# How Reliable are Cointegration-Based Estimates for Wealth Effects on Consumption? Evidence from Switzerland[a]

Alain Galli[b]

*JEL classification*: D12, E21, E44
*Keywords*: Wealth effects, consumption-to-wealth ratio, cointegration, cay residual

SUMMARY

According to economic theory, the intertemporal budget constraint of households implies that a permanent increase in wealth should have a positive effect on consumer spending. Given the comparatively strong increase in Swiss household wealth over the past few years, the question of the extent to which changes in wealth influence expenditures of households has become of special interest for Switzerland. In this paper, I show that while the link among consumption, wealth and income was quite strong from 1981 to 2000, it has been very unstable since 2001. This fact suggests that the gap among the three variables, i.e., the deviation from long-run equilibrium, that has opened over the last few years is less likely to close. The results apply to aggregate wealth effects as well as to separate financial and housing wealth effects. Furthermore, I document several fragility issues related to the use of the cointegration approach to estimating wealth effects. These issues highlight the importance of carefully checking the robustness of the results, instead of looking just at one cointegration estimation method and only one time period. They also highlight the need for a non-cointegration approach to estimating wealth effects.

a I want to thank Gregor Bäurle, Pascal Gantenbein, Mathias Hoffmann, Katarina Juselius, Mico Loretan, Matthias Lutz, Massimiliano Marcellino, John Muellbauer, Klaus Neusser, Thomas Nitschka, Rolf Scheufele, Frank Schmid, Mark Watson, three anonymous referees, and seminar participants at the 2015 OeNB-BuBa-SNB workshop for valuable comments. The views expressed in this paper are those of the author and not necessarily those of the Swiss National Bank.
b Swiss National Bank, P.O. Box, Börsenstrasse 15, 8022 Zürich. E-Mail: alain.galli@snb.ch.

## 1. Introduction

According to economic theory, the intertemporal budget constraint of households implies that a permanent increase in wealth should have a positive effect on consumer spending. The quantification of such wealth effects, i.e., the estimation of marginal propensities to consume (MPC) out of wealth, is crucial to understanding the transmission mechanism of wealth effects from stock market booms and busts as well as from changes in housing wealth on consumer spending. Given the importance of these issues for conducting monetary policy and the interpretation of economic business cycles, the number of studies looking at this topic has increased over time.

For Switzerland, the question of the extent to which changes in wealth can affect expenditures of households has become of special interest. Uptrends in stock market prices and the parallel increase in real estate prices have led to a strong increase in Swiss household wealth over the past few years. From 2004 to 2014, per capita wealth rose by nearly 40 %. Consumption expenditures, however, rose by only 6.5 % per capita over the same period.

Despite the potential importance of wealth effects for Switzerland, hardly any studies have investigated the effects of wealth changes on consumption for the Swiss case. To my knowledge, the only study that did so was Schmid (2013). He estimated that a 1 % increase in asset wealth increases consumption expenditures by a 0.42 % in the long-run. Given the latest wealth developments described above, these estimates would suggest that a large gap between consumption and the other two cointegrated variables, wealth and income, has opened in recent years.

In Schmid (2013), as in most of the existing literature, the estimation of long-run MPCs out of wealth is based on a cointegrating relationship among consumption, wealth and income, motivated by a log-linearization of the intertemporal budget constraint of households. However, several studies have recently shown that this cointegrating relationship is quite fragile.[1] In this paper, I will show that while the link among consumption, wealth and income of Swiss households was quite strong from 1981 to 2000, it has been very unstable since 2001 and the results indicate that wealth effect do not seem to be present anymore. This makes restoration of the equilibrium less likely and the cointegration approach would not be appropriate anymore to estimate wealth effects.

1 see, e.g., Carroll, Otsuka, and Slacalek (2011).

Another issue when analyzing wealth effects is the possible difference in the strength of consumer reactions to changes in financial wealth on the one hand and changes in housing wealth on the other hand. In addition, the relative importance of these two wealth components for consumption can vary over time. The issue of households' responses to changes in real estate prices and housing wealth has been especially controversial. In the mid-2000s, discussions on the possible consequences of a fall in real estate prices in the U.S., particularly for households, showed that there are several reasons, pro and contra, for a housing wealth effect being larger or smaller than the financial wealth effect. An article in *The Economist*, e.g., highlighted that although rising real estate prices do not necessarily create large gains, a much larger fraction of households owns housing wealth than owns financial wealth in the U.S.[2] Thus, aggregate housing effects could still become as important as financial wealth effects. For Switzerland, knowledge of the housing wealth effect is especially important because real estate asking prices grew by approximately 35 % from 2004 to 2014. Within a cointegration approach, however, estimating housing and financial wealth effects is not straightforward as I will show in this paper.

