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Labour market fluctuations and the housing net worth channel in the EU

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Abstract

The credit-driven housing net worth channel has been identified as a determinant of the sharp drop in US employment between 2007 and 2009. We examine the impact of this channel on the labour market in the EU using panel data for 20 countries covering the period 1996 to 2017. This period saw substantial changes in both credit provision and labour market performance in the EU. The full sample results show changes in housing net wealth having a significant influence on total employment and its traded and non-traded components, with a one per cent change in housing net wealth being associated with about a 0.2 per cent change in total employment. Coefficient values are larger when changes in non-traded employment are the dependent variable, while the wealth effect is greater when negative housing net wealth shocks occur. In contrast to the US evidence, we find significant wage responses to housing net worth shocks arising in the EU.

Keywords: Housing Net Worth, Employment, Wages.

JEL codes: E24, E32, E51.

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1. Introduction

The credit-driven housing net worth (HNW) channel is established as having a significant impact on macroeconomic and labour variables in the US and internationally (Mian *et al.* (2013), Mian and Sufi (2014, 2017, 2018). As postulated in those contributions, changes in housing net worth that occur through a direct wealth effect arising from a fall in house prices, or tighter borrowing constraints reflecting lower collateral values, affect economic activity and, in the case of labour markets, cause a decline in employment. The channel primarily operates through household behaviour. The contention is that when households (i.e., homeowners) are highly leveraged, any reduction in house prices causes a fall in their consumption expenditure and that then feeds through into labour markets and the wider economy. The most high-profile empirical assessments of the channel have been conducted with US data.[1] Mian and Sufi (2014) contend that the deterioration in household balance sheets was critical to the decline in US employment over the period 2007–2009. At that time, a sharp fall in housing net wealth suppressed households' consumption expenditure through direct wealth effects and tighter borrowing constraints arising from the decrease in collateral value available to them. Mian and Sufi's research shows that this had a significant effect on the US labour market; in particular, counties with larger falls in housing net worth saw a bigger decline in non-traded employment.

In this paper, we use changes in housing net worth, calculated using OECD and other data, to assess the validity of the HNW channel in 20 EU countries over the period 1996 to 2017. In particular, the net worth data are used to explain labour market developments in this block of countries, i.e. to assess the role and significance of the channel in shaping employment and wage developments. While Mian and Sufi conceive of the HNW channel as an influence on economic activity during a downturn in the housing market and wider economy, the panel and the time period covered here allows us to assess the relevance of the housing net worth variable in Europe in both good times and bad times. Within our sample, positive changes in housing net worth occur predominantly in the pre-2008 period, a time when credit conditions were, in general, lax and European economies were on the upside of the economic cycle. Negative housing net worth observations arise predominantly after the severe financial shock of 2008, when credit conditions facing households were more restrictive. Consequently, not only does

[1] Using a 22-country OECD panel, Cronin and McQuinn (2021) confirm the relevance of the HNW channel to consumption beyond the United States.

our sample provide an opportunity to examine the housing net wealth channel in Europe but it also allows an examination of whether it is more or less relevant when such wealth is increasing or decreasing.[2]

We find a positive relationship between changes in the housing net worth variable and changes in employment. The full sample estimated elasticity of non-traded employment to net housing worth is about 0.25. This rises to about 0.4 when negative wealth shocks occur, which is broadly similar to Mian and Sufi's (2014) estimate for the US. There are also notable differences to Mian and Sufi. For the sample period as a whole, the credit-driven housing demand channel has a significant impact on total employment. The channel also operates through both the tradable and non-tradable sectors of the economy with a larger effect observed in the latter. This stands in contrast to Mian and Sufi's (2014) empirical finding that the effects of the channel occur in the non-traded component of the US economy only, but it is not out of line with their view that the effects of the channel can occur in both sectors with the greater impact arising in the non-traded sector. We then break up the dataset on the basis of whether the observed change in housing net wealth is negative or not. The econometric results indicate that the channel has a larger effect on employment when negative housing shocks occur. The channel affects wage growth irrespective of whether the change in housing net wealth is positive or negative.

The rest of the paper is structured as follows. The next section considers how credit conditions, which affect housing net worth, changed in the EU over the period 1996 to 2017. Section 3 then describes the data and methodology used in the econometric analysis. In section 4, the effects of the HNW channel on employment are presented and discussed. Section 5 considers how the channel operated on wage developments over the sample period. Section 6 concludes by drawing together the import of the results presented in the paper.

2. Changing credit provision and the housing net worth channel

The credit-driven household demand channel, as outlined by Mian and Sufi (2018), has the principal characteristic that an expansion in credit supply results in a boom-bust cycle in both household debt and economic activity, with a large accumulation of household debt in the pre-

[2] A significant literature exists examining the relationship between housing markets, credit provision and the real economy across countries. Examples include, but are not confined to, Goodhart and Hofmann (2008), Musso *et al.* (2011), Aron *et al.* (2012) and Kishor and Marfatia (2017).

recession period followed by a substantial decline in asset prices and consumption. Greater credit provision affects the real economy through an increase in household debt, as opposed to a rise in the productive capacity of firms. The downturn in economic activity that follows initially occurs through a fall in household demand and is then exacerbated by "nominal rigidities, constraints on monetary policy, banking sector disruptions and legacy distortions from the boom" (Mian and Sufi (2018, p. 32)).

The financial crisis of 2008 led to a growing interest not just in the impact that changes in total household wealth have on consumption but in the role played by household debt in that relationship. Dynan (2012), Christelis *et al.* (2015), Baker (2018), and Le Blanc and Lydon (2019) note that differences in indebtedness across households or regions can lead to variations in the relationship between consumption and wealth shocks. On the other hand, Kaplan *et al.* (2020) argue that, after controlling for the drop in house prices, only a relatively minor, independent effect of initial housing exposure and initial leverage is found on non-durable expenditure.

Whilst a boom and bust in credit expansion over the period 1996–2017 arose internationally, the case of European countries stands out. Prior to the introduction of the euro, those countries had seen some changes in how credit is provided to households and other sectors of the economy. International financial markets had been the subject of substantial liberalisation and heightened competition in the 1980s and 1990s that had the effect of easing the liquidity constraints facing households (Boone *et al.*, 2001). These changes in financial markets included the removal of credit ceilings, interest rate deregulation, and the taking away of barriers to competition among credit institutions. There were also financial innovations in banking (e.g., securitisation) and important policy initiatives (e.g., the Second Banking Directive in EU countries) at that time.

The origination and introduction of the single currency in the late 1990s improved further the extension of credit to EU households with Mian *et al.* (2017) citing the introduction of the euro as a positive credit supply shock in Europe. Le Leslé (2012) and McCarthy and McQuinn (2017) argue that fewer regulatory controls, market innovations and, in particular, the onset of cross-border lending between credit institutions as a result of the euro had a substantial effect on credit provision. A deeper and more integrated bond market after 1999 improved the funding choices of European financial institutions by allowing for the use of more market-based capital structures, thereby enabling institutions with a surplus of funds to lend to those

