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Uncertainty in financial markets and business cycles

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ABSTRACT

Can financial uncertainty shocks induce real downturns? To investigate this question theoretically, this paper develops a dynamic stochastic general equilibrium model with two period lived heterogenous agents, monopolistically competitive firms and sticky prices. In the model financial uncertainty is measured by the volatility of stock prices and this volatility results from the stochastic irrational beliefs of nonsophisticated agents about the future performance of the stock. An increase in the stock price volatility decreases aggregate demand and generates a significant contraction in output. The model contributes to the literature by modeling financial market volatility in a general equilibrium framework, establishing its causal impact on real variables, highlighting the mechanisms through which the impact works, and providing estimates of its magnitude.

1. Introduction

This paper investigates whether uncertainty originating in financial markets affects real variables and helps drive business cycles. The impact of uncertainty is investigated based on a New Keynesian model with two types of agents, sophisticated and nonsophisticated, who price the risky asset, stock, differently. In the model, an increase in volatility of future stock price expectations of nonsophisticated agents increases the volatility of current stock prices. The stock price volatility, in turn, reduces consumption, investment, employment and output. The paper contributes to the literature by modeling financial market volatility in a general equilibrium framework, establishing its causal impact on real variables, highlighting the mechanisms through which the impact works, and providing estimates of its magnitude.

By investigating the real consequences of financial volatility, the paper fills a gap in the existing DSGE literature on business cycles. In the DSGE literature, the prevalent approach is to model volatility as originating from real sector. This modeling choice reflects the fact that modeling financial markets as an exogenous source of volatility is not straightforward when all agents are assumed to be rational. Hence, volatility is modeled as second moment shocks to the total factor productivity,[2] household discount rates,[3] idiosyncratic productivity of the firms,[4] or fiscal policy tools.[5] In these models an increase in real volatility in turn causes a contraction in output and induces endogenous volatility in asset prices.

The innovation in the current model is that it generates financial market volatility even in the absence of real shocks. In other words, in this model uncertainty shocks originate in the financial sector and are transmitted to real sector. The critical assumption for generating financial market volatility in the absence of real shocks is the existence of nonsophisticated agents in the model who are boundedly rational and have volatile expectations about future stock market performance. This modeling setup reflects the insight that financial markets might themselves be an independent source of uncertainty. Theoretically and empirically, there is a large body of work that suggests behavioral and informational shocks might lead financial volatility to increase over and above volatility due to fundamental shocks.[6] In this respect, this paper identifies a mechanism both for the exogenous increase in financial

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[2] See Bloom et al. (2012) and Basu and Bundick (2017).

[3] See Basu and Bundick (2017).

[4] See Gilchrist et al. (2014), Christiano et al. (2013), and Arellano et al. (2010).

[5] See Fernández-Villaverde et al. (2015) and Born and Pfeifer (2014).

[6] See De Long et al. (1990), Barberis et al. (1998) and Baker and Wurgler (2006).

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uncertainty caused by nonfundamental factors and its transmission to real industry. This independent impact of financial uncertainty might be working together with real uncertainty shocks emphasized in the literature and help understand the severity of the resulting downturns. This setup is particularly relevant for the recent Great Recession, considering the widespread consensus about the role of financial sector in instigating the crisis.

The current work is also closely related to the literature on the role financial imperfections play in business cycles. Greenwald and Stiglitz (1993), Kiyotaki and Moore (1997), Bernanke et al. (1999), Bacchetta and Caminal (2000), Gatti et al. (2007) and Gatti et al. (2010) add financial sector to the standard dynamic general equilibrium framework and show that financial frictions accelerate the impact of negative real shocks because credit constraints become tighter and default risk and real cost of borrowing increases. More recently, Gilchrist et al. (2014), Christiano et al. (2013), and Arellano et al. (2010) model the impact of uncertainty shocks and how financial frictions amplify their impact to explain the role financial sector played during the Great Recession. Both of these literatures highlight the importance of financial sector in making cyclical fluctuations worse when real shocks hit the economy, but financial sector is not the source of the shock. The current study differs from these literatures by modeling the financial sector as the source of uncertainty and shows that financial uncertainty shocks can drive business cycles even in the absence of a fundamental shock elsewhere.

The model is closely related to Basu and Bundick (2017). In particular, in this paper, the firms' problem is based on Basu and Bundick (2017), and in both papers uncertainty shocks depress output through precautionary increases in labor supply and savings. There are, however, also a number of ways that the models are different. In the current paper, uncertainty originates from financial sector, whereas Basu and Bundick (2017) does not model financial sector, and uncertainty shocks enter through increases in the volatility of household discount rate and productivity. Second, while in both papers uncertainty shocks depress output through precautionary incentives, in the current paper, there is second channel, where the increase in the volatility of future stock prices induces an immediate fall in the current stock prices, decreases wealth of the agents and depresses demand.