Overall, according to both empirical evidence and economic theory, higher wealth can lead to higher consumption. The results in this study initially suggest that wealth effects are hardly present in Switzerland, with a 1 % increase in wealth only yielding a 0.06 % increase in consumption expenditures. This is substantially lower than in Schmid (2013). There are two reasons why the estimate has come down: First, the sample is extended by 3 years and now ends in 2012 instead of 2009. Second, there was a conceptional revision of the national accounts (ESA2010) in Switzerland/Europe in 2014, which incorporated substantially revised series for consumption, disposable income and wealth.[3] A more detailed analysis reveals that the result of finding only very small wealth effects is mainly driven by the most recent past. Before 2001, a 1 % increase in wealth had increased consumption expenditures by 0.14 to 0.34 %. This corresponds to an absolute MPC out of asset wealth of 2.0 to 4.8 Swiss centime for an increase in wealth of one Swiss franc. For the more recent period, in contrast, wealth effects do not seem to be present anymore according to cointegration-based estimates. However, this finding could just be due to the fact that consumption, wealth and income do not share a common trend anymore, so that the cointegration approach is not appropriate any more. This would indicate the need for another method to estimate wealth effects on consumption.

2 "Home truths: economic focus", *The Economist*, 14 October 2006.

3 Such a conceptional revision of national accounts occurs roughly every 15 years.

The remainder of this paper is organized as follows: Section 2 provides an overview of the existing literature on wealth effect and section 3 summarizes the cointegration-based approach to estimating wealth effects. Section 4 then describes the data and presents some stylized facts, before section 5 presents the estimation results. Section 6 relates the findings to several fragility issues related to the cointegration approach before section 7 concludes.

## 2. Literature Review

The economic literature on wealth effects in general and on the relationship among consumption, wealth and income in particular is very broad. Possible effects of changes in household wealth on private consumption expenditures were first discussed in FRIEDMAN (1957), BRUMBERG and MODIGLIANI (1954) and ANDO and MODIGLIANI (1963). In general, there are several approaches to empirically estimating such wealth effects. The most popular, from a macro perspective, is the cointegration approach, where a cointegrating relationship among consumption, wealth and income is motivated by linearizing and rewriting the intertemporal budget constraint of households. The corresponding cointegration residual has been shown to be a function of the present value of expected future net returns on aggregate wealth and expected future consumption growth.

Internationally, this MPC out of wealth usually lies between 3 and 7 cents. In terms of separate financial and housing wealth effects, the housing wealth effect is mostly estimated to be larger in countries where it is possible to obtain consumer credit against housing collateral (US, UK) than in countries where this is not as common (Continental Europe). A good and broad survey on the literature on empirical evidence for wealth effects on consumption can be found in COOPER and DYNAN (2014) for studies using micro data and those using macro data. In the remainder of this section, I only discuss selected studies that are particularly related to the use of a cointegration approach to estimating wealth effects.

LUDVIGSON and STEINDEL (1999) were among the first to investigate wealth effects in quite a broad manner. They estimated wealth effects for the U.S. by the use of different models, and they divided wealth into stock market and non-stock market wealth to estimate separate wealth effects. Over the full sample (1953–1997), their estimated MPC out of asset wealth was approximately 4 cents, with the same value for both wealth components. However, the authors documented that the effect of wealth changes on consumption is rather unstable over time and difficult to pin down. The same applied to the general relationship among consumption, wealth and income.

Lettau and Ludvigson (2001) and Lettau and Ludvigson (2004) estimated the cointegrating vector of the cointegrating relationship among U.S. consumption, wealth and income with quarterly data. The MPC out of wealth in their study is approximately 4.6 cents. They also showed that that resulting cointegration residual, called cay residual (c stands for consumption, a for asset wealth and y for income), has forecasting power for the stock market. Furthermore, Afonso and Sousa (2011) showed that the cay residual should also predict government bond yields. A version of the cay residual with disaggregated wealth was presented in Sousa (2010a). In Lettau and Ludvigson (2011), the authors updated the estimates with new, revised data. Interestingly, based on the re-estimated cointegrating vector, the MPC out of wealth decreased by nearly 40 % to 2.8 cents.

