Projecting post-crisis house and equity prices since the 1870s:not all crises are alike

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Abstract

This paper projects house and equity prices following different types of macroeconomic shocks since the 1870s in 17 western economies. In doing so, we classify macroeconomic downturns into three distinct groups: normal recessions, financial recessions, and disasters. By combining three newly available historical data sets spanning 143 years and by employing local projection technique, this study finds that financial recessions have the most detrimental effect and cause substantial decreases in house prices, stock prices and construction costs. Post-crisis stock price declines are observed through the whole sample period, but both house prices and construction costs were the most vulnerable to crises after WWII. The study also finds that stock prices drop substantially immediately after financial crises and rebound within four to six years, while shocks to house prices are more persistent. This asymmetry of persistence and magnitude of shocks among housing and equity prices might have had a substantial impact on post-recession wealth re-distribution since WWII as lower and middle class families are more likely to have their wealth invested in a home rather than in other financial investments like stocks.

Keywords: Financial crisis, Normal recessions, House prices, Stock prices, Local projection.

JEL Classification: C14, E44, G01, N10

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Abstract

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1. Introduction

Since the Global Financial Crisis of 2008, pre-crisis asset price trends have attracted substantial interest in the academic literature (Shiller, 2007; Mian and Sufi, 2010, 2014; Jordá et al., 2015; Knoll et al., 2017). Most of these scholarly endeavors document that asset price bubbles are one of the major signals of economic fragility prior to financial crises (Mian and Sufi, 2010; Jordá et al., 2015). Projecting how prices of different asset classes respond to recovery efforts following a crisis is important because how they rebound has a profound effect on post-crises wealth redistribution. Such reallocation, in due course, has a knock-on effect on economic and social inequality. However, we know very little about how asset prices behave after shocks.

While there was minimal government intervention until the 1930s, in the second half of the twentieth century both monetary and fiscal policies were increasingly employed by governments to stabilize crisis affected economies. One can presume that the impacts of such stabilization policies are likely to be asymmetric across various asset markets and crises types. If recovery in house and equity prices is asymmetric, this will amplify inequality in post-recession economic regimes. This influences inequality because while lower and middle-income families are more likely to have their wealth invested in a home, higher income families invest more in financial instruments like stocks. Hence, comparatively more persistent downturns in the housing sector exacerbate the wealth gap and social inequality (Foster and Magdoff, 2009; Piketty, 2014). Consequently, studying post-crises asset price trends is important from both policy and scholarly perspectives. The present study fills this void in the literature by investigating an intriguing question; how key asset prices behave following different types of shocks.

Crises come in different shapes and sizes. Rietz (1988) first introduced extreme events in the macro-finance literature. Following Rietz (1988), Barro (2006), Barro (2009), Barro and Ursúa (2012) popularized the concept of a 'rare macroeconomic disaster,' arguing that they may explain a wide range of asset-pricing puzzles. Barro and Ursúa (2012) defined these disasters as, 'major disaster events exemplified by the world wars and the Great Depression.' More recently, Jordá et al. (2015) and Funke et al. (2016) have divided recessions into financial crises and non-financial macroeconomic disasters. Consequently, this paper is built on these crises categorization schemes and classifies macroeconomic downturns into three distinct groups: normal recessions, financial recessions, and disasters. In this backdrop of asset classes and crises types, this study examines how different classes of asset prices (house and equity) behave in the aftermath of each crisis types (normal recessions, financial recessions and macro-disasters). For this purpose, this study combined three recently available historical datasets into one comprehensive database covering 17 western economies over a period of 143 years and employed a relatively new empirical local projection technique.

This research contributes to our understanding of post-crisis asset price trends in at least two important ways. First, this study examines the impact of three different classes of crisis on two different asset classes. Second, to this end it employs a relatively advanced econometric technique, namely Jordá (2005)'s local projection, in order to study post-recession asset prices over a long period. Tracing impulse responses of asset price paths based on local projections offers favorable statistical properties if there are asymmetries, nonlinearities and model misspecification (Jordá, 2005; Jordá et al., 2015; Funke et al., 2016).

This study finds that financial recessions are the most detrimental of the three types of crisis, causing substantial decreases in house prices, stock prices and construction costs. The prominence of financial crises in the business cycle is documented in earlier works by Fisher (1933), Minsky (1986), Leamer (2007), Jordá et al. (2011), Eggertsson and Krugman (2012) and Muir (2017). This could be because a financial crisis is associated with increased uncertainty about the macro-financial outlook and intense media speculations. Our results document that post-crisis stock price declines are observed through the whole sample period, *i.e.* both pre-World War II and post-World War II (WWII, hereafter), whereas both house prices and construction costs are more vulnerable to crises after WWII. This could be due to the increased leverage in housing markets in recent decades, leading to house price booms which result in events like 'bubbles bursting.'

This research also finds that stock prices drop substantially immediately after financial crises and rebound within four to six years, but shocks to house prices are more persistent. As equity investments are often made with comparatively short-term intent and are transacted in almost real time, stock prices react immediately to any macro financial changes. The greater persistence of house prices is documented by Reinhart and Rogoff (2009a). The sheer size and complexity of the housing market could impede the ability of stabilization measures to have an immediate impact on house prices. Our study finds that in periods after WWII, both house prices and their construction costs fall after each of the three types of crisis. However, while house price falls are largest after financial recessions, construction costs decrease most after non-financial disasters. This could reflect that house prices are more susceptible to uncertainty during adverse financial events, whereas construction costs are more prone to supply disruptions during non-financial disasters like war and natural calamities.

Existing studies mainly focus on pre-and-post-crisis trends in major macroeconomic aggregates like GDP, inflation, investment and unemployment (Romer, 1986; Backus and Kehoe, 1992; Basu and Taylor, 1999; Cerra and Saxena, 2008; Reinhart and Rogoff, 2009a,b; Teulings and Zubanov, 2010; Jordá et al., 2011; Schularick and Taylor, 2012, and others). More recently, some studies have linked political outcomes with

crises periods (Funke et al., 2016; Mian et al., 2014). There are very few studies that examine post-crisis asset price trends. Reinhart and Rogoff (2009a) studied 22 (systematic) banking crises post WWII to identify the magnitude and persistence of their impact on house and equity price cycles as well as unemployment and income. They found that following financial crises 'asset market collapses are deep and prolonged.' Goetzmann and Kim (2018) studied crashes using data from 101 global stock markets between 1692 and 2015. Using conditional distributions methodology, they found that large, annual stock market declines (negative bubbles) were typically followed by positive returns. While they considered a long period, their study only included a rapid and unusually large decline in a national stock market index. In contrast, this present study analyses both stock and housing market responses after three types of crisis. This study also differs from Reinhart and Rogoff (2009a) in several aspects; it considers three types of shocks instead of only a banking crisis, and the crises data set used here includes a wide range of shocks over a much longer time. With regards to analysis techniques, while they employ very basic percentile and averaging exercises to identify the impact and duration of the effect of a systematic financial crisis in the context of an individual country, this study undertakes a local projections technique within a panel of 17 countries over a period of 143 years. Muir (2017) analyzes the behavior of risk premia in financial crises, wars, and recessions in an international panel spanning over 140 years and 14 countries. However, this study did not look at house prices.

In summary, this study put together three recently available historical datasets to develop a comprehensive database consisting of macroeconomics, housing, equity and political variables over more than 140 years and notably includes the aftermath of the recent global financial crisis. Furthermore, the housing database has aggregate house prices as well as its disentangled components *i.e.* land price and construction cost. In our analysis, in addition to financial crisis, we consider the impact of normal recessions and non-financial disasters. Comparing normal with financial recessions enables us to develop a cleaner identification of the effects of financial crises than comparing crisis periods to counter factual of all other years. On the empirical side, this study undertakes local projection analyses due to Jordá (2005) to project five and ten year paths of house and equity prices following the beginning of three different types of crisis. Hence, this study traces post-crises asset prices using a statistically advanced technique with a comprehensive historical data set.

The remainder of the paper is organized as follows. Section 2 provides a brief description of two major crises the world economy has gone through in the last century. Section 3 offers definitions for three types of crisis studied in this paper. Section 4 describes the data. Section 5 discusses empirical strategies and Sections 6 and 7 summarize our findings and provide conclusions.

2. Crises Explained: Normal Recessions, Financial Crisis and Non-Financial Recessions

Following Funke et al. (2016), this study defines financial crises as periods when the economy experiences events like, increased default rates associated with large capital losses fueling public intervention, bank runs and bankruptcy or forced merger of financial institutions. Dates are matched with Jordá et al. (2013) and presented in Appendix Table A3. While historical crisis events are identified through Bordo et al. (2001) and Reinhart and Rogoff (2009b), the post-1970 data set of systematic banking crises is gathered from Valencia and Laeven (2008) and Valencia and Laeven (2012). In addition to financial crisis dates, this paper identifies the dates of recessions following Funke et al. (2016).

Recessions are identified through the basic intuition of Bry and Boschan (1971)'s algorithms where a peak represents a local maximum and a trough represents a local minimum in real GDP per capita. This paper defines recession as the period between a peak and the following trough and expansion as the period between a trough and the subsequent peak. We then make a distinction between normal and financial crisis recessions. To elaborate, once recessions are identified, we distinguish financial crisis recessions as the ones where a financial crisis occurred within a two year window and a normal recession which is not associated with any financial crisis event. A full list of normal and financial crisis recession dates are provided in Appendix Table 4.

In the spirit of Barro (2006), Barro and Ursúa (2008) and Barro and Ursúa (2012), this study also compares financial recessions to another subset of normal recessions that are infrequent and large in magnitude (Barro (2006) termed them as 'Rare Macroeconomic Disasters'). Keeping in line with Funke et al. (2016) we term these rare disasters as non-financial macro disasters. They are disasters as they are those non-financial recessions which experience a higher than average GDP decline during financial recessions. Depending on asymmetry in magnitudes of pre-and post-WWII recessions, we apply two separate cut-offs for the pre-WWII sample (with a threshold of 3.35%) and the post-WWII period (with -2.55% as the threshold). A list of these disasters are offered in Appendix Table A5.[1]

3. Data

This paper makes use of three very recently available historical databases: Jordá et al. (2015) macro-financial data set, the house price data set offered by Knoll et al. (2017) and the political data set by Funke et al. (2016). The combined database covers 17 countries over the period from 1870 to 2013. Hence, it

[1] A detailed explanation about crisis designation and classification is offered in Appendix A9.

includes the recent global financial crisis and its aftereffects. Figure 1 plots the consumer price index, house prices and stock prices for individual countries. A quick glimpse of the trend lines offers four important insights:

1) trends in each of these series differ between pre-WWII and post-WWII.