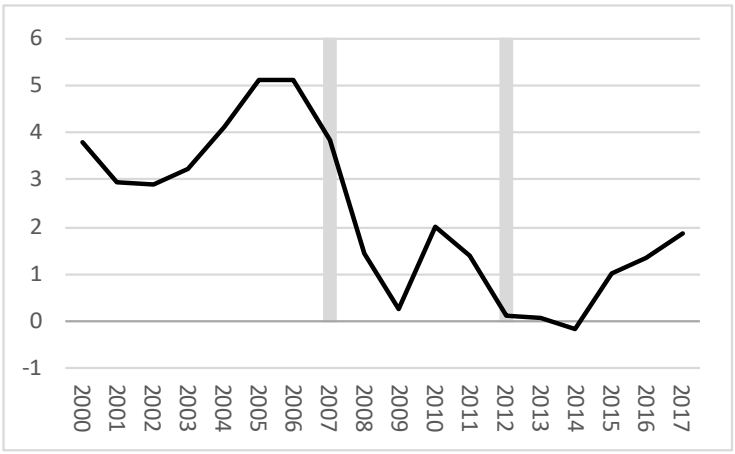
in deficit. The euro is also one of the reasons why European financial institutions tend to be more procyclical in their loan-loss provisioning compared to institutions in other developed countries (Huizinga and Laeven, 2019). Furthermore, the single currency limits potential real exchange rate adjustment in euro area member states, removing a stabilising influence on credit conditions in the face of output shocks. Huizinga and Laeven (2019) conclude that the sensitivity of provisioning to output growth has significant implications for bank lending in Europe, finding that loan growth is related positively to bank capitalization and negatively to loan-loss reserves. Against this background, EU countries, both within the euro area and those outside of it, operate in credit markets that are sensitive to financial and economic shocks.

Antoshin *et al.* (2017) provide an in-depth study and chronology of the relationship between credit growth and economic developments in Europe since the introduction of the euro. They subdivide the period 1999 to 2017 into three distinct phases: gradual acceleration and boom (1999–2008), bust (2009–11), and a sluggish recovery (2012–17). They conclude that almost a decade after the Great Financial Crisis took hold in 2008, bank lending and economic activity in Europe had only partially recovered from that shock with restricted credit flows being the norm in 2017. This, in large part, reflects recovery from boom-bust episodes occurring against persistent, weaker financial market conditions.[3]

Developments in the extension of euro area credit to households can be illustrated further through Figure 1, which covers the period 2000 to 2017. The chart plots the total amount of loans extended within the euro area to households as a percentage of euro area GDP each year. From the chart, three different sub-periods of credit extension are apparent. The initial phase 2000–2007 witnessed strong growth in credit extension to the household sector, with annual growth rates of close to, or above, 3 per cent. The second period, 2008–2011, was one of low, or stagnant, loan growth to households. The subsequent post-crisis recovery period of 2012–2017 initially saw no new loan growth. A pickup did subsequently occur, but not at pre-2008 rates.

[3] Everaert *et al.* (2015) document how the credit boom-bust that occurred in the euro area also occurred in Central, Eastern, and Southeastern Europe (CESEE). Credit expanded strongly in that bloc of countries between 2003 and 2008 in the context of convergence towards, and integration with, the rest of Europe. Credit growth then paused or became negative with the ratio of credit to GDP remaining broadly unchanged between 2009 and 2012 as households were over-indebted and banks exercised tighter lending policies.

Figure 1. Loans to euro area households (as a percentage of GDP)



Source: European Central Bank (ECB) and European Commission.

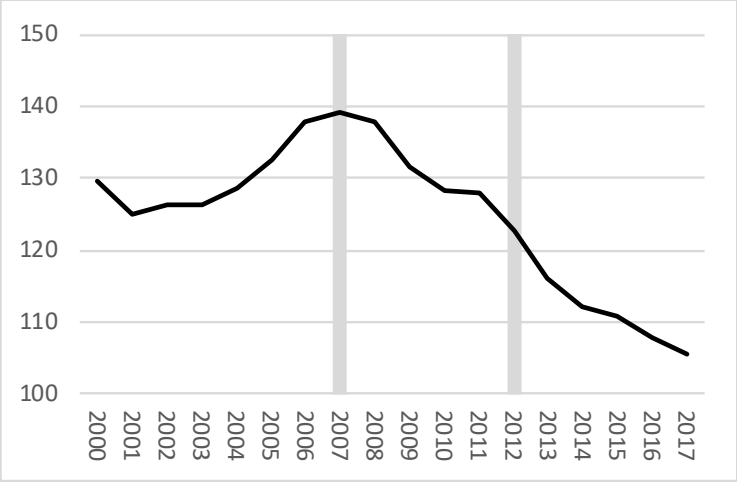
Note: the shaded bars indicate the breakdown of the sample into 2000-2007, 2008-2011, and 2012-2017 sub-periods. The vertical axis is measured in percentage points and the horizontal axis shows years.

For the initial phase (1996-2007) in the credit cycle considered here, the sustained increase in lending was not accompanied by a rise in traditional deposits. Instead, the growing gap between loans and deposits was financed by banks through a greater use of market-based funding in the form of debt securities and borrowing on the money market. Within the euro area, the abolition of exchange rate risk between countries greatly facilitated the use of such funding across member countries. To illustrate the growing gap between traditional deposits and total lending, Figure 2 plots the ratio of total loans to total deposits of euro area households and non-financial corporations (NFCs) over the period from 2000 to 2017. A clear wedge emerges between deposits and loans over time with the ratio rising to almost 140 per cent by end-2007. The emergence of the gap between traditional deposits and credit rendered many European financial institutions, as well as households and firms, particularly vulnerable to the impact of the financial crisis that took effect in 2007/8 and precipitated a significant degree of deleveraging across the European financial system over the period 2008-2011. As Figure 2 shows, the loan-to-deposit ratio declined in the years after 2007 and had a value of 105 per cent by 2017. The adverse effect on European credit provision during those years is noted by Feyen *et al.* (2012), Giannetti and Laeven, (2012), Altavilla *et al.* (2019) and Acharya *et al.* (2018).

The nexus between the banking and sovereign sectors in many euro area member states prolonged the impact of the initial financial shock, with the cost of financial support provided to banks by state authorities and the effects of the crisis on the sustainability of the public finances causing severe disruption to European sovereign bond markets. The impact of the financial crisis on European economies culminated with countries such as Greece and Portugal

entering official support programmes in 2011. The scale of financial distress prior to 2012 inevitably had consequences for the recovery period in the euro area and the EU more generally thereafter. As noted in Antoshin *et al.* (2017), bank lending in Europe after the financial crisis has been subdued, and they contend that much of the economic recovery experienced by European countries after 2012 was "credit-less" in nature.[4]

Figure 2. Loan to deposit ratio for euro area households and NFCs (%)



Source: European Central Bank (ECB)

Note: Entries are end-year values. The shaded bars indicate the breakdown of the sample into 2000-2007, 2008-2011, and 2012-2017 sub-periods. The vertical axis is measured in percentage points and the horizontal axis shows years.

3. Data and methodology

There have then been significant fluctuations in the amount of credit extended to households across European countries over the period 1996 to 2017, which beggars an assessment of the relationship between European labour markets and the housing net worth channel over this period. Following Mian-Sufi (2014), the basic regression specification used below is:

$$\Delta ln E_{i,t}^{S} = \alpha_i + \tau_t + \delta \Delta HNW_{i,t} + \varepsilon_{i,t} \qquad (1)$$

Where $\Delta \ln E_{i,t}^{S}$ is the change in the natural log of employment in sector S of country i in year t, $\Delta HNW_{i,t}$ is the change in housing net wealth in country i in year t, α_i, τ_t and δ are coefficients (α applies for the pooled regressions below) and ε is an idiosyncratic error term. As well as

[4] The term "credit-less" recovery is attributed to Calvo *et al.* (2006a, 2006b) and Claessens *et al.* (2009).

considering total employment (TOT), we also consider employment in the traded ($TRAD$) and non-traded ($NTRAD$) sectors.

