

Monitoring Household Liquidity Constraints and Home Ownership: A Panel Approach *

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Abstract

Excessive real estate credit is a major threat to financial stability. However, risk arising from household credit is difficult to monitor at an aggregate level. As household liquidity constraints play a key role, we propose a new indicator for the analysis of mortgage lending restrictions: the average marginal effect of household income on the probability of home ownership according to Hoderlein and White (2012). Despite of a complex econometric background this indicator is easy to compute. Moreover, it only requires information on age, household income and property as collected anyway in representative panel surveys.

Resorting to data from the European Union Statistics on Income and Living Conditions (EU-SILC), the preceding European Community Household Panel (ECHP) and the German Socio Economic Panel (SOEP), we conduct a comprehensive empirical investigation based on various panels for European countries between 1999 and 2010. We find significant differences in marginal effects across countries as well as across time. Most striking are low and weakening liquidity constraints before the beginning of the financial crisis for countries such as Spain and the United Kingdom - countries severely affected by bursting real estate bubbles since 2008. We conclude that the indicator is useful in context of the literature on financial crises and early warning systems. It allows an isolated monitoring of changing lending practices and attitudes towards credit risk across countries and time.

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1 Introduction

Since the financial crisis of 2007 at the latest, there has been an ongoing debate both in the scientific and non-scientific literature on how to correctly assess real estate credit developments. The essential role of sound lending practices is widely acknowledged. The threatening role of excess real estate credit to financial stability is extensively documented for example in Reinhart and Rogoff (2009). The key challenge in credit assessment is to disentangle unsustainable from sustainable developments. However, a large number of different influencing factors can play a role.

Amongst practitioners it is popular to watch the joint endogenous change of economic averages and aggregates. Indicators typically monitored are ratios such as prices to income or housing debt to income. By rules of thumb the levels of such indicators are compared to their own levels during past periods of economic stability. Differences might then indicate undesirable developments.

In econometric studies authors try to identify and estimate the impact of relevant variables for booms and busts in house prices and to find suitable models to predict crises. Recent complex work with aggregate data is for example Agnello and Schuhknecht (2011), Bunda and Zorzi (2010), Gerdesmeier, Reimers, and Roffia (2011) or Alessi and Detken (2011). Despite considerable progress a key challenge, however, remains the identification of structural relationships between different variables and the micro-foundation of outcomes at the aggregate level.

As a useful complement we, therefore, propose an indicator based on individual household data, dating back to the econometric approach of Hoderlein and White (2012). We step in at the relation between household income and the acquisition of home ownership. The basic assumption is that under sound lending practices a fundamentally positive and stable relation between these two dimensions should exist: households are then constrained in their liquidity and transitory income is a key determinant for households to get access to credit. In the working paper version, Hoderlein and White (2009), the authors illustrate

the application of their new panel data approach within the context of household liquidity constraints. The advantage of this approach is that it allows to control for different unobserved factors so that the nonlinear relation between income and the probability of home ownership is isolated. Moreover, it is easy to compute despite a complex econometric background. Using data from the US Panel Study of Income Dynamics (PSID), Hoderlein and White (2009) estimate the marginal effect of income on the probability of home ownership for the panels 1999 to 2001 as well as 2003 to 2005. They show that US household liquidity constraints vanish in the second panel, short before the outbreak of the financial crisis of 2007.

Up to now the only study working with this approach is Maderitsch (2011) who conducts an analysis analogous to Hoderlein and White (2009) with German households, based on data from the German Socio Economic Panel (SOEP). Using the same time periods as Hoderlein and White (2009) he cannot confirm an easing of liquidity constraints for German households, most likely reflecting the sound developments in the German real estate market at that time.

The interest in testing the econometric approach of Hoderlein and White (2012) on further datasets from different countries is obvious. In its simplest form the approach only requires data on household income and home ownership from panel surveys.¹ Up to now, however, testing the approach on comparable different data sets is not an easy task. Appropriate household data is hard to obtain. However, we acquire longitudinal data for different European countries accessing the EU-SILC database. These data allow us to compute the marginal effect of income on the probability of home ownership across various European countries and across time - unfortunately up to now only beginning with the year 2004. However, to get a more comprehensive view we additionally resort to data from the ECHP between 1999 and 2001 and the SOEP between 1999 and 2010.

Overall, we find appealing differences between the magnitude of the marginal effects across

¹Hence it should also be applicable on new data bases such as the comprehensive panel survey on household finances and wealth in Germany (PHF-SAVE) as introduced by von Kalckreuth, Eisele, le Blanc, Schmidt, and Zhu (2012).

countries and time, standing well in line with the extent to which countries were affected by bursting real estate bubbles since 2008.

