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THE ROLE OF HOUSING AND FINANCIAL WEALTH

by Jiri Slacalek

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Abstract

I investigate the effect of wealth on consumption in a new dataset with financial and housing wealth from 16 countries. The baseline estimation method based on the sluggishness of consumption growth implies that the eventual (long-run) marginal propensity to consume out of total wealth is 5 cents (averaged across countries). While the wealth effects are quite strong—between 4 and 6 cents—in countries with more developed mortgage markets and in market-based, Anglo-Saxon and non euro area economies, consumption only barely reacts to wealth elsewhere. The effect of housing wealth is somewhat smaller than that of financial wealth for most countries, but not for the US and the UK. The housing wealth effect has risen substantially after 1988 as it has become easier to borrow against housing wealth.

Keywords: housing prices, wealth effect, consumption dynamics, portfolio choice.

JEL Classification: E21, E32, C22

Non-technical Summary

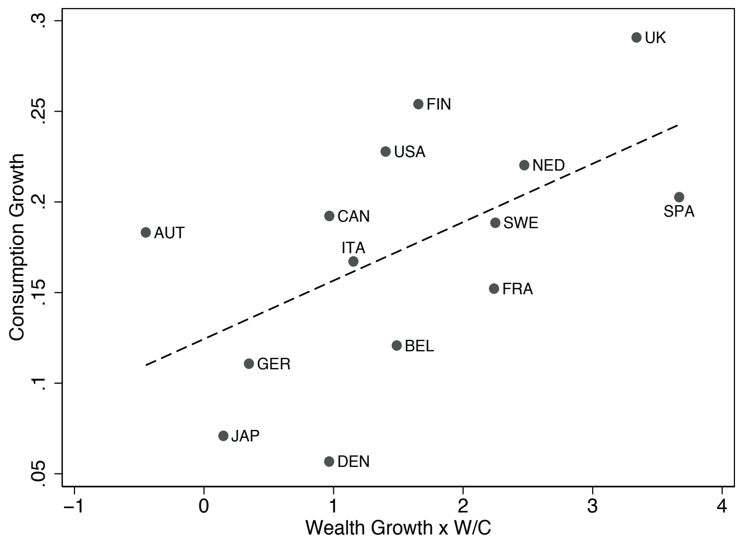
I investigate the effect of wealth on personal consumption in 16 industrial countries. Beside constructing a new dataset with measures of housing wealth from 16 countries, this paper makes two contributions. First, I investigate the heterogeneity in housing and financial wealth effects at the country-level and for various groups of countries and over time. Second, in contrast to almost all literature, which is based on cointegrating regressions, I use an estimation method based on the sluggishness of aggregate consumption growth recently proposed by Carroll et al. (2006). The key advantage of this alternative method (over cointegrating regressions) is higher robustness to changes in underlying parameters (including expected income growth, financial market institutions or demographics).

My baseline estimation method consists of three steps. First, I document substantial persistence (denoted χ) in consumption growth in almost all countries in my dataset. The benchmark IV estimate of χ is about 0.6. Contrary to the standard permanent income hypothesis (PIH) model of Hall (1978) (which assumes $\chi = 0$), when $\chi \gg 0$ consumption responds *sluggishly* to shocks like unexpected movements in income or housing wealth. Consequently, the initial response to new information is smaller than in the PIH model but the effect is long-lasting. $\chi = 0.6$ implies that the eventual effect is 2.5 times larger than the immediate impact. The two remaining steps of the estimation procedure are identifying the immediate MPC out of wealth and finally combining the immediate MPC with χ to back out the eventual MPC.

My main findings are as follows. First, the full-sample estimates imply that the marginal propensities to consume out of total, financial and housing wealth averaged across all countries lie close to 5 cents. Second, there are distinct, statistically significant differences between countries. Consumers in Anglo–Saxon and market-based economies, and in countries with more developed mortgage markets and outside the euro area react more strongly to wealth shocks: they spend between 4 and 6 cents on an additional dollar of wealth. On the other hand, consumption expenditures in most of continental Europe are much less responsive to wealth shocks (and the wealth effect is only about 1 cent). Third, while the housing wealth effect grew substantially stronger after 1988 from roughly zero to about 3 cents, financial wealth effect remained unchanged around 3–4 cents. These findings may reflect the development of financial infrastructure: as mortgage markets become more competitive and new financial products appear, it is easier to borrow against housing wealth. As housing wealth becomes more liquid, households can adjust their portfolios more easily and more often (e.g. by borrowing against housing wealth) and, consequently, the link between housing wealth and spending tightens up.

Section 3 documents that housing prices and housing wealth are much smoother than equity prices and financial wealth. This fact, together with the sluggishness of aggregate consumption growth, has important implications for policy-makers. Large sudden declines in housing prices are relatively rare and even when they occur their immediate impact on personal consumption is limited by consumption sluggishness. On the other hand, I also find that the growth rate of housing prices is quite persistent. This means that periods of falls in housing prices may be long—even up to several years—which in turn magnifies the total effect on consumption.

Figure 1: Consumption Growth and Wealth Growth 1994–2002



Note: Consumption growth and rescaled wealth growth between 1994Q4 and 2002Q4; wealth growth is rescaled by multiplying with the wealth–consumption ratio of 1994Q4. Slope of the regression line, $\text{MPC}_w^{\text{ev}}=$ 0.032, t-statistic: 2.36, p-value: 0.018.

1 Introduction

Figure 1 plots consumption growth in major industrial countries against wealth growth multiplied with the wealth–consumption ratio.[1] It suggests that larger household wealth is associated with higher personal consumption. The slope of the regression line is a rough estimate of the size of the marginal propensity to consume out of wealth (MPCW): about 3 cents are consumed from an additional $1 of wealth. The figure also indicates that in countries lying above the regression line, including the US and the UK, consumption expenditures rose more than implied by the increase in wealth (relative to a typical country in the dataset). Analogous scatter plots for disaggregated wealth components—housing and financial wealth—point to

[1]The growth rate of wealth in figure 1 is multiplied with the wealth–consumption ratio so that the slope of the regression line can be interpreted as the marginal propensity to consume. The positive significant relationship remains to hold between (non-rescaled) growth rates of consumption and wealth.

Below I distinguish between the *immediate* (or short-run) impact of wealth shocks on consumption and the *eventual* (or long-run) impact (after consumption completely adjusts). Because the scatter plot 1 shows changes over a nine-year horizon, which is (given our estimates of consumption sluggishness χ below) long enough for consumption to react to most variation in wealth, I call the MPCW "the eventual" marginal propensity.

similar marginal propensities to consume.

While the surges in stock and housing prices of the late 1990s and early 2000s spurred much interest among economists, little systematic work in international context exists on the effect of financial and in particular of housing wealth on consumption. The principal reason is the lack of standardized international data on financial and housing wealth. This study uses the best available wealth data to estimate the wealth effect.

Beside constructing a new dataset with measures of housing wealth from 16 countries, this paper makes two contributions. First, I investigate the heterogeneity in housing and financial wealth effects at the country-level and for various groups of countries and over time.[2] Second, in contrast to almost all literature, which is based on cointegrating regressions, I use an estimation method based on the sluggishness of aggregate consumption growth recently proposed by Carroll et al. (2006). The key advantage of this alternative method (over cointegrating regressions) is higher robustness to changes in underlying parameters (including expected income growth, financial market institutions or demographics).

My baseline estimation method consists of three steps. First, I document substantial persistence (denoted χ) in consumption growth in almost all countries in my dataset. The benchmark IV estimate of χ is about 0.6.[3] Contrary to the standard permanent income hypothesis (PIH) model of Hall (1978) (which assumes $\chi = 0$), when $\chi \gg 0$ consumption responds *sluggishly* to shocks like unexpected movements in income or housing wealth. Consequently, the initial response to new information is smaller than in the PIH model but the effect is long-lasting. $\chi = 0.6$ implies that the eventual effect is 2.5 times larger than the immediate impact. The two remaining steps of the estimation procedure are identifying the immediate MPC out of wealth and finally combining the immediate MPC with χ to back out the eventual MPC.

My main findings are as follows. First, the full-sample estimates imply that the marginal propensities to consume out of total, financial and housing wealth averaged across all countries lie close to 5 cents. Second, there are distinct, statistically significant differences between countries. Consumers in Anglo–Saxon and market-based economies, and in countries with more developed mortgage markets and outside the euro area react more strongly to wealth shocks: they spend between 4 and 6 cents on an additional dollar of

[2]See section 2 for a short review of some papers which also address cross-county heterogeneity of wealth effects.

