Housing Equity Withdrawal and Consumption Dynamics in Estonia 2002-2011*

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Abstract

The linkages between housing wealth and household consumption are contentious. This paper uses a recently introduced statistical concept, housing equity withdrawal (HEW), to investigate the linkages in the case of Estonia. HEW is defined as net borrowing by the household sector, which is secured on housing equity but not invested in housing assets. HEW is thus a direct measure of the cash flow from housing assets available to the household sector. The HEW series computed for Estonia are much more volatile than similar series in countries such as the UK and the USA. The volatility is related to rapidly changing financing conditions and real estate prices, but also to consumption aspirations. Econometric analysis confirms a close correlation between housing equity withdrawal and consumption, but the relation appears to differ between the boom in 2002-2007 and the downturn period 2008-2011.

JEL classification codes: D12, E21, R21, R31
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"Housing wealth isn't wealth"
Mervin King, Governor of the Bank of England, 1997 (Buiter, 2010, p. 1)

1. Introduction

The linkages between housing wealth and household consumption are contentious in both the theoretical and the empirical literature. Some theories imply that an increase in housing wealth due to higher real estate prices leads to increased consumption, while other theories suggest that this is not the case. Empirical studies of housing wealth and consumption have often provided rather inconclusive results and typically do not reveal the exact mechanisms or linkages between housing wealth and consumption. To attain a deeper understanding of the linkages, the statistical concept of Housing Equity Withdrawal (HEW) was introduced in the UK in the beginning of the 1990s (Westaway, 1993; Holmes, 1993). The amount of housing equity withdrawal (HEW) is calculated as the household sector's net borrowing that is secured on housing but not invested in housing. HEW measures the liquid funds or cash flow attained by the household sector from otherwise illiquid housing assets and is thus a means to establish a direct link between, on the one hand, housing assets and financial intermediation and, on the other hand, the consumption and saving of the household sector.

This paper investigates linkages between housing wealth and household consumption in Estonia based on HEW data. The analysis comprises two steps. The first step entails the computation of annual and quarterly HEW data for the period 2002–2011.[1] Two different versions of HEW are computed based on different data sources. The main components of HEW are examined and some features specific to Estonia are investigated. The second step entails the estimation of consumption functions in which real household consumption is explained by real income and real HEW. The estimations are undertaken using the Engle-Granger two-stage methodology as this method was found to provide the most reliable and robust results. The analyses consider structural breaks around 2007 when the preceding boom was replaced by a severe downturn.

The choice of the sample country is of significance for several reasons. First, households in Estonia own a lot of housing assets in the form of both dwellings and land. This widespread ownership dates back to the restitution and privatisation processes which took place throughout the 1990s. As a result, home-ownership in Estonia is among the highest in Europe. The private sector owns 96% of all dwellings in Estonia (ES 2011). Second, Estonia has experienced rapid developments of financial markets, particularly in association with the admission of Estonia to the European Union in 2004 (Brixiova et al., 2010). Third, Estonia has, like other countries from Central and Eastern Europe, experienced larger business cycle fluctuations than typically seen in West European countries (Becker et al., 2010). The findings for Estonia may arguably have lessons for other CEE countries with similar developments.

The rest of the paper is organised as follows. Section 2 discusses the theoretical and empirical background for the paper. Section 3 introduces the concept of HEW and describes different activities of the household sector, which make up HEW. Section 4 presents two HEW time series for Estonia for the period 2002–2011 and discusses factors that explain the

[1] It is the first time such data have been made available for a country from Central and Eastern Europe. Due to a comprehensive register of all real estate contracts held in the Land Board of Estonia, it is possible to compute HEW series for Estonia with a delay of only approximately one month.

dynamics. Section 5 considers the relation between HEW and household consumption based on graphical and econometric analyses. Finally, Section 6 concludes the paper.

2. Housing Wealth, HEW and Household Consumption

The effect of changes in real estate prices on household consumption is subject to considerable controversy. The theoretical starting point is the models of intertemporal smoothing, pioneered by Friedman (1957) and Modigliani (1966). According to these models of rational choice, the individual household smooths consumption across all future periods in its remaining lifetime. The implication is that the household will consume a fraction of its discounted lifetime wealth. The upshot is that there are two main channels through which changes in the value of housing assets can affect consumption, viz. a wealth effect and a credit or collateral effect.

The wealth channel posits that households view their housing asset as any other form of wealth. Households aim to smooth consumption, and an increase in house prices therefore leads households to consume a fraction of the wealth increase. Buiter (2010), among others, questions this argument by noticing that households that own a housing asset likely possess the asset in order to consume the services of the housing asset in the future. An increase in the price of the housing asset also implies an increase in the price of housing services in the future, and households will therefore save the increased housing wealth in order to pay for the higher housing services in the future. In this case, an increase in housing prices will have no noticeable effect on consumption. This is a rationalisation of Mervin King's argument that "housing wealth isn't wealth" (Buiter, 2010).

The credit or collateral channel is based on the assumption that many households are credit constrained due to lack of collateral. If housing wealth increases, households can provide more collateral, and this may allow otherwise credit-constrained households to borrow and increase consumption in the short run. The credit or collateral channel suggests a close relationship between housing wealth, financial intermediation and consumption (Muellbauer, 2008).

Numerous empirical studies estimate the wealth effect from housing and stock market developments on household consumption, using either aggregate or micro data (Paiella, 2009). Most studies find a statistically significant positive relationship between housing wealth and household consumption, but the underlying reason for the result (pure wealth effect or collateral effect) is typically not investigated. Muellbauer & Murphy (1990) argue that financial liberalisation in the early 1980s allowed UK households to use more valuable housing assets as collateral to finance consumption. Aron et al. (2011) find that increased consumption in the UK and the USA is related to increased asset prices, but also the liberalisation of financial markets initiated in the 1980s, which made it possible for households to liquidise their more valuable housing assets.

For Estonia the propensity to consume out of housing wealth has been found to be modest based on estimations for the period 1997–2005: an increase of 100 EUR in housing wealth increases consumption by 0.4 EUR in the short term and by 1 EUR in the long term (Paabut and Kattai, 2007). The results capture primarily the effect before the rapid changes in housing and mortgage markets that began around 2004, after the accession of Estonia to the EU. In a later study Sonje et al. (2012) estimate the effect of housing wealth on consumption in four Central and Eastern European countries, including Estonia. They find a stronger

relationship between housing wealth and consumption in Estonia: if housing wealth increases by 100 EUR, consumption increases by 4 EUR in the long term.