The annual change in housing net wealth, $\Delta HNW_{i,t}$, is the product of the change in the natural logs of house prices between years $t-1$ and t for country i and the ratio of the value of dwellings to the value of household total net worth in year $t-1$ for country i. More formally, in line with Mian *et al.* (2013), the change in housing net wealth between year $t-1$ and t for country i is as follows:

$$\Delta HNW_{i,t} = \frac{(\ln(HP_{i,t}) - \ln(HP_{i,t-1})) * H_{i,t-1}}{NW_{i,t-1}} = \frac{\Delta HP_{i,t} * H_{i,t-1}}{NW_{i,t-1}} \quad (2)$$

Where HP is the house price, H is housing assets, NW is household net worth, $\Delta HP_{i,t}$ represents $\ln(HP_{i,t}) - \ln(HP_{i,t-1})$, and net wealth at the end of year $t-1$ is defined as:

$$NW_{i,t-1} = S_{i,t-1} + B_{i,t-1} + H_{i,t-1} - D_{i,t-1}$$

Where S, B and D are the household sector's outstanding savings, bond holdings and debt levels owed, respectively. This captures the total household balance sheet. The $\Delta HNW_{i,t}$ variable thus scales the change in house prices, $\Delta HP_{i,t}$, by the lagged ratio of housing assets to household net wealth, $(\frac{H_{i,t-1}}{NW_{i,t-1}})$. This scaling allows one to capture the shock to total net worth that comes just from a shock to house prices (Mian *et al.*, 2013, p. 1701).

One issue, which has been cited in the application of the Mian and Sufi framework, is their use of expensive and hard-to-access proprietary data. This, inevitably, poses difficulties in replicating their empirical results. Therefore, along with Kaplan *et al.* (2020), we regard our application as also serving as a robustness check on their findings as all of our data are available from official sources.[5] In terms of the sources of the data used here, the OECD provides, on an annual basis, measures of household net worth as a percentage of net disposable income.[6] The coverage is for the years between 1995 and 2017, although data are not available for all years for each country. This timeframe then affects the overall sample size employed in the regression analysis. Household total net worth is measured by the OECD as "the total value

[5] The use of country-level data may mask the type of geographical differences within individual countries that Mian and Sufi consider in their US studies of the housing net worth channel. By the same token, there is a heterogeneity of market and institutional differences between countries in the sample here.

[6] Source: https://data.oecd.org/hha/household-net-worth.htm (accessed: 23 May 2022).

of assets (financial and non-financial) minus the total value of outstanding liabilities of households (including non-profit institutions serving households)".[7] Net disposable income data from the EU AMECO database are used to convert household net worth from a percentage of net disposable income to a domestic currency measure, thus providing the measure of NW.[8] The value of dwellings, which is measured in domestic currency, is sourced as series N1111 from Table 9b ("Balance sheets for non-financial assets, 2019 archive") of the OECD Financial Accounts Archive and provides the measure of H for each country.[9]

The house price series is compiled from two sources: house price levels for most years are taken from Bricongne *et al.* (2019) and observations for the remaining years are generated from the cross-country house price indices of Mack and Martínez-García (2011).[10] [11] House price coverage is not as extensive as for the dwellings-to-household total net worth ratio and, consequently, it dictates the country coverage of the ΔHNW_t series (and that of the other variables used in the regressions below).

Three change-in-employment variables are used as alternative regressands in equation (1), namely changes in total employment and in its two components: traded employment and non-traded employment. These two components are used as Mian and Sufi (2014, p. 2198) argue that is it a "natural prediction" of the HNW channel theory that traded employment should not be as strongly positively correlated with a change in housing net wealth as non-traded employment. The employment data are sourced from the European Commission's New Cronos database. It provides employment data for EU member states at a sectoral level.[12] Following definitions used in Bradford Jensen *et al.* (2005) and Schmillen (2013), we use these sectoral data to construct measures of traded and non-traded employment. Non-traded employment is the sum of employment in nine components of total employment and traded

[7] It also notes that the financial assets and liabilities included are: "currency and deposits; debt securities; loans; equity and investment fund shares/units; insurance, pensions and standardised guarantee schemes; financial derivatives and employee stock options; and other accounts receivable/payable."

[8] https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm (accessed: 23 May 2022).

[9] https://stats.oecd.org/Index.aspx?datasetcode=SNA_TABLE9B_ARCHIVE# (accessed: 23 May 2022).

[10] The particular year varies depending on the country.

[11] The house price indices are used to backcast and forecast the house price level from Bricongne *et al.* (2019). They are part of an international database of house prices for 19 advanced economies available on a quarterly basis from 1975 quarter 1 onwards. The database has been used in a wide variety of studies and further information can be obtained at https://www.dallasfed.org/institute/houseprice#tab3.

[12] https://ec.europa.eu/eurostat (accessed: 23 May 2022).

employment is the aggregate of the remaining 12 categories.[13] Those categories are outlined in Table A.1 in the appendix. In later regressions, the change in total nominal compensation per employee (on a whole economy basis) is used as a left-hand-side variable, with the series taken from the EU AMECO database.[14] Table 1 indicates the country and years coverage in the compiled dataset and used in the regression analysis in subsequent sections.

Table 1. Data coverage for each country

Total observations (*N*)	342
Austria	2001-2017
Belgium	1996-2016
Czechia	2009-2017
Denmark	1996-2017
France	1996-2017
Finland	1996-2016
Germany	1996-2017
Greece	1996-2016
Hungary	2008-2016
Italy	1996-2016
Latvia	2007-2015
Lithuania	1999-2016
Luxembourg	2000-2016
The Netherlands	1996-2017
Poland	2007-2015
Portugal	2009-2016
Slovenia	1997-2016
Slovakia	2007-2016
Sweden	1996-2017
United Kingdom	1996-2017

[13] Sectoral employment data are available at a NACE Rev 1.1 basis from 1983–2008 and at a NACE Rev 2 basis from 2008–2017. The definition of some categories of employment differ between pre-2008 and post-2008 definitions, affecting the construction of the non-traded employment variable. The category "electricity, gas and water supply" is sub-divided into two categories in the later period, as shown in the appendix. A similar procedure follows for the "hotel and restaurants" and "health and social work" categories.

[14] See item 15.1 at https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm (accessed: 23 May 2022).

In Table 2, we present a summary of some of the key variables for each country. Home-ownerships rates in 2019 ranged from 43.6 per cent in Germany to just under 91 per cent in Hungary. Latvia registered the largest yearly average decrease in housing net wealth at -1.7 per cent, while Lithuania experienced the biggest increase at 4.9 per cent.