[3]This value of χ can be motivated by habit formation or consumers' inattentiveness to macroeconomic developments. Considerable positive χ is in line with findings of a number of theoretical and empirical papers from various fields of macroeconomics. For example, Campbell and Cochrane (1999) and others argue that habit formation can explain the equity premium puzzle; Carroll et al. (2000) report that it can provide a rationale for the Granger causality of economic growth for saving and Fuhrer (2000) finds that it captures the hump-shaped response of consumption to income shocks.

wealth. On the other hand, consumption expenditures in most of continental Europe are much less responsive to wealth shocks (and the wealth effect is only about 1 cent). Third, while the housing wealth effect grew substantially stronger after 1988 from roughly zero to about 3 cents, financial wealth effect remained unchanged around 3–4 cents. These findings may reflect the development of financial infrastructure: as mortgage markets become more competitive and new financial products appear, it is easier to borrow against housing wealth. As housing wealth becomes more liquid, households can adjust their portfolios more easily and more often (e.g. by borrowing against housing wealth) and, consequently, the link between housing wealth and spending tightens up.

Section 3 documents that housing prices and housing wealth are much smoother than equity prices and financial wealth. This fact, together with the sluggishness of aggregate consumption growth, has important implications for policy-makers. Large sudden declines in housing prices are relatively rare and even when they occur their immediate impact on personal consumption is limited by consumption sluggishness. On the other hand, I also find that the growth rate of housing prices is quite persistent. This means that periods of falls in housing prices may be long—even up to several years—which in turn magnifies the total effect on consumption.

Essentially any estimate of the wealth effect in macro data is to some extent subject to endogeneity: wealth is not exogenous with respect to consumption but rather jointly, endogenously determined. Both variables are partly driven by other variables, in particular income expectations (or credit market conditions). I follow other work with macro data in implicitly assuming that a large fraction of fluctuations of housing wealth is exogenous and its dynamics have not been substantially affected by the decision about consumption. More practically, I include a number of control variables, such as income, in my baseline wealth effect regressions to filter out some endogenous movements. Finally, for policy-makers the estimates may be useful in answering the following question: if housing wealth rises, by how much should I adjust my forecast of aggregate consumption growth (irrespective of whether the increase in wealth is exogenous or driven by a third factor)?

An alternative approach to estimate the wealth effect, probably more immune to endogeneity, is to use household-level data, where housing wealth is to a smaller extent determined by macroeconomic circumstances. I view the estimates on aggregate data as complementary to micro-level studies. My results may be particularly informative to policy-makers, who may want to concentrate primarily on aggregate implications of wealth shocks. In addition, given the lack of adequate, consistent household-level data on consumption and wealth, cross-country comparisons can be done more easily with aggregate data.

2 Determinants of the Wealth Effect: Review of the Literature

The standard infinite horizon model with liquid assets, perfect capital markets, no uncertainty and CRRA utility implies that consumption C is a linear function of asset holdings W and human wealth H (i.e. the discounted sum of future incomes):

$$C_t = \left(1 - R^{-1}(R\beta)^{1/\rho}\right)(W_t + H_t),$$

where R is the interest factor, β is the discount factor and ρ is the coefficient of relative risk aversion. The marginal propensity to consume out of wealth is $1 - R^{-1}(R\beta)^{1/\rho}$, which, if $R\beta = 1$, equals $(R-1)/R \approx R-1$, a number that likely lies between 0 and 0.05.

The marginal propensity to consume can differ substantially from $R-1$ in a more realistic model. For example, Muellbauer (2007), pp. 272–273, shows that once housing services are included, higher housing prices can actually decrease total personal consumption expenditures. Many authors have pointed out that *frictions*, such as collateral constraints (Iacoviello and Neri, 2007) and down-payments, play an important role in determining the wealth effect. While positive shocks to house prices substantially increase consumption of collateral-constrained households, Muellbauer (2007) points out that the housing wealth effect can be negative for prospective first-time home buyers who are saving for down-payments: higher real estate prices raise down-payments, increase the need for more savings and depress consumption spending. Consequently, the varying extent of frictions can help explain the differences in wealth effect across countries and over time.

The relative size of financial and housing wealth effects is influenced by many factors, including the cross-sectional distribution of assets (and liabilities), persistence of wealth shocks and the degree of liquidity of housing. First, the aggregate MPCs are in part driven by the distribution of assets across households. The median dollar of financial wealth is held by a substantially wealthier household than the median dollar of housing wealth. Rich consumers have a lower MPC due to weaker precautionary motive. Consequently, financial wealth effect might be smaller than housing wealth effect. Second, shocks to housing wealth are substantially more persistent than shocks to financial wealth: the initial impulse thus signals additional effects to come. As a result, the response of consumption response to housing wealth shocks is stronger. On the other hand, it is likely that housing wealth is measured relatively imprecisely (compared to financial wealth; see e.g., European Central Bank, 2003 and Ahnert and Page, 2005), which may bias the estimates of the wealth effect toward zero. In addition, the degree of liquidity of an asset affects the consumption response: transaction costs on housing diminish the consumption response to small shocks; in contrast, the reaction to large shocks is more pronounced than in the frictionless model (see e.g., Grossman and Laroque, 1990 and Otsuka, 2004). In sum, while theory suggests that the MPC out of wealth lies between 0 and 5 cents, it is not sharp enough to pin down relative size of MPCs out of housing and financial wealth. The hope is that empirics can shed more light on these important parameters.

Growing empirical literature estimates the wealth effect on consumption.[4] In a closely related paper, Ludwig and Sløk (2004) estimate in a panel of 14 OECD countries that the *elasticity* of consumption with respect to stock prices is considerably higher than with respect to housing prices. Both elasticities have increased after 1984. Ludwig and Sløk find little difference for the role of housing prices in bank-based and market-based economies but substantially higher values for stock prices in market-based countries. Case et al. (2005) report that (both in the sample of 14 countries and in the sample of US states) the elasticity of consumption with respect to housing wealth is much bigger that with respect to stock market wealth (which is often insignificant). Cardarelli et al. (2008) construct an index of the development of mortgage markets and find that housing wealth effects tend to be larger in countries with access to mortgage credit (as reflected in the availability of mortgage equity withdrawal, size of refinancing fees, loan-to-value ratios, etc).

The literature agrees that the estimates of the marginal propensity to consume out of wealth lie between 0 and 10 cents. Conventional wisdom is that the wealth effects are larger in Anglo–Saxon economies, around 4–5 cents, than elsewhere (roughly 1–3 cents).[5] Partly because of data limitations there is not much consensus on how the wealth effects differ for housing and financial wealth.

[4] A number of recent empirical studies including Fernandez-Corugedo et al. (2003) and Hamburg et al. (2005) follow Lettau and Ludvigson (2004) in using estimation methods that impose cointegration between consumption, income and wealth in national contexts. Cross-country comparative work includes Bertaut (2002), Ludwig and Sløk (2004), Catte et al. (2004), Case et al. (2005) and Labhard et al. (2005). The implications of these papers are constrained by data limitations, which I try to alleviate. In particular, the above papers do not investigate housing wealth effect (Bertaut, 2002 and Labhard et al., 2005), use annual data (Case et al., 2005 and in part Catte et al., 2004), relatively few countries (Bertaut, 2002; Catte et al., 2004 and Cardarelli et al., 2008) or proxy wealth variables with stock and real estate prices (Ludwig and Sløk, 2004 and Cardarelli et al., 2008).

[5] Ludwig and Sløk (2004), Catte et al. (2004) and Cardarelli et al. (2008) bring some evidence on this, which I confirm and extend below.

3 Data and Summary Statistics

3.1 Data Coverage

The data are quarterly (unless otherwise noted) and cover roughly the last 35 years (as indicated in tables 1 and 2) and the following 16 countries: Australia, Canada, France, Germany, Italy, Japan, the United Kingdom, the United States, Austria, Belgium, Denmark, Finland, Ireland, the Netherlands, Spain and Sweden.[6] Most data were taken from the database of the NiGEM model of the NIESR Institute, London. Original sources for most of these data are OECD, Eurostat, national statistical institutes and central banks.

The consumption data are total private consumption expenditures from OECD's Main Economic Indicators database (as nondurables and services data are not available for all countries). The labor income data were approximated with total compensations of employees. The net financial wealth data come originally from the national central banks or Eurostat. All series were deflated with consumption deflators and expressed in per capita terms. The population series were taken from DRI International and interpolated (from annual data). The series were de-seasonalized using the X-12 method where necessary. Housing prices for some countries (as indicated in the tables below) were linearly interpolated from annual or semiannual data.

3.2 Construction of Housing Wealth

This section describes the construction of housing wealth using housing prices from the Bank for International Settlements dataset (BIS).[7] I use the following procedure (in the spirit of Case et al., 2005) to construct housing wealth. I calculate housing wealth HW as

$$HW_t = sf \times \big(DS_t \times N_t\big) \times HP_t, \tag{1}$$

where sf is a scaling factor, DS_t is dwelling stock defined as the number of dwellings per capita,[8] N_t is population and HP_t is the housing price index. Housing wealth is thus approximated as a rescaled product of quantity of housing ($DS_t \times N_t$) and housing price HP_t. The scaling factor was computed as

$$sf = \frac{HW}{FW} \times FW,$$

[6] The countries are sorted as follows. The first 8 countries are the G7 countries and Australia; the remaining 8 countries are "smaller" industrial countries.

