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WEALTH DIFFERENCES ACROSS BORDERS AND THE EFFECT OF REAL ESTATE PRICE DYNAMICS: EVIDENCE FROM TWO HOUSEHOLD SURVEYS

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Wealth differences across borders and the effect of real estate price dynamics:
Evidence from two household surveys*

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Abstract:

Crossing borders, be it international or regional, often go together with price, wage or indeed wealth discontinuities. This paper identifies substantial wealth differences between Luxembourg resident households and cross-border commuter households despite their similar incomes. The average (median) net wealth difference is estimated to be €367,000 (€129,000) and increases for higher percentiles. Using several different regression and decomposition techniques, spatial (regional) differences in real estate price developments, and thus differences in accumulated nominal capital gains are shown to be one main driving factor for these wealth differences. Other factors contributing to the observed wealth differences are differences in age, income, education and other household characteristics.

Keywords: household survey, wealth, real estate price dynamics, cross-border commuting
JEL Codes: D31, J61, F22, R23, R31

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Non-technical summary

The Luxembourg labour market is characterised by a very high share of cross-border commuters, i.e. people with employment in Luxembourg but residing in Belgium, France or Germany. These cross-border commuters are attracted by both high wages and lower taxes and social security contributions; they pay the same income taxes and social contributions, and receive similar social transfers as employed households resident in Luxembourg. In a sense, cross-border commuters exploit the existing national boundary and the arising income discontinuities. Such discontinuities between regions are well documented in the economics literature. For example, access to public infrastructure, school rankings and crime rates have been reported to affect house prices. Equally well documented are tax induced price differences in border regions, which affect the consumption behaviour of residents, cross-border commuters and tourists. In the Luxembourg context, the national border exhibits a considerable influence on property and house prices.

However, whereas cross-border commuters receive similar incomes to employed Luxembourg resident households, recent results from two surveys among these two populations reveal sizeable net wealth differences between them. According to these two surveys, employed households resident in Luxembourg hold a median total net wealth, which is almost twice as high as that of cross-border commuter households (€295,500 vs. €167,000). The discrepancy at the mean is even larger (€607,500 vs. €240,000). Thus, this paper seeks to analyse the underlying factors for these wealth differences. In this respect, it focuses on differences in house price dynamics and their effect on net wealth differences. Differences in house price developments are expected to have a big influence on wealth accumulation and resulting wealth differences, as the household main residence is commonly the single most important asset held by households, typically contributing to more than 50% of household net wealth.

Using these two aforementioned household surveys, we show that, over the last 20 years, Luxembourg and cross-border commuter households saw the value of their household main residence on average to increase by 6.2% and 3.4% yearly. Homeownership and accumulated capital gains since acquisition exert considerable influence on total net wealth. Based on various decomposition techniques, we show that, at the respective median (50^{th} percentiles) of the net wealth distribution, differences in accumulated house price developments contribute 127% to the observed wealth difference between employed households resident in Luxembourg and cross-border commuter households. Other factors, such as income and employment characteristics, educational attainment and other household characteristics can only explain a minor or negative part of this difference (13%, -21% and -39%). The importance of house price dynamics extends to other percentiles of the respective wealth distribution, such as the 75^{th} and 90^{th} percentile and holds true for household total net wealth as well as the net value of the household main residence. Differences in house price dynamics can therefore be considered the single most important factor for the sizeable wealth differences between employed households resident in Luxembourg and cross-border commuter households.

Nichttechnische Zusammenfassung

Charakteristisch für den luxemburgischen Arbeitsmarkt ist sein sehr hoher Anteil an Grenzpendler-Haushalten, d.h. Haushalte, die in Belgien, Frankreich oder Deutschland wohnen aber in Luxemburg arbeiten. Grenzpendler werden durch attraktive Löhne und geringere Steuern und Sozialversicherungsbeträge angezogen. Sie zahlen die gleiche Einkommenssteuer und Sozialversicherungsbeiträge und erhalten ähnliche Sozialtransferleistungen wie in Luxemburg wohnhafte Haushalte. Grenzpendler nutzen damit nationale Grenzen und die dadurch entstehenden Einkommensdiskontinuitäten. Diskontinuitäten zwischen Regionen wurden vielfach in der ökonomischen Literatur genutzt, um beispielsweise den Einfluss des Zugangs zu öffentlicher Infrastruktur, besseren Schulen oder Kriminalität auf Hauspreise zu quantifizieren. Gut dokumentiert sind ebenfalls durch oftmals unterschiedliche Besteuerung ausgelöste Preisunterschiede zwischen Grenzregionen, die das Konsumverhalten von Einwohnern, Grenzpendlern und Touristen beeinflussen. Im luxemburgischen Kontext betrachtet hat die luxemburgische Staatsgrenze einen erheblichen Einfluss auf Grundstücks- und Hauspreise.

Obwohl Grenzpendler ein ähnliches Einkommen haben wie in Luxemburg wohnhafte Beschäftigte, zeigen die Ergebnisse zweier repräsentativer Erhebungen, dass erhebliche Vermögensunterschiede zwischen beiden Gruppen bestehen. Nach diesen Umfragen haben beschäftigte luxemburgische Haushalte ein fast zweimal größeres mittleres Haushaltsnettogesamtvermögen als Grenzpendler-Haushalte (€295.500 gegenüber €167.000). Der Unterschied ist beim durchschnittlichen Haushaltsnettogesamtvermögen sogar noch größer (€607.500 gegenüber €240.000). Diese Studie versucht, die den Vermögensunterschieden zugrunde liegenden Faktoren zu analysieren. Da das selbstgenutzte Wohneigentum mehr als 50% zum Haushaltsnettogesamtvermögen beiträgt, ist es wahrscheinlich, dass unterschiedliche Hauspreisentwicklungen einen großen Einfluss auf die Vermögensakkumulation und die daraus entstehenden Vermögensunterschiede haben.

Die zwei zuvor genannten Haushaltserhebungen zeigen, dass der Wert des selbstgenutzten Wohneigentums der luxemburgischen und Grenzpendler-Haushalte während der letzten 20 Jahre um durchschnittlich 6,2% und 3,4% pro Jahr anstieg. Das selbstgenutzte Wohneigentum und die Hauspreisentwicklung haben einen erheblichen Einfluss auf die Höhe des Nettogesamtvermögens. Am jeweiligen Median (50. Perzentil) der Nettogesamtvermögensverteilung lässt sich anhand verschiedener Dekompositionstechniken zeigen, dass 127% des beobachteten Vermögensunterschiedes zwischen luxemburgischen und Grenzpendler-Haushalten durch unterschiedliche akkumulierte Hauspreissteigerungsraten hervorgerufen wurde. Andere Faktoren wie Einkommens- und Beschäftigungsverhältnisse, Bildung und andere Haushaltscharakteristika können nur einen geringen oder negativen Teil des beobachteten Unterschieds erklären (13%, -21% und -39%). Die Bedeutung der Hauspreisentwicklung zeigt sich auch für andere Perzentile der Vermögensverteilung, wie zum Beispiel dem 75. oder 90. Perzentil, und sowohl für das Nettogesamtvermögen als auch für den Nettowert des selbstgenutzten Wohneigentums. Die

unterschiedliche Hauspreisentwicklung ist somit der wichtigste einzelne Faktor, um die hohen Nettogesamtvermögensunterschiede zwischen den beschäftigten luxemburgischen Haushalten und Grenzpendler-Haushalten zu erklären.

1 Introduction and motivation

Wealth holdings of households vary substantially among developed countries (e.g. Davies et al., 2011; Christelis, Georgarakos and Haliassos, 2013; HFCN, 2013b). It is thus natural to look for explanations. In this respect, it astonishes that the economic situation, such as prices, wages or well-being often seem to abruptly change when crossing international borders. In Europe, this is now and again visible in terms of suddenly encountering nicer houses and neighbourhoods or much improved (rail-)road conditions (e.g. passing by car on the motorway from Luxembourg to Belgium). Such discontinuities arise in the small when crossing city, communal or district boundaries and in the large when crossing national borders. Furthermore, it impacts on various aspects of economic activity. In the economic literature, this phenomenon is very well established and researched.

In the metropolitan and urban setting, house prices have been shown to be affected by access to public infrastructure, school rankings, and crime records.[1] For example, an invisible school district boundary may effectively censor whether or not children are allowed to attend schools with good reputation and ranking, which pushes up house prices in those areas. Conversely, districts with bad crime rates suffer from lower demand, in turn depressing house prices (e.g. Black, 1999; Gibbons and Machin, 2003, 2006 and Fack and Grenet, 2010 for schools and Lynch Rasmussen, 2001 and Gibbons, 2004 for crime). In the international context, the prime example relates to international price differences. Borders create a price discontinuity that, if large enough, is systematically exploited. Local residents, tourists or cross-border commuters use existing arbitrage opportunities and buy fuel, tobacco, alcohol or other products in the country where it is cheaper (see e.g. Manuszak and Moul, 2009 for fuel, Thursby, Jensen and Thursby, 1991 for tobacco and Asplund, Friberg and Wilander, 2007 for alcohol). This is for example also the case for Luxembourg and its neighbouring countries (Mathä, Porpiglia and Ziegelmeyer, 2014a).

This paper can be seen in light of the above literature on boundaries, but relates it to a different economic setting – household wealth differences across borders. Household wealth (differences) are usually studied in context of household characteristics, such as income, age or education. Recent contributions for example explore the effect of immigration (e.g. Bauer et al., 2011), ethnicity (e.g. Blau and Graham, 1990), intergenerational transfers (e.g. Wolff and Gittleman, 2011), gender (Sierminska, Frick and Grabka, 2010) etc… Cross-country wealth differences are additionally related to institutional differences in financial developments, pensions and social security. International comparisons are a cumbersome undertaking as many different institutional factors need to be taken into account and be controlled for in multivariate and decomposition analysis.

This paper analyses total net wealth differences of households, thereby focusing on homeowners and the role of spatial differences in house price dynamics. Homeownership is re-

[1] See for example Gibbons and Machin (2008) for a review of the literature on house prices and local (dis-)amenities.

garded as (one of) the most important components of household wealth. It stands for the lion's share of total real asset and usually contributes more than 50% to average total net wealth of households (e.g. HFCN, 2013b). In many countries, homeownership is regarded as a form of old age provision and a natural hedge against an uncertain future shielding against high inflation rates. Many governments actively support homeownership, with tax rebates and subsidies (e.g. Andrews and Caldera Sánchez, 2011). Apart from attributing wealth differences to household characteristics, we analyse spatial differences in (nominal) non-realised capital gains to real estate wealth as reflected by differences in housing value appreciation rates across countries. In order to limit the influence of international differences in institutional factors, we exploit representative household data in a very unique setting.

We compare the wealth of Luxembourg resident households with households residing abroad, yet in close proximity to Luxembourg and working in Luxembourg, thereby exploiting both the effect of the international border and the high degree of internationalisation of the Luxembourg labour market. First, Luxembourg serves as a very fruitful case study, as by international standards Luxembourg is a wealthy country. Estimates from the Eurosystem Household Finance and Consumption Survey (LU-HFCS) report Luxembourg resident households to hold net assets of about €710,000 on average. At the median the estimated value still an impressive €398,000 (HFCN, 2013b). To put these numbers in international context, consider that estimates (from representative household surveys) for (most) other developed countries in the western hemisphere are far lower. In the U.S., average (median) household total net wealth is estimated to be about €425,000 (€90,000) in 2009 (Bricker et al., 2011). For the euro area, recent estimates provided by the Eurosystem Household Finance and Consumption Network (HFCN, 2013b) indicate a mean of €231,000 and median of €109,000 for total net household wealth. Furthermore, there are sizeable household net wealth differences in the euro area, ranging from €80,000 (Slovakia) to €710,000 (Luxembourg) for the mean and €51,000 (Germany) to €398,000 (Luxembourg) for the median. A natural question then is to ask why Luxembourg households are so rich.

Second, the Luxembourg labour market provides jobs for more than 150,000 cross-border commuters. These commuters represent about 44% of domestic employment in Luxembourg (154,000 of 347,000) (Statec, 2012b) and contribute very substantially to Luxembourg's GDP. Based on estimates from the same data sources used in this paper, in 2010, cross-border commuter households spent on average €9,300 for products and services in Luxembourg, which represented roughly 17% of their gross household income from Luxembourg (Mathä, Porpiglia and Ziegelmeyer, 2012b, 2014a).

Third, using representative data of these sets of households provides an indigenous opportunity to analyse the contribution of differences in house price dynamics for wealth differences. As we will show, the gross household income of Luxembourg resident and cross-border commuter households are very similar limiting the possibility of income difference to be a dominating factor. In addition, cross-border commuters working in Lux-

embourg pay their income tax and all social contributions (medical insurance, public pension contributions, unemployment insurance) and receive their transfers (e.g. family allowances, child benefits) in and from Luxembourg. Thus, we can quasi abstract from international differences in institutional characteristics related to the work place across countries and focus on other factors; we focus on spatial differences in non-realised capital gains from housing value appreciations. We believe that this provides value added and offers a unique setting to compare household wealth levels across countries and across neighbouring regions.