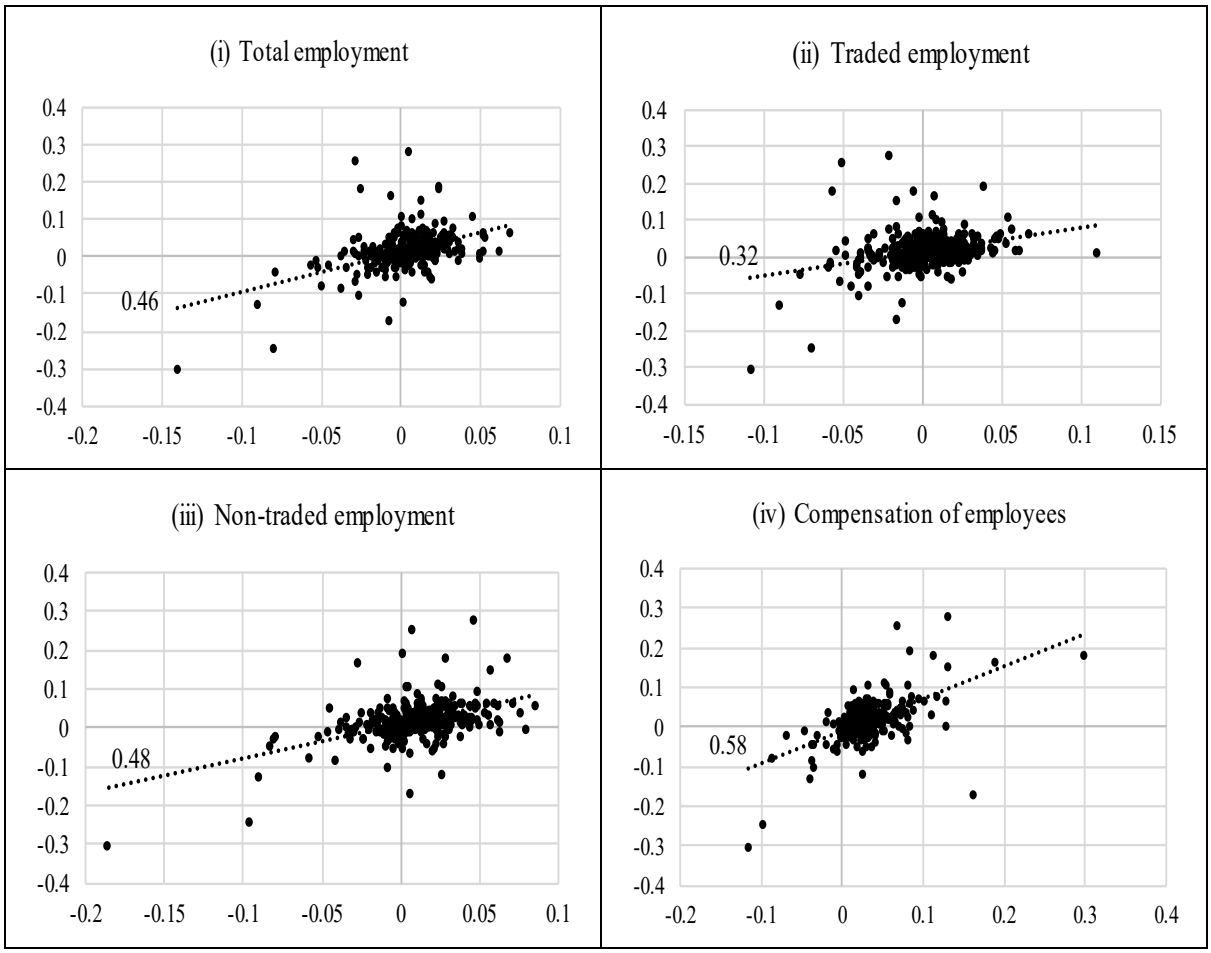
Table 2. Summary of critical data for each country

	(i) Home-ownership rate	(ii) Change in housing net wealth	(iii) Non-traded employmt. as a % of total	(iv) Employmt. growth	(v) Wage growth
Austria	47.6	1.9	41.8	0.7	2.1
Belgium	66.5	1.5	46.0	0.9	2.3
Czechia	75.9	0.9	37.4	0.3	2.7
Denmark	53.2	2.3	46.6	0.2	2.9
France	61.1	2.1	44.9	0.9	2.2
Finland	64.1	3.3	43.4	0.9	2.6
Germany	43.6	0.7	41.8	0.6	1.6
Greece	73	0.6	39.1	0.0	2.8
Hungary	90.9	0.6	39.9	1.0	2.0
Italy	71	0. 6	39.2	0.6	2.3
Latvia	77.7	-1.7	39.4	-0.5	6.4
Lithuania	90.2	4.9	38.5	-0.5	6.3
Luxembourg	67.3	2.4	42.9	2.3	2.8
The Netherlands	58.3	1.5	42.2	1.0	2.5
Poland	81.1	0.5	34.1	0.5	4.4
Portugal	72.3	0.2	40.6	0.4	0.3
Slovenia	74.4	2.9	34.7	0.5	5.4
Slovakia	90.0	1.9	40.8	0.7	3.7
Sweden	57.6	2.2	47.7	0.9	3.3
United Kingdom	65.3	1.6	46.3	0.9	3.4

Note: Homeownership rates are for 2019 and are from the OECD. For columns (ii) to (v), the figure is the average over the sample period in question. The sample period for each country is summarised in Table A.2 in the appendix. All data are expressed in percentage terms.

In Figure 3, we show full-sample scatter plots of the relevant left-hand-side variables (changes in employment and nominal compensation) and changes in housing net wealth, with linear trend lines added. These panels suggest a positive relationship between each labour market variable and housing net wealth, with those relationships quantified on a more formal basis in the next two sections. The negative change-in-housing-net-worth observations are concentrated in the post-2007 sample.

Figure 3. Changes in employment/ nominal compensation per employee and housing net wealth shocks, 20 EU countries, 1996-2017 (unbalanced)



Note: x-axis: log change in employment/nominal compensation variable; y-axis: log change in housing net wealth; sample size: 342 observations. The embedded number in each panel represents the full sample correlation value between the two series.

4. The effect of changes in housing net wealth on employment

Table 3 shows the estimation results of regression specification (1) above, where the alternative dependent variables are changes in the natural logs of total employment (TOT), and of its sub-sectors: traded employment ($TRAD$) and non-traded employment ($NTRAD$). Across the three sets of columns, columns (i) to (iii) are those from a pooled OLS estimation; columns (iv) to (vi) have country fixed effects in all regressions; columns (vii) to (ix) are those where both

country fixed effects and time dummy variables are included. All regressions in Table 3 and subsequent tables (with the exception of Table 5) are estimated with robust standard errors.[15] [16]

In each column of Table 3, the δ coefficient is positive and statistically significant at the one percent level and there is little variation in coefficient values for each particular employment category across estimation methods. As a point of reference, the coefficients on ΔHNW in the columns where non-traded employment is the dependent variable are in a narrow range of 0.255-0.271, which correspond broadly to those in Table III of Mian and Sufi (2014).[17] These coefficient values indicate that a one per cent change in housing net worth is associated with a change in non-traded employment of about one-quarter of one per cent. The estimates of the ΔHNW coefficient here indicate housing net wealth shocks having a larger effect on the non-traded sector compared to the traded sector (the coefficient values for that sector range from 0.129 to 0.165 in Table 3).[18] This is to be expected as changes in housing net wealth will have a greater effect on the non-traded sector, which depends on domestic consumers and their financial circumstances. In contrast, traded employment will depend more on international economic conditions and so the effect of changed housing net wealth on it should be less strong. Nevertheless, at a national level (as opposed to the US county-based analysis of Mian-Sufi, 2014), the channel could have an influence on traded employment, as arises here, as there is an inevitable degree of interaction between the traded and non-traded sectors of the economy.

[15] The final row of Table 3 and subsequent tables includes, where appropriate, F-tests of the significance of fixed effects, be that for country fixed effects alone or the joint significance of country and time fixed effects. These tests rely on estimating both an unrestricted regression specification and one using the restrictions.

[16] We use the "robust errors" command in RATS to cluster the country-level standard errors.

[17] To provide some additional context, Cronin and McQuinn (2021) estimate elasticities of consumption with respect to housing net worth for a similar dataset to that used here and find those elasticities to be comparable in value to those of Mian *et al.* (2013) for the US. Consequently, there is, at a high level, a broad correspondence between the effects of the housing net worth channel on macroeconomic variables between Europe and the US.