[7] See Arthur (2005) for a description of the BIS dataset. The data originally come from national sources. Italian housing prices are from Nomisma. Japanese residential property prices originate from the following source: `http://www.reinet.or.jp/e/jreidata/a_shi/index.htm`.

[8] Per capita dwelling stocks in most countries in 2003 ranged between 0.4 and 0.5.

where HW/FW is the latest ratio of housing to financial wealth extracted using data from the Statistical Annex to OECD's Economic Outlook (Table 58), Arnold et al. (2002), Table 1, p. 4, and Altissimo et al. (2005), Table 3.1, p. 13, and FW is the relevant value of financial wealth (obtained from the NiGEM's database).

Dwelling stocks are calculated from data obtained from the United Nations' Bulletin of Housing Statistics for Europe and North America, available at: `http://www.unece.org/hlm/prgm/hsstat/welcome_hsstat.html`.

3.3 Descriptive Statistics

Figures 2 and 3 plot housing, financial and total wealth. The figures and the related descriptive statistics illustrate some stylized facts about financial and housing wealth:

- Financial wealth grows by 3.7 percent a year on average, about 1.2 percentage points higher than housing wealth.
- Financial wealth growth is in terms of standard deviations almost twice as volatile as housing wealth growth.
- Growth of housing wealth is substantially more persistent than growth of financial wealth. First autocorrelation of the former is almost 0.6, compared to 0.27 for the latter (in annual data).

The (high-frequency) dynamics of housing wealth are driven primarily by housing prices.[9] Financial wealth on the other hand is more weakly related to stock prices as equities typically make up only about 20–40 percent of net financial wealth (and 10–20 percent of net worth). Compared to other countries, the correlation between stock prices and net financial wealth is quite strong in the US, where people invest a large fraction of their assets in equities.

[9]This is in part due to how housing wealth is approximated: To construct housing wealth I multiply housing prices with per capita dwelling stocks and population series. Since dwelling stocks and population are smooth (compared to housing prices), large portion of the dynamics of housing wealth is driven by housing prices.

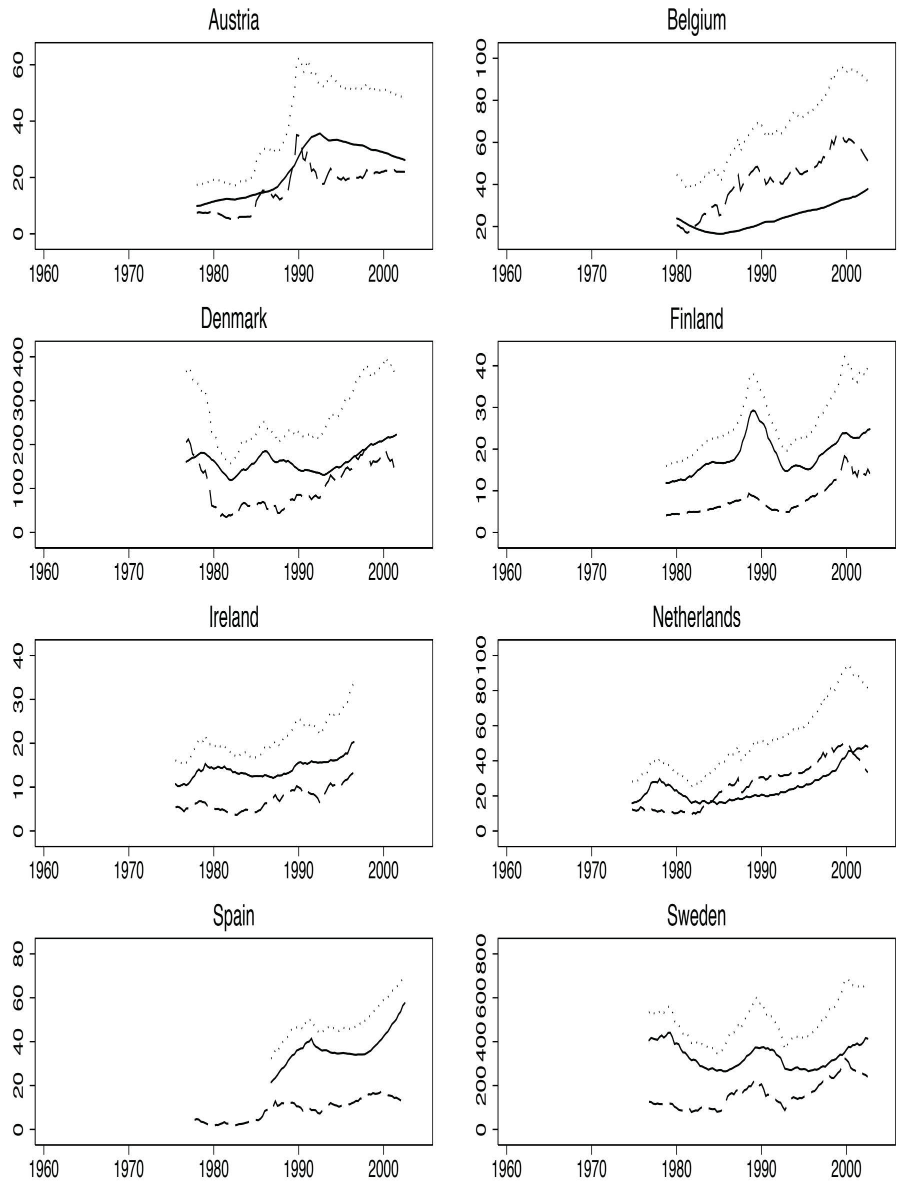
There are good reasons to expect that the approximation error is relatively small as the changes in quantity of housing are limited. For the US, where both the "true" housing wealth series (in the Flow of Funds) and its approximation are available, the correlation between the quarterly *growth rates* is 0.86.

When the equations below are estimated with housing prices rather than housing wealth (constructed using definition (1)), the estimates of the wealth effects do not change much. (For example, the restricted estimate of the evnetual MPCW falls from 1.97 reported in the first cell of Table 4 below to 1.64.) Generally, the housing wealth effect is more strongly affected (than the financial wealth effect), typically downward, which probably reflects that the approximation with housing prices only is cruder and contains more measurement error.

Figure 2: Financial and Housing Wealth I.

Note: Per capita real terms, local currency.

Figure 3: Financial and Housing Wealth II.



— Housing Wealth — — — Net Financial Wealth · · · Net Total Wealth

Note: Per capita real terms, local currency.

Figures 2 and 3 document the finding of Helbling and Terrones (2003) that sharp housing price decreases are infrequent—substantially rarer than stock price falls.[10] In contrast to stock prices, when housing prices fall they typically do so gradually over several quarters or even years rather than days.

The proportion of wealth held in housing varies substantially among countries, between roughly 40 percent in the US and almost 70 percent in Germany, Italy and Spain.[11] The US together with Belgium and the Netherlands is the only country that has more financial wealth than housing wealth. Consequently, if the MPCs out of housing and financial wealth were the same, this would imply that the aggregate effect of housing wealth on consumption would in most countries be larger simply because they have more housing wealth.

4 Estimation

My baseline estimation methodology consists in three steps: (i) estimate the persistence of consumption growth χ, (ii) estimate the immediate (short-run) effect of wealth shocks on consumption (immediate MPC) and (iii) use the parameters from steps (i) and (ii) to back out the eventual (long-run) marginal propensity to consume out of wealth.[12]

4.1 Sluggishness of Aggregate Consumption Growth

Hall (1978) showed that consumption expenditures of a household with time-separable quadratic utility follow a random walk. However, much of the later work (including Flavin, 1981 and Campbell and Mankiw, 1989) argued that random walk is not an adequate approximation of the actual aggregate consumption. A number of "excess sensitivity" puzzles has been documented: contrary to the Hall model, future consumption growth was shown to be significantly affected by past variables (predicted income growth, consumption growth or consumer sentiment).

Sommer (2007) argues that much of the excess sensitivity puzzle[13] can be explained by intertemporal dependence of consumption growth, so that the following simple equation

$$\Delta \log C_t = \varsigma + \chi \Delta \log C_{t-1} + \varepsilon_t \tag{2}$$

[10]Helbling and Terrones investigate post-1970 data from 14 industrial countries and report 20 housing price crashes and 25 equity price crashes in their sample. The difference is relatively small due to their identification procedure: to qualify for a bust stock prices must fall by at least 37 percent whereas housing prices only by 14 percent.

[11]These numbers are based on data for 2000, from Statistical Annex to OECD Economic Outlook 78, December 2005, Table 58 and Arnold et al. (2002), Table 1, p. 4.

[12]The technique follows Carroll et al. (2006).