What Lettau and Ludvigson (2001, 2004, 2011) did for the U.S. was replicated by other authors for other countries. Hamburg, Hoffmann, and Keller (2008) estimated the MPC out of wealth in Germany to be approximately 4–5 euro cents. The study of Sousa (2010b) suggested that the MPC out of asset wealth is only 0.4 cents for the euro area. Fisher and Voss (2004) estimated the cay residual for Australia. They were unable to find an empirical cointegrating relationship between consumption, wealth and income, but they argued that this was due to problems with separating permanent and transitory components of wealth in finite samples.

The studies described here and in Cooper and Dynan (2014) show a wide and sometimes contradictory variety of findings on wealth effects. The same applies to the relative importance of housing wealth effects compared to financial wealth effects. Related to housing wealth effects, a good review of estimates for transitory and permanent effects of changes in house prices on consumer spending for the U.S. can be found in a background paper of the Congressional Budget Office (2007).

A critique of the estimation of wealth effects through cointegration methods, was brought up by Carroll, Otsuka, and Slacalek (2011). They argued that changes in fundamentals such as the long-run growth rate, the long-run interest rate, the tax scheme, social security generosity or demographics affect the equilibrium among consumption, wealth and income and thus the cointegrating vector. The existence of labor frictions and income uncertainty may also be problematic. The authors also argued that, due to these changes in factors that affect the economy, one would need very long data series to obtain reliable estimates of the cointegrating vector.

Another critique, aiming at the setup wealth effects are usually estimated with was expressed by Muellbauer (2007) and Aron, Muellbauer, and Murphy (2008). When estimating wealth effects, controls for common drivers of house

prices and consumption are often omitted, including income growth expectations, interest rates, credit supply conditions, other assets, indicators of income uncertainty and even income itself. In ARON, MUELLBAUER, and MURPHY (2008), the authors argued that, when not controlling for the direct effect of credit liberalization, housing wealth effects can be over-estimated. Both MUELLBAUER (2007) and ARON, MUELLBAUER, and MURPHY (2008) also showed that when controlling for credit market liberalization, the estimate on the MPC out of income increases.

## 3. The Cointegration Approach

As mentioned before, the most common way to estimate MPCs out of wealth is based on the assumption of a cointegrating relationship among consumption, wealth and income. The respective cointegrating residual, denoted by cay, is also often found to have predictive power for stock market developments. Two of the most influential studies in this area were LETTAU and LUDVIGSON (2001) and LETTAU and LUDVIGSON (2004).

The cointegration-based approach relies on the assumption that aggregate consumption $C_t$ and aggregate wealth $W_t$ (defined as the sum of asset wealth and human capital) follow a common long-run trend. Thus, the consumption-to-wealth ratio and its log representation

$$\log\left(\frac{C_t}{W_t}\right) \equiv c_t - w_t \tag{1}$$

should be stationary. Lowercase letters denote the natural logarithms of the corresponding variable.

The theoretical foundation for this concept of a stable consumption-to-wealth ratio comes from the intertemporal budget constraint of households, which is given by

$$W_{t+1} = R_{t+1}(W_t - C_t), \tag{2}$$

where $R_{t+1}$ is the gross return on investment $W_t - C_t$. Dividing (2) by $W_t$ and loglinearzing the resulting expression yields the following approximate linear relationship:

$$c_t - w_t \approx \rho(r_{t+1} - " c_{t+1}) + \rho(c_{t+1} - w_{t+1}) + \rho k_1, \tag{3}$$

with $\rho = 1 - e^{c-w}$, where $c - w$ is the steady state level of the consumption-to-wealth-ratio; see, e.g., Campbell and Mankiw (1989). Solving (3) forward results in a forward-looking approximation of the consumption-to-wealth ratio:

$$c_t - w_t \approx E_t \sum_{j=1}^{\infty} \rho^j (r_{t+j} - \Delta c_{t+j}) + \frac{k_1 \rho}{1-\rho}, \tag{4}$$

Thus, the approximate consumption-to-wealth ratio is a function of forecasts of returns on aggregate wealth and of consumption growth. If $r_t$ and $\Delta c_t$ both follow a stationary process (so that the forecasts are also stationary), the consumption-to-wealth ratio $c_t - w_t$ will also be stationary, and consumption and aggregate wealth follow a common long-run trend.

