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**Working Paper**

## National and international business cycle effects of housing crises

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# Working Papers

Kiel Institute  
for the World Economy



## National and International Business Cycle Effects of Housing Crises

by Nils Jannsen

1510 | April 2009

Kiel Working Paper 1510 | April 2009

## **National and International Business Cycle Effects of Housing Crises\***

Nils Jannsen

### **Abstract:**

Housing crises usually go hand in hand with a long lasting recession and a considerable loss in output. We first re-examine the effects of a housing crises on the business cycle based on historical crises. Then we estimate the international spill-over-effects if several huge industrial countries face a housing crisis simultaneously. While the economic impact of the housing crisis in the United States, from a historical perspective, should have bottomed out at the end of 2008 and the business cycle pattern differed significantly from that in a typical crisis, house prices in Great Britain, Spain and France just started to drop at the end of 2007. If we assume that a typical housing crisis occurs in all of these three countries, international transmission effects then would lead to significant losses of GDP growth in several other countries, notably in Europe.

**Keywords:** Housing Crisis, Business Cycle, International Transmission, Global VAR

**JEL classification:** C50, E32, F42

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## **1 Introduction**

Developments at the housing market can have an enormous influence on the business cycle of a country. Housing crises usually go hand in hand with a long lasting recession and a considerable loss in output.<sup>1</sup> After the United States, in 2006 many other countries face downswings at their housing markets. Most prominently among these are Great Britain and Spain, but also in France decreasing house prices can be observed in 2008—the first sign of an upcoming downswing. If several huge industrial countries are hit by a housing crisis simultaneously, this should lead to significant negative transmission effects to the rest of world and may trigger a world-wide recession. The scope of this paper is twofold. First we re-examine the effects of a housing crisis on the business cycle drawing on existing literature and relate the historical experience to recent developments in the four countries mentioned above. Then we estimate the international transmission effects, in case that several countries simultaneously suffer through a—in historical terms—typical housing crisis, making use of a small empirical international business cycle model. Given that the economic development during the current housing crisis in the United States differed substantially from typical housing crisis and that from a historical perspective it should have bottomed out at the end of 2008, we focus on the housing crises in Great Britain, Spain and France in the simulation exercise. The second section provides a literature overview. Section 3 illustrates the typical behaviour of macroeconomic variables during housing crises and analyses the development in countries which already do or may shortly face a housing crisis. The fourth section shows possible transmission effects to other countries, assuming that Great Britain, Spain and France should face a typical housing crisis. Finally, Section 5 draws conclusions from our findings.

## **2 Review of Literature**

The role of asset prices and in particular of real house prices in the business cycle is subject of several studies.<sup>2</sup> Overall, they conclude that a strong decline in asset prices is usually followed by a severe economic downturn in affected countries. Closely related to our historical comparison in Section 3 is a study of the International Monetary Fund (IMF 2003), which evaluates the effects of boom and busts at the stock and housing market with a dataset

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<sup>1</sup> See Leamer (2007).

<sup>2</sup> Asset prices are deflated with consumer prices if not mentioned otherwise.

of 15 industrial countries between 1970 and 2002. It determines price peaks and troughs and defines 25 percent of the most severe price decreases as busts.<sup>3</sup> The typical development of important macroeconomic variables indicates that busts at the housing market are followed by recessions with more severe consequences—on average—than busts at the stock market. Accordingly to the same study, two years after the outbreak of a housing crisis, output is at about eight percent below the level that could have been reached without a housing crisis. A study of Ahearne et al. (2005) is closely related to this approach. They assess the average business cycle pattern after a house price peak, which is defined as a centred six-year high. The authors conclude that declines in house prices go hand in hand with recessions, turning the output gap negative for more than five years on average. Several other related papers confirm these results. For instance, Jonung et al. (2006) find that a strong decline in asset prices has usually long-lasting negative effects on GDP growth and the output gap. Independently, Detken and Smets (2004) analyze the behaviour of several macroeconomic variables before, during and after an asset price boom. They show that usually a boom is followed by a serious slow down of economic activity. Moreover, booms causing an above average loss of output usually come along with an above average asset price increase, before the boom and a stronger price decline afterwards. Bordo and Jeanne (2002) regard boom and busts at asset and housing markets as a considerable deviation of prices from their average development measured by the three year mean. According to their study, boom and bust cycles occur more frequently at housing than at asset markets. Moreover, after a boom at the housing market, the output gap drops by five percentage points on average within a three year span. In a separate study with a slightly different focus, Reinhart and Rogoff (2008) investigate the implications of 18 banking crises in industrial countries. They conclude that banking crises are frequently preceded by significant price increases at the housing markets. GDP growth usually slows prior to the crisis and remains weak for more than two years. The international implications of housing crises have not yet been in the focus of research. In contrast international business cycle transmission mechanisms have been analyzed frequently. Usually two-country vector autoregressive models are applied to evaluate the transmission mechanisms between two countries or regions. Recently multi-country models—so-called

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<sup>3</sup> The detection of price peaks and troughs is carried out according to an algorithm of Bry and Boschan (1971) developed for the detection of business cycle turning points.

global vector autoregressive models (Global VAR)—were introduced in literature. A related model is adopted in this study.<sup>4</sup>

### **3 Historical Housing Crises**

Housing crises are rare events. Thus their effects are hard to be modelled empirically by time series techniques, which capture the average behaviour of the economy. Therefore, historical comparisons of a panel of housing crises are commonly applied to assess their impact on the business cycle. For the historical comparison we first define a housing crisis on the basis of two criteria and then analyze the typical business cycle behaviour during a crisis.

#### **3.1 Methodology for Detecting Housing Crises**

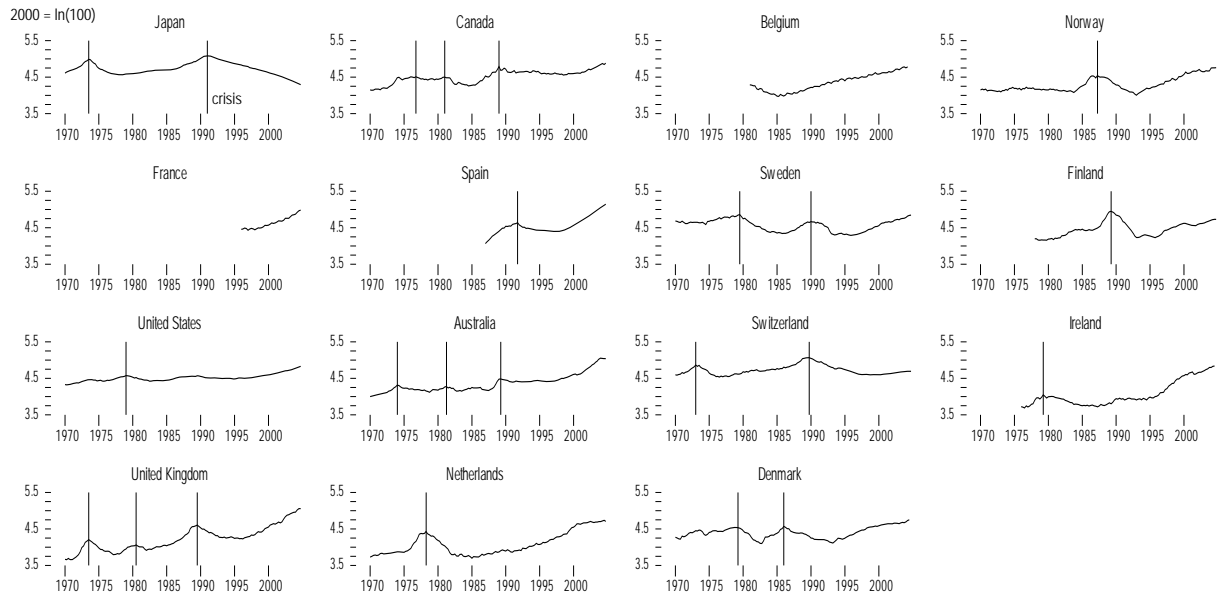
In current literature two methods are basically engaged for identifying housing crises. One is based on deviations from the trend of house prices, while the other one seeks for turning points in price movements and regards strong price declines as crises. In the following we draw on an approach related to the latter by setting two criteria to define a housing crisis. Namely, the start of a housing crisis is defined as the peak of houses prices within a rolling window of eight years, followed by a price decline from the peak of at least 7.5 percent during the next four years. Based on a dataset of 15 industrial countries between 1970 and 2004 with quarterly data for real house prices we can identify 23 housing crises across those countries (Figure 1).<sup>5</sup>

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<sup>4</sup> Abeyasinghe and Forbes (2001) introduced a global vector autoregressive business cycle model in the literature which summarizes several countries via a certain weighting scheme in one model, in particular to analyze business cycle transmissions in the East Asia area. Peseran et al. (2004) develop a more extensive model with several domestic and foreign variables under explicit consideration of cointegration relationships. This model was used among others to analyze transmission effects from the United States to Europe (Déés und Di Mauro et. al 2007) and international long-run relationships (Déés and Holy et al. 2007).

