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Understanding Chinese provincial real estate investment: A Global VAR perspective☆

Y. Chen[a], M. He[a], S. Rudkin[b,*,1]

[a] International Business School Suzhou, Xi'an Jiaotong-Liverpool University, 111 Renai Road, Suzhou 215123, China
[b] School of Management, University of Bradford, Emm Lane, Bradford BD9 4JL, United Kingdom

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ABSTRACT

This article investigates the spatial interdependence within China's real estate industry, a sector assuming increasing importance in the national economy. The Global Vector Autoregressive (GVAR) model allows us to explicitly address the presence of spatial linkages, including spillover and backwash effects, without a stringent requirement on data. Applying the model to monthly Chinese provincial data for the first time we highlight clear advantages in forecasting and steady-state value prediction. We also demonstrate through the contemporaneous correlation coefficients a growing divide between the previously highly industrialized north and the rest of China. The insights provided by our empirical study have clear value to a wide range of audiences, including researchers, policy makers, and business investors.

1. Introduction

As China transitions to a consumption-oriented economy, a new set of imbalances between traditional industrial bases in Northeast China and new urban and industrial regions in the Pearl River Delta, the Yangtze River Delta and the Circum-Bohai-Sea Economic Zone emerges. Real estate is cited as a long term engine of this development; investment therein becomes a key economic barometer. Deeper understanding of real estate investment can inform both redistribution policy and growth strategies, as well as the investment profitability itself. Permitting analysis of spatial linkage on few observations, and in the presence of structural breaks, the Global Vector Autoregressive (GVAR) specification of Pesaran et al. (2004) has clear advantages for studying China, which has thirty provinces[2] and recent rejuvination interventions that we show have indeed created structural breaks. In using GVAR, analysts gain a model which generates meaningful forecasts and crucially can inform about the impacts of shocks to other provinces, while policy-makers can see where best to direct attention whilst avoiding unintended negative spillovers. Our specific focus here is on the investment in the real estate sector, but an alternatively specified GVAR model would permit the exploration of any other covariates of interest.

In exploiting the ability of the GVAR framework to reflect spatial linkages, the work which follows can direct better targeting of government policy to gain maximum positive spillover benefits whilst enabling them to guard against potential backwash effects; addressing the challenges in post-industrial provinces like Liaoning for example and enabling the identification of systematic risk in the real estate sector and its impacts upon the real economy. It can also give property investors information about potential future opportunities and pitfalls, and can serve as a start point for further theoretical and empirical research into this critical element of China's major economic transition.

This paper makes three key contributions to the existing literature. Firstly we are, to our knowledge, the first to apply GVAR in any form to Chinese real estate investment using provincial-level monthly data; existing studies consider house prices in major cities (Yu, 2015) or use annual data and the related structural VAR model (Huang et al., 2015). Secondly we demonstrate the importance of considering inter-province spatial spillovers in terms of outputs, investments, loans and prices using the contemporaneous correlation coefficients and generalised impulse response functions (GIRF) to various potential shocks. Finally we show that the GVAR model can enable better forecasting perfor-

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* Corresponding author.
E-mail addresses: yang.chen@xjtlu.edu.cn (Y. Chen), ming.he@xjtlu.edu.cn (M. He), simon.rudkin@uts.edu.au (S. Rudkin).
[1] Present address: SHU-UTS SILC Business School, Shanghai University, No. 20 Cheng Zhong Road, Jiading, Shanghai 201899, China.
[2] Tibet is excluded here, as it is in most studies, due to the lack of accurate data for many variables over the time frame.

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mance than individual province models which have been optimised to the data from that province.

Section 2 provides a background to the topic, the framework and existing studies to motivate the modelling undertaken here. Section 3 then introduces the data and the processes used to prepare it for analysis, and Section 4 provides a full exposition of the GVAR framework adopted in the current study. In Section 5 we present our main results, demonstrating the significance of contemporaneous correlations across provinces. Section 6 looks at the implications of the model, using impulse response functions to explore the national and regional responses to potential negative shocks to real estate investment should the bubble burst, and providing the baseline results on forecast performance. Section 7 then concludes.

2. Background

The bursting of the U.S. housing bubble and the subsequent global financial crisis brought China's real estate market under the spotlight. The phenomenal amount of vacant apartments, the rocketing housing price, and the subsequent credit expansion in the banking system remind people of another real estate bubble.[3] For investors considering China, policy-makers seeking to maintain economic stability, and those keen to understand more of the world's second richest economy, the focus and additional understanding afforded in what follows is invaluable. Supporting this understanding, studies of Chinese real estate investment and its correlates are reviewed to inform our empirical treatment, whilst works refining the GVAR methodology set up the techniques employed herein.

The real estate industry has been viewed as an engine for China's economic growth; the 1998 *Report on the Work of the Government* prepared by the The State Council called the real estate industry the "new growth pole." The 2008 *Central Economic Work Conference* finally defined it as one of the "supporting pillars" of the national economy. At the local level, it is found that politicians have strong incentives to manipulate the urban land market in the direction of attracting investment in real estate development and to achieve growth objectives (Gao et al., 2016). Our GVAR model offers an ability to understand the implications of this across China, but also makes these politicians aware of the other factors that influence their ability to achieve their goals. For example competing provinces can see how investment by others might bring spillover investment benefits to theirs without any stimulus monies being used.

