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Housing Market and the Transmission of Monetary Policy: Evidence from U.S. States

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Abstract

What are the effects of monetary policy on the housing market? Is the response of the housing market similar across different states? We explore the impact of monetary policy shocks on real house prices and housing investment, using US state-level data. To this end we estimate VAR models for the period 1988-2009, to assess the differential effect - if any - of a common monetary policy shock on house prices and investment. Our VAR models also allow us to explore the macroeconomic effect of wealth shocks that originate in the housing market (housing prices). Our empirical models include key macroeconomic variables, namely personal income, prices and the federal funds rate, as well as housing market variables, e.g. real house prices, given by the FHFA house price index, and housing investment, proxied by the number of housing starts. Our baseline estimates suggest that transmission of monetary policy is heterogeneous across US states. Moreover, our VAR models indicate the presence of a wealth effect across most US states, as a positive housing price innovation leads to a strong, negative response of personal income.

Keywords: House prices, Monetary policy transmission, VAR, Wealth effect

JEL Classification: C32; E21; E52; R31

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1 Introduction

The role of the housing market boom during the last decade as well as its importance in the recent financial crises have attracted a lot of attention during the past years, giving rise to a set of stylized facts (Catte et al., 2004). In particular, house price fluctuations have become larger over the business cycle and generated strong wealth effects, attracting the interest of policy makers (Girouard et al., 2006). The exact mechanisms through which housing prices affect economic activity, or are affected by it, in fact vary. For instance, according to the European Central Bank (ECB, 2003) disposable income, real interest rates, housing supply and bank credit are some of the key factors influencing housing prices, while some authors argue also for the importance of inflation (Tsatsaronis and Zhu, 2004) and stock prices (Sutton, 2002).

On the other hand, house prices may also affect economic activity. For instance, conventional wisdom holds that private consumption is influenced by housing price fluctuations, as these tend to generate wealth effects, which in turn affect households' lifetime wealth and consequently determine their spending and borrowing plans. According to the OECD (Boone and Girouard, 2002), housing wealth accounts for a large share of household wealth and in some countries is the principal component of total wealth, so the wealth effect of house price movements is expected to be stronger than that of any other financial asset. For this reason, housing wealth may cause a higher marginal propensity to consume than stock market wealth does (Ludwig and Slok, 2004). Furthermore, rising housing prices tend to stimulate residential investment, thereby increasing economic activity, while increasing real estate prices lead to increases of the value of firms' and households' collateralizable assets, affecting their ability to borrow and to further finance business investment and consumption (Girouard and Blondal, 2001), with this increase in credit demand affecting bank lending. Moreover, rising housing prices increase both banks property's value as well as the value of loans secured by housing collateral. Consequently, the transmission of monetary policy may also be influenced by the housing market via its effect on the cost of capital, housing supply and demand, households' wealth and bank credit (Mishkin, 2007).

However, what are the exact effects of monetary policy on the housing market? Does a contractionary monetary policy lead to a fall in housing prices and housing investment? If this is so, is the response across heterogeneous states within the same country similar (uniform) or not? In addi-

tion, what are the exact effects of housing demand and supply on economic activity? In this paper we focus on these questions by characterizing empirically the joint dynamics of housing prices, housing investment, interest rates and personal income. Drawing on prior work by Vargas-Silva (2008) we adopt a simple methodology that allows us to assess the effects of monetary policy in the U.S. housing market and in addition answer what are the effects of the housing market on the macroeconomy. In particular, we employ VAR models for the 48 contiguous U.S. states, which allow us to assess these effects in a quantitative manner.

We find that a – common across states – contractionary monetary policy leads, to a reduction in housing investment, proxied by the number of housing starts, which is not necessarily accompanied by a fall in real housing prices. In greater detail, we find that a contractionary monetary policy leads to a fall in housing investment, however these effects are neither uniform across states, nor always significant. For instance, we document that for some US states the effects of monetary policy tend to be long-lasting, leading to a prolonged reduction in housing investment, whereas in other states the effects on housing investment are extremely short-lived and are clearly reversed within horizons of less than five years.

A second set of results that is noteworthy relates to the effects of monetary policy on real housing prices. Whereas we document that the general effect is a pronounced and long-lasting fall in housing prices, there are important exceptions (states) in which a contractionary monetary policy leads to increases in real housing prices.

A third set of results relates to the effects of house price shocks on personal income. In particular, we find evidence of wealth effects, since a rise in house prices leads to a fall in personal income for many states.

Finally, the bidirectional effects of the two housing variables, i.e. investment and prices, are mentioned; an increase in house prices leads to a short-lived increase in investment, which is reversed within one to two years in most states, while an increase in housing investment leads to an increase in house prices for the majority of the states.

Apart from shedding light on the effects of monetary policy in the housing market and the effects of the housing market on key macroeconomic variables, our results also have important implications for the conduct of monetary policy in monetary unions.

The remainder of the paper is structured as follows. In the next section we briefly discuss the

findings of prior empirical work, while in the third section we present the data and the structure of our empirical methodology. Our main results and extensions are discussed in the fourth section, while the last section concludes.