[18] A Z-test owing to Clogg *et al.* (1995) is used to test whether the difference in coefficient values on $\Delta HNW_{i,t}$ between the traded and non-traded regressions are statistically significant or not. In Table 3, the coefficients are only statistically significantly different, at the 10 per cent level, between traded and non-traded employment regressions in columns (viii) and (ix).

Table 3. Full sample results: Pooled OLS; Fixed Effects; Fixed Effects and Time-Dummies

Dependent variable: $\Delta lnE_{i,t}$	(i)	(ii)	(iii)		(iv)	(v)	(vi)		(vii)	(vii)	(ix)
Employment category	TOT	TRAD	NTRAD		TOT	TRAD	NTRAD		TOT	TRAD	NTRAD
	Pooled OLS				Fixed Effects				Fixed Effects & Time-Dummies		
$\Delta HNW_{i,t}$	0.199*** (0.052)	0.157*** (0.052)	0.263*** (0.060)		0.208*** (0.041)	0.165*** (0.041)	0.271*** (0.052)		0.179*** (0.043)	0.129*** (0.041)	0.255*** (0.058)
$intercept$	0.002** (0.001)	0.001 (0.004)	0.005*** (0.001)								
Countries	20	20	20		20	20	20		20	20	20
N	342	342	342		342	342	342		342	342	342
Adj. R^2	0.207	0.098	0.228		0.281	0.159	0.253		0.387	0.288	0.277
Fixed effects test (Prob.)					0.000	0.019	0.000		0.000	0.000	0.072

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of employment in sector S of country i in year t on the change in housing net wealth in country i in year t.

As a robustness check, columns (i) to (iii) of Table 4 report the results of the estimation of a variant of (1) as follows:

$$\Delta lnE^{S}_{i,t} = \alpha_i + \tau_t + \delta \Delta HNW_{i,t} + \mu \Delta lnE^{S}_{i,t-1} + \rho CONSHARE_{i,t} + \theta OPENNESS_{i,t} + \sigma RRATE_{i,t} + \varepsilon_{i,t} \quad (3)$$

Columns (iv) to (vi) include a household credit variable, $HCRED$:

$$\Delta lnE^{S}_{i,t} = \alpha_i + \tau_t + \delta \Delta HNW_{i,t} + \mu \Delta lnE^{S}_{i,t-1} + \rho CONSHARE_{i,t} + \theta OPENNESS_{i,t} + \sigma RRATE_{i,t} + \gamma HCRED_{i,t} + \varepsilon_{i,t} \quad (4)$$

These regressions include a lagged dependent variable, $\Delta lnE^{S}_{i,t-1}$. Other variables are added here to control for other possible influences on the change in employment variable. The first is construction's share of total employment, $CONSHARE$. This is included to control for the relative importance of this industry in the economy. This was a sector that was affected more than most during the 2008-2011 downturn (Whitehead *et al.*, 2014). Consequently, it may magnify or add to the effects of a deterioration in housing net wealth on employment and is controlled for. The second control variable, $OPENNESS$, is imports and exports' combined share of GDP, capturing the national economy's exposure to international economic developments.[19] The third control variable is the real rate of interest, $RRATE$.[20] Finally, the variable $HCRED$ is included in the regressions in the final three columns of Table 4.[21] Notwithstanding the significance or insignificance of these control variables for the respective sectors, the coefficients on ΔHNW are broadly unchanged in columns (i) to (iii) of Table 4 compared to those reported in Table 3 with the exception of column (ii) where the coefficient is insignificant. The coefficient on ΔHNW is larger in column (v) compared to column (vi).

As a final set of robustness tests, the Arellano-Bover/Blundell-Bond estimation procedure is applied to regression equation (3). The Arellano-Bover/Blundell-Bond estimator builds on the earlier Arellano and Bond (1991) and Blundell and Bond (1998) dynamic panel estimators. Both those estimators use generalised method of moments (GMM) to address endogeneity

[19] The three series used to calculate the $OPENNESS$ variable are sourced from the EU AMECO database.

[20] The interest rate and inflation (HICP) data are both taken from EuroStat's Newcronos database.

[21] The HCRED variable is total credit extended to the household sector and is taken from the Bank of International Settlements database: https://www.bis.org/statistics/totcredit.htm?m=2669. The data are expressed on a per capita basis. Data on total outstanding residential loans are available for a number of countries from the European Mortgage Federation (2019); however, the coverage is not as complete as for the household credit sector data.

concerns. The Arellano-Bover/Blundell-Bond estimator augments Arellano and Bond (1991) by assuming that the first differences of the instrumental variables are uncorrelated with the fixed effects. This enables the introduction of new instruments, thereby, improving the efficiency of the estimator. The econometric results are reported in Table 5. The coefficient values are significant and the coefficient in the $NTRAD$ column is larger than that in the $TRAD$ column.

Table 4. Full sample results: control and household credit variables included

Dependent variable: $\Delta lnE_{i,t}$	(i)	(ii)	(iii)		(iv)	(v)	(vi)
Employment category	TOT	TRAD	NTRAD		TOT	TRAD	NTRAD
	Fixed Effects & Time Dummies				Fixed Effects & Time Dummies		
$\Delta HNW_{i,t}$	0.123*** (0.042)	0.071 (0.046)	0.212*** (0.049)		0.165*** (0.045)	0.217*** (0.054)	0.125*** (0.058)
$\Delta lE_{i,t-1}$	0.107 (0.071)	0.022 (0.084)	-0.042 (0.062)		0.082 (0.070)	-0.031 (0.072)	-0.058 (0.074)
$CONSHARE_{i,t}$	-0.542*** (0.180)	-0.897*** (0.253)	-0.036 (0.209)		-0.537*** (0.199)	-0.892*** (0.288)	-0.063 (0.243)
$OPENNESS_{i,t}$	0.005 (0.011)	0.001 (0.002)	0.016 (0.019)		-0.007 (0.013)	-0.014 (0.015)	0.005 (0.021)
$RRATE_{i,t}$	-0.003*** (0.001)	-0.003*** (0.001)	-0.004*** (0.001)		-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)
$HCRED_{i,t}$					-0.002 (-0.372)	0.006 (0.005)	-0.019** (0.009)
Countries	20	20	20		16	16	16
N	317	317	317		269	269	269
Adj. R^2	0.487	0.384	0.367		0.467	0.433	0.248
Fixed effects test (Prob.)	0.000	0.000	0.051		0.050	0.000	0.162

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of employment in sector S of country i in year t on the change in housing net wealth in country i in year t, construction share of employment, the openness of the economy, the real interest rate and, in columns (iv) to (vi), total credit extended to the household sector per capita. Both fixed effects and time dummies are included.

Table 5. Full sample results: Arellano-Bover / Blundell-Bond estimation

Dependent variable: $\Delta lnE_{i,t}$	(i)	(ii)	(iii)
Employment category	TOT	TRAD	NTRAD
$\Delta HNW_{i,t}$	0.148*** (0.021)	0.097*** (0.025)	0.249*** (0.028)
$CONSHARE_{i,t}$	-0.571*** (0.131)	-0.893*** (0.154)	-0.138 (0.157)
$OPENNESS_{i,t}$	-0.001 (0.003)	0.005 (0.006)	-0.006 (0.005)
$RRATE_{i,t}$	-0.003*** (0.001)	-0.003*** (0.001)	-0.004*** (0.001)
Countries	20	20	20
N	317	317	317

Note: Standard errors in parentheses. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of employment in sector S of country i in year t on the change in housing net wealth in country i in year t, construction share of employment, the openness of the economy, and the real interest rate.