This paper is structured as follows: We present the basics on identification and estimation in section 2. Section 3 describes the data set. In section 4 we present our estimation results. Section 5 concludes.

2 Identification and Estimation

Unobserved individual-specific characteristics often pose problems in applied microeconomics: if unobserved heterogeneity is correlated with the observed regressors, this unobserved heterogeneity constitutes a source of endogeneity and leads to biased estimated effects of the regressors on the dependent variable. If panel data are available, this problem can be handled by estimating a fixed effects model: persistent influencing factors can then be eliminated. Unfortunately, fixed effects models only work within a linear context with regressors that are additively separable.

Hoderlein and White (2012), however, show that the notion of fixed effects can be extended to nonlinear structures with infinite-dimensional unobservables and that a generalized version of differencing identifies so called local average responses. The main advantage of their approach is, that it neither requires strong restrictions on the functional form nor independence between persistent unobservables and the regressors. It only requires two time periods and can be applied to estimate household liquidity constraints. The model context is then the so called semiparametric panel data binary choice model with fixed effects and the marginal effect of income on the probability of home ownership is the average structural marginal probability which Hoderlein and White (2012) show to be identified. Resorting to this theoretical result, we estimate the following equation via kernel density estimation:

$$D_{\xi}\mathbb{E}[\Delta Y|\Delta X = \xi, X_1 = x, \Delta Z = 0, Z_1 = z]|_{\xi=0}. \quad (1)$$

The binary variable Y is the variable for home ownership. If Y equals 1, a household possesses an own home in the given period. If Y equals 0, then the household does not possess property in the given period. X_1 denotes the logarithmized household gross income in period one of the panel², ΔX is its change from period one to period two. Z_1 displays the age of the household head in period one of the respective panel. ΔZ denotes its change from period one to two.

The marginal effect of household income on the probability of home ownership is theoretically identified, if household gross income and the age of the household head are constant ($\Delta X = 0$ und $\Delta Z = 0$). This is of course unrealistic in empirical applications because both household gross income and the age of the household head vary over time. However, for big parts of the populations, income changes are only small.³ As Hoderlein and White (2009) show, the estimations can be done for different bandwidths of income changes. They find these changes to be neglectable. The age variable can be assumed as constant; this is not a severe problem because the changes are deterministic and equal over all household heads. The level of the age variable chosen for the household head is more critical though. Hoderlein and White (2009) choose $z = 40$ in their example and still employ data on approximately 1000 PSID households. In our application however we would loose too many observations if we only kept for example households with the population average age. Therefore, we report our results not controlling for age.⁴

Most importantly, it is now possible to control for all time-constant factors of influence, no matter if observable or not. Such factors are for example education, credit history or household fortune. Seeing them as time-constant seems justified according to Hoderlein

²For better readability in the following often only "income".

³We do not respect for different intervals of income changes in our empirical analysis because we would loose too many observations. However, we conduct the estimations for groups as a robustness check and do not find serious changes of our main findings. Results are available upon request.

⁴In a sensitivity analysis, however, we found out that this does not alter the basic results, because the age structures of the households are well comparable across the different panels. The magnitude of our effects reported however is a little bit smaller than in Hoderlein and White (2009) due to averaging the effects over different age groups. Overall a trade-off exists between complete fulfilment of theoretical assumptions and going deeper into cross-country comparisons.

and White (2009).⁵ The effect of income changes is hence isolated which is important, because in a direct regression of income on the binary property variable the coefficients would be strongly biased due to omitted variables.

Additionally the relation between the probability of home ownership is not assumed as linear a priori. This is favourable; from a theoretical standpoint it is to be expected that households with lower to middle incomes face stronger liquidity constraints than high income households for which income gains should be less important, because their income is already sufficiently high to get access to credit easily.

3 The Data

We use data from the EU-SILC, an official survey designed to describe and to explain living conditions in all EU member states as well as data from the preceding panel study ECHP. The ECHP was conducted between 1994 and 2001 in all countries that were members of the EU then and Norway. Afterwards, the panel study was replaced by EU-SILC. Both, the ECHP and the EU-SILC, collect data at the individual level. EU-SILC is conducted annually since 2004. Every year, approximately 130,000 households in the actual EU member states are interviewed. Although the Statistical Office of the European Union (Eurostat) is responsible for providing the EU-SILC data at the European level, the collection and preparation of the data is conducted by the individual countries' statistical offices.⁶ Unfortunately, there has been no European panel survey in the years 2002 and 2003.⁷ Therefore, the panel data most close in time to the financial crisis consist of the EU-SILC waves in the years 2004 and 2006.⁸ To provide some evidence of changing

⁵With a very big dataset, however, these quantities can be used as control variables for subsample estimations.

