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DISSERTATION SUMMARY

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The impact of US housing demand and supply shocks on the Australian economy: Analysis implementing a SVAR model

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Abstract

This thesis develops an open economy structural vector autoregression model to determine how the Australian economy is affected by both a US housing demand shock and a US housing supply shock. Previous literature has either grouped Australia with other economies or has excluded Australia altogether. This leaves a significant literature gap in explaining how the Australian economy is solely impacted. The results of the model indicate both a US housing demand and a US housing supply shock significantly impact the Australian economy, with the most significant being the impact of a US house price shock upon Australian GDP which is large and persistent over time. The results contribute to the understanding of how Australian policymakers should incorporate the US housing market into policy decisions and central bank modelling.

KEYWORDS

Housing, SVAR, USA

I would like to thank Dr. Mengheng Li for his guidance and supervision throughout the writing of this thesis.

This is a summary of an Economics Honours dissertation. The full dissertation can be accessed upon request.

1 | INTRODUCTION

The paper employs a structural vector autoregression (SVAR) model to determine the implications of both a US housing demand shock and a US housing supply shock on the Australian economy. Demand and supply shocks are separated through a Cholesky Decomposition identification scheme. The results are analysed using impulse response functions which trace the housing market shocks across the following Australian variables: Australian GDP, stock market, terms of trade, housing market, and bilateral exchange rate. The SVAR model created in this paper is strongly influenced by the Dungey and Pagan (2000, 2009) Australian models, with key adjustments being made to tailor the model to include housing market-specific variables.

Crucially, this paper makes three contributions to the line of literature:

First, this thesis builds a broad model of the Australian economy that includes the US economy and more specifically, the US housing market. Previous SVAR models have only accounted for the external sector through a GDP variable and terms of trade variable, whereas this paper delves deeper by including both the US house price variable and the US housing supply variable. An Australian housing market variable is also included in this paper, a sector that has been excluded in past SVAR models of the Australian economy.

Second, this thesis fills the void in literature by exploring how US housing demand and US housing supply impact the Australian economy. Previous literature that explores this topic fails to isolate the impact of the US housing market on Australia by either grouping Australian with other economies or excluding Australia in their analysis.

Third, the paper provides policy recommendations of how the findings of this literature can be applied in a monetary policy setting. Alluding to the results of the paper, the US housing market has a significant impact on a range of Australian economic variables. This shows the need for the US housing market to be included in Australian policy analysis with this paper giving example of how this may be accommodated.

2 | LITERATURE REVIEW

The section builds a fundamental understanding of what channels the US housing market may flow through the local economy and how the effects may spill over internationally. Understanding these channels motivates the decision of what variables should be included within the SVAR model of this paper.

2.1 | House Price transmissions to the US economy

2.1.1 | Wealth effect—consumption

One of the earliest studies of the wealth effect using housing assets was by Case et al. (2006) who used US panel data to analyse the impact of the 1980s and 1990s housing boom upon US consumption. They found a statistically significant and 'rather large' impact of housing on consumption that generated a larger wealth effect than the stock market. The authors later extended their fundamental study (Case et al., 2013) across a longer 37-year period, finding that a US house price increase similar to the rise between 2001 and 2005, would increase household spending by 4.3% over the 4 years. These findings are consistent across a breadth of studies which conclude that the housing wealth channel creates between two to eight cents of consumption for every dollar increase in house prices (Benjamin et al., 2004; Juster et al., 2006; Lehnert, 2004). These findings provide empirical evidence of a consumption channel, indicating the need to include US GDP within the model as well as Australian variables that are exposed to foreign consumption including the exchange rate, terms of trade, and GDP.

2.1.2 | Collateral channel

Regarding a collateral channel, we must turn to previous studies to understand the strength of this channel in regard to the housing market. Mian and Sufi (2014) studied cross-sectional data during the 2002–2006 housing boom in the USA to examine shocks to both borrowing and consumption. They find that the entire housing wealth effect during this period was due to a collateral channel, with consumption through this channel representing between 0.8% and 1.3% of GDP throughout 2004–2006.