The paper formalizes the impact of financial uncertainty on real variables based on a model that works in two steps. The first step generates financial uncertainty as the outcome of "mood" shocks to agents. In particular, there are two types of agents, sophisticated and nonsophisticated, who price the risky asset, stock, differently. Sophisticated agents correctly discount future dividends. Nonsophisticated agents, on the other hand, are subject to "mood" shocks which change their level of "pessimism" about the future performance of the stock, and cause their valuation to deviate from sophisticated agents' valuation. The "mood" of nonsophisticated agents is subject to volatility shocks causing the volatility of the stock prices to be stochastic.

The second step in the model, the main focus of the paper, captures the impact of greater stock price volatility on real variables. The impact works as follows. First, because agents are risk averse, when future stock price volatility increases, demand for stocks and equilibrium stock price falls, and because agents hold stocks, there is a negative wealth shock. Second, the increase in stock price volatility implies an increase in volatility of future income, which induces agents to take precautionary measures. In response to both the wealth shock and precautionary motives, agents cut back on consumption and increase their labor supply. On the firm side, under the New Keynesian assumptions of monopolistic competition and sticky prices, lower wages increase markup, and higher markup contracts labor demand. Under plausible parameter values, labor demand contracts more than the increase in labor supply, and so equilibrium employment and output fall. All in all, the model generates a decline in equilibrium employment, consumption and output. However, the model does not capture the reduction in investments because agents tend to increase their savings which in turn increases investments.

In the model outlined above, uncertainty in financial markets is generated by "mood" shocks. The model, however, can be interpreted more broadly, as a general model of uncertainty shocks that spread from financial sector to real sector. Uncertainty in financial markets can also go up, for example, if the quantity and quality of available information changes (Ross, 1989; Andersen, 1996). Whatever the ultimate exogenous source of financial uncertainty is, the mechanisms of its impact on real variables, identified in the second step of the model, are still at work.

The negative causal effect of financial uncertainty on real output in the model is consistent with empirical evidence from both older and more recent economic downturns. For example, Romer (1990) finds that doubling of stock market volatility, which is measured by historical variation in stock prices, reduces durable consumption goods output significantly. She also argues that 1929 stock market crash led to a recession, but 1987 crash did not, because in the 1929 crisis volatility was much higher. Choudhry (2003) investigates the impact of stock market volatility on real production, consumption and investment using an error-correction model under the assumption that volatility follows a nonstationary stochastic process. His results suggest that stock market volatility has adverse effects on consumption and investment.

The sequencing of events during the recent and earlier financial crises also provide evidence for the negative impact of financial market volatility on real production. In the build up to the Great Recession of 2008, a critical turning point was the collapse of Lehman Brothers. After Lehman failed, it created a widespread panic in financial markets about the possible bankruptcy of other financial institutions. The panic arguably increased the volatility in the financial markets, a feeling of uncertainty replaced economic optimism and this in turn played a role in the decision by consumers and firms to cut back their spending.

Historical evidence suggests that a similar mechanism was at work during the Great Depression of 1929. The US entered a mild recession in the summer of 1929, explained in the literature mainly by the monetary tightening of the Federal Reserve. The severe collapse in output, however, began in October 1929 after the stock market crash and the spike in financial volatility. Volatility stayed high for the next few years because of the concerns about the health of the banking system while real production continued to decline. This sequence of events has motivated Friedman and Schwartz (1986) and others to argue that the spike in the financial market volatility played an independent and important role in the real contraction during the Great Depression.

Fig. 1 and 2 demonstrate, in both instances, at the outset of the real downturn there was a significant spike in stock market volatility. The spike was partly a consequence of a turn for worse in the real variables.

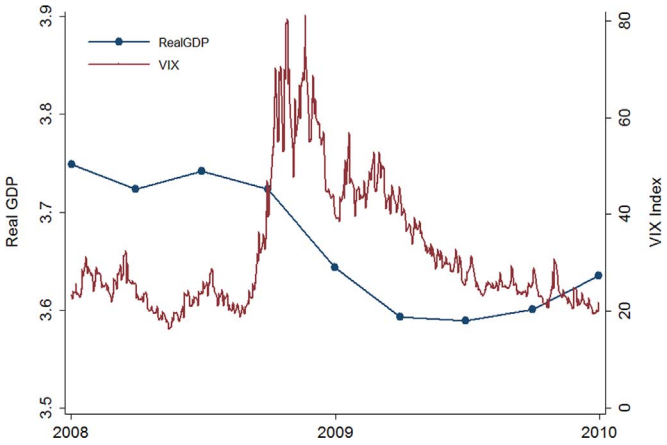

Fig. 1. Real GDP and implied volatility during the great recession.

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