By combining the log-linearized budget constraint with a behavioral restriction on household behavior, given, e.g., by a log-linear Euler equation of the form

$$E_t \Delta c_{t+1} = \mu + \sigma E_t r_{t+1}, \tag{5}$$

we obtain the following consumption function:

$$c_t - w_t \approx (1-\sigma) E_t \sum_{j=1}^{\infty} \rho^j r_{t+j} + \frac{(k_1 - \mu)\rho}{1-\rho}, \tag{6}$$

where $r_{t+1} \approx \log(1 + R_{t+1})$, $\sigma$ is the intertemporal elasticity of substitution and $\mu$ is a constant term.

From the rewritten approximate consumption-to-wealth ratio (6) we can see that if the income effect dominates the substitution effect ($\sigma < 1$), the consumption-to-wealth ratio falls if expected returns fall. On the other hand, if the substitution effect dominates the income effect (i.e., $\sigma > 1$ ), the consumption-to-wealth ratio increases if expected returns fall. In the special case of $\sigma = 1$, the income effect and the substitution effect offset each other, so that the consumption-to-wealth ratio is constant, independently of the expectations on returns. In the other special case, $\sigma = 0$ , we end up with the permanent income hypothesis, where consumption follows a random walk.

So far, all derivations have been in terms of total wealth $W_t$, which includes human capital. However, to derive MPCs out of asset wealth only, total wealth needs to be substituted by its two components, asset wealth $A_t$ (i.e., the sum of financial and housing wealth) and human capital wealth $H_t$. To obtain a log-linearized relationship between aggregate wealth and its two components, the wealth

decomposition equation $W_t = A_t + H_t$ is first divided by $A_t$ and then log-linearized around the long-run human capital wealth to asset wealth ratio, assuming that the ratios $A_t/W_t = \pi$ and $H_t/W_t = 1-\pi$ are constant on the balanced growth path. This yields the following approximate decomposition of total wealth:

$$w_t \approx k_2 + \pi a_t + (1-\pi)h_t, \tag{7}$$

where $k_2$ summarizes all constant terms.

Because human capital is not observable, I follow LETTAU and LUDVIGSON (2001) and approximate it with income. Combining (4) and (7), ignoring constants, the yields the following relationship among consumption, asset wealth and income:

$$c_t - \pi a_t - (1-\pi)y_t \approx E_t \sum_{j=1}^{\infty} \rho^j (r_{t+j} - \Delta c_{t+j}) + \frac{k\rho}{1-\rho} + (1-\pi)z_t. \tag{8}$$

The left hand side can be interpreted as a cointegrating residual, known as *cay*.

Because the equation above is specified in log-terms, the coefficient $\pi$ is an elasticity,

$$\frac{\Delta C_t / C_t}{\Delta A_t / A_t}$$

and is not directly the MPC out of (asset) wealth. Wealth effects in terms of MPCs are obtained through the following transformation (see, e.g., HAMBURG, HOFFMANN, and KELLER, 2008):

$$MPC = \frac{\Delta C_t}{\Delta A_t} = \pi \frac{C_t}{A_t}, \tag{9}$$

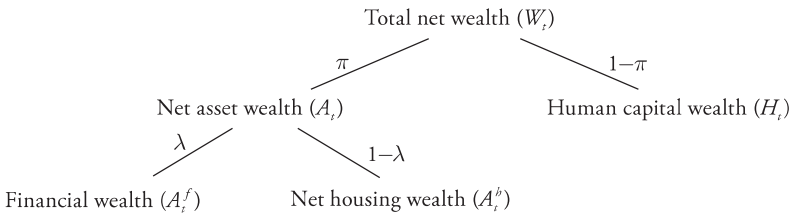
### *3.1 Separating financial and housing wealth effects*

Thus far, the cointegration framework to estimate wealth effects has been derived in terms of total asset wealth, $A_t$, which only allows one to estimate an MPC out of total asset wealth. However, we are often not only interested in the effect of changes in aggregate asset wealth on consumption but also in the separate effects of changes in financial wealth and housing wealth. The decomposition of total wealth into its components is illustrated in Figure 1. $\pi$ and $1-\pi$ represent the (steady state) shares of asset wealth $A_t$ and human capital wealth $H_t$ in total

wealth $W_t$. $\lambda$ and $1-\lambda$ represent the (steady state) shares of financial wealth $A_t^f$ and housing wealth $A_t^h$ in total asset wealth $A_t$.