2) after WWII, the series show steeper upward trends for most of the countries.

3) during the second half of the twentieth century, there is substantial heterogeneity of the increasing trends among countries depending on when the upward swings began.

4) equity prices are generally more volatile than house prices.

[Figure 1]

One of the explanations for house prices being more persistent than equity prices could be the land component of house prices. This study analyses both land and construction cost components of house prices. The variables employed along with their descriptions and sources are provided in Appendix Table A1. Adding up three long historical databases enables us to get 1855 country-year house prices and 2139 country-year equity prices. In particular, by combining these three datasets, this research obtains the largest historical asset price-macro-finance-political data set of its kind. Summary statistics of these variables are provided in Appendix Table A2.

The macro-finance-political data set that this study put together offers some favorable features under important circumstances:

1) models based on universal economic mechanisms of the business cycle must account for patterns observed across time and space.

2) a very long-run perspective facilitates capturing enough 'rare events', such as major financial dislocations and 'macroeconomic disasters', to robustly analyze their impacts on the volatility and persistence of real business cycles.

3) the political database includes more than 800 elections enabling our model to control for a Government's political strength which is pivotal to successful implementation of macro-financial policies.

Even though the political data set of Funke et al. (2016) contains data for 20 countries, we had to sacrifice the data for three countries during the data merging process.

4. Empirical Design

At the outset, we extensively analyze the dependent variables in our study *i.e.* house prices, equity prices, construction costs and residential land prices using summary statistics, a visual scrutiny, and a basic

ordinary least square (OLS) regression. Afterwards we perform our main statistical exercise using a local projection technique suggested by Jordá (2005) and subsequently adopted in Jordá et al. (2015) and Jordá et al. (2016). We finally provide a battery of robustness checks to examine our results.

Following Mian et al. (2014), we start our diagnosis of dependent variables by comparing their values in pre-crisis with post-crisis spells. In this regard, we use a similar method to Funke et al. (2016) as we restrict the sample to a full five year pre-financial crisis and post-financial crisis excluding the crisis year itself. In the case of sequel crises, where five-year pre-crisis and post-crisis periods overlap, we exclude subsequent crises as we consider them as the after-effect of the preliminary crisis. We further omit crisis events coinciding with global wartime periods from 1914 to 1918 and from 1939 to 1949. After removing all the crisis periods, we consider 63 out of 96 periods (see Appendix Table A3 for our descriptive analysis).

We then perform fixed effect panel regression of our full sample to compare crisis times to non-crisis times. This enables us to tease out post-crisis deviations from the long-run historical average over more than 140 years of data. Particularly, we undertake a very basic model where our dependent variables, *i.e.* house prices and equity prices (represented as Y_{it}) regressed on post-crisis indicator variable ($post_{it}$), as:

$$Y_{it} = \alpha + \beta \times post_{it} + \mu_i + \varepsilon_{it}, \tag{1}$$

where, the indicator variable $post_{it}$ takes the value of 1 in each of the five years after a crisis event. Unlike our descriptive analyses, post-crisis years include all years within the five years following a financial crisis event. Only country fixed effects μ_i included to allow for unobserved country specific heterogeneity. Hence, we include 90 out of 96 crisis periods for our OLS analysis (see Appendix Table A3). We remove all the crisis and follow-ups that began during global wartime.

After these two preliminary diagnoses of dependent variables, we enter into our main empirical analysis to calculate dynamic multipliers by implementing Jordá (2005)'s local projection technique. These days, the local projection method is gaining popularity for some of its favorable properties. This technique can tackle asymmetries, nonlinearities and richer data structures with great convenience (Funke et al., 2016). The method is more robust to model misspecifications, provides appropriate inference (point-wise and joint) that does not require asymptotic delta-method approximations or numerical techniques for its calculation, and can easily accommodate experimentation with flexible specifications that may be impractical in a multivariate context (Jordá, 2005). Following Funke et al. (2016) and Jordá et al. (2013), we distinguish between financial and non-financial recessions (without major financial disruption). Since financial crises and recessions are usually coupled, we might fail to understand that the housing and equity market environment

that a country experiences after a financial crisis are mainly a function of the recession and independent of the financial crisis. Hence, as can be seen from Appendix Table A4, in the chronology of a business cycle, we distinguish between non-financial business cycle peaks (denoted as 'N') and peaks associated with a systematic financial crisis (represented by 'F'). A reduced form of this table is separately presented in Appendix Table A5, which includes a subsample of crises connected with severely non-financial recessions *i.e.* macro disasters. As with earlier instances, we exclude wartime periods.

A major limitation of fixed effect regression presented above is that it considers every crisis identically. Nonetheless, since economies are complicated dynamic entities, such an approach may not provide sufficient economic intuition. Therefore, we undertake a local projection technique as this controls for macroeconomic contexts of the countries, that might affect their post-crisis trajectory. As a proxy for overall macroeconomic condition, we control for growth in per capita GDP, CPI inflation, long and short run interest rates and unemployment. Historical data for macroeconomic variables are collected from Jordá et al. (2015). Since the effectiveness of any stabilization policy is dependent on the political strength of a government, we also control for the vote share of the government in the earlier election. Data of this political variable is salvaged from Funke et al. (2016). By controlling for macroeconomic and political factors with greater array of data and dynamics, we make it far less likely that financial crises *per se* are an independent driver of asset market reactions and not a function of economic conditions. Following Funke et al. (2016), we calculate the response from house and equity prices, construction costs and residential land prices by estimating the following fixed-effects panel model with discrete treatment depending on whether the recession is financial or not (F, N):

$$\Delta_h y^k_{it+h} = \alpha^k_i + \theta^k_N N + \theta^k_F F + \theta^k_D D + \sum_{j=0}^{p} \Gamma^k_j Y_{it-j} + u^k_{it}; k = 1, ..., K; h = 1, ..., H, \tag{2}$$

where treatment variables, θ^k_N, θ^k_F and θ^k_D are the occurrence of a normal recession (N=1), financial recession (F=1) and non-financial disasters (D=1), respectively. It is worth noting here that, the term treatment is not interpreted in a causal sense. While N and T represent cross sectional and time dimensions of the panel, Y_{it} is a vector of the macroeconomic and political variables. These controls are introduced in the model with their lagged values and α^k_i is country fixed effects. For any dependent variable (house prices, construction costs, residential land prices or equity prices) we will estimate the change in that variable from the beginning of the recession (previous peak) at time t to time $t+h$ through $\Delta_h y^k_{it+h}$. To elaborate, while *t(r)* refers to a *peak* of economic activities, *t(r)+h* for h = 1,....,H refers to the subsequent H periods, some of which will be

recessionary periods (those immediately following *t(r)*), some of which will be expansionary periods linked to the recovery from the r^{th} recession. K is the number of variables in the regression system.

4.1. Local projections technique

This paper constructs impulse responses of equation (2) through a local projections method. Impulse responses (IRFs) within Vector Autoregressive (VAR)-type models measure the reaction of the system to a shock of interest. Unfortunately, when the underlying data generating process (DGP) cannot be well approximated by a VAR(p) process, IRFs derived from such a model will be biased and misleading. Jordá (2005) introduced an alternative method for computing IRFs based on local projections that do not require specification and estimation of the unknown true multivariate dynamic system. A distinct advantage of this approach is the incorporation of nonlinear endogenous variable terms that can still be estimated by ordinary least squares. Its linear version is immediately comparable to a given VAR setting. It entails estimating:

$$Y_{t+h} = \alpha^s + \Lambda_1^{h+1} y_{t-1} + \Lambda_2^{h+1} y_{t-2} + ... + \Lambda_p^{h+1} y_{t-p} + u_{t+h}^h, \tag{3}$$

at alternative horizons $h = 0, \ . \ . \ . \ , H$, where, again, the local-projections model may be augmented by the presence of exogenous terms, x. Jordá (2005) then shows that impulse responses in the local projection framework are given by the coefficient matrices $\Psi_h = \Lambda_1^s$ while normalizing the impact response to be, again, $\Psi_0 = I$.

5. Post-Crisis House and Equity Prices

In this section, we present our findings from the basic descriptive analysis, ordinary least square estimations and local projection followed by some robustness checking exercises. In doing so, we will compare our findings for pre- and post-crisis, for pre- and post-WWII.

5.1. Basic descriptive analyses of dependent variables

Basic descriptive statistics provide us evidence that the consumer price index rises significantly within five years of a financial crisis. This is expected because of government's stabilization efforts through expansionary policies. However, Figure 2 also suggests that there is very little changes in post-crisis house and stock prices for the whole period. However, as we have previously identified from Figure 1, both house and stocks prices reveal different trends between pre- and post-WWII. Hence, we perform basic OLS regressions of post-crisis prices before and after WWII.

[Figure 2]

5.2. Post-crisis effects on housing and equity prices

To extend our anecdotal observations from the descriptive study, we have undertaken a fixed-effect panel regression for house and equity prices on a post-crisis dummy (taking a value of 1 for each of the five years after the financial crisis). We include all non-crisis years as we want to tease out any deviation in prices from their long run averages. From the results provided in Table 1, we can find that post-crisis stock price increases are around 3.25 after the financial crisis and are significant for the whole sample period but insignificant for either pre- or post-WWII periods. House price increases are significant at the one percent level with a very small magnitude of 0.26 percent points after the WWII. However, a basic panel fixed effect regression suffers from severe identification issues. Hence, these results can be considered to be a preliminary step that warrants a deeper analysis of the post-crisis price paths in these asset markets.

[Table 1]

Figure 3 displays local projections of the cumulative changes in the house price index for years 1-5 after the financial recession (red solid line), controlling for GDP growth rate and CPI inflation (and their lags). The shaded region represents a 90% confidence interval. Likewise OLS regression: left panel shows cumulative projection for the whole sample with middle and right panels displaying projections for pre- and post-WWII periods, respectively. Both for the whole and post-WWII panels, there is a consistent downward trend in the house price index. The same can be observed in corresponding findings about trends in house prices from Table 4. On average, for full sample period, the house price index decreases by more than 7% five years after the financial recession. While there is very little change in post-financial crisis house prices prior to WWII, in the post-WWII sample house prices fall to more than 14% by the fifth year after a crisis. This might be due to heightened house prices often resulting in bubbles during post-WWII periods in the developed world (Jordá et al., 2015).

