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Aggregate volatility and international dynamics. The role of credit supply

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ABSTRACT

Changes in country-specific aggregate volatility are positively correlated with the current account but negatively correlated with investment, output and credit flows. An International Real Business Cycle model with time-varying aggregate uncertainty, through a precautionary savings channel, can account for the positive correlation but implies counterfactual comovements for the other variables. Adding a credit supply channel with default and lenders exposed to aggregate risk allows the model to match all the facts. Higher volatility contracts credit supply and lowers investment and output. The current account turns to a surplus because savings increase, but also because investment collapses.

1. Introduction

There is increasing evidence that time-varying uncertainty is important for macroeconomic dynamics (see Bloom, 2014 for a survey). A new literature studies the international dimensions of uncertainty. For example, Fogli and Perri (2015) and Hoffmann et al. (2016) document that uncertainty and current account dynamics are positively correlated across countries. Both papers explain the correlation using an International Real Business Cycle model (IRBC) with a precautionary savings channel: when countries become more volatile than their partners, their households save and run a current account surplus.

In this paper we use OECD data from the period 1970q1–2014q4 to document four other international facts: when aggregate uncertainty increases in a country, then investment, credit flows and output fall, while the credit spread increases. An IRBC model with only the precautionary savings channel is unable to simultaneously get right all the previous correlations. In the model, investment and output increase in the more volatile country. The reason is an application of Jensen's inequality: due to convex returns from investment, higher volatility leads to higher investment, capital, output and employment.[1]

We show that an IRBC model correctly predicts all the previous correlations if it is expanded with a credit supply mechanism in which countries have domestic credit markets with default and lenders exposed to aggregate risk. Moreover, with a credit supply channel, the model generates current account dynamics consistent with the data as higher uncertainty induces an investment collapse and a surge of savings. In the IRBC the counterfactual investment boom pushes the current account towards a deficit.

We study a two-country, incomplete markets IRBC model extended with a costly state verification friction à la Bernanke et al. (1999, BGG) between domestic entrepreneurs and domestic lenders. Households deposit with banks that lend to a continuum of entrepreneurs, who use the funds to buy capital that they then rent to the firms. However, a crucial difference from BGG is that in our model lenders are exposed to both aggregate and idiosyncratic credit risk. That is, the lenders' return is not risk-free. If lenders' return does

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[1] Cho et al. (2015) and Lester et al. (2014) analyze how higher uncertainty leads to higher investment in the standard real business cycle model with variable productive inputs.

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not vary with the aggregate state of the economy as in BGG, then the model with financial accelerator generates the same counterfactual predictions as the IRBC model.[2]

Our mechanism works as follows: higher aggregate uncertainty increases the probability of entrepreneurs' default and, because banks are exposed to aggregate risk, this leads to a contraction of credit supply even if banks' cost of funds remains constant.[3] Moreover, when banks' credit risk increases, the risk of losses on bank deposits also becomes higher and households, who would like to avoid the riskier deposits, require a higher risk premium to finance the banks. The combined effect is that higher aggregate uncertainty induces a large contraction of credit supply, and lending rates to entrepreneurs soar. Since entrepreneurs need credit to finance investment, the credit crunch leads to an investment collapse. Less investment lowers capital, employment and output. Moreover, the current account and the trade balance react strongly and move towards surpluses since the precautionary savings channel is accompanied by an investment collapse.

Quantitative simulations of the model show that the credit channel is consistent with the data. That is, following volatility shocks, the credit crunch dominates the convex returns from investment that lead to the counterfactual predictions of the IRBC model. Moreover, the model with a credit channel is supported by the cross-country evidence on credit flows and spreads that we show in Section 3. That is, more volatile countries see a reduction in credit towards the private non-financial sector and an increase in credit spreads.

The credit channel that we analyze in the benchmark economy is mitigated when we study global instead of domestic banks. The reason is that with diversified global banks higher volatility in one country does not alter the ability of the global bank to raise funds. Higher uncertainty still contracts credit supply because it increases the likelihood of default and debt contracts imply concave payoffs for the lender. In this regard, the model shows that the retreat of banking globalization after the 2008 financial crisis (Forbes et al., 2017) may amplify the negative effects of higher uncertainty.

The rest of the paper is organized as follows. Section 2 discusses the related literature. Section 3 documents the facts. Section 4 presents the model. Section 5 explains how volatility affects credit supply. Section 6 has the core quantitative exercise. Section 7 studies the case when banks are global instead of domestic. Section 8 compares with the time-varying volatility of interest rates studied by Fernández-Villaverde et al. (2011). Section 9 concludes. The appendix documents the data sources. An online appendix contains the algebra and the robustness exercises.