⁶Serious concerns about the data quality of the first waves of EU-SILC in 2004 and 2005 exist (see, e.g., Hauser (2007)).

⁷In 2003 a first wave of EU-SILC has been conducted as an experiment in six European countries. However, the sample size is too small to apply our econometric analysis to this data set.

⁸In 2004 Germany, the Netherlands and the United Kingdom did not take part in EU-SILC because their deadline to introduce EU-SILC was extended to 2005. Norway, Iceland and Switzerland take part in EU-SILC since 2004.

liquidity constraints over time, we compare that data set to a panel including the data of the ECHP in the years 1999 and 2001.

When interpreting the results later on, it has to be kept in mind that the panel data sets at use do not stem from the same survey. However, the aim of both, the ECHP and the EU-SILC, are the same and the construction of the surveys is similar. Both include the variables we need for our analysis and define them in the same way. Therefore, we do not consider the change of the surveys as a critical issue for the quality of our empirical results. The main focus of both surveys is to provide data on social inclusion, poverty and living standards. Furthermore, the design of EU-SILC is based on the multidimensional Laeken indicators that have been introduced by the Council of the European Union to measure the member states' progress in poverty reduction. The introduction of these Laeken indicators have made it necessary to design a new household panel, EU-SILC. The survey, therefore, contains detailed information, at the individual and at the household levels, on the family and education background in addition to the current living environment. For our empirical analysis, the EU-SILC longitudinal data of the waves 2004/2006 and 2007/2009 are used. We compare the results to the data of the ECHP in the years 1999/2001 in which also all necessary variables are included.

A problem occurs when we want to analyse the relationships between household liquidity constraints and home ownership for Germany: the longitudinal data sets of EU-SILC do not include any observations from Germany because of data privacy regulations. If we want to provide some estimation results for Germany we are forced to use different data, e.g. data from the SOEP, a nationally representative random sample survey covering more than 11,000 private households every year since 1984. The SOEP contains information on the financial situation of the household as well as its tenure status. We use the waves 1999/2001, 2003/2005, 2005/2007, 2007/2009 and 2008/10 to estimate the average marginal effect of a household's income on home ownership.

All data sets comprise households with full information on tenure status, household income and the age of the household head in both years. The binary variable Y_{it} equals 1

if the household i owns a home in period t . The variable Z_i includes the age of the head of the household i , calculated as the difference between the year of the survey and his/her year of birth; X_{it} is household i 's gross income in period t . At least around the mean income levels, we expect the marginal effects estimated on the basis of these variables to be broadly comparable across countries and time.⁹

4 Empirical Results

We conduct the empirical analysis for all panels and countries possible with our different data sets.¹⁰ However, as mentioned in the previous paragraph, not all countries are available for every panel. Additionally, a technical limitation for our nonparametric estimations is the insufficient number of observations for small countries like Malta or Ireland. Therefore, we only present the results for countries for which we are confident that the number of underlying observations is large enough. However, if possible to estimate, the results for other countries are available upon request.¹¹

To make clear how our graphical estimation results can be interpreted, we first elaborate on an arbitrarily chosen result for Germany, depicted in Figure 1.

– Figure 1 about here –

The graph shows that the marginal effect of household income on the probability to possess an own home is positive and significantly different from zero for the biggest part of the income spectrum of German households. The point estimate of the marginal effect as well as the bootstrap-based 95% confidence bands are permanently above zero. Only at the left boundary the effect is not significant with the confidence bands surrounding zero.

⁹Mean income levels are provided in Tables 1 and 4.

¹⁰For all estimations we only include observations within the 5% to 95% income quantils in our data set to ensure that outliers do not significantly influence our estimation results.

¹¹Other countries are Bulgaria, Cyprus, Czech Republic, Estland, Hungary, Iceland, Ireland, Latvia, Lithuania, Norway, Poland, Romania, Slovakia, Slovenia.