[Figure 3]

We now turn our focus to projecting equity prices. According to Figure 4, irrespective of periods covered *i.e.* for full sample, pre-WWII and post-WWII, stock prices display a consistent downward trend after financial crises. In contrast to house prices, where price responses are different between pre and post-WWII, stock prices show a similar trend in both pre- and post-WWII indicating absence of 'bubble' like events after WWII in the equity market. Fama (2014) also points out the absence of 'bubbles' in equity market in his Nobel Lecture, while defining 'bubbles' as 'irrational strong price increase that implies a predictable strong

decline' (Fama, 2014, p.1475). As revealed by corresponding results in Appendix Table A6, stock prices decline by more than 7% after two and five years of the financial crisis events for the full and post-WWII periods, respectively. Our results are robust to adding more control variables such as government vote share, long and short run interest rates and unemployment rate. We include vote share to allow for a government's strength in decision-making and implementation as far as stabilization policies are concerned.

[Figure 4]

Now we dig deeper by projecting both of the components of house prices. Results from our fixed effect OLS regressions for construction costs and residential land prices are presented in Table 2. As the table suggests, while the residential land prices (the largest component of house prices) have not experienced any change, there is a very small increase of only 0.09% in the level of construction costs five years after crisis in post-WWII period. Figure 5 displays local projections of these two components. Likewise for local projection results for house prices, both construction costs and residential land prices experience persistent declines even after five years of the financial crisis. However, while the decrease is immediate for construction costs, residential land prices drops sharply four years after the crisis. Results in the corresponding Tables A7 and A9 suggest that, on average, construction costs fall by 2.18% after three years, whereas residential land prices in the post-WWII sample fall by more than 31% after five years.

[Table 2]

[Figure 5]

We present OLS results for our three major control variables in Table 3. While little happens to short and long term interest rates, the post-crisis government vote share reduced significantly after World War II indicating the declining political power of the incumbent government and is indicative of weak policy implementation regimes. This is consistent with the findings of Funke et al. (2016).

[Table 3]

5.3. How persistent are these effects on prices?

How long lasting are these housing and equity market aftershocks from financial crises? Do these negative effects fade out with time and stabilization efforts? To find out answers to these questions we extend the time frame of our local projection exercises to ten years after the crisis event. Fig. 6 presents the post-crisis path of house prices, stock prices, construction costs and residential land prices over a ten year horizon. The

graphs reveal that both stock prices and construction costs effects are temporary and diminish over time. For the overall sample, stock prices takes about eight years and construction costs requires a little more than ten years to return to their pre-crisis levels. However, impacts on house and residential land prices seem to be quite persistent.

As indicated by projections of stock prices in the second top panel, stock prices return to pre-crisis levels earlier in post-WWII than pre-WWII times. With regards to pre-WWII data, it takes almost nine years for stock prices to return to their pre-crisis level, while in post-WWII periods they return to their original level within only six years. This might be due to greater interventions by governments in recent years, *i.e.* post-WWII periods. Another reason could be the increased ease and frequency in equity market operations because of rapid advancement in electronic transactions.

There seemed to be no effect of financial crises on house prices and its components before WWII. However after WWII, all three of these series experienced decreasing trends. While house and residential land prices are far below the pre-crisis level even after ten years, construction costs are almost back to pre-crisis levels after twelve years. This could also be due to the fact that any expansionary policy transmits relatively quickly in row material and supply markets rather than in bigger chunks of wealth component *i.e.* land prices. In summary, the equity market consequences of financial crises start to rebound about six to eight years after the beginning of the crisis, but housing market implications are more persistent. House and residential land prices do not return to their pre-crisis levels even ten years after the crisis, but effects on construction costs seem to dissipate after about ten years.

[Figure 6]

5.4. Normal recessions and non-financial macro disasters

In the previous section we showed that financial crises precede a substantial fall in both house and equity prices. It is now well established in the literature that financial crises are typically accompanied by economic recessions (Jordá et al., 2013, 2015, 2016; Funke et al., 2016). In this section, we compare price declines from financial crises with other episodes of economic downturns. In our local projections we will subject the economy to three different 'treatments' recessions associated with a systemic financial crisis, normal

recessions, and other (non-financial) macro disasters.[2] Table 4 offers local projections of the house price index during these three economic crisis periods.

[Table 4]

Table 4 indicates that house prices react differently to each of the three distinct crisis periods. Financial recessions are followed by significantly larger decreases in house prices than either normal recessions or non-financial macro-disasters. While house prices decline significantly after each of the three crisis types in the post-WWII period there has been very little movement during any of these crises in pre-WWII periods. This has macro-economic reasoning. It might be associated with too much leverage in our financial system in recent years in post-WWII periods. During this period, the F-statistic rejects the null hypothesis of equal coefficient for all crises at most of the horizons. The only exception is during the inter-war period, where there has been very little price movement associated with any of the crisis periods.

Table 5 presents coefficients for all three types of crisis for each of the independent variables. To conserve space, projections are only provided for the post-WWII period. The full set of results is offered in Appendix Tables A6 through A8. Table 6 shows, the stock price index decreases sharply just after financial recessions and then rebounds quickly within four years, while the other two crisis types, *i.e.* normal and disasters, do not have any impact on equity prices at all. Construction costs and house prices receive a negative shock in response to each of the three types of crisis. However, the most significant and persistent decline in construction costs comes from non-financial disasters.

To sum up from Table 5, financial recessions are the most detrimental crises causing substantial decreases in house prices, stock prices and construction costs. Second, stock prices fall significantly immediately after a financial crisis and detrimental impacts fade away within four years but shocks to house prices are persistent. Third, during normal recessions and non-financial macro-disasters, stock prices and residential land prices remain stable, whereas house prices and construction costs fall.

[Table 5]

As the results suggest, house prices are the most vulnerable against any type of crisis; financial and normal recessions and non-financial disasters. The persistence of downward trends in house prices can be

[2]Section 3 of this paper offered a discussion on these three types of crisis. In this regard we follow Jordá et al. (2015) and Funke et al. (2016) in that non-financial disasters are more severe than the typical financial crisis recession, *i.e.*, the annualized percentage decline in GDP per capita exceeds the respective thresholds of 3.35% (pre-World War II sample) and 2.55% (post-World War II sample). Financial crisis recessions are all recessions that coincide with a systemic financial crisis. All other recessions are called 'normal recessions'.

explained by the sheer size and complexity of the housing market. These reasons might restrict expansionary policies like lowering interest rates, increasing money supply, and more recently implemented quantitative easing initiatives, to have an immediate impact on prices. The time lag between crisis and policy result realization is relatively large in the housing market compared to the equity market. Since the purpose of equity investment is different from housing investment, and equity trading requires relatively smaller commitment within a relatively fast trading window, any shock has an immediate impact and any monetary and fiscal policy initiative gets an immediate response, too.

Our results also reveal that financial crises provoke greater disruptions in house and equity prices. As revealed by Funke et al. (2016), this is also true for political disturbances like increased extremism. This could be due to a large degree of uncertainty associated with financial crises. Unlike normal recessions and non-financial disasters, financial crisis events call for more unprecedented policies. Furthermore, compared to normal recessions due to factors like oil price shocks and nonfinancial disasters like cyclone, financial recessions attract greater media coverage.

6. Concluding Remarks and Policy Implications

This study projects post-crisis (including, financial, normal recessions and non-financial disasters) responses from housing and equity prices in 17 countries over 143 years. Our analyses suggest that financial crises, normal recessions and non-financial disasters put immediate downward pressure on house prices, stock prices and construction costs and a lagged declining effect on residential land prices. However, the magnitude and persistence of these negative impacts vary across time and asset classes. These findings have insightful implications as discussed in order.

First, we find that both house prices and construction costs are more vulnerable to crises only after WWII, while post-crisis stock price declines are detected throughout the whole sample period, *i.e.* in both pre- and post-WWII. This difference in timing of impacts between housing and equity market could be due to recent increased leverage in housing sectors in developed countries. As Jordá et al. (2015) indicate, most of these financial crises are followed by bubble bursting.

Second, with regards to severity of impacts, financial crises seem to be the most detrimental of the three types of crises causing substantial decreases in house prices, stock prices and construction costs. This could be because financial crises diffuse more uncertainty about the economic outlook and attracts greater media speculation. The blurry images about the future lead to declines in both asset prices and construction costs.

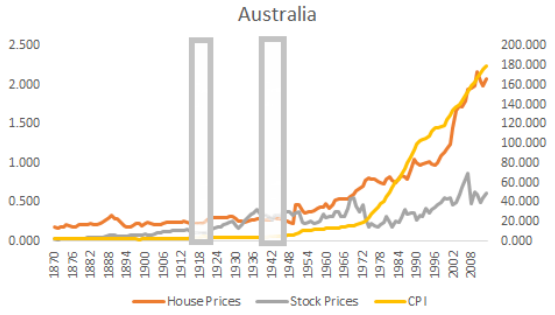
Third, stock prices drop significantly immediately after financial crises and rebound within four to six years, while shocks to house prices are persistent and the declining trend continues even after ten years horizon. This contrast in persistence could be because of differences in investor intentions in the two separate asset markets. Housing investors have a longer-term view than do equity market operators. Since equity trading requires a relatively smaller commitment within a relatively quick trading window, any macro-financial shock has an immediate impact. For the same reason, any monetary and fiscal policy initiative gets an immediate response from the stock market. The persistence of downward pressure in house prices may also be due to the size and complexity of the housing market which restricts expansionary policies (like lowering interest rates, increasing money supply, and more recently, quantitative easing initiatives) from having an immediate impact on prices. Therefore, the time lag between crisis and response to policy is relatively large in the housing market compared to other asset markets.

In terms of housing and wealth, recovery from recessions may have a social inequality slant, with upper class families rebounding with a quick stock market recovery but lower middle class families being persistently burdened, years later. Families of low-middle income are more likely to have their wealth wrapped up in a home, and less in financial investments like stocks. They conventionally are more likely to be pushed into risky mortgages, and thus into foreclosure, and far more likely to be targeted by predatory lenders. Controlling for all other factors, the interest rates that low and middle-income families pay for their mortgages are, in many instances, higher than those of higher income families. Thus, recession and subsequent stabilization efforts may amplify the wealth gap and inequality. A deeper insight into these is worthy of future research.

Fourth, in periods after the Second World War, both house prices and their construction costs drop in response to all three types of crisis. However, as far as magnitude is concerned, while house prices react substantially after financial recessions, construction costs fall most after non-financial disasters. This could be because house prices are more susceptible to uncertainty during adverse financial events, whereas construction costs are more prone to supply disruptions during non-financial disasters like war, transportation or weather related disruptions.

Fifth, financial crises put substantial downward pressure on residential land prices but with a lag of four to five years. This decline seems to be persistent. A probable reasoning might be that since residential land prices are the biggest component of housing wealth and they are traded infrequently, the negative effects from the crisis are actualized after larger lags than other asset price counterparts.