Generally, both forms of asset wealth can affect consumer spending. However, the channels are somewhat different and the size of the effect can potentially differ quite a bit. Developments related to financial wealth can affect spending in several ways. A stock market rally, for example, directly results in higher equity wealth, but it can also have a positive effect on consumer confidence, which usually boosts consumption. Furthermore, most components of financial wealth (except for pension claims) are usually quite liquid and can be used for consumption more or less immediately.

**Figure1: Decomposition of Total Wealth**




The main factor driving housing wealth is typically real estate prices. However, a higher value of the owned house does not necessarily have to lead to higher consumption, because rising house prices do not necessarily create aggregate gains, since on aggregate the transaction from one household to another is a zero sum game, which makes the home-owners relatively richer and the non-home-owners relatively poorer. Based on a Yaari-Blanchard OLG model, this was also shown in Buiter (2008).

From this perspective, direct aggregate housing wealth effects seem to be limited. An exception, also brought up by Buiter (2008), is when the increase in house prices reflects a change in the speculative bubble prices component and not a change in fundamental value. In that case, there can be direct effects of changes in house prices and housing wealth on consumption.

In a mortgage market that is characterized by high down-payment requirements and little equity finance, as it is the case in Switzerland, the MPC out of housing wealth is even likely to be negative, as shown by Aron, Duca, Muellbauer, Murata, and Murphy (2011). Furthermore, when increases in (aggregate) housing wealth are not due to higher house prices but to an increase in the home owner rate, more people face amortization requirements, which

may force them to restrict their consumption expenditures, so that the debt service to income ratio rises. DREHMANN and JUSELIUS (2012) showed that "high debt service ratios prevent borrowers from smoothing consumption (…)" (p. 26).

In addition to these direct channels, there are other, indirect ways house prices and housing wealth influence spending. One is an implicit easing in credit constraints for households. Households may benefit from rising house prices through taking out new loans against the increased value of their home (home equity withdrawal). The size of this effect, however, depends strongly on credit market regulations and the home owner rate of the respective country. While it may be larger for countries with a market-based financial system (e.g., in the U.K. and the U.S.) it can be assumed to be less important for Switzerland (and other European economies).

Different channels through which changes in housing wealth, housing prices and related credit conditions can affect consumption expenditures were also extensively discussed in MUELLBAUER (2007) and ARON, MUELLBAUER, and MURPHY (2008).

Within the discussed standard cointegration framework, splitting up wealth effects while (a) continuing along the lines of the theoretical foundation from the intertemporal budget constraint and (b) being simultaneously able to estimate separate MPCs is quite difficult to achieve. To split up wealth in a way that is consistent with the theory, one could proceed similarly to the decomposition of total wealth into asset wealth and human capital wealth. A loglinear approximation of asset wealth $A_t$ around the ratio of housing wealth $A_t^h$ to financial wealth $A_t^f$ ($a_t^f$ and $a_t^h$ in log terms) yields

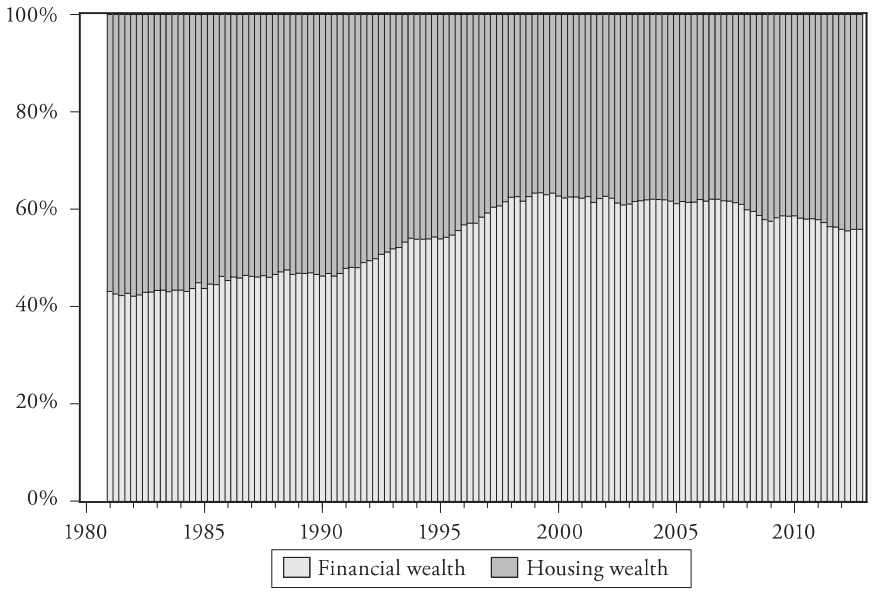
$$a_t \approx k_3 + \lambda a_t^f + (1-\lambda) a_t^h, \tag{10}$$

where $k_3$ is a constant term and $\lambda$ is the share of financial wealth out of asset wealth $A_t$. I then proceed similarly to NITSCHKA (2010)'s decomposition of financial assets into domestic and foreign stock and let $\lambda$ (an observed value) be time-varying. By substituting (10) into (8) and rearranging terms, we obtain the following relationship among consumption, financial wealth, housing wealth and income.

