

# **Global Research Unit**

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### International Macroeconomic Aspect of Housing

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# **International Macroeconomic Aspect of Housing**

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## **Abstract**

This paper studies whether the relationships between housing prices and macroeconomic variables have changed after the 2008 Global Financial Crisis (GFC). I re-examine the business cycle correlations in 22 Organization for Economic Cooperation and Development (OECD) member countries. In general, macro variables exhibited a strong association with housing prices. While some correlations are weakened or strengthened, some are even reversed after the GFC. I also provide a literature review on why housing markets are essential for propagating shocks and related to business cycles.

Keywords: Stylized facts, macro-housing-finance linkage, global financial crisis, business cycle frequency, housing market variables

JEL classifications: E30, G10, R30

## 1. Introduction

For decades, economists seek to establish “stylized facts” among aggregate variables and provide theories to explain those facts (Cooley 1995). Among others, Leung and Ng (2019) recently show that the relationships among housing market variables and macro-finance variables in the U.S. have significantly changed after the 2008 Global Financial Crisis (GFC). This paper extends their analysis to 22 Organization for Economic Co-operation and Development (OECD) member countries. The focus is to investigate the relationships among the business cycle components of housing prices and macroeconomic variables in each country.<sup>1</sup> I separate the pre-crisis from the post-crisis sub-samples and examine whether the correlations have changed after the 2008 GFC.

This paper focuses on business cycle (a periodical fluctuation between 6-32 quarters) correlations for reasons. Most of the economic and financial variables are non-stationary, either contain a trend, a unit root, or both. Taking the first difference is a typical way to remove the unit root.<sup>2</sup> A natural question arises: what should we do if some of the variables are trend-stationary, but some are difference-stationary?<sup>3</sup> One may take the first difference on all the variables because growth rates are easier to compare and interpret. However, by doing so, we only study the short-run components or the fast-moving components of the variables. How about the lower frequency components? It is well-known that relationships could exist only in lower-frequency bands of variables (Baxter 1994). For instance, Kishor and Marfatia (2016), who study relationship between housing prices and the macroeconomy in 15 OECD countries, find that short-run movements in house prices are independent of the movements in income and interest rates and only their permanent movements are associated with each other. Therefore, to complement studies that focus on growth rates, this paper compares variables at a lower frequency band, i.e., the business cycle

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<sup>1</sup> Some prior literature study how housing bubbles in an economy would transmit to other economies. For example, see Gomez-Gonzalez et al. (2018).

<sup>2</sup> Some series require to take the second difference or even more.

<sup>3</sup> Trend-stationary means once the deterministic trend is estimated and removed from the data, the residual series is a stationary stochastic process. Difference-stationary means the trend is stochastic and differencing the series  $n$  times yields a stationary stochastic process.

frequency.

Leung (2004) indicates that traditional macroeconomics did not include housing. However, much has changed in recent decades. In the following, I will first show that housing prices and macro variables are correlated, and their relationships have changed. Hopefully, this will inspire new research on macro-housing. Section 2 will provide a literature review on why housing markets are essential for propagating shocks and how they are related to business cycles. The last section concludes.

## **2. Stylized Facts**

To establish some stylized facts on the international macro aspects of housing, this section provides some (unconditional) correlations between the business cycle frequency of real housing prices and macro variables in 22 OECD countries, namely Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, Korea, Lithuania, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, and United Kingdom. The business cycle frequency is extracted by using the band-pass filter developed by Christiano and Fitzgerald (2003). Studies on a large group of countries are subject to data availability. Here, I only study a sub-set of macro variables as in Leung and Ng (2018). Table 1 summarizes the sample size. To study whether there is a structural change following the 2008 Global Financial Crisis as suggested by some authors, I compare two sampling periods: (1) from 1997Q1 to 2006Q4, which will be referred to as the pre-crisis sub-sample, and (2) from 2010 Q1 to 2019 Q4, which will be referred to as the post-crisis sub-sample. In the following, we will see that some of the correlations may be “counter-intuitive.” This is not uncommon when we study the same relationship across countries with different economic structures, institutions, and government policies. I will conjecture some possible reasons and hopefully, this may perhaps encourage more in-depth research.

**[Figure 1 about here]**

Figure 1 shows the correlations between real housing prices and macro variables in different countries.<sup>4</sup> The x-axis and the y-axis are respectively the pre-crisis and the post-crisis correlation. Table 2 shows the abbreviation. The correlations are also summarized in Table 3. Several observations are in order. First, for most of the countries, the correlations do not lie on or close to the 45-degree line, suggesting that the GFC has an impact on the macro-housing relationship.

**[Table 2 and 3 about here]**

Second, in the relationship between the real housing prices and the real GDP, most of the countries lie on the first quadrant, while many countries lie on the third quadrant in the relationship between the real housing prices and the unemployment rate. In other words, in both pre-crisis and post-crisis sub-sample, the real housing prices are negatively and positively correlated with the unemployment rate and the real GDP, respectively, in general. These correlations are intuitive. For instance, when an economy receives a positive productivity shock, it produces more goods and services for the same amount of relative work. Firms hire more workers and people are more willing to buy housing units, resulting in an increase in real output and a decrease in unemployment rate. However, in some countries, like Australia, Canada, and Israel, the correlations do not in line with these theoretical predictions either in the pre-crisis sub-sample or in both sub-samples. The most interesting case is Australia. The unemployment rate at time  $t-1$  is significantly and positively correlated with the real housing price at time  $t$  in both pre-crisis and post-crisis period, and the real output at time  $t-1$  is significantly and negatively correlated with the real housing price at time  $t$  in the post-crisis period (see Table 3 for the test of correlation significance). This suggests the real output and the unemployment rate lead the real housing price in Australia. A conjecture is that these correlations may exist in a supply-driven housing market. Suppose in an economy, the demand for housing is inelastic and a large portion of the labor force is employed by the construction industry. When the economy is hit by an adverse productivity shock, the unemployment rate rises and the

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<sup>4</sup> A correlation table is also provided in the Appendix.

real output drops. A large number of workers in the construction industry becomes unemployed and the housing supply decreases. Since the demand for housing is inelastic, the housing price, which mainly reflects the movements in housing supply, increases. In fact, the Australian construction industry hires 9.3% of the labor force in 2019 and the inelastic housing demand may be caused by strong foreign demand for Australian real estate, especially the demand from Chinese investors.

Another set of important correlations is related to the current account balance. On the one hand, a current account surplus (deficit) indicates the capital account is in deficit (surplus), suggesting that there is an outflow (inflow) of capital. If foreign capital is an important driver of real housing prices, real housing prices will be negatively correlated with the current account balance. On the other hand, their relationship could be positive in a trade-dependent economy. For instance, if the demand for export of a trade-dependent economy shrinks after a global crisis, the current account deficit increases and the real income decreases, resulting in a decrease in the real housing prices. Figure 1 and Table 3 show that in most of the countries, after the GFC, the negative correlations between current account balance and real housing prices are significantly reduced, and some even become statistically insignificant, which may be a result of shrinking demand for exports.