Figures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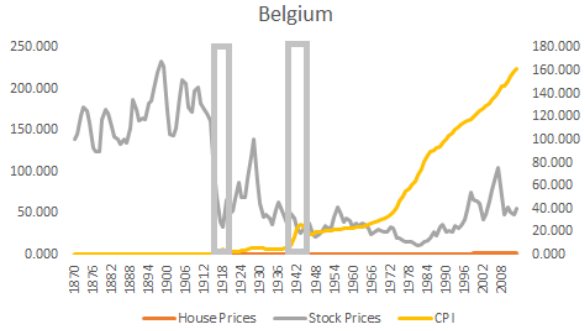
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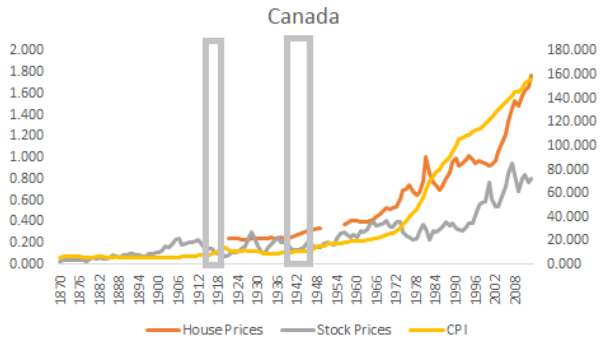
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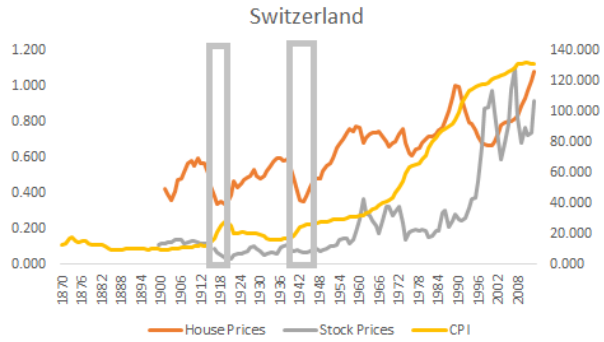
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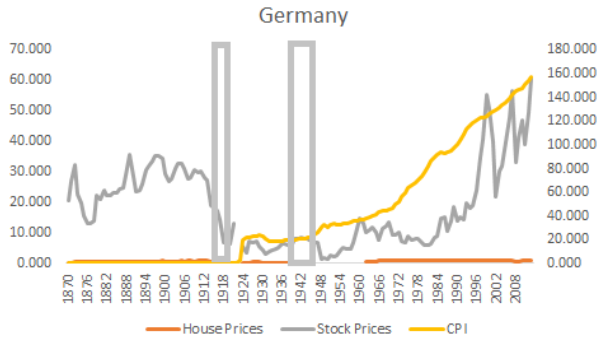
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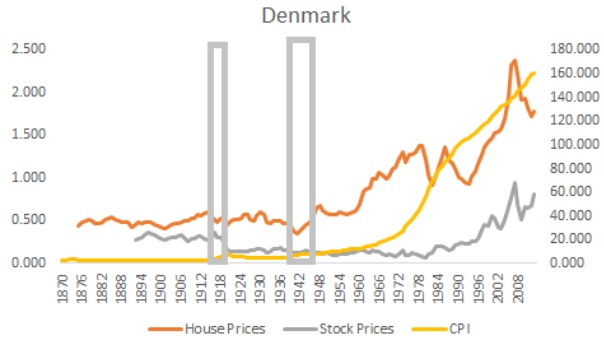
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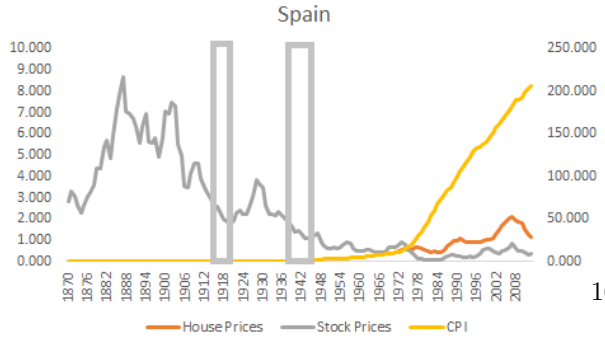
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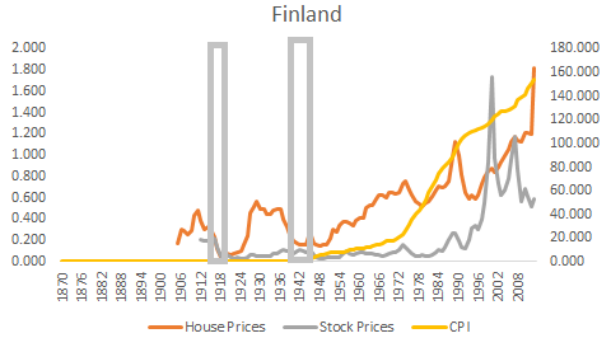
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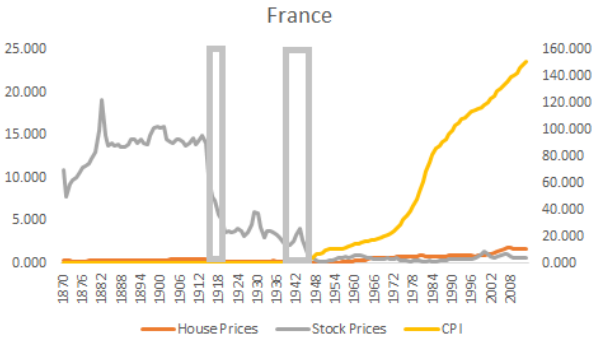
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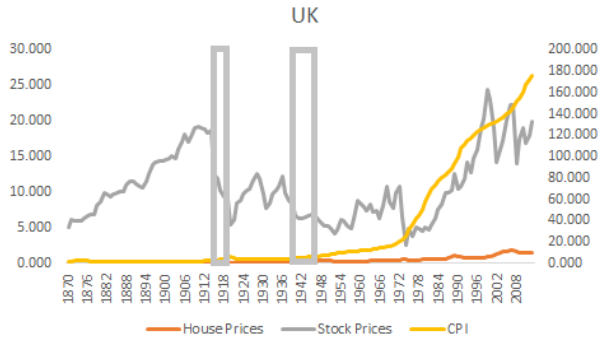
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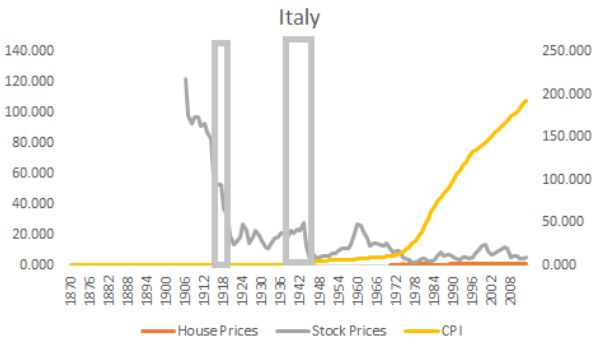
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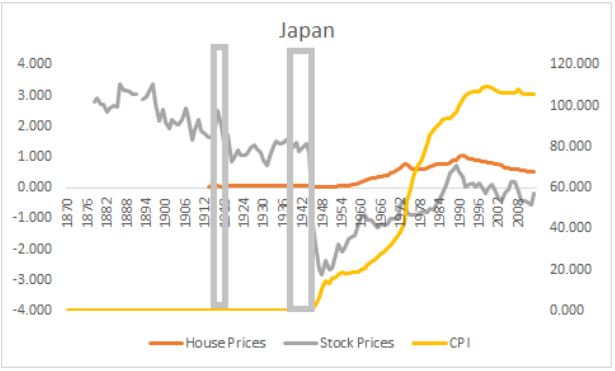
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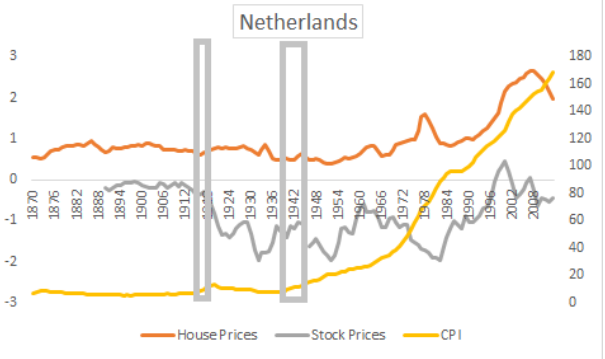
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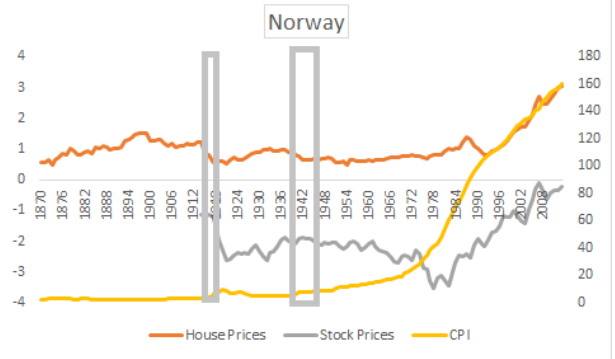
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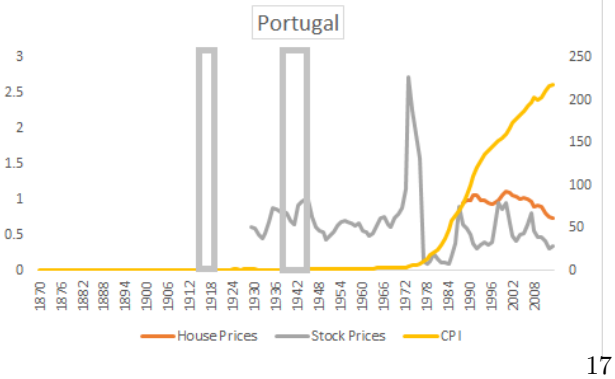
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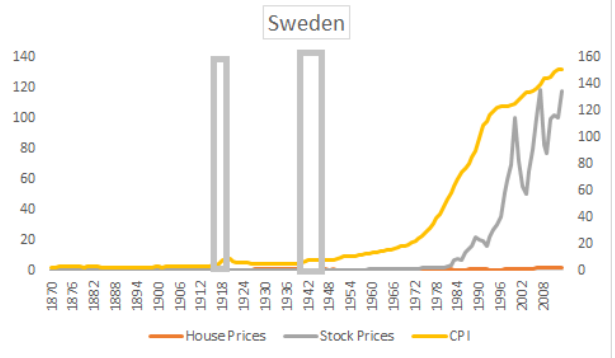
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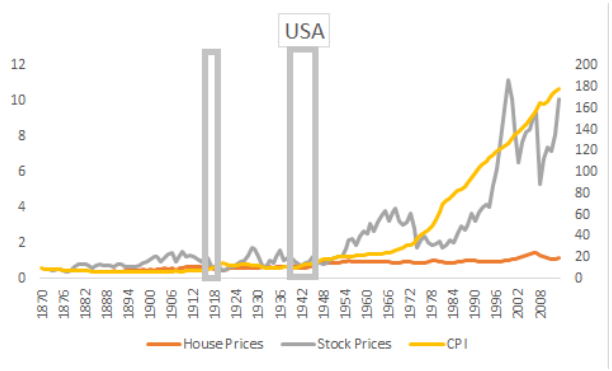

Figure 1: Real house prices, equity prices and CPI in the long run.
Note: Nominal house and equity price indexes are divided by consumer price index to get real house prices.