On the one hand this reflects decreasing observations towards the borders of the income spectrum. On the other hand this is in line with theoretical considerations. Marginal income gains only increase the probability to obtain an own home, if a household already possesses a certain amount of minimum income, making the acquisition of an own home in principle possible. The higher the household income, the more the probability of home ownership increases with marginal income gains. This effect continues until the maximum marginal effect is reached. From here on income increases have a decreasing effect on the home ownership probability, because household income is already large enough to get access to credit easily. Hence under sound credit conditions especially households with small to middle incomes should be characterized by strong marginal effects reflecting their liquidity constraints. As shown in Figure 1, this applied for German households which were indeed significantly constrained in their liquidity between 1999 and 2001, with the marginal effect of income on home ownership probability being very pronounced around the mean income of approximately 10.05. Being able to control for fixed effects, we hence conclude that lending was carried out cautiously in this period.

To draw comparison between liquidity constraints, we estimate the effects as depicted in Figure 1 for different panels over time and for different countries. The results are combined in Figure 2 and 3. To condense the information given by the graphs, we additionally present the estimated marginal effects at the mean incomes in Tables 1 to 3. As already mentioned, these quantities appear most suitable to us for matters of comparison. However, in principle the effects can also be computed for example at the median incomes or other chosen income levels.¹² We also experimented with different currencies and purchasing power equivalents, the marginal effects at the mean incomes however remained remarkably stable.¹³

The first group of countries analysed are Germany, France, Luxembourg, Finland, Bel-

¹²The median however does not make a big difference compared to the mean in our samples.

¹³Generally all incomes in this study are denoted in Euros, if possible. For the ECHP-data we converted the incomes with the exchange rates from the Euro introduction. However, for UK for example we took incomes in British Pounds in all panels.

gium, Italy, Spain and United Kingdom. From the graphs in Figure 1 and 2 it is obvious that the course of the marginal effect looks similar for most of these countries; up to a threshold higher income is associated with a higher probability of obtaining an own home.¹⁴ Moreover the effect is significantly different from zero for all countries around the center of the income spectrum. This stands in contrast to the insignificant effect that Hoderlein and White (2009) found for the United States between 2003 and 2005 and indicates that an overall vanishing of liquidity constraints cannot be confirmed analogously for European countries. Still it is striking that the maxima of the marginal effects of income on the home ownership probability are often highly distinct from country to country and over time.

Table 1 and 2 show the estimated marginal effects at the mean incomes. It is apparent that all countries show rather strong marginal effects and hence household liquidity constraints in the first panels from 1999 to 2001. Moreover, the effects are broadly comparable over the different countries. In the subsequent panels, however, the marginal effects of income on the probability to possess home ownership decrease over all countries. To further illustrate this development, we computed Figure 4. It graphically illustrates the course of the country-marginal effects over time. Most striking is the significant drop of the marginal effects for Spain, United Kingdom and Italy. For the other countries, however, the marginal effects also dropped, especially in the beginning. All in all though in none of these countries the marginal effect fell below approximately 0.3. Lending standards have hence become laxer in all European countries, but in countries such as Spain, Italy and UK this effect is particularly pronounced. This is in line with the fact that these economies were later on more strongly affected by the financial crisis.

Similar results are found for Austria, Denmark, Greece, the Netherlands, Portugal and Sweden. Only for Austria the estimated effect remains rather stable whereas for the other countries strong changes can be found.

¹⁴Again we face the problem of few observations and high standard errors at the border regions of the graphs. Therefore, not too much weight should be given to the border regions of the graph.

Overall the results are well in line with the fact that Europe was partially hit by real estate crises. Moreover the results fit for example to an analysis with pre-crisis data conducted by the ECB (2009), finding that households' debt for house purchases had increased between 2000 and 2007 in many euro area countries. As explanations the study offers factors such as low interest rates, income and population growth and the effects of deregulation as contributing to this development. Concerning explanations related to credit standards it remains vague: "more favourable financing conditions and a possible under-assessment of risks may have contributed to a loosening of credit standards between 2003 and 2007". The reason is possibly the that "under-assessment of risk" is typically extremely hard to measure and assess. Our study though provides an approach how this can be done and shows that "under-assessment of risk" indeed has also played an important role in Europe. We show that a changing attitude towards household default risk has lead to an easing of liquidity constraints in various European countries before the financial crisis.

5 Conclusion

This paper has shown how the marginal effect of income on the home ownership probability can be used as an indicator to monitor household liquidity constraints across countries and over time, controlling for (un-)observed persistent factors. Due to its easyness to compute we suggest that the approach according to Hoderlein and White (2009) is an interesting complement to existing early warning approaches.