We show that differences in house price dynamics are likely to be a major explanatory factor. Quantile regressions, Oaxaca-Blinder and DFL decompositions demonstrate that wealth differences are mainly driven by spatial differences in house price dynamics. The DFL decomposition shows that differences in house price dynamics explain 127% (65% and 41%) of the wealth differences at the median (75th percentile, 90th percentile) of the respective total household net wealth distribution. Other factors contributing to the observed wealth differences are differences in endowments, such as differences in employment (income, (self-)/employed), educational attainment, and other household characteristics (age, marital status, number of children, migration status). These factors explain at the median only a minor or negative part (13%, -21% and -39%) of the observed differences (with the remainder being unexplained).

Section 2 presents the data and main sample characteristics, including income and wealth. Section 3 presents multivariate regression results and sample decompositions à la Oaxaca (1973) and Blinder (1973) and Di Nardo, Fortin and Lemieux (1996). Section 4 reports some robustness checks. Section 5 concludes.

2 Data

2.1 The resident and cross-border Household Finance and Consumption Survey

For the purpose of this paper we combine two representative household surveys targeted at obtaining detailed micro-data on household balance sheets. Both surveys were conducted in 2010/2011 by the Central Bank of Luxembourg together with CEPS/INSTEAD. The first survey, conducted as part of the Eurosystem Household Finance and Consumption Survey (HFCS), is representative of the Luxembourg resident population (LU-HFCS). The second survey is a specific companion survey targeted at households living in the neighbouring cross-border regions (Lorraine, Saarland, Rhineland-Palatinate and Wallonie) and working in Luxembourg, i.e. cross-border commuter households. The XB-HFCS was designed, such that the main aggregate wealth components can be matched to the LU-HFCS. The questionnaires share the same main features; both contain questions aimed at individual household members and questions aimed at the household as an entity (as main unit of analysis). The topics regarding household-level questions relate to the subsequent areas: real assets and their financing, other liabilities/loans, private businesses/financial assets and consumption.

Some relevant differences exist and limitations apply, though. First, for the lack of data in the XB-HFCS, we cannot account for intergenerational transfers, which are an important factor in the wealth accumulation process in general and for homeownership in particular.[2] Second, the survey methodologies differ; the LU-HFCS was conducted as Computer Assisted Personal Interview (CAPI), whereas the XB-HFCS was conducted as postal survey. Due to this difference the XB-HFCS could not be as detailed. While underlying concepts of derived variables are identical, we cannot exclude that answers requesting a total amount over several categories does not return the same value as summing over amounts provided for each category separately.[3] However to alleviate criticism in this respect, the analytic part of this paper focuses on one particular aspect of household total net wealth, the household main residence, for which the questions and the wording between the two surveys are almost completely identical. Thus, we are confident that this is generally not a major concern with respect to the main conclusions we draw. Both datasets are multiply stochastically imputed.[4] All descriptive statistics contain household level weights. The multivariate analysis is not weighted as explained at the end of subsection 3.1. The LU-HFCS is representative of 186,440 households resident in Luxembourg. The XB-HFCS is representative of 99,181 cross-border commuter households, i.e. households residing outside Luxembourg within the *"Grande-Région"* where at least one household member works in Luxembourg at the time of the data collection.

To jointly analyse resident and cross-border commuter households we merged the two datasets. In an attempt to further harmonise the information underlying these two datasets we restricted the resident survey to contain households with at least one employed or self-employed household member (similar to the cross-border commuter survey). This reduces the number of households in the resident dataset from 950 to 706 (compared to 715 cross-border commuter households). This restriction is necessary since the cross-border survey is targeted at households residing abroad within the Grande-Région and having at least one household member at work in Luxembourg (either employed or self-employed). Households consisting exclusively of pensioners, unemployed and members non-active in the labour market are excluded from the analysis in this paper.

The socio-economic characteristics of the households of both samples are described in more detail in Appendix 1. Here, it suffices to note that cross-border commuters tend to be well educated (44% with 1st or 2nd stage tertiary education), male (70%), married or living together in consensual union (68%), about 40 years of age, working fulltime with a permanent contract. The predominant share of cross-border commuters is born in the country where they reside (88%). Overall, differences between cross-border commuter households and resident households seem to be economically small for items like age, household size

[2] In a companion paper, Mathä, Porpiglia, Ziegelmeyer (2014b) show that, while important for the wealth accumulation process, intergenerational transfers are much less relevant for explaining differences in household total net wealth between euro area countries.

[3] Further issues related to data comparability between the two surveys are addressed in Appendix 1.

[4] For a detailed description and preliminary results of both the LU-HFCS and XB-HFCS please refer to Mathä, Porpiglia and Ziegelmeyer (2012a,b). For the sake of brevity, we will not present details here.

or working hours. Still, differences are most often statistically significant. Cross-border commuter households tend to be somewhat younger, are more often headed by a male, are higher educated and are less often self-employed compared to resident households. Thus, we control for the differences of the sample characteristics in the multivariate analysis below.

2.2 Income and wealth of resident and cross-border commuter households[5]

Table 1 shows gross labour income by country of residence.[6] Labour income of resident households is on average about €79,000. This is significantly higher (p-value=0.000) than the Luxembourg income of cross-border commuter households with about €54,000. Further taking into account the income of cross-border commuter households from their respective country of residence reduces the differences but does not suffice to equalise the household income of resident and cross-border commuter households (p-value=0.000). Normalising the income from Luxembourg by dividing it by number of household members employed in Luxembourg, reduces the income difference between resident households (€51,000) and cross-border commuter households (€42,000), which is due to more household members of Luxembourg resident households being in work in Luxembourg. Nevertheless, differences remain highly significant (p-value=0.000). Similarly, adjusting the combined labour income from Luxembourg and the country of residence by the number of household members in work (regardless of the country) and comparing it to the adjusted income of Luxembourg residents has no effect (with 1.68, the average number of household members in work, is slightly higher than the 1.64 for Luxembourg resident households). The difference in total adjusted income remains highly significant (p-value=0.000).

Table 1: Gross household labour income by country of residence

Household	**Origin**	**Luxembourg**		**Home country**		**Total**		**Hh. members**	**Labour inc. LU**
type		Mean	Median	Mean	Median	Mean	Median	empl.in LU (*)	adjusted by (*)
Cross-border commuter	*Belgium*	*60,640*	*37,500*	*8,686*	*0*	*69,327*	*55,000*	*1.32*	*46494*
	France	*46,925*	*37,500*	*8,145*	*0*	*55,071*	*41,250*	*1.31*	*36345*
	Germany	*59,037*	*37,500*	*10,580*	*251*	*69,617*	*55,000*	*1.23*	*46839*
	Total	53,501	37,500	8,904	0	62,405	55,000	1.29	41601
Luxembourg resident	*National*	*83,174*	*69,000*	*0*	*0*	*83,174*	*69,000*	*1.60*	*55346*
	Foreign	*74,104*	*54,000*	*0*	*0*	*74,104*	*54,000*	*1.69*	*47257*
	Total	78,781	60,600	0	0	78,781	60,600	1.64	51428

Source: own calculations based on the XB-HFCS 2010 and the LU-HFCS 2010/2011; data are multiply imputed and weighted. The number of cross-border commuters from Luxembourg to the three neighbouring countries is negligible. Although the LU-HFCS did not ask for labour income in Belgium, France and Germany, we can safely assume that it is very close to zero.

[5] Mathä, Porpiglia and Ziegelmeyer (2012b) provide a basic aggregate depiction of income and wealth differences between Luxembourg resident and cross-border commuter households. As this paper addresses the factors for wealth differences, the two surveys were merged and the analysis restricted to a "comparable" sample population, i.e. (self-)/employed resident households and commuter households, which by definition are (self-)/employed.

[6] We take the midpoint of each income bracket for cross-border workers to obtain a point estimate of labour income. For resident households we take exact values as reported.

Next, we turn to wealth levels and differences therein. The estimated mean (median) of total household net wealth is around €240,000 (€167,000) for cross-border commuter households and around €610,000 (€296,000) for resident households (Table 2).[7] Whereas the wealth categories are on average always significantly larger for resident households (Table 2, last column), foreign households resident in Luxembourg seem to be much more similar to cross-border commuter households with respect to wealth holdings. For example, while average total net wealth and net real wealth are significantly higher for foreign resident households than for cross-border commuter households, no significant difference is found for the average net value of the household main residence and net financial wealth.

Table 2: Mean and median of main wealth categories over country of residence

	Cross-border commuter households				Luxembourg resident households				
Wealth category	**Belgium**	**France**	**Germany**	**Total**	**Nationals**	**Foreigners**		**Total**	
mean									
net real wealth	290,266	188,831	194,136	215,959	772,467	335,216	**	560,686	***
net value household main residence	179,013	150,114	117,764	149,203	473,608	163,369	n.s.	323,345	***
net financial wealth	46,240	8,823	30,738	23,922	61,828	30,415	n.s.	46,613	***
total net wealth	336,506	197,654	224,874	239,881	834,295	365,630	**	607,300	***
median									
net real wealth	197,265	150,000	113,500	154,635	414,995	93,002	***	275,710	***
net value household main residence	163,282	135,000	70,000	128,000	350,000	0	***	188,000	**
net financial wealth	7,000	0	10,000	1,444	16,482	5,000	**	10,000	***
total net wealth	210,000	152,887	142,000	167,000	443,044	140,306	n.s.	295,500	***

*Source: own calculations based on the XB-HFCS 2010 and the LU-HFCS 2010/2011; data are multiply imputed and weighted. We run a weighted OLS and quantile regression including a constant and a cross-border dummy as explanatory variables taking the 5 multiple imputed datasets into account to test for differences in the mean and median. We tested two specifications: In specification I the reference group for the cross-border dummy are foreign households in Luxembourg and in the second specification the reference group are all resident households. The last column following the mean (median) of the corresponding resident group indicates the significance level (n.s. - not significant; * 10%; ** 5%; *** 1%) of the cross-border dummy on each explained variable.*

For both populations, net real wealth is the most important component contributing about 90% to net wealth. The most important component of net real wealth, in turn, is the net value of the household main residence contributing 62% to average total net wealth for cross-border households and 53% for resident households. Thus, this one single asset accounts for more than one half of total net wealth on average. Therefore, in the analytic part, we separately look into differences in owner-occupied housing wealth to explain the large difference in total net wealth holdings of almost €370,000 (€130,000) on average (median). Almost 50% of this difference in total net wealth holdings both at the mean and median can be attributed to the differences in the net value of the household main residence.

[7] The different degree of detail with respect to financial wealth items is likely to lead to an underestimation of this wealth component for cross-border commuter households relative to Luxembourg resident households. The low mean and median net financial wealth of cross-border commuter households from France may be related to the generally higher underreporting of French households compared to Belgian or German households. See also HFCN 2013a, Table 10.5 for details on this issue.

Net real wealth and the net value of household main residence have prominent roles in explaining the wealth differences between cross-border commuter and resident households. For both the mean and the median, 94% of the difference in total net wealth is due to differences in net real wealth, whereas 6% only are due to differences in net financial wealth. In turn, the difference in the HMR net value contributes 47% or €174,000 (€60,000) to the mean (median) difference in total net wealth (Table 2). This difference is not explained by a higher ownership rate among resident households. On the contrary, the ownership rate of resident households is 63% and almost 10 percentage points lower than that of cross-border commuter households (p-value=0.000). Within the Luxembourg resident population there are sizeable differences between native and immigrant households (i.e. households born and not born in Luxembourg). The former own their HMR in 82% of cases, the latter in 43% of cases. Thus, whereas cross-border commuter households are significantly more likely to be owners of their HMR than Luxembourg immigrant households, they are less likely to be HMR owners than Luxembourg native households.

Table 3: Contribution of the HMR to total net wealth

	Cross-border commuter households				Luxembourg resident households		
Percentile	**Belgium**	**France**	**Germany**	**Total**	**Nationals**	**Foreigners**	**Total**
net value household main residence							
p10	0	0	0	0	0	0	0
p25	62,717	0	0	0	70,000	0	0
p50	163,282	135,000	70,000	128,000	350,000	0	188,000
p75	260,175	230,000	206,937	234,152	585,711	282,871	458,143
p90	400,000	349,887	300,000	350,000	900,000	532,000	704,191
total net wealth							
p10	5,000	3,500	9,700	5,000	14,600	1,219	3,559
p25	100,000	25,000	30,000	35,000	166,500	12,406	36,700
p50	210,000	152,887	142,000	167,000	443,044	140,306	295,500
p75	393,456	270,569	315,000	312,000	867,080	419,500	636,000
p90	732,267	425,000	560,000	549,880	1,417,000	830,656	1,180,000
net value household main residence/total net wealth							
p10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
p25	62.7%	0.0%	0.0%	0.0%	42.0%	0.0%	0.0%
p50	77.8%	88.3%	49.3%	76.6%	79.0%	0.0%	63.6%
p75	66.1%	85.0%	65.7%	75.0%	67.5%	67.4%	72.0%
p90	54.6%	82.3%	53.6%	63.7%	63.5%	64.0%	59.7%

Source: own calculations based on the XB-HFCS 2010 and the LU-HFCS 2010/2011; data are multiply imputed and weighted.