2 Literature Review

2.1 Housing and Macro Models

Among the most important research that has been made in this field lays the work of Goodhart and Hofmann (2004, 2007, 2008). In particular, they claim that house prices play an important role in explaining inflation and forecasting consumer price indexes. Apart from that, they underline a significant positive relation between house prices and the business cycle, with the former driving the real economy, and a strong link between house prices, monetary variables and the macroeconomy. They argue that house prices have a direct impact on economic activity and the financial sector and therefore amplify the effects of macroeconomic shocks, even drive macroeconomic fluctuations. They also show a significant effect of house prices on the monetary transmission mechanism. House prices are sensitive to monetary shocks and strongly procyclical, according to Iacoviello and Neri (2010), as well. Similar findings are provided by Bjornland and Jacobsen (2008), who find that real house prices fall after a monetary policy shock, while house price shocks influence interest rates, as well. Moreover, house price shocks seem to have important effects on key macroeconomic variables and vice versa according to Assenmacher-Wesche and Gerlach (2008a, 2008b), while house prices do not seem to be significantly affected by credit shocks. Furthermore, Carstensen et al. (2009) show that the reaction of key macroeconomic variables to a monetary policy shock is related to the volatility of real house prices and in particular it is amplified in countries where house prices react more to a monetary policy shock.

However, the findings of Gilchrist and Leahy (2002) do not show a strong case for including asset prices in monetary policy rules, while the impact of monetary policy shocks on the housing boom is significant, though small, according to Del Negro and Otrok (2007). Iacoviello (2000, 2004, 2008) reports that monetary policy shocks seem to affect asset prices in such a way that house price inflation is quite sensitive to economic fluctuations, even more than consumer price inflation and the variability of real house prices is mostly explained by monetary factors and demand shocks.

Credit and collateral constraints amplify the response of consumption to house price shocks (Iacoviello, 2005) and a credit channel is likely to exist in housing markets (Iacoviello and Minetti, 2008). Ludwig and Slok (2004) find a positive relation between house prices and consumption, though it is rather unclear whether changes in housing or stock market wealth have a higher impact on consumption. However, Paiella (2008) suggests that a change in house prices affects consumption at least as much as a change in stock prices. According to Pavlidis et al. (2009), however, the wealth effect of house price fluctuations on consumption is strong only during a bubble period. Finally, residential investment is another factor that responds negatively to monetary policy shocks, according to Vargas-Silva (2008) and Iacoviello and Neri (2010).

2.2 Related Approaches

A number of papers examine the link between housing and monetary policy in the U.S. Bjornland and Jacobsen (2008) analyze the role of house prices in the monetary transmission mechanism for the U.S. economy using structural VAR models and impose short-run and long-run restrictions, in order to allow for full independence between monetary policy and asset prices. According to their findings there is an interaction between house prices and monetary policy, since they show a negative response of the former to an interest rate shock. Jarocinski and Smets (2008) estimate a Bayesian vector autoregression model and find that housing demand shocks have only limited effects on U.S. growth and inflation, while monetary policy has a significant impact on both house prices and housing investment.

However, regional heterogeneity is significant and should be taken into account in order to predict the effects of monetary policy on the housing market, according to Fielding and Shields (2011). In their study they find that property prices, among other things, affect the sensitivity of households to monetary policy transmission, since cities with higher property values exhibit more sensitivity to monetary policy shocks, compared to cities with lower property values. Several studies incorporate such heterogeneity in the analysis of monetary policy transmission; Fratanoni and Schuh (2003) introduce a heterogeneous-agent VAR model for 27 U.S. metropolitan areas including the mortgage rate, since it directly affects regional variables such as income, housing investment and house prices and therefore plays an important role in the monetary policy transmis-

sion mechanism. According to their findings, there is a negative response of housing investment and housing price inflation to an interest rate shock, though heterogeneous across the regions in magnitude and duration. Del Negro and Otrok (2007) use state level data in order to estimate a dynamic factor model via Bayesian methods, to find that the local component has driven historical fluctuations in house prices, while there is a small impact of monetary policy shocks on the housing boom. State level data for the eleven states in the west census region are also used by Kuethe and Pede (2009), in order to examine the effects of macroeconomic shocks, such as income and unemployment shocks, on house prices for the period after 1988. Their analysis is based on a spatial VAR model in order to incorporate locational information and their results indicate a link between states, since each state responds to its neighbor's shocks. Vargas-Silva (2008) estimates regional VAR models for the four census regions, including housing starts and residential investment, as well. His findings show a negative impact of contractionary monetary policy on residential investment, especially in the Midwest region. The impact of monetary policy on house price inflation is examined for the nine census divisions by Gupta and Kabundi (2009). In their analysis they use a factor-augmented VAR with 126 variables and find that in general a monetary policy shock has a negative impact on house price inflation, though heterogeneous across the nine divisions. Finally, Gupta et al. (2010) examine the impact of monetary policy shocks on the U.S. housing sector using a large-scale Bayesian VAR model with 143 macroeconomic variables, including 21 housing variables related to house prices and housing investment, on both the national level and the four census regions. In order to test whether the financial market liberalization of the early 1980s has affected such impact, they split their sample in the period prior to 1982 and after 1989, to find that the negative effect of a monetary policy shock on real house prices is larger in the post-liberalization period at both the national and the regional level, though heterogeneous across regions.