The years of two World Wars are shown with shading

Figure 2: Pre- and Post-Crisis House, stock and consumer price indexes.
Note: The left panel refers to average house, stock and consumer price indexes in the five year before the start of a financial crisis, while the right panel reflects average prices five years after.

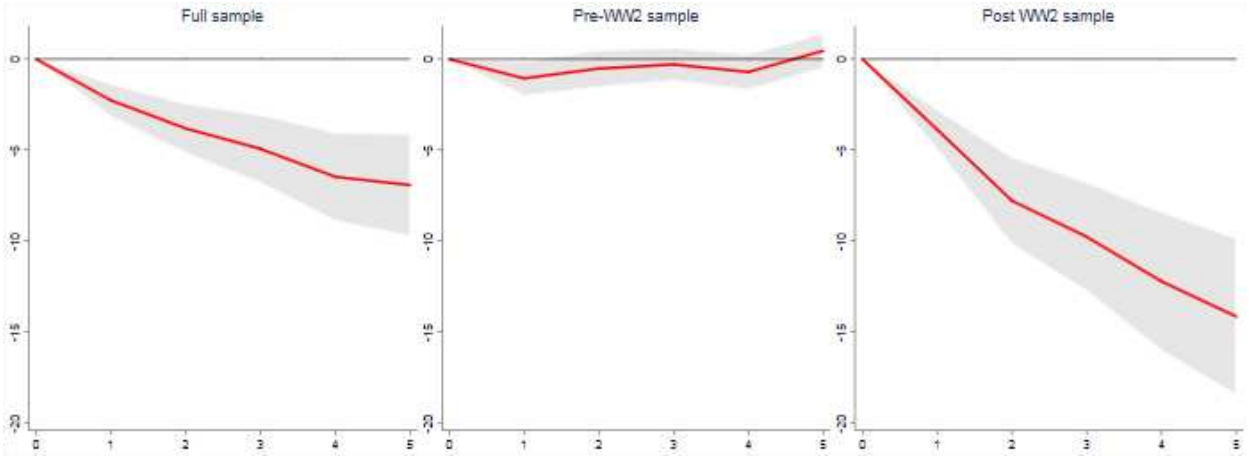

Figure 3: House Price Index (local projection).

Note: Each path shows local projections of the cumulative change relative to peak (in %, y-axis) for years 1-5 of the recession/recovery period (x-axis).The red line refers to the average path in financial crisis recessions and the shaded region is a 90% confidence interval. The controls are contemporaneous and 1-year lagged values of the growth rate of GDP per capita and the CPI inflation rate at peak. The left panel covers the years 1919-2014, excluding World War II, the middle panel 1919-1938, and the right panel 1950-2014. Table A4 shows the recessions included. The dependent variable is the house price index. For the corresponding regression results see Table 4 in the text below.

Figure 4: Stock Price Index (local projection).

Note: Each path shows local projections of the cumulative change relative to peak (in %, y-axis) for years 1-5 of the recession/recovery period (x-axis).The red line refers to the average path in financial crisis recessions and the shaded region is a 90% confidence interval. The controls are contemporaneous and 1-year lagged values of the growth rate of GDP per capita and the CPI inflation rate at peak. The left panel covers the years 1919-2014, excluding World War II, the middle panel 1919-1938, and the right panel 1950-2014. Table A4 shows the recessions included. The dependent variable is the stock price index. For the corresponding regression results see Appendix Table 6 in the text below.

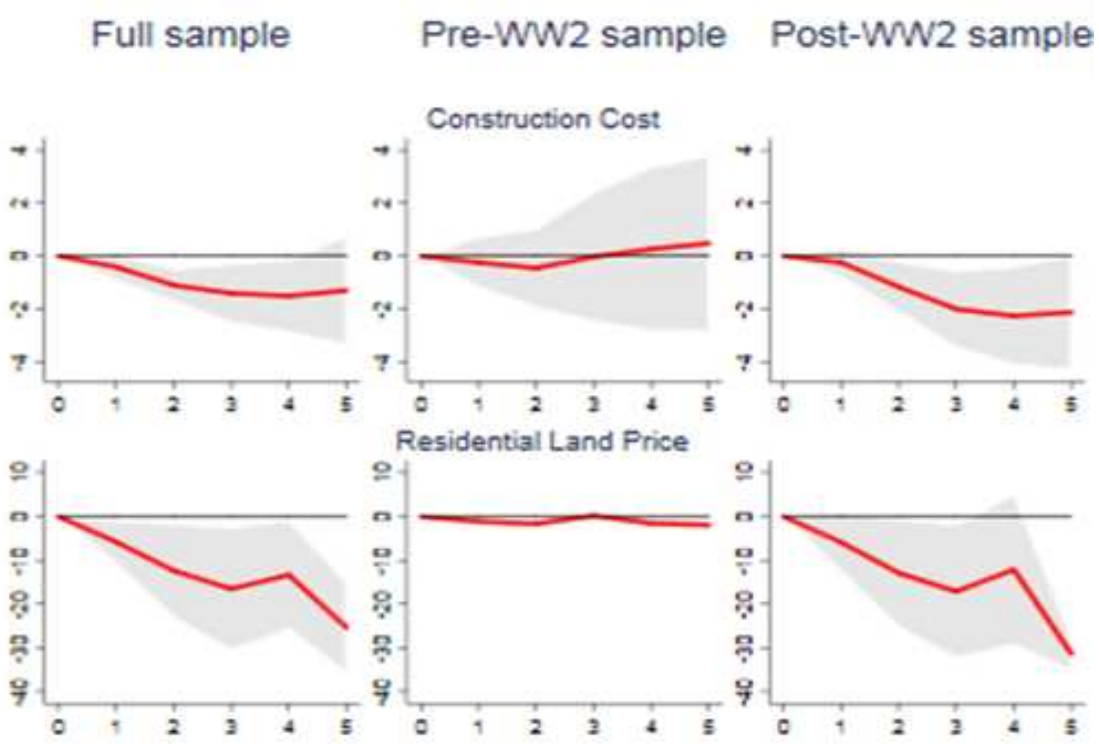

Figure 5: House Price Components- Construction Cost and Residential Land Prices (Local Projections): Financial Crisis Recessions.

Note: Each path shows local projections of the cumulative change relative to peak (in %, y-axis) for years 1-5 of the recession/recovery period (x-axis).The red line refers to the average path in financial crisis recessions and the shaded region is a 90% confidence interval. The controls are contemporaneous and 1-year lagged values of the growth rate of GDP per capita, the CPI inflation rate and government vote share at peak. The left panels cover the years 1870-2014, the middle panels 1870-1938, and the right panels 1950-2014. The periods of global war (1914-1918 and 1939-1949) are excluded. Table A4 shows the recessions included. For the corresponding regression results refer to Appendix Table E2 and E3.

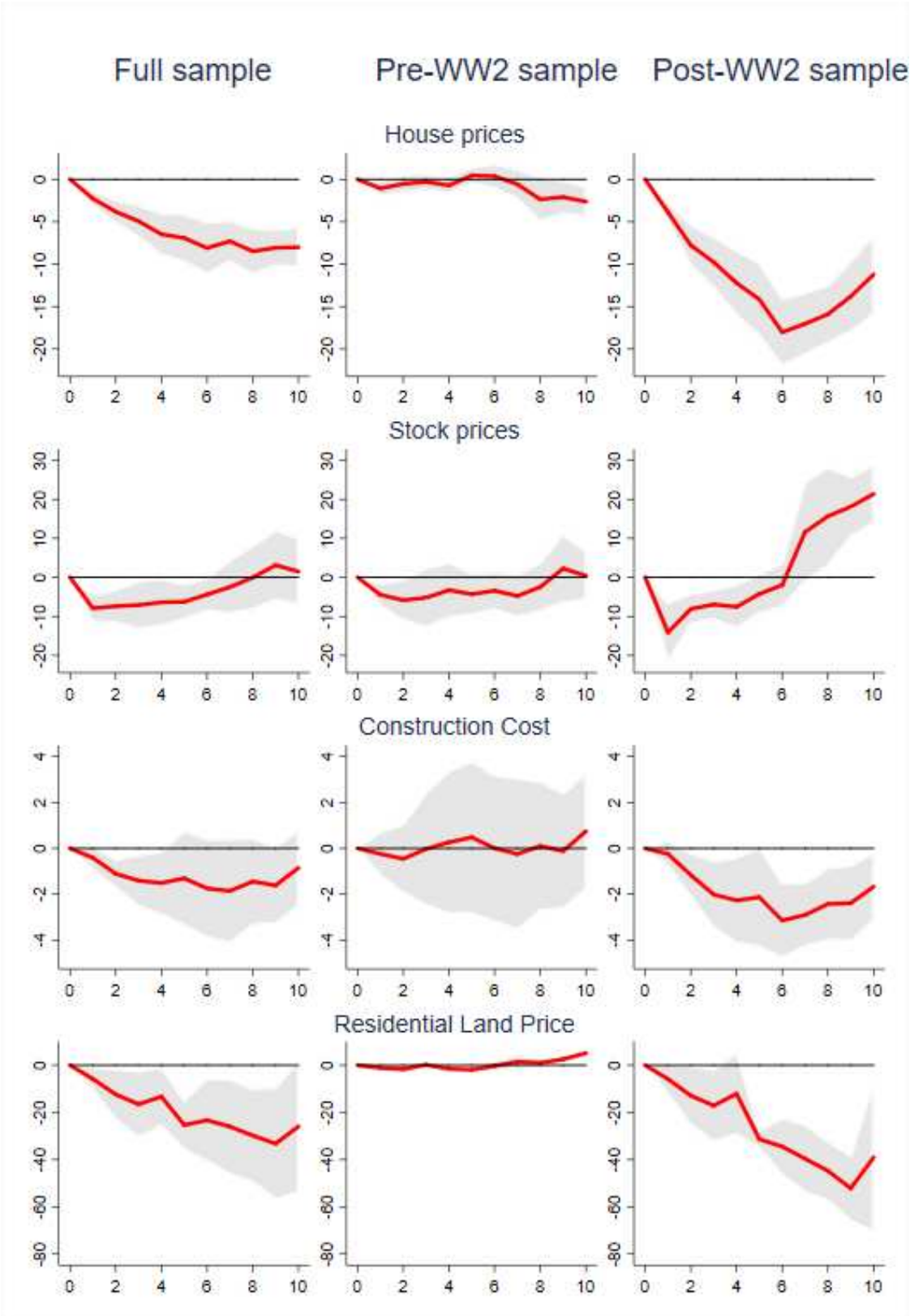

Figure 6: 10-year Local Projections: Financial Crisis Recessions.