The housing wealth effect indicates a positive relationship between real housing prices and real consumption. After the GFC, while the positive relationship between real housing prices and real consumption is weakened in many countries, some countries exhibit a stronger positive correlation. It adds to the evidence that the correlations between real housing prices and macroeconomic variables have changed after the GFC. It is not surprising that some countries, like Israel, Italy, and the United Kingdom, show a negative correlation. The relationship between real housing prices and real consumption also depends on other factors, such as the size of the rental market and the down-payment requirement. For instance, The Bank of Israel sets a minimum down-payment requirement of 25% for a mortgage. In practice, the banks

demand closer to 40%.<sup>5</sup> With a large amount of down-payment, people may save more when real housing prices increase, leading to a decrease in consumption.

In the relationship between short-term interest rates and real housing prices, the locations of countries in Figure 1 are quite dispersed and mainly lie on the first, third, and fourth quadrant. In many countries, the relationship changes from positive in the pre-crisis period to negative in the post-crisis period. The idea for a positive correlation is simple. Short-term interest rates are mainly driven by the central bank policy rate. During an economic boom, housing prices increase, and inflation rises above the targeted level. The central bank raises the (targeted) policy rate in response, resulting in an increase in short-term interest rates. On the other hand, a negative relationship could be explained by a reduction in the cost of borrowing. In the post-crisis period, real short-term interest rates drop below zero in many countries. If a large majority of the population tends to borrow money to purchase property, a lower cost of borrowing will stimulate the demand for housing.

There is every reason to expect that the provision of credit to households is correlated with housing prices which may be used as collateral. Obviously, credit is also an endogenous variable that responds to macro factors and expectations. Therefore, its relationship with real housing prices could be complicated across countries with different economic conditions. A simple economic intuition is that when the demand for housing increases, the demand for mortgage and housing prices will also increase. Therefore, a positive relationship exists between the two variables. In general, countries with insignificant correlations between real housing prices and credit to households in the pre-crisis period tend to have positive and significant correlation after the GFC, while countries with positive and significant correlations in the pre-crisis period tend to have weakened or insignificant correlations after the GFC. Denmark is a special case. The correlations turn from positive in the pre-crisis period to negative after the GFC. These evidence, again, show that the GFC has an impact on the housing-macro relationship.

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<sup>5</sup> See: <https://www.ogen.org/en/loans-for-homes/>

Lastly, CPI and inflation are important variables in macroeconomics since inflation targeting is widely adopted by central banks around the world. In many countries, the relationship between CPI and real housing prices is positive and significant but has been either weakened or strengthened after the GFC. Australia shows negative correlations between CPI and real housing prices. As discussed earlier, in a supply-driven housing market, the relationship between real housing prices and real output could be negative. As CPI and real output tend to move in the same direction, correlations between CPI and real housing prices will also be negative. Furthermore, Denmark, Ireland, and Norway exhibit a negative relationship in the post-crisis period. A conjecture is that the housing market has not fully recovered yet after the GFC while quantitative easing adopted by central banks has already pushed up the price level.

### **3. Literature Review**

In this section, I provide a literature review on why housing markets are important for the propagation of shocks and how they are related to business cycles. Since these topics are too broad to review, here, I only highlight a few important studies. Interested readers can find more complete discussions in Leung and Ng (2018) and Duce et al. (2020), among others.

#### **3.1 Shock propagation**

As mentioned by Leung (2004),  
*“Conventional housing economics and urban economics research for its part virtually ignores interactions with the macroeconomy. At best, some of the theoretical and empirical analyses for urban and housing economics include macroeconomic variables (such as the inflation, the economic growth, GDP, the unemployment rate, etc.) as exogenous control variables.”*



However, much has changed in recent decades.<sup>6</sup> Literature finds that frictions in credit markets are important in propagating the effects of shocks. What will happen in an economy where credit limits are endogenously determined? In the model proposed by Kiyotaki and Moore (1997), durable assets, such as land, buildings, and machinery, can serve as collateral for loans. Therefore, the prices of collateral affect the borrowers' credit limits. In such a model, the dynamic interaction between credit limits and asset prices generates a powerful transmission mechanism. Suppose there is a temporary adverse productivity shock that reduces net worth at time  $t$ . Firms, who are credit constrained and have borrowed heavily against the value of their durable assets, are unable to borrow more. Those firms are forced to reduce their investment expenditure. In the next period, since they earn less, their net worth falls, and, again, they reduce investment. Such knock-on effects will continue and hence, the effects of the temporary shock persist.

Aoki et al. (2004) study the impact of housing prices on consumption when houses are served as collateral to lower the borrowing cost. In their model, homeowners face an external finance premium due to imperfections in credit markets. In this framework, the endogenous developments in credit markets, such as variations in net worth or collateral, will amplify and propagate shocks to the economy. Suppose an economy receives a positive shock to economic activity causing an increase in demand for housing. A rise in housing prices leads to an increase in homeowners' net worth and hence, lowers the external finance premium. This will lead to a further rise in housing demand and spills over into consumption demand. Aoki et al. (2004) also consider the implications for monetary policy when home equity becomes easier and cheaper to access. They find that response of consumption to an unanticipated change in interest rates will be amplified because when housing prices increase, more borrowing will be devoted to consumption relative to housing investment, and so the response of house prices and housing investment will be smaller.

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<sup>6</sup> See for example, Chang (2000), Favilukis et al. (2017), Ghent and Owyang (2010), Justiniano (2015), Kan et al. (2004), Kwong and Leung (2000), Leung (1999, 2003, 2014), Leung and Feng (2005), Leung et al. (2002a, b), Lin et al. (2004), Ortalo-Magné and Rady (2006), Pataracchia et al. (2013), Tse and Leung (2002).

Iacoviello (2005) focuses on how a general equilibrium model with financial frictions can explain the aggregate time-series evidence and be used for monetary policy analysis. In the model, collateral constraints are tied to real estate values for firms as in Kiyotaki and Moore (1997); and nominal debts for a subset of households. The transmission mechanism is as follows. Suppose a positive demand shock leads to an increase in consumer and asset prices. Borrowers are less constrained and willing to spend and invest more. Furthermore, the increase in consumer prices will benefit the borrowers and hurt the lenders. So, the borrowers have a higher propensity to spend than lenders, and the net effect on demand is positive. Given that, demand shocks move housing and nominal prices in the same direction and are amplified and propagated over time.

Iacoviello and Neri (2010) attempt to explain the dynamics of residential investment and housing prices and the spillover effect of the housing market. In the model, they introduce sectoral heterogeneity as in Davis and Heathcote (2005). Also, housing can be used as collateral for loans, as in Kiyotaki and Moore (1997) and Iacoviello (2005). In the model, fluctuations in house prices affect the borrowing constraint of a fraction of households and the relative profitability of producing new homes. These generate feedback effects for the expenditure of households and firms. He finds that the housing market spillovers are nonnegligible and concentrated on consumption rather than business investment.

### **3.2 Business cycle**

As mentioned by Leamer (2007, 2015), housing is the single most critical part of the U.S. business cycle. Although it may be unimportant during normal periods, weakness in housing is a critical part of US economic recessions. Indeed, the literature finds durable assets are important for the generation and propagation of business cycles.