Differences between cross-border commuter and Luxembourg resident households appear negligible at the lower end of the net wealth distribution, i.e. at the 10th and 25th percentile. At the median the difference is already sizable at €128,500, and approximately doubles for the 75th and again for the 90th percentile. As the contribution of the HMR to these differences is zero at lower percentiles, it is likely that the differences in total net wealth at the median and higher end of the distribution are linked to differences in the HMR net values. The conditional mean (median) net value of the HMR is €633,000 (€500,000) for resident households and €268,000 (€250,000) for cross-border households, which is to say that the

mean (median) net HRM value is 2.4 (2.0) times as high for resident households.[8] At the upper half of the total net wealth distribution, the HMR is always the single most important contributing asset. At the median, the net value of the HMR contributes about 77% and 64% to net total wealth of cross-border commuter and Luxembourg resident households, respectively. The corresponding figures are 75% and 72% at the 75th percentile and 64% and 60% at the 90th percentile, respectively. Furthermore, differences in net HMR wealth between Luxembourg resident and cross-border commuter households contribute 47%, 69% and 56% to the difference in total net wealth at the 50th, 75th and 90th percent of the distribution.

One might ask whether this huge difference in the value of the HMR is related to characteristics of the HMR. Easy to compare are the number of square metres of the household main residence. To reduce the difference, cross-border commuter households should have a smaller HMR on average. This is indeed the case. Resident HMR measures on average (median) 162 (145) square metres, while it is 150 (140) square metres for cross-border commuter households. The difference is statistically significant (p-value=0.009), and thus contributes, albeit marginally so, to explaining in the immense difference in HMR values. The average price per square metre for a cross-border household is almost €1,800. This represents only 46% of the €3,900 average price per square metre for Luxembourg resident households. The next section traces differences in house prices back to differences in past house price dynamics in Luxembourg and in the cross-border regions.

3 Why is net (real) wealth of Luxembourg households so high?

The striking difference between net (real) wealth of resident and cross-border commuter households raises questions regarding possible explanations thereof. As indicated in the introduction, we suspect that real estate or property price dynamics play a key role. Figure 1 shows the evolution of the official index of residential property prices for new and existing dwellings in Luxembourg by the Luxembourg statistical institute Statec. The index starts in 1974 and shows a steady increase over years with the exception of the recent economic and financial crisis in 2008/2009.[9] Except for the most recent period, the annualised average nominal capital gain over n years (calculated as $((p_{t+n}/p_t)^{1/n}-1)$ where p_t refers to the real estate price index) of real estate investments hovered around between 6% and 8%. These capital gains are higher than corresponding figures for neighbouring countries or the euro area (Figure 1).

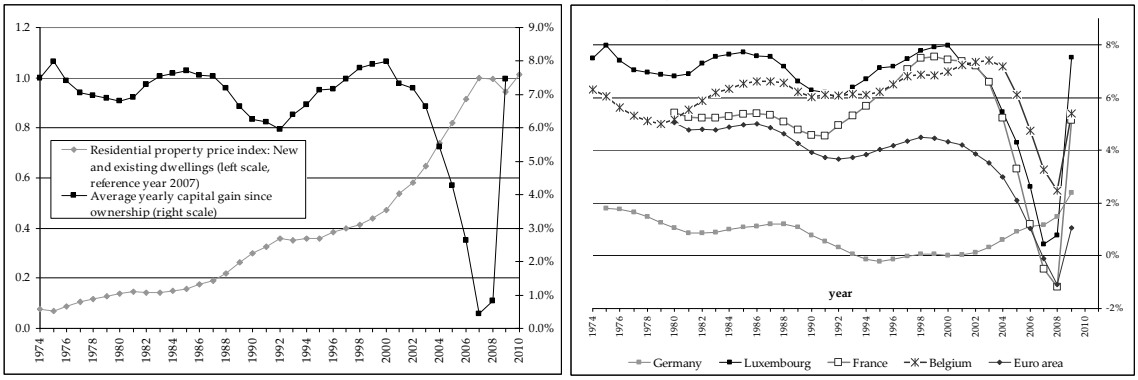
[8] There is no difference for the median value of €500,000 between resident households born and not born in Luxembourg. The mean value is around 30% larger for resident households born in Luxembourg.

[9] See BCL (2000) for a description of the index construction.

Figure 1: Residential property price dynamics

Luxembourg *Selected countries*

Average yearly capital gain since acquisition



Source: Statec residential property price index, authors' calculations. ECB Statistical Data Warehouse: Structural Housing Indicators Statistics (ESCB): Index for new and existing dwellings for Germany, Luxembourg and the euro area; index for existing dwellings for Belgium and France.

Measuring property price developments is subject to a number of challenges and it seems that none provides an optimal yet practicable solution; collecting means or medians of transactions may be easy, but the composition of transactions may change over time or transactions are not representative for the whole market; representative property price methods may not be fully comparable across markets, repeat sales methods require at least two transactions of a single property, while hedonic price models require large and detailed data sets to correct for quality differences over time (see for example Hilbers et al., 2008 and Case and Wachter, 2005 for details). One rather common approach is to construct house price indices out of self-reported house values from representative household surveys. On the positive side, constructing a house price index based on self-reported information encompasses both relevant demand and supply conditions shaping the development of real estate prices. Furthermore, such a house price index is based on a comparison of the same property over time. On the negative side, self-reported house prices are known of being slightly (usually in the order of <10%) biased upward (e.g. Ihlanfeldt and Martinez-Vazquez, 1986; Goodman and Ittner, 1992; Benítez-Silva et al., 2009). Using, data from the U.S. Survey of Consumer Finances, Bucks and Pence (2006) for example report that U.S. homeowners report house values reasonably accurately.

Since house price indices are not available for the cross-border regions of the neighbouring countries of Luxembourg, and allowing for the fact that regional price developments might differ within countries, we construct corresponding house price indices using the data of both HFC surveys separately. For both the resident (*RES*) and the cross-border (*XB*) subsample separately and for each year, we take the average of the current (self-assessed) estimated selling price P_T and divide it by the average (self-assessed) acquisition price P_t of all dwellings (serving as HMR) bought or built in this year. The result is a time-varying index of the accumulated nominal capital gain since HMR acquisition. Expressed in mathematical terms, for each homeowner household h in the set H_t of households who

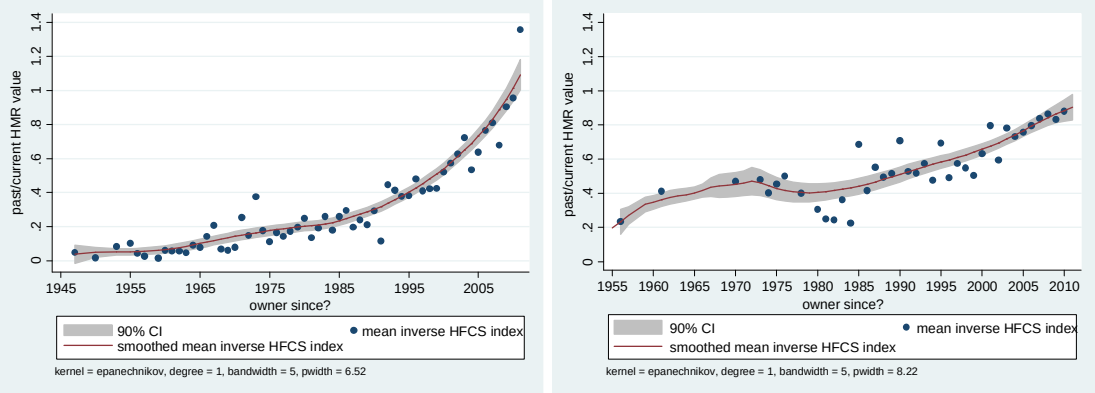
acquired their HMR in year *t*, we sum over the self-assessed value *P* at the time of interview *T* and divide by the sum of the value *P* at time of acquisition *t*, where *RES* and *XB* refer to the respective subsample.

$$(1) \qquad h \in H_t \qquad r_{t,C}^{\mathrm{RES,XB}} = \sum_{h \in H_t} P_{T,C}^{\mathrm{RES,XB}} / \sum_{h \in H_t} P_{t,C}^{\mathrm{RES,XB}}$$

For both the LU-HFCS and the XB-HFCS, the development of the raw (inverse) index is depicted in Figure 2 for the last 50+ years. Furthermore, Figure 2 shows the respective inverse index based on kernel-weighted local polynomial smoothing with corresponding confidence intervals.

Figure 2: Accumulated capital gains

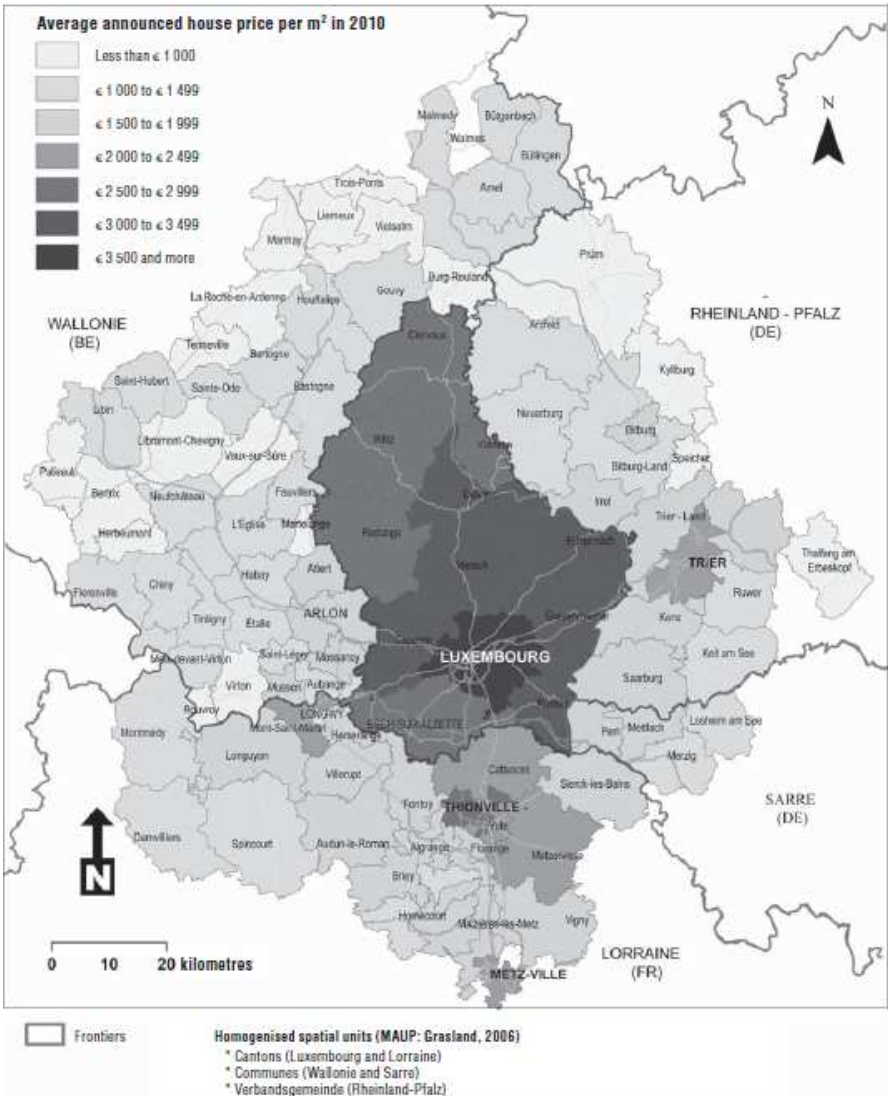
Resident households | *Cross-border commuter households*



Note: The figure shows the ratio of the HMR mean value at survey date to acquisition date, by year, inverted scale
Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed and weighted. The figures exclude very early data points to improve the visual display (LU-HFCS excludes the years before 1945; XB-HFCS excludes the years before 1955).

A graphical comparison between the official Statec residential property price index with the smoothed HFCS indices reveals that the two indices move closely together, and thus share similar dynamics (Figure 4). The smoothed indices are analogous to Figure 2 with the difference that a polynomial smoothing is applied and the index is normalised to 1 for the (wealth) reference year of the two surveys. We will refer to this index as (mean) HFCS (house price) index. The similarity between the official and the HFCS indices provides an indication of the good quality and validity of the HFCS index for further analysis. In addition, house price dynamics were seemingly lower in cross-border regions than in Luxembourg, as is very persuasively depicted in Figure 3. Thus, over the years, existing homeowners in Luxembourg profited from higher valuations of house prices.

Figure 3: Map of Luxembourg with neighbouring regions, depicting average house prices



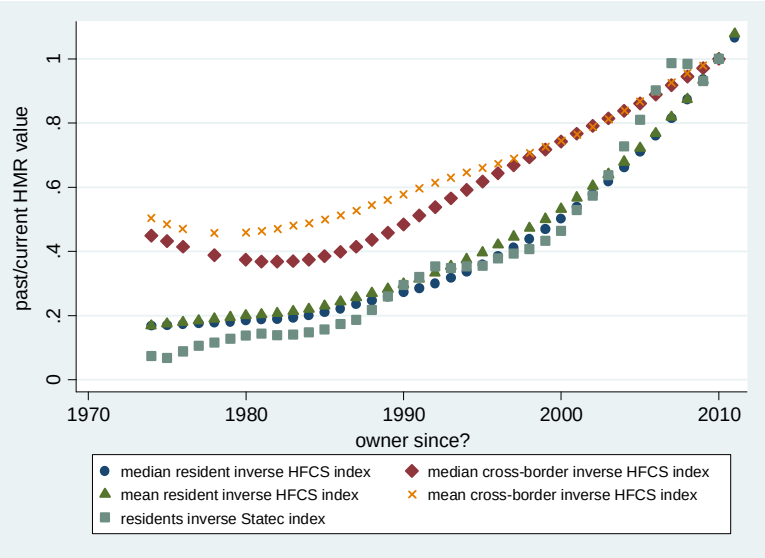
Source: OECD (2012), based on Diop (2011).