The importance of the developments in the financial sector point to the need for a direct measure of the household sector's cash flow from housing assets. Housing equity withdrawal is such a measure. It was introduced in the UK in the early 1990s when mortgage borrowing by the household sector exceeded residential investment (Westaway, 1993; Holmes, 1993). HEW facilitates analyses of linkages between, on the one hand, house prices and financial development and, on the other hand, consumption and saving by the households.

Evidence on the relationship between HEW and household consumption differs across countries. Boone et al. (2001) investigate the relationship between HEW and consumption in the USA, the UK and Canada during the period of financial market liberalisation. Their findings provide some support to the hypothesis that increasing housing equity withdrawal, following the relaxing of credit conditions, is linked to increased consumption in those three countries in the sample. Catte et al. (2004) compare the marginal propensity to consume of housing wealth in OECD countries for the period 1990–2002. They find that in countries with developed credit markets HEW explains consumption changes better than house prices as HEW is a direct measure of the liquidising of housing wealth. They find that HEW drives consumption and estimate that 89% is consumed in the United Kingdom, 63% in Canada and Australia and 20% in the USA.

Benito (2009) finds that while HEW tracked consumption quite closely in the UK until the end of the 1990s, the linkage has subsequently become weaker. Klyuev and Mills (2006) report that HEW explains some short-run fluctuations in consumption in the USA, the UK, Australia and Canada, but there is no long-run effect. They find for the USA that HEW had a short-term negative impact on household saving, in the order of 20 cents to a dollar, and argued that HEW could explain part of the decrease in the saving rate since the mid-1990s. Smith (2010) also finds that that there are only short-term effects of HEW on consumption in the case of New Zealand.[2]

Catte et al. (2004) conclude that HEW can explain a large part of consumption changes for countries in which three conditions prevail. First, financial markets provide easy access to mortgage financing and to financial products that facilitate equity withdrawal. Second, a high rate of owner-occupation implies a wider distribution of housing wealth. And third, low housing transaction costs and housing wealth exemption from capital gains taxes encourage owners to perceive housing assets as more liquid.

In spite of the potential use of HEW in macroeconomic analyses, data has been only produced for a relatively small number of developed countries. For an extended period of time, quarterly HEW data have been published by the Bank of England. Detailed HEW measures have also been produced for the USA (Greenspan and Kennedy, 2008), Australia (Bloxham et al., 2010) and New Zealand (Smith, 2010).

The overall conclusion in the empirical literature is that HEW has substantial explanatory power vis-à-vis household consumption, but the reaction of consumption to higher HEW varies substantially across countries. Remarkably no studies have investigated possible asymmetric reactions across different phases of the business cycle.

[2] A number of studies have used microeconomic survey data to determine the allocation of resources from HEW to *inter alia* consumption. Important studies include Benito and Power (2004) and Smith and Searle (2008) for the UK, Hurst and Stafford (2004) and Cooper (2010) for the USA, Schwartz et al. (2008) for Australia and van Els et al. (2005) and Ebner (2010) for the Netherlands.

3. Types of Housing Equity Withdrawal and Injection

The amount of housing equity withdrawal (HEW) is calculated as the household sector's net borrowing that is secured on housing but not invested in housing. Housing equity is withdrawn when lending secured on housing increases more than spending on housing assets, which generates a cash flow that can be spent on consumption or investment in financial assets. Conversely, equity is injected into housing stock when spending on housing assets exceeds lending secured on housing, which reduces the cash flow available for consumption and financial investments.

Although HEW, as it is defined and calculated in this paper, is an aggregate cash flow measure for the household sector as a whole, it is instructive to specify household level individual actions which constitute the aggregate figure. Withdrawals and injections can stem from a large number of individual micro level activities (Klyuev and Mills, 2006).

A withdrawal takes place when a household:

- sells real estate without buying new one (last time sales);[3]
- trades down to cheaper real estate, while reducing the mortgage by less than the price difference;
- when moving, increases its mortgage by more than the difference in house prices;
- takes out a second mortgage or refinances an existing one with higher principle (remortgaging) without moving properties;
- increases mortgage-backed consumer credit.

An injection takes place when a household:

- makes a down payment on a first-time purchase of real estate;
- makes amortisation and additional payments on a mortgage;
- remortgages with a lower principal;
- purchases a second home and investment properties with cash;
- makes home improvements classified as investment in housing stock;
- reduces mortgage-backed consumer credit.

The transactions of households with the financial sector are quite straightforward – they either increase or decrease the aggregate stock of mortgage backed loans for the whole household sector. However, purchase and sale of real estate may take place with another household or with an entity from another sector in the economy, and this distinction makes a difference form the point of view of aggregate HEW. In the former case, the buyer household is an equity injector and the seller, correspondingly, is an equity withdrawer with a similar amount. This real estate transaction has no impact on aggregate HEW, as the injection of one household cancels out the withdrawal of the other. However, if a household buys real estate from another sector (a new flat from the enterprise sector, for instance), housing equity is being injected by that transaction, and vice versa.

The aggregate or macro level HEW measure adds up all these different micro level transactions from the household sector's point of view. Hereby, if the household sector on

[3] Households may move into rental accommodation or may have a spare flat, house or area of land (stemming for instance from a bequest or property restitution).

aggregate has increased its mortgage backed loan stock by more than it has acquired housing assets during a certain period of time, housing equity has been withdrawn.

The term housing should be interpreted broadly in this context as all real estate transactions by the household sector (including land, with or without dwellings) are included in the computation of HEW. An alternative term would be real estate equity withdrawal, but housing equity withdrawal is the conventional and most recognisable term.

4. HEW Results for Estonia

HEW can be computed from two broad components: the change in the household sector's stock of loans secured by housing assets and the household sector's net investment in housing. The first component is quite straightforward and can easily be calculated using financial sector statistics.

Concerning the second component, data on the household sector's net investment in dwellings and net acquisition of land are needed. Data series on both items are calculated by Statistics Estonia (SE), but there may be concerns about whether the data fully takes into account all real estate transactions between the household sector and other sectors. We therefore supplement the data from Statistics Estonia with data from the register of real estate contracts of the Estonian Land Board (LB) in order to calculate an alternative HEW series. The register should capture all real estate transactions between different sectors. As we are interested in net real estate investments by the resident household sector, the sales of real estate to the business, government and foreign sectors are subtracted from the gross investment.

