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Banks' risk taking, financial innovation and macroeconomic risk[☆]

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ABSTRACT

This paper shows how financial innovation in combination with the fall of macroeconomic risk can explain the strong growth of the primary and secondary credit markets in the U.S. economy. We document empirically the fall in macroeconomic risk, the expansion of the prime and secondary credit market and we provide evidence that changes in macroeconomic risk are closely related to the evolution of the prime market. In the theoretical part of the paper we study in a simple portfolio optimization framework the effect of financial innovation and macroeconomic risk on banks' risk taking. The results of the model show that financial innovation increases bank appetite for risky investment both in the prime and secondary markets and that this effect is stronger in environments with low aggregate macroeconomic risk. In addition the banking system becomes less stable because of the portfolio risk of each individual bank increases.

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1. Introduction

The global financial and economic crisis of 2007 turned the attention to many issues that the economists had not paid special attention before it. One of these is the big credit expansion that characterized the U.S. financial market the last 20 years (Fig. 1). How can such a credit boom be justified? How is it related to the crisis? In Section 2 I present a literature review on the different reasons that the existing literature provides as potential motives for the increase in the aggregate credit volume. This paper adds to the literature by offering a complementary explanation for the credit boom. The rationale of this study is that the credit boom could have been created as a combination of macroeconomic and financial effects that changed banks' perception about total risk and which led to a big increase in the total supply of credit in the financial system. More specifically, the last 20 years, the financial

system was characterized by a strong innovation in the secondary markets which gave birth to new financial products that the financial intermediaries could use to hedge their idiosyncratic risk. The improved risk diversification ultimately led to credit expansion because they were facing less risk. However an interesting observation arises from the study of the evolution of both prime and the secondary markets for risk and the history of financial innovation. Even though many of these new financial products were available from the 1970s, it was almost two decades later, in the 1990s that both the prime and the secondary markets for risk expanded substantially. In the meantime, in the mid-1980s, the macroeconomy was characterized by a big drop in macroeconomic risk which marked the start of the period known as the Great Moderation. According to Wilson (1998) the systematic risk of a loan determines most of the part of all risk related to a loan and only a small number of macroeconomic factors are sufficient to explain it. Hence I believe that the decrease in aggregate risk played an important role in the credit expansion not only through the direct decrease of the total risk that banks were facing but also through its effect on the use and development of new financial products in the secondary markets. In environments with lower macroeconomic risk, the weight of idiosyncratic risk is higher and therefore the role of financial innovation on portfolio decisions is more important. Therefore the purpose of this paper is to understand how the fall of macroeconomic risk in combination with financial innovation has contributed to the credit boom. It is worth clarifying that

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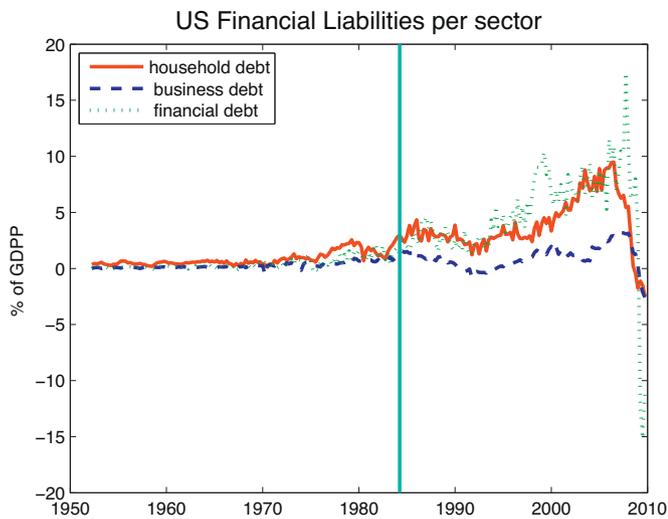


Fig. 1. U.S. Financial Liabilities per Sector. *Note:* This figure plots the growth rate of the U.S. Financial Liabilities for the household, the business and the financial sector as percent of the GDP. All variables are measured in 2005-chained dollars. The financial liabilities are defined in debt terms. The data are quarterly and they span the period 1952Q2–2010Q2. The vertical sky-blue line denotes the first quarter of 1984. The data source for the GDP is BEA and for the financial data is the Flow of Funds Accounts of the United States.