The originality of the present paper derives from the fact that VAR models for the 48 contiguous U.S. states are estimated, in order to examine the heterogeneity of a common monetary policy shock to house prices in all these areas. Additionally, our dataset includes a measure of housing investment as well, which, to the best of our knowledge, has not been used in the state level so far.

3 Data and Empirical Methodology

In this section, we discuss the data we employ in our analysis and give an overview of our empirical methodology.

3.1 Data

In our work we employ quarterly data covering the period from the first quarter of 1988 to the fourth quarter of 2009. In particular, we employ two sets of data in our work, namely macroeconomic variables that are common across U.S. states and variables that are state-specific. The former include the Federal Funds rate and a commodity price index and were obtained from the Federal Reserve Bank of Saint Louis and the OECD Economic Outlook, respectively. The latter include quarterly data on real personal income, the GDP deflator, housing investment, and real house prices.

Personal income is state nominal personal income from the Bureau of Economic Analysis. Housing investment is the number of privately owned housing starts from the Census Bureau. Housing price is the all-transactions house price index from the Federal Housing Finance Agency and GDP deflator is from the Bureau of Economic Analysis. Personal income and housing prices are deflated using the GDP deflator. All data are in logarithms and seasonally adjusted. The specific period chosen reflects data availability considerations as well as the requirement to avoid the less stable monetary policy regime that ended in the mid-1980s (see Bagliano and Favero, 1998 and Clarida et al., 2000).¹

Figure 1 in the Appendix shows the real house price index for all states as well as for the aggregate economy. As it is clear from the graphs, real house prices experienced an increase during the last two decades, which turned into a decrease for the vast majority of the states in the mid 2000s.

3.2 Econometric Models

Vector autoregressive (VAR) models are popular in analyzing the effects of monetary policy, since they are flexible enough in summarizing key features of the data, without the need of a rigid prior

¹Summary statistics are included in an appendix for space conservation reasons. They are available upon request.

theoretical structure (Sims, 1980). The models we employ are of the form:

$$\mathbf{A}_0 \mathbf{x}_t = \mathbf{\Phi} \mathbf{D}_t + \mathbf{A}(L) \mathbf{x}_{t-1} + \boldsymbol{\varepsilon}_t, \quad (1)$$

where \mathbf{x}_t is a $n \times 1$ vector of endogenous variables observed over time $t = 1, \dots, T$, \mathbf{D}_t is a $q \times 1$ vector of exogenous deterministic variables (e.g. constant, trends, etc.) with $\mathbf{\Phi}$ being the $n \times q$ matrix of their coefficients, $\mathbf{A}(L)$ is a $n \times n$ matrix polynomial in the lag operator, $\boldsymbol{\varepsilon}_t$ is a $n \times 1$ vector of structural disturbances and \mathbf{A}_0 is a $n \times n$ matrix that describes the contemporaneous relations among the endogenous variables. In our analysis we specify a six dimensional VAR with $\mathbf{x}_t = [y_{it}, p_{it}, inv_{it}, ff_t, hpi_{it}, cp_t]'$, where y_{it} is real personal income in state i in year t , p_{it} is GDP deflator, inv_{it} is housing investment, ff_t is the federal funds rate (common across states), hpi_{it} is the housing price index and cp_t is the (common) commodity price index. The inclusion of the commodity price index is essential in order to avoid the so-called ‘price puzzle’ (Christiano et al., 1996). We also include a deterministic time trend. The inclusion of time as explanatory variable is due to the fact that almost all the variables are I(1), as indicated by the panel unit root test proposed by Im et al. (2003).² However, we estimate unrestricted VAR in levels, since the monetary transmission mechanism is a short-run phenomenon and unrestricted VARs are preferred to VEC models (Favero, 2001). The lag length was set to four lags for the quarterly data. The choice of the lag length has been due to the fact that all VARs should have the same specification, in order to catch any heterogeneity in the transmission mechanism. For this reason four lags were chosen, following Christiano et al. (1999). In order to identify the structural shocks we use a Cholesky decomposition, with the variables ordered as above. This triangular identification imposed by the Cholesky decomposition allows output, GDP deflator and housing investment to react only with a lag to monetary policy shocks, whereas house prices and commodity prices may respond immediately. Moreover, house price shocks affect output, GDP deflator, housing investment and the federal funds rate only with a lag.³

²The unit root test results are available upon request.

³An alternative specification, with the hpi ordered prior to ff was also estimated and the responses remained unchanged.

4 Results

The results of the impulse response analysis are shown in the Appendix. Figures 2 to 6 show the impulse response functions for the 48 states as well as for the aggregate economy.

We have four sets of empirical results. The first set of results relates to the effects of monetary policy on housing investment, which are not uniform across states. In particular, a contractionary monetary policy leads to a fall in housing investment for most states, however such effects are heterogeneous both in magnitude and duration. The second set of results relates to the effects of monetary policy on real housing prices, which are heterogeneous as well, since there are large differences both in the sign of the impact (in most states the responses are negative, while in others they are positive) and in duration. Figures 2 and 3 show the impulse responses of the two housing variables, i.e. housing investment and house prices, to a monetary policy shock. A common contractionary monetary policy leads to a reduction in housing investment in the majority of the states. However, this reduction in housing investment is not accompanied by a reduction in house prices in all cases. In particular, we see that in the case of 15 states the fall in housing investment is accompanied by an increase in house prices, though the responses are short-lived. On the other hand, in New Jersey and Nevada there is an increase in housing investment, accompanied in the former case by a fall in house prices. Therefore, we see a heterogeneity in the responses of the housing variables to a common monetary policy shock between the different states.