$$\begin{aligned} c_t - \pi a_t^h - \pi \lambda_t (a_t^f - a_t^h) - (1-\pi) y_t \\ = E_t \sum_{j=1}^{\infty} (r_{t+j} - \Delta c_{t+j}) + \frac{k\rho}{1-\rho} + (1-\pi) z_t. \end{aligned} \tag{11}$$

However, in this approach, the coefficient on housing and on financial wealth, i.e., the elasticities $\pi^f$ and $\pi^h$, must be the same, by definition. Thus, while it may conceptually be correct, it is not useful for our purpose.

**Figure 2: Decomposition of Swiss Household Wealth: Fractions of Financial and Housing Wealth**




Therefore, I use another – more empirical and ad hoc – way to estimate separate asset wealth effects and simply replace asset wealth $a_t$ in the cointegrating vector with its two components, financial wealth $a_t^f$ and housing wealth $a_t^h$. Equation (8) would then change to

$$c_t - \pi^h a_t^h - \pi^f a_t^f - (1 - \pi^h - \pi^f) y_t = E_t \sum_{j=1}^{\infty} (r_{t+j} - \text{”} c_{t+j}) + \frac{k\rho}{1-\rho} + (1-\pi) z_t, \tag{12}$$

allowing for separate coefficients on financial wealth ($\pi^f$) and housing wealth ($\pi^h$). However, this approach assumes that the shares of housing wealth and financial wealth in asset wealth are constant over time. Only if this is true will the coefficients lead to the correct MPCs out of financial wealth and housing wealth. As we see in Figure 2, this is not the case for Switzerland. While households held 43% of their asset wealth in financial assets in 1981, this fraction increased to 63% in 2000. In 2012, it stood at 56%.

## 4. Data and Stylized Facts

The data covers the period 1981Q1 to 2012Q4.[4] Data on all measures of consumption (total, non-durable, non-housing) and on the consumption deflator are obtained from the official national accounts for Switzerland, published by the federal statistical office (annual figures) and the state secretariat of economic affairs (quarterly, calendar and seasonally adjusted figures), as they were available after the conceptional revision of the national accounts (ESA2010) in autumn 2014.

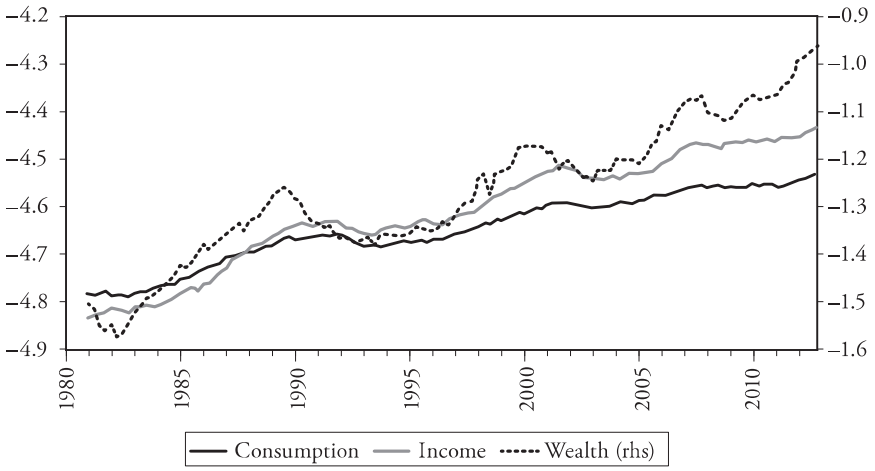
For income, the measure of disposable income (which consists of compensation of employees, net operating surplus, property income and net-transfers) is used.[5] Annual data from 1990 onward are obtained from the official national accounts. For 1981–1990, annual figures reflect SNB internal retropolations using old national accounts data. Quarterly, seasonally adjusted figures are obtained using the Chow-Lin procedure with labor income as the relevant indicator. The other components of disposable income are unfortunately not available on a quarterly basis for Switzerland.

