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Financial conditions and density forecasts for US output and inflation

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ABSTRACT

If the links between credit markets and real economy tighten in a crisis, financial indicators might be particularly useful in forecasting the macroeconomic outcomes associated with episodes of financial distress. We examine this conjecture by using a range of linear and nonlinear VAR models to generate predictive distributions for US inflation and industrial production growth. Financial variables display significant predictive power over the Great Recession period, particularly if used within a threshold model that captures the structural break associated to the crisis. However, the Great Recession is unique: financial information and thresholds make little difference for forecasting prior to 2008.

1. Introduction

The economic slowdown that followed the financial crisis of 2008 suggests that the link between financial markets and the real economy might be nonlinear and that severe financial shocks might have disproportionately large costs in terms of economic activity. If that is the case, financial market information might be particularly useful in forecasting the macroeconomic outcomes associated with episodes of financial distress. In order to test this conjecture, we use monthly observations on the USA between 1973 and 2012 to analyze the predictive power of financial market indicators in vector autoregression models that allow for a range of nonlinearities, including stochastic volatility and finance-driven shifts in regimes. We find that financial variables improve output forecasts over the Great Recession period. Their predictive power emerges clearly in specifications with and without stochastic volatility, and it turns out to be stronger in a threshold model that captures changes in the size and transmission of financial shocks over time. However, the Great Recession is a *unicum*. Unlike stochastic volatility, threshold effects do not yield reliable forecast improvements prior to 2008. Furthermore, the good performance of the threshold model over the crisis would have been hard to anticipate based on the model's track record, so the warnings issued by the model in 2007 would have been very likely to go unheeded.

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The question of whether financial markets predict economic activity has a long history in economics. The conclusion by Stock and Watson (2003) that "*some asset prices predict inflation or output growth in some countries in some periods*" epitomizes the common view among econometricians that financial indicators are too noisy and erratic to be exploited for macroeconomic forecasting. Yet macroeconomists have got to the conclusion that financial shocks are an important source of business cycles (Jermann and Quadrini, 2012; Gilchrist and Zakrajsek, 2012; Liu et al., 2013), which implies that financial information should, in the right circumstances, be useful in predicting macroeconomic fluctuations. In this paper we offer two contributions to the debate. First, we focus on distributions rather than just point forecasts. Density forecasts have been studied extensively in finance and macroeconomics.[1] However, they have not been used to study the relation between financial variables and macroeconomic aggregates, which has so far been investigated almost exclusively using point forecasts and linear models (see Stock and Watson, 2003 for an earlier survey; more recent discussions can be found in Stock and Watson, 2012 and Ng and Wright, 2013). Second, we examine nonlinear VAR models that are capable of capturing two potentially crucial features of the data: changes in aggregate volatility and structural breaks associated to financial crises.

Our claim that nonlinearities may be important in this context rests on two simple considerations. The first consideration is that "volatility matters". Heteroscedasticity is a pervasive feature in US data and it is known to play a significant role for forecasting (Sims and Zha, 2006; Justiniano and Primiceri, 2008; Clark, 2011; Carriero et al., 2015). Accounting for it is in our case particularly important. Financial markets price aggregate risk. If changes in the volatility of the fundamentals are one of the reasons why asset prices move in the first place, then exploiting their fluctuations to predict the fundamentals might be intrinsically very difficult. The second consideration is that perhaps "crises are different". Sims (2012) and Ng and Wright (2013) suggest that structural breaks played an important role during and after the financial crisis of 2008. Macroeconomic models with financial frictions provide a natural way to formalize this possibility. Firms and households are subject to borrowing constraints that limit their access to credit markets and financial crises might constitute episodes where these constraints bind at the aggregate level, amplifying the propagation of real and financial shocks with potentially dramatic implications for the dynamics of the economy.[2] This mechanism has first-order implications for forecasting: financial variables might become more informative if and when borrowing constraints tighten and these amplification effects are activated.[3] By studying threshold vector autoregressions (TARs) where the dynamics of the economy change at times of financial distress we can allow for this possibility and test its relevance for forecasting. In a similar spirit, Del Negro et al. (2016) compare DSGE models with and without financial frictions, showing that the former delivers better forecasts in periods of financial turmoil but not in normal times.

Our analysis confirms that heteroscedasticity helps a great deal in forecasting output and inflation. Thresholds may help too, but not in a systematic way. Although there is clear evidence of two distinct financial regimes in US history, the 2008–2009 period is the only one where this knowledge turns out to be useful for forecasting. Furthermore, since the defining characteristic of the 'crisis' regime is an increase in the variance of the shocks rather than a change in their transmission mechanism, the line between TAR and heteroscedastic VAR models is thinner than one could expect. The warning issued by the TAR at the end of 2007 is fairly forceful: the model predicts a 20% recession probability for 2008, compared to only 5% for a heteroscedastic VAR based on the same data. But the rarity of the event, combined with the impossibility to foresee the improvement in the relative performance of the TAR, implies that it would have been extremely hard for policy makers to act upon this signal.

The structure of the paper is the following. Sections 2 and 3 describe respectively our data and forecasting models. Section 4 presents empirical evidence on the existence of finance-driven regimes in the USA. In Section 5 we document the results of the forecasting exercises and discuss the accuracy of the models before and after the Great Recession. Section 6 examines a number of robustness issues and extensions. Section 7 concludes.

2. Data and forecasting methodology

We use monthly data covering the period between March 1973 and August 2012. Industrial production index, consumer price index and the effective federal funds rate (an average of daily figures) are taken from the Federal Reserve Bank of St. Louis (FRED) Database. Industrial production and prices are transformed into annualized log changes between month $t-1$ and month t, while the monetary policy rate is used in levels. We do not use real-time data. Hence, our forecasts and statistics are not comparable to those presented e.g. in Clark (2011). To capture the state of financial markets we use the Financial Condition Index (FCI) constructed and maintained by the Chicago Fed. FCI is constructed using dynamic factor analysis from a set of 120 series that relate to money, debt and equity markets, as well as the leverage of financial intermediaries, and

[1] A non-exclusive list of density forecasting applications includes Clements and Smith (2000), Cogley et al. (2005), Geweke and Amisano (2010), Jore et al. (2010), Clark (2011), De Nicolo and Lucchetta (2012), Carriero et al. (2015).

[2] See e.g. Bianchi and Mendoza (2010), Bianchi (2011), He and Krishnamurthy (2011), Brunnermeier and Sannikov (2014). Empirical evidence in support of this possibility is provided for instance by McCallum (1991), Balke (2000), Li and Dressler (2011), Guerrieri and Iacoviello (2013) and Hubrich and Tetlow (2015).

[3] In the online appendix to the paper we flesh out the link between financial frictions and forecasting using a stylized partial equilibrium model with an occasionally binding borrowing constraint. When agents are close to their borrowing limits credit shocks have a stronger impact on their consumption-saving decisions and consumption is both lower and more volatile. This also illustrates why studying distributions as well as point forecasts may be important.