The third set of results provides evidence of wealth effects, again heterogeneous across states. Figure 4 shows the impulse responses of income to a house price shock. The aggregate economy shows a positive response, however this does not seem to be the case for all states. In particular, 19 states show a negative response, suggesting an underlying wealth effect; when house prices rise the households' wealth rises as well, leading the households to reduce their working hours in order to substitute work with leisure since they are wealthier, decreasing their income.

The fourth set of results relates to the bidirectional effects of the two housing variables, i.e. investment and prices, which still seem to be heterogeneous across states. Figure 5 shows the impulse responses of housing investment to a house price shock, which is positive for the whole economy and for most states. However, this positive response is reversed in most cases within horizons of less than three years. Finally, figure 6 shows the impulse responses of the house price

index to housing investment, which is positive for the majority of the states, suggesting a possible increase in housing demand.

Our results are robust with the literature, according the heterogeneous responses of a contractionary monetary policy. Such heterogeneity could be due to heterogeneity in housing supply and demand elasticities or heterogeneity in the sensitivity of regional housing to interest rates, as mentioned by Fratantoni and Schuh (2003), and should be taken into account when making monetary policy decisions by the monetary authorities.

5 Conclusions

In this paper we investigate the impact of monetary policy shocks on real house prices and housing investment. To this end we estimate VAR models for the 48 US states, in order to assess the differential effect of a common monetary policy on house prices and investment and to explore the macroeconomic effect of wealth shocks that originate in the housing market. Our empirical findings suggest that transmission of monetary policy is heterogeneous across US states. Moreover, our VAR models indicate the presence of a wealth effect across most US states, as a positive housing price innovation leads to a strong, negative response of personal income.

Why such heterogeneity arises? It may be due to heterogeneity in housing supply and demand elasticities or in regional housing to interest rates (Fratantoni and Schuh, 2003). In any case regional heterogeneity should be taken into account by central banks when conducting monetary policy, since ignorance of such heterogeneity may lead to welfare losses, when there are asymmetries in the transmission mechanism (Aksoy et al., 2002 and Gros and Hefeker, 2002).

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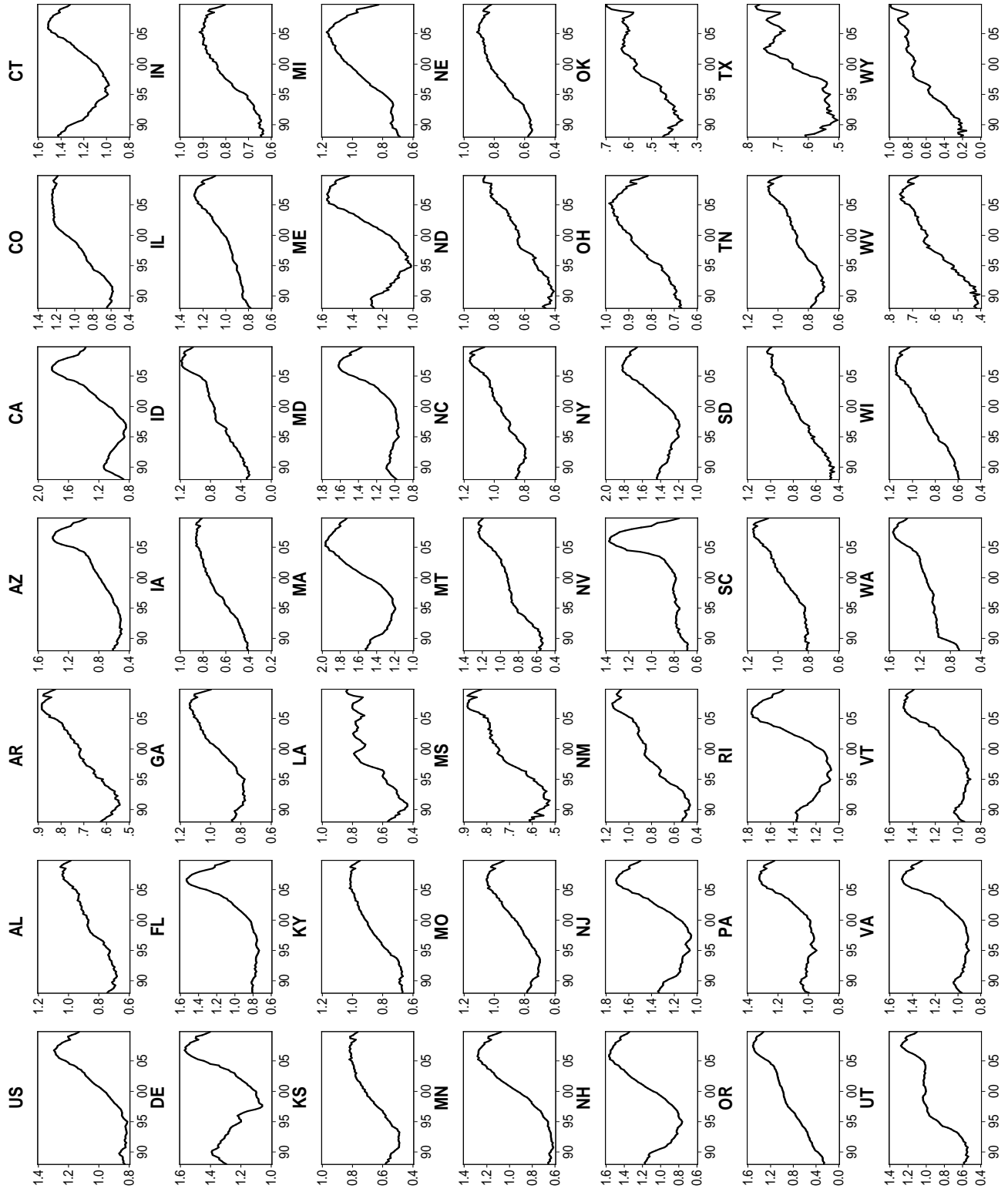