<sup>5</sup> The dataset consists of data for Great Britain, Canada, Spain, Australia, Netherlands, Belgium, Sweden, Switzerland, Denmark, Norway, Finland and Ireland and was kindly provided by the Bank for International Settlements (BIS). Quarterly house prices for France and the Unites States as well as land prices in Japan were added from national sources (see Appendix A).

Figure 1:  
Real House Prices in Selected Countries



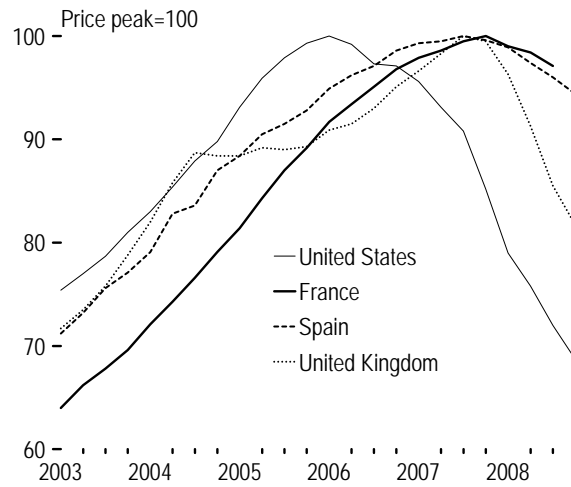
Our approach is robust against moderate modifications of both criteria. Most of the crises took place during the seventies and eighties in the last century. During the last 20 years no housing crisis in the dataset can be observed. Moreover, housing crises seem to cluster within certain time periods. For instance, eight countries faced housing crises in the period from 1989 to 1991, while seven countries were affected in the period from 1979 to 1981 and four in the period from 1973 to 1974. Furthermore, the United States, while not fulfilling the criteria for a housing crisis introduced above, were also confronted with decreasing real house prices in 1973 (with a following price decrease of 4.3 percent) and in 1989 (with a decrease of 7.3 percent).

To compare historical crises with the current situation in different countries, it is necessary to detect starting points of housing crises or at least turning points of the price development. In this study we consider the following four countries: United States, Great Britain, Spain and France. Figure 2 illustrates that these countries currently face decreasing real house prices.<sup>6</sup> While the United States reached the price peak already at the first quarter of 2006, the price peaks in the other three countries were clustered together at the end of 2007; Great Britain and Spain at the third quarter and France at the fourth quarter of 2007 respectively.

<sup>6</sup> Also several other countries are affected by shrinking house prices or even a recession at the housing market like Ireland, Australia, Canada and the Scandinavian countries. Here we focus on the most important countries.



Figure 2:  
Real House Prices in Selected Countries 2003 to 2008



According to the criteria described above, the United States and Great Britain are already facing housing crises, while in Spain and France merely decreasing real house prices can be observed up to the end of 2008.<sup>7</sup>

### 3.2 Historical Comparison

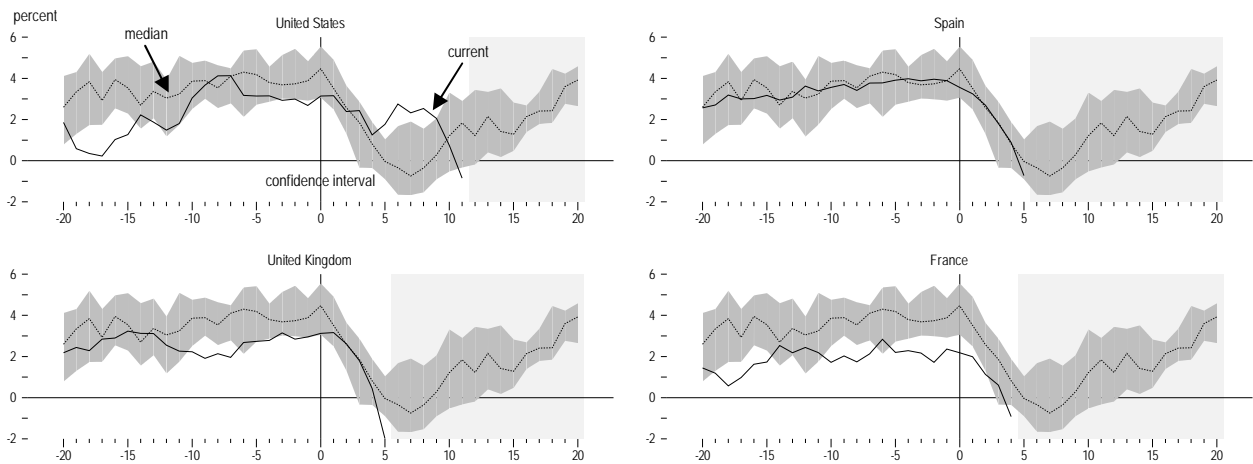
To extract the typical business cycle behaviour of economies during housing crises we derive the median values of several macroeconomic variables within a time span from 20 quarters before a crisis to 20 quarters after the start of a housing crisis, based on the 23 identified historical crises. In the following figures the quarter of the price peak is quarter zero, so that quarter one is the first with declining house prices. The shaded area around the median marks the bandwidth of the medium fifty percent of all crises. Growth of GDP (Figure 3), private consumption (Figure B.1), residential investment (Figure B.2) and business investment (Figure B.3) decline sharply on average at the beginning of the housing crisis and require more than four years to reclaim their old levels.<sup>8</sup> The trough is usually reached five to eight quarters after the price peak. Since most of the historical housing crises took place in the seventies and the eighties of the last century, where macroeconomic conditions differed crucially from today's, it seems sensible to adjust the series for their trends. The deviation of trend for all four series reveals a pronounced business cycle pattern reaching the peak

<sup>7</sup> House price data for France is only covering the third quarter of 2008.

<sup>8</sup> Figures B.1, B.2 and B.3 can be found in the Appendix.

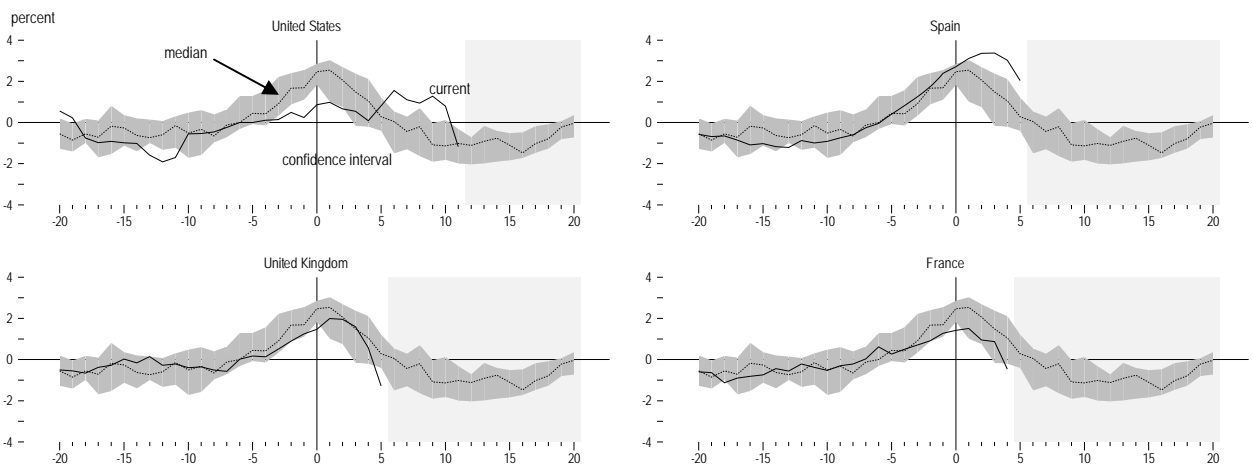
contemporaneously with house prices, which is followed by a long-lasting bust with a negative deviation of trend for a period of five years (Figure 4).<sup>9</sup>

Figure 3:  
Gross Domestic Product During a Housing Crisis<sup>a</sup>



<sup>a</sup>Percentage change, year to year; current development includes data up to the fourth quarter 2008.