Our findings for the years 1999 to 2010 suggest significant cross-country differences in marginal effects in line with the happenings of the financial crisis since 2007. As an indication of changing attitudes towards credit risk, we find weakening liquidity constraints before the financial crisis, in particular for countries facing trouble in the real estate sector since the outbreak of the crisis. However, an overall vanishing of liquidity constraints such as shown in Hoderlein and White (2009) for the United States cannot be confirmed - not even for a single European country.

In future research it would be interesting to compute marginal effects with additional data sources and to assess the consequences of the financial crisis on household liquidity constraints. The latter unfortunately is not possible with our data. It has to be assumed that the panel 2007/2009 from EU-SILC only insufficiently captures the consequences of the financial crisis. The later panel for 2008/2010 for Germany might be more conclusive. However it only indicates that during this period liquidity constraints did not tighten in Germany.

The variety of data sources used in our analysis and the associated difficulties finally demonstrate the urgent need for comprehensive, harmonised and readily-available datasets as pursued by the Household Finance and Consumption Survey (HFCS).

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Appendix

Table 1

Marginal effect of income on the probability of home ownership: Germany

Wave	1999/2001		2003/2005		2005/2007		2007/2009		2008/10	
	N	ME	N	ME	N	ME	N	ME	N	ME
	6527	0.047	10642	0.042	9842	0.037	9841	0.034	9186	0.030
Mean income	10.07		10.24		10.24		10.23		10.26	

ME: approximate marginal effect at the mean income.

N: number of households.

Mean income: of logarithmized household gross incomes in Euros (first year of the panel).

For 1999: Euro exchange rate as on first of January 1999.

Source: SOEP, own calculations.

Table 2

Marginal effect of income on the probability of home ownership: selected EU countries

Wave Country	ECHP 1999/2001		EU-SILC 2004/2006		EU-SILC 2007/2009	
	N	estimated ME	N	estimated ME	N	estimated ME
France	4801	0.053	5957	0.034	6313	0.034
Luxembourg	2134	0.060	2555	0.036	2605	0.049
Finland	2683	0.069	3153	0.057	2779	0.044
Belgium	2180	0.057	1722	0.048	2581	0.034
Italy	5055	0.045	8165	0.023	7783	0.020
Spain	4430	0.053	4532	0.017	5154	0.011
UK	4229	0.041	.	.	3164	0.013

ME: approximate marginal effect at the mean income.

N: number of households.

Source: ECHP and EU-SILC, own calculations.

Table 3

Marginal effect of income on the probability of home ownership: further countries

Wave	ECHP 1999/2001		EU-SILC 2004/2006		EU-SILC 2007/2009	
Country	N	estimated ME	N	estimated ME	N	estimated ME
Austria	2317	0.037	1923	0.033	2023	0.030
Denmark	2014	0.061	1922	0.046	1922	0.041
Greece	3596	0.030	2218	0.016	2354	0.014
Netherlands	3846	0.044	.	.	3671	0.028
Portugal	4211	0.037	1928	0.011	1813	0.012
Sweden	.	.	2749	0.053	2808	0.055

ME: approximate marginal effect at the mean income.

N: number of households.

Source: ECHP and EU-SILC, own calculations.

Table 4

Mean income in selected European countries for different panel data sets

Country	ECHP 1999	EU-SILC 2004	EU-SILC 2007
Austria	10.06	10.22	10.26
Belgium	10.05	10.08	10.16
Germany	10.06	.	.
Denmark	.	10.54	10.64
Spain	9.48	9.68	9.89
Finland	9.91	10.25	10.36
France	9.96	10.12	10.18
Greece	9.16	9.52	9.63
Italy	10.34	10.03	10.10
Luxembourg	10.51	10.79	10.77
Netherlands	9.96	.	10.36
Portugal	9.03	9.36	9.46
Sweden	12.12	10.28	10.42
UK	9.59	.	10.35

Mean income: of logarithmized household gross incomes in Euros if possible.