an increase in aggregate credit does not necessarily mean that bank's increase risk taking. However many studies after the last crisis have pointed out that the credit boom, preceding the crisis, contribute to the vulnerability of the financial system and that is why the consequences of this crisis were so harsh. Moreover Reinhart and Rogoff (2009) show that credit booms are some of the best indicators of financial crisis throughout the history of financial markets. Therefore this paper contributes to the literature by showing how credit booms can reduce financial stability. My main investigation contains two parts. In the first part, I present the empirical motivation for my study by providing stylized facts on my variables of interest. I characterize the evolution of the prime and secondary market for credit and I identify the decline in macroeconomic volatility by estimating the standard deviation of the real GDP growth rate. Consistent with the literature, the estimation produces evidence of a substantial downward shift of the aggregate volatility after the mid-1980s. Finally, I also show graphically the correlation of the macroeconomic risk with the prime market for risk. The empirical results show that changes in macroeconomic conditions are closely related to the evolution of the prime market for risk. In the second part, I put together these different elements and I show their interconnection in a simple portfolio optimization model. The theoretical part of my study explores the portfolio optimization problem of a bank with constant absolute risk aversion (CARA) preferences, under two different scenarios; (i) Autarky, i.e. without a secondary markets and (ii) Financial Innovation, i.e. with a secondary markets. The banking system is segmented and the banks are identical except of the fact that they face different idiosyncratic return risk. Therefore the total risk that the bank faces has both a systematic/macro component and an idiosyncratic/regional-specific component.¹ In the "financial innovation" scenario banks can use credit

¹ Throughout the paper I refer more to macroeconomic risk because the aim of the paper is to show how changes in macroeconomic volatility could have affected the banks' portfolio decisions and risk taking behavior. In this paper I am considering only changes in aggregate volatility and in financial innovation and I am basically assuming that any other variable, including idiosyncratic risk, stays constant.

derivatives in order to hedge their idiosyncratic risk. By using the credit derivatives, the banking sector becomes more homogeneous, more integrated, given that the regional differences between the different banks decrease. I solve the model and compute the optimal portfolio choices of the bank under the two different scenarios. The CARA-Normal specification of the model permits the generation of closed-form expressions for the demand of risky assets and for the demand of credit derivatives. Pursuing a comparative statics analysis I show that the use of the credit derivatives induces banks to invest more in risky assets and in credit derivatives. The portfolio variance of the banks increases because even though credit derivatives help to hedge the idiosyncratic risk, they induce the banks to acquire more risky assets that embody also unhedgeable aggregate risk. Therefore the total variance increases. The results also highlight the interesting nonlinear effects that arise between financial innovation and macroeconomic risk. The strength of the effect of the financial innovation on the banking sector is stronger in environments with low aggregate macroeconomic risk. The reason is that when aggregate risk decreases, the importance of the idiosyncratic risk on the bank's portfolio choices is bigger. As a result the effect of financial innovation is more powerful. In addition I also extend the model in general equilibrium and I study the effect of financial innovation and aggregate risk on prices. Consistent with the literature, the results show that the decrease in aggregate risk and the increase in the degree of financial innovation decrease the equity premium. Finally, I also consider the role of regulations. VaR constrained banks have a more prudent behavior towards risk compared to unregulated ones. A tightening of the constraint improves financial stability but in the cost of lower banks' welfare.

The rest of this paper is organized as follows. Section 2 reviews the literature and Section 3 presents the empirical motivation. Section 4 presents the model and discusses the results. Section 5 concludes.

2. Literature review

This paper presents a very simple model that provides a rationale for the credit boom, which characterized the financial markets before the 2007 crisis. I support that financial innovation in combination with changes in macroeconomic risk, have significantly affected the intermediaries incentives for risk and as a consequence the final volume of credit in the economy. This analysis is therefore related to other studies, both in the macroeconomic and in the finance literature that investigate the reasons that led to the extraordinary credit expansion observed the last two decades.

Both practitioners (Cantor, 2008; Cantor & Hu, 2007) and academics in finance (Bolton, Freixas, & Shapiro, 2010; Pagano & Volpin, 2010) share the view that financial innovation on one hand was facilitating risk diversification and risk hedging but on the other hand its opaque and complex nature led to an over-expansion of credit. In these papers, agency problems lead to a credit expansion because financial institutions, which were trading securities and derivatives, were able to increase their profits by not disclosing their true risk. In addition Shin (2009) underlines that the securitization process increased the leverage ratio of the financial institutions and as a consequence lending standards were decreased and credit was extended also to low quality borrowers. In my model I completely abstract from agency problems and all information is common knowledge and symmetric. However I can still generate an expansion of credit beyond the level that is generated purely from diversification and hedging because I take into account the specific macroeconomic conditions that the economy experienced the last two decades before the 2007 crisis. In this way I want to stress out that in order to fully understand the effect of financial innovation on credit expansion, except of the

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