Note: Each path shows local projections of the cumulative change in the house prices, stock prices, construction costs and residential land prices relative to peak (in %, y-axis) for years 1-10 of the recession/recovery period (x-axis). The red line refers to the average path in financial crisis recessions and the shaded region is a 90% confidence interval. The controls are contemporaneous and 1-year lagged values of the growth rate of GDP per capita, the CPI inflation rate, long run interest rate, short run interest rate and government vote share at the peak.

Tables

TABLE 1: **House Price and Stock Index: Post-Crisis Years versus Normal Years**

	(a) Full Sample	(b) Pre-WWII	(c) Post-WWII
	House Price Index		
Post-crisis	0.024	0.027	0.262*****
	(0.044)	(0.017)	(0.083)
R^2	0.012	0.033	0.041
Obs.	1663	672	991
	Stock Price Index		
Post-crisis	3.276*	-2.101	1.852
	(1.574)	(2.317)	(1.575)
R^2	0.005	0.003	0.008
Obs.	1917	829	1088

Note: This table compares the post-crisis levels of house price and stock price indexes to their average levels. The time window for post-crisis is five years. Robust standard errors (clustered by country) are in parentheses. The results are similar when controlling for economic fundamentals, such as the growth rate of GDP per capita and the CPI inflation rate (not reported).The left panel covers the years 1870-2013, excluding World War II, the middle panels 1870-1938, and the right panels 1950-2013. Table A3 shows the crises included. * p <0.10, ** p <0.05, *** p <0.01.

TABLE 2: **Construction Costs and Residential Land Prices: Post-Crisis Years versus Normal Years**

	(a) Full Sample	(b) Pre-WWII	(c) Post-WWII
	Construction Cost		
Post-crisis	-0.079	-0.001	0.091**
	(0.046)	(0.009)	(0.027)
R^2	0.015	0.001	0.035
Obs.	1326	444	882
	Residential Land Price		
Post-crisis	1.519	0.029	1.315
	(1.716)	(0.027)	(1.232)
R^2	0.001	0.001	0.001
Obs.	293	48	245

Note: This table compares the post-crisis levels of Construction Costs and Residential Land Prices to their average levels. The time window for post-crisis is five years. Robust standard errors (clustered by country) are in parentheses. The results are similar when controlling for economic fundamentals, such as the growth rate of GDP per capita and the CPI inflation rate (not reported).The left panel covers the years 1870-2013, excluding World War II, the middle panels 1870-1938, and the right panels 1950-2013. Table A3 shows the crises included. * p <0.10, ** p <0.05, *** p <0.01.

TABLE 3: **Control Variables: Post-Crisis versus Normal Years**

	(a) Full Sample	(b) Pre-WWII	(c) Post-WWII
	Short-term interest rate		
Post-crisis	-0.590*	-0.272	0.073
	(0.317)	(0.169)	(0.517)
R^2	0.071	0.046	0.365
Obs.	2121	1041	1063
	Long-term interest rate		
Post-crisis	-0.513*	-0.200	0.678
	(0.290)	(0.291)	(0.517)
R^2	0.077	0.022	0.342
Obs.	2239	1151	1071
	Government Vote		
Post-crisis	-1.713	-0.178	-3.617***
	(1.562)	(1.566)	(1.111
R^2	0.013	0.015	0.042
Obs.	1705	661	1027

Note: This table compares the post-crisis levels of Construction Costs and Residential Land Prices to their average levels. The time window for post-crisis is five years. Robust standard errors (clustered by country) are in parentheses. The results are similar when controlling for economic fundamentals, such as the growth rate of GDP per capita and the CPI inflation rate (not reported).The left panel covers the years 1870-2013, excluding World War II, the middle panels 1870-1938, and the right panels 1950-2013. Table A3 shows the crises included. * p <0.10, ** p <0.05, *** p <0.01.

TABLE 4: **Local Projections of House Price Index**

(a) Full Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-2.38***	-3.91***	-5.07***	-6.68***	-7.14***
	(0.55)	(0.84)	(1.15)	(1.47)	(1.70)
Normal Recession	-1.60***	-2.17***	-3.00***	-3.61***	-3.69***
	(0.28)	(0.37)	(0.51)	(0.51)	(0.63)
Non-financial Disaster	-1.57**	-1.39	-3.50***	-4.48***	-3.78***
	(0.58)	(1.12)	(1.15)	(1.03)	(1.33)
H_0: Financial=Normal;p-value	0.18	0.04	0.06	0.04	0.05
H_0: Financial=Disaster;p-value	0.38	0.15	0.36	0.24	0.15
R^2	0.164	0.159	0.153	0.147	1.444
Obs.	1687	1665	1644	1623	1602
(a) Pre-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-1.01	-0.30	-0.08	-0.56	0.60
	(0.60)	(0.67)	(0.62)	(0.62)	(0.64)
Normal Recession	-0.86**	-0.77*	-1.13*	-1.31*	-0.83
	(0.36)	(0.40)	(0.60)	(0.68)	(0.71)
Non-financial Disaster	-0.05	0.52	0.01	-0.62	-0.22
	(0.66)	(0.92)	(0.99)	(1.07)	(0.95)
H_0: Financial=Normal;p-value	0.83	0.56	0.23	0.41	0.16
H_0: Financial=Disaster;p-value	0.26	0.55	0.92	0.82	0.44
R^2	0.103	0.158	0.203	0.245	0.291
Obs.	718	713	709	705	701
(a) Post-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-4.11***	-8.05***	-10.02***	-12.46***	-14.36***
	(0.68)	(1.46)	(1.83)	(2.32)	(2.61)
Normal Recession	-1.95***	-2.31***	-2.57***	-2.54***	-2.11*
	(0.34)	(0.69)	(0.71)	(0.78)	(1.01)
Non-financial Disaster	-3.31**	-2.43	-5.61**	-5.32**	-1.89
	(1.28)	(3.31)	(2.52)	(2.43)	(3.86)
H_0: Financial=Normal;p-value	0.00	0.00	0.00	0.00	0.00
H_0: Financial=Disaster;p-value	0.66	0.20	0.19	0.06	0.03
R^2	0.339	0.323	0.317	0.321	0.346
Obs.	969	952	935	918	901

Note: Robust standard errors (clustered by country) are in parentheses. Results correspondent to local projections of cumulative change in 100 times the logged variable relative to peak for year 1-5 of the financial recession (first row), normal recession (second row), and non-financial macro disaster (third row). The top panel (a) covers the periods during 1870-2014 excluding World War II years (1939-1949), the middle panel (b) ranges the years 1870-1938, and the bottom panel (c) covers years 1950-2014. Financial = normal (disaster) tests the null that coefficients for each type of recession are the same with regards to intercept terms in the first and second (third) rows. In each instance, p-value is provided. The controls are contemporaneous and 1-year lagged values of the growth of GDP per capita and the CPI inflation rate at peak (coefficients are not reported). See text.* p <0.10, ** p <0.05, *** p <0.01.

TABLE 5: **Local Projections of all Dependent Variables, Post-World War II Sample**

	Year1	Year2	Year3	Year4	Year5
			House Price Index		
Financial Recession	-4.11***	-8.05***	-10.02***	-12.46***	-14.36***
	(0.68)	(1.46)	(1.83)	(2.32)	(2.61)
Normal Recession	-1.95***	-2.31***	-2.57***	-2.54***	-2.11*
	(0.34)	(0.69)	(0.71)	(0.78)	(1.01)
Non-financial Disaster	-3.31**	-2.43	-5.61**	-5.32**	-1.89
	(1.28)	(3.31)	(2.52)	(2.43)	(3.86)
H_0: Financial=Normal;p-value	0.00	0.00	0.00	0.00	0.00
H_0: Financial=Disaster;p-value	0.66	0.20	0.19	0.06	0.03
			Stock Price Index		
Financial Recession	-14.32***	-8.40***	-7.11***	-7.76**	-4.32
	(4.58)	(2.30)	(2.28)	(3.48)	(3.13)
Normal Recession	-2.01**	-2.73**	-1.42	-2.14	-0.69
	(0.93)	(1.07)	(1.14)	(2.25)	(2.40)
Non-financial Disaster	-5.62*	-6.61	-10.35	-13.50	-13.88
	(3.03)	(4.98)	(6.47)	(9.13)	(8.10)
H_0: Financial=Normal;p-value	0.01	0.04	0.02	0.07	0.16
H_0: Financial=Disaster;p-value	0.15	0.78	0.57	0.48	0.21
			Construction Costs		
Financial Recession	-0.32	-1.32**	-2.18**	-2.44*	-2.30
	(0.35)	(0.60)	(0.89)	(1.15)	(1.34)
Normal Recession	-0.69**	-1.51***	-1.79***	-1.79***	-1.87*
	(0.23)	(0.47)	(0.51)	(0.58)	(0.61)
Non-financial Disaster	-1.57***	-3.77***	-3.76***	-4.02**	-3.90**
	(0.45)	(1.17)	(1.17)	(1.45)	(1.56)
H_0: Financial=Normal;p-value	0.27	0.76	0.63	0.54	0.74
H_0: Financial=Disaster;p-value	0.05	0.07	0.26	0.38	0.44
			Residential Land Prices		
Financial Recession	-5.89	-12.89	-17.13	-12.08	-31.27***
	(3.95)	(7.55)	(9.23)	(10.42)	(2.21)
Normal Recession	-0.19	0.26	-0.15	0.55	1.23
	(0.52)	(1.25)	(1.53)	(1.72)	(2.09)
Non-financial Disaster	-0.47	1.02	2.65	3.49	4.15
	(0.47)	(0.73)	(2.11)	(3.16)	(2.92)
H_0: Financial=Normal;p-value	0.22	0.16	0.15	0.32	0.00
H_0: Financial=Disaster;p-value	0.22	0.10	0.06	0.09	0.00

Note: Robust standard errors (clustered by country) are in parentheses. Results correspond to local projections of cumulative change in 100 times the logged variable relative to peak for years 1-5 of the financial recession (first row), normal recession (second row), and non-financial macro disaster (third row). The data covers years 1950-2014. Financial = normal (disaster) tests the null that coefficients for each type of recession are the same with regards to intercept terms in the first and second (third) rows. In each instance, p-value is provided. The controls are contemporaneous and 1-year lagged values of the growth of GDP per capita and the CPI inflation rate at peak (coefficients are not reported). See text.* p <0.10, ** p <0.05, *** p <0.01.