Regarding wealth, annual financial wealth figures from 1999 onward come from the official Swiss financial accounts. For 1981–1998, the annual figures reflect SNB internal retropolations. Quarterly financial wealth figures are SNB internal calculations. Annual and quarterly housing wealth figures are based on SNB internal estimates using data on dwellings from the Federal Register of Buildings and Dwellings (RBD), published by the federal statistical office, and data on hedonic price indices (transaction prices). More details on the calculation of financial and housing wealth can be obtained from SWISS NATIONAL BANK (2012) and the working paper version of this study (GALLI, 2016a).

4 Disposable income is published with a lag of two years in Switzerland, so that the year 2013 cannot be included.

5 The preferred income measure for Switzerland, where proprietors' wealth is not included in household wealth, would be labor income plus proprietors' income minus rental income, after transfers and taxes. Conceptually, this should be roughly equal to disposable income minus rental income and distributed income. Unfortunately, necessary components of this most preferable measure are not available at all (non-rental income), or at least not for a sufficiently large time span (disposable non-property income). Therefore, the only remaining measure is disposable income. Since the ratio of non-property to total disposable income has been quite stable for the available time span (1990–2012), it should not matter whether one works with total disposable income or with disposable non-property income. See section 6.2 for a general discussion on the most appropriate income measure.

**Figure 3: Log Levels of Swiss Real Per Capita Consumption, Income and Wealth (rhs)**

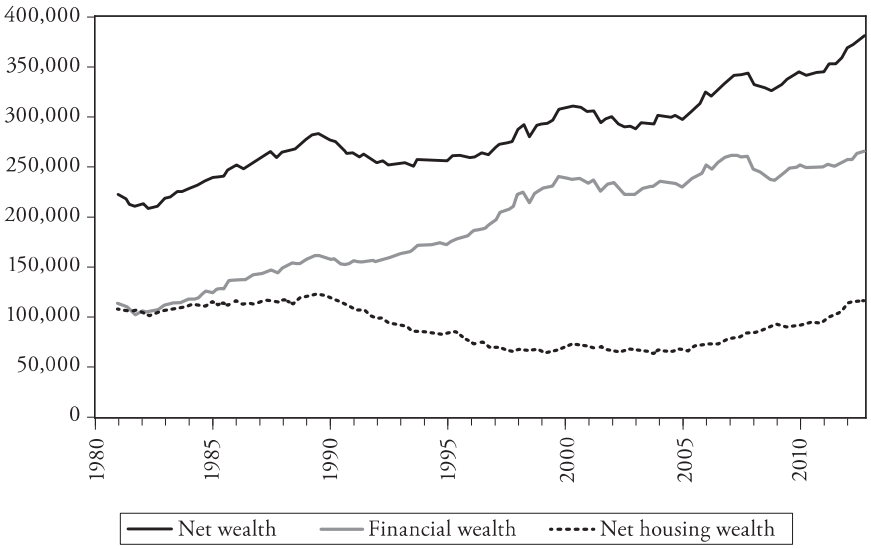



In what follows, consumption, wealth and income data are used in real per capita terms. Total wealth is defined in net terms, i.e., financial wealth plus housing wealth minus all liabilities. When working with separate wealth components (financial wealth and housing wealth), netting is performed on the housing wealth side.[6]

The log levels of consumption, income and wealth are shown in Figure 3. At first sight, there is much co-movement among consumption, wealth and income from 1981 to 2000. Apart from the general upward trend in the saving rate, indicating that income grew more strongly than consumption, increases (decreases) in wealth were usually followed by solid (subdued) consumption developments. From 2000 onward, however, the links seem to have become less clear. Consumption expenditures hardly reacted to strong increases and drops in wealth during this period. On the other hand, the relationship between income and consumption seems to have become stronger. On average, consumption grew by 0.8 %, asset wealth by 1.2 %, and income by 1.2 % per year in real per capita terms.

6 The reason for doing so is that for Switzerland, 94 % of households' liabilities consist of mortgage loans, which are usually directly linked to housing wealth.