Baxter (1996) develops a two-sector model (consumption goods and durable

goods sector) to simulate empirical patterns of cross-sector volatility and co-movement and attempt to investigate whether consumer durables are important for the generation and propagation of business cycles. He studies the source of the higher volatility in the durable goods industry and finds that roughly half it is due to the higher volatility of productivity shocks in that industry, with the remaining half due to the endogenous accelerator mechanism. The model also correctly predicts positive cross-sectoral co-movement of outputs, investments, and labor input. Unfortunately, compared to a one-sector model, incorporating durable consumer goods does not have much effect on the behavior of other macroeconomic variables.

Different from Baxter (1996), Jin and Zeng (2004) consider a three-sector dynamic stochastic general equilibrium to distinguish the production of residential investment goods, nonresidential investment goods, and consumption goods. In the model, monetary frictions and credit market activities are introduced and households need to finance residential investment out of their nominal wealth. Under this framework, fluctuations in the nominal interest rate affect the financing cost of firms' working capital and households' residential investment. Therefore, both residential investment and house prices are sensitive to fluctuations in the nominal interest rate. The model also generates the procyclicality of house prices, and the high volatility of residential investment and hours worked in the house investment goods producing sector.

Davis and Heathcote (2005) construct a multisector growth model with two final-goods sectors: one produces the consumption or business investment goods, the other produces residential structures that are combined with newly available land to produce houses. The model succeeds in reproducing two facts: GDP, consumption, residential investment, and nonresidential investment co-move positively; and the volatility of residential investment is more than twice that of nonresidential investment.

Iacoviello and Pavan (2013) study housing and mortgage debt in a general equilibrium model in which a house can be owned or rented and can be used as collateral for loans. The model matches the cyclicity and volatility of housing

investment, and the procyclicality of debt. Also, the reduced volatility of housing investment and the reduced procyclicality of debt can be explained by higher individual income risk and lower down payments.

## **Conclusion**

Housing variables not only affect but also interact with the macroeconomy. Much prior literature shows that housing market fluctuations can propagate shocks or even generate aggregate volatility. This paper studies whether the relationships between housing prices and macroeconomic variables have changed after the 2008 Global Financial Crisis (GFC) in 22 OECD countries. In general, macro variables exhibited a strong association with housing prices. While some correlations are weakened or strengthened, some are even reversed after the GFC. Therefore, we should pay more attention to the stylized facts in macro-housing, especially after the GFC. Hopefully, this will inspire new research on macro-housing.