As robustness check, we compare the mean HFCS house price index with its counterpart derived from median house price values for both the resident and the cross-border household sample. They indicate only minimal differences (Figure 4). We therefore concentrate on the mean HFCS index in the further analysis (subsequent results also hold for the median index). We construct a variable that, for all HMR owners with year of acquisition at year *t*, equals the smoothed index derived from the ratio of the average HMR value at its average current value to the value at year *t* of acquisition (as self-reported in the 2010/2011 survey). For all households not owning their HMR, the index is zero by construction.

The reasoning behind this variable is that, over time, homeowners profit from increases in the value of their HMR. The accumulated increase in the value represents the accumulated nominal capital gain if the household were to sell the HMR. Households owning their

HMR for a longer time are thus expected to receive a higher accumulated capital gain; accumulated capital gains from house price increases are generally lower for cross-border commuter households and zero for non-owners. We subsequently use this index to explore to what extent differences in house price dynamics explain observed differences in total net wealth and net HMR wealth across the two samples.

Figure 4: Inverse Statec residential property price index and smoothed inverse mean/median indices



Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed and weighted. Statec, authors' calculations. The reference year 2010 is set to 1.

3.1 Estimation strategies

Following the approach of Gale and Pence (2006), we use different methodologies to assess how the differences in a set of selected covariates affect differences in household total net wealth and the net value of the household main residence between Luxembourg resident and cross-border commuter households.

We start by estimating a quantile regression model between the median level of either total net or net HMR wealth and a set of covariates. We include an indicator variable discriminating between the two sample populations (Luxembourg and cross-border commuter households). This approach allows identifying whether or not a significant wealth gap between Luxembourg resident and cross-border commuter households exists if the main household characteristics are controlled for. However, this approach does not tell us what factors contribute to the gap we observe.[10] Next, we therefore use decomposition

[10] It also relies on a number of restrictive assumptions considered suboptimal in the framework of wealth analysis. The most relevant restriction in practice is, with the exception of the allowed shift in the intercept, the usual imposition of an otherwise identical relationship between the dependent and the explanatory variables across the two groups (i.e. the assumption of the same slope coefficients).

methods, which have become a standard technique to overcome such limitations.[11] The Oaxaca-Blinder decomposition of mean differences (Oaxaca, 1973; Blinder, 1973), widely used in the framework of labour economics, allows assessing how much of the difference in the group mean of the variable of interest is due to the differences in endowments (i.e. the level of the covariates commonly referred to as "explained" part) and how much is due to the changes in the relationship between the dependent and explanatory variables (i.e. the difference in the covariates' coefficients, commonly referred to as "unexplained" part) (Jann, 2008). The counterfactual conditional means of the Oaxaca-Blinder decomposition is calculated using an OLS model, and thus seeks to explain group differences at the mean of the distribution, but does not allow making inferences about changing importance of explanatory factors as we move along the distribution of the variable of interest.

The Oaxaca-Blinder decomposition is criticised, as it both presumes a linear relationship between the dependent and the explanatory variables and a quasi-normal distribution of the dependent variable (e.g. Cobb-Clark and Hildebrand, 2006; Gale and Pence, 2006), both of which are unlikely to be fulfilled in the framework of wealth analysis (see among others Barsky et al., 2002). Although it is possible to partially overcome these shortcomings using an appropriate non-linear transformation of the dependent variable (Pence, 2006), the skewness of the wealth data, its economic meaning, as well as changes in the wealth and household main residence value gap along the distribution suggest using techniques tailored to analyse differences in the whole distribution rather than being restricted to analysing mean or median differences.

To examine the varying importance of explanatory variables along the distribution we, therefore, complement the quantile regression and Oaxaca-Blinder decomposition with the Di Nardo, Lemieux, Fortin (1996) decomposition (henceforth DFL decomposition). The DFL decomposition was initially introduced to study the effect of labour market institutions on the wage distribution (Di Nardo, Lemieux, Fortin, 1996), and is widely used in the framework of labour economics, with particular focus on wage differentials between ethnic groups, immigrant and native workers (Chiquiar and Hanson, 2005), gender (Barón and Cobb-Clark, 2010), sexual orientation (Antecol et al. 2008) and unionisation (Di Nardo and Lemieux, 1997). In wealth studies, the DFL decomposition was applied by Cobb-Clark and Hildebrand (2006) to analyse the wealth gap of Mexican Americans and by Bauer et al. (2011) and Sinning (2007) in context of the immigrant to native wealth gap, while Sierminska, Frick and Grabka (2010) applied the decomposition in the context of gender wealth inequalities.

To ensure maximum comparability between the subpopulations in the merged dataset we restrict our analysis to the subpopulation of resident and cross-border commuter households where at least one member is either employed or self-employed. In addition to the analysis for the above sample, we also conduct the analyses for various subpopulations, in particular homeowners to asses the overall validity of the obtained results. For presenta-

[11] For an exhaustive description of these methodologies see Fortin, Lemieux and Firpo (2011).

tional purposes, we restrict ourselves to the discussion of results for i) the sample with households in employment and ii) the sample with homeowner households. Furthermore, due to the relevance of the HMR for total net household wealth and differences therein, we present regression results for both total net wealth and net HMR value of homeowners. Results for other subpopulations are discussed within the section concerning the robustness of the results. To account for the multiply imputed nature of the databases, all the coefficients and standard errors obtained are corrected by using Rubin's (1987) combination rules.

The two surveys use a very similar sampling design in terms of sample frame, variables used for the construction of weights and calibration (see Mathä, Porpiglia and Ziegelmeyer 2012a,b); therefore and to preserve the comparability across different estimation techniques, we included the variables used in the construction of the household weights, i.e. nationality, income, age, gender, into the regression model at the expense of applying weighted regression techniques.[12]

3.2 Quantile Regression

The size of the unconditional difference in total net wealth and net HMR wealth between resident and cross-border commuter households naturally raises questions about the causing factors. In the literature analysing wealth differences, a well-established model has emerged (see Bauer et al. 2011, Sinning, 2007 among others) that identifies a set of variables to determine the existence of different conditional levels of the wealth aggregate of interest and to explain the determinants of this difference. Besides its obvious relationship with income, wealth is likely to be influenced by a number of factors related to the household structure and characteristics of the household head. We follow this basic set up and estimate the following model:

$$(1) \qquad W = \beta_0 + \beta_1 Y + \beta_2 E + \beta_3 Z + \beta_4 I(+\beta_5 H) + \varepsilon ,$$

where, omitting the household identifier *i*, W represents the wealth aggregate of interest (i.e. total net wealth or net HMR value) of each household in the sample, *Y* is a vector representing the total household income and the employment status; *E* is a vector of dummies representing the education level. *Z* stands for a set of households' characteristics such as the age of the household head, the number of children below the age of 18 present in the household, the civil status (single, married, divorced or widowed), and the immigration status. *I* is an indicator variable that takes value 0 if the household is resident in Luxembourg and 1 if it is a cross-border commuter household. *H*, included in the second specification of the model, represents the smoothed mean house price index (thereafter the smoothed mean index) introduced in the previous section. All individual characteristics refer to the household head defined as the most financial knowledgeable person in the

[12] The choice of using unweighted regression is also due to the impossibility to use weights in the quantile regression in the statistical package used for the estimation (STATA 13; this is differently and wrongly indicated in the Stata manual).

household. To address problems related to heteroskedasticity, standard errors are calculated over 1000 bootstrap replicates (Cameron and Trivedi, 2010, pp. 222-226).

Table 4: Quantile regression

	Total sample		Homeowners only			
	Total net wealth (1)	Total net wealth (2)	Total net wealth (3)	Total net wealth (4)	Net HMR value (5)	Net HMR value (6)
Total household income	2.19 ***	1.84 ***	1.74 ***	1.83 ***	0.39 ***	0.45 ***
	(5.85)	(5.74)	(4.89)	(5.64)	(3.01)	(3.10)
Self-employed	194,166 **	148,040 **	430,039 ***	386,103 ***	100,906 **	76,503 *
	(2.23)	(2.15)	(4.50)	(3.92)	(2.12)	(1.88)
Secondary education	101,931 **	39,387 **	43,291	56,021 *	34,394	34,418
	(2.45)	(2.03)	(1.20)	(1.71)	(1.28)	(1.46)
Tertiary education	126,085 ***	66,877 **	120,391 **	132,971 ***	81,518 ***	89,743 ***
	(2.74)	(2.32)	(2.57)	(3.38)	(2.85)	(3.46)
Male	-11,487	10,014	20,826	24,628	-16,309	-10,095
	(-0.47)	(0.64)	(0.88)	(1.16)	(-1.30)	(-0.73)
Age	10,993 ***	3,984 ***	13,695 ***	10,276 ***	9,856 ***	7,894 ***
	(5.33)	(3.34)	(8.27)	(5.88)	(11.63)	(6.82)
Married	72,751 **	1,231	-14,685	-4,882	18,592	20,906
	(2.18)	(0.06)	(-0.44)	(-0.13)	(0.86)	(0.99)
Divorced	-42,279	-18,570	-72,164 *	-41,132	-55,238 **	-30,847
	(-0.92)	(-0.67)	(-1.66)	(-0.93)	(-2.29)	(-1.11)
Widowed	-13,676	-54,524	-136,550	-136,263	-27,137	-65,031
	(-0.11)	(-0.57)	(-1.05)	(-0.87)	(-0.42)	(-0.70)
Number of children < 18	3,036	4,993	12,860	14,893	23,529 ***	26,582 ***
	(0.21)	(0.61)	(1.05)	(1.19)	(2.97)	(3.68)
Immigrant	-147,689 ***	-51,902 **	-93,834 ***	-58,443 *	-73,291 ***	-50,254 ***
	(-3.87)	(-2.38)	(-3.37)	(-1.85)	(-3.87)	(-2.86)
Cross-border household	-187,328 ***	-87,027 ***	-234,489 ***	-164,172 ***	-208,100 ***	-157,843 ***
	(-5.65)	(-4.19)	(-7.56)	(-5.04)	(-10.18)	(-6.43)
Mean smoothed house price index		137,317 ***		69,567 ***		42,765 **
		(10.41)		(2.77)		(2.41)
Constant	-325,621 ***	-185,704 ***	-266,180 ***	-324,177 ***	-99,465 **	-153,160 ***
	(-3.35)	(-3.34)	(-3.32)	(-4.35)	(-2.03)	(-3.33)
Observations	1,420	1,420	1,030	1,030	1,030	1,030
Pseudo R2	0.15	0.22	0.16	0.16	0.19	0.21

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Base employed, primary education, female, single, national, resident in Luxembourg. Bootstrapped std. errors based on 1,000 replicates. t-statistics in parentheses. * p<0.1, ** p<0.05 and *** p<0.01.*

The results of the quantile regression (Table 4) are in line the main findings in the empirical wealth literature (see among others Gale and Pence, 2006; Bauer et al., 2011; Sinning 2007). Household (labour) income and being self-employed contribute significantly positive to the median level of household total net wealth and the net HMR value. As usual in this type of analysis, age is positively linked to higher net wealth; since the sample includes households only where at least one household member is in work, the age squared term, usually included to capture effects related to life-cycle theory, is omitted. Other household characteristics, such as the civil status or the number of dependent children, seem to play a smaller or no role in determining the median level of total net wealth. Median net total wealth and net HMR values generally increases with education attainments;

secondary education is positive significant in the specification of total net wealth, but mostly insignificant for homeowners. In contrast, tertiary education is always positive and statistically significant for both subsamples. Furthermore, across specifications, the coefficient size is higher than the respective secondary education coefficient, indicating that tertiary education in particular, and in partial contrast to secondary education, is very relevant for the wealth accumulation (at the median level). Immigrant households (i.e. defined as households heads born outside the country of residence) have significantly lower median levels of total net wealth than comparable native households, thus corroborating previously reported results by Mathä, Porpiglia and Sierminska (2011) for Luxembourg based on a different dataset.

Table 4 (specifications 2, 4, and 6) includes the smoothed mean housing value capital gains index previously discussed. This index plays a relevant and highly significant role in explaining the median total net household wealth in both the full sample and the homeowner sample and the difference between Luxembourg resident and cross-border commuter households. Including the house price index sizeably reduces the median total net and net HMR wealth difference between resident and cross-border commuter households. For the full sample, the house price index reduces total net wealth difference attributed to foreign residency by about €100,000 to €87,000. For homeowners, correspondingly, the house price index reduces the median total net wealth and net HRM wealth difference between Luxembourg resident and cross-border commuter households by €70,000 and €43,000 to €164,000 and €158,000 respectively. Thus, these results show that Luxembourg residents, over the years, have benefitted more from increasing house prices than cross-border commuter households. The house price index is very effective tool to synthesise relevant features of the respective housing markets, as it among others incorporates supply and demand conditions.[13] Furthermore, it captures that nominal capital gainshave been higher in Luxembourg than in neighbouring regions but also that households resident in Luxembourg have on average profited longer from increasing house prices since their ownership dates back longer.