[13]See Sommer (2007) for US and Carroll et al. (2008) for international evidence.

captures well the dynamics of *aggregate* consumption.[14]

There are two main frameworks to justify the equation: Habits and sticky expectations. The former setup assumes that consumers maximize a utility function with additive habits,[15]

$$\max_{\{C_s\}} \mathbf{E}_t \sum_{s=t}^{\infty} \beta^{s-t} U(C_s - \chi C_{s-1})$$

subject to the standard intertemporal budget constraint and transversality condition. The parameter χ, which lies between 0 and 1, determines the strength of habits: $\chi = 0$ implies a time-separable utility, for $\chi = 1$ the utility depends only on consumption growth, not on its level. Dynan (2000) approximates the Euler equation for this objective function with the CRRA outer utility $U(C) \equiv C^{1-\rho}/(1-\rho)$ with (2).

Carroll and Slacalek (2006) show that essentially the same equation for aggregate consumption holds if one aggregates households which have *time-separable* CRRA utility but are inattentive to aggregate uncertainty and estimate the persistence parameter χ to be about 0.75 (in quarterly data).[16]

While the two frameworks are essentially indistinguishable in aggregate data, they differ considerably in micro data. The advantage of the sticky expectations model is that it implies that consumption growth at the household level is unpredictable, which is in line with most of the literature that

[14] In particular, this means that once past consumption growth is included among explanatory variables, other regressors X_{t-1} (most prominently past income growth) tend to be insignificant when the following equation is estimated:

$$\Delta \log C_t = \varsigma + \chi \Delta \log C_{t-1} + \gamma^{\top} X_{t-1} + \varepsilon_t.$$

Note that equation (2) does not for simplicity include interest rates r_t. The reason is that estimates of θ from equations like

$$\Delta \log C_t = \varsigma + \chi \Delta \log C_{t-1} + \theta r_t + \varepsilon_t$$

are typically found to be insignificant or implausible (see, e.g., Hall, 1988 and Campbell and Mankiw, 1991). In addition, another potential concern—highlighted by Carroll (2001) in the context of simulated household-level data—is that expected real interest rates are endogenous (correlated with an error term). (Inclusion of r_t results in insignificant θ and does not substantially affect the estimates of χ reported below.)

[15] This functional form imposes that the stock of habits is equal to the previous period's consumption C_{s-1}. Fuhrer (2000) argues (and estimates) that this is the case rather than a specification in which habits have longer "memory" in that they are a weighted average with large weights on consumptions of times $t-1, \ldots, t-\infty$.

While this specification of habits ($H_t = C_{t-1}$) is more restrictive than, say, Fuhrer's: $H_t = (1-\delta) \sum_{i=0}^{\infty} \delta^i C_{t-1-i}$, it implies particularly simple dynamics of consumption growth (2) and performs well empirically.

[16] In particular, Carroll and Slacalek (2006) find that in aggregate US data on consumption of nondurables and services equation (2) with $\chi \approx 0.75$ beats its two competitors: the random walk model of Hall (1978) and the Campbell and Mankiw (1989) model with the rule-of-thumb consumers, which can account for the excess sensitivity to predicted income.

rejects habits in micro data (including Meghir and Weber, 1996; Dynan, 2000 and many others).[17]

4.2 Estimates of Sluggishness of Aggregate Consumption Growth χ

Estimation of consumption sluggishness χ in (2) is complicated by the presence of measurement error, time-aggregation bias and transitory components not captured by the theory (e.g., expenditures caused by weather, such as floods or hurricanes). Several authors (Wilcox, 1992; Sommer, 2007; Bureau of Economic Analysis, 2006) document that a large fraction of consumption data (around 30 percent of the total personal consumption expenditures in the US, probably even more in other countries) is estimated, imputed or interpolated. Consequently, the OLS estimator of χ is biased toward zero. The standard solution, used by Sommer (2007) in the US data, is to estimate (2) with instrumental variables regression in which instruments are correlated with (future) consumption growth and unrelated to measurement error.

Table 1 reports the IV estimates of χ from equation (2) in total personal consumption expenditures from major industrial countries.[18] The key finding is that χ *is very different from zero:* the average of χs across all countries is 0.62. This means that a typical household is about two thirds of distance away from time-separability in the direction of habits.

The first two columns show the point estimates of χ and their standard errors. Consumption sluggishness χ is typically larger than 0.5 (for 12 countries of 16). As the standard error of χ is about 0.22 the persistence of consumption growth (χ) is statistically significantly different from zero. The last column on the right ($\bar{R}_1^2$) displays the adjusted R^2s from the first-stage regressions, which indicate the strength of instruments. As in some countries $\bar{R}_1^2$ is quite low (below 0.1 for Australia, Belgium, Denmark and Austria),[19] I also report in column 3 confidence intervals for χ which

[17]The Euler equation (2) clearly presents a stylized model of aggregate consumption dynamics, which nevertheless performs well empirically. Carroll et al. (2008) find in a dataset similar to that this simple model of consumption sluggishness wins a horse-race regression with instrumented income growth and wealth.

One can also imagine that housing stock can directly enter the right-hand side of the Euler equation, which would in presence of non-separabilities between housing and non-housing consumption bias the estimates of χ reported in table 1 below. I have investigated the possibility and but the added regressor typically did not affect much the baseline estimates of χ (the results are available upon request).

[18]The instruments are standard and include lagged consumption growth, lagged income growth, unemployment, change in short-run interest rates, interest rate spread and where available consumer sentiment (G7 countries and Australia).

[19]The first-stage F statistics are in some cases below the rule-of-thumb value of 10 recommended by Stock et al. (2002) (they range between 2.3 and 10.7; in 8 countries they are higher than 8). If the instruments are weak, the IV estimator is biased toward the

Table 1: Consumption Sluggishness

$$\Delta \log C_t = \varsigma + \chi \mathbf{E}_{t-2} \Delta \log C_{t-1} + \varepsilon_t$$

Country	Time Range	χ	se_χ	Moreira's CLR 95% CI	Robust p val $H_0 : \chi = 0$	$\bar{R}_1^2$
Australia	70Q1–99Q4	0.84	0.36	(0.35, 4.05)	0.003	0.07
Canada	65Q1–03Q3	0.74	0.21	(0.43, 1.42)	0.000	0.23
France	70Q2–03Q2	0.22	0.19	(0.04, 1.30)	0.031	0.21
Germany	65Q1–02Q4	0.14	0.23	(−0.06, 1.66)	0.092	0.13
Italy	71Q4–99Q4	0.74	0.15	(0.46, 1.18)	0.000	0.31
Japan	65Q1–01Q1	0.20	0.17	(−0.10, 0.66)	0.199	0.30
United Kingdom	61Q2–03Q4	0.62	0.25	(0.29, 1.71)	0.001	0.17
United States	65Q1–03Q4	0.74	0.16	(0.51, 1.23)	0.000	0.29
Austria	78Q2–02Q4	0.40	0.26	(−0.02, 1.69)	0.061	−0.01
Belgium	80Q2–02Q4	0.66	0.33	($-\infty$, $+\infty$)	0.095	0.07
Denmark	77Q1–01Q4	0.55	0.37	(0.03, 4.30)	0.040	0.07
Finland	79Q1–03Q1	0.92	0.20	(0.59, 1.50)	0.000	0.28
Ireland	75Q4–96Q4	0.86	0.10	(0.68, 1.07)	0.000	0.57
Netherlands	75Q1–02Q4	0.51	0.27	(0.09, 1.65)	0.020	0.14
Spain	78Q1–02Q4	0.84	0.16	(0.56, 1.28)	0.000	0.30
Sweden	77Q1–02Q4	0.88	0.19	(0.63, 1.63)	0.000	0.24
Mean	–	0.62	0.22	–	–	–

Notes: Instruments: Lag $t-2$ of consumption growth, income growth, unemployment rate, differenced short-term interest rate, interest rate spread and consumer sentiment (for G7 countries). Regressions estimated with instrumental variables. Moreira's CLR denotes confidence interval for χ obtained by inverting the conditional likelihood ratio statistic of Moreira (2003). Robust p val denotes the p value testing $\chi = 0$ with Moreira's CLR test (robust to weak instruments). $\bar{R}_1^2$ is the adjusted R^2 from the first-stage regressions of $\Delta \log C_{t-1}$ on instruments. Regression for Germany includes a dummy for German reunification in 1991Q1.

are valid with weak instruments (as well as with strong). The intervals are calculated by inverting the conditional likelihood ratio statistic (CLR) of Moreira (2003).[20] If the instruments are weak, the confidence intervals are wide (even infinitely as in the case of Belgium), which reflects the fact that χ is not identified under weak instruments. Finally, column 4 displays the p value of the test $\chi = 0$ using the CLR statistic (robust to weak instruments).

The evidence in table 1 suggests that the persistence of consumption growth χ is substantially and statistically significantly different from zero. The null hypothesis ($\chi = 0$) is clearly not rejected only for Japan. Statistical significance (p values in column 4) is inconclusive for three countries (p values for Germany, Belgium and Austria range between 0.05 and 0.1) and the null is clearly rejected for the remaining twelve countries.