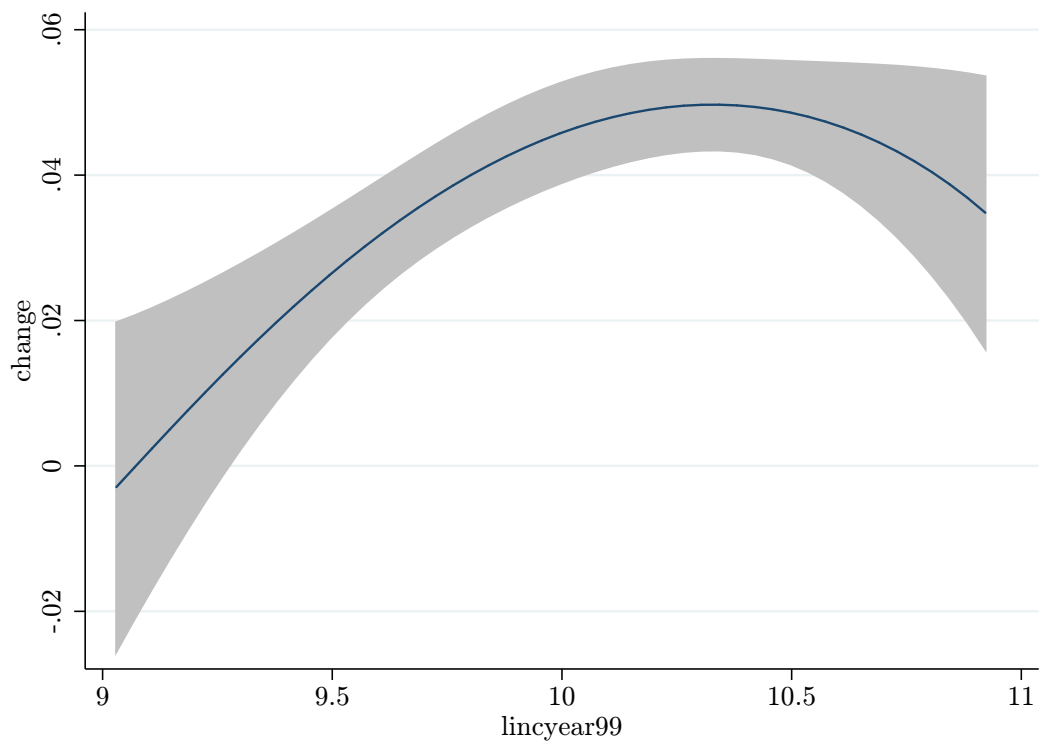
Otherwise: of logarithmized household gross incomes in local currencies.

For 1999: Euro exchange rate as on first of January 1999.

Source: ECHP and EU-SILC, own calculations.