Table 1. HEW and its Components for Estonia (EUR in Millions)

		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1.	**HEW (SE) = 3 – 6**	**16**	**163**	**237**	**646**	**1,082**	**780**	**4**	**-572**	**-438**	**-481**
2.	**HEW (LB) = 3 – 9**	..	..	**376**	**776**	**1,390**	**1,032**	**193**	**-379**	**-371**	**-334**
3.	NASFL = 4 + 5	185	393	585	1,142	1,841	1,511	631	-120	-156	-115
4.	New mortgage-backed consumer credit	4	9	18	62	181	200	83	-39	-25	-21
5.	New mortgage-backed housing loans	181	384	567	1,080	1,660	1,311	548	-81	-131	-94
6.	NAHA (SE) = 7 + 8	169	230	348	495	759	731	626	453	281	366
7.	Housing investment (SE)	206	274	365	542	904	994	718	491	466	550
8.	Net acquisition of non-produced assets (SE)	-38	-44	-17	-47	-145	-263	-92	-38	-184	-184[a]
9.	NAHA (LB) = 10+11+12–13	..	..	209	366	451	479	438	259	215	219
10.	Purchases from other sectors (LB)	..	..	282	549	789	652	417	200	207	237
11.	Home improvements (SE)	63	83	81	108	153	181	174	127	112	143
12.	Transfer costs (SE)	27	39	40	59	101	75	61	33	37	42
13.	Sales to other sectors (LB)	..	..	195	350	592	429	213	101	141	203

[a] Estimate.
Source: Authors' calculations, Statistics Estonia, Estonian Land Board

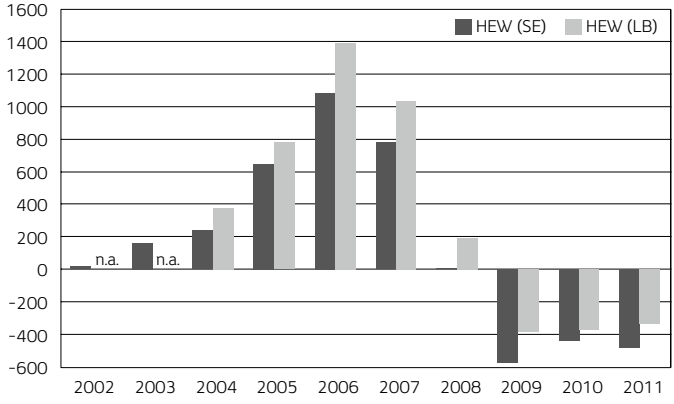
Table 1 presents two measures of HEW in Estonia as well as the source data necessary for their calculation. Row 1 shows HEW (SE) based on data from Statistics Estonia and row 2 shows HEW (LB) based on data from the Estonian Land Board. The estimation methodology is detailed in Appendix 1, while an overview of the computations is provided below. All rows present cash flows during the period. The source data for HEW (LB) starts from 2003Q3, so 2004 is the first full year for which this measure can be calculated. Quarterly HEW series are reproduced in Appendix 2.

The two main components of HEW are the change in the household sector's stock of loans secured by housing assets (the net acquisition of secured financial liabilities, NASFL) and the household sector's net investment in housing (the net acquisition of housing assets, NAHA). As positive NASFL generates cash to households, while positive NAHA implies spending on real estate, the latter has to be subtracted from the first in order to obtain HEW.

The net acquisition of secured financial liabilities (NASFL, row 3) is calculated from the change of the loan stock secured on housing assets (both new mortgage backed housing loans and mortgage backed consumer credit). The household sector's net investment in housing (NAHA) is computed using two sources; NAHA based on data from Statistics Estonia (SE) is given in row 6, while NAHA based on data from the Estonian Land Board (LB) is given in row 9. When SE is used as the data source, housing investment and net purchases of land are summed. When LB is used as the data source, construction and improvements undertaken by households and transaction costs are added to the net cash flow from real estate transactions (row 10 minus row 13).

Figure 1 shows the two HEW measures based on data from, respectively, Statistics Estonia and the Estonian Land Board. The two HEW series co-vary closely within the common sample, but the LB measure gives a higher value than the SE measure in all periods. As described in Appendix 1, the SE version of HEW tends to underestimate the sale of real estate assets to other sectors; the LB version measures the flows from real estate transactions between the household sector and other sectors more precisely.

Figure 1. HEW for Estonia Using Two Different Data Sources (EUR in Millions)

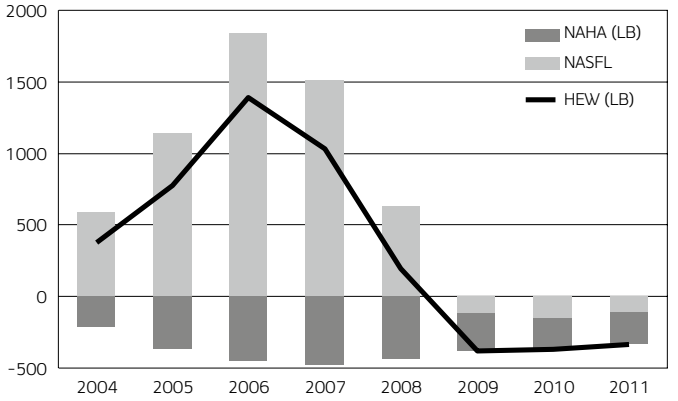


Note: n.a. indicates that data is not available.
Source: Table 1, Statistics Estonia and Bank of Estonia, authors' calculations.

The dynamics of the HEW series reveal that the household sector withdrew large amounts of equity from the housing stock during the period 2004–2007 with a peak in 2006. A sharp reversal occurred in 2008 and HEW subsequently turned negative, implying that the Estonian household sector injected liquidity into housing assets during the period 2009–2011.

Figure 2 shows the two main components of HEW, i.e. the net investment in housing assets, NAHA (LB), and the change in the stock of mortgage backed loans, NASFL. The two components exhibit different dynamics during the period 2004–2011. Net investment in housing assets was relatively stable and positive in all years, implying negative housing equity withdrawal. During the downturn starting in 2008, the household sector continued to invest in the housing stock; even if purchases of new dwellings from the enterprise sector were modest, own construction and repair still contributed to injections.