Figure 4:  
Output Gap During a Housing Crisis<sup>a</sup>



<sup>a</sup>Calculated based on a Hodrick-Prescott filter with a value for lambda of 1600; current development includes data up to the fourth quarter 2008.

<sup>9</sup> The deviation of trend for private consumption, residential investment and business investment are illustrated in Figures B.4, B.5 and B.6 in the Appendix.

On a yearly basis GDP growth reaches its bottom in the second year after the price peak with an average growth rate of 0.1 percent (Table 1). This is far below the average growth rate of all considered countries, which amounts to 2.0 percent. With  $-1.1$  percent, the output gap reaches its lowest value in the second and third year of the crisis.

Table 1:  
Average Growth Rates of GDP and Average Output Gap During a Housing Crisis<sup>a</sup>

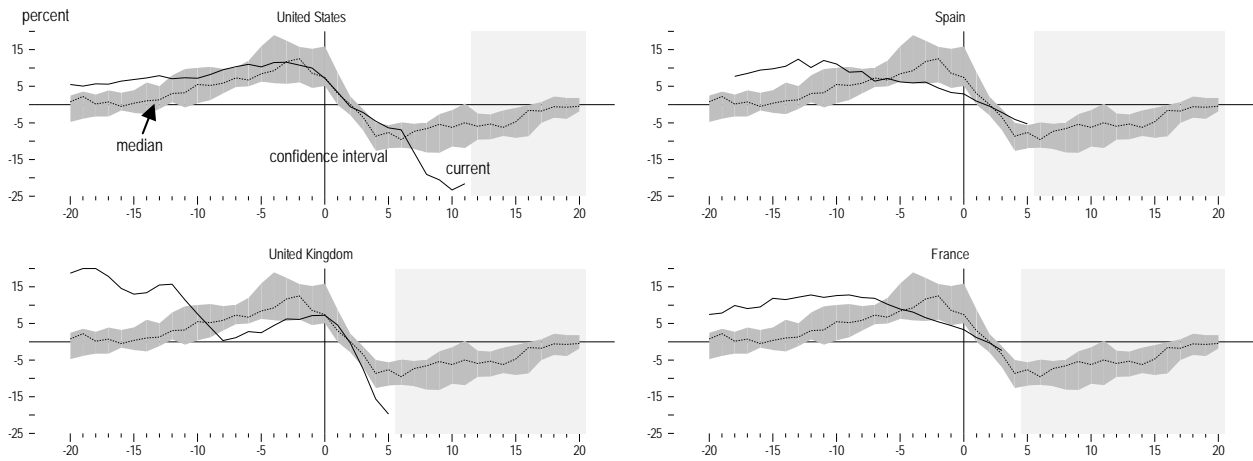
Year	Real domestic product <sup>b</sup>			Average output gap <sup>c</sup>		
	Median	Lower quantile	Upper quantile	Median	Lower quantile	Upper quantile
-4	3.3	1.1	5.8	-0.5	-1.2	0.2
-3	3.4	1.5	5.7	-0.4	-1.4	0.5
-2	4.1	1.5	6.2	0.2	-0.3	1.2
-1	4.1	2.0	6.1	1.7	1.1	2.5
0	2.3	0.2	4.5	1.8	0.4	2.6
1	0.1	-2.4	2.4	-0.1	-1.2	0.7
2	1.0	-1.7	3.5	-1.1	-1.9	-0.2
3	1.7	-0.2	3.7	-1.1	-1.9	-0.4
4	3.3	1.6	4.8	-0.5	-1.1	0.0

<sup>a</sup>Housing crisis starts in the first quarter of year 0. — <sup>b</sup>Growth rates calculated on the basis of yearly averages of quarterly GDP in levels.  
— <sup>c</sup>Yearly average over quarterly values.

Additionally, the results suggest that an increase in house price previous to a crisis could stimulate the economy and contributes to an upswing ahead of the crisis, since the output gap is increasing notably before the crisis.<sup>10</sup> The monetary and financial indicators react significantly on a housing crisis as well. On average real house prices deteriorate sharply at the beginning of a housing crisis (Figure 5), even more than is induced by the criteria that is employed to define a housing crisis. Furthermore, share prices depreciate considerably with the start of a housing crisis (Figure 6). They drop by 15 percent on average within the first year. The volatility seems to increase significantly, as the crisis surges. The short-run real interest rate starts to rise roughly two years before house prices reach their peak (Figure 7). One explanation behind could be that central banks embark on tightening monetary policy to dampen a boom, which was to some extent induced by rising house prices. Right after the turning point, when the crisis becomes visible, monetary policy is eased.

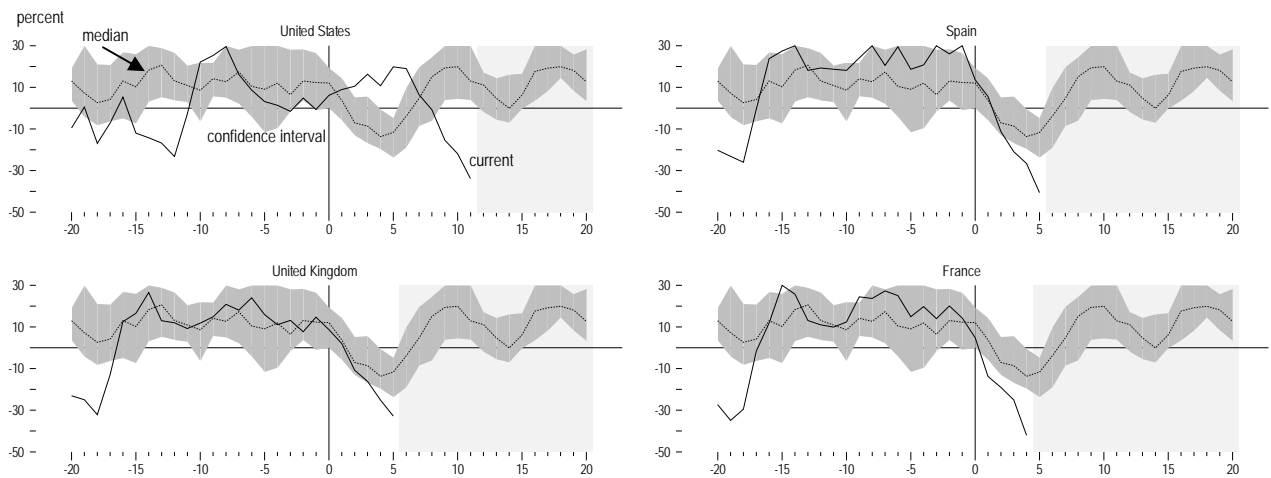
<sup>10</sup> While the output gap is a good measure to capture the dynamics of the business cycle, it is not appropriate to calculate the costs of a housing crisis compared with the gains of a housing boom that usually takes place before the crisis. It is because for a longer time span by definition the output gap adds up to zero and thus is biased to the result of no costs.