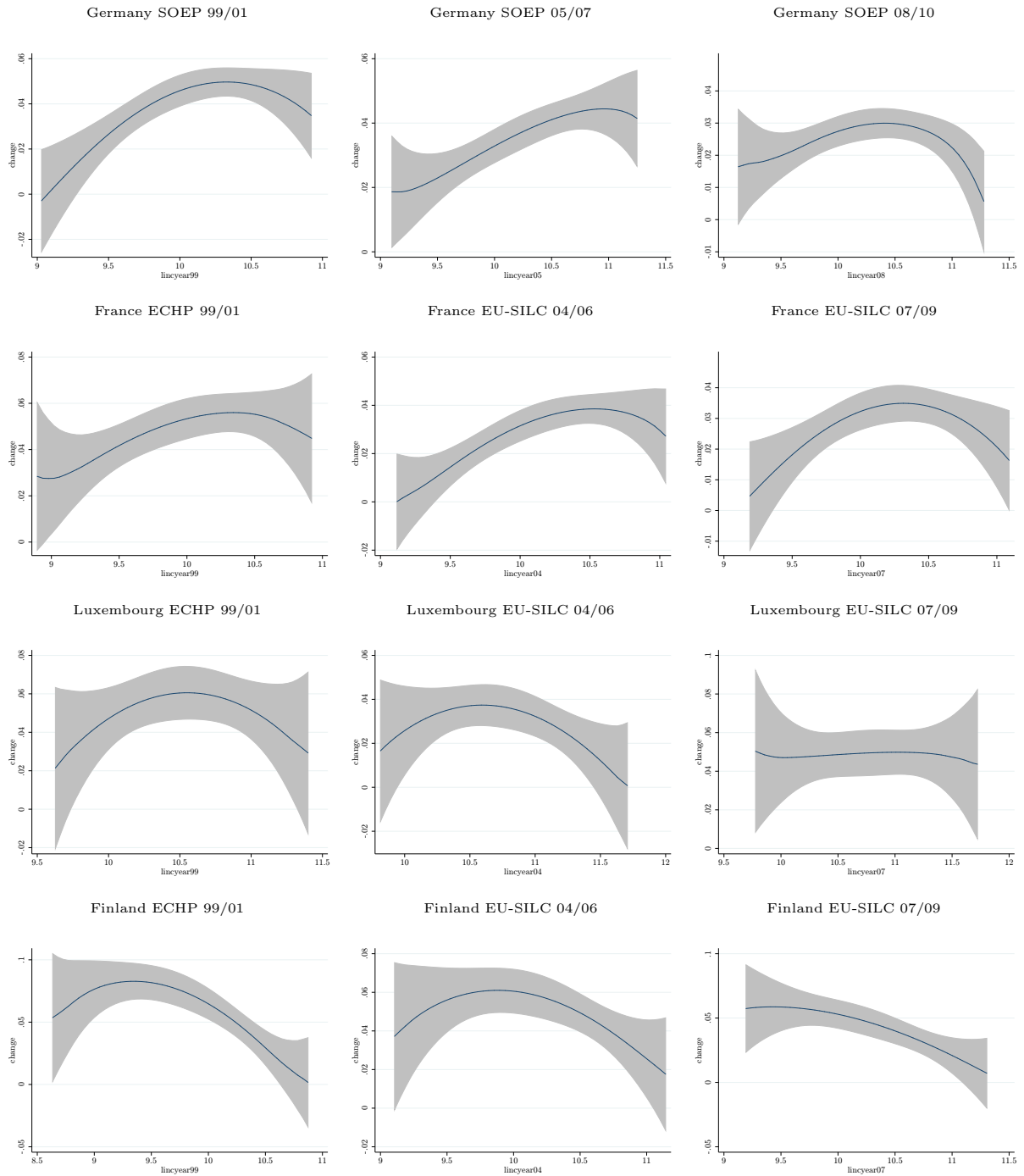
Figure 1

Marginal effect of income on the probability of home ownership



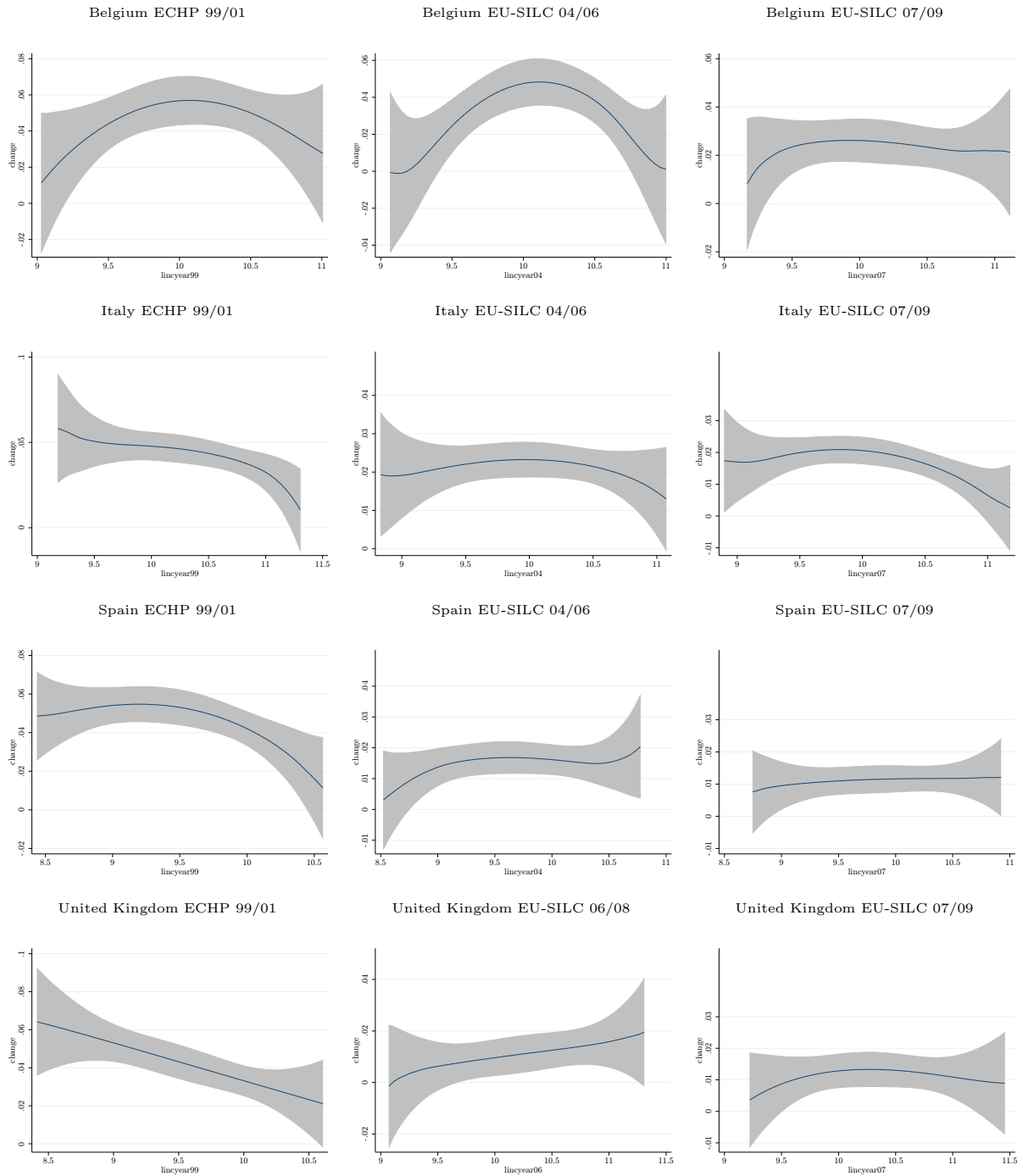
Germany, SOEP 1999/2001, 5% - 95% income quantile.