Figure 2. Equity Withdrawal from Net Acquisition of Housing Assets, NAHA (LB), and Net Acquisition of Secured Financial Liabilities, NASFL (EUR in Millions)



Source: Table 1, Statistics Estonia and Bank of Estonia, authors' calculations.

Mortgage-backed borrowing has shown much more volatility. During the period 2004–2008 the secured loan stock rose far more than the household sector's net investment in housing. The substantial increase of the stock of housing loans, compared to housing investment, is due to the fact that about half of the real estate contracts were between two households; if such purchases are financed by mortgage loans, the cash flow from the bank ends up in the hands of the household sector.

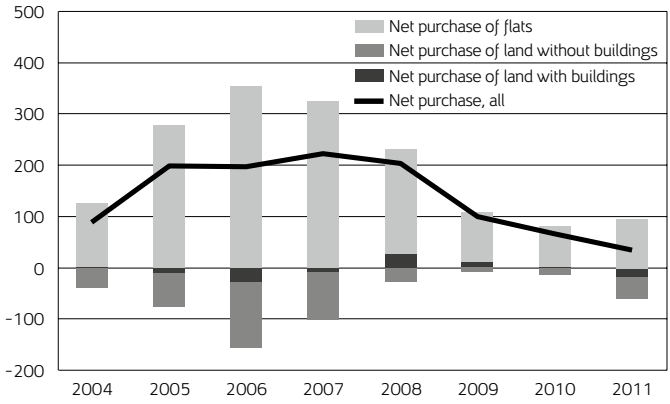
During the period 2004–2008 the household loan stock increased rapidly as initially it was at a low level: the ratio of debt to disposable income increased from 45% in 2004 to 91% in 2008 (Eurostat, 2012). The growth followed looser credit conditions coinciding with large capital inflows (Brixiova et al., 2010). The share of mortgage-backed loans in the total household loan stock increased from 55% in 2002 to 85% in 2007, indicating a tight connection between developments in real estate and credit markets.

The household loan stock began to decrease from the beginning of 2009. The contraction occurred due to the global financial crisis and concerns about the sustainability of the stock of debt accumulated by the household sector, while demand for borrowing shrank due to increased income risk. In periods, new lending to the household sector virtually ceased. As activity in the real estate market decreased, amortisation of mortgages exceeded the amount of

new loans. Consequently, in addition to investment to housing assets, mortgage-backed loans contributed to the net injection of equity into housing stock during the period 2009–2011.

The LB data allow a disaggregation of the flows from different types of real estate: flats, land with buildings and land without buildings. It follows from Figure 3 that the household sector bought more flats from other sectors than vice versa during the whole sample period.

Figure 3. Composition of Net Flows of Transactions Based on LB Dataset (EUR in Millions)



Note: Values of real estate contracts only; transaction fees and own construction and repairs are not included.
Source: Table 1, Statistics Estonia and Bank of Estonia, authors' calculations.

During 2004–2011, the household sector sold more land without buildings than it bought from other sectors; net land sales contributed to about one tenth of overall HEW. Some of the real estate stock that was obtained by restitution during 1990s could be sold on favourable conditions during the economic boom, consequently generating cash to the household sector.[4] In the process of restitution around 33% of the land (incl. residential property) has been distributed among a large proportion of households, though many of them did not live on the property (Giovarelli and Bledsoe, 2001). Significant resources have been withdrawn from land property especially during the economic boom period and the explanation can be ownership of "excess land" that could be easily liquidised during the vigorous economic growth period, accompanied by increasing real estate prices.

The development of real estate prices contributed to the volatility of HEW series. Before the crisis real estate prices increased very rapidly; at the end of 2007 the average prices of flats and land without buildings were 2–3 times higher than at the beginning of 2003. The reversal of prices was pronounced and very rapid until the stabilisation of prices in 2009 (Estonian Land Board, 2012).

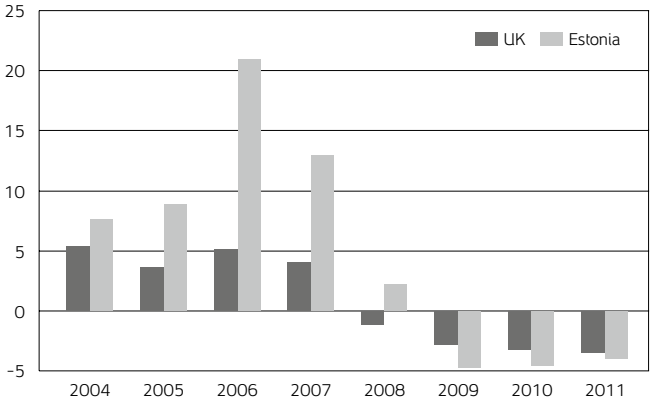
To put the Estonian results into an international context, Figure 4 presents HEW (as a share of household disposable income and in millions of GBP) for the UK and Estonia. The UK data are from the Bank of England statistical database.[5] The overall dynamics of HEW

[4] The widespread ownership of real estate made it possible for the households to sell their spare land to real estate developers, who sold the properties back to households, but with dwellings on them.

[5] Bank of England Statistics, table LPQB3VH (Quarterly percentage of total sterling housing equity withdrawal (previously called mortgage equity withdrawal) by individuals (in percent) seasonally adjusted); http://www.bankofengland.co.uk/mfsd/iadb/fromshowcolumns.asp?travel=nix&searchtext=housing+equity+withdrawal&point.x=16&point.y=8.

in Estonia is very similar to that of the UK, but the volatility in Estonia is much higher. In the UK, HEW as a share of household disposable income reached 5.1% in 2006, while in Estonia the ratio was 21% or 16%, depending on the calculation method, in the same year. Such high ratios of HEW to disposable income have not been reported for any other country. During 2009–2011, the difference between the HEW measures for the UK and Estonia is somewhat smaller than observed during the years of rapid economic growth. In 2011 HEW was -3.5% of disposable income for the UK, while HEW based on Land Board data was -5.5% of disposable income for Estonia.