## Figures

Figure 1a Correlation between real housing prices and unemployment rate

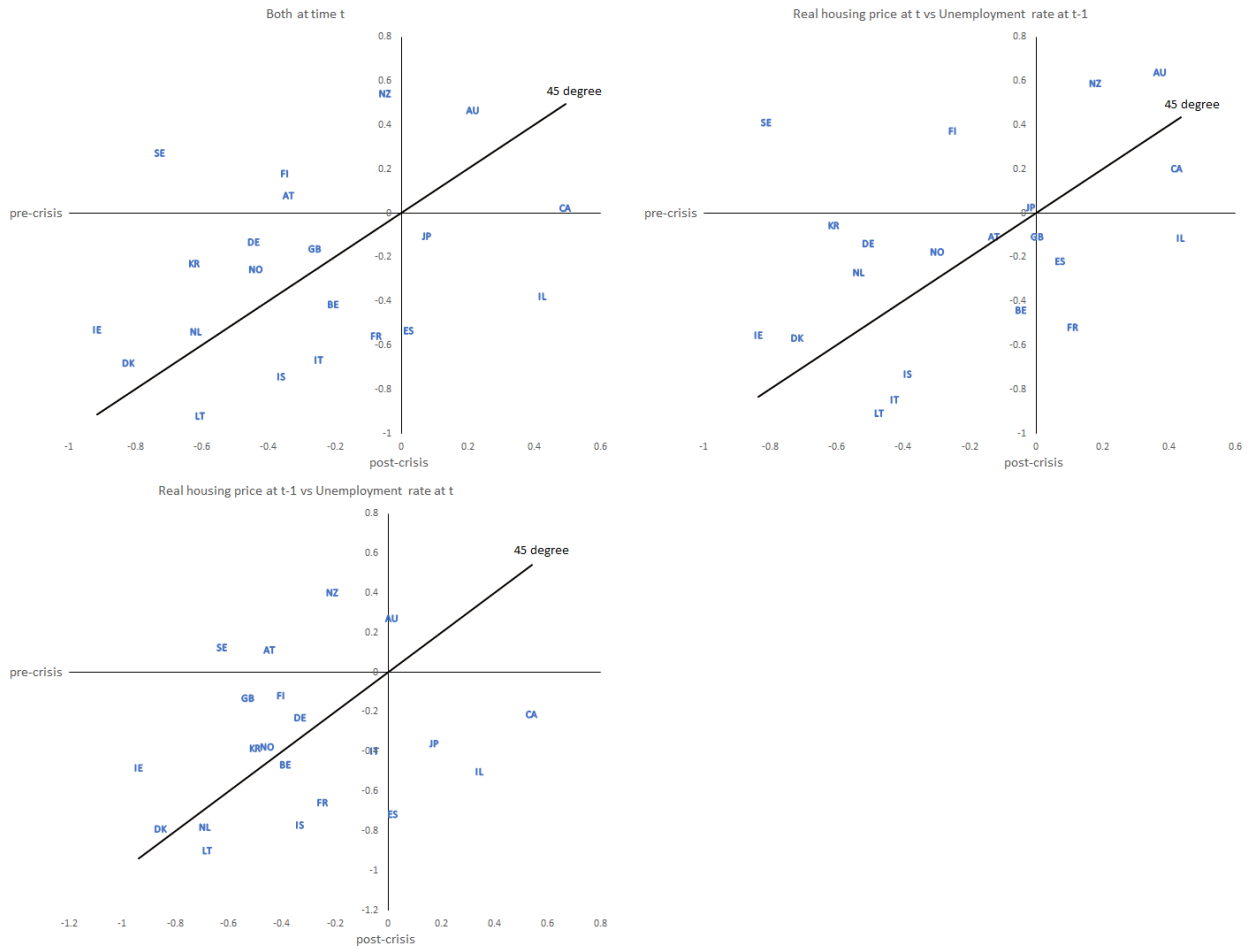


Figure 1b Correlation between real housing prices and real GDP

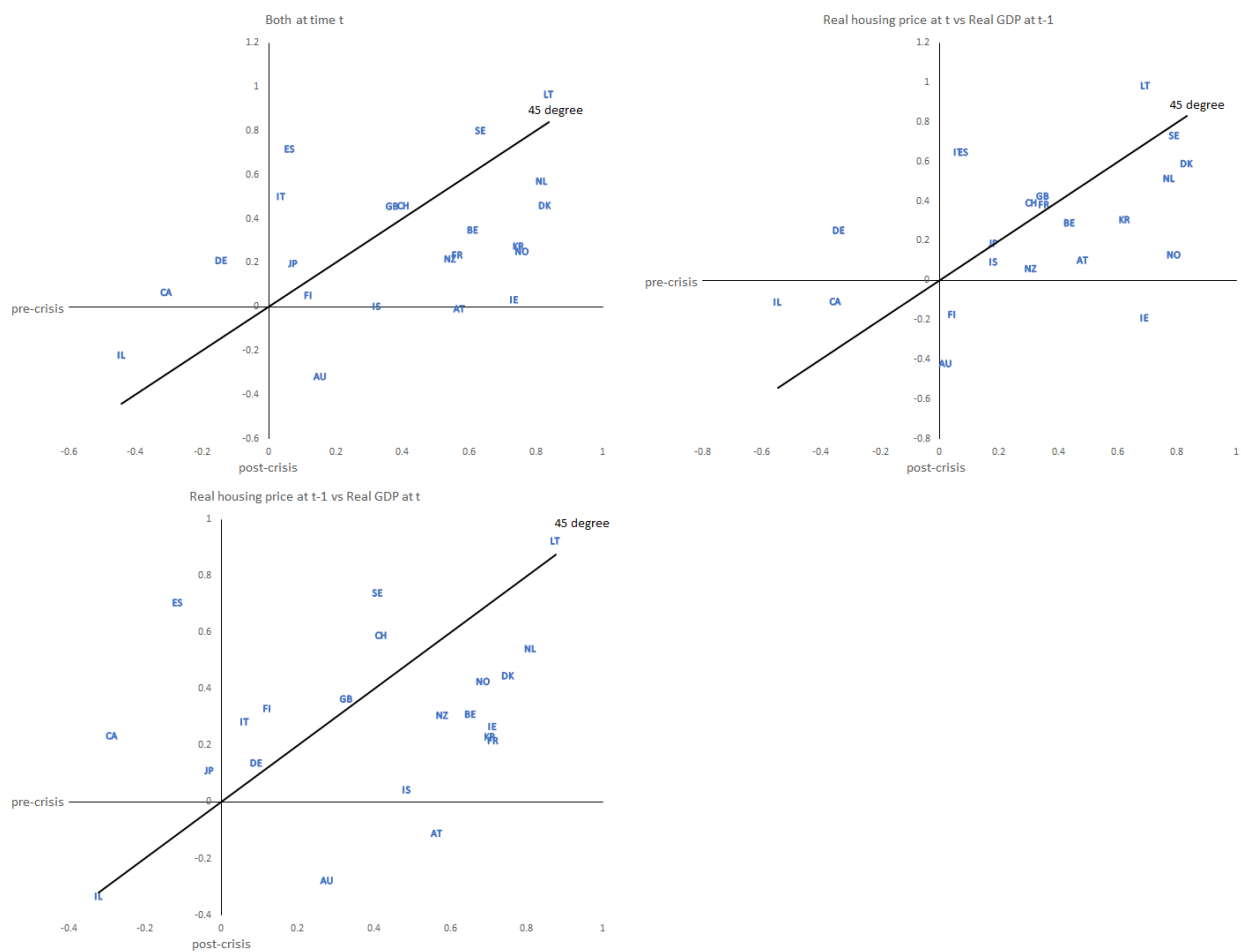