2. Related literature

Our paper contributes to the literature studying uncertainty in open economies, and to the literature studying uncertainty and credit markets. Since these are large areas here we only review the more related papers.

Fogli and Perri (2015) and Hoffmann et al. (2016) document that countries which become more volatile have current account surpluses. Both papers use models driven by precautionary savings motives. Clarida (1990) and Chang et al. (2013) also study the role of precautionary savings in accounting for current account dynamics.

Our paper complements the previous papers in both the empirical and the theoretical dimensions. On the empirical side, we confirm the link between volatility and current account dynamics and expand it to other key macro variables: investment, output and credit variables.[4] We show that the precautionary savings channel alone can account for the correlation between volatility and current account dynamics. However, the precautionary savings channel generates counterfactual predictions concerning the effects of volatility on investment and output. We show how to extend the IRBC model with a credit sector to be consistent with all the empirical correlations. Our model gets the current account dynamics right by getting right both the savings and the investment dynamics. To the best of our knowledge this is the first paper to show this result.

Carrière-Swallow and Céspedes (2013) estimate vector autoregressions and show that there is substantial heterogeneity in the reaction to uncertainty shocks across countries. They find that in comparison to the U.S. and other developed countries, emerging economies suffer more severe falls in investment and private consumption. Their evidence suggests that differences in credit market depth across countries explain the cross-country heterogeneity. Our theoretical framework rationalizes these facts by showing that financial intermediation and credit market frictions are key for the transmission of uncertainty into investment.

In cross-sectional regression analysis on long-run averages, Hoffmann et al. (2016) find that investment reacts by less than consumption to long-run volatility of GDP growth. Our results, although focused on the short-run effects of uncertainty shocks on real economic activity, provide further evidence that changes in aggregate uncertainty have strong effects on investment.

Fernández-Villaverde et al. (2011) show that changes in the volatility of international interest rates have significant negative effects on small open economies. We complement this paper because we show that shocks to interest rate volatility are isomorphic to shocks to domestic TFP growth volatility. This result suggests that domestic macroeconomic factors, such as uncertainty about productivity shocks or default risk, can cause the time-varying volatility of interest rates.

To our knowledge, we are the first to document the cross-country patterns of uncertainty and credit variables with an international focus. Several recent papers have looked at U.S. data. For example, Gilchrist et al. (2014) document that in the U.S. fluctuations in idiosyncratic uncertainty across-firms (measured from high-frequency stock market data) affect credit spreads. Baum et al. (2009) and Bordo et al. (2016), using U.S. bank data, show that aggregate uncertainty is a driver of credit supply. Caldara et al. (2016) show that identified uncertainty shocks have a significant negative effect on real economic activity, and that the effect is larger when these shocks are being accompanied by tightening of financial conditions.

The literature that analyzes credit frictions and volatility fluctuations has focused on closed economies and shocks to the cross-sectional dispersion of firms' productivity. This literature includes, among others, Arellano et al. (2016), Christiano et al. (2014), Chugh (2016), Gilchrist et al. (2014), Pesaran and Xu (2016) and Straub and Ulbricht (2015). In this paper we show that aggregate uncertainty shocks with lenders exposed to those shocks generate similar transmission channels.[5] Given the substantial evidence on aggregate uncertainty discussed above there is value in expanding the credit

[2] In the BGG framework, borrowers (entrepreneurs) bear the aggregate risk of the financial contract. Lenders obtain a riskless rate of return. Thus, since depositing with lenders is a risk-free investment, higher aggregate uncertainty makes households more willing to supply loanable funds due to a "flight-to-safety" mechanism. As a consequence, in the BGG framework, higher aggregate uncertainty leads to an expansion of credit supply.

[3] In a debt contract, banks' payoff from holding risky loans is a concave function of the borrowers' stochastic income. Thus, a mean-preserving spread (i.e. higher uncertainty) to the borrowers' income reduces lenders' expected return through Jensen's inequality effect.

[4] We measure uncertainty as the realized stock market returns volatility, which is a standard measure in the literature as discussed in the next section.

[5] Basu and Bundick (2017) and Born and Pfeifer (2014) show that nominal rigidities can help RBC models produce data-consistent comovement between uncertainty and macro aggregates through countercyclical mark-ups.