Figure 1: Real House Prices

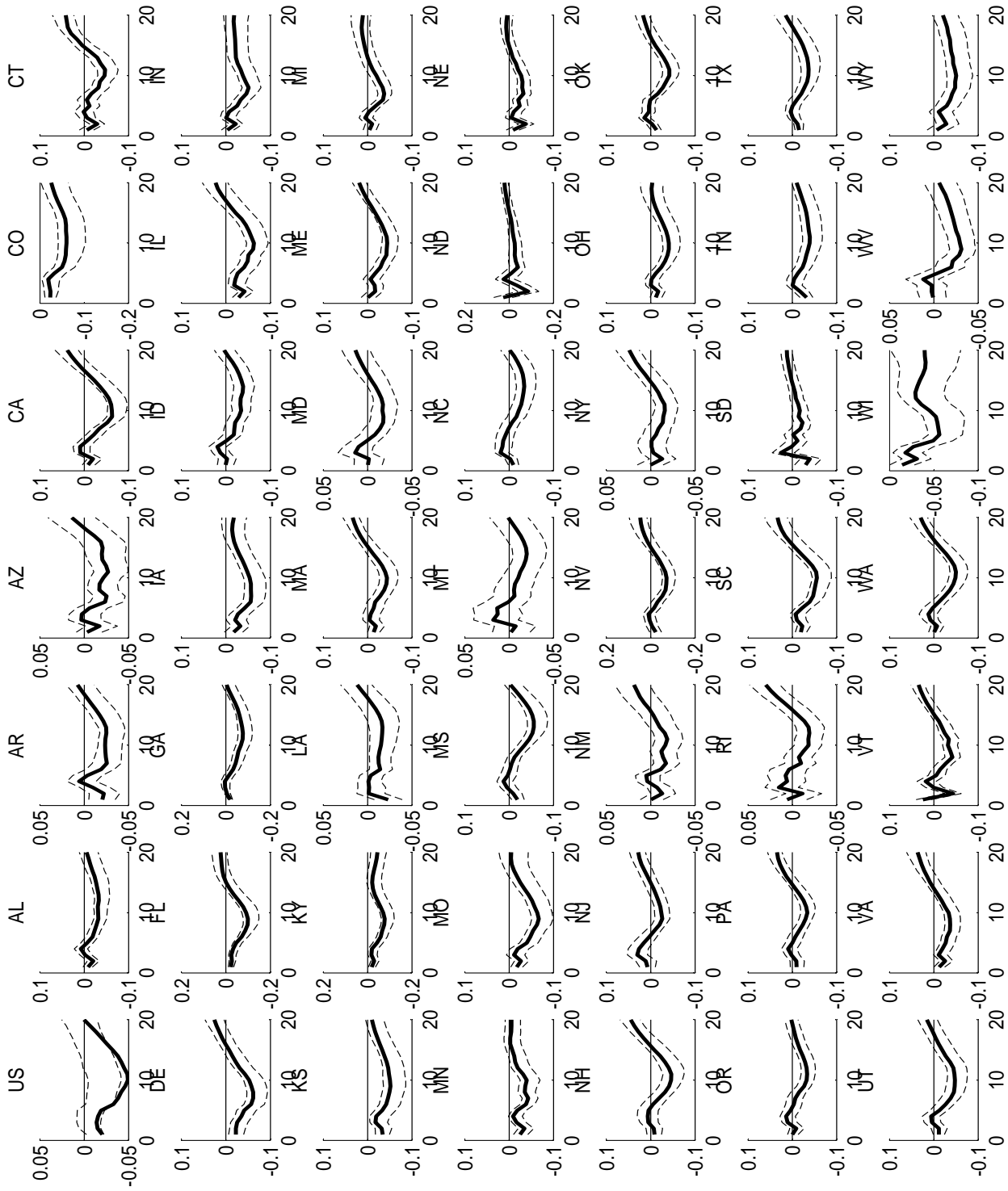


Figure 2: Impulse Responses of Housing Investment to Federal Funds Rate