Figure 1c Correlation between real housing prices and current account balance

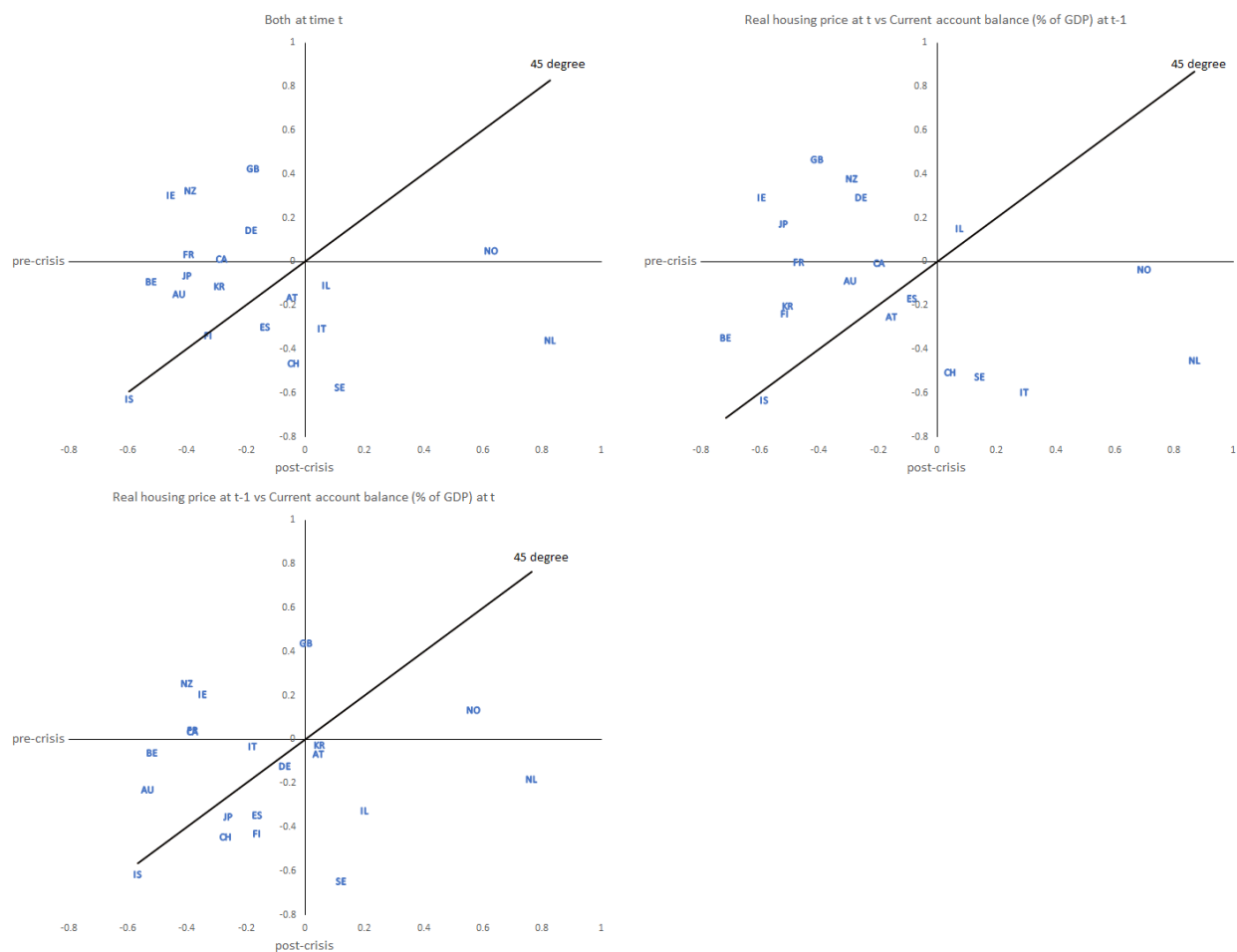


Figure 1d Correlation between real housing prices and real consumption

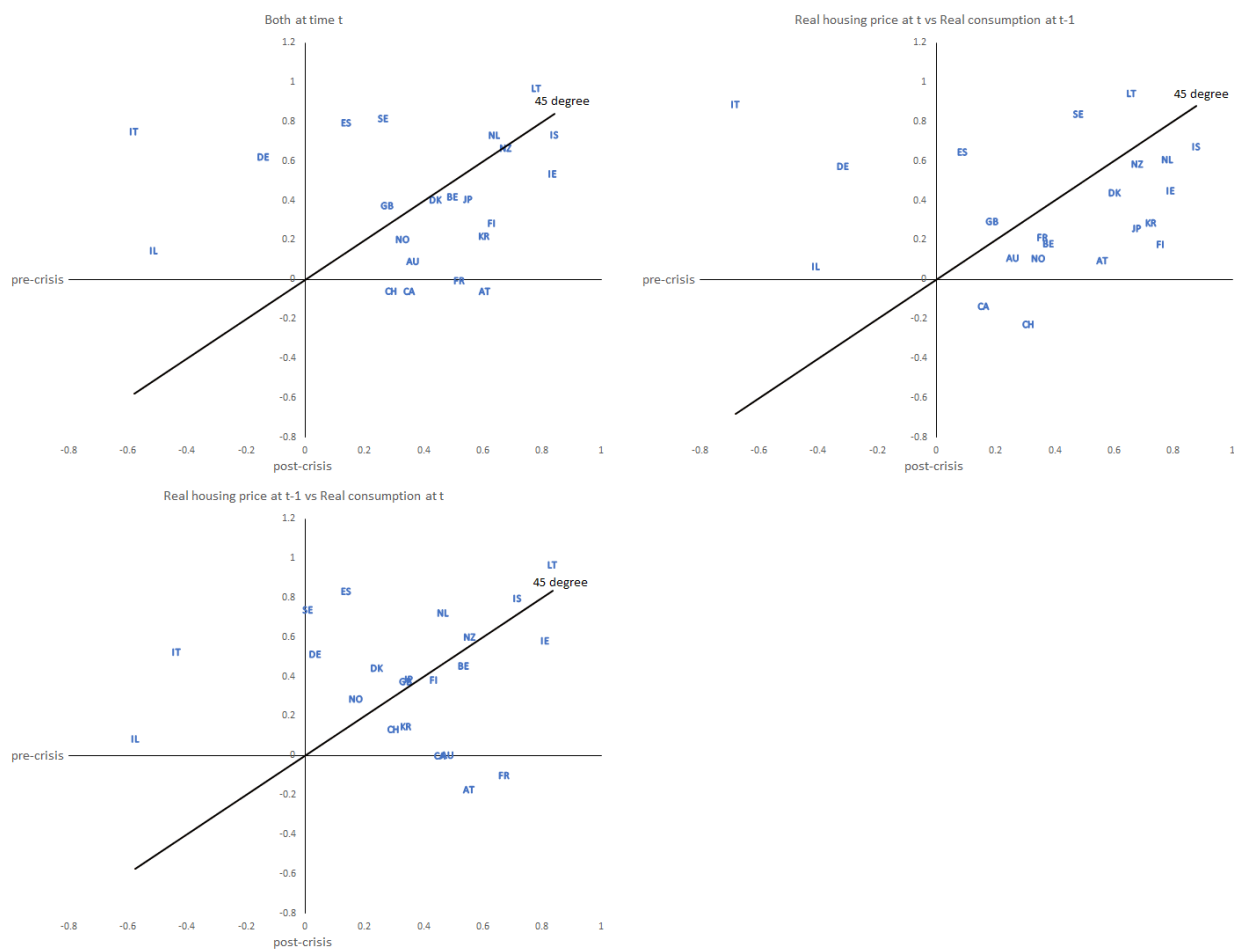