Figure 5:  
Real House prices During a Housing Crisis<sup>a</sup>



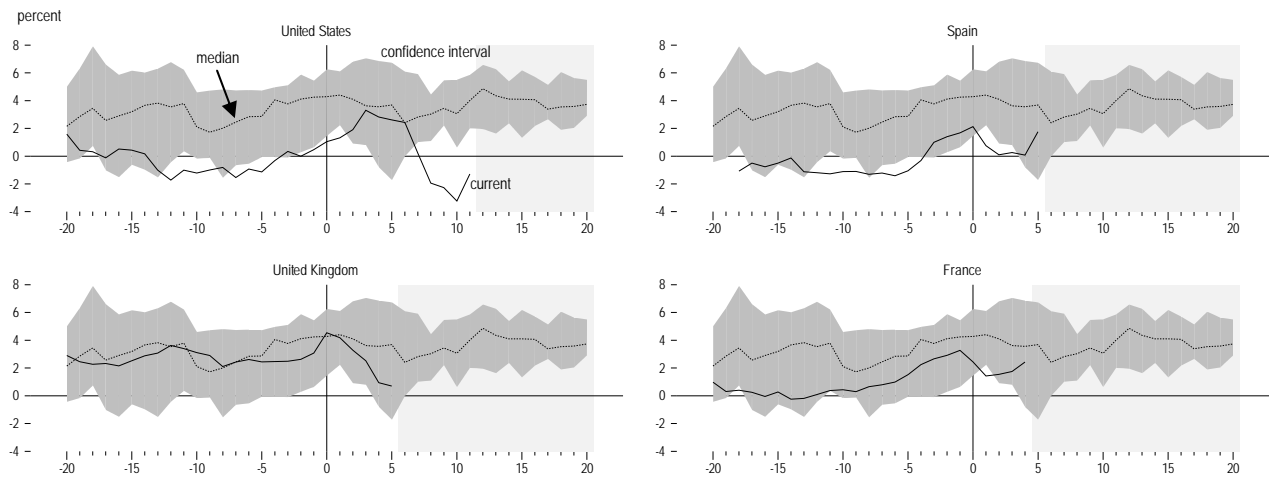
<sup>a</sup>Percentage change, year to year; current development includes data up to the fourth quarter 2008.

Figure 6:  
Nominal Share Prices During a Housing Crisis<sup>a</sup>



<sup>a</sup>Percentage change, year to year; current development includes data up to the fourth quarter 2008.

Figure 7:  
Real Interest Rates During a Housing Crisis<sup>a</sup>



<sup>a</sup>Calculated as difference of short-term interest rate and year-to-year percentage change of the headline consumer price index; current development includes data up to the fourth quarter 2008

A comparison of the historically typical business cycle pattern during a housing crisis with the current development in the United States and in the three European countries shows that GDP growth in Great Britain and Spain loses momentum in line with the historical experience. Also, the development in France is only slightly worse than the historical average suggests. In contrast, GDP growth in the United States differs significantly from the development during a typical crisis. Particularly in the second and third quarter of 2007 GDP growth is noticeably higher than the historical comparison would suggest. On top of that, the most recent data indicates, the United States will reach a trough in fourth quarter 2008, just when the most severe consequences of the housing crisis have bottomed out in previous crises on average.

The three European countries show a declining output gap after the price peak, even though the peak is not as pronounced as in typical crises.<sup>11</sup> In the United States, the output gap

<sup>11</sup> The output gap was calculated as the deviation from a HP filter trend extracted with a value for lambda of 1600. Since the trend is calculated as a moving average the HP filter has for the most recent data an end-point bias so that the calculated trend can be revised considerably the more data are available. To dampen this effect GDP growth was forecasted for eight quarters with specifically adjusted autoregressive models for each country. If GDP growth is below the forecast, what seems to be reasonable if we assume that all these countries face a housing crisis, the trend for the last quarters will be then revised downwards, which means at the same time that the output gap before the crisis will be revised upwards and thus would correspond even better with the historical pattern.

evolves nearly flat with neither a boom prior to the house price peak nor with a bust afterwards.<sup>12</sup>

Private consumption and business investment develop a similar pattern to the GDP growth. In the three European countries, a sharp decline in line with the historical experience can be observed, whereas consumption growth in the United States develops better than in an average housing crisis. In contrast, residential investment decreases much sharper in the United States, when compared to previous crises. The exaggeration in the subprime segment could play a considerable role here, which should have led to higher residential investment growth prior to the crisis and thus potentially to a stronger correction in the housing sector afterwards. In case of the European counterparts, the deviation of residential investment from its trend is rather flat, when compared to a typical crisis. Nevertheless, recently residential investment has fallen in all of these countries.

The increase in real interest rates starts in all of our four underlying countries about two years prior to the price peak. In the United States, real interest rate begins to decline four quarters after the price peak and turns negative after two years. In the European countries real interest rates fall with the beginning of the crisis. However, this is mainly due to the commodity price hike at that time. Moreover, the nominal interest rates start to decline not before the fourth quarter 2008 in these countries. In the United States, Spain and France we can also observe long-lasting phases of very low or even negative real interest rates before the price peak, but also in the United Kingdom real interest rates were relative accommodative in the pre-crisis phase. This indicates a close relationship between house prices and monetary conditions, which seems to support price increases before a crisis and contribute to the ending of the housing boom. Share prices decreased sharply in all four countries in the last quarters in line with the experience during historical housing crises.

## **4 International Transmission Mechanisms of Housing Crises**

A simultaneous economic slowdown in several important industrial countries should have significant negative transmission effects on other countries. The historical comparison in

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<sup>12</sup> Since the crisis started much earlier in the United States already more data are available and the potential for a revision of the output gap around the price peak is much smaller than for the other countries. All in all it is unlikely that we ex post will observe a similar output gap pattern for the United States compared with a typical housing crisis.

Section 3 indicates that the United States, firstly, revealed a different business cycle pattern compared to a typical historical crisis and secondly, that the impact of the crisis is expected to bottoms out in 2009. Therefore, to estimate the international transmission effects of the recent housing crises, we focus only on the three European countries, namely the United Kingdom, Spain and France. For our analysis of the transmission effects we apply a global vector autoregressive model and assume that each of these three countries will face an average housing crisis, with respect to GDP growth.

#### 4.1 International Business Cycle Model

Due to lack of a global model that incorporates the housing market explicitly and to our focus on GDP growth rather than the detailed channels of transmission, we draw on a multi-country-model, according to Abeyasinghe and Forbes (2001), that explains domestic GDP growth  $\Delta y_t$  by means of own lags and the export-weighted foreign GDP growth  $\Delta y_t^*$ . The implicit assumption is that international transmission works mainly through the trade channel, while domestic economic activity can be explained adequately by an autoregressive process. The economy of each country in the model is described by two equations:

$$\Delta y_{i,t} = D_t + \sum_{i=1}^n \alpha_i \cdot \Delta y_{i,t-i} + \sum_{j=0}^m \beta_j \cdot \Delta y_{i,t-j}^* + u_t, \text{ with} \quad (1)$$

$$\Delta y_{i,t}^* = \sum_{k=1}^p g_{ik,t} \cdot \Delta y_{k,t}, \quad (2)$$

where  $D_t$  in equation (1) describes the deterministic part of the equation and can consist of a constant and a trend term. For equation (1), foreign economic activity is allowed to influence domestic GDP growth contemporaneously. Equation (2) allows to summarize GDP growth of all foreign countries via the individual export weights  $g_{ik,t}$  into one variable for the perspective of country  $i$ . This results in a feasible model with respect to the number of parameters that have to be estimated. The export weights are calculated as average over the last four quarters such that short-term fluctuations do not influence the results, respectively.<sup>13</sup> The United States are the only country assumed to be a big open economy. Thus, GDP growth

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<sup>13</sup> The weights are assumed to be exogenous.

is not allowed to be affected contemporaneously by the foreign variable. Under the assumption that each of the other countries is a small open economy, the contemporaneous foreign variable in equation (1) is weakly exogenous and the model can be estimated equation by equation with the Method of Least Squares. In this paper we adopt a model with 25 countries, among these are the most important industrial countries.<sup>14</sup> In each equation we permit five lags for domestic and foreign GDP growth at maximum. The equations are estimated with a model selection method.<sup>15</sup> The model is estimated on the basis of quarterly data from 1985:1 to 2007:4.

## **4.2 Simulation Method**

For the simulation of the transmission effects of a housing crisis in the United Kingdom, Spain and France on other countries, we compare a baseline scenario to a crisis scenario. The consequences of a housing crisis in the three countries for other countries are then measured by impulse response functions, calculated as the difference of GDP growth in both scenarios. The baseline scenario is the unconditional model forecast, which converges to the growth rate of potential output after some quarters (Figure 8). In the case of the crisis scenario, we assume that the GDP growth of the three countries will develop as during a typical housing crisis – derived in Section 3 – and then forecast GDP growth in the other countries conditionally on this assumption.