Figure 4. HEW as a Percentage of Household Disposable Income, UK and Estonia, 2004–2011



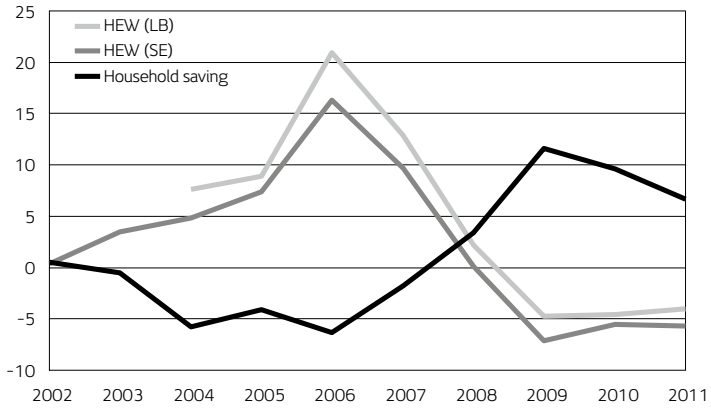
Note: The Variable for Estonia is HEW (LB).
Source: Table 1, Statistics Estonia and Bank of Estonia, authors' calculations.

5. The Relationship between HEW and Consumption in Estonia

This section discusses the linkages between HEW and household consumption in Estonia. Figure 5 shows the two measures of HEW as well as household saving as percentages of household disposable income. The household saving rate is the reverse mirror of the average consumption propensity of the household sector. The figure illustrates that the household sector attained substantial liquid funds from HEW during the growth period 2003–2007, a period in which consumption consistently exceeded household disposable income, resulting in a negative saving rate. HEW amounted to 15–20% of disposable income in 2006, and in the same year household consumption outstripped disposable income by 6%.

The expectations of households and the resulting consumption aspirations may be an important factor for the volatile HEW dynamics in Estonia. The integration into the European economy and the convergence process was accompanied by a rapid increase in disposable income until 2006. Improved confidence and expectations of rapidly increasing income also boosted consumption aspirations (Becker et al., 2010). The liquidising of real estate assets comprised an opportunity to obtain liquid funds for consumption. The global financial crisis and the deteriorating outlook may have led households to reconsider their income prospects and postpone consumption in order to consolidate their finances and pay back housing loans, which ceteris paribus would reduce HEW.

Figure 5. HEW and Household Saving as Percentage of Household Disposable Income, 2002–2011



Source: Table 1, Statistics Estonia and Bank of Estonia, authors' calculations.

Figure 5 suggests a close correlation between HEW and household saving or, conversely, between HEW and household consumption. However, such co-variation may be coincidental or spurious. We will use econometric modelling to provide a more detailed analysis of the connection between HEW and consumption.

The modest number of observations implies that we need to specify very parsimonious consumption models. The analysis includes quarterly data of four variables, viz. consumption, household disposable income and the two measures of housing equity withdrawal. When HEW from Statistics Estonia is used, the sample is 2002Q1–2011Q4, in total 40 observations; when HEW from the Land Board is used, the sample is 2003Q3–2011Q4, in total 34 observations. The series are deflated using the quarterly average of the monthly HICP price index. The series HEW (LB) and HEW (SE) are from Appendix 2, quarterly household consumption and the monthly HICP index are from Eurostat (2012) and household disposable income is from the Bank of Estonia.[6] The following notation is used for the series: real consumption is RCONS, real disposable household income is RINC and real housing equity withdrawal is RHEWLB when based on data from the Land Board and RHEWSE when based data from Statistic Estonia.

The series RCONS, RINC, RHEWSE and RHEWLB exhibit substantial persistence. Augmented Dickey-Fuller tests suggest that the four series represent borderline cases between integration of order one and integration of order two. Unit root tests typically possess little power in small samples, which may explain the borderline results. In the following we will treat the series as integrated of order one and, consequently, look for cointegration between the variables depicting consumption, income and housing equity withdrawal.

Preliminary investigation using the Johansen methodology showed the presence of one co-integrating vector. Moreover, estimation of dynamic adjustment indicated that the

[6] These data series are provided by the Bank of Estonia. Statistics Estonia provides data on household disposable income from the national accounts but only on an annual basis and the Bank of Estonia therefore computes a quarterly series for the purpose of macroeconomic modelling. The quarterly data are computed from the same components as used for the annual data, but some components are interpolated.

adjustment mainly took place via changes in consumption. We will not present the results here as the small number of observations in the dataset combined with the estimation of many coefficients implies that the results using the Johansen methodology lack robustness. In many cases changes in the sample length and changes in the lag structure affect the estimated coefficients and standard errors considerably.

We will instead use the more robust Engle-Granger two-stage methodology (Engle and Granger, 1987; Veerbek, 2012, Sec. 9.2). The Engle-Granger methodology entails that the long-term cointegrated relation and the short-term adjustment relation are estimated in two separate stages, where the estimation of the short-term adjustment relation in the second stage is conditional on cointegration being detected in the first stage.

The first stage entails estimation of a "long-term" relation in which the level of the dependent variable is regressed on the levels of the explanatory variables using ordinary least squares. To rule out spurious correlation, the variables in the long-term relation must be cointegrated, which entails that the residuals must be stationary (residual-based cointegration test). The augmented Dickey-Fuller test is a unit root test with the null hypothesis that the residual contains a unit root. In case of cointegration, the adjustment can be estimated in a second stage in which changes in the dependent variable are modelled as a function of the lagged residual from the first stage as well as lagged changes in the dependent variable and current and lagged changes in the explanatory variables. The estimated coefficient of the lagged residual provides information on the extent and speed of error correction taking place through the dependent variable.

In the first stage, real household consumption RCONS is the dependent variable in all cases, while the real income RINC and RHEW (where RHEW is either RHEWLB or RHEWSE) are the explanatory variables. The first-stage estimation is shown in eq. (1), where the index t denotes the quarter and takes all values within the sample.

$$\mathrm{RCONS}(t) = \mathrm{Constant} + \alpha_0 \mathrm{RINC}(t) + \alpha_1 \mathrm{RHEW}(t) + \varepsilon(t) \quad (1)$$

Quarterly dummies are included in all regressions to account for seasonality in data but not shown. The residuals are denoted $\varepsilon(t)$. The coefficients α_0 and α_1 are estimated using OLS. The standard errors of the first stage estimation follow a non-standard distribution due to the variables exhibiting unit roots, and it is therefore not possible to ascertain the statistical significance of the estimated coefficients.