Figure 1e Correlation between real housing prices and real short rate

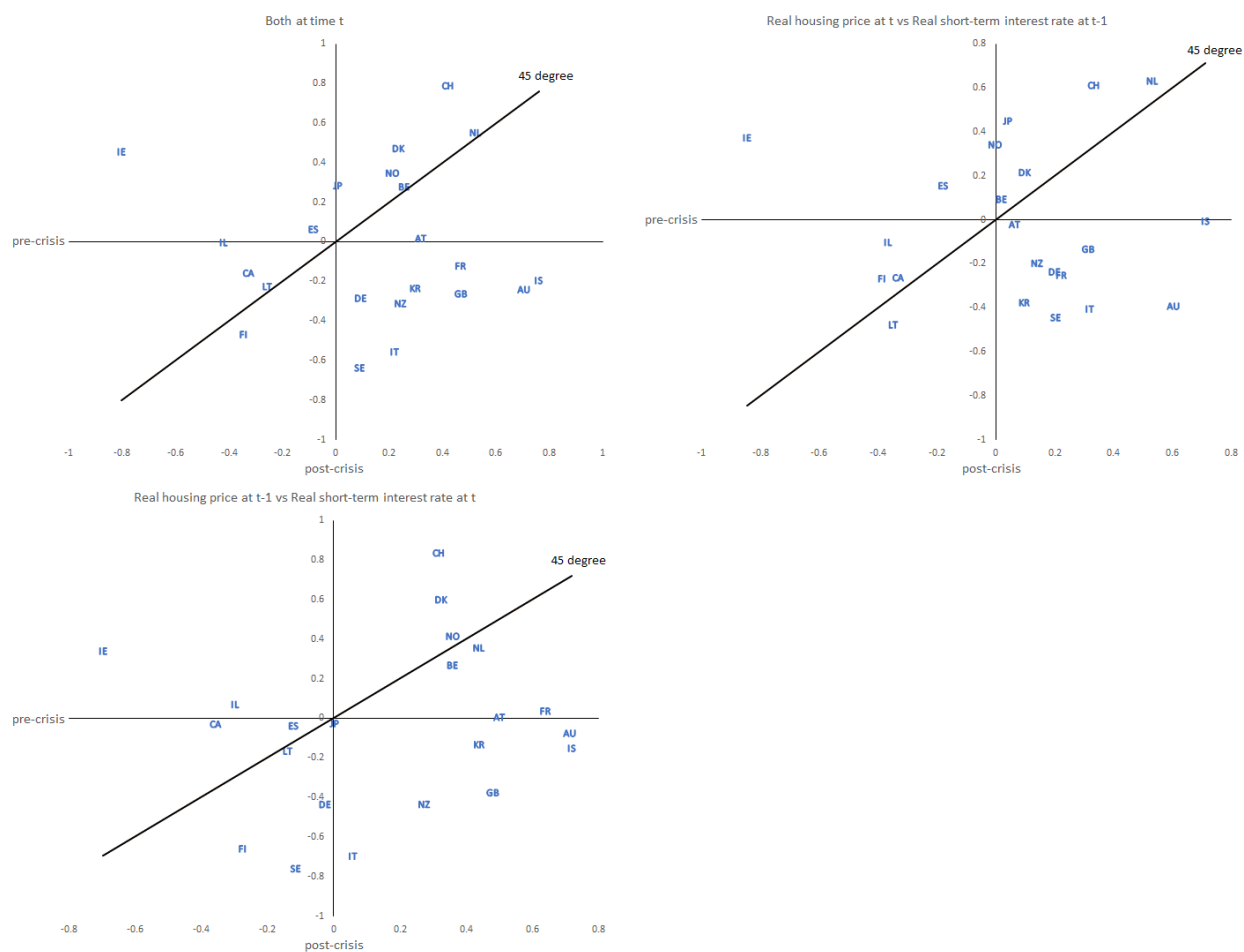


Figure 1f Correlation between real housing prices and real credit to household

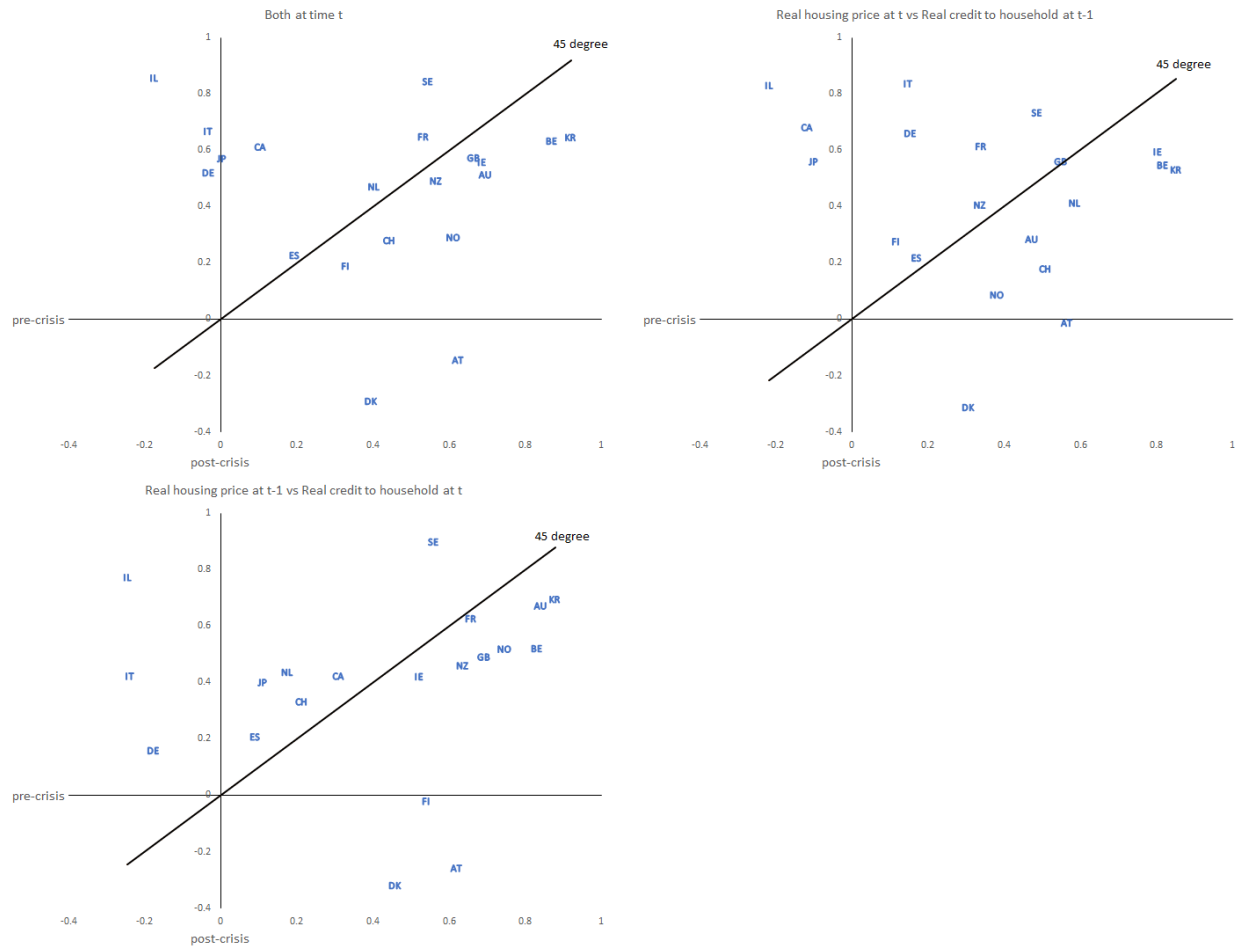
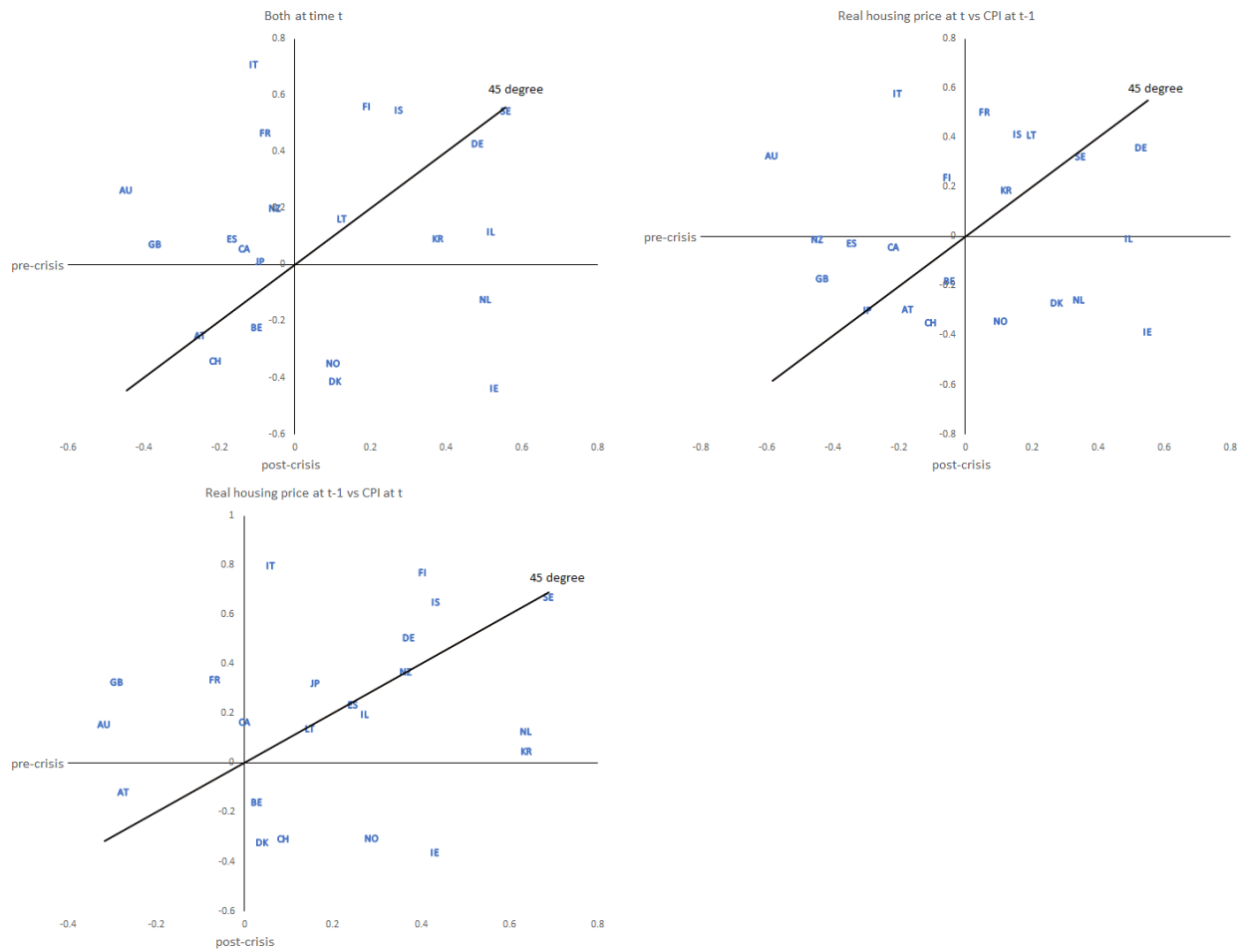