Many housing crises took place in the seventies and eighties of the last century and therefore under different macroeconomic conditions. Most notably, the trend growth rates in this period were usually higher such that the average GDP growth of a historical housing crisis could be still higher than the forecast of GDP growth in the baseline scenario. To circumvent this problem we calculate GDP growth for the three countries in the crisis scenario as the change of the output gap during a historical housing crisis (“implicit shocks”) added to the baseline forecast. This method ensures a reasonable replication of the typical

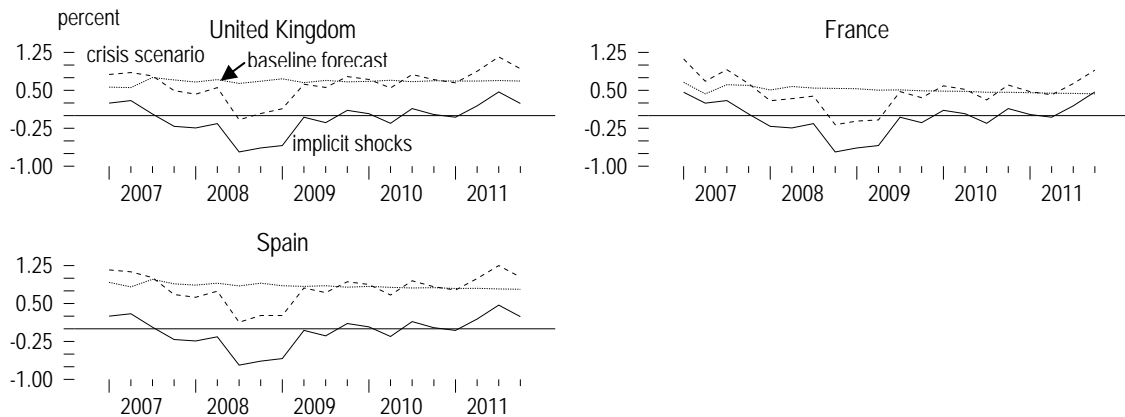
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<sup>14</sup> The countries are Germany, France, Netherlands, Belgium, Ireland, Portugal, Finland, Italy, Spain, Greece, United States, United Kingdom, Japan, Denmark, Norway, Sweden, Switzerland, Canada, Australia, South Africa, South Korea, Israel, Turkey, Singapore and Mexico.

<sup>15</sup> The model selection method deletes, based on the complete model with all lags, the variable with the smallest significance level until all remaining variables are significant at the ten percent level. All included deterministic terms are structurally stable at the five percent level. We test for autocorrelation in the first, second, fourth and eighth lag of the residuals. The country equation for Greece is allowed to include the maximum number of eight lags to ensure that the residuals are free of autocorrelation. For the United Kingdom autocorrelation is detected for the eighth lag. All other residuals are free of autocorrelation.



Figure 8:  
Baseline Forecast, Crisis Scenario and Implicit Shocks



business cycle pattern during a historical crisis under consideration of different trend growth rates in the seventies and the eighties compared to today's. We start the simulation in the first quarter of 2007, since the housing crises in the three European countries broke out in that year. The implicit shocks at the beginning of 2007 are positive, indicating beneficial effects of the housing crises, before prices reach their peak. In the third and fourth quarter of the same year, the output gap starts to decrease and turns GDP growth in the crises scenario below the baseline forecast. The housing crises are expected to have their largest negative impact in the winter half year 2008/2009. Of course, this simulation exercise can only provide a broad measure of the international effects of housing crises. However, due to the lack of a tractable global model that incorporates explicitly the housing market and in particular house prices as well as the possibly nonlinear behaviour of economic relationships during a housing crisis, this method is appropriate to give us an idea about the strength and the length of international effects of housing crises in the four countries.<sup>16</sup>

### 4.3 International Effects of Typical Housing Crises

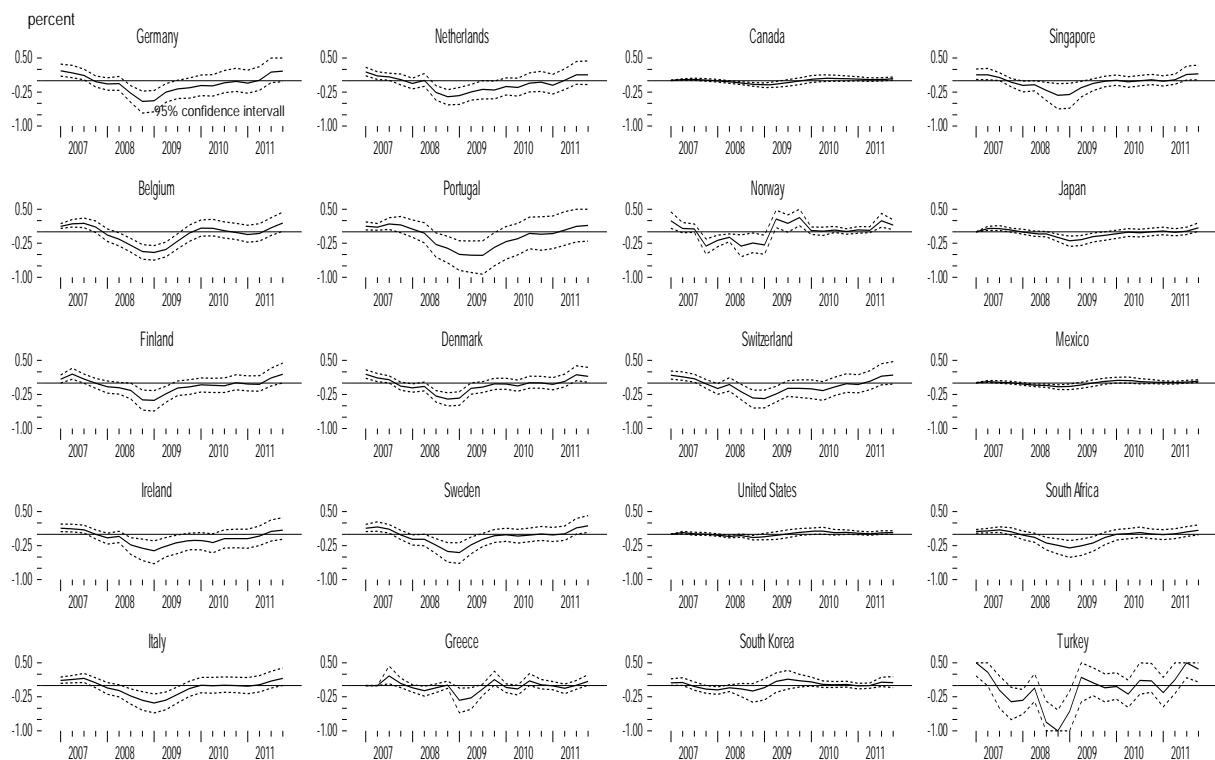
Figure 9 illustrates that housing crises in the United Kingdom, Spain and France lead to a significant drop of GDP growth in most European countries, after initially inducing some small, but significantly positive impact.<sup>17</sup> Most countries face the biggest drop between the

<sup>16</sup> Since the housing market is not modelled explicitly the following results for the international transmission mechanisms hold also for comparable phases of economic downturns in the discussed countries.

<sup>17</sup> Estimation with the model selection method results in no significant effects of the foreign variable on GDP growth in Israel. The effects on GDP growth in Australia is very small and insignificant. Therefore these countries are excluded from the figures.

third quarter 2008 and the first quarter 2009 and thus in the same time period as the three directly affected countries. At the end of 2009, GDP growth of most other countries is not significantly dampened any more. The impulse response functions show only small variations for most non-European countries, indicating that the European economy has only small impact on the rest of the world. Although GDP growth in South Africa and Japan is decreasing more pronouncedly, the effect is still considerably smaller than that in the European countries.