2.1.3 | Investment effect—financial markets

A further house price transmission channel to the local economy is through the stock market and stock market participation. Using Chinese house price data, Kong et al. (2021) find three channels through which changes in house prices can affect the local stock market. The first is through a 'pure wealth effect' (Chetty et al., 2017) where an increase in asset prices leads to an increase in household wealth, which creates higher levels of stock market participation. The second channel is through a 'liquidity constraint effect' (Hurst & Stafford, 2004), which uses a collateral channel to theorise that a relaxed household budget increases stock market participation. The final channel is the 'precautionary savings effect' (Painter et al., 2021), which states an increase in house prices reduces the need for household precautionary savings, encouraging increased stock investment. The presented evidence emphasises the need to include a stock market channel within our model, as excluding this channel would risk omitted variable bias. Therefore, an Australian Q-ratio variable is included to represent the Australian stock market.

2.2 | Housing supply transmissions to the US economy

The relationship between housing supply and its effect on GDP remains a subject of extensive debate, marked by conflicting findings in empirical studies. Richard Green (1997) analysed US quarterly data spanning from 1959 to 1992 with his findings indicating that residential investment Granger causes GDP, suggesting that the housing sector takes a lead role while other forms of investment trail behind in the business cycle. However, the reliance on Granger causality in this study introduces some uncertainty in the results, as Granger causality inherently addresses predictability rather than establishing a causal relationship among the variables.

2.3 | International transmissions

Despite the abundance of literature regarding international house price channels, there is yet to be a comprehensive study of how US house prices affect a broad range of Australian variables, a void that is filled by the contributions of this study. The most closely aligned study of this topic was produced by Cesa-Bianchi (2013) who used a GVAR model to estimate the impact of a US house price shock upon the GDP of many nations, including Australia. This study found that a positive shock to US house prices increased the Australian GDP, although, this result was not statistically significant. Bagliano and Morana (2012) analysed the effect of a US house price shock on the GDP of 50 countries, grouped by region. The authors found that a US house price shock had no significant impact upon the Asian group of economies, of which Australia was included in. However, since the results were taken at a group level, a conclusion of the impact of a US house price shock on Australia cannot be concluded from this study.

3 | MODELLING METHODOLOGY

3.1 | Structural vector autoregression (SVAR) modelling

Before analysing the structural aspects of the model, it is essential to define the standard reduced form VAR model, which takes the following form:

$$y_t = A_1 y_{t-1} + \epsilon_t \text{ where } \epsilon_t \sim \left(0, \sum\right). \quad (1)$$

Within this structure: y_t is a $k \times 1$ vector of k variables in period t, A_1 is a $k \times k$ coefficient matrix and, ϵ_t is a $k \times 1$ vector of errors which have a multivariate normal distribution with zero mean and a $k \times k$ variance–covariance matrix $\sum$.

Now focusing on the structural aspect of the SVAR model, the model within this paper employs a Cholesky decomposition which is a 'lower triangular' matrix that utilises the ordering of the variables to control the contemporaneous reaction of the variables to an impulse. This structure can be applied using three methods; an A model, B model, or an AB model, of which, the latter is used in this paper.

Turning first to the A model, this model is in the form of an additional non-singular matrix that represents the contemporaneous relationship between the observable variables (Lütkepohl, 2005, p. 358). This matrix is represented as A on the left-hand side of the following equation:

$$Ay_t = A_1^* y_{t-1} + \ldots + A_p^* y_{t-p} + \epsilon_t. \quad (2)$$

Within this structure:

$$A_p^* = AA_j \ \ (j = 1, \ldots, p),$$

$$\epsilon_t = Au_t \sim \left(0, \sum\nolimits_{\in} = A \sum\nolimits_u A'\right).$$

The B-model differs to the A-model as it identifies the structural relationship of the error terms directly, rather than identifying the relationship between the observable variables as in the A-model. The B-matrix is imposed on the error terms in the following equation:

$$y_t = A_1^* y_{t-1} + \ldots + A_p^* y_{t-p} + B\epsilon_t. \tag{3}$$

Within this structure:

$$u_t = B\epsilon_t,$$

$$\epsilon_t \sim (0, I_K).$$

As done in this paper, it is possible to use both an A-matrix and a B-matrix within the one model, creating an AB-model. This method allows economic theory to be applied to both the error terms as well as the observable variables in the model (Lütkepohl, 2005, p. 364). An AB model takes the following form:

$$Au_t = B\epsilon_t \text{ with } \epsilon_t \sim (0, I_K). \tag{4}$$

Within this paper, these restrictions are set out so that the A-matrix takes the form of a lower-Cholesky decomposition while the B-matrix is restricted only across the diagonal, restricting the variance terms only. This structure relies on the ordering of variables to reflect economic theory, which may then be examined through an impulse response function.