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Appendix

TABLE A1: **Main Variables: Description and Sources**

Variable	Description	Sources
Real House Price Index	Nominal house price index divided by consumer price index.	Knoll et al. (2017)
Real Construction Cost Index	Nominal construction cost index divided by consumer price index.	Knoll et al. (2017)
Real Residential Land Price Index	Nominal residential land price index divided by consumer price index.	Knoll et al. (2017)
Real Stock Price Index	Nominal stock price index divided by consumer price index.	Jordá et al. (2015)
Systematic Financial Crisis	Binary variable for financial crisis events since 1870.	Jordá et al. (2015)
Recessions	Binary variable for normal recessions since 1870. Financial recessions: financial crisis within +/-2 years around peak. Nominal recessions: all non-financial peaks. Non-financial macro-disasters: normal recessions with yearly real per capita GDP percentage loss is greater than average loss in financial recessions.	Funke et al. (2016)
GDP per capita	Real GDP per capita	Jordá et al. (2015)
Inflation	Consumer price index	Jordá et al. (2015)
Short Term Interest Rate	Short-term interest rate (nominal, percent per year)	Jordá et al. (2015)
Long Term Interest Rate	Long-term interest rate (nominal, percent per year)	Jordá et al. (2015)
Current Account	Current account (nominal, local currency)	Jordá et al. (2015).
Investment-to-GDP Ratio	Investment-to-GDP ratio	Jordá et al. (2015)
Government Expenditure	Government expenditure (nominal, local currency)	Jordá et al. (2015)
Total loans to non-Financial Private Sector	Total loans to non-financial private sector (nominal, local currency)	Jordá et al. (2015)
Total Loans to Households	Total loans to households (nominal, local currency)	Jordá et al. (2015)
Total Loans to Business	Total loans to business (nominal, local currency)	Jordá et al. (2015)
Government vote share	Vote share of governing party or coalition whichever appropriate in the most recent general elections to the national parliament (lower chamber).	Funke et al. (2016)

TABLE A2: **Summery Statistics**

Variable	Obs.	Mean	Std. Dev.	Min	Max
House Prices	1854	0.730718	0.436288	0.007481	3.04466
Stock Prices	2182	9.560855	27.17124	0.023980	232.7631
Construction Costs	1508	0.796783	0.259924	0.160421	1.4875
Residential Land Prices	321	4.116542	18.91574	0.140432	205.663
Real GDP Per Capita	2448	36.61966	30.93255	3.26308	113.343
Consumer Price Index	2448	34.97026	49.67926	1.10e–11	217.943
Short-Term Interest Rate	2285	4.912854	3.195364	0.000102	21.733
Long-Term Interest Rate	2.413	5.613159	3.026959	0.56	23.7154
Total Loans to Non-Financial Private Sector	2247	2262049	1.9e+07	7.6e–12	3.1e+08
Government Expenditure	2366	448444	2.8e+06	5.0e–13	4.5e+07
Total Loans to Business	1183	2363565	1.4e+07	0.2137	1.7e+08
Government Vote Share	1854	50.3444	14.3498	12.3	100

Note: Summary statistics refer to the raw data collected for all 17 countries and all years from 1870 to 2014, including non-democratic spells and periods of global war (1914-1918 and 1939-1949). Generally not considered in the empirical analysis of political variables are Austria and Ireland prior to World War I, and Australia prior to 1901 (no independent states). Finland prior to 1917, as an autonomous part of the Russian Empire, is considered.

TABLE A3: **Financial Crisis Events, 1870–2014**

Australia	1893	1989							
Belgium	1870	1885	1925	1931	1939*	2008			
Canada	1873	1907	1923						
Denmark	1877	1885	1908	1921	1931	1987	2008		
Finland	1878	1900	1921	1931	1991				
France	1882	1889	1907	1930	2008				
Germany	1873	1891	1901	1907	1931	2008			
Italy	1873	1887	1893	1907	1921	1930	1935*	1990	2008
Japan	1882	1900	1904*	1907	1913	1927	1992		
Netherlands	1893	1907	1921	1939*	2008				
Norway	1899	1922	1931	1988					
Portugal	1890	1920	1923*	1931	2008				
Spain	1883	1890	1913	1920	1924*	1931	1978	2008	
Sweden	1878	1907	1922	1931	1991	2008			
Switzerland	1870	1910	1931	1991	2008				
UK	1873	1890	1974	1984	1991	2007			
USA	1873	1884	1893	1907	1929	1984	2007		

Note: This table is reproduced from Funke et al. (2016) who have collated financial crisis events from Bordo et al. (2001), Reinhart and Rogoff (2009b), Laeven and Valencia (2008), Laeven and Valencia (2012), and Jord et al. (2013). These financial crisis events are systematic banking crises that took place since 1870 in 17 countries of our sample. * = crises removed from OLS regressions. Italic = crises removed from the descriptive analysis.

TABLE A4: **Financial Recessions (F) and Normal Recessions (N), 1870-2014**

	N	1875	1878	1981	1883	1885	1887	1889	1896	1898	1900	1904
Australia		1910	1913	1926	1938	1943	1951	1956	1961	1973	1976	1981
		2008										
	F	1891	1894	1989								
	N	1872	1874	1887	1890	1900	1913	1916	1942	1951	1957	1974
Belgium		1980	1992	2011								
	F	1870	1883	1926	1930	1937	2008					
	N	1871	1877	1882	1888	1891	1894	1903	1913	1917	1928	1944
Canada		1947	1953	1956	1981	1989	2007					
	F	1874	1907									
	N	1870	1880	1887	1911	1914	1923	1939	1944	1950	1962	1973
Denmark		1979	1992	2011								
	F	1872	1876	1883	1920	1931	1987	2007				
	N	1870	1883	1890	1898	1907	1913	1916	1938	1941	1943	1952
Finland		1957	1975	2008	2011							
	F	1876	1900	1929	1989							
	N	1872	1874	1892	1894	1896	1900	1905	1907	1909	1912	1916
France		1920	1926	1933	1937	1939	1942	1974	1992	2012		
	F	1882	1929	2007								
	N	1879	1898	1905	1913	1922	1943	1966	1974	1980	1992	2001
Germany		2012										
	F	1875	1890	1908	1928	2008						
	N	1870	1883	1897	1918	1923	1925	1932	1939	1974	2002	2004
Italy		2010										
	F	1873	1887	1891	1929	1992	2007					
	N	1875	1877	1880	1887	1890	1892	1895	1898	1903	1919	1921
Japan		1929	1933	1940	1973	2001	2007	2010				
	F	1874	1901	1907	1913	1925	1997					
	N	1870	1873	1877	1889	1894	1899	1902	1913	1929	1957	1974
Netherlands		1980	2001	2011								
	F	1892	1906	1937	1939	2008						
	N	1876	1881	1885	1893	1902	1916	1923	1939	1941	1957	1981
Norway		2007	2012									
	F	1897	1920	1930	1987							
	N	1870	1873	1877	1888	1893	1900	1904	1907	1912	1914	1916
Portugal		1925	1927	1934	1937	1939	1941	1944	1947	1951	1973	1982
		1992	2002	2004	2010							
	F	1890	1923	1929	2007							
	N	1873	1877	1892	1894	1901	1909	1911	1916	1927	1932	1935
Spain		1940	1944	1947	1952	1958	1974	1980	1992	2011		
	F	1883	1889	1913	1925	1929	1978	2007				
	N	1873	1876	1881	1883	1885	1888	1890	1899	1901	1904	1913
Sweden		1916	1924	1939	1976	1980	2011					
	F	1878	1907	1920	1930	1990	2007					
	N	1875	1880	1886	1890	1893	1899	1902	1906	1912	1916	1920
Switzerland		1933	1939	1947	1951	1957	1974	1981	1994	2001		
	F	1871	1929	1990	2008							
	N	1875	1877	1891	1883	1896	1899	1902	1907	1918	1925	1929
UK		1938	1943	1951	1957	1979	2010					
	F	1873	1889	1973	1990	2007						
	N	1875	1887	1889	1895	1901	1909	1913	1916	1918	1926	1937
USA		1944	1948	1953	1957	1969	1973	1979	1981	1990	2000	
	F	1873	1882	1892	1906	1929	2007					

Note: This table is reproduced from Funke *et al.* (2016)

TABLE A5: **Non-financial Macro-Economic Disasters, 1870-2014**

Australia	1881	1889	1896	1926	1981			
Belgium	1913	1916	1942					
Canada	1877	1884	1913	1917	1928	1944	1953	1981
Denmark	1877	1884	1914	1916	1939	1944	1953	1981
Finland	1890	1913	1916	1938	2008	2011		
France	1892	1909	1912	1920	1939	1942	2012	
Germany	1879	1913	1922	1943				
Italy	1918	1939	1974	2010				
Japan	1880	1887	1890	1895	1898	1919	1929	1940
		1973	2007					
Netherlands	1873	1913						
Norway	1873	1916	1939	1941				
Portugal	1916	1927	1934	1939	1973			
Spain	1873	1877	1894	1909	1935			
Sweden	1916	1939						
Switzerland	1875	1890	1893	1916	1920	1939	1957	1974
UK	1907	1918	1925	1929	1943			
USA	1895	1913	1918	1937	1944	1957	1981	

Note: This table is reproduced from Funke et al. (2016). It shows a sub-sample of non-financial macro-economic disasters from the normal recessions listed in Table A4. Non-financial macro-economic disasters are defined as normal recessions where the yearly real per capita GDP percentage loss is higher than the average in financial crisis recessions. Thresholds are calculated separately for the pre-World War II sample (-3.35%) and the post-World War II sample (-2.55%).