Cointegration requires that the residuals $\varepsilon(t)$ are stationary. This is tested using an augmented Dickey-Fuller test with the null hypothesis that the residuals contain a unit root. The residuals $\varepsilon(t)$ do not follow a standard Dickey-Fuller distribution since they result from an estimated equation, but tabulated critical values are readily available. In case of cointegration, the residuals $\varepsilon(t)$ can be considered deviations from a long-term "equilibrium" relation.

In case of cointegration, the short-term adjustment equation can be estimated using OLS, as all variables, including the residuals $\varepsilon(t)$, are stationary. The short-term equation is given in eq. (2); the operator Δ denotes quarter-on-quarter change and $\xi(t)$ is the residual in this case.

$$\Delta\mathrm{RCONS}(t) = \mathrm{Constant} + \sum_{i=1}^{4} \beta_i \Delta\mathrm{RCONS}(t\text{-}i) + \sum_{i=1}^{4} \delta_i \Delta\mathrm{RINC}(t\text{-}i) + \sum_{i=1}^{4} \gamma_i \Delta\mathrm{RHEW}(t\text{-}i) + \lambda\varepsilon(t\text{-}1) + \xi(t) \quad (2)$$

Quarterly dummies are included but not shown. The short-term coefficients β_i, δ_i, γ_i and λ are to be estimated. The coefficient λ depicts the short-term adjustment to lagged deviations from the long-term "equilibrium" relation estimated in the first stage. The adjustment coefficient is expected to be negative and statistically significant in which case deviations from the long-term relation are corrected through short-term changes in consumption.
Table 2 shows the results of the Engle-Granger estimations, specifically the full results of the first stage, the results of the cointegration test (in the second last line) and the estimated adjustment or error correction coefficient of the second stage (in the last line). Detailed results for the estimation of the short-term adjustment of the second stage are shown in Appendix 3.

Table 2. Estimation of Long-Term Relation and Adjustment Coefficient

	(1)	(2)	(3)	(4)
RINC	0.849 (0.048)	0.899 (0.031)	..	..
RINC (pre-crisis)	..	..	0.950 (0.038)	1.193 (0.043)
RINC (post-crisis)	..	..	1.116 (0.175)	1.627 (0.110)
RHEWLB	0.747 (0.054)	..	..	..
RHEWSE	..	0.840 (0.052)	..	..
RHEWSE (pre-crisis)	..	..	0.592 (0.108)	..
RHEWSE (post-crisis)	..	..	0.981 (0.252)	..
Constant	199.7 (74.85)	145.6 (49.75)	..	..
Constant (pre-crisis)	..	..	99.5 (46.6)	-179.7 (67.9)
Constant (post-crisis)	..	..	-208.8 (307.0)	-1124.8 (193.3)
R^2	0.952	0.970	0.980	0.980
DW	0.898	1.136	1.575	1.575
Time	2003Q3–2011Q4	2002Q1–2011Q4	2002Q1–2011Q4	2002Q1–2011Q4
Observations	34	40	40	40
H_0: Unit root in residuals[a]	-3.032	-3.860	-4.895	-4.064
Adjustment coefficient	..	-0.621 (0.181)	-0.689 (0.246)	-0.418 (0.167)

[a] Asymptotic critical values for ADF unit root test with three variables and the null hypothesis of no cointegration: -4.29 at 1% level, -3.74% at 5% level and -3.45 at 10% level (Veerbek 2012, p. 345).

Notes: OLS estimation. The dependent variable is RCONS in the long-term relation (and RCONS in the short-term adjustment relation used to estimate the adjustment coefficient). Quarterly dummies are included in all estimations, but the results have not been reported. Standard errors are shown in brackets. The standard errors in the long-term relation follow a non-standard distribution so the statistical significance of the estimated coefficients cannot be ascertained.

Source: Authors' calculations

Column (1) in Table 2 shows the results when the variable RHEWLB, based on data from the Land Board, is used as the measure of housing equity withdrawal. The estimated coefficient to the income measure is 0.85 and thus close to one, while the estimated coefficient to the HEW measure is 0.75. The lag structure of the differenced variables in the augmented Dickey-Fuller test is found using the Akaike information criterion. The test statistic is -3.032 which implies that the null hypothesis of a unit root cannot be rejected. The number of observations is low, which may explain that the hypothesis of a unit root in the residual cannot be rejected. Due to the absence of cointegration, no short-term adjustment equation has been estimated in this case.

To attain more observations, RHEWSE based on data from Statistics Estonia is used as the measure of housing equity withdrawal. The results are shown in Column (2). The estimated coefficient of the income variable is largely unchanged, while the coefficient of RHEWSE is slightly higher than the one for RHEWLB in Column (1). This result seems reasonable given that RHEWSE exhibit less variability than RHEWLB. The hypothesis of a unit root can be rejected at the 5% level, which suggests that the three variables RCONS, RINC and RHEWSE are cointegrated and the residual therefore can be interpreted as an error correction term depicting deviations from a long-term "equilibrium" relation between the variables.

The speed with which deviations from the long-term relation are closed can be found from the short-term adjustment relation. The adjustment is modelled in eq. (2): the change in consumption is regressed on the lagged error correction term as well as the change in consumption (three lags), the change in income (current and three lags) and the change in housing equity withdrawal (current and three lags). The coefficient to the lagged error correction term is estimated at -0.621, which implies that deviations from the long-term relation are essentially eliminated within a couple of quarters. The result is qualitatively similar if statistically insignificant coefficients are removed from the adjustment regression using a general-to-specific methodology.