Figure 2
Marginal effect of income on the probability of home ownership.



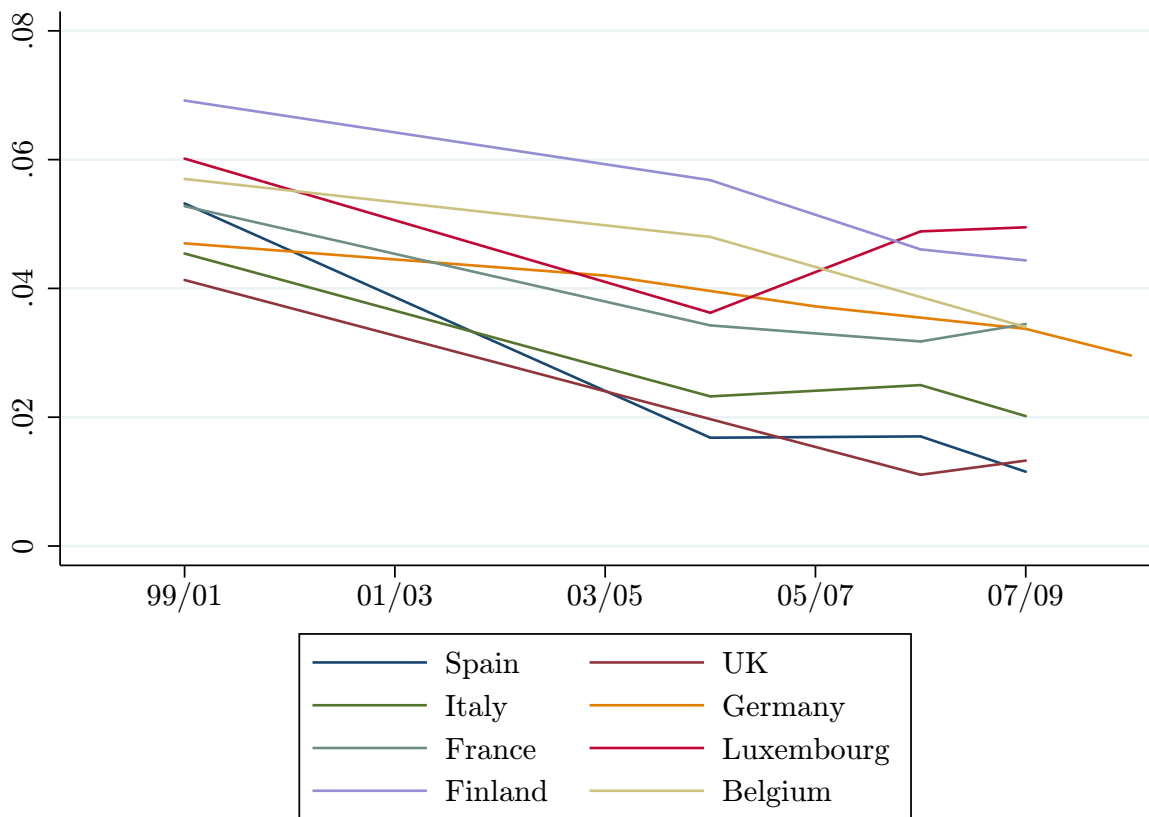
Selected results for different panels, 5% - 95% income quantiles for all countries.

Figure 3
Marginal effect of income on the probability of home ownership.



Selected results for different panels, 5% - 95% income quantiles for all countries.

Figure 4
 Marginal effect of income on the probability of home ownership



Selected results over time, again 5% - 95% income quantiles for all countries.