3.3 Oaxaca-Blinder Decomposition

Next, we analyse the explanatory factors of the wealth differences between resident and cross-border commuter households. The most widely used methodology is the Oaxaca-Blinder decomposition (Oaxaca 1973, Blinder 1973). The intuition behind this decomposition is to divide the wealth difference between cross-border commuter and Luxembourg resident households into a part that is explained by the difference in their respective explanatory factors / endowments, and a part that is unexplained, meaning that part of the difference is explained by different coefficient estimates for the respective explanatory factors / endowments. In gender and ethnicity studies the unexplained part is commonly referred to as discriminatory part (Oaxaca, 1973). In our context, the unexplained part be in-

[13] To rule out the possibility that the house price index coefficient incorporates effects due to mere home ownership, specification (2) was re-estimated including a home ownership dummy, which however turned out to be insignificant.

terpreted to relate to both international differences in institutional aspects (e.g. property and income taxation other than labour income derived from Luxembourg), but also aspects related to differences in housing markets (e.g. transaction cost differences) that impact the wealth accumulation process.

Relying on the notation as outlined by Jann (2008), we define the difference of the mean between the two groups as $R = E(Y_{RES}) - E(Y_{XB})$. Assuming the expected value of net wealth to be linear in the covariates it is possible to express the difference in the mean of the outcome variable as:[14]

$$(2) \qquad \hat{R} = \underbrace{(\overline{X}_{RES} - \overline{X}_{XB})'\hat{\beta}_{XB}}_{\text{Endowment effect}} + \underbrace{\overline{X}_{RES}'(\hat{\beta}_{RES} - \hat{\beta}_{XB})}_{\text{Coefficient effect}}$$

In Equation 2, the first term is the endowment effect. It amounts to the expected change of Luxembourg resident households' mean net wealth (net total or net HMR wealth) were they to have the same characteristics as cross-borders commuter households. Put differently, the explained part reveals the wealth differences that are explained by differences in the covariates. The second term, i.e. the unexplained or discrimination effect, quantifies the expected variation in Luxembourg resident households' mean net wealth were they to have the same coefficients as cross-border commuter households. Put differently again, the unexplained part reveals the wealth differences that are explained by differences in the coefficient estimates.

It is natural to analyse the contribution of each single covariate to the difference in the overall outcome. This contribution can be calculated considering that the total explained and unexplained component can be expressed as the respective sum over the individual contributions of each explanatory factor. Being an OLS based methodology, the Oaxaca-Blinder decomposition is prone to the influence of outliers. To avoid this problem both total net wealth and net HMR wealth are trimmed at 1st and 95th percentile of the respective distribution. This is done separately for each subpopulation, i.e. separately for Luxembourg resident and cross-border commuter households.

To ease the interpretation, covariates are grouped in four different categories: *employment* includes the household income and a dummy indicating whether or not the household head is self-employed; *education* includes two dummies representing secondary and tertiary education; *demography* includes a number of relevant household characteristics, such as age, civil status, immigration status and number of children below the age of 18; finally *house price index* includes the smoothed mean index as a separate category.

[14] $Y_l = X_l'\beta_l + \varepsilon_l$, $E(\varepsilon_l) = 0$; $l = [RES, XB]$ where X is a matrix including the set of covariates listed in the previous paragraph.

Table 5 reports the results for the Oaxaca-Blinder decomposition. For the full sample, the mean total net wealth difference between the two groups amounts to €244,000; for homeowners it is higher at €368,000 while the difference in the net HMR value is €240,000. Differences in endowments explain almost 36%, 23% and 24% of the respective wealth difference. Thus, the unexplained part dominates the explained part, indicating large positive coefficient effects in favour of Luxembourg resident households. Differences in the covariates income and employment status (grouped) are statistically significant and thus contribute to the explanation of total net household wealth differences. Differences in education endowments tend to decrease this gap or put differently they contribute negatively in explaining the gap. This is clear considering that cross-border commuter households have a higher average level of education than Luxembourg resident households, and given its positive relationship with household total net wealth (Table 4). Were resident and cross-border commuter households to have the same education endowments implied wealth differences would even be larger than those observed. Differences in demographic characteristics between the two groups do not play a statistically significant role in explaining wealth differences across the two subpopulations.

The interpretation of the coefficients related to the HFCS house price index is different to that of other covariates. Given the HFCS index can broadly speaking be interpreted as non-realised accumulated capital gain on housing investment a positive and significant coefficient indicates by itself differences in accumulated capital gains on real estate investments for both groups. The house price index contributes between 83%-102% to the explained part of the decomposition, thus demonstrating the overwhelming importance of differences in the real estate price dynamics for the net wealth accumulation.

Briefly turning to the unexplained part, differences in wealth are mainly attributed to differences in coefficients for the category demographics. Differences in the coefficient estimates contributing to the unexplained differences in wealth between Luxembourg resident and cross-border commuter households are found for the covariates male (+), married (+), age (+) and immigration (-) (detailed results not shown). Significant differences in the house price coefficients between groups exist in the full sample. In specification (2) and (3), which restrict the sample to homeowners, differences in coefficient estimates between Luxembourg resident and cross-border commuting households are not significant.

Table 5: Oaxaca-Blinder Decomposition

	Full sample		Homeowners			
	Total net wealth (1)		Total net wealth (2)		Net HMR value (3)	
	absolute	in %	absolute	in %	absolute	in %
Overall						
Resident households	492,290 ***		674,811 ***		448,532 ***	
	(23.22)		(26.14)		(33.53)	
Cross-border households	248,036 ***		306,383 ***		208,148 ***	
	(27.04)		(30.38)		(36.88)	
Difference	244,254 ***	50%	368,428 ***	55%	240,384 ***	54%
thereof	(10.42)		(13.38)		(16.64)	
Explained	89,025 ***	36%	85,558 **	23%	56,903 ***	24%
	(4.33)		(2.23)		(2.61)	
Unexplained	155,229 ***	64%	282,870 ***	77%	183,481 ***	76%
	(6.35)		(6.21)		(7.47)	
Explained						
Employment	24,774 ***	28%	26,438 ***	31%	9,177 **	16%
	(3.44)		(3.28)		(2.35)	
Education	-21,393 ***	-24%	-28,314 ***	-33%	-13,146 ***	-23%
	(-3.40)		(-3.63)		(-3.07)	
Demographics	-5,153	-6%	16,684	20%	6,540	11%
	(-0.47)		(1.43)		(1.02)	
Mean smoothed house price index	90,797 ***	102%	70,749 *	83%	54,332 **	95%
	(6.68)		(1.82)		(2.50)	
		100%		100%		100%
Unexplained						
Employment	15,372	10%	47,793	17%	17,568	10%
	(0.68)		(1.50)		(1.02)	
Education	51,311	33%	19,926	7%	-5,659	-3%
	(1.37)		(0.36)		(-0.19)	
Demographics	195,146 **	126%	261,796 *	93%	316,108 ***	172%
	(1.98)		(1.82)		(4.39)	
Mean smoothed house price index	-65,174 **	-42%	-29,519	-10%	-47,251	-26%
	(-2.23)		(-0.32)		(-0.95)	
Constant	-41,427	-27%	-17,126	-6%	-97,284	-53%
	(-0.41)		(-0.12)		(-1.32)	
		100%		100%		100%
Observations	1,349		962		985	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Values trimmed at 95% and 1% of the distribution of household net wealth for each group. t statistics in parentheses. * p<0.1, ** p<0.05 and *** p<0.01.*

3.4 DFL Decomposition

The DFL decomposition allows obtaining detailed information on the factors explaining differences between our two sub-populations for the entire distribution of the variable of interest. Our implementation closely follows the approach by Cobb-Clark and Hildebrand (2006) and as applied among others by Bauer et al. (2011) and Sinning (2007). In analogy to the Oaxaca-Blinder decomposition, the difference in the total net wealth (net HMR wealth)

densities between resident and cross-border commuter households can be then expressed as a combination of counterfactual wealth (w) distributions:

$$
\begin{aligned}
f^{res}(w) - f^{xb}(w) = & \left[f^{res}(w) - f^{h}(w)\right] \\
& + \left[f^{h}(w) - f^{y}(w)\right] \\
& + \left[f^{y}(w) - f^{e}(w)\right] \\
& + \left[f^{e}(w) - f^{z}(w)\right] \\
& + \left[f^{z}(w) - f^{xb}(w)\right]
\end{aligned} \tag{3}
$$

Again, we group the covariates into four categories: the first category contains the HFCS house price index; the second group y contains total household income and a dummy indicating whether the household head is self-employed, the third group e contains the dummies indicating secondary and tertiary education level achieved by the head of household and the fourth group z includes age, marital status, number of children aged below the age of 18, gender, and the immigration status of the head of household. As for the Oaxaca-Blinder decomposition, each term of equation 3 represents the contribution of the difference in each covariates' category to the difference in the total net wealth (net HMR wealth) level between cross-border commuter and Luxembourg resident households.

As is well-established in the literature analysing wealth differences and given the wealth distribution of net total wealth is significantly more compressed for cross-border commuter than for Luxembourg resident households, we estimate all aforementioned counterfactual distributions by reweighting the distribution of Luxembourg residents. This extends to the decomposition with respect to the net HMR wealth. Due to the sensitivity of the DFL decomposition to the ordering of the categories we provide results based on averaging of all possible sequences as has become common practice (e.g. Barsky et al., 2002, Cobb-Clark and Hildebrand, 2006; Bauer et al., 2011; Sinning, 2007 and Sierminska, Frick and Grabka, 2010).

Turning to the results, the findings of the DFL decomposition (Table 6-Table 8) for the household total net wealth distributions support and strengthen the results of the Oaxaca decomposition at the mean level and the results from the quantile regressions. Differences in the distribution of the house price index between the two groups play a major role in explaining differences in the total net wealth (considering the full sample and the homeowner sample) and net HMR wealth through the whole respective distributions. Its contribution to explaining total net wealth differences in the full sample between Luxembourg resident and cross-border commuter households is 127%, 65% and 41% at the 50th, 75th and 90th percentile. At the 10th and 25th percentile, the inclusion of the house price index is not really meaningful as the number of households owning their HMR is very low. This also becomes apparent when comparing the decomposition for the full sample with the homeowner sample. For homeowners, it is the single most important covariate explaining dif-

ferences in total net wealth and net HMR wealth. For the lower half of the total net wealth (net HMR wealth) distribution, the contribution of the house price index is 74% (104%) at the 10th percentile, 56% (66%) at the 25th percentile and 58% (62%) at the 50th percentile and significant; its importance decreases in the upper half part of the distribution to 40% (43%) at the 75th and 35% (20%, non-significant) at 90th percentile. This tendency, for what concerns the total net wealth, reflects the decreasing contribution of the household main residence over the distribution of total net wealth (Table 3).

Employment related characteristics seem not to play a relevant role in explaining observed total net wealth differences at the median for the full sample, while its effect is statistically significant at 75th and 90th percentile, accounting respectively for 23% and 34% of the total difference. Differences in employment characteristics are relevant for explaining differences in homeowners' total net wealth between the two considered groups, while their influence is negligible for net HMR wealth differences, which is likely to be due to the omission of business wealth from total net wealth and the higher income of the self-employed. The contribution tends to increase from the 50th percentile upward for total net wealth of homeowners.

In the full sample, educational attainment contributes always negatively to the wealth differences between Luxembourg resident and cross-border commuter households. This is regardless of the percentile and variable of interest although, for the full sample, it is significant mainly for the decomposition of total net wealth, where the contribution varies between -14% and -21% for the upper half of the distribution.[15] Differences in educational attainments are relevant for explaining homeowners' total net wealth differences between the two groups at median level only, where they account for -14%.

Accounting respectively for -39% at median level and -28% at 75th percentile level, demographic characteristics tend to contribute negatively to explaining observed total net wealth differences for the total sample, whereas their contribution is non significant for homeowners (both for total net wealth and net HMR wealth).

The last column accounts for the difference in total net wealth and net HMR distribution not explained by the difference in endowments. At the median, unexplained differences account for 20% of the difference in total net wealth in the full sample and 52% (41%) of total net wealth (net HMR wealth) for homeowners. There is a general tendency of a higher contribution at percentiles in the upper half compared to the lower half of the distribution. Thus, while differences in endowments generally play a sizeable role in explaining total net wealth differences between the resident and the cross-border commuter households, differences between groups in endowment returns seem more pronounced for households in the upper part of the wealth distributions.

[15] For homeowners, it varies between -7% and -14% for total net wealth and 1% and -9% for net HMR wealth. Across percentiles considered here, the contribution of educational attainment is higher (less negative) for net HMR wealth than for total net wealth.