TABLE A6: **Local Projections of Stock Prices Index**

(a) Full Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-7.87***	-7.21***	-6.44	-5.25	-5.01
	(2.11)	(2.46)	(3.76)	(3.75)	(2.88)
Normal Recession	-1.62***	-2.64**	-1.87	-1.44	-1.39
	(0.50)	(0.97)	(1.09)	(1.72)	(1.74)
Non-financial Disaster	-0.93	-3.42	-4.79*	-2.88	-3.11
	(1.63)	(2.52)	(2.47)	(2.76)	(2.55)
H_0: Financial=Normal;p-value	0.01	0.15	0.26	0.31	0.25
H_0: Financial=Disaster;p-value	0.02	0.43	0.77	0.55	0.62
R^2	0.069	0.088	0.119	0.131	0.149
Obs.	1965	1945	1927	1910	1893
(a) Pre-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-4.46**	-5.65*	-4.48*	-1.72	-2.94
	(1.76)	(3.15)	(4.94)	(5.06)	(3.99)
Normal Recession	-1.80*	-3.02**	-2.80	-1.71	-2.67
	(1.01)	(1.05)	(1.97)	(3.02)	(2.51)
Non-financial Disaster	1.21	-2.33	-3.27	-0.67	-0.35
	(2.83)	(1.81)	(2.15)	(3.23)	(2.19)
H_0: Financial=Normal;p-value	0.06	0.42	0.70	1.00	0.94
H_0: Financial=Disaster;p-value	0.12	0.53	0.88	0.56	0.37
R^2	0.088	0.132	0.177	0.187	0.203
Obs.	894	891	890	890	890
(a) Post-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-4.32***	-8.40***	-7.11***	-7.76**	-4.32
	(4.58)	(2.30)	(2.28)	(3.48)	(3.13)
Normal Recession	-2.01**	-2.73**	-1.42	-2.14	-0.69
	(0.93)	(1.07)	(1.14)	(2.25)	(2.40)
Non-financial Disaster	-5.62*	-6.61	-10.35	-13.50	-13.88
	(3.03)	(4.98)	(6.47)	(9.13)	(8.10)
H_0: Financial=Normal;p-value	0.01	0.04	0.02	0.07	0.16
H_0: Financial=Disaster;p-value	0.15	0.78	0.57	0.48	0.21
R^2	0.134	0.148	0.201	0.250	0.283
Obs.	1071	1054	1037	1020	1003

Note: Robust standard errors (clustered by country) are in parentheses. Results correspond to local projections of cumulative change in 100 times the logged variable relative to peak for year 1–5 of the financial recession(first row), normal recession (second row), and non-financial macro disaster (third row). The top panel (a) covers the periods during 1870–2014 excluding World War II years (1939–1949), the middle panel (b) ranges the years 1870–1938, and the bottom panel (c) covers years 1950–2014. Financial = normal (disaster) tests the null that coefficients for each type of recession are the same with regards to intercept terms in the first and second (third) rows. In each instance, p-value is provided. The controls are contemporaneous and 1-year lagged values of the growth of GDP per capita and the CPI inflation rate at peak (coefficients are not reported). See text.* p <0.10, ** p <0.05, *** p <0.01.

TABLE A7: **Local Projections of Construction Costs**

(a) Full Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-0.52	-1.32***	-1.66**	-1.74*	-1.61
	(0.30)	(0.34)	(0.64)	(0.81)	(1.23)
Normal Recession	-0.97***	-1.87***	-1.92***	-1.77***	-2.30***
	(0.16)	(0.35)	(0.38)	(0.41)	(0.42)
Non-financial Disaster	-1.13***	-2.04***	-2.67***	-2.70***	-2.74***
	(0.30)	(0.58)	(0.60)	(0.70)	(0.72)
H_0: Financial=Normal;p-value	0.26	0.33	0.74	0.97	0.58
H_0: Financial=Disaster;p-value	0.07	0.17	0.17	0.31	0.35
R^2	0.101	0.099	0.107	0.119	0.143
Obs.	1345	1328	1311	1295	1279
(a) Pre-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-0.40	-0.68	-0.32	0.01	0.12
	(0.55)	(0.81)	(1.31)	(1.74)	(1.94)
Normal Recession	-1.01***	-1.58***	-1.10**	-0.67**	-1.63**
	(0.34)	(0.53)	(0.37)	(0.24)	(0.58)
Non-financial Disaster	-0.48	-0.27	-1.02	-0.72	-0.73
	(0.38)	(0.49)	(0.86)	(0.85)	(0.83)
H_0: Financial=Normal;p-value	0.27	0.36	0.58	0.69	0.38
H_0: Financial=Disaster;p-value	0.65	0.80	0.51	0.66	0.59
R^2	0.135	0.180	0.191	0.203	0.240
Obs.	477	474	471	469	467
(a) Post-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-0.32	-1.32**	-2.18**	-2.44*	-2.30
	(0.35)	(0.60)	(0.89)	(1.15)	(1.34)
Normal Recession	-0.69**	-1.51***	-1.79***	-1.79***	-1.87***
	(0.23)	(0.47)	(0.51)	(0.58)	(0.61)
Non-financial Disaster	-1.57***	-3.77***	-3.76***	-4.02**	-3.90**
	(0.45)	(1.17)	(1.17)	(1.45)	(1.56)
H_0: Financial=Normal;p-value	0.27	0.76	0.63	0.54	0.74
H_0: Financial=Disaster;p-value	0.05	0.07	0.26	0.38	0.44
R^2	0.189	0.214	0.240	0.258	0.278
Obs.	868	854	840	826	812

Note: Robust standard errors (clustered by country) are in parentheses. Results correspond to local projections of cumulative change in 100 times the logged variable relative to peak for year 1–5 of the financial recession(first row), normal recession (second row), and non-financial macro disaster (third row). The top panel (a) covers the periods during 1870–2014 excluding World War II years (1939–1949), the middle panel (b) ranges the years 1870–1938, and the bottom panel (c) covers years 1950–2014. Financial = normal (disaster) tests the null that coefficients for each type of recession are the same with regards to intercept terms in the first and second (third) rows. In each instance, p-value is provided. The controls are contemporaneous and 1-year lagged values of the growth of GDP per capita and the CPI inflation rate at peak (coefficients are not reported). See text.* p <0.10, ** p <0.05, *** p <0.01.

TABLE A8: **Local Projections of Residential Land Price**

(a) Full Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-5.83	-12.30	-16.40	-13.05	-24.69**
	(2.92)	(6.50)	(8.49)	(7.57)	(6.33)
Normal Recession	-0.80	-0.50	-1.18	-1.18	-0.75
	(0.48)	(1.08)	(1.19)	(1.46)	(1.98)
Non-financial Disaster	-0.51	1.50	-2.45	-3.53	-5.14
	(0.31)	(1.11)	(2.80)	(4.39)	(4.33)
H_0: Financial=Normal;p-value	0.16	0.13	0.16	0.21	0.03
H_0: Financial=Disaster;p-value	0.11	0.06	0.05	0.01	0.00
R^2	0.284	0.277	0.279	0.255	0.240
Obs.	269	263	257	251	245
(a) Pre-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-1.33	-1.40	-0.29	-1.66	-1.46
	(0.82)	(0.99)	(0.08)	(0.63)	(0.67)
Normal Recession	-0.63	-0.84	-0.82	-0.32	1.34
	(0.19)	(0.37)	(0.76)	(1.54)	(0.89)
Non-financial Disaster	-1.16	0.95	-1.80	-4.12	-1.74
	(2.07)	(3.43)	(3.44)	(2.40)	(4.99)
H_0: Financial=Normal;p-value	0.47	0.17	0.58	0.38	0.05
H_0: Financial=Disaster;p-value	0.96	0.46	0.66	0.51	0.97
R^2	0.446	0.460	0.593	0.624	0.633
Obs.	47	47	47	47	47
(a) Post-WWII Sample	Year1	Year2	Year3	Year4	Year5
Financial Recession	-5.89	-12.89	-17.13	-12.08	-31.27***
	(3.95)	(7.55)	(9.23)	(10.42)	(2.21)
Normal Recession	-0.19	0.26	-0.15	0.55	1.23
	(0.52)	(1.25)	(1.53)	(1.72)	(2.09)
Non-financial Disaster	-0.47	1.02	2.65	3.49	4.15
	(0.47)	(0.73)	(2.11)	(3.16)	(2.92)
H_0: Financial=Normal;p-value	0.22	0.16	0.15	0.32	0.00
H_0: Financial=Disaster;p-value	0.22	0.10	0.06	0.09	0.00
R^2	0.308	0.326	0.355	0.361	0.383
Obs.	222	216	210	204	198

Note: Robust standard errors (clustered by country) are in parentheses. Results correspond to local projections of cumulative change in 100 times the logged variable relative to peak for year 1–5 of the financial recession(first row), normal recession (second row), and non-financial macro disaster (third row). The top panel (a) covers the periods during 1870–2014 excluding World War II years (1939–1949), the middle panel (b) ranges the years 1870–1938, and the bottom panel (c) covers years 1950–2014. Financial = normal (disaster) tests the null that coefficients for each type of recession are the same with regards to intercept terms in the first and second (third) rows. In each instance, p-value is provided. The controls are contemporaneous and 1-year lagged values of the growth of GDP per capita and the CPI inflation rate at peak (coefficients are not reported). See text.* p <0.10, ** p <0.05, *** p <0.01.

A9: **More on Crises Explained: Normal Recessions, Financial Crisis and Non-Financial Recessions**

Following Funke et al. (2016) and Jordá et al. (2013) this study identifies recessions according to the Bry and Boschan (1971) algorithm. The algorithm for annual frequency data follows an easy process for identifying local minima in an upward trending real GDP per capita. Each minimum is labelled as a trough and the preceding maximum as a peak. Recessions are identified as the period between a peak and a subsequent trough and expansions are characterized in the opposite way, trough-to-peak.

First, the recession years were sorted into *financial crisis recession* 'F' which coincide with a major financial crisis (identification of financial crisis are discussed in section 3) and *normal recessions* 'N' - those with no proximity to financial crisis, *per se*. More specifically, we call a recession *financial* if a major financial crisis erupts within the two year window (before or after) a peak of the cycle. This benchmarking exercise between normal and financial recessions offers us with cleaner identification of the effects of financial crises instead of comparing financial crises years to a counterfactual of all other years.

As the final step of sorting recessions; since normal recessions are usually less acute than financial recessions, we also compare financial recession to a subset of normal recessions that are particularly deep. Hence, in the spirit of Barro (2006) and Barro and Ursúa (2012) this study performs a second benchmarking exercise to compare the asset price aftermath of financial recessions with sever non-financial recessions (popularly named as 'rare macroeconomic disaster').These deep recessions are more severe than average financial crisis recession, i.e., the yearly percentage fall in GDP per capita exceeds the respective threshold of 3.35% in pre-WWII and 2.55% in post-WWII samples. Accordingly in local projections, this study has subjected the economies to three different 'treatments': recessions coupled with a systematic financial crisis, normal recessions and other (non-financial) macro disasters.