Figure 1g Correlation between real housing prices and CPI



## Table

Table 1 Sample size

All the variables from 1997Q1 to 2019Q4 except the followings

Real housing prices		Unemployment rate		Current account balance	
Austria	2000Q1 - 2019Q4	Ireland	2003Q1 - 2019Q4	Belgium	2003Q1 - 2019Q4
Ireland	2000Q1 - 2019Q4	Switzerland	Not available	Denmark	Not available
Lithuania	1998Q4 - 2019Q4			France	1999Q1 - 2019Q4
				Ireland	2002Q1 - 2019Q4
				Lithuania	Not available
				Netherlands	2003Q2 - 2019Q4
				Switzerland	2000Q1 - 2019Q4
Real short-term interest rate		Real credit to households			
Japan	2002Q2 - 2019Q4	Iceland	Not available		
Lithuania	1999Q1 - 2019Q4	Ireland	2002Q1 - 2019Q4		
		Lithuania	Not available		
		Switzerland	1999Q4 - 2019Q4		

Table 2 Abbreviation

Austria	AT
Australia	AU
Belgium	BE
Canada	CA
Denmark	DK
Finland	FI
France	FR
Germany	DE
Iceland	IS
Ireland	IE
Israel	IL
Italy	IT
Japan	JP
Korea	KR
Lithuania	LT
Netherlands	NL
New Zealand	NZ
Norway	NO
Spain	ES
Sweden	SE
Switzerland	CH
United Kingdom	GB

Table 3 Business cycle correlations

Macro variable at time t	Austria real housing price						Australia real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.34	-0.44**	-0.13	0.08	0.11	-0.11	0.22	0.02	0.37**	0.47***	0.27	0.64***
Real GDP	0.57***	0.57***	0.48***	-0.01	-0.11	0.1	0.15	0.28	0.02	-0.32**	-0.28	-0.42***
Current account balance	-0.04	0.05	-0.15	-0.16	-0.07	-0.25	-0.42***	-0.53***	-0.29	-0.15	-0.23	-0.09
Real consumption	0.61***	0.55***	0.56***	-0.06	-0.17	0.09	0.37**	0.48***	0.26	0.09	0	0.11
Real short rate	0.32	0.5***	0.07	0.02	0	-0.02	0.71***	0.71***	0.61***	-0.24	-0.08	-0.39**
Real credit to household	0.62***	0.62***	0.57***	-0.15	-0.26	-0.01	0.7***	0.84***	0.47***	0.51***	0.67***	0.28
CPI	-0.25	-0.27	-0.17	-0.25	-0.12	-0.3	-0.44***	-0.32**	-0.58***	0.26	0.16	0.33**

	Belgium real housing price						Canada real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.2	-0.38**	-0.04	-0.41***	-0.47***	-0.44***	0.49***	0.54***	0.42***	0.02	-0.21	0.2
Real GDP	0.61***	0.65***	0.44***	0.35**	0.31	0.29	-0.31	-0.29	-0.35**	0.06	0.23	-0.11
Current account balance	-0.52**	-0.52**	-0.71***	-0.09	-0.06	-0.35**	-0.28	-0.38**	-0.2	0.01	0.03	-0.01
Real consumption	0.5***	0.54***	0.38**	0.42***	0.45***	0.18	0.35**	0.46***	0.16	-0.06	0	-0.14
Real short rate	0.26	0.36**	0.02	0.28	0.27	0.09	-0.32**	-0.36**	-0.33**	-0.16	-0.03	-0.26
Real credit to household	0.87***	0.83***	0.82***	0.63***	0.52***	0.55***	0.1	0.31	-0.12	0.61***	0.42***	0.68***

CPI	-0.1	0.03	-0.05	-0.22	-0.16	-0.18	-0.13	0	-0.22	0.06	0.16	-0.04
	Denmark real housing price						Finland real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.82***	-0.86***	-0.72***	-0.68***	-0.79***	-0.57***	-0.35**	-0.4**	-0.25	0.18	-0.12	0.37**
Real GDP	0.83***	0.75***	0.83***	0.46***	0.45***	0.59***	0.12	0.12	0.04	0.05	0.33**	-0.17
Current account balance							-0.33**	-0.16	-0.51***	-0.34**	-0.43***	-0.24
Real consumption	0.44***	0.24	0.6***	0.4***	0.44***	0.44***	0.63***	0.43***	0.76***	0.28	0.38**	0.18
Real short rate	0.23	0.32**	0.1	0.47***	0.6***	0.21	-0.34**	-0.27	-0.39**	-0.47***	-0.66***	-0.27
Real credit to household	0.39**	0.46***	0.3	-0.29	-0.32**	-0.31**	0.33**	0.54***	0.12	0.19	-0.02	0.28
CPI	0.11	0.04	0.27	-0.41***	-0.32**	-0.27	0.19	0.4**	-0.05	0.56***	0.77***	0.24
	France real housing price						Germany real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.07	-0.24	0.11	-0.56***	-0.66***	-0.52***	-0.44***	-0.33**	-0.5***	-0.13	-0.23	-0.14
Real GDP	0.57***	0.71***	0.35**	0.23	0.22	0.38**	-0.14	0.09	-0.34**	0.21	0.14	0.25
Current account balance	-0.39**	-0.38**	-0.47***	0.03	0.04	0	-0.18	-0.07	-0.26	0.14	-0.12	0.29
Real consumption	0.52***	0.67***	0.36**	-0.01	-0.1	0.21	-0.14	0.03	-0.32**	0.62***	0.51***	0.57***
Real short rate	0.47***	0.64***	0.22	-0.12	0.04	-0.25	0.09	-0.03	0.2	-0.29	-0.44***	-0.24
Real credit to household	0.53***	0.66***	0.34**	0.65***	0.63***	0.61***	-0.03	-0.18	0.15	0.52***	0.16	0.66***

CPI	-0.08	-0.07	0.06	0.47***	0.34**	0.5***	0.48***	0.37**	0.53***	0.43***	0.51***	0.36**
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	Iceland real housing price						Ireland real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.36	-0.33	-0.39	-0.74***	-0.77***	-0.73***	-0.91***	-0.94***	-0.83***	-0.53***	-0.48***	-0.55***
Real GDP	0.32	0.49**	0.18	0	0.04	0.09	0.73***	0.71***	0.69***	0.03	0.27	-0.19
Current account balance	-0.59***	-0.57***	-0.58***	-0.63***	-0.62***	-0.63***	-0.45**	-0.35	-0.59***	0.3	0.2	0.29
Real consumption	0.84***	0.72***	0.88***	0.73***	0.8***	0.67***	0.83***	0.81***	0.79***	0.53***	0.58***	0.45***
Real short rate	0.76***	0.72***	0.71***	-0.2	-0.15	-0.01	-0.8***	-0.7***	-0.84***	0.45***	0.34**	0.37**
Real credit to household							0.69***	0.52**	0.8***	0.56***	0.42***	0.59***
CPI	0.27	0.43**	0.16	0.55***	0.65***	0.41***	0.53***	0.43***	0.55***	-0.44***	-0.36**	-0.39**