4 | DISCUSSION OF RESULTS

4.1 | US housing demand shock results

4.1.1 | Australian GDP

A shock to US housing demand has a significant and enduring impact on the Australian GDP. Initially, there is a + 0.05 per cent increase in the Australian GDP due to the contemporaneous shock. Over time, this effect accumulates, reaching a substantial +0.18 per cent positive shock by the 7th period.

These findings align closely with parallel results found in the studies outlined in the literature review. Given the model's ability to encompass various channels through which Australian GDP can be influenced, these outcomes are unsurprising.

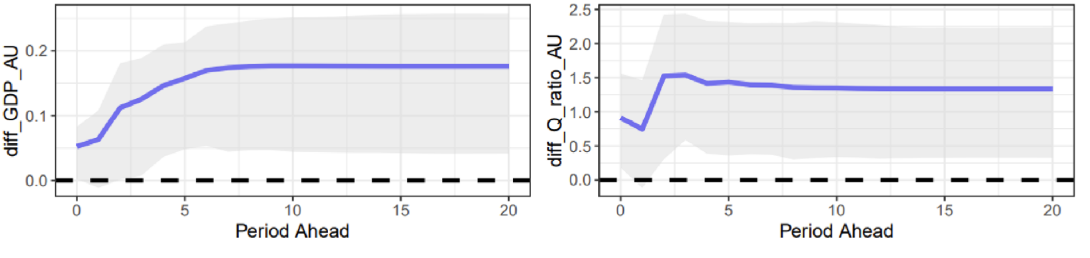

FIGURE 1 US housing demand shock to AU GDP and AU Q-ratio IRF. Figure 1 visualises the impulse response of the AU GDP and AU Q-ratio variables to a one standard deviation shock applied to the error term of the US House Price variable. The response is graphed over a period of 20 quarters. [Color figure can be viewed at wileyonlinelibrary.com]

4.1.2 | Australian Q-ratio

The results reveal that a substantial positive shock to housing demand also increases the value of the Australian stock market as indicated by an increase in the *q*-ratio variable. Initially, there is a large +1.43% increase. This builds over time to reach a cumulative effect of +2.26% in the 11th period.

4.1.3 | Australian terms of trade

A positive impact on the Australian terms of trade is created from the shock, although this increase is not statistically significant. The contemporaneous shock causes an initial decrease to the Australian terms of trade variable by −0.09% in the first period. This shortly corrected to a positive output, building to a cumulative total of +0.55% in the 12th period.

4.1.4 | Bilateral exchange rate

Turning to the IRF impact on the bilateral exchange rate, a US housing demand increase initially has a negative, although insignificant effect on the exchange rate variable. This is followed by a sudden spike in the third period to +1.07%, the only statistically significant period. The cumulative increase then slightly falls, settling at an overall increase of +0.77% by the 11th period.

4.1.5 | Australian house prices

Analysing the result of Australian house prices to a US housing demand shock, the IRF results indicate a positive reaction of Australian house prices to a US housing demand shock, although it is to be noted that this result is only statistically significant across the third–seventh period. The cumulative increase of this variable is +0.47% with this level being reached by the third period.

4.2 | US housing supply shock results

4.2.1 | Australian GDP

The Australian GDP variable has no statistically significant movement as a result of a US housing supply shock. The GDP variable begins with a positive reaction in the first period, rising to +0.04% before a negative correction takes place in period 3, at a level of −0.54%. In the long run, the GDP variable returns to a value close to zero, indicating no long-run significant effect.

4.2.2 | Australian Q-ratio

The Australian stock market has a positive reaction to the increase in US housing supply, as represented by the Q-ratio variable. The Q-ratio initially increases to +1.15% before

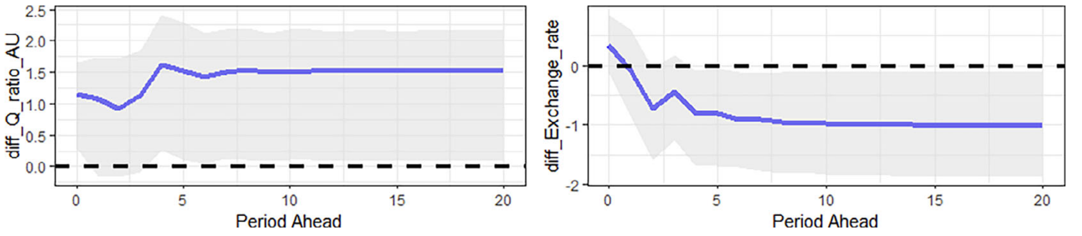

FIGURE 2 US housing starts shock to AU Q-ratio and Exchange Rate IRF. Figure 2 visualises the impulse response of the AU Q-ratio and Exchange Rate variables to a one standard deviation shock applied to the error term of the US Housing Start variable. The response is graphed over a period of 20 quarters. [Color figure can be viewed at wileyonlinelibrary.com]

accumulating to +1.51% by the 10th period. These results are all statistically significant except for the result in the third period which is minorly insignificant.