Real estate investment has been around 20% of total fixed asset investment since 2000, generating a massive supply of new units. Nationwide, the annual floor area of new starts rapidly increased from 283 million square metres in 2000 to 2 billion square metres in 2011 and 2013, although this subsequently subsided to 1.5 billion square metres in 2015. Empirically, the real estate industry is found to contribute strongly to China's economic growth. Using provincial data over the 1999–2007 period, Zhang et al. (2012) estimate that a 1% increase in real estate investment induces a 3.15% increase in China's GDP,[4] which may justify why China's real estate market faces frequent intervention from government at all levels. A bi-directional relationship between economic growth and real estate development is suggested and is inherent in the GVAR framework that we use.

Empirical studies underpin strong forward and backward linkages between real estate and other economic sectors, in particular finance and security, commerce, construction, and non-metallic material manufacturing (Wang and Liu, 2004; Chan et al., 2016). Ups and downs in real estate investment propagate to other sectors via the input-output relationship. Termed *the income effects* by Case and Quigley (2008) these mechanisms motivate us to incorporate the spatial influence into the analytical framework.

Statistics also reveal a tight linkage between the real estate market and the financial sector. In 2015, outstanding commercial real estate loans were 22.3% of total bank loans, or RMB 21 billion. Out of the RMB 12.5 billion spent on real estate development in the same year, 29% is financed by loans, second place after self-raising (39%). Besides, local governments and SOEs have made massive borrowings from the banking system using land as collateral. It has been estimated that total liabilities of local governments amounted to RMB 17.89 trillion by the end of 2013 (Deng et al., 2015). Reliance on bank loans makes the real estate market highly responsive to the supply of bank credit (Collyns and Senhadji, 2003; Koh et al., 2005). In the Chinese context, it leaves the stakeholders (government and banks) vulnerable to cycles in the real estate market (Lu and Sun, 2013; Zhang and Barnett, 2014).

Economic theory supports the credit channel through which the real estate market affects aggregate output (Bernanke and Gertler, 1995; Case and Quigley, 2008). In a real estate downturn, the decreasing value of real estate collateral worsens the balance sheets of borrowers and reduces their debt capacity. Banks suffering from bad loans or collateral losses are forced to reduce their supply of credit, even to financially healthy borrowers. Consequently aggregate investment and total output declines. Empirical studies lend support to this mechanism in the U.S. (Iacoviello, 2005; Chaney et al., 2012). We are thus inspired to consider the role of loans in affecting real estate investment.

Relationships between the real estate market and the rest of the economy have been studied from different angles. A popular statistical framework is the panel data model of multiple sectors (Wang and Liu, 2004; Chan et al., 2016), or multiple regions (Aizenman and Jinjarak, 2014; Zhang et al., 2012). Some are based on the VAR model (Ahuja and Myrvoda, 2012; He et al., 2013). However, these studies fail to address the spatial linkage. Numerous studies have unveiled the spatial interaction of regional markets, including that of real estate. Among them Hartmann et al. (2004) find that the extreme cross-border linkage between the stock market and the bond market are very similar among selected nations. Bouchouicha and Ftiti (2012) found strong evidence of a common trend between the real estate markets of the U.S. and U.K. Given the integrated domestic commodity market and a common monetary authority, it is hard to assume the absence of spatial linkages among regional real estate markets in China.

The GVAR model is a convenient statistical framework to study the dynamics of regional economic systems as well as their interactions. Specifically it is the ability of the framework to handle large numbers of spatial units over comparatively short time periods, whilst still producing robust interpretable results, that so commends it to us and the literature within which our work sits. Since its introduction by Pesaran et al. (2004), this method has gained increasing popularity in the study of interactive markets. Topics include business cycle transmission, exchange rate and global imbalance, interdependence of financial markets, etc.[5] These studies provide clear evidence that regional markets or economies are interdependent via multiple channels (Chudik and Fratzscher, 2011; Eickmeier and Ng, 2015; Allegret et al., 2015; Dees, 2016). Most of these studies, however, are based on national data. Sub-national applications are sporadic in the GVAR literature.[6]

Within the modelling process, the weight matrix has a valuable role

[3] See for example, *The Great Property Bubble of China May Be Popping*, The Wall Street Journal, 2011/06/11 and *More Than 1 in 5 Homes in Chinese Cities Are Empty, Survey Says*, The Wall Street Journal, 2014/06/11 for press coverage of recent developments.

[4] The estimated output elasticity of real estate investment by Ahuja and Myrvoda (2012) is 0.1%. However, their estimate is based on the 2000–2011 monthly data of China and G20 economies.

[5] Chudik and Pesaran (2016) provide an excellent review of recent applications.

[6] There are a few semi-regional studies. For instance, Favero (2013) and Vansteenkiste and Hiebert (2011) study the Euro area, while Boschi and Girardi (2011) distinguish regional factors from international ones in their model.