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The effect of monetary policy on real house price growth in South Africa: A factor-augmented vector autoregression (FAVAR) approach[☆]

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ABSTRACT

This paper assesses the impact of monetary policy on real house price growth in South Africa using a factor-augmented vector autoregression (FAVAR), estimated using a large data set comprising of 246 quarterly series over the period 1980:01 to 2006:04. The results based on the impulse response functions indicate that, in general, house price inflation responds negatively to monetary policy shock, but the responses are heterogeneous across the middle-, luxury- and affordable-segments of the housing market. The luxury-, large-middle- and medium-middle-segments are found to respond much more than the small-middle- and the affordable-segments of the housing market. More importantly, we find no evidence of the *home price puzzle*, observed previously by other studies that analyzed house prices using small-scale models. We put this down to the benefit gained from using a large information set.

1. Introduction

The recent global economic downturn attributed to the sub-prime crisis in the US with rapid contagion worldwide, particularly in the housing sector, has attracted the attention of academics, policymakers, and economic agents at large. Stock and Watson (2003) pointed out that housing prices are leading indicators for real activity, inflation, or both, and, hence, can serve as an indicator as to where the real economy is heading. Evidence in the recent literature, for example, Iacoviello (2005), Case et al. (2005), Iacoviello and Neri (2008) and Vargas-Silva (2008a,b) amongst others, show a strong link between the housing market and economic activity in the US. Moreover, the recent emergence of boom–bust cycles in house prices have been an issue of concern for policy markers (Borio et al., 1994; Bernanke and Gertler, 1995, 1999), since the bust of the house price bubble is always followed by significant contractions in the real economy (Iacoviello and Neri, 2008). Given this, it is crucial for central banks to analyze thoroughly the effects of monetary policy on asset prices in general, and real estate in particular, which, in turn, would lead to the understanding of effects of policy on the economy at large.

In this backdrop, this paper assesses the impact of monetary policy shocks on real house price growth, i.e., the growth rate of the ratio of nominal house price to the Consumer Price Index (CPI), for the luxury, large-, medium- and small-middle-segments and affordable housing for the South African economy[1] by exploiting a data-rich environment that includes 246 quarterly series, such as income, interest rates, construction costs, labour market variables, stock prices, industrial production, and consumer confidence index over the period 1980:01 to 2006:04. For this purpose, the framework used in this paper is a factor-augmented vector autoregression (FAVAR) model proposed by Bernanke et al. (2005). As Bernanke et al. (2005) indicate, monetary authorities analyze literally thousands of variables in their decision-making process, hence, it is aberrant for anyone, who tries to mimic actions of a central bank, to ignore this fact. Furthermore, the recent literature (Stock and Watson, 2004; Rapach and Strauss, 2007, 2009; Das et al., 2008, 2009, forthcoming) provide evidence of the fact that numerous economic variables are potential predictors of house price growth. Intuitively, the FAVAR approach boils down to extracting a few latent common factors from a large matrix of many economic variables, with the former maintaining the same information contained in the original data set without running into the risk of the degrees of freedom problem.[2] Note,

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[1] Data on house prices are obtained from the ABSA Housing Price Survey, with ABSA being one of the leading private banks of South Africa. The ABSA Housing Price Survey, distinguishes between three price categories as — luxury houses (R2.6 million to R9.5 million), middle-segment houses (R226,000 to R2.6 million) and affordable houses (R226,000 and below with an area in the range of 40 m^2–79 m^2); and further subdivides the middle-segment category based on the square meters of house area into small (80 m^2–140 m^2), medium (141 m^2–220 m^2) and large (221 m^2–400 m^2).

[2] See Section 2 for further details.

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the motivation to use the three major segments of the housing market, with the middle-segment subdivided further into three categories based on sizes, and not just the aggregate housing market, emanates from the fact that the market for different house-types are found to behave differently (Burger and van Rensburg, 2008). Clearly then, the impact of monetary policy on the different segments of the South African housing market is less likely to be homogenous. This is more so, when one realizes that different housing segments cater to different income-groups.

To the best of our knowledge, this is the first study to analyze the effect of monetary policy on real house price growth in South Africa using a FAVAR. The only other paper that deals with the impact of monetary policy on the South African housing market is that by Kasai and Gupta (2008). The authors investigated the effectiveness of monetary policy on house prices in South Africa, before and after financial liberalization, with financial liberalization being identified with the recommendations of the De Kock Commission (1985). Using both impulse response and variance decomposition analysis performed on three-variable structural VARs (SVARs), comprising of the growth rate of the real GDP, house price inflation and the Treasury Bill rate, estimated separately on the three categories of the middle-segment of the housing market, the authors found that irrespective of house sizes, during the period of financial liberalization, interest rate shocks have had relatively stronger effects on house price inflation. But, given that the size of these effects were nearly negligible, the result seems to indicate that house prices are exogenous, and, at least, are not driven by monetary policy shocks.