Finally, the confidence intervals in table 1 suggest that the countries in my sample are quite homogenous in terms of χ. The average consumption growth persistence $\chi = 0.62$ is (barely) rejected for only two countries (Ireland and Sweden).

4.3 Wealth Effects

The second step of my estimation procedure consists in identifying the immediate effect of wealth shocks on consumption. Consumption shocks ε_t from (2) are in part driven by wealth shocks ∂W_t, in part by other (control) variables $\tilde{Z}_t$:

$$\varepsilon_t = \alpha_w \partial W_t + \alpha_z^\top \tilde{Z}_t, \tag{3}$$

where $\partial W_t = \frac{\Delta W_t}{C_{t-1}} = \frac{\Delta W_t}{W_{t-1}} \times \frac{W_{t-1}}{C_{t-1}}$ denotes the rescaled wealth growth (which approximates wealth shocks). Wealth growth $\frac{\Delta W_t}{W_{t-1}}$ in ∂W_t is multiplied with the wealth–consumption ratio to ensure that the parameter α_w is the immediate marginal propensity to consume out of wealth.

The goal of decomposition (3) of consumption shocks into the two parts is to identify the contribution of wealth shocks controlling for the impact of other, potentially correlated variables collected in $\tilde{Z}_t$. These variables are chosen a priori, are quite standard determinants of consumption dynamics—income growth, unemployment, change in short-run interest rate and interest rate spread—and represent the effects on spending of income, uncertainty, interest rates and expectations about future economic developments (interest rate spread).

As estimating (3) directly yielded rather imprecise estimates of α_w I use the restrictions implied by the theory of consumption dynamics (2) to identify α_w more accurately as follows. Using (2), consumption growth has

OLS estimator. Consequently, if anything, the IV estimates of χ in table 1 should be biased downward.

[20] Andrews et al. (2006) show that the CLR test is more powerful than other available tests on endogenous variables in an IV model.

the moving average representation

$$\Delta \log C_t = \alpha_0 + \sum_{i=1}^{\infty} \chi^i \varepsilon_{t-i} + \varepsilon_t \tag{4}$$

with $\alpha_0 = \varsigma/(1-\chi)$. Substituting (3) into (4) gives

$$\Delta \log C_t = \alpha_0 + \alpha_w \sum_{i=1}^{\infty} \chi^i \partial W_{t-i} + \alpha_{\tilde{z}}^\top \sum_{i=1}^{\infty} \chi^i \tilde{Z}_{t-i} + \varepsilon_t$$

or

$$\Delta \log C_t = \alpha_0 + \alpha_w \bar{\partial} W_{t-1} + \alpha_z^\top Z_{t-1} + \varepsilon_t \tag{5}$$

denoting $\bar{\partial} W_{t-1} \equiv \sum_{i=1}^{\infty} \chi^i \partial W_{t-i}$, $\alpha_z^\top = (\alpha_{\tilde{z}}^\top \chi, \alpha_{\tilde{z}}^\top \chi^2, \dots)$ and $Z_{t-1}^\top = (\tilde{Z}_{t-1}^\top, \tilde{Z}_{t-2}^\top, \dots)$ control variables.

To estimate equation (5) I approximate the infinite sum $\bar{\partial} W_{t-1}$ with a finite one, $\bar{\partial} W_{t-1} \approx \chi(\Delta W_{t-1} + \chi \Delta W_{t-2} + \chi^2 \Delta W_{t-3} + \chi^3 \Delta W_{t-4})/C_{t-5}$.[21] To be able to interpret α_w as the marginal propensity to consume out of wealth it is necessary to consistently re-scale consumption and wealth with the same initial consumption level, C_{t-5} (because $\bar{\partial} W_{t-1}$ consists of differenced wealth lagged up to $t-4$). I thus estimate the equation in the following form:

$$\partial C_t = \alpha_0 + \alpha_w \bar{\partial} W_{t-1} + \alpha_z^\top Z_{t-1} + \varepsilon_t, \tag{6}$$

where $\partial C_t \equiv \Delta C_t / C_{t-5}$ and $\bar{\partial} W_{t-1} = \chi(\Delta W_{t-1} + \chi \Delta W_{t-2} + \chi^2 \Delta W_{t-3} + \chi^3 \Delta W_{t-4})/C_{t-5}$. Note that while ∂C_t is not equal to consumption growth $\Delta C_t / C_{t-1} \approx \Delta \log C_t$, the two variables are almost perfectly correlated as C_t and C_{t-5} are very similar.[22]

Given the estimates of χ and α_w, the immediate marginal propensity to consume is α_w/χ. Finally, the eventual MPCW is the geometric sum $\sum_{i=0}^{\infty} \chi^i \alpha_w / \chi = \alpha_w / \big(\chi(1-\chi)\big)$.

In short, the whole estimation procedure consists of three steps:

1. Estimate consumption growth persistence χ in (2) with IV.
2. Given χ, estimate the sensitivity of consumption to wealth α_w in (6).
3. Given χ and α_w, back out the immediate and eventual marginal propensities to consume out of wealth as α_w/χ and $\alpha_w/\big(\chi(1-\chi)\big)$, respectively.

Table 2: Immediate and Eventual Effects of Total Wealth on Consumption (MPCs)

$$\partial C_t = \alpha_0 + \alpha_w \bar{\partial} W_{t-1} + \alpha_z^\top Z_{t-1} + \varepsilon_t$$

		χ Unrestricted			$\chi = 0.60$	
Country	Time Range	χ	MPC_w^{im}	MPC_w^{ev}	MPC_w^{im}	MPC_w^{ev}
Australia	70Q1–99Q4	0.84	1.64***	10.05***	2.86***	7.14***
Canada	70Q1–03Q3	0.74	1.06**	4.06**	1.70***	4.25***
France	70Q2–03Q2	0.22	3.57	4.60	1.07	2.69
Germany	70Q1–02Q4	0.14	6.61	7.70	1.33*	3.32*
Italy	71Q4–99Q4	0.74	−0.25	−0.95	−0.33	−0.83
Japan	70Q1–01Q1	0.20	10.57**	13.15**	2.97***	7.44***
United Kingdom	70Q1–03Q4	0.62	2.00***	5.31***	2.12***	5.31***
United States	65Q1–03Q4	0.74	1.53***	5.95***	2.16***	5.41***
Austria	78Q2–02Q4	0.40	0.13	0.21	0.06	0.14
Belgium	80Q2–02Q4	0.66	−0.05	−0.14	−0.01	−0.02
Denmark	77Q1–01Q4	0.55	4.33***	9.68***	3.72***	9.29***
Finland	79Q1–03Q1	0.92	1.95***	24.08***	4.03***	10.08***
Ireland	75Q4–96Q4	0.86	0.80	5.57	1.84*	4.59*
Netherlands	75Q1–02Q4	0.51	1.27**	2.60**	1.14**	2.84**
Spain	87Q1–02Q4	0.84	1.29***	8.32***	2.38***	5.96***
Sweden	77Q1–02Q4	0.88	0.83**	6.91**	1.84**	4.61**
Mean	–	0.62	2.33	6.69	1.81	4.51

Notes: MPC_w^{im} and MPC_w^{ev} denotes the *immediate* and *eventual* marginal propensities to consume in cents per dollar of additional wealth. $\{^*, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent.

4.4 Country-Specific Results

Table 2 compares two sets of estimates of immediate and eventual marginal propensities to consume out of *total* wealth. The MPCs in the left panel are calculated using the (unrestricted) estimates of consumption persistence χ displayed in the first column. The right panel reports MPCs when the average consumption persistence $\chi = 0.6$ is imposed for all countries. Control variables Z include income growth, unemployment, change in short-term interest rate and interest rate spread.

The estimates imply that:

- The averages of immediate and eventual MPCs across all countries reported in the last row are about 2–2.5 cents and 4.5–7 cents, respectively.
- The variation in MPCs across countries is substantial. Eventual MPCs tend to lie between 0 and 10 cents.
- The MPCs are large and significant in the US, Australia, UK, Japan and some smaller European countries (Denmark, Finland, the Netherlands, Sweden) and relatively modest or statistically insignificant in larger countries of continental Europe (France, Germany and Italy).
- Imposing the average $\chi = 0.6$ shrinks country-specific MPCs toward their average. The shrinkage depends on how far the estimated χ is from 0.6. The estimates with restricted consumption growth persistence ($\chi = 0.6$) are arguably closer to conventional wisdom as imposing homogenous χ eliminates outliers (such as Finland).[23]

4.5 Disaggregated Wealth Effects

An advantage of my dataset is that it makes it possible to separate the MPC out of housing and financial wealth, and test if they differ from each other. To do so I estimate the following equation, in which financial (FW) and housing (HW) wealth are included separately:

$$\partial C_t = \alpha_0 + \alpha_{fw}\bar{\partial} FW_{t-1} + \alpha_{hw}\bar{\partial} HW_{t-1} + \alpha_z^\top Z_{t-1} + \varepsilon_t, \qquad (7)$$

[21] The results below are robust to the choice of the cutoff point for the cutoff point = 3, 4 and 5.