Mian and Sufi (2014) focus on data from the US recession of 2007-9, a period marked by tight credit conditions and declining housing net wealth. As shown in section 2, such credit conditions were prevalent in the EU after 2007. An inspection of the full sample $\Delta HNW_{i,t}$ data indicates 85 observations of that variable having a negative value and only 13 of those occurring before 2007. To assess whether the influence of the housing net wealth channel on employment wanes or strengthens depending on whether the change in housing net worth is positive or negative, we specify the following equation:

$$\Delta lnE_{i,t}^{S} = \alpha_i + \tau_t + \delta \Delta HNW_{i,t} + \gamma DV_{neg} * \Delta HNW_{i,t} + \varepsilon_{i,t} \qquad (5)$$

Where DV_{neg} has a value of one if $\Delta HNW_{i,t}$ is negative, and a value of zero otherwise.

As before, we estimated this equation with alternative intercept/fixed effects combinations and with the addition of the control variables used in Table 4. In Table 6, we report the estimations of (5) with the alternative intercept/fixed effects combinations. The coefficient values on $\Delta HNW_{i,t}$ are positive and significant in the non-traded employment regressions but not that for traded employment. The coefficients on $DV_{neg} * \Delta HNW_{i,t}$ are positive and significant in all

columns and indicate an effect, and a larger one in the case of the non-traded sector, on employment when the change in housing net wealth is negative.[22]

These results likely arise from the asymmetrical response of consumption and the wider economy to changes in housing net worth and specifically the central role played by house prices and credit conditions in affecting housing net wealth. Many European countries experienced sizeable house price booms in the period leading up to 2007 only for substantial contractions in prices to arise over the following years (see Whitehead *et al.*, 2014, for details). Hviid and Kuchler (2017) and de Roiste *et al.* (2021) argue that asymmetrical housing wealth effects can be explained by the role played by household indebtedness over the residential property market cycle. Depending on where the housing market is in its cycle, either the precautionary savings effect or the collateral effect will prevail in determining household behaviour in relation to consumption and saving. When the market is experiencing an expansionary phase and house prices are increasing, the precautionary motive results in households saving any equity gains that arise and hence consumption does not increase or does so only marginally, with little impact on labour market developments arising from this source. In a downturn, when house prices fall, the resulting collateral effect is more pressing and the increasingly over-indebted position of the household results in reduced consumption and lower employment. Accordingly, the HNW channel having a lesser effect on employment in Table 6 when $\Delta HNW_{i,t}$ is positive may reflect wealth gains being maintained rather than spent by households, while the larger effects on employment when housing net wealth falls may reflect their over-indebtedness and attendant retrenchment in their spending.

Another general feature of the results is the significant effects that the HNW channel has on traded employment, as well as on the non-traded sector. This stands in contrast to Mian and Sufi's (2014) assessment for the US. A possible reason for this difference is that their study is conducted at a county level where, they argue, non-traded employment is heavily dependent on local demand, while the traded sector is dependent on economic conditions at the national and global level. The data examined here are at the national level. It would be reasonable to expect the housing net wealth channel to have a broader effect at the country level and, consequently, to affect demand for traded goods and services.

[22] The results of regressions where $CONSHARE$, $OPENNESS$, $RRATE$ and a lagged dependent variable are added to (5) are available in Table A.3.

In understanding the role of housing net worth within the European Union on broader economic variables, it is worth considering the heterogenous nature of European housing and mortgage markets. Ampudia *et al.* (2016) and European Mortgage Federation (2019), amongst others, have noted the highly fragmented nature of the European Union mortgage market with some countries, for example, relying exclusively on variable rate mortgages, while others rely on long-term finance or a mix of the two. There is also a significant degree of variation across European countries in terms of macroprudential measures introduced after the financial crisis with varying loan-to-value, debt-to-income and debt-service ratios applied. Housing and credit variables may then affect the wider economy differently across European countries.

Table 6. Full sample results with multiplicative dummy: Pooled OLS; Fixed Effects; Fixed Effects and Time-Dummies

Dependent variable: $\Delta lnE_{i,t}$	(i)	(ii)	(iii)		(iv)	(v)	(vi)		(vii)	(vii)	(ix)
Employment category	TOT	TRAD	NTRAD		TOT	TRAD	NTRAD		TOT	TRAD	NTRAD
	Pooled OLS				Fixed Effects				Fixed Effects & Time-Dummies		
$\Delta HNW_{i,t}$	0.053 (0.041)	0.003 (0.061)	0.135*** (0.044)		0.080* (0.044)	0.024 (0.050)	0.166*** (0.052)		0.047 (0.050)	-0.0001 (0.100)	0.120** (0.058)
$DV_{neg} * \Delta HNW_{i,t}$	0.355*** (0.077)	0.375*** (0.079)	0.311*** (0.113)		0.301*** (0.087)	0.333*** (0.090)	0.248** (0.127)		0.297*** (0.092)	0.289*** (0.099)	0.300** (0.127)
$intercept$	0.008*** (0.001)	0.006*** (0.002)	0.009*** (0.002)								
Countries	20	20	20		20	20	20		20	20	20
N	342	342	342		342	342	342		342	342	342
Adj. R^2	0.311	0.187	0.277		0.333	0.208	0.273		0.433	0.321	0.305
Fixed effects test (Prob.)					0.000	0.003	0.000		0.000	0.000	0.009

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of employment in sector S of country i in year t on the change in housing net wealth in country i in year t and a multiplicative dummy variable.

5. The effect of the housing net worth channel on wages

It is possible that labour market adjustment to housing net worth shocks occurs through changes in wages as well as, or as an alternative, to changes in employment. Consequently, we estimate (6) to see whether the HNW channel affects changes in total wages:

$$\Delta lnW_{i,t} = \alpha_i + \tau_t + \vartheta \Delta HNW_{i,t} + \varepsilon_{i,t} \qquad (6)$$

Where W indicates nominal compensation of employees.

Following on regression (6), we also estimate:

$$\Delta lnW_{i,t} = \alpha_i + \tau_t + \vartheta \Delta HNW_{i,t} + \omega DV_{neg} * \Delta HNW_{i,t} + \varepsilon_{i,t} \qquad (7)$$

Where, as previously, DV_{neg} has a value of one if $\Delta HNW_{i,t}$ is negative, and a value of zero otherwise.

The regressions results pertaining to (6) and (7) are shown in Table 7.[23] [24] The full-sample estimates indicate the housing net wealth channel having a positive effect on wage growth, such that an increase (decrease) in housing net worth occurs alongside wages rising (falling). The channel has no smaller or larger effect on wage developments in years when housing net wealth declines.

The HNW channel having an influence on both wages and employment in Europe is somewhat surprising when compared with the US experience and the considerable literature on the comparative flexibility of labour markets in the EU and the US. This may be due to the relatively larger and prolonged impact of the financial crisis on the European economy. A significant literature has compared and contrasted the response of the US authorities to the financial crisis to that of European institutions with Blanchard and Leigh (2012, 2013) and Mody (2015), for instance, arguing that European policymakers' focus on austerity in 2010/2011 impeded and delayed the European recovery. This contrasts with the passage into law in the US in 2009 of the American Recovery and Reinvestment Act (ARRA), the primary

[23] A wage breakdown between the traded and non-traded sectors of the economy was not possible.

[24] The regressions were also augmented by the control variables CONSHARE, OPENNESS and RRATE in a second set of estimations and are reported as Table A.4. The estimates of the coefficient on $\Delta HNW_{i,t}$ do not materially differ from those in Table 7.

objective of which was to support employment measures in light of the post-2007 economic downturn.

