high, keeping liquidity scarce can be socially optimal. A liquidity crisis affecting the acceptability of private assets as collateral widens the rate-of-return difference between private and public liquidity, also increasing unemployment.

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## 1. Introduction

Since its creation in 1913 a main mission of the Federal Reserve has been to provide and manage the liquidity—broadly defined as the sum of all assets that play a role as media of exchange—required to maintain an orderly financial system while achieving maximum employment, price stability, and moderate long term interest rates.<sup>1</sup> Aggregate liquidity management has become increasingly important due to the reliance of economic agents on safe and liquid assets to secure their various obligations arising from their lending, hedging, and payment activities (BIS, 2001) and due to the relative scarcity of such assets in the global economy (IMF, 2012). In spite of aggregate liquidity management being a key economic policy, little theoretical work has been done to relate it to macroeconomic outcomes, such as interest rates and unemployment.

The objective of this paper is to fill this void by providing a tractable framework to analyze the joint determination of aggregate liquidity, interest rates, and labor market outcomes. Along the lines of Friedman and Schwartz (1970), throughout this paper we think of aggregate liquidity as “the weighted sum of the aggregate value of all assets, the weights varying with the degree of *moneyness*.” The *moneyness* of an asset corresponds to its ability to serve as media of exchange, means of payment, or collateral in various transactions.

On the positive side we describe how changes in the supply and demand of liquidity affect interest rates, the supply of jobs, and unemployment. We identify a market mechanism that reduces the scarcity of liquid assets, and a liquidity channel through which monetary policy has permanent effects on the labor market. Moreover, our model provides a setting to

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<sup>1</sup> The Federal Reserve was created by the Federal Reserve Act of 1913 in order to prevent financial panics such as the one in 1907. It was amended in 1977 (Section 2A) to specify the objectives of monetary policy: maximum employment, stable prices, and moderate long-term interest rates. For a description of how the mandates of the Federal Reserve have been shifting over time, see Reinhart and Rogoff (2013).

analyze financial crises by describing how adverse shocks to the acceptability of private assets as media of exchange alter the effective liquidity supply of the economy, the structure of interest rates, and the functioning of the labor market. On the normative side, we show that the optimal provision of liquidity depends on the frictions in the labor market, and we investigate a trade-off between public provision of liquidity and unemployment.

From a methodological standpoint we develop a continuous-time model of the labor market that extends the Mortensen–Pissarides framework (MP hereafter) to include a demand and supply of liquidity and endogenous interest rates. We incorporate liquidity considerations by adding an over-the-counter (OTC) market—similar to the one in Shi (1995), Trejos and Wright (1995), and Duffie et al. (2005)—in which *traders* exchange services financed with collateralized loans. This OTC market aims to capture the wholesale financial markets, including repo markets, markets for derivatives, and large-value payment systems (BIS, 2001). It can also be interpreted as a market where households finance idiosyncratic consumption opportunities or firms finance investment opportunities.

As a benchmark we first describe an economy where OTC-traders can commit to repay their debt (e.g., they can be subject to large penalties if they fail to do so). The equilibrium interest rate is the rate of time preference (as in the textbook MP model) and trades in the OTC sector are socially efficient. In the rest of the paper we relax this commitment assumption in order to make liquidity essential.

In the absence of commitment, two types of assets can serve as collateral in the OTC market: claims on firms' profits, and public assets that are backed by the ability of the policymaker to raise taxes.<sup>2</sup> When the supply of liquidity is abundant, the interest rate is maximum and equal to the rate of time preference (as in the economy with full commitment); in this case, the total surplus in the OTC market is maximized. When the supply of liquidity is scarce—so that OTC-traders' borrowing constraints are binding—the interest rate falls below the rate of time preference. Firms respond to the lower interest rate by opening more jobs so that total market capitalization increases, which raises the private supply of liquidity in accordance with a Tobin effect.

Our model generates the following comparative statics for the supply and demand of liquidity. Regulations that raise collateral requirements for OTC transactions IMF (2012, p. 95) lead to a reduction in the interest rate, more job creation, and lower unemployment. Moreover, if private assets are heterogeneous in terms of their pledgeability, such regulatory changes lead to collateral expansion, i.e., assets of lower quality that are subject to lower loan-to-value ratios start being used as collateral. Along the transition, market tightness—the ratio of the number of vacancies to the number of unemployed—overshoots its new steady-state value.

When liquidity is scarce, an increase in the supply of real government bonds raises the interest rate (by reducing their convenience yield), which slows job creation and reduces the private supply of liquidity. Hence, our model predicts a crowding out of the private liquidity by the public one, in accordance with the evidence from Krishnamurthy and Vissing-Jorgensen (in press). An open-market sale of bonds in exchange for currency or reserves has a redistribution effect across trades by shrinking narrow measures of liquidity (currency) and expanding broader measures (currency plus bonds), which leads to higher interest rates and unemployment. Conversely, an increase in the inflation rate reduces the real interest rate and unemployment.

From a normative standpoint our model identifies a trade-off between liquidity provision and unemployment. This trade-off arises because of search externalities that can make the unemployment rate inefficiently high. For instance, if the wage is too high relative to the workers' contribution to the matching process (as formally defined by the Hosios condition), then it is optimal to keep liquidity scarce to lower the cost of financing firms and to promote job creation. This finding suggests that a situation where liquidity needs are not satiated might correspond to a second-best outcome.

Lastly, we use our model to describe a liquidity “crisis” that makes private claims less acceptable as collateral in OTC transactions—for example, due to more acute informational asymmetries. Such a shock leads to a higher financing cost for firms, a higher rate-of-return differential between private and public liquidity, and higher unemployment. The policymaker can mitigate the adverse effect of this shock by committing to purchase private assets at their pre-crisis price in exchange for public liquidity.

## 1.1. Literature

Our model is related to the literature on unemployment and financial frictions. Wasmer and Weil (2004) extend the MP model to incorporate a credit market with search frictions.<sup>3</sup> In contrast to our approach, there is no OTC market and no liquidity considerations to endogenize the interest rate. There is also a literature on unemployment and money/liquidity, e.g., Shi (1998) and Berentsen et al. (2011). Our description of the OTC market is similar to their search market with bilateral matches. However, the interest rate faced by firms in these models is exogenous and equal to the rate of time preference since claims on firms' profits are assumed to be illiquid.<sup>4</sup> Moreover, from a methodological point of view, our model is written in continuous time, which considerably simplifies the presentation and dynamics since the equilibrium is unique.

<sup>2</sup> The assumption that some assets play a special role in transactions is consistent with the evidence from Krishnamurthy and Vissing-Jorgensen (2012) according to which both government bonds and highly rated corporate bonds exhibit convenience yields. According to BIS (2001, p. 8) securities accepted as collateral in derivatives markets are limited to government securities. In contrast, in repo transactions a broad range of assets can serve as collateral, including mortgage-backed securities, corporate bonds, and equity. Recently, corporate bonds have also become acceptable for cleared interest swaps.

<sup>3</sup> This model was extended and calibrated by Petrosky-Nadeau and Wasmer (2013).

<sup>4</sup> There are other models of money and frictional labor markets where the goods market is frictionless, i.e., it is not described as a decentralized market with search and bargaining. See, e.g., Cooley and Quadrini (2004).

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