[22] Correlation between ∂C_t and $\Delta \log C_t$ exceeds 0.998 for all countries. The estimates of χ do not practically depend on whether equation (2) above is estimated with $\Delta \log C_t$ or ∂C_t.

[23] Note that the standard errors in the left panel of table 2 do not account for the generated regressor bias caused by the fact that the parameter χ is estimated. (The standard solution of Pagan, 1984, is to estimate standard errors by an IV regression rather than OLS. This procedure is not applicable here as χ is already estimated in the first step by IV, $\bar{\partial} W$ is a weighted sum of lagged variables, and it is difficult to find good predictors of ΔW_t five quarters ahead, especially for financial wealth.)

Table 3: Housing vs. Financial Wealth Effect—Eventual MPCs

$$\partial C_t = \alpha_0 + \alpha_{fw}\bar{\partial} FW_{t-1} + \alpha_{hw}\bar{\partial} HW_{t-1} + \alpha_z^\top Z_{t-1} + \varepsilon_t$$

		Wealth	
Country	Time Range	Financial	Housing
Australia	70Q1–99Q4	7.26***	7.10***
Canada	70Q1–03Q3	8.05**	1.28
France†	70Q2–03Q2	2.89*	2.30
Germany†	70Q1–02Q4	14.24	2.86
Italy‡	71Q4–99Q4	10.30*	−1.07*
Japan‡	70Q1–01Q1	9.48**	6.30**
United Kingdom	70Q1–03Q4	3.71*	6.95***
United States	65Q1–03Q4	5.33***	7.04
Austria†	78Q2–02Q4	0.40	−2.17
Belgium†	80Q2–02Q4	0.63	−6.74
Denmark	77Q1–01Q4	5.95	17.33**
Finland	79Q1–03Q1	−3.58	18.15***
Ireland	75Q4–96Q4	2.09	9.15*
Netherlands	75Q1–02Q4	2.68*	3.17
Spain	87Q1–02Q4	5.33**	6.24***
Sweden	77Q1–02Q4	5.74**	2.56
Mean	–	5.03	5.03

Notes: Marginal propensities to consume in cents per dollar of additional wealth. $\{^*, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent. $\chi = 0.60$ imposed. † : Housing prices for France, Germany, Austria and Belgium were interpolated from annual data. ‡ : Housing prices for Italy and Japan were interpolated from semiannual data.

instead of (6).

Table 3 summarizes the eventual MPCs out of housing and financial wealth. I find that:

- The cross-country averages of housing and financial wealth effect both lie in the neighborhood of 5 cents.
- While there is some evidence that housing wealth effect is smaller than financial wealth effect (in nine of sixteen countries), ...
- ... countries like the UK and the US have substantially larger housing wealth effect. This last finding confirms similar results for the US of Case et al. (2005), Carroll et al. (2006) and others.
- Overall, the estimates in table 3 are rather imprecise. In seven countries is neither MPC out of financial nor housing wealth significantly different from zero (at the 95 percent significance level) despite the fact that the point estimates of MPCs are sometimes quite large (e.g., financial wealth in Germany and Italy).

4.6 Wealth Effects for Groups of Countries and over Time

While the MPCs in table 3 are often large and significant, the estimates are in many cases quite imprecise and statistically indistinguishable from zero. This is not surprising. Labhard et al. (2005) and others also find substantial uncertainty about the wealth effects in individual countries. Fortunately, I can take advantage of the cross-section dimension of my dataset and address the issue by imposing homogeneity restrictions on groups of similar countries.

I estimate the equations with seemingly unrelated regressions (SUR). This method is useful for two reasons: (i) it increases efficiency when disturbances from individual country regressions are correlated and (ii) it makes it possible to impose cross-equation restrictions. I estimated equation (6) in the following system:

$$\partial C_{t,i} = \alpha_{0,i} + \alpha_{w,i}\bar{\partial} W_{t-1,i} + \alpha_{z,i}^{\top} Z_{t-1,i} + \varepsilon_{t,i}, \qquad i = 1, \ldots, 16,$$

where i denotes the country dimension. The estimates of two key drivers of consumption—(total, financial or housing) wealth and income ($\alpha_{w,i}$ and the income parameter in $\alpha_{z,i}$)—were restricted to be the same across countries from the same group. The cross-correlation of the error terms was freely estimated (not imposed or restricted).

Table 4 presents the results for four groups of countries: "complete" mortgage markets, market-based, Anglo–Saxon and the euro area.

Countries with complete mortgage markets were defined using the new mortgage market index of Cardarelli et al. (2008), table 3.1, arguably the

Table 4: Wealth Effects for Country Groups—Eventual MPCs

Country	Wealth Total	Wealth Financial	Wealth Housing
All Countries	1.97***	2.77***	1.19***
"Complete" Mortgage Markets	4.04***	4.34***	3.77***
"Incomplete" Mortgage Markets	0.67*	1.75**	0.09
p val: CMM = IMM	0.000	0.020	0.000
Market-Based	3.70***	3.79***	3.76***
Bank-Based	0.74*	2.02**	0.08
p val: MB = BB	0.000	0.101	0.000
Anglo–Saxon	5.86***	6.40***	5.30***
Non Anglo–Saxon	0.84**	1.74**	0.16
p val: AS = Non AS	0.000	0.001	0.000
Euro Area	0.78**	1.83**	0.12
Non Euro Area	4.21***	4.60***	3.88***
p val: EA = Non EA	0.000	0.014	0.000

Notes: Marginal propensities to consume in cents per dollar of additional wealth. SUR Estimates, $\{^{*}, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent. Time range: 1979Q1–1999Q4.
All Countries: Aus, Can, Fra, Ger, Ita, Jap, UK, US, Aut, Bel, Den, Fin, Ire, Ned, Swe.
"Complete" Mortgage Markets (following Cardarelli et al. (2008)): Aus, Can, UK, US, Den, Ned, Swe.
Market-based (following Levine (2002)): Aus, Can, Jap, UK, US, Ire, Ned, Swe.
Anglo–Saxon: Aus, Can, UK, US, Ire.
Euro Area: Fra, Ger, Ita, Aut, Bel, Fin, Ire, Ned.

best available indicator of flexibility and development of mortgage markets. The indicator, which ranges between 0 and 1, was constructed using data on typical loan-to-value ratios, availability of home equity withdrawal, size of early repayment fees for mortgages and development of secondary markets for mortgage loans. Countries with "complete" mortgage markets are those where the index exceeds 0.5 (ranked in decreasing order by the index): US, Denmark, the Netherlands, Australia, Sweden, UK and Canada. Because more flexible mortgage markets increase the liquidity of housing wealth, one would expect that the housing wealth effects in these countries are larger (which as we will see is confirmed in the data).

Market-based economies are defined following Levine (2002) as countries where the stock market plays more important role in financial transmission than banks. The degree of development of financial markets can be thought of as a proxy for the importance of secondary mortgage markets, which facilitate banks' funding of mortgages. The definition of market- and bank-based economies is based on Levine's aggregate structure index. The index is constructed as the three first principal component series which measure the activity, size and efficiency of stock market relative to the banking system. Countries with Levine's "structure–aggregate" indicator greater than 0.3 are defined as market-based (ranked by the indicator): US, UK, Japan, Canada, Sweden, Australia, Ireland and the Netherlands. The bank-based countries are: Germany, Denmark, Belgium, France, Italy, Finland and Austria.[24]

The following findings emerge:

- *The MPC out of total, financial and housing wealth restricted across all countries range from 1 to 3 cents.*

- *There are large, statistically significant differences in MPCs between countries.* The wealth effects in Anglo–Saxon countries are about 6 cents. MPCs for complete mortgage markets, market-based economies and countries outside the euro area are roughly 4. Bank-based economies, countries with "incomplete" mortgage markets, non Anglo–Saxon countries, and members of the euro area have substantially smaller MPCs (0–2 cents). As indicated by the "p val ..." rows, these differences are statistically significant.

- *Differences between MPC out of housing and financial wealth are less pronounced.* I find some evidence that the housing wealth effect is somewhat smaller than the financial wealth effect in the euro area, bank-based and non Anglo–Saxon countries and in countries with incomplete mortgage markets but the difference is relatively small (less

[24]Similar ordering is used in Borio (1996) and Beck and Levine (2002). The definitions of all country groups are given in the notes below table 4. Spain was excluded from estimation as the data are available only after 1986, which would considerably limit the estimation sample.

than 2 cents). Housing and financial wealth effects are about the same in other countries.