Table 7. The housing net worth channel and wages: results

Dependent variable: $\Delta lnW_{i,t}$	(i)	(ii)		(iii)	(iv)		(v)	(vi)
	Pooled OLS			Fixed Effects			Fixed Effects & Time Dummies	
$\Delta HNW_{i,t}$	0.402*** (0.073)	0.483*** (0.101)		0.402*** (0.069)	0.353*** (0.092)		0.396*** (0.071)	0.310*** (0.095)
$DV_{neg} * \Delta HNW_{i,t}$		-0.196 (0.197)			0.116 (0.171)			0.191 (0.162)
$intercept$	0.024*** (0.002)	0.021*** (0.003)						
Countries	20	20		20	20		20	20
N	342	342		342	342		342	342
Adj. R^2	0.318	0.327		0.428	0.429		0.517	0.517
Fixed effects test (Prob.)				0.000	0.000		0.000	0.000

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of nominal wages of country i in year t on the change in housing net wealth in country i in year t.

6. Conclusion

The results in this paper provide an insight into the consequences for European labour markets of shocks to housing net worth. Since the early 1990s, household balance sheets across developed economies have experienced significant changes due to variations in the provision of credit, reflecting the increased integration of the financial sector and the real economy in that period. This leaves the household balance sheet and the influence of credit provision on its housing component having a channel of influence on economic activity. Mian *et al.* (2013)

and Mian and Sufi (2014) quantify the channel as having an effect on US consumption and employment behaviour during the 2007-2009 period.

The opening up of capital markets in Europe from the mid-1990s and the adoption of the single currency at the turn of the century led to many changes within the European financial sector, which, on balance, resulted in a significant increase in the provision of credit across participating countries in the period up to 2008. This period being followed by the sharp downturn in economic and financial conditions between 2008 and 2011 and the period of slow recovery thereafter provides a basis for examining how the housing net worth channel affects economic variables in different circumstances. In some respects, the results presented here for the EU are broadly in line with the Mian and Sufi (2014) investigation of the channel's influence in the US downturn of 2007-2009. We find the HNW channel having a significant impact on employment, with a stronger effect arising in the non-traded sector. This effect is larger during a downturn, which we argue may follow from the contrasting influences of the precautionary savings and collateral effects on household behaviour in response to changes in housing wealth. In contrast to the US evidence, the housing net worth channel has an effect on wage developments in the sample here, which may reflect the relatively prolonged and severe nature of the post-2008 downturn in Europe.

References

Acharya, V., Eisert, T., Eufinger, C., and Hirsch, C. (2018), "Real Effects of the Sovereign Debt Crisis in Europe: Evidence from Syndicated Loans", *The Review of Financial Studies* 31, 2855-96.

Altavilla, C., Paries, M., and Nicoletti, G. (2019), "Loan Supply, Credit Markets and the Euro Area Financial Crisis", *Journal of Banking and Finance*, 109, 105658.

Ampudia, M., Van Vlokhoven, H., and Żochowski, D. (2016), "Financial Fragility of Euro Area Households", *Journal of Financial Stability*, 27, 250-262.

Antoshin, S., Arena, M., Gueorguiev, N., Lybek, T., Ralyea, J., and Yehoue, E. (2017), "Credit Growth and Economic Recovery in Europe After the Global Financial Crisis", Working Paper WP/17/256, International Monetary Fund.

Arellano, M. and Bond, S. (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations", *Review of Economic Studies,* 58, 2, 277-297.

Aron, J., Duca, J., Muellbauer, J., Murata, K., and Murphy, A. (2012), "Credit, Housing Collateral and Consumption: Evidence from the UK, Japan and the US", *Review of Income and Wealth*, 58, 3, 397-423.

Baker, S. (2018), "Debt and the Response to Household Income Shocks: Validation and Application of Linked Financial Account Data," *Journal of Political Economics*, 126(4), 1504–1557.

Blanchard, O. and Leigh, D. (2012), "Are We Underestimating Short-Term Fiscal Multipliers?", Box 1.1 in International Monetary Fund World Economic Outlook, October 2012, Washington D.C.: International Monetary Fund.

Blanchard, O. and Leigh, D. (2013), "Growth Forecast Errors and Fiscal Multipliers", *American Economic Review,* 103, 3, 117-20.

Blundell, R. and S. Bond (1998), "Initial Conditions and Moment Restrictions in Dynamic Panel Data Models", *Journal of Econometrics,* 87, 1, 115–143.

Boone, L., Girouard, N. and Wanner, I. (2001), "Financial Market Liberalisation, Wealth and Consumption", Working Paper 308, Organisation for Economic Co-operation and Development.

Bradford Jensen, J., Kletzer, L.G., Bernstein, J. and Feenstra, R.C. (2005), "Tradable Services: Understanding the Scope and Impact of Services Offshoring", Brookings Trade Forum Offshoring White-Collar Work, 75-133.

Bricongne, J.C., Turrini, A. and Pontuch, P. (2019), "Assessing House Prices: Insights from "Houselev", A Dataset of Price Level Estimates", Discussion Paper 101, European Commission.

Calvo, G., Izquierdo, A. and Talvi, E. (2006a), "Sudden Stops and Phoenix Miracles in Emerging Markets", *American Economic Review* 96, 405–10.

Calvo, G., Izquierdo, A. and Talvi, E. (2006b), "Phoenix Miracles in Emerging Markets: Recovering without Credit from Systemic Banking Crises", Working Paper 12101, National Bureau of Economic Research.

Clogg, C., Petkova, E. and Haritou, A. (1995), "Statistical Methods for Comparing Regression Coefficients Between Models", *American Journal of Sociology*, *100*(5), 1261-1293.

Christelis, D., Georgarakos, D. and Jappelli, T. (2015), "Wealth Shocks, Unemployment Shocks and Consumption in the wake of the Great Recession," *Journal of Monetary Economics*, 72, 21–41.

Claessens, S., Kose, M.A. and Terrones, M.E. (2009), "What Happens During Recessions, Crunches and Busts?", *Economic Policy* 24, 653–700.

Cronin, D., and McQuinn, K. (2021). "Consumption and Housing Net Worth: Cross-country Evidence", *Economics Letters*, 209, 110140.

De Roiste, M., Fasianos, A., Kirkby, R. and Yao, F. (2021), "Are Housing Wealth Effects Asymmetric in Booms and Busts?", *The Journal of Real Estate Finance and Economics*, 62, 578-628

Dynan, K. (2012), "Is a Household Debt Overhang Holding Back Consumption," *Brookings Papers on Economic Activity*, 43(1), 299–362.

European Mortgage Federation (2019), Hypostat 2019: A Review of Europe's Mortgage and Housing Markets. Available online at:
https://hypo.org/app/uploads/sites/3/2019/09/HYPOSTAT-2019_web.pdf

Everaert, G., Che, N., Geng, N., Gruss, B., Impavido, G., Lu, Y., Saborowski, C., Vandenbussche, J. and Zeng, L. (2015), "Does Supply or Demand Drive the Credit Cycle? Evidence from Central, Eastern, and Southeastern Europe", Working Paper WP/15/15, International Monetary Fund.

Feyen, E., Kibuuka, K. and Ötker-Robe, I. (2012), "Bank Deleveraging: Causes, Channels, and Consequences for Emerging Market and Developing Countries", Working Paper 6086, World Bank.

Giannetti, M., and Laeven, L. (2012), "The Flight Home Effect: Evidence from the Syndicated Loan Market during Financial Crises", *Journal of Financial Economics* 104, 23-43.

Guerrieri C. and C. Mendicino (2018). "Wealth Effects in the Euro Area", European Central Bank (ECB) Working Paper No 2157 / June.