In sum, the results in Column (2) suggest that real consumption is closely related to real income and real HEW in the longer term. An increase in income of 100 EUR is associated with an increase in consumption of 89 EUR, while an increase in HEW of 100 EUR is associated with an increase in consumption of 84 EUR. The latter result implies that 5/6 of liquidised housing assets are consumed over time. Deviations from the long-term relation are eliminated very fast.[7]

Estonia entered recession in the fourth quarter of 2007 and subsequently experienced a pronounced downturn. Column (3) shows the results when the explanatory variables from Column (2) are interacted with a dummy for the pre-crisis period (2002Q1–2007Q3) and a dummy for the post-crisis period (2007Q4–2011Q4), thus allowing different estimated effects for the two periods. The marginal effects of income are rather similar across the two periods and are estimated to be around one. The marginal effects of housing equity withdrawal, however, vary considerably across the two periods. The marginal effect of RHEWSE is around 0.6 in the pre-crisis period when the housing equity withdrawal was

[7] This paper focuses on the applicability of the HEW variable in models of consumption. Some experimentation with the inclusion of house price indices instead of the HEW provided unsatisfactory results (not shown). Consumption, income and house prices were not cointegrated as the null hypothesis of a unit root in the residual from the first stage regression could not be rejected even at the 10% level. Moreover, the coefficient of the income term changed markedly and the regression was not robust to even minor sample changes.

positive, while it is around 1 for the post-crisis period when housing equity withdrawal was negative. The upshot is that while the household sector withdrew liquidity from housing assets, a little more than half of the HEW was consumed, but when it was injecting liquidity into housing assets it coincided with a one-to-one compression of consumption. The latter result may be related to tight credit conditions and a need to deleverage the balance sheets of households by decreasing the high debt levels (Meriküll, 2012).

Column (4) repeats the estimation from Column (3) but leaves out the interacted HEW variables. The result is interesting as the estimated coefficient of the income variable increases and the estimated coefficient for the post-crisis period of 1.63 is substantially larger than the corresponding coefficient estimate in the model in which HEW is included. The upshot is that by omitting the HEW measure, the coefficients of the remaining variables, in this case the income variable, may become biased. The falling consumption in the crisis period is not the result of an extreme overreaction to the falling income, but in large part the result of substantial housing equity injections.

Overall the results in this section suggest that the liquidising of housing assets plays an important role for consumption in Estonia although the effect has varied across the business cycle. The results for Estonia are in line with findings for some other countries, cf. the literature survey in Section 2. The cross-country study by Catte et al. (2004), for instance, estimates that 89% of HEW was consumed in the United Kingdom, 63% in Canada and Australia, and 20% in the United States. There are no studies that have investigated a possible asymmetric reaction of consumption to HEW across different phases of the business cycle.

6. Final Comments

There is substantial disagreement in the academic and policy-oriented literature about the size of the effect of housing wealth on household consumption and the channels through which the effect takes place. In any case housing wealth must be liquidised before it can be translated into a consumption response. Household equity withdrawal depicts the liquid funds or cash flows generated by the household sector from otherwise illiquid housing assets.

This paper provides data on housing equity withdrawal in Estonia for the period 2002–2011 and assesses the impact of HEW on household consumption. The data show that the amount of housing equity withdrawal was substantial during the economic boom in 2004–2007, in particular in 2006 when HEW amounted to 15–20% of household disposable income. From 2008 the household sector injected cash into housing assets as the global financial crisis led the banking sector to curtail lending; the housing equity injection amounted to around 5% of income during the period 2008–2011. The results reflect that the HEW series is very volatile for Estonia. The volatility comes mainly from one of the two HEW components, viz. mortgage-backed loans, while the net investment in housing exhibits a more stable trajectory.

Catte et al. (2004) argue that HEW is very important in countries with developed mortgage markets; we find that HEW exhibits substantial variation in Estonia, a country that experienced fast changes in financial markets during the sample period. A number of factors may help explain the very volatile development of HEW in Estonia during the decade of 2002–2011. First, the financial sector has undergone rapid changes, initially with a rapid

expansion of the loan stock and subsequently with a retrenchment of credit provisioning. Second, real estate prices followed a strong pro-cyclical pattern and consequently changed the scope of housing equity withdrawal across time. Third, the restitution and privatisation of land and housing assets meant that many households possessed excessive real estate (not backed with mortgage) which could be liquidised as soon as favourable conditions appeared. Fourth, sentiments have changed markedly over the decade with follow-on effects on the consumption, saving and portfolio preferences of the households.

The analysis showed a substantial correlation between HEW and consumption during the period 2002–2011; the dynamics of HEW is an important component of consumption behaviour. Econometric analysis, however, reveals that the linkage between HEW and consumption shifts over time. During the first part of the sample, 2002–2007, Estonia experienced an economic boom. In this period HEW was positive and attained very high values, but only approximately half of the cash generated was carried into consumption. During the second part of the sample, 2008–2011, Estonia experienced a deep economic crisis. In this period HEW was negative, and the housing equity injection appears to have been entirely financed by lower consumption. The different household behaviour across the business cycle might reflect differences in credit conditions in Estonia and the need of households to adjust their balance sheets.

Several directions for further research may be suggested. First, further empirical evidence is needed to provide a thorough understanding of the use of HEW in financial management at the household level. One issue of particular importance is how HEW is divided between changes in consumption and financial assets. Second, a comparison of developments in HEW across European countries would undoubtedly produce additional information on the linkages between housing assets, consumption and business cycle developments. It would be particularly interesting to ascertain to which extent the linkage between HEW and consumption differs across the developed countries in Western Europe and the transition countries in Eastern Europe. Third, restitution and privatisation of land and housing has taken place in all CEE countries (Giovarelli and Bledsoe, 2001). The implications of the privatisation on the balance sheets, consumption and saving of the household sector warrant further investigation. Finally, it may be instructive to estimate consumption models with a richer set of explanatory variables, including variables capturing housing prices, interest rates and consumer confidence. Such complex modelling will likely yield the best results if a large number of observations are available.

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Appendix 1. Data and HEW Calculation Methodology

HEW is equal to the net acquisition of secured financial liabilities (NASFL) minus the net acquisition of housing assets (NAHA). As HEW is not regularly calculated in most countries, no single, precise and internationally agreed definition is available. The following methodology follows the one used by the Bank of England (2011):

HEW = Net Acquisition of Secured Financial Liabilities (NASFL)
– Net Acquisition of Housing Assets (NAHA)

The net acquisition of secured financial liabilities can be calculated from the quarterly or yearly change of the loan stock secured on housing assets. The source data can be obtained from the Bank of Estonia.[8] The change in the stock during the period includes both new granted loans and the amortisation of existing ones.[9] The NASFL measure can be either positive or negative, as the loan stock can increase or decrease during any period.