Table 6: DFL decomposition: Total net wealth – full sample

	Raw		Index		Employment		Education		Demographics		Unexplained	
50th Percentile	174,688	***	222,216	***	23,396		-36,403	**	-68,780	**	34,260	
t-stat	6.10		7.84		1.40		-2.51		-2.46		0.96	
%	*100%*		*127%*		*13%*		*-21%*		*-39%*		*20%*	
75th Percentile	440,285	***	286,533	***	101,347	***	-85,301	***	-122,395	**	260,101	**
t-stat	7.24		5.80		2.62		-2.85		-2.22		2.69	
%	*100%*		*65%*		*23%*		*-19%*		*-28%*		*59%*	
90th Percentile	837,444	***	347,183	***	288,478	*	-119,383	*	-110,116		431,282	**
t-stat	6.13		3.53		1.78		-1.74		-0.92		3.25	
%	*100%*		*41%*		*34%*		*-14%*		*-13%*		*51%*	
50-10 Dif	176,818	***	211,496	***	20,279		-30,420	**	-62,271	**	37,733	
t-stat	6.37		7.53		1.25		-2.14		-2.28		1.08	
%	*100%*		*120%*		*11%*		*-17%*		*-35%*		*21%*	
75-25 Dif	441,578	***	208,898	***	90,952	**	-62,091	**	-78,969		282,788	**
t-stat	7.83		4.07		2.55		-2.18		-1.49		2.93	
%	*100%*		*47%*		*21%*		*-14%*		*-18%*		*64%*	
90-50 Dif	662,756	***	124,968		265,083	*	-82,980		-41,336		397,022	**
t-stat	5.19		1.28		1.72		-1.26		-0.36		3.07	
%	*100%*		*19%*		*40%*		*-13%*		*-6%*		*60%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 7: DFL decomposition: Total net wealth – homeowners

	Raw		Index		Employment		Education		Demographics	Unexplained	
10th Percentile	91,315	***	67,754	***	18,755	*	-7,381		-366	12,552	
t-stat	3.90		3.27		1.72		-0.57		-0.02	0.31	
%	*100%*		*74%*		*21%*		*-8%*		*0%*	*14%*	
25th Percentile	170,667	***	96,413	***	14,235		-11,787		-2,068	73,874	**
t-stat	8.44		3.92		1.35		-1.04		-0.09	2.82	
%	*100%*		*56%*		*8%*		*-7%*		*-1%*	*43%*	
50th Percentile	287,918	***	166,550	***	43,564	**	-40,629	*	-29,954	148,387	**
t-stat	8.65		4.21		2.39		-1.87		-0.87	3.16	
%	*100%*		*58%*		*15%*		*-14%*		*-10%*	*52%*	
75th Percentile	591,776	***	236,478	**	130,574	**	-65,887		-79,007	369,618	**
t-stat	7.70		2.21		2.18		-1.10		-0.93	2.25	
%	*100%*		*40%*		*22%*		*-11%*		*-13%*	*62%*	
90th Percentile	1,096,977	***	389,343	*	365,055	*	-160,195		-44,136	546,910	
t-stat	4.38		1.67		1.92		-1.05		-0.20	1.56	
%	*100%*		*35%*		*33%*		*-15%*		*-4%*	*50%*	
50-10 Dif	196,603	***	98,797	**	24,808		-33,248		-29,589	135,835	**
t-stat	5.46		2.35		1.34		-1.45		-0.81	2.44	
%	*100%*		*50%*		*13%*		*-17%*		*-15%*	*69%*	
75-25 Dif	421,108	***	140,064		116,339	**	-54,100		-76,939	295,744	*
t-stat	5.74		1.29		2.08		-0.94		-0.96	1.82	
%	*100%*		*33%*		*28%*		*-13%*		*-18%*	*70%*	
90-50 Dif	809,059	***	222,792		321,492	*	-119,566		-14,182	398,524	
t-stat	3.35		0.97		1.74		-0.82		-0.07	1.16	
%	*100%*		*28%*		*40%*		*-15%*		*-2%*	*49%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 8: DFL decomposition: Net HMR wealth – homeowners

	Raw		Index		Employment		Education	Demographics	Unexplained	
10th Percentile	48,669	*	50,410	***	16,517	*	343	-4,808	-13,792	
t-stat	1.84		2.84		1.90		0.03	-0.23	-0.49	
%	*100%*		*104%*		*34%*		*1%*	*-10%*	*-28%*	
25th Percentile	129,446	***	84,831	***	10,751		-5,410	-9,278	48,552	*
t-stat	7.95		4.11		1.23		-0.58	-0.47	1.69	
%	*100%*		*66%*		*8%*		*-4%*	*-7%*	*38%*	
50th Percentile	237,141	***	146,563	***	23,315		-22,064	-8,715	98,042	**
t-stat	11.03		4.99		1.64		-1.46	-0.33	2.35	
%	*100%*		*62%*		*10%*		*-9%*	*-4%*	*41%*	
75th Percentile	363,800	***	156,563	***	29,845		-30,226	-63,158	270,776	**
t-stat	11.63		2.87		1.29		-0.99	-1.31	3.41	
%	*100%*		*43%*		*8%*		*-8%*	*-17%*	*74%*	
90th Percentile	598,658	***	122,099		36,666		664	-57,039	496,269	**
t-stat	20.59		1.49		0.86		0.02	-0.97	3.71	
%	*100%*		*20%*		*6%*		*0%*	*-10%*	*83%*	
50-10 Dif	188,472	***	96,153	***	6,798		-22,407	-3,906	111,834	**
t-stat	6.29		3.01		0.50		-1.40	-0.15	2.50	
%	*100%*		*51%*		*4%*		*-12%*	*-2%*	*59%*	
75-25 Dif	234,354	***	71,732		19,094		-24,816	-53,880	222,224	**
t-stat	7.61		1.25		0.83		-0.86	-1.18	2.76	
%	*100%*		*31%*		*8%*		*-11%*	*-23%*	*95%*	
90-50 Dif	361,517	***	-24,464		13,351		22,728	-48,325	398,227	**
t-stat	11.51		-0.29		0.32		0.63	-0.85	3.11	
%	*100%*		*-7%*		*4%*		*6%*	*-13%*	*110%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

4 Robustness of results

Next, we briefly discuss results of some alternative specifications. Despite including a control for self-employed households heads and having shown that the constructed house price index and the Statec residential property price index share similar dynamics, we would like to rule out that i) the non-homogeneity of the resident and the cross-border commuter household sample with respect to self-employed headed households and ii) the construction of the mean house price index (based on household self-assessments) affect the previously discussed results.

Table 12 to Table 18 (presented in the appendix) show the estimates for the previously reported models either restricting the sample to non-self-employed households[16] or substituting the HFCS house price index with the Statec residential property price index, with the latter specification being estimated for homeowners only.[17]

[16] This sample is constructed by excluding households where at least one member is self-employed.

[17] Due to data limitations of the Statec house price index, this sample includes solely homeowners who acquired their HRM after 1974. Since it is not possible to trim in an analogues way the non-homeowners, for sake of consistency, we exclude non-homeowner cross-border commuter households. As this index is not available for bordering regions, the house price index used for cross-border commuter households remains unchanged and is also restricted to the years after 1974.

Quantile regressions

In the specification restricted to non-self-employed households (Table 12), we note that first, the house price index and the cross-border commuter dummy coefficients retain their significance and are comparable in magnitude when compared to the main specification (Table 4). In the specification restricted to non-self-employed households, the conditional total net wealth gap between resident and cross-border commuter households decreases by 6% in the median regression (see Table 12, (1) compared to the results Table 4, (2)). For the specification (2) and (4), which further restricts the sample to non-self-employed homeowners, the total net wealth (total net HMR value) gap of cross-border commuter household is 9% (11%) smaller than in the respective base model since we restrict the sample to a more homogenous group. The coefficient estimate of the house prices index for total net wealth level increases by a negligible 2%. Restricting the sample to non-self-employed homeowners the coefficient size of HFCS house price index increases by 23% (36%) for total net wealth (net HMR value). Substituting the HFCS house price index with the Statec residential property price index reduces the coefficient estimates of the house price index in the net wealth equation for the homeowners by 17%, while the corresponding coefficient in the net HMR equation is reduced by 6%. The net wealth gap and the net HMR value gap between resident and cross-border commuter households is reduced by 6%. However, none of the above reported differences are significant at 90% level. In summary, the two additional robustness tests deliver very similar results.

Oaxaca-Blinder decomposition

Restricting the sample to non-self-employed households, the different regional house price dynamics in Luxembourg and bordering regions increase in its explanatory power; they are able to explain 34% percentage points more of the explained difference in mean total net wealth (Table 13) than in the base model of Table 5. In the sample further restricted to homeowners, the house price index's explanatory power increases by 29 (25) percentage points for total net wealth (total net HMR value). Using the Statec residential property price index increases the explanatory power for the differences in total net wealth (total net HMR wealth) by 7 (9) percentage points. Thus, these restrictions tend to reinforce the obtained results. In particular, the restriction to the sample of the non-self employed results in a noticeably increased explanatory power of the different house price developments in Luxembourg and the border regions, which should not come as much of a surprise, as the restriction tends to harmonise the two samples further.

DFL decomposition

The robustness of the mean decomposition findings are reinforced by those at various points of the respective total household net wealth distribution. Restricting the sample to non-self-employed households (Table 14), the contribution of regional house price differences toward explaining differences in the total net wealth distribution increases by 20, 15 and 9 percentage points at 50th, 75th and 90th percentile relative to the full sample, respectively. Table 15 (Table 17) presents analogous results to Table 7 (Table 9). The coefficients

related to the real estate price index changes by 10 (41), -1(0), 2(4), 9(3) and -1(-1) percentage points with respect to base model at 10th, 25th, 50th, 75th and 90th percentile, respectively.

The last robustness check for the DFL decomposition replaces the HFCS house price index with the Statec residential property price index (Table 16 and Table 18) for the sample of homeowners. The contribution of the price index differences to the difference of total net wealth between resident and cross-border commuter households remains almost unchanged with respect to the base model presented in Table 7. The absolute variation of the coefficients ranges between 4 and 14 percentage points. A similar conclusion is reached for the total net HMR value where the absolute variation of the house price index coefficients with respect to Table 9 is less than 6 percentage points through the whole distribution.

Other specifications not shown

Aside of the presented robustness checks we re-estimated the quantile regression, the Oaxaca-Blinder and the DFL decomposition, by altering the sample size and composition (i.e. restricting the sample to households where all household members work in Luxembourg) in order to rule out that our results are driven by unobservable household characteristics with respect to labour market differences of household members which are non-cross-border commuter workers. In an additional specification, we used income deciles instead of a continuous variable to rule out the possible bias introduced by influential observations in this variable, including a control for being a public employee to account for possible differences in the household wealth accumulation behaviour induced by the special working conditions of this category. These specifications did not substantially change the obtained results and are therefore not presented in the paper.[18]

Despite careful modelling and selection of the sample, it is impossible to entirely rule out endogeneity with respect to households' choice of residency (i.e. residing within or outside Luxembourg) and self-selection of cross-border commuters within the resident population of the neighbouring regions. With regard to the latter, it is not possible, using the available data, to control for cross-border commuter self-selection. For this, it would have been necessary to use representative household data for neighbouring regions, which contain information on work location, which does not exist. Corresponding surveys to the Luxembourg LU-HFCS for the neighbouring countries do neither contain the country of work nor are they representative at the geographical level studied in this paper.

5 Final remarks

Crossing borders and boundaries often goes together with discontinuities, i.e. changed price and wages levels, crime rates, etc… This paper exploits this phenomenon and applies it to Luxembourg and its surrounding regions. We show that household wealth differs substantially across Luxembourg's borders. Luxembourg resident households are much

[18] Results not shown are available upon request from the authors.

richer than cross-border commuter households. The average (median) net wealth difference is estimated to be €367,000 (€129,000). This difference in wealth is the more surprising as income differences between Luxembourg resident and cross-border commuter households seem limited in size.

This paper analyses the main contributing factors and explores the inherent link between homeownership and house price dynamics for the wealth accumulation process. In particular, we show that accumulated non-realised capital gains from house price appreciations for employed households resident in Luxembourg are substantially above the capital gains of cross-border commuter homeowners, suggesting this variable to be central for explaining observed wealth differences. Using various decomposition techniques, spatial differences in real estate price dynamics, and thus differences in non-realised capital gains, are shown to be the main driving factor for existing differences in household wealth, whereas income, education and demographic differences are of minor importance. The presented results appear robust to the different methodologies, assumptions, and subsamples applied.

The total wealth of households resident in Luxembourg strongly depends on housing wealth. The recent boom and bust of house prices in some euro area countries such as Spain, Ireland or Cyprus demonstrates the vulnerability of household real estate wealth to changes in the price level of the residential property market. Since the HMR contributes more than 50% to mean total net wealth (even excluding other real estate investment), price corrections in the residential property market can have a major impact on the net wealth position of households resident in Luxembourg. In addition, high Luxembourg property prices result in non-affordability of homeownership for some parts of the Luxembourg population, who then turn to the cheaper property market across the border, thereby resulting in price pressure on properties in neighbouring regions. In an accounting framework, households in Luxembourg seem to be wealthy due to their accrued capital gains. However, as long as household use the consumption services of their homeownership they will not be better off. Only if Luxembourg households realise the accrued capital gains from the housing investment, they will be financially better off.

Turning to possible avenues for future research, the Eurosystem HFCS reports huge wealth differences across euro area countries (HFCN, 2013b), which to some extent may also be related to homeownership rates and past house price dynamics. The methodology applied in this paper is appropriate to analyse these issues in a wider European context and to analyse specifically the effect of intergenerational transfers on homeownership and the wealth accumulation process (see Mathä, Porpiglia and Ziegelmeyer, 2014b).