Though insightful, the paper by Kasai and Gupta (2008), just like Iacoviello (2002), McCarthy and Peach (2002), Iacoviello and Minetti (2003, 2008),[3] Vargas-Silva (2008a), is based on a small-scale model, which, in turn, limits it to only three variables. In fact, all the other studies, being based on either reduced-form Vector Autoregressive (VAR), Vector Error Correction (VEC), SVAR or DSGE models, could handle at most 8 to 12 variables only. Arguably, and as indicated above, there are a large number of variables that affects monetary policy and the housing market, and not including them often leads to puzzling results, for example the *home price puzzle*[4] in McCarthy and Peach (2002) and Kasai and Gupta (2008),[5] which are not in line with economic theory due to the small information set (Sims, 1992; Walsh, 2000). Moreover, in these studies, the authors often arbitrarily accept specific variables as the counterparts of the theoretical constructs (for example the gross domestic product as a measure of economic activity or the first difference of the logarithm transformed consumer price index as a measure of inflation), which, in turn, may not be perfectly represented by the selected variables. In addition, previous studies can only obtain the impulse response functions (IRFs) from those few variables included in the model, implying that in each VAR, VECM, SVAR or DSGE, the IRFs are typically obtained with respect to only one variable related to the housing market. Given its econometric construct, the FAVAR model addresses all these problems.

The remainder of the paper is organized as follows: Section 2 briefly discusses the FAVAR framework, while, Section 3 discusses the data and the identification structure. Section 4 reports and analyzes the impulse response functions, and Section 5 concludes.

[3] Note, besides the empirical part of the paper, Iacoviello and Minetti (2003) uses a calibrated Dynamic Stochastic General Equilibrium (DSGE) model to analyze the impact of monetary policy on house prices. More recently, Iacoviello and Neri (2008) used a more elaborate estimated DSGE model for this purpose. However, the model is restricted in the sense that it used only 10 macroeconomic variables including only a few housing market variables.

[4] The *home price puzzle* occurs when the home price increases, instead of declining, following a contractionary monetary policy.

[5] As will be seen below in Section 2, the FAVAR model nests a simple VAR. Given this, when we estimated the VAR model comprising of the real house price growth rates of the five categories and the interest rate measure, using our data set, as in Kasai and Gupta (2008), we too observed the prevalence of the home price puzzle for not only the large-, medium- and small-middle-segment housing, but also for affordable housing. These results are available upon request from the authors.

2. The FAVAR[6]

Let Y_t be a $M \times 1$ vector of observable economic variable assumed to drive the dynamics of the economy. In the standard approach, we would proceed by estimating a structural VAR (SVAR), or other forms of multivariate time series model using data for only Y_t. In many cases, however, additional economic information that cannot be fully captured by Y_t may be required to model appropriately the dynamics of these series. Assume that F_t is a $K \times 1$ vector of unobserved factors, with K being small, that summarizes additional important information not fully captured by Y_t. Note F_t can also represent theoretical concepts such as price pressures, credit conditions, or even economic activity that are a combination of economic variables which cannot be represented by one particular series. Assume that the joint dynamics of (F_t, Y_t) are given by the following equation:

$$\begin{bmatrix} F_t \\ Y_t \end{bmatrix} = \Phi(L) \begin{bmatrix} F_{t-1} \\ Y_{t-1} \end{bmatrix} + v_t \qquad (1)$$

where $\Phi(L)$ is a conformable lag polynomial of finite order p and v_t is the error term with zero mean and a covariance matrix Q.

Eq. (1) is a standard VAR in (F_t, Y_t) and nests a standard VAR in Y_t, if the terms of $\Phi(L)$ that relate to Y_t to F_{t-1} are equal to zero. In its current form we refer to Eq. (1) as a factor-augmented vector autoregression (FAVAR). Clearly the system defined by Eq. (1) helps in assessing the marginal contribution of the additional information content of F_t. Moreover, if Eq. (1) is estimated without the factors then we would obtain biased estimates of coefficients for both the VAR and the impulse responses.

However, the difficulty here is that the vector of factors F_t is unobserved, which means that the model cannot be estimated based on standard econometric techniques, such as the ordinary least squares (OLS). The proper estimation of the model entails the use of factor analysis, as proposed by Stock and Watson (1998). For this purpose, we interpret the factors as summarizing information contained in a large panel of economic time series. Given this, we can hope to infer about the factors from these variables. Let X_t be a $N \times 1$ vector of informational variables, where N is large, such that $N >> K + M$. Assume X_t is related to both the observed variables Y_t and unobserved factors F_t as follows:

$$X_t' = \Lambda^f F_t' + \Lambda^y Y_t' + e_t' \qquad (2)$$

where Λ^f is a $N \times K$ matrix of factor loadings, Λ^y is $N \times M$, and e_t is a $N \times 1$ vector of the error term, which, in turn, is assumed to be weakly correlated with mean zero. In essence, Y_t and F_t are common forces that drive the dynamics of X_t. Note, it is not restrictive to assume in principle that X_t is dependent only on the current values of F_t and not its lagged value, since the factors can always be interpreted to capture arbitrary lags of some fundamental factors. Excluding the observable factors from Eq. (2), we have what Stock and Watson (1998) refer to as a dynamic factor model (DFM).

The estimation procedure consists of a two-step principal components approach proposed by Bernanke et al. (2005), which, in turn, provides a non-parametric way of uncovering the space spanned by the common components, $C_t = (F_t', Y_t')$. In the first step, the common components, C_t are estimated using the first $K + M$ principal components of X_t, defined as $\hat{C}_t$. Note the estimation of the first step does not use the fact that Y_t is observed. Stock and Watson (2002) demonstrates that with a large N and if the number of principal components is at least as large as the number of factors, the principal components can consistently recover the space spanned by both F_t

[6] This paper follows the econometric framework of the FAVAR model described in Bernanke et al. (2005).