Goodhart, C., and Hofmann, B. (2008), "House Prices, Money, Credit and the Macroeconomy", *Oxford Review of Economic Policy*, 24, 1, 180-205.

Huizinga, H. and Laeven, L. (2019), "The Procyclicality of Banking: Evidence from the Euro Area", *IMF Economic Review*, 67, 3, 496-527.

Hviid, S. and Kuchler, A. (2017), "Consumption and Savings in a Low Interest-rate Environment", Working Paper 116, Danmarks National Bank.

Kaplan, G., Mitman, K., and Violante, G. (2020), "Non-durable Consumption and Housing Net Worth in the Great Recession: Evidence from Easily Accessible Data", *Journal of Public Economics*, 108, 104-176.

Kishar, N.K., and Marfatia, H.A. (2017), "The Dynamic Relationship Between Housing Prices and the Macroeconomy: Evidence from OECD Countries", *The Journal of Real Estate Finance and Economics*, 54, 237–268.

Le Blanc, J. and Lydon, R. (2019), "Indebtedness and Spending: What Happens When the Music Stops?", Central Bank of Ireland Research Technical Paper 2019/14.

Le Leslé, V. (2012), "Bank Debt in Europe: Are Funding Models Broken?", Working Paper 12/299, International Monetary Fund.

Mack, A. and Martínez-García, E. (2011), "A Cross-Country Quarterly Database of Real House Prices: A Methodological Note", Working Paper 99, Globalization and Monetary Policy Institute, Federal Reserve Bank of Dallas.

McCarthy, Y. and McQuinn, K. (2017), "Price Expectations, Distressed Mortgage Markets and the Housing Wealth Effect", *Real Estate Economics* 45, 478 - 513.

Mian, A., Rao, K. and Sufi, A. (2013), "Household Balance Sheets, Consumption and the Economic Slump", *The Quarterly Journal of Economics* 128, 1687-1726.

Mian, A. and Sufi, A. (2014), "What Explains the 2007-2009 Drop in Employment", *Econometrica* 82, 2197-2223.

Mian, A. and Sufi, A. (2017), "Household Debt and Business Cycles Worldwide", *The Quarterly Journal of Economics* 132, 1755-1817.

Mian, A. and Sufi, A. (2018), "Finance and Business Cycles: The Credit-driven Household Demand Channel", *The Journal of Economic Perspectives* 32, 31-58.

Mody, A. (2015), "Living (Dangerously) Without a Fiscal Union", Routledge Handbook of the Economics of European Integration, Routledge, 392-427.

Musso, A., Neri, S., and Stracaa, L. (2011), "Housing, Consumption and Monetary Policy: How Different are the US and the euro area?", *Journal of Banking and Finance*, 35, 11, 3019-3041.

Schmillen, A. (2013), "Are Wages Equal Across Sectors of Production? A Panel Data Analysis for Tradable and Non-tradable Goods", *Economics of Transition*, 21, 4, 655-682.

Whitehead, C., Scanlon, K. and Lunde, J. (2014). "The Impact of the Financial Crisis on European Housing Systems: A Review", Report 2, Swedish Institute for European Policy Studies.

Appendix

Table A.1 Construction of Sectoral Employment Aggregates

	1996-2008 definition	*2008-2017 definition*
Non-traded sector		
	Electricity, gas and water supply	Electricity, gas, steam and air conditioning supply
		Water supply; sewerage, waste management and remediation activities
		Construction
	Hotels and restaurants	Accommodation and food service activities
		Public administration and defence; compulsory social security
		Education
	Health and social work	Human health and social work activities
		Arts, entertainment and recreation
	Other community, social and personal service activities	Other service activities
Traded sector		
		Agriculture, forestry and fishing
		Mining and quarrying
		Manufacturing
		Wholesale and retail trade; repair of motor vehicles and motorcycles
		Transportation and storage
		Information and communication
		Financial and insurance activities
		Real estate activities
		Professional, scientific and technical activities
		Administrative and support service activities
		Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
		Activities of extraterritorial organisations and bodies

Table A.2 Data coverage for sample averages in Table 2

	Change in housing net wealth	Non-traded employment as a % of total	Annual employment/wage growth
Austria	2001-2017	1995-2017	1996-2017
Belgium	1996-2016	1995-2017	1996-2017
Czechia	2009-2017	1997-2017	1998-2017
Denmark	1996-2017	1995-2017	1996-2017
France	1996-2017	1995-2017	1996-2017
Finland	1996-2016	1995-2017	1996-2017
Germany	1996-2017	1995-2017	1996-2017
Greece	1996-2016	1995-2017	1996-2017
Hungary	2008-2016	1996-2017	1997-2017
Italy	1996-2016	1995-2017	1996-2017
Latvia	2007-2015	1998-2017	1999-2017
Lithuania	1999-2016	1998-2017	1999-2017
Luxembourg	2000-2016	1999-2016	2000-2016
The Netherlands	1996-2017	1995-2017	1996-2017
Poland	2007-2015	1997-2017	1998-2017
Portugal	2009-2016	1995-2017	1996-2017
Slovenia	1997-2016	1996-2017	1997-2017
Slovakia	2007-2016	1998-2017	1999-2017
Sweden	1996-2017	1995-2017	1996-2017
United Kingdom	1996-2017	1995-2017	1996-2017

Table A.3 Full sample results with multiplicative dummy and additional controls: fixed effects

Dependent variable: $\Delta lnE_{i,t}$	(iv)	(v)	(vi)
Employment category	TOT	TRAD	NTRAD
	Fixed Effects		
$\Delta HNW_{i,t}$	0.043 (0.035)	0.007 (0.054)	0.153*** (0.045)
$DV_{neg} * \Delta HNW_{i,t}$	0.300*** (0.077)	0.294*** (0.090)	0.233*** (0.107)
$\Delta lE_{i,t-1}$	0.259*** (0.049)	0.161*** (0.056)	0.067 (0.058)
$CONSHARE_{i,t}$	-0.433*** (0.146)	-0.710*** (0.193)	0.003 (0.198)
$OPENNESS_{i,t}$	-0.001 (0.010)	-0.001 (0.013)	-0.003 (0.016)
$RRATE_{i,t}$	-0.002*** (0.001)	-0.002*** (0.001)	-0.003*** (0.001)
Countries	20	20	20
N	317	317	317
Adj. R^2	0.460	0.305	0.355
Fixed effects test (Prob.)	0.000	0.000	0.260

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of employment in sector S of country i in year t on the change in housing net wealth in country i in year t, a multiplicative dummy variable, construction share of employment, the openness of the economy and the real interest rate.

Table A.4 The housing net worth channel and wages: additional controls

Dependent variable: $\Delta lnW_{i,t}$	(i)	(ii)
	Fixed effects	
$\Delta HNW_{i,t}$	0.353*** (0.051)	0.318*** (0.061)
$DV_{neg} * \Delta HNW_{i,t}$		0.084 (0.128)
$CONSHARE_{i,t}$	1.002*** (0.229)	1.013*** (0.226)
$OPENNESS_{i,t}$	-0.005 (0.129)	-0.006 (0.012)
$RRATE_{i,t}$	-0.004 (0.001)	-0.004*** (0.001)
Countries	20	20
N	342	342
Adj. R^2	0.628	0.628
Fixed effects test (Prob.)	0.000	0.000

Note: Standard errors in parentheses. Robust/clustered errors used throughout. ***, ** and * denote statistical significance at the one, five and ten percent levels, respectively. Regression is of the change in the natural log of nominal wages of country i in year t on the change in housing net wealth in country i in year t, a multiplicative dummy variable (column ii only), construction share of employment, the openness of the economy, and the real interest rate.

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