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Appendix 1: Comparability and socio-economic characteristics

Comparability of the two surveys

As reported, the survey mode of the two surveys differs due to legal and organisational reasons: while the survey among Luxembourg resident households (LU-HFCS) is a computer assisted personal interview, the survey among cross-border commuter households (XB-HFCS) is a postal survey. Despite the difference in the data collection method, the two questionnaires allow the construction of comparable aggregates. Notwithstanding some differences in the length of the data collection period, the reference year of wealth (2010) and income (2009) aggregate coincide. Furthermore, there is a close similarity in the survey design; both surveys have the same sample frame and the same sampling units (aside of the obvious difference in the country of residence), both present the same oversampling rate of wealthy households and a similar stratification set up.

Table 9: Survey characteristics

	LU-HFCS	**XB-HFCS**
Interview mode	CAPI	Postal survey
Planned fieldwork	End of Sep 2010 to Dec. 2010	Nov. 2010 – Dec. 2010
Actual end of fieldwork	Apr 2011	Jan. 2011
Sample frame	IGSS (Inspection Générale de la Sécurité Sociale – Social security register)	
Sampling unit	Resident fiscal households	Cross-border worker fiscal households
Oversampling of wealthy units	Yes – 20%	Yes – 20%
Sample size	950 households (planned 1000)	715 households (planned 500)
Number of strata	20	42 (14 for each country of residence)
Stratification variables	Nationality, empl. status, income	Country of residence, gender, income

Source: XB- and LU-HFCS 2010/2011.

Table 10: Unit non response

	LU-HFCS		XB-HFCS	
Overall response rate		20.0%		15.0%
Response rate by national-ity/country of residence	National HH:	19.7%	France:	15.0%
	Non-national HH:	20.3%	Belgium:	16.0%
			Germany:	14.2%
Response rate by income class	< 7000 EUR	18.4%	< 1500 EUR	9.3%
	> 7000 EUR	24.2%	1500 - 2000 EUR	12.2%
			2000 - 2500 EUR	12.7%
			2500 - 3000 EUR	12.7%
			3000 - 4000 EUR	13.8%
			4000 - 6000 EUR	15.5%
			>6000 EUR	19.6%

Source: Own calculations based on the XB- and LU-HFCS 2010/2011.

Taking into account the difference in the survey mode, unit non response of the two surveys is sufficiently comparable, with a 20% of response rate for the LU-HFCS and a 15% for the XB-HFCS. While a detailed analysis of unit non-response pattern in each survey

can be found respectively in Mathä, Porpiglia and Ziegelmeyer (2012a,b) here we just want to underline that response rates in both surveys follow a similar pattern.

Socio-demographic characteristics

Table 11 provides detail of the socio-demographic and employment characteristics of cross-border commuter households and (self-)/employed households in Luxembourg. Almost one half of cross-border commuting workers in Luxembourg reside in France, the other half is almost equally divided between Belgium and Germany. The weighted resident sample is almost equally split between national and foreign households. National in our case means that the household head is born in Luxembourg.[19] Thus, the country of birth is by construction Luxembourg for all resident national households. As expected the majority of cross-border commuters are natives of their respective country of residence. More than 80%, 90% and 85% of cross-border workers from Belgium, France and Germany are born in their respective country of residence.[20]

Overall about 70% (BE: 75%; DE: 71% and FR: 66%) of all commuter households are headed by a male person, closely matching official figures, which indicate 67% of cross-border commuters to be male (STATEC, 2012b). The average age of cross-border commuters is very similar in all three out-commuting countries: 41 years for cross-border commuters from Belgium; the corresponding ages for France and Germany are 39 and 41 years. Again, these figures correspond closely to previously reported figures (e.g. Allegrezza et al., 2005). In contrast, with an average (median) of 43 (44) years the resident household heads in our employed sample are slightly older.

The civil status is similar across countries; the mode is *"married"*, with relative frequencies of 69% in Belgium, 72% in France, 62% in Germany, 48% for nationals and 61% for foreign households; the second most frequent category is *"single"* with a share of around 21-24% in all three neighbouring countries. In 26% and 32% of cases, foreign and national households are single households, respectively. Cross-border commuters tend to be highly educated regardless of the country of residence. The distribution of educational levels is as follows: the most important category for cross-border households is to have achieved a (upper) secondary and post-secondary education degree (47%), followed by tertiary education (44%)[21]. This is in contrast to the educational status of households resident in Luxembourg which is lower on average. This is partly related to a high share of foreign household in Luxembourg with primary or lower secondary education, resulting in the share of households with tertiary education being around 13 percentage points lower for resident households than for cross-border households. The median household size is 3 for

[19] The household head is defined as the most financial knowledgeable person in the household.

[20] The sample characteristics match the characteristics published by STATEC well. STATEC (2012a) estimates the respective share of Belgian, French and German cross-border commuters from Belgium, France and Germany to be 90%, 96% and 92%.

[21] Cross-border commuters from France show the lowest share of household heads with completed primary education (3%). This is in line with the previous findings reported in Zanardelli (2004).

commuters from France and Belgium and households in Luxembourg and 2 commuters from Germany.

Table 11: Socio-economic and employment characteristics of the combined sample

		XB-HFCS				LU-HFCS			Test
		BE	FR	DE	Total XB	National	Foreign	Total LU	(*)
Country of residence	Observations	192	353	170	715	339	367	706	
	Percentage	26.9%	49.4%	23.8%	100.0%	48.0%	52.0%	100.0%	
	Percentage weighted	25.4%	49.1%	25.5%	100.0%	51.6%	48.4%	100.0%	
Country of birth	Belgium	83.1%	1.4%	1.2%	22.1%	0.0%	8.5%	3.8%	
	France	6.0%	91.5%	0.2%	46.5%	0.0%	17.5%	7.8%	
	Germany	1.1%	1.0%	86.2%	22.8%	0.0%	7.2%	3.2%	
	Luxembourg	3.9%	1.8%	7.0%	3.7%	100.0%	0.0%	55.3%	
	Rest EU	2.3%	1.7%	3.9%	2.4%	0.0%	52.5%	23.5%	
	Rest of the world	3.7%	2.5%	1.4%	2.5%	0.0%	14.4%	6.4%	
Gender	Male	74.5%	65.7%	70.9%	69.3%	56.6%	66.2%	61.3%	***
Age	Mean	40.9	39.3	41.3	40.2	43.8	42.7	43.3	***
	Median	41	38	40	40	44	43	44	
Marital status	Single/never married	21.0%	22.8%	23.4%	22.5%	31.6%	25.7%	28.8%	***
	Married or consensual union	68.6%	71.7%	61.9%	68.4%	48.2%	60.7%	54.3%	***
	Widowed	0.7%	0.4%	1.9%	0.8%	3.3%	3.0%	3.2%	***
	Divorced	9.8%	5.2%	12.8%	8.3%	16.9%	10.5%	13.8%	***
Education	Primary or lower secondary	10.6%	3.9%	16.8%	8.9%	26.8%	37.1%	31.8%	***
	(Upper) and post secondary	38.9%	50.8%	48.0%	47.1%	45.4%	28.1%	37.0%	***
	First and second stage of tertiary	50.5%	45.3%	35.2%	44.0%	27.8%	34.8%	31.2%	***
Household size	Mean	3.2	3.0	2.7	3.0	2.7	2.9	2.8	**
	Median	3	3	2	3	3	3	3	
Employment status	Self-employed	3.7%	2.0%	1.8%	2.4%	9.9%	9.5%	9.7%	***
	Employee	96.3%	98.0%	98.2%	97.6%	90.2%	90.5%	90.3%	***
	thereof with permanent contract	96.8%	97.3%	97.8%	97.3%	92.2%	92.2%	92.2%	***
Sector of company / employer (incl. NACE Code, Rev. 2), employees only	Agriculture (A)	0.0%	0.0%	0.0%	0.0%	2.3%	1.4%	1.9%	***
	Industry (B, C, D, E)	19.7%	18.4%	13.0%	17.4%	7.6%	4.1%	5.9%	***
	Construction (F)	6.8%	11.0%	15.0%	11.0%	3.3%	16.0%	9.4%	ns.
	Wholesale & retail trade; repair (G)	12.9%	10.5%	12.3%	11.6%	4.3%	5.7%	5.0%	***
	Financial services (K)	17.9%	15.7%	24.2%	18.4%	13.6%	16.9%	15.2%	ns.
	Market services (H, I, J)	18.9%	19.3%	7.6%	16.2%	12.1%	17.1%	14.5%	ns.
	Non market services (L-S)	23.8%	25.1%	27.8%	25.5%	56.8%	38.7%	48.0%	***
Working hours / week	Mean	39.5	39.7	39.9	39.7	39.5	41.5	40.5	*
	Median	40	40	40	40	40	40	40	

*Source: own calculations based on the XB-HFCS 2010; data are multiply imputed and weighted on a household level. (*) We run a weighted regression including a constant and a cross-border dummy as explanatory variables taking the 5 multiple imputed datasets into account. The last column indicates the significance level (n.s. - not significant; * 10%; ** 5%; *** 1%) of the cross-border dummy on each explanatory variable.*

With about 98%, almost all cross-border commuters are employees, with a negligible variance among the different countries of residence. 97% of all employed cross-border commuters have a permanent contract. Both fractions are higher compared to resident households with more self-employed households (10%) and a lower fraction of employees having a permanent contract. By far the most important sector for cross-border commuters is the services sector, where almost 60% of jobs are located (NACE codes: H–S). At a more disaggregate level, the main sectors of activity are non-market services and financial services followed by Industry and Market Services. For nationals the fraction of households employed in the services sector increases to 78%, of which the majority is working in Non-Market services. The median number of working hours is 40 per week for cross-border commuting and resident households.

Appendix 2

Table 12: Quantile regression

	Total sample	Homeowners only			
	Total net wealth✖ (1)	Total net wealth✖ (2)	Total net wealth✚ (3)	Net HMR value✖ (4)	Net HMR value✚ (5)
Total household income	1.53 ***	1.71 ***	1.93 ***	0.43 ***	0.47 ***
	(4.53)	(5.06)	(5.62)	(3.18)	(3.11)
Self-employed			376,909 ***		57,629
			(3.52)		(1.32)
Secondary Education	40,386 **	61,329 *	43,410	42,699 *	28,724
	(2.12)	(1.84)	(1.11)	(1.76)	(1.08)
Tertiary Edcuation	70,671 **	134,925 ***	113,117 **	95,027 ***	81,299 ***
	(2.01)	(3.27)	(2.25)	(3.69)	(2.84)
Male	4,423	13,656	24,408	-3,564	-6,922
	(0.34)	(0.62)	(0.97)	(-0.26)	(-0.51)
Age	2,728 **	8,839 ***	10,200 ***	6,607 ***	7,868 ***
	(2.05)	(6.02)	(6.37)	(5.87)	(8.50)
Married	7,327	7,235	-21,512	22,062	8,827
	(0.45)	(0.21)	(-0.52)	(1.08)	(0.39)
Divorced	-3,163	-35,195	-54,903	-11,872	-27,204
	(-0.12)	(-0.74)	(-1.19)	(-0.43)	(-0.93)
Widowed	-29,823	-34,230	2,539	-41,157	-18,197
	(-0.41)	(-0.21)	(0.02)	(-0.43)	(-0.13)
Number of children below 18	6,228	16,933	16,872	28,838 ***	28,393 ***
	(0.53)	(1.49)	(1.35)	(4.03)	(3.74)
Immigrant	-41,126	-47,993 *	-64,094 **	-45,834 ***	-52,424 ***
	(-1.26)	(-1.69)	(-2.04)	(-2.74)	(-2.72)
Cross-border household	-81,708 ***	-148,747 ***	-153,656 ***	-139,840 ***	-149,080 ***
	(-2.91)	(-4.97)	(-4.20)	(-6.00)	(-7.35)
Mean smoothed house price index	139,616 ***	85,437 ***		58,261 ***	
	(10.58)	(3.75)		(3.38)	
Statec house price index			57,553 ***		40,129 ***
			(3.68)		(5.11)
Constant	-129,895 *	-304,310 ***	-292,994 ***	-152,702 ***	-145,689 ***
	(-1.95)	(-3.95)	(-3.72)	(-3.39)	(-3.16)
Observations	1273	932	1009	932	1009
Pseudo R2	0.25	0.17	0.17	0.22	0.21

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Bootstrapped std. errors based on 1,000 replicates. ✖ Subpopulation of non-self-employed, ✚ Subpopulation homeowners after 1974; t-statistics in parentheses. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 13: Oaxaca-Blinder Decomposition