Figure 9:  
International Impact of Housing Crises on GDP Growth

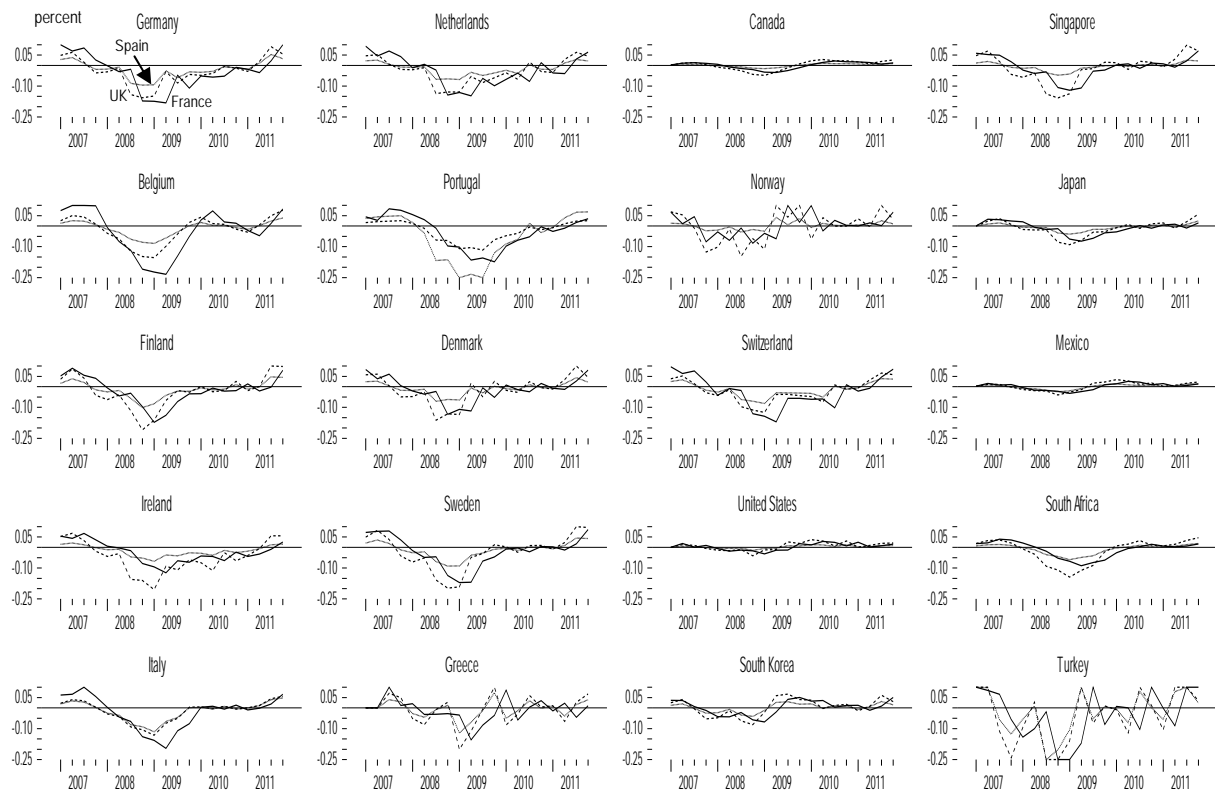


<sup>a</sup>Calculated via bootstrap simulation with 1,000 replications.

Figure 10, where the individual transmission effects of each housing crisis are illustrated, shows that a housing crisis in Great Britain and France generally has stronger international transmission effects than a crisis in Spain (Figure 10). Portugal is one exception, as it suffers disproportionately strong from the economic downturn in Spain. Ireland's economy is affected most by a housing bust in Great Britain, whereas Belgium and Italy have a closer economic relationship to France. Moreover, Great Britain and France generally seem to have a stronger

economic impact on non-European countries, even though for several countries the effects are small.

Figure 10:  
International Impact of Single Housing Crises<sup>a</sup>



<sup>a</sup>Abreaveations: United Kingdom (UK).

Table 2 provides an overview of the changes in GDP growth due to the housing crisis in the three underlying countries on an annual basis. The overall transmission effect can be divided into the effects caused by each single housing crisis. Again, it becomes obvious that in 2007 most countries first gain from the housing boom in the three countries that occurs before the crises starts. In 2008, most countries start to moderately lose GDP growth. The strongest negative effect is commonly expected for 2009, where most of the European countries loose more than one percentage point of GDP growth. For 2010, the expected effects are rather mixed for the European countries. While some countries like Portugal (1.1 percentage points)

Table 2:  
International Impact of Typical Housing Crises: Effects on GDP Growth<sup>a,b,c</sup>

	Overall	ES	UK	FR	Overall	ES	UK	FR
Germany				Italy				
2007	0.4	0.1	0.1	0.2	0.3	0.1	0.1	0.2
2008	-0.3	-0.1	-0.2	0.0	-0.2	-0.1	-0.1	0.0
2009	-1.2	-0.3	-0.4	-0.5	-1.2	-0.3	-0.3	-0.5
2010	-0.6	-0.1	-0.2	-0.3	-0.2	0.0	0.0	-0.2
2011	0.0	0.0	0.0	-0.1	0.1	0.0	0.0	0.0
Finland				Ireland				
2007	0.3	0.1	0.1	0.2	0.3	0.0	0.1	0.1
2008	-0.3	-0.1	-0.2	0.0	-0.2	0.0	-0.2	0.0
2009	-1.1	-0.2	-0.5	-0.4	-1.1	-0.2	-0.6	-0.3
2010	-0.3	-0.1	-0.1	-0.2	-0.7	-0.1	-0.3	-0.2
2011	0.1	0.0	0.1	0.0	-0.3	-0.1	-0.1	-0.1
Belgium				Netherlands				
2007	0.4	0.0	0.1	0.2	0.3	0.0	0.1	0.2
2008	-0.2	-0.1	-0.1	0.0	-0.2	-0.1	-0.1	0.0
2009	-1.4	-0.2	-0.4	-0.7	-1.0	-0.2	-0.4	-0.4
2010	-0.1	0.0	0.0	-0.1	-0.6	-0.1	-0.2	-0.3
2011	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	-0.1
Portugal				Denmark				
2007	0.3	0.1	0.1	0.1	0.3	0.0	0.1	0.1
2008	0.1	-0.1	0.0	0.2	-0.3	-0.1	-0.2	-0.1
2009	-1.6	-0.8	-0.4	-0.4	-0.8	-0.2	-0.3	-0.3
2010	-1.1	-0.4	-0.2	-0.4	-0.1	0.0	0.0	-0.1
2011	0.0	0.0	0.0	-0.1	0.1	0.0	0.1	0.0
Norway				Sweden				
2007	0.2	0.0	0.1	0.1	0.4	0.1	0.1	0.2
2008	-0.5	-0.1	-0.3	-0.1	-0.4	-0.1	-0.2	0.0
2009	-0.1	0.0	0.0	-0.1	-1.2	-0.2	-0.5	-0.5
2010	0.4	0.0	0.2	0.2	-0.2	0.0	0.0	-0.1
2011	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.0
Switzerland				Turkey				
2007	0.3	0.1	0.1	0.2	0.8	0.1	0.2	0.4
2008	-0.2	-0.1	-0.1	0.0	-1.3	-0.4	-0.6	-0.3
2009	-1.0	-0.2	-0.3	-0.4	-1.6	-0.3	-0.5	-0.8
2010	-0.6	-0.1	-0.2	-0.3	0.0	0.0	0.0	0.0
2011	0.0	0.0	0.0	0.0	0.5	0.1	0.3	0.1
Greece				Singapore				
2007	0.1	0.0	0.1	0.1	0.3	0.0	0.1	0.1
2008	0.0	0.0	0.0	0.0	-0.3	-0.1	-0.2	0.0
2009	-0.7	-0.2	-0.3	-0.3	-0.8	-0.1	-0.4	-0.3
2010	-0.1	0.0	0.0	-0.1	-0.1	0.0	0.0	-0.1
2011	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0
Japan				United States				
2007	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0
2009	-0.5	-0.1	-0.2	-0.2	-0.1	0.0	0.0	-0.1
2010	-0.2	0.0	-0.1	-0.1	0.2	0.0	0.1	0.1
2011	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1

Table 2 continued

	Overall	ES	UK	FR	Overall	ES	UK	FR
<i>Australia</i>				<i>Canada</i>				
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	-0.1	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
2009	0.1	0.0	0.1	0.0	-0.3	0.0	-0.1	-0.1
2010	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0
2011	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.1
<i>South Africa</i>				<i>Mexico</i>				
2007	0.2	0.0	0.1	0.1	0.0	0.0	0.0	0.0
2008	0.0	0.0	-0.1	0.1	-0.1	0.0	0.0	0.0
2009	-0.9	-0.2	-0.4	-0.2	-0.2	-0.1	-0.1	-0.1
2010	-0.2	0.0	-0.1	-0.1	0.2	0.0	0.1	0.0
2011	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0
<i>South Korea</i>								
2007	0.1	0.0	0.0	0.1				
2008	-0.3	-0.1	-0.1	-0.1				
2009	-0.2	0.0	0.0	-0.1				
2010	0.3	0.1	0.1	0.1				
2011	0.1	0.0	0.0	0.0				

<sup>a</sup>Differences between overall effect and sum of country effects are due to rounding errors. — <sup>b</sup>Abbreviations: Spain (ES), United Kingdom (UK) and France(FR). — <sup>c</sup>Growth rates calculated on the basis of yearly averages of quarterly GDP in levels.

and Germany (0.6 percentage points) still loose a considerable amount of growth, the negative international transmission effects to other countries like Italy or Belgium already bottoms out. Again, non-European countries are usually affected to a much smaller extent. Exceptions are Japan, South Africa and Singapore, whereas the results on a quarterly basis have shown that the effects on Singapore are quiet uncertain.