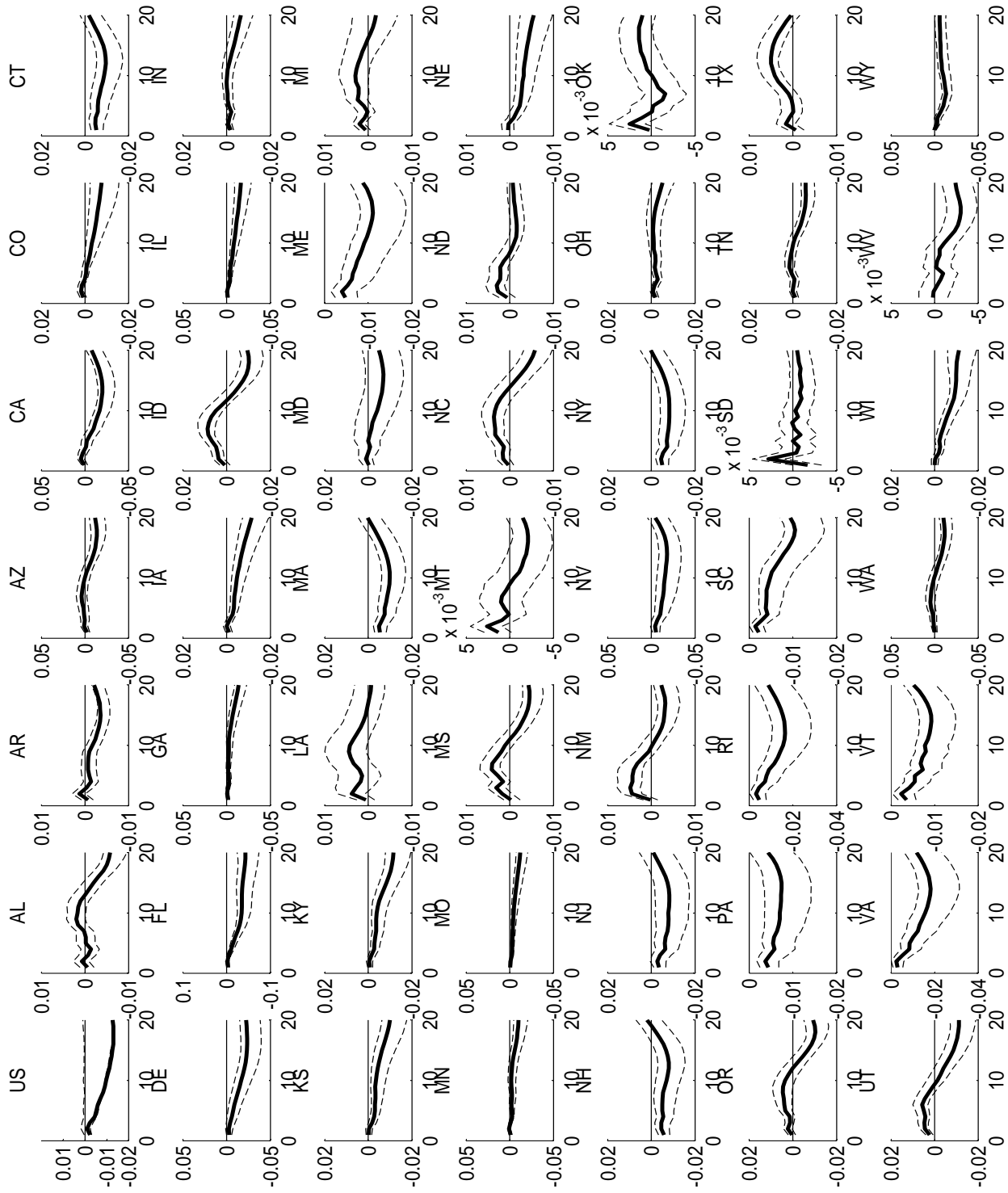


Figure 3: Impulse Responses of House Prices to Federal Funds Rate

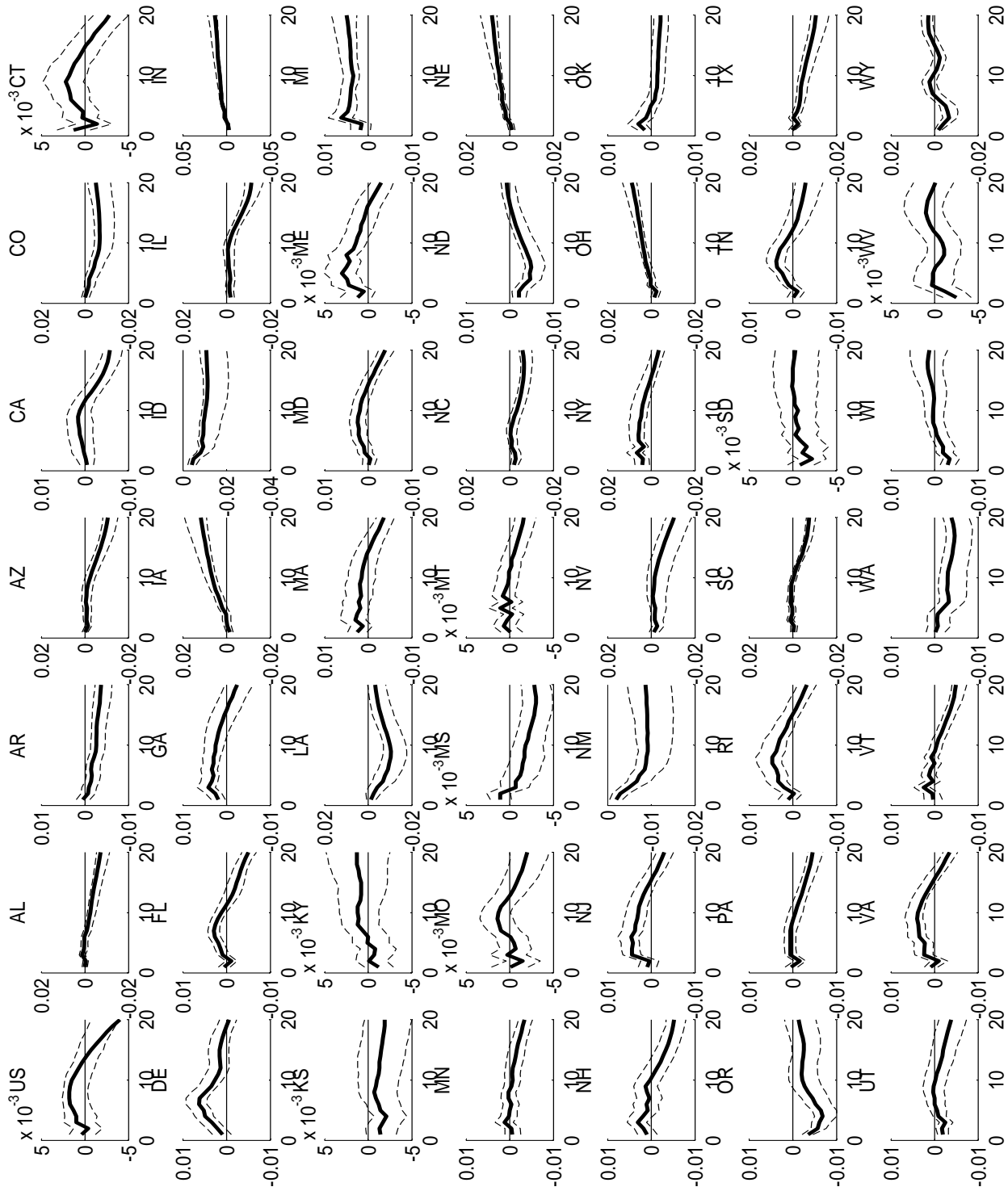