	Full sample		Homeowners							
	Total net wealth✖ (1)		Total net wealth✖ (2)		Total net wealth✚ (3)		Net HMR value✖ (4)		Net HMR value✚ (4)	
	absolute	in %	absolute	in %	absolute	in %	absolute	in %	absolute	in %
Overall										
Resident households	446,641 ***		612,441 ***		669,424 ***		431,800 ***		431,741 ***	
	(22.12)		(25.19)		(25.91)		(30.69)		(32.17)	
Cross-border households	244,358 ***		302,195 ***		306,234 ***		205,483 ***		200,037 ***	
	(26.68)		(30.13)		(30.18)		(36.17)		(35.22)	
Difference	202,282 ***	45%	310,246 ***	51%	363,190 ***	54%	226,317 ***	52%	231,704 ***	54%
thereof	(9.02)		(11.73)		(13.17)		(15.03)		(15.93)	
Explained	58,700 ***	29%	46,605	15%	142,503 **	39%	36,959 *	16%	103,856 ***	45%
	(3.12)		(1.39)		(2.18)		(1.90)		(2.89)	
Unexplained	143,583 ***	71%	263,641 ***	85%	220,688 ***	85%	189,358 ***	85%	127,848 ***	85%
	(6.33)		(6.46)		(3.16)		(8.30)		(3.44)	
Explained										
Employment	6,135	10%	8,634 **	19%	26,706 ***	19%	2,355	6%	5,216	5%
	(1.41)		(2.05)		(3.37)		(1.62)		(1.39)	
Education	-23,186 ***	-39%	-29,383 ***	-63%	-25,355 ***	-18%	-15,030 ***	-41%	-11,751 ***	-11%
	(-3.43)		(-3.52)		(-3.26)		(-3.19)		(-2.69)	
Demographics	-3,916	-7%	15,247	33%	12,613	9%	5,424	15%	2,010	2%
	(-0.35)		(1.31)		(1.10)		(0.84)		(0.31)	
Mean smoothed house price index	79,666 ***	136%	52,106	112%			44,210 **	120%		
	(6.52)		(1.53)				(2.29)			
Statec house price index					128,538 *	90%			108,380 ***	104%
					(1.91)				(2.97)	
		100%		100%		100%		100%		100%
Unexplained										
Employment	-23,329	-16%	2,003	1%	57,668 *	26%	19,372	10%	27,413	21%
	(-1.33)		(0.07)		(1.81)		(1.22)		(1.56)	
Education	46,129	32%	14,578	6%	1,901	1%	-2,340	-1%	-17,185	-13%
	(1.36)		(0.29)		(0.03)		(-0.08)		(-0.58)	
Demographics	79,391	55%	92,409	35%	197,630	90%	278,342 ***	147%	278,955 ***	218%
	(0.92)		(0.68)		(1.38)		(3.83)		(3.92)	
Mean smoothed house price index	-1,351	-1%	110,178	42%		0%	3,671	2%		0%
	(-0.05)		(1.23)				(0.07)			
Statec house price index					-87,304	-40%			-121,835 *	-95%
					(-0.68)				(-1.79)	
Constant	42,743	30%	44,473	17%	50,793	23%	-109,685	-58%	-39,500	-31%
	(0.47)		(0.34)		(0.37)		(-1.49)		(-0.54)	
		100%		100%		100%		100%		100%
Observations	1,225		885		942		896		911	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Values trimmed at 95% and 1% of the distribution of household net wealth for each group. ✖ Subpopulation of non-self-employed, ✚ Subpopulation homeowners after 1974. t statistics in parentheses. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 14: DFL Decomposition - Total net wealth - subpopulation of non-self-employed households

	Raw		Index		Employment	Education		Demographics		Unexplained	
50th Percentile	146,392	***	215,714	***	10,968	-46,788	***	-71,902	**	38,400	
t-stat	4.45		6.70		0.83	-2.97		-2.56		1.05	
%	*100%*		*147%*		*7%*	*-32%*		*-49%*		*26%*	
75th Percentile	324,707	***	260,017	***	23,487	-94,603	***	-124,760	**	260,566	***
t-stat	7.10		5.64		1.06	-2.73		-2.21		2.67	
%	*100%*		*80%*		*7%*	*-29%*		*-38%*		*80%*	
90th Percentile	597,781	***	301,334	***	18,423	-99,710	**	-79,256		456,990	***
t-stat	6.64		3.73		0.72	-2.02		-1.04		3.92	
%	*100%*		*50%*		*3%*	*-17%*		*-13%*		*76%*	
50-10 Dif	151,178	***	205,580	***	10,198	-41,009	***	-65,930	**	42,339	
t-stat	4.72		6.45		0.82	-2.58		-2.39		1.18	
%	*100%*		*136%*		*7%*	*-27%*		*-44%*		*28%*	
75-25 Dif	336,948	***	182,547	***	18,138	-66,434	*	-78,675		281,371	***
t-stat	7.95		3.75		0.95	-1.92		-1.42		2.83	
%	*100%*		*54%*		*5%*	*-20%*		*-23%*		*84%*	
90-50 Dif	451,389	***	85,621		7,454	-52,922		-7,354		418,590	***
t-stat	5.29		1.07		0.33	-1.12		-0.10		3.69	
%	*100%*		*19%*		*2%*	*-12%*		*-2%*		*93%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 15: DFL Decomposition - Total net wealth – subpopulation of non-self-employed homeowners

	Raw		Index		Employment	Education	Demographics	Unexplained	
10th Percent	82,087	***	68,963	***	6,937	-5,506	2,348	9,345	
t-stat	2.90		3.03		0.80	-0.36	0.09	0.23	
%	*100%*		*84%*		*8%*	*-7%*	*3%*	*11%*	
25th Percentile	154,560	***	84,411	***	6,605	-11,783	-4,958	80,286	***
t-stat	7.34		3.20		1.02	-0.90	-0.20	2.78	
%	*100%*		*55%*		*4%*	*-8%*	*-3%*	*52%*	
50th Percentile	237,234	***	143,441	***	15,426	-38,536	-36,251	153,153	***
t-stat	7.90		3.54		1.27	-1.55	-0.96	3.04	
%	*100%*		*60%*		*7%*	*-16%*	*-15%*	*65%*	
75th Percentile	458,907	***	222,905	**	35,698	-50,412	-134,755	385,471	**
t-stat	8.49		1.98		1.07	-0.72	-1.47	2.31	
%	*100%*		*49%*		*8%*	*-11%*	*-29%*	*84%*	
90th Percentile	687,741	***	235,179		53,148	-81,689	-96,550	577,652	
t-stat	5.55		0.94		0.37	-0.49	-0.34	1.26	
%	*100%*		*34%*		*8%*	*-12%*	*-14%*	*84%*	
50-10 Dif	155,147	***	74,479	*	8,489	-33,030	-38,598	143,808	**
t-stat	4.66		1.73		0.63	-1.23	-0.99	2.45	
%	*100%*		*48%*		*5%*	*-21%*	*-25%*	*93%*	
75-25 Dif	304,347	***	138,494		29,094	-38,629	-129,797	305,185	*
t-stat	6.01		1.22		0.96	-0.59	-1.47	1.85	
%	*100%*		*46%*		*10%*	*-13%*	*-43%*	*100%*	
90-50 Dif	450,507	***	91,737		37,722	-43,153	-60,299	424,498	
t-stat	3.79		0.38		0.27	-0.27	-0.22	0.94	
%	*100%*		*20%*		*8%*	*-10%*	*-13%*	*94%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 16: DFL Decomposition - Total net wealth - homeowners after 1974 - Statec Index

	Raw		Index		Employment		Education	Demographics	Unexplained	
10th Percent	89,815	***	78,809	***	17,878		-5,065	1,087	-2,892	
t-stat	3.66		3.33		1.34		-0.36	0.04	-0.07	
%	*100%*		*88%*		*20%*		*-6%*	*1%*	*-3%*	
25th Percentile	167,186	***	87,556	***	16,894		-9,129	-778	72,643	**
t-stat	7.94		3.60		1.47		-0.74	-0.03	2.27	
%	*100%*		*52%*		*10%*		*-5%*	*0%*	*43%*	
50th Percentile	286,449	***	146,135	***	41,941	**	-30,577	-22,710	151,660	***
t-stat	8.24		3.88		2.30		-1.47	-0.67	3.02	
%	*100%*		*51%*		*15%*		*-11%*	*-8%*	*53%*	
75th Percentile	575,460	***	252,468	**	145,103	**	-52,937	-71,967	302,793	*
t-stat	8.06		2.39		2.08		-0.93	-0.85	1.92	
%	*100%*		*44%*		*25%*		*-9%*	*-13%*	*53%*	
90th Percentile	1,010,645	***	267,381		351,724	*	-154,585	-33,498	579,623	
t-stat	4.52		0.92		1.67		-0.88	-0.12	1.14	
%	*100%*		*26%*		*35%*		*-15%*	*-3%*	*57%*	
50-10 Dif	196,634	***	67,326		24,063		-25,512	-23,796	154,553	***
t-stat	5.33		1.62		1.27		-1.11	-0.66	2.78	
%	*100%*		*34%*		*12%*		*-13%*	*-12%*	*79%*	
75-25 Dif	408,273	***	164,912		128,210	*	-43,809	-71,189	230,149	
t-stat	6.04		1.53		1.95		-0.82	-0.88	1.46	
%	*100%*		*40%*		*31%*		*-11%*	*-17%*	*56%*	
90-50 Dif	724,196	***	121,246		309,783		-124,008	-10,788	427,963	
t-stat	3.38		0.42		1.52		-0.73	-0.04	0.86	
%	*100%*		*17%*		*43%*		*-17%*	*-1%*	*59%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 17: DFL Decomposition - Net HMR value – subpopulation of non-self-employed homeowners

	Raw		Index		Employment		Education	Demographics	Unexplained	
10th Percent	35,399		51,175	***	7,679		1,728	-4,544	-20,638	
t-stat	1.35		2.73		1.45		0.15	-0.22	-0.73	
%	*100%*		*145%*		*22%*		*5%*	*-13%*	*-58%*	
25th Percentile	124,877	***	82,860	***	6,413		-1,841	-10,374	47,820	
t-stat	6.42		3.79		1.24		-0.17	-0.49	1.61	
%	*100%*		*66%*		*5%*		*-1%*	*-8%*	*38%*	
50th Percentile	215,229	***	142,672	***	13,623		-24,197	-16,869	100,000	**
t-stat	10.18		4.50		1.41		-1.33	-0.58	2.21	
%	*100%*		*66%*		*6%*		*-11%*	*-8%*	*46%*	
75th Percentile	302,312	***	138,112	**	13,515		-28,978	-94,022	273,684	***
t-stat	11.50		2.37		0.83		-0.73	-1.60	3.03	
%	*100%*		*46%*		*4%*		*-10%*	*-31%*	*91%*	
90th Percentile	529,251	***	102,499		16,275		4,288	-97,506	503,694	***
t-stat	9.61		1.09		0.36		0.08	-1.34	3.30	
%	*100%*		*19%*		*3%*		*1%*	*-18%*	*95%*	
50-10 Dif	179,831	***	91,497	***	5,945		-25,925	-12,325	120,638	**
t-stat	6.85		2.60		0.68		-1.35	-0.40	2.40	
%	*100%*		*51%*		*3%*		*-14%*	*-7%*	*67%*	
75-25 Dif	177,435	***	55,252		7,102		-27,136	-83,648	225,865	**
t-stat	6.69		0.91		0.49		-0.72	-1.46	2.42	
%	*100%*		*31%*		*4%*		*-15%*	*-47%*	*127%*	
90-50 Dif	314,021	***	-40,172		2,652		28,484	-80,636	403,694	***
t-stat	5.98		-0.43		0.06		0.63	-1.15	2.67	
%	*100%*		*-13%*		*1%*		*9%*	*-26%*	*129%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

Table 18: *DFL Decomposition - Net HMR value – subpopulation homeowners after 1974 – Statec Index*

	Raw		Index		Employment		Education	Demographics	Unexplained	
10th Percent	48,665	*	48,661	***	15,824	*	1,090	4,670	-21,581	
t-stat	1.86		2.63		1.76		0.09	0.20	-0.62	
%	*100%*		*100%*		*33%*		*2%*	*10%*	*-44%*	
25th Percentile	128,489	***	75,139	***	12,741		-1,987	-9,452	52,047	
t-stat	7.02		3.61		1.42		-0.19	-0.45	1.51	
%	*100%*		*58%*		*10%*		*-2%*	*-7%*	*41%*	
50th Percentile	230,076	***	136,205	***	25,742	*	-19,133	-7,403	94,664	*
t-stat	10.31		4.47		1.71		-1.26	-0.26	1.93	
%	*100%*		*59%*		*11%*		*-8%*	*-3%*	*41%*	
75th Percentile	359,680	***	162,859	***	37,643		-29,865	-55,524	244,566	***
t-stat	11.56		3.27		1.53		-1.08	-1.25	3.26	
%	*100%*		*45%*		*10%*		*-8%*	*-15%*	*68%*	
90th Percentile	596,133	***	131,817		55,753		-7,562	-64,818	480,944	***
t-stat	21.80		1.41		0.95		-0.17	-0.85	2.83	
%	*100%*		*22%*		*9%*		*-1%*	*-11%*	*81%*	
50-10 Dif	181,411	***	87,545	***	9,918		-20,223	-12,073	116,245	**
t-stat	6.29		2.70		0.67		-1.21	-0.41	2.28	
%	*100%*		*48%*		*5%*		*-11%*	*-7%*	*64%*	
75-25 Dif	231,191	***	87,720	*	24,902		-27,878	-46,072	192,519	**
t-stat	7.59		1.68		1.04		-1.05	-1.06	2.43	
%	*100%*		*38%*		*11%*		*-12%*	*-20%*	*83%*	
90-50 Dif	366,057	***	-4,389		30,010		11,571	-57,416	386,280	**
t-stat	12.04		-0.05		0.53		0.29	-0.78	2.30	
%	*100%*		*-1%*		*8%*		*3%*	*-16%*	*106%*	

*Source: Own calculations based on the XB- and LU-HFCS 2010/2011; data are multiply imputed. Results are based on averaging over all possible sequences. * p<0.1, ** p<0.05 and *** p<0.01.*

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