## 5 Conclusion

After the United States, also other countries find themselves in a housing crisis or probably slide into one. In terms of international economic influence, Great Britain, Spain and France are the most prominent countries of those. The historical comparison illustrates that a long-lasting economic downturn is presumable, once a country faces a housing crisis. On average, a housing crisis has the most severe effects in the first two years and particularly between the fifth and the seventh quarter after the house prices have reached their peak. In case of typical historical housing crises, output gap is expected to close not until five years. When several important industrial countries face a housing bust at the same time, economic activity in other countries is likely to be dampened as well via international transmission effects. While the

economic impact of the housing crisis in the United States, from a historical perspective, should have bottomed out at the end of 2008 and the business cycle pattern differed significantly from that in a typical crisis, house prices in Great Britain, Spain and France just started to fall at the end of 2007. If we assume that a typical housing crisis occurs in all of these three countries, international transmission effects will then lead to significant losses of GDP growth in a number of other countries, notably in Europe. The economic development would be dampened significantly at least until the end of 2009 and the crises would have their biggest impact between the fourth quarter of 2008 and the second quarter of 2009. Countries outside Europe in contrast will suffer only modestly in this scenario. Only Japan and South Africa are expected to lose a considerable amount of GDP growth. For the simulated scenario, several downside risks need to be taken into account. The most obvious one is that the United States are expected to face a severe economic downturn in 2009. If one interprets this as a direct consequence of the housing crises started in 2006, then the scenario has to be augmented by the United States leading to much stronger negative spill-over effects to the rest of the world. The fact that a number of smaller countries is already in a housing crises or may likely face a housing bust in near future points to even stronger effects than shown here as well. Upward risks have to be seen primarily in the development in France, where housing prices decreased only slightly until the fourth quarter 2008 and a housing crisis has not been as apparent as for example in the United States or United Kingdom.

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## **Appendices**

### **Appendix A: Data Description**

For the historical comparison in Section 3 real house prices primarily consists of a dataset from the Bank of International Settlements. House prices for France (Existing Houses & Apartments, I.N.S.E.E.) and the United States (House Price Index – All Transactions, Office of Federal Housing Enterprise) as well as land prices for Japan (Nationwide Land Price Index, Japan Real Estate Institute) deflated by consumer prices taken from the national statistical agencies were added. All other data for the historical comparison were taken from the OECD Economic Outlook database. Current data in the figures of Section 3 were taken from various national sources to ensure the most recent data used.<sup>18</sup>

GDP data for the model in Section 4 were mainly obtained from the OECD Economic Outlook database. Data for Singapore, South Africa and Israel originates from the International Financial Statistics Database of the International Monetary Fund. Seasonal adjustment with Census X11 was performed for GDP data of Singapore and Israel. Bilateral export data for calculating the weights for the foreign variables were taken from the International Financial Statistics Database of the International Monetary Fund.

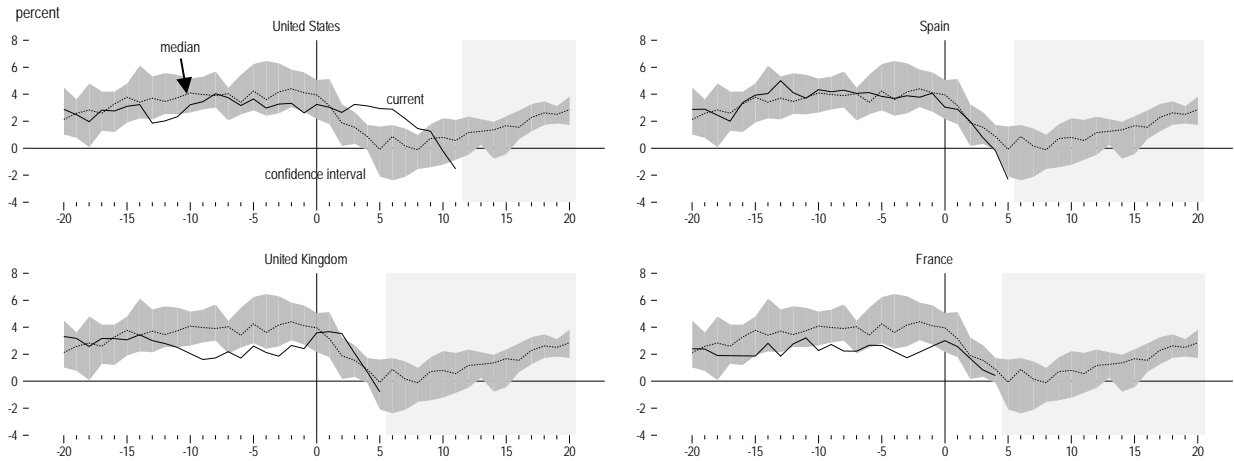
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<sup>18</sup> Detailed sources of the current data can be made available upon request.