- *The group estimates are substantially more precise than the equation-by-equation estimates of table 2.* For example, the t statistic on the MPCW in the first cell of the table (restricted across all countries) is 5.53 (compared to the statistics in table 2, which are insignificant for six countries). This is for two reasons. Quantitatively more important is that I impose homogeneity restrictions across countries. The other efficiency gain is through the correlation of error terms across countries.[25]

Countries with more complete mortgage markets (ie, higher typical loan-to-value ratios, availability of mortgage equity withdrawal, ease of early mortgage refinancing, ...), where it is easier and less costly to borrow against houses, have higher housing wealth effects. This finding is in line with much of the recent work (including Iacoviello and Neri, 2007; Muellbauer, 2007 and Cardarelli et al., 2008). In addition, it is well-documented (see e.g., Davey, 2001; Debelle, 2004 and Greenspan and Kennedy, 2005) that in Anglo–Saxon countries the amount of money households withdraw from their mortgages (mortgage equity withdrawal) is strongly correlated with housing wealth and housing prices. As argued by Catte et al. (2004) this has less so been the case in continental Europe, where mortgage markets are not as developed (in this respect). Consequently, the full-sample estimates in table 4 detect essentially no housing wealth effect in such countries.

At the same time, it is also well-known that the pace of innovation in mortgage markets and their deregulation, which broadened households' access to credit, accelerated substantially in the 1980s (in many industrial economies; see, e.g., Diamond and Lea, 1991 and Cardarelli et al., 2008).

Table 5 investigates how the wealth effect changes over time. The results from table 4 are reestimated for the full sample (1979Q1–1999Q4, left panel) and two subsamples: 1979Q1–1988Q4 and 1989Q1–1999Q4 (middle and right panels, respectively). The sample was split in 1988 as the year happens to be in the middle of my sample. However, the late 1980s seem a good candidate for a break date as financial innovation was quite intense in many industrial countries. For example, Muellbauer (2007) constructs indexes of credit conditions for the UK and the US, which rise substantially between 1980 and 1990, reflecting higher supply of credit.

I find a marked increase in housing and total wealth effects after 1988. This increase was stronger in countries where the effects are weaker (non

[25]Given the relatively wide standard errors in table 2 (and their only moderately narrower counterparts from unrestricted SUR estimation) the cross-country homogeneity restrictions are not rejected.

Table 5: Wealth Effects for Country Groups over Time—Eventual MPCs

	Full Sample			Pre-1989			1989 And Later		
Country Group	Total	Financial	Housing	Total	Financial	Housing	Total	Financial	Housing
All Countries	1.97***	2.77***	1.19***	1.36***	4.10***	−0.05	2.97***	3.08***	2.72***
Complete MM	4.04***	4.34***	3.77***	5.20***	6.50***	3.81***	3.93***	3.87***	4.01***
Incomplete MM	0.67*	1.75**	0.09	−0.98	0.55	−1.36	2.65***	3.58***	2.06***
Anglo–Saxon	5.86***	6.40***	5.30***	6.29***	8.66***	4.29**	6.18***	6.66***	5.75***
Non Anglo–Saxon	0.84**	1.74**	0.16	0.31	2.66***	−0.70	1.95***	1.96**	1.84***
Market-Based	3.70***	3.79***	3.76***	4.11***	5.23***	2.93***	4.28***	3.98***	4.68***
Bank-Based	0.74*	2.02**	0.08	−0.44	1.71	−1.09	2.20***	3.44***	1.63***
Euro Area	0.78**	1.83**	0.12	−0.74	1.04	−1.31	2.65***	3.80***	1.95***
Non Euro Area	4.21***	4.60***	3.88***	5.77***	7.62***	4.04***	3.94***	3.73***	4.20***

Notes: Marginal propensities to consume in cents per dollar of additional wealth. SUR Estimates, $\{^{*}, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent. Full sample time range: 1979Q1–1999Q4.
Complete Mortgage Markets (following Cardarelli et al. (2008)): Aus, Can, UK, US, Den, Ned, Swe.
Market-based (following Levine (2002)): Aus, Can, Jap, UK, US, Ire, Ned, Swe.
All Countries: Aus, Can, Fra, Ger, Ita, Jap, UK,US, Aut, Bel, Den, Fin, Ire, Ned, Swe.
Anglo–Saxon: Aus, Can, UK, US, Ire.
Euro Area: Fra, Ger, Ita, Aut, Bel, Fin, Ire, Ned.

Anglo–Saxon, bank-based and euro area): the wealth effect there rose from essentially zero to about 3 cents. The wealth effects in Anglo–Saxon, market-based and non euro area countries have been stable at roughly 4–6 cents or increased only mildly. While financial wealth effects have also risen in incomplete mortgage markets, non Anglo–Saxon countries and in the euro area, they have fallen somewhat in complete mortgage markets, Anglo–Saxon countries and outside the euro area. Finally, the results in table 5 suggest that the housing wealth effect in Anglo–Saxon, bank-based and non euro area countries and economies with incomplete mortgage markets between pre- and post-1989 periods increased from about 0 to 2 cents, about one third of the way toward the Anglo–Saxon countries.

4.7 Robustness Checks

As a robustness check, table A.2 in the appendix reports two sets of country-level estimates of the wealth effect, in which consumption is regressed on income and wealth in (i) log-levels and (ii) growth rates. First, table A.1 documents the mixed evidence on the existence of a stable cointegrating relationship between consumption, income and wealth: almost none of the Phillips–Ouliaris tests rejects the null of no cointegration and 22 of 32 Johansen tests reject the lack of cointegration. With this caveat in mind, the cointegration method actually happens to pin down the (total) wealth effect broadly in line with the baseline approach, at around 3 cents. In contrast, the housing wealth effect is often insignificant and sometimes even negative. Estimating the equation in growth rates (in the right panel of table A.1) gives results more consistent with our baseline, even for the regression with separate terms for housing and financial wealth effect. This finding is perhaps not surprising as the baseline method above can be interpreted as a theoretically motivated, restricted and consequently more efficient version of the regression in growth rates.

5 Conclusion

This paper uses a novel methodology to estimate the wealth effect on consumption in 16 countries. The marginal propensities to consume out of wealth typically range between 1 and 5 cents. This result generally confirms the findings of other authors (in particular those of Case et al., 2005 and Ludwig and Sløk, 2004) using different methods and less complete data.

Some of my results are relevant for policy-makers. Descriptive evidence on housing prices in section 3 implies that even though declines or stagnations of housing wealth are typically gradual, they also tend to be protracted and the resulting aggregate impact on personal consumption—determined by the marginal propensity to consume out of housing wealth and the amount of housing wealth consumers hold—can be large. I find that the MPC to consume out of housing wealth is quite high in the Anglo–Saxon, market-based, non euro area economies with more "complete" mortgage markets and has probably recently increased in many countries. In addition, the amount of housing wealth (relative to consumption) is in some European countries (in particular France, Italy and the UK) and Australia substantially greater than in the US. This means that the aggregate effect of housing wealth on consumption is large there too.

For example, suppose the MPC out of housing wealth in Germany is 2.9 cents (in table 3) and the housing wealth–consumption ratio 3.6 (actual value in 2002). A back-of-the-envelope calculation suggests that had the German housing prices between 1996 and 2006 grown by 64 percent—as much as the US ones did—rather than falling by 13 percent, (real) consumption growth would have been by about 8 percentage points or 0.8 percentage point per year stronger. These considerations imply that the dynamics of housing prices may have a sizable impact on the economy and should be carefully monitored by policy-makers.

Appendix: Robustness Checks—Levels and Differences

A.1 Tests for Cointegration

Table A.1 reports the Phillips–Ouliaris and Johansen tests for cointegration for the two models in levels (A.1) and (A.2), described in section A.2. The first model is shown in the left panel and consists of consumption, income and wealth, the second of consumption, income, financial wealth and housing wealth.

The Phillips–Ouliaris test applies the augmented Dickey–Fuller test on regression residuals to test whether they are I(1) with the statistic $t_{\hat{\alpha}_*}$. The test results imply little evidence of a stable cointegrating relationship in either model.

To complement these results I report the Johansen trace and max tests. To conserve space I only test for the existence of cointegration (not for the number of cointegrating vectors). The null hypothesis of both tests is that there is no cointegrating vector. The tests differ in their alternative hypotheses. While the max test takes as the alternative the existence of *one* cointegrating vector, the trace test's alternative is that there are *at most* p cointegrating vectors, where p is the number of endogenous variables in the system (3 or 4 in this case).