Figure 4: Impulse Responses of Income to House Prices

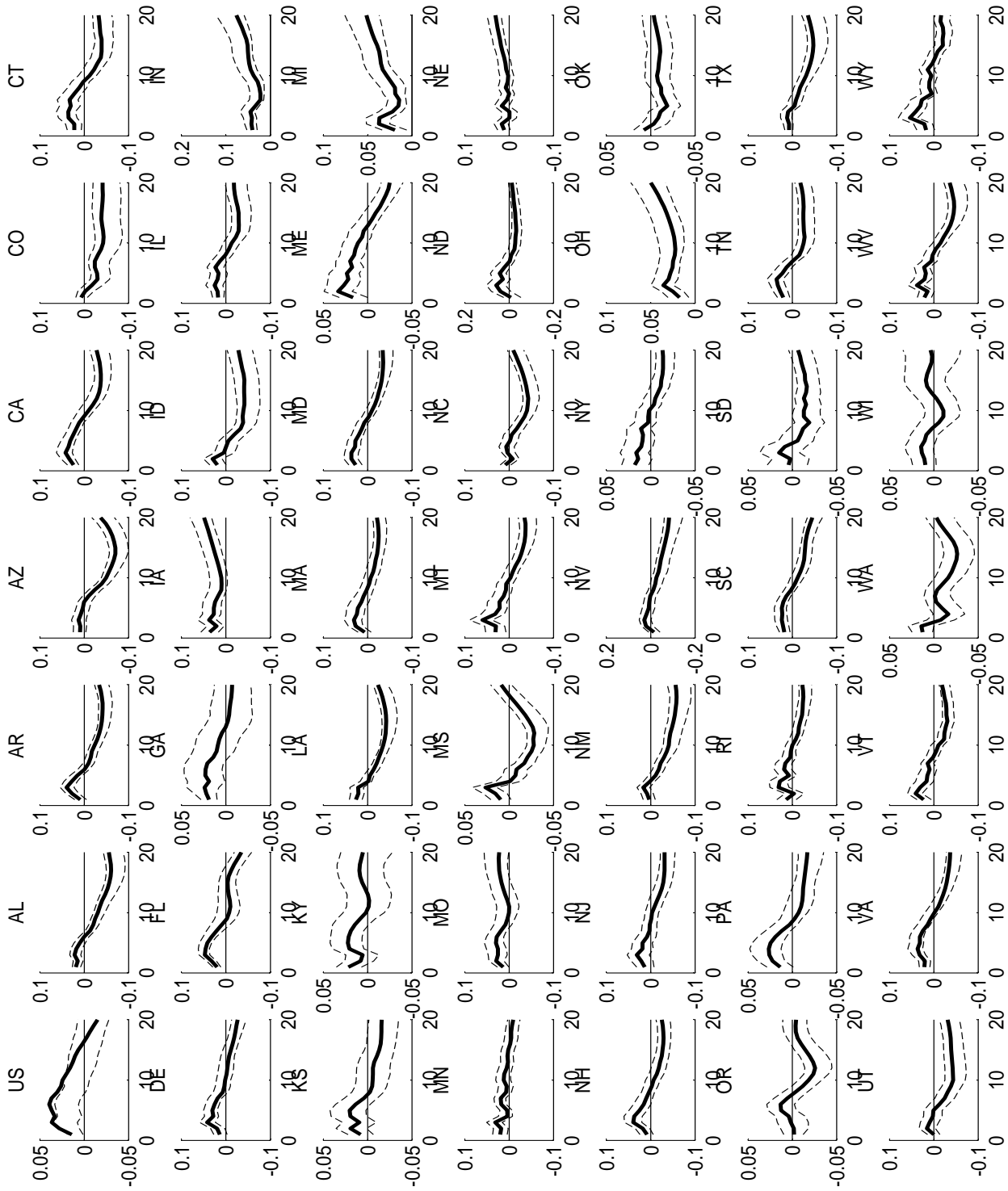


Figure 5: Impulse Responses of