	Israel real housing price						Italy real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	0.43***	0.35**	0.44***	-0.38**	-0.5***	-0.11	-0.25	-0.05	-0.43***	-0.67***	-0.4**	-0.85***
Real GDP	-0.44***	-0.32**	-0.55***	-0.22	-0.33**	-0.11	0.04	0.06	0.06	0.5***	0.28	0.65***
Current account balance	0.07	0.2	0.08	-0.11	-0.33**	0.15	0.06	-0.18	0.29	-0.31	-0.03	-0.6***
Real consumption	-0.51***	-0.57***	-0.41**	0.15	0.08	0.07	-0.58***	-0.44***	-0.68***	0.75***	0.52***	0.89***
Real short rate	-0.42***	-0.3	-0.37**	0	0.07	-0.1	0.22	0.06	0.32**	-0.56***	-0.7***	-0.41***
Real credit to household	-0.17	-0.24	-0.22	0.86***	0.77***	0.83***	-0.03	-0.24	0.15	0.67***	0.42***	0.84***



CPI	0.52***	0.27	0.49***	0.12	0.2	-0.01	-0.11	0.06	-0.2	0.71***	0.8***	0.58***
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	Japan real housing price						Korea real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	0.08	0.17	-0.02	-0.1	-0.36**	0.03	-0.62***	-0.5***	-0.61***	-0.23	-0.38**	-0.06
Real GDP	0.07	-0.03	0.18	0.2	0.11	0.19	0.75***	0.71***	0.62***	0.28	0.23	0.31
Current account balance	-0.4**	-0.26	-0.52***	-0.06	-0.35**	0.17	-0.29	0.05	-0.5***	-0.11	-0.03	-0.2
Real consumption	0.55***	0.35**	0.68***	0.41***	0.39**	0.26	0.61***	0.34**	0.73***	0.22	0.15	0.29
Real short rate	0.01	0	0.04	0.28	-0.03	0.45***	0.3	0.44***	0.1	-0.24	-0.13	-0.38**
Real credit to household	0	0.11	-0.1	0.57***	0.4**	0.56***	0.92***	0.88***	0.85***	0.65***	0.69***	0.53***
CPI	-0.09	0.16	-0.3	0.01	0.32**	-0.3	0.38**	0.64***	0.13	0.09	0.05	0.19

	Lithuania real housing price						Netherlands real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.6***	-0.68***	-0.47***	-0.92***	-0.9***	-0.91***	-0.62***	-0.69***	-0.53***	-0.54***	-0.78***	-0.27
Real GDP	0.84***	0.88***	0.69***	0.97***	0.92***	0.98***	0.82***	0.81***	0.77***	0.57***	0.54***	0.51***
Current account balance							0.83***	0.76***	0.87***	-0.36**	-0.18	-0.45***
Real consumption	0.78***	0.84***	0.66***	0.97***	0.97***	0.94***	0.64***	0.47***	0.78***	0.73***	0.72***	0.61***
Real short rate	-0.25	-0.14	-0.35	-0.23	-0.17	-0.48***	0.52***	0.44***	0.53***	0.55***	0.35**	0.63***
Real credit to household							0.4***	0.18	0.59***	0.47***	0.44***	0.41***

CPI	0.13	0.15	0.2	0.16	0.14	0.41***	0.5***	0.64***	0.34**	-0.12	0.13	-0.26
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	New Zealand real housing price						Norway real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	-0.05	-0.21	0.18	0.54***	0.4**	0.59***	-0.44***	-0.45***	-0.3	-0.26	-0.38**	-0.18
Real GDP	0.54***	0.58***	0.31	0.22	0.31	0.06	0.76***	0.69***	0.79***	0.25	0.43***	0.13
Current account balance	-0.39**	-0.4**	-0.29	0.32**	0.25	0.38**	0.63***	0.57***	0.7***	0.05	0.13	-0.04
Real consumption	0.68***	0.56***	0.68***	0.67***	0.6***	0.58***	0.33**	0.17	0.34**	0.2	0.29	0.11
Real short rate	0.24	0.27	0.14	-0.31**	-0.44***	-0.2	0.21	0.36**	0	0.35**	0.41***	0.34**
Real credit to household	0.57***	0.64***	0.34**	0.49***	0.46***	0.4***	0.61***	0.74***	0.38**	0.29	0.52***	0.09
CPI	-0.05	0.37**	-0.45***	0.2	0.37**	-0.01	0.1	0.29	0.11	-0.35**	-0.31	-0.34**

	Spain real housing price						Sweden real housing price					
	pre-crisis			post-crisis			pre-crisis			post-crisis		
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate	0.02	0.02	0.07	-0.53***	-0.72***	-0.22	-0.73***	-0.62***	-0.81***	0.27	0.12	0.41***
Real GDP	0.06	-0.11	0.08	0.72***	0.71***	0.65***	0.63***	0.41***	0.79***	0.8***	0.74***	0.73***
Current account balance	-0.14	-0.16	-0.09	-0.3	-0.35**	-0.17	0.12	0.12	0.14	-0.58***	-0.65***	-0.53***
Real consumption	0.14	0.14	0.09	0.79***	0.83***	0.65***	0.26	0.01	0.48***	0.82***	0.74***	0.84***
Real short rate	-0.08	-0.12	-0.18	0.06	-0.04	0.15	0.09	-0.11	0.2	-0.64***	-0.76***	-0.45***
Real credit to household	0.19	0.09	0.17	0.23	0.21	0.22	0.54***	0.56***	0.49***	0.84***	0.9***	0.73***

CPI	-0.17	0.25	-0.34**	0.09	0.23	-0.03	0.56***	0.69***	0.35**	0.54***	0.67***	0.32**
Switzerland real housing price						United Kingdom real housing price						
pre-crisis						pre-crisis						
post-crisis						post-crisis						
	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1	t	t-1	t+1
Unemployment rate							-0.26	-0.52***	0.01	-0.16	-0.13	-0.11
Real GDP	0.4***	0.42***	0.31	0.46***	0.59***	0.39**	0.37**	0.33**	0.35**	0.46***	0.36**	0.43***
Current account balance	-0.04	-0.27	0.04	-0.47***	-0.45***	-0.51***	-0.17	0	-0.4**	0.42***	0.44***	0.47***
Real consumption	0.29	0.3	0.31	-0.06	0.13	-0.23	0.28	0.34**	0.19	0.37**	0.37**	0.29
Real short rate	0.42***	0.32**	0.33**	0.79***	0.83***	0.61***	0.47***	0.48***	0.32	-0.26	-0.38**	-0.13
Real credit to household	0.44**	0.21	0.51***	0.28	0.33**	0.18	0.67***	0.69***	0.55***	0.57***	0.49***	0.56***
CPI	-0.21	0.09	-0.1	-0.34**	-0.31	-0.35**	-0.37**	-0.29	-0.43***	0.07	0.33**	-0.17

Note: \*\* and \*\*\* indicate 5% and 1% level of significance.

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