Incomplete markets, liquidation risk, and the term structure of interest rates

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Abstract

We analyse the term structure of interest rates in a general equilibrium model with incomplete markets, borrowing constraint, and positive net supply of government bonds. Uninsured idiosyncratic shocks generate bond trades, while aggregate shocks cause fluctuations in the trading price of bonds. Long bonds command a "liquidation risk premium" over short bonds, because they may have to be liquidated before maturity – following a bad idiosyncratic shock – precisely when their resale value is low – due to the simultaneous occurrence of a bad aggregate shock. Our framework endogenously generates limited cross-sectional wealth heterogeneity among the agents (despite the presence of uninsured idiosyncratic shocks), which allows us to characterise analytically the shape of the entire yield curve, including the yields on bonds of arbitrarily long maturities. Agents' desire to hedge the idiosyncratic risk together with their fear of having to liquidate long bonds at unfavourable terms implies that a greater bond supply raises the level of the yield curve, while an increase in the relative supply of long bonds raises its slope.
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1. Introduction

This paper analyses the term structure of real interest rates in an infinite-horizon, general equilibrium framework in which agents are hit by aggregate shocks, as well as idiosyncratic shocks that cannot be fully insured due to incomplete markets and borrowing constraint. On the one hand, uninsured idiosyncratic shocks generate bond trades – as traders willing to buy bonds for precautionary purposes purchase them from traders willing to sell to buffer the shocks. On the other hand, aggregate shocks cause fluctuations in bond prices, and hence induce some volatility in the terms at which bond trades take place.

The key novelty of our approach is the construction of a tractable equilibrium allowing for an analytical characterisation of the entire yield curve (from one-period to arbitrarily long bonds), while accommodating active trades of positive net bond supplies at all maturities. Tractability follows from two main underlying assumptions, which jointly ensure that the model generates a finite-dimensional cross-sectional distribution of wealth as an equilibrium outcome.[1] The first assumption is that agents' instant utility is separable in consumption and labour and linear in labour (as in, e.g., Scheinkman and Weiss [36]). As we show, endogenous labour supply with quasi-linear preferences implies that agents entering the good idiosyncratic state ("employment") are willing to work as much as necessary to instantaneously replete their bond portfolio; in consequence, bond holdings are homogeneous across agents in that state – and independent of their *history* of idiosyncratic states. The second assumption is that equilibrium bond holdings are sufficiently small for agents entering the bad idiosyncratic state ("unemployment") to be willing to liquidate their asset wealth in a small number of periods. The reason is that, under transitory idiosyncratic shocks, agents in the bad idiosyncratic state may be willing to *borrow* against future income, in which case they hit the borrowing constraint. Agents in this situation simply liquidate their bond portfolio and, by way of consequence, no longer affect bond prices. We focus on the equilibria with "full asset liquidation", where small equilibrium bond holdings in the first place ensures that agents immediately face a binding borrowing constraint when hit by a bad idiosyncratic shock.[2]

The theoretical investigation of the model shows that, in this framework i) a higher net supply of government bonds of any maturity – financed by lump-sum taxes – raises the level of the entire yield curve; ii) a higher net supply of long bonds raises the slope of the yield curve – where we define the "slope" as the yield difference between the two ends of the curve.[3] The first effect (on the *level* of the curve) can be seen as a generalisation to the full set of bond maturities of a common implication of non-Ricardian economies, according to which an increase in the supply

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[1] This is in contrast with most incomplete market economies, where any agent's wealth depends on his entire own history of idiosyncratic shocks, so that infinitely many agent types ultimately coexist in the economy. Such models must be solved numerically and can accommodate only a small number of assets, typically one or two (e.g., Den Haan [11], Heaton and Lucas [21], Krusell and Smith [30], Heathcote [19]).

[2] In the separate technical appendix to the paper, we study numerically a relaxed model wherein asset liquidation is gradual rather than immediate, and confirm all the results obtained in the case of instantaneous asset liquidation.

[3] Empirically, Laubach [31] reports that higher levels of public debt or larger fiscal deficits significantly raise real interest rates. Relatedly, Krishnamurthy and Vissing-Jorgensen [26] show that the size of public debt negatively affects the spread between corporate and Treasury bond yields, a reflection of the presence of a "Treasury demand function". The work of Engen and Hubbard [12], Gale and Orszag [13] and Longstaff [32] point toward a similar relationship.