Housing Investment to House Prices

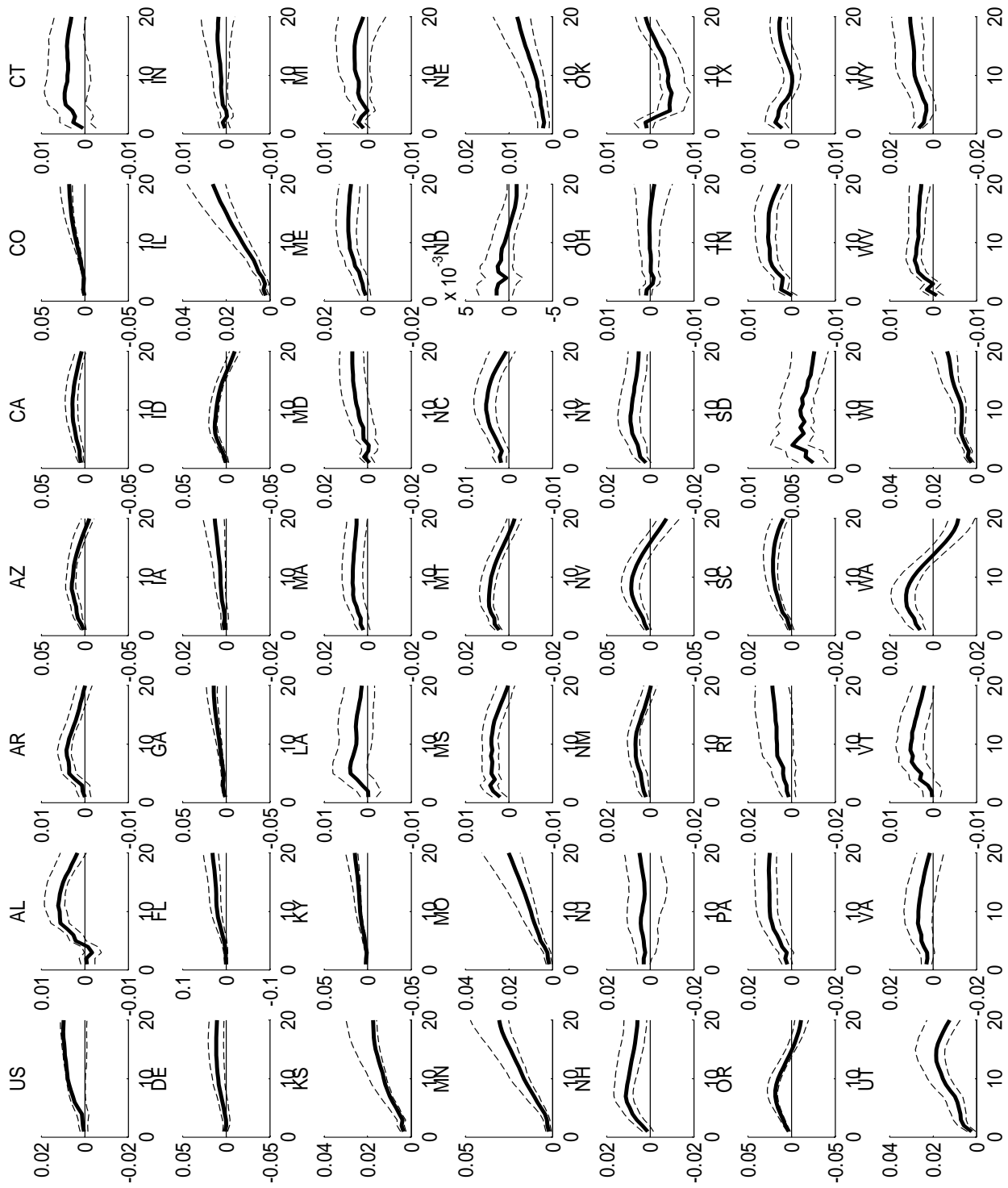


Figure 6: Impulse Responses of House Prices to Housing Investment