Johansen tests imply less clear-cut results than Phillips–Ouliaris. For the first model, in about half of the countries the null of no cointegration is rejected (at the 95 percent significance level). In the second model (with disaggregated wealth) cointegration is more likely: 22 of 32 tests in the table

Table A.1: Tests for Cointegration in the "Levels" Model

		Total Wealth			Financial and Housing Wealth		
		Phillips–Ouliaris	Johansen		Phillips–Ouliaris	Johansen	
Country	Time Range	$t_{\hat{\alpha}_*}$	λ_{max}	λ_{trace}	$t_{\hat{\alpha}_*}$	λ_{max}	λ_{trace}
Australia	70Q1–99Q4	−1.45	32.13**	18.05	−1.66	43.19	20.93
Canada	70Q1–03Q3	−2.26	48.58***	37.37***	−2.77	60.61***	39.78***
France†	70Q2–03Q2	−2.09	28.90*	24.18	−2.32	48.71**	26.13***
Germany†	70Q1–02Q4	−1.64	38.22***	29.57**	−2.66	78.85***	39.18***
Italy‡	71Q4–99Q4	−1.07	34.34**	24.13**	−2.87	49.28**	28.41**
Japan‡	70Q1–01Q1	−3.27	46.64***	29.83***	−4.22*	68.02***	37.48***
United Kingdom	70Q1–03Q4	−2.45	33.68**	19.80*	−3.94	44.62*	20.92
United States	65Q1–03Q4	−2.90	28.49*	18.48	−2.55	32.52	13.53
Austria†	78Q2–02Q4	−2.30	18.25	13.56**	−2.30	45.27*	29.77**
Belgium†	80Q2–02Q4	−4.53**	58.08***	40.91***	−3.73	72.89***	36.67***
Denmark	77Q1–01Q4	−1.88	33.17**	18.64*	−1.83	52.59**	24.54
Finland	79Q1–03Q1	−1.78	26.19	18.38	−1.72	57.54***	25.18*
Ireland	75Q4–96Q4	−3.33	23.37	14.55	−4.11	52.52**	24.13
Netherlands	75Q1–02Q4	−3.00	39.21***	23.77**	−3.04	70.04***	36.77***
Spain	87Q1–02Q4	−2.19	22.77	18.87*	−2.57	72.53***	33.95***
Sweden	77Q1–02Q4	−2.06	16.87	11.37	−3.43	50.89**	28.70**

Notes: $\{^*, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent. † : Housing prices for France, Germany, Austria and Belgium were interpolated from annual data. ‡ : Housing prices for Italy and Japan were interpolated from semiannual data. Statistical significance for the Phillips–Ouliaris test was calculated using the critical values from Phillips and Ouliaris (1990), Table IIc, p. 190. Statistical significance for the Johansen tests was calculated using the critical values from Osterwald–Lenum (1992). ADF and Johansen test statistics are calculated with 2 lags.

reject the null (at the 95 percent significance level).

In addition, panel cointegration tests of Pedroni (2004) (available from the author) suggest similar conclusions: Five and two out of seven alternative tests investigated by Pedroni cannot reject the null of no cointegration between consumption, income, and total wealth; and consumption, income, financial wealth, and housing wealth, respectively (at the 95 percent significance level).

A.2 Estimation in Levels and Differences

The literature (e.g., most empirical papers cited in section 2) typically estimates the wealth effect using cointegrating regressions between consumption, income and wealth, what I call the levels model. To compare the results of this model with the above method I estimate the model in two variants: with total wealth,

$$\log C_t = \beta_0 + \beta_w \log W_t + \beta_y \log Y_t + \varepsilon_t, \tag{A.1}$$

(where Y_t denotes labor income) and with housing and financial wealth separately,

$$\log C_t = \beta_0 + \beta_{fw} \log FW_t + \beta_{hw} \log HW_t + \beta_y \log Y_t + \varepsilon_t. \tag{A.2}$$

Coefficients β_w, β_{fw} and β_{hw} are *elasticities* of consumption with respect to total, financial and housing wealth, respectively. To obtain *marginal propensities* these elasticities are commonly rescaled by dividing with a recent value of the wealth–consumption ratio (which is analogous to what I do in figure 1 and when constructing ∂W in (3) above).

I estimate the levels model in the left panel of table A.2. As the evidence on the existence of a stable cointegrating relationship is mixed (see table A.1 and Rudd and Whelan, 2006 for a detailed analysis of the US data), the right panel displays wealth effect estimates from the following model in differences

$$\frac{\Delta C_t}{C_{t-3}} = \beta_0 + \sum_{i=1}^{2} \beta_{c,i} \frac{\Delta C_{t-i}}{C_{t-3}} + \sum_{i=0}^{2} \beta_{w,i} \frac{\Delta W_{t-i}}{C_{t-3}} + \sum_{i=0}^{2} \beta_{y,i} \frac{\Delta Y_{t-i}}{C_{t-3}} + \varepsilon_t, \tag{A.3}$$

in which the eventual MPC to consume out of wealth is calculated as the sum of the wealth coefficients $\sum_{i=0}^{2} \beta_{w,i}$. Equation (A.3) can be thought of as an atheoretical version of my preferred model (6). The number of lags was set to two to keep the number of regressors manageable. This means that all variables are rescaled with initial consumption level C_{t-3} (rather than C_{t-5} as in section 4.3).

The findings in table A.2 resemble the results of my baseline estimates of tables 2 and 3 in a number of ways:

Table A.2: Eventual Wealth Effects: Levels vs. Differences

Levels: $\log C_t = \beta_0 + \beta_w \log W_t + \beta_y \log Y_t + \varepsilon_t$

Differences: $\frac{\Delta C_t}{C_{t-3}} = \beta_0 + \sum_{i=1}^{2} \beta_{c,i} \frac{\Delta C_{t-i}}{C_{t-3}} + \sum_{i=0}^{2} \beta_{w,i} \frac{\Delta W_{t-i}}{C_{t-3}} + \sum_{i=0}^{2} \beta_{y,i} \frac{\Delta Y_{t-i}}{C_{t-3}} + \varepsilon_t$

		Levels			Differences		
Country	Time Range	Total MPC_w^{ev}	Financial MPC_{fw}^{ev}	Housing MPC_{hw}^{ev}	Total MPC_w^{ev}	Financial MPC_{fw}^{ev}	Housing MPC_{hw}^{ev}
Australia	70Q1–99Q4	4.99***	2.79**	2.25**	3.86***	3.28**	4.13***
Canada	70Q1–03Q3	6.48***	12.22***	2.12	2.18**	3.52**	1.16
France†	70Q2–03Q2	3.15***	2.64***	1.99	2.09**	2.49**	1.55
Germany†	70Q1–02Q4	2.43	17.75***	2.65	4.17***	12.85*	3.76***
Italy‡	71Q4–99Q4	−0.16	7.80***	−0.48	−0.53**	2.20	−0.51**
Japan‡	70Q1–01Q1	1.15	1.91	−0.84	1.43	−0.24	1.63
United Kingdom	70Q1–03Q4	4.37***	6.86***	1.34	3.48***	1.91**	4.85***
United States	65Q1–03Q4	5.21***	1.34	−0.66	2.80***	2.73***	2.13
Austria†	78Q2–02Q4	−2.18	−3.05	−1.13	1.30	0.85	0.53
Belgium†	80Q2–02Q4	2.22***	2.45***	−2.49	0.35	0.43	−3.11
Denmark	77Q1–01Q4	2.37*	1.42	1.12	7.01***	5.31***	12.68***
Finland	79Q1–03Q1	11.41	9.84***	−2.26	5.36***	2.48	6.86***
Ireland	75Q4–96Q4	9.16**	8.43***	5.47	2.74**	3.56**	0.87
Netherlands	75Q1–02Q4	2.12***	1.85***	2.59	2.79***	2.00**	4.55***
Spain	87Q1–02Q4	0.76	3.96**	0.44	2.13***	3.14**	1.71**
Sweden	77Q1–02Q4	−2.37	5.76***	−4.75	2.07**	2.43**	1.30
Mean	–	3.19	5.25	0.46	2.70	3.06	2.76

Notes: Marginal propensities to consume in cents per dollar of additional wealth. $\{^*, ^{**}, ^{***}\}$ = Statistical significance at $\{10, 5, 1\}$ percent. † : Housing prices for France, Germany, Austria and Belgium were interpolated from annual data. ‡ : Housing prices for Italy and Japan were interpolated from semiannual data. The levels regression was estimated with dynamic least squares with 1 lag and lead. Statistical significance for the levels regression was calculated using the rescaled t statistics as described in Hayashi (2000), p. 656, for which the long-run variance of residuals from DLS regression was computed using the Newey–West window with 4 lags. Statistical significance for the regression in differences was calculated as the p value of the test: $\sum_{i=0}^{2} \beta_{w,i} = 0$.

- The estimates in levels and differences both pin down the average eventual MPC (MPC_w^{ev}) out of total wealth around 3 cents. The average financial and housing wealth effects ($\text{MPC}_{fw}^{ev}$and MPC_{hw}^{ev}) lie around 3–5 cents and 0.3–3 cents, respectively. The levels method implies lower housing wealth MPCs but stronger financial wealth effect.

- There is quite a bit of heterogeneity across countries and uncertainty about the estimates, especially when I estimate housing and financial wealth separately.

- Using both methods I find some evidence that the total wealth effect in Anglo–Saxon countries (US, UK, Australia and Canada) is stronger than in continental Europe.

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