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News Driven Business Cycles and data on asset prices in estimated DSGE models [☆]

Stefan Avdjiev

Monetary and Economic Department, Bank for International Settlements, Centralbahnplatz 2, 4002 Basel, Switzerland

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ABSTRACT

We demonstrate that inference from estimated structural News Driven Business Cycle (NDBC) models about the main drivers of fluctuations in macroeconomic variables and asset prices is sensitive to assumptions about the structure of the news shock processes. We show that, when data on asset prices are used in the estimation, a long-run news shock specification has a better fit than the short-run news shock specification which is prevalent the existing literature. The variance decompositions from the former model specification reveal that long-run news shocks are not the main drivers of macroeconomic variables, but do account for the majority of aggregate stock market fluctuations.

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1. Introduction

There exists a large body of literature that emphasizes the possibility that news shocks, or changes in economic agents' expectations about the future values of fundamentals, play an important role in driving macroeconomic fluctuations. This idea, whose origins can be traced back to Pigou (1926) and Clark (1934), has been recently revived by Beaudry and Portier (2004, 2006), Christiano et al. (2008), and Jaimovich and Rebelo (2009). A major strand in this rapidly-growing literature estimates structural News Driven Business Cycle (NDBC) models (i.e. fully-specified DSGE models that feature both, unanticipated shocks and news shocks) and uses the results in order to quantify the relative contribution of news shocks in driving macroeconomic fluctuations (Davis, 2007; Khan and Tsoukalas, 2010; Fujiwara et al., 2011; Schmitt-Grohe and Uribe, 2012). The essence of any estimation exercise that belongs to this strand of the literature consists in using data on directly observable variables (e.g. macroeconomic aggregates, asset prices, etc.) in combination with model-implied relationships between those variables and the model's unobserved states (e.g. unanticipated shocks and news shocks) in order to extract information about the latter.

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E-mail address: Stefan.Avdjiev@bis.org.

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The benchmark estimates of virtually all papers in the existing NDBC literature are obtained using mainly data on macroeconomic variables and largely ignoring data on asset prices.[1] This practice is quite surprising considering the existence of a large empirical literature which suggests that stock price movements reflect changes in economic agents' expectations of future developments in the economy (e.g. Fama, 1990; Schwert, 1990; Beaudry and Portier, 2006, etc.). Given this body of evidence, not including data on asset prices in the estimation of a structural NDBC model would only be justified if all the information about changes in expectations that is contained in asset prices could be extracted by using solely macroeconomic variables. If this was the case, adding data on asset prices in the estimation would be unnecessary as it would not add any new information about the unobserved shock processes and would not alter the results obtained by using only data on macroeconomic variables.

Nevertheless, there is no paper in the existing literature that systematically examines the extent to which including data on asset prices in the estimation of a structural NDBC model has an impact on inference about the main drivers of business cycle fluctuations. The authors of several papers (Davis, 2007; Khan and Tsoukalas, 2010; Schmitt-Grohe and Uribe, 2012) re-estimate their benchmark models after adding stock prices to the set of observable variables as a robustness check. All of them conclude that adding data on stock prices has only a marginal impact on inference about the main sources of business cycle fluctuations and as a result do not include such data in their benchmark estimations. As we show below, such conclusions are sensitive to assumptions about the structure of the news shock processes.

This paper is the first to formally study the impact of including data on asset prices in the estimation of a structural NDBC model while allowing for alternative specifications for the structure of the news shock processes. Our results indicate that, when asset prices are included in the vector of observables, a long-run news shock specification fits the data better than the short-run news shock specification which is prevalent the existing literature. The variance decompositions implied by the former model specification suggest that long-run news shocks are not the main drivers of macroeconomic variables, but do account for the majority of aggregate stock market fluctuations.

The analysis is performed in several steps. We start by solving a structural NDBC model under the two alternative assumptions about the structure of the news shock processes discussed above. Next, we use Bayesian Markov Chain Monte Carlo (MCMC) methods in order to estimate each model specification using data on asset prices in addition to data on macroeconomic variables. After that, we compare the marginal likelihoods of the two alternative model specifications. We then select the model specification with the best fit and use the estimates of the structural parameters and the unobserved states from that specification in order to make an inference about the main drivers of fluctuations in the observable variables.

Our theoretical framework is most closely related to the one used in Schmitt-Grohe and Uribe (2008). We focus on a real business cycle (RBC) model that is augmented with four real rigidities: capital adjustment costs, variable capacity utilization, internal habit formation in consumption, and internal habit formation in leisure. The first three of the above rigidities have been shown to improve the empirical fit of NDBC models and are fairly standard in the existing literature. The last rigidity, internal habit formation in leisure, is introduced because, as discussed in Schmitt-Grohe and Uribe (2008), it has the potential to dampen the wealth effect of anticipated changes in productivity on labor supply.

We recognize that casting the model in a New Keynesian setting rather than in the real business cycle environment that we focus on may improve its ability to fit the macro data. However, the main objective of the paper is not to propose a model that produces the best possible fit for the macro data alone – numerous other papers have already done that. Instead, the paper's main goal is to demonstrate that, when data on asset prices are included in the estimation of a structural NDBC model, the long-run news shock specification has a better fit than the traditional short-run news shock specification. Keeping in mind that two of the seminal papers in the NDBC literature (Beaudry and Portier, 2004; Jaimovich and Rebelo, 2009) are set in a real business cycle framework, we believe that obtaining the above result in such a setting is an important finding on its own. While exploring whether this result also holds in a New Keynesian setting would be an intriguing exercise, it is beyond the scope of this paper.

The model is driven by the four exogenous shock processes which govern the evolution of labor augmenting technology (LAT), investment-specific productivity (ISP), total factor productivity (TFP), and the marginal efficiency of investment (MEI). Each of the exogenous driving processes is subject to two types of shocks – unanticipated shocks and news shocks.

We consider two alternative news shock specifications. In the first one, news shocks are modeled as one-off shocks to fundamentals which materialize n $(n = 1, 2, 3\ldots)$ periods after they enter the information set of the representative agent. We call that the short-run news (SRN) specification. This is the only specification that is considered by the vast majority of the estimated structural NDBC literature (e.g. Davis, 2007, Khan and Tsoukalas, 2010; Fujiwara et al., 2011; Schmitt-Grohe and Uribe, 2012). As Walker and Leeper (2011) point out, it is quite surprising that, despite the centrality of the exact structure of information flows to the NDBC literature, there has been virtually no examination of alternative equally plausible information flow structures.

This prompts us to explore an alternative specification for the structure of the news shock processes. Our choice of an alternative specification is motivated by the combination of two facts. First, asking the model to fit data on asset prices is a crucial part of our experiment. Second, as demonstrated by the asset pricing literature on long-run risks

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[1] A small number of papers (Davis 2007; Khan and Tsoukalas, 2010; Fujiwara et al., 2011) have used interest rates, but not stock prices, as observables in their benchmark estimations.

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