NASFL = Net acquisition of secured housing loans
+ Net acquisition of mortgage-backed consumer credit

Concerning the net acquisition of housing assets (NAHA), we are interested in all real estate transactions between the household sector and other sectors, because all such transactions generate cash flows. One possibility to capture these flows is to use housing investment of the household sector as computed by Statistics Estonia (SE) for the GDP calculations. This measure includes purchases of new dwellings, construction of dwellings and home improvements done by the household sector and all costs associated with the transfer of ownership, e.g. dealer fees, legal fees and state duties. It should in principle include net purchases of existing dwellings from other sectors, but methodological requisites imply that the sale of real estate by the household sector to other sectors may be underestimated and the series may be subject to revision if additional data sources were used.[10]

In addition to dwellings, we also have to take into account transactions involving the purchase and sale of land, which are not considered investments but rather acquisition of non-produced non-financial assets and are presented in the non-financial accounts of national accounts, row code K2 (Läänemets and Mertsina, 2009). Thus, using SE as a data source, the second component of HEW is just the sum of housing investment and net purchases of land.

NAHA (SE) = Housing investment (SE)
+ Net purchase of land K2 (SE)

[8] See Bank of Estonia, http://statistika.eestipank.ee/?lng=en#treemenu/finantssektor/147/650, Table "3.3.3 Stock and number of loans granted to households by type of loan, currency and collateral".

[9] The source statistics do not allow a distinction between the two subcomponents, but it is not necessary for the present purpose. Interest payments do not appear in the calculations; interest payments are considered negative capital income and are thus part of disposable income and do not influence HEW.

[10] This information was provided by Tõnu Mertsina from Statistics Estonia.

Another possibility to capture the net cash flow from real estate transactions between the household sector and other sectors is provided by the data on real estate contracts collected by the Estonian Land Board (LB). As this source should include precise data from all contracts, the net flow of funds for the household sector can be calculated. Because this data source does not capture construction and improvements undertaken by households or transaction costs, these components have to be taken from the dwelling data from SE and added to the LB flows.

NAHA (LB) = Purchases of dwellings and land from other sectors (LB)
+ Home improvements and own construction (SE)
+ Transaction costs (SE)
– Sales of dwellings and land to other sectors (LB)

In conclusion, we can calculate two different HEW series using different data sources.

HEW (SE) = NASFL – NAHA (SE)
HEW (LB) = NASFL – NAHA (LB)

As explained above, the two measures will not fully coincide because of differences in the methodologies used by SE and LB to calculate housing assets' acquisition. Two main differences can be highlighted. First, the LB measure includes *all* real estate transactions between the household sector and other sectors, while the SE measure may underestimate the sales of real estate by the household sector to other sectors. This has the effect of increasing the LB measure relative to the SE measure. Second, the LB measure likely underestimates transaction fees, as only housing-related transaction fees are taken into account (from the SE dwelling investment statistics) while fees related to land sales are omitted. Both of these factors widen the gap between the two measures, but the first is arguably more important than the latter in quantitative terms. Hence, if the purpose of the use of HEW series is to track all monetary flows between the household sector and other sectors, the LB measure would be the most appropriate, while the longer series of HEW (SE) can be used as a reference.

Appendix 2. HEW for Estonia

Table A2.1. HEW for Estonia, Quarterly Data, No Seasonal Adjustment (EUR in Millions)

Note: HEW (SE) is based on data from Statistics Estonia and HEW (LB) on data from the Estonian Land Board. HEW (LB) only available from 2003Q3.

	HEW (SE)	HEW (LB)[a]
2002 Q1	-0.7	..
Q2	6.8	..
Q3	-0.9	..
Q4	11.3	..
2003 Q1	29.8	..
Q2	49.4	..
Q3	34.1	68.9
Q4	49.4	65.3
2004 Q1	19.7	66.7
Q2	62.5	97.4
Q3	72.6	97.5
Q4	82.5	114.7
2005 Q1	83.8	111.6
Q2	163.2	196.2
Q3	169.7	183.2
Q4	229.8	284.7
2006 Q1	212.3	265.0
Q2	301.4	373.8
Q3	291.8	360.9
Q4	276.0	390.0
2007 Q1	230.8	322.2
Q2	260.7	337.9
Q3	172.2	218.3
Q4	116.2	153.4
2008 Q1	42.5	121.2
Q2	65.9	110.6
Q3	4.7	32.5
Q4	-108.6	-71.7
2009 Q1	-123.5	-80.3
Q2	-159.6	-105.0
Q3	-148.4	-99.3
Q4	-141.0	-94.5
2010 Q1	-95.3	-94.4
Q2	-104.2	-87.8
Q3	-111.7	-97.3
Q4	-126.3	-91.9
2011 Q1	-110.5	-87.8
Q2	-96.7	-61.7
Q3	-120.1	-83.3
Q4	-153.5	-101.6

Appendix 3. Short-Term Dynamics and Adjustment

Table A3.1. Estimation of Short-Term Adjustment Relation

	(2)	(3)	(4)
ΔRCONS (-1)	0.233 (0.212)	0.192 (0.230)	0.100 (0.222)
ΔRCONS (-2)	0.435 (0.205)	0.404 (0.221)	0.366 (0.225)
ΔRCONS (-3)	0.374 (0.164)	0.324 (0.172)	0.316 (0.177)
ΔRINC	0.714 (0.178)	0.780 (0.195)	0.713 (0.197)
ΔRINC (-1)	0.278 (0.213)	0.221 (0.244)	0.317 (0.238)
ΔRINC (-2)	-0.425 (0.222)	-0.423 (0.244)	-0.329 (0.239)
ΔRINC (-3)	-0.260 (0.176)	-0.258 (0.191)	-0.259 (0.198)
ΔRHEWSE	0.633 (0.191)	0.607 (0.204)	0.481 (0.208)
ΔRHEWSE (-1)	0.287 (0.227)	0.393 (0.233)	0.666 (0.215)
ΔRHEWSE (-2)	-0.354 (0.333)	-0.217 (0.346)	-0.054 (0.339)
ΔRHEWSE (-3)	-1.028 (0.311)	-0.800 (0.314)	-0.735 (0.319)
Adjustment coefficient (-1)	-0.622 (0.181)	-0.689 (0.246)	-0.418 (0.167)
R^2	0.940	0.932	0.940
DW	1.938	1.974	1.938
Time	2003Q–2011Q4	2003Q1–2011Q4	2003Q1–2011Q4
Observations	36	36	36

Note: OLS estimation. The dependent variable is quarterly change ΔRCONS. The column numbers correspond to those in Table 2. A constant and quarterly dummies are included in all estimations, but the results are not reported. Standard errors are shown in brackets.