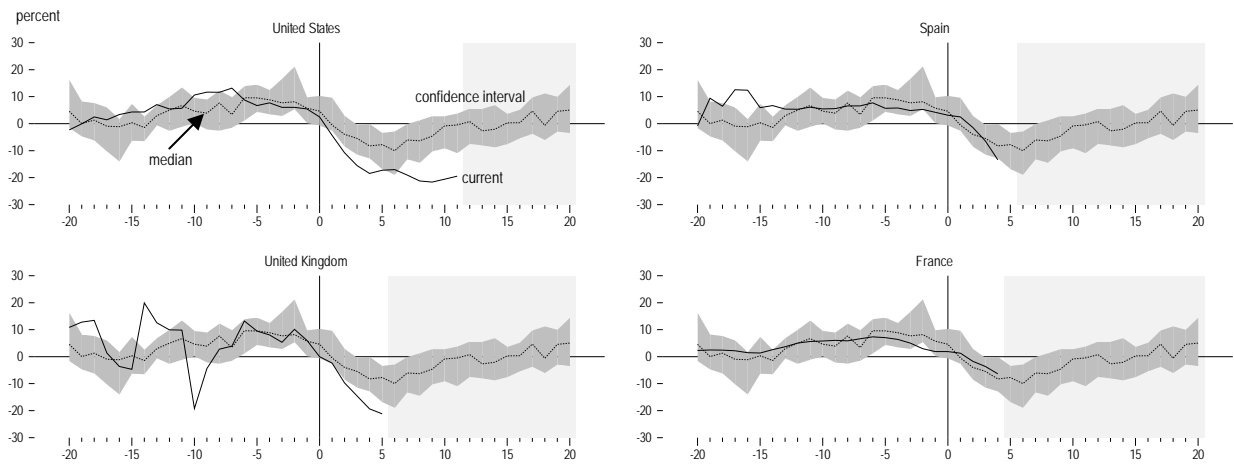
## Appendix B: Additional Figures

*Figure B.1:*  
Private Consumption During a Housing Crisis<sup>a</sup>



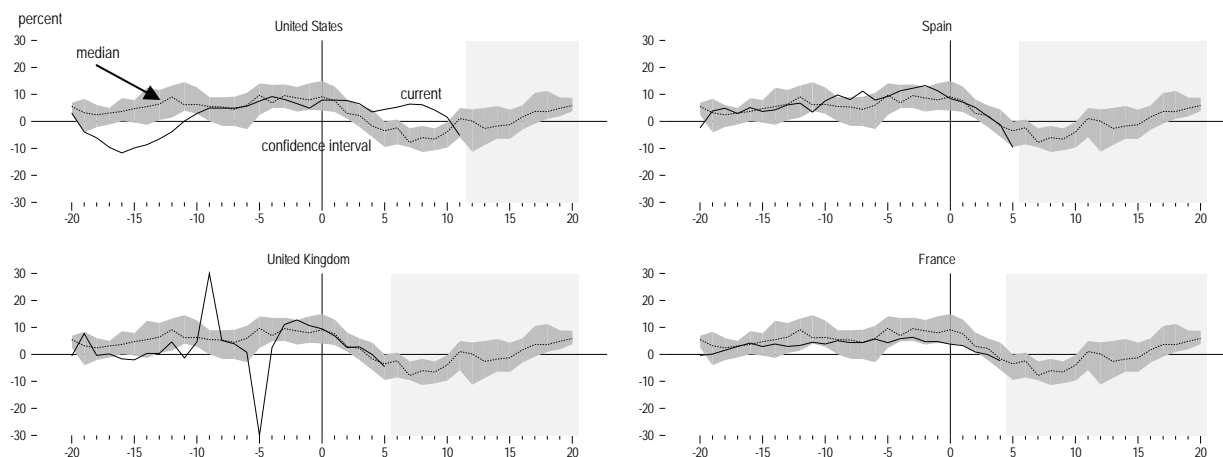
<sup>a</sup>Percentage change year to year; current development includes data up to the fourth quarter 2008.

*Figure B.2:*  
Private Residential Investment During a Housing Crisis<sup>a</sup>



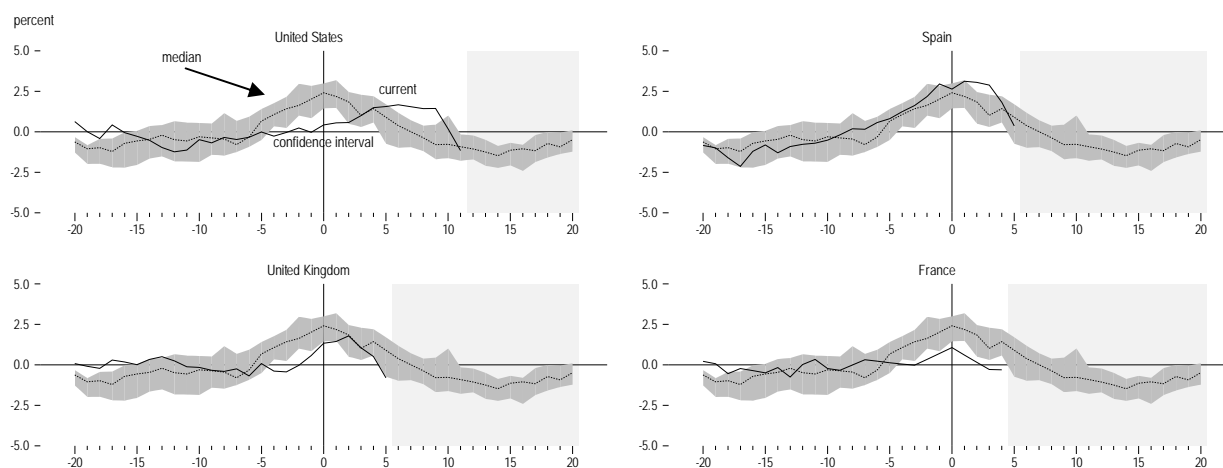
<sup>a</sup>Percentage change year to year.

*Figure B.3:*  
Investment in Software and Equipment During a Housing Crisis<sup>a</sup>



<sup>a</sup>Percentage change year to year; current development includes data up to the fourth quarter 2008.

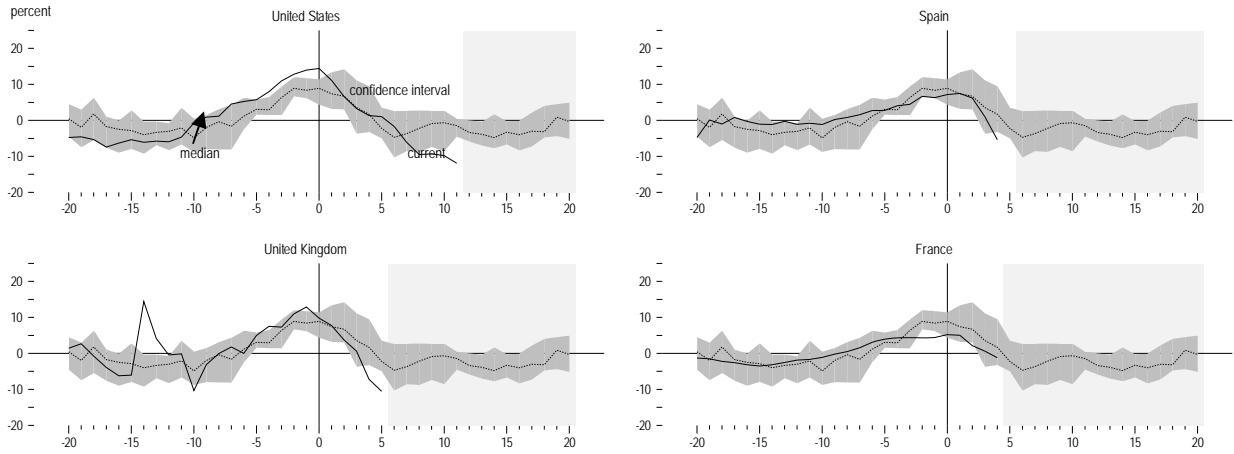
*Figure B.4:*  
Private Consumption During a Housing Crisis – Deviation from Trend<sup>a</sup>



<sup>a</sup>Calculated based on a Hodrick-Prescott filter with a value for lambda of 1600.

Figure B.5:

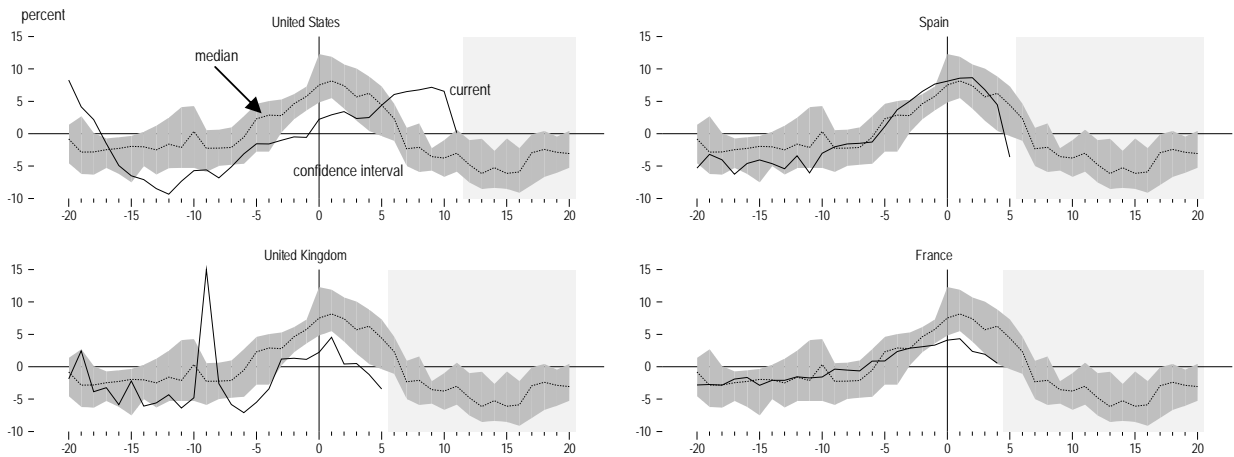
Private Residential Investment During a Housing Crisis – Deviation from Trend<sup>a</sup>



<sup>a</sup>Calculated based on a Hodrick-Prescott filter with a value for lambda of 1600; current development includes data up to the fourth quarter 2008.

Figure B.6:

Investment in Software and Equipment During a Housing Crisis – Deviation from Trend<sup>a</sup>



<sup>a</sup>Calculated based on a Hodrick-Prescott filter with a value for lambda of 1600; current development includes data up to the fourth quarter 2008.