4.2.3 | Australian terms of trade

Turning to the Australian terms of trade, the variable reacts negatively to the modelled shock throughout the entire cumulative period. The negative effect begins at period one at a level of −0.26% before extending the decrease to a cumulative level of −0.90% in period 15. Each period is statistically significant except for the third period.

4.2.4 | Bilateral exchange rate

Analysing the IRF impact on the bilateral exchange rate, the positive shock to US housing supply initially has a positive, although insignificant impact on the exchange rate. This increase is only short-term, as the variable accumulates to a negative level in the second period and becomes significantly negative in the fifth period. The exchange rate accumulates to −1.01% over the 20-period forecast.

4.2.5 | Australian house prices

The Australian house price variable has a statistically insignificant reaction over the entire IRF period. Whilst insignificant, it is still worth noting that the variable initially reacts slightly positively to a US housing supply shock before correcting to a negative cumulative result, decreasing to a level of −0.29% by the 14th period.

4.3 | Robustness testing

4.3.1 | Cointegration and VECM testing

The long-run modelled relationship is assessed using a vector error correction model (VECM). Analysing the longer-run relationship through the VECM ensures that the results of the paper are accurate and consistent across both the short-term SVAR dynamics and the long-run equilibrium results.

The transformed data must first be tested for cointegration. To test for cointegration, two versions of the Johansen test were used, those being the trace test and the eigenvalue test. The results of both Johansen tests indicate that cointegration may be present within the data, supporting the implementation of a VECM model to analyse the long-run relationship.

The US housing demand shock results are strongly aligned with the results produced by the SVAR model, with the differences largely being the significance levels of the irf results. A notable difference is in the Q-ratio result. Whilst still positive, it is a smaller and less significant increase compared to the SVAR result. Overall, the VECM irf results align strongly with the SVAR results, adding to the long-term robustness of the conclusions made in this paper regarding a US housing demand shock.

Turning to the VECM irf that follows a US housing starts shock, the results produce some differences to those of the SVAR model. The main differences are observed through the Q-ratio, terms of trade and exchange rate variables. The Australian GDP variable takes the same shape as the SVAR result, although it is significantly negative, unlike the SVAR result. Overall, the VECM US housing starts results indicate weak robustness of the modelled results for certain variables.

5 | FUTURE RESEARCH, POLICY IMPLICATIONS AND CONCLUSION

5.1 | Limitations and future areas of study

Future research may study the research question using the variables selected in this paper but utilise a different modelling technique. Such modelling techniques could include a mixed data sampling regression model or a mixed frequency VAR model. Further studies may choose to implement long-run theoretical restrictions on the data, allowing the interaction of each variable to be fully contained within the scope of the applied theory. Theoretical models such as the IS-LM model or New-Keynesian models are examples of models that may be implemented in future studies.

5.2 | Policy implications

The results of this thesis indicate that the Australian economy is significantly impacted by changes to the US housing market with the largest impact on Australian GDP being through a US housing demand shock. Acknowledging this influence, Australian policymakers must consider adapting the guidelines they use whilst setting monetary policy to include the US housing market.

Including the US housing market in the Taylor rule is one of many options for central bankers, as they may instead include the necessary exposure through different models such as the IS-LM model, or through unique models used internally by the central bank. In whichever way they may be inclined, the US housing market must be included in the policy decision tools of the Australian central bank as excluding this sector could result in inaccurate forecasts, potentially leading to incorrect monetary policy decisions.

5.3 | Conclusion

This study has developed an open economy Australian SVAR model that to our knowledge, is the first of its kind to capture the US housing market. The modelled results capture two US housing market shocks, those being a housing demand change and a housing supply change. Overall, the results of this study found a significant impact of both a US housing supply and demand shock on the Australian economy, filling the gap in literature. The study serves as a strong foundation for analysing the complex relationship of the US housing market and its impact on the Australian economy. We encourage future studies of this topic, utilising different modelling techniques to apply long-run economic theory to build on this founding paper.

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CONFLICT OF INTEREST STATEMENT

The authors have declared no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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