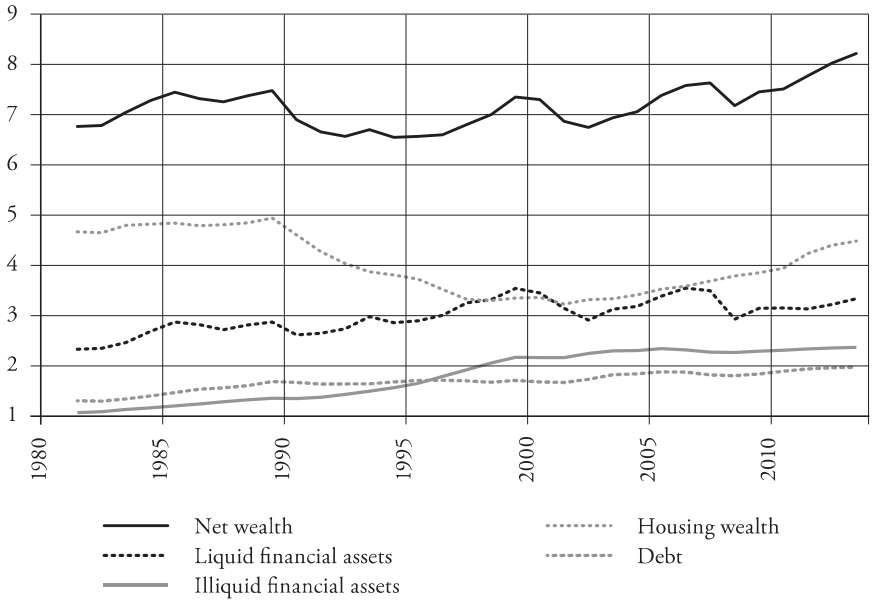
**Figure 4: Total Net Wealth, Financial Wealth and Net Housing Wealth (Real, Per Capita, in 2010 Swiss Francs)**




A decomposition of wealth into financial wealth and net housing wealth, shown in Figure 4, indicates that short-run dynamics in asset wealth are more driven by financial wealth while the long-run dynamics are more influenced by net housing wealth, which is somewhat smoother. Looking at financial wealth exclusively, the stock market is the main driver of short-run fluctuations in financial wealth. The main drivers in the long-run, however, are pension claims and deposits which are the two largest components and are much smoother.

When looking at developments in wealth relative to disposable income, Figure 5 shows that the ratio of net wealth to disposable income remained roughly stable from 1981 to 2000, fluctuating between 6.5 and 7.5. Since the beginning of the new century, however, an upward trend seems to be present. This upward trend is mainly driven by increases in housing wealth. Liquid and illiquid financial assets, on the other hand, have roughly stagnated relative to disposable income since 2000, after having trended upward previously.

**Figure 5: Components of Swiss Household Wealth Relative to Disposable Income**




*Note:* Liquid financial assets are defined as the sum of deposits, bonds and stock market shares. Illiquid financial assets equal pension wealth.

## 5. Estimation Results

### *5.1 Baseline Results for the Entire Sample*

To test for cointegration among the three variables, cointegration tests using different approaches are performed.[7] The results turn out to be mixed. While residual-based tests reject the hypothesis of no cointegration, the results from the

7 As highlighted in Ludvigson and Steindel (1999), cointegration is important because only then can OLS estimates of a cointegration vector result in parameters and, ultimately, in MPCs that are robust to the presence of regressor endogeneity which may be present in our case. The parameters on wealth and income could possibly reflect the effect of an increase in consumption on these two variables. The authors refer to this simultaneity problem as "reverse causality" (p. 35), or endogeneity bias. Thus, the cay residual is typically correlated with the regressors ($W_t$ and $Y_t$).

Johansen tests suggest that no cointegrating relationship is present.[8] For baseline estimation purposes, I continue assuming that a cointegrating relationship among consumption, wealth and income exists.

Several methods can be used to estimate a cointegrating vector. For the baseline estimation, I will focus on dynamic OLS (DOLS), as presented in STOCK and WATSON (1993), and estimate the following equation by ordinary least squares

$$c_t = \alpha + \pi^a a_t + \pi^y y_t + \sum_{k=-K}^{K} (\beta^{ka} \Delta a_{t+k} + \beta^{ky} \Delta y_{t+k}) + v_t^{DOLS}, \qquad (13)$$

where the long-run equation is augmented by K leads, K lags and the contemporaneous element of the changes in wealth and income in order to soak up short-run dynamics.

For baseline estimation purposes, I estimate the cointegrating vector using $K=4$. The baseline estimation results in the following cointegrating relationship:

$$c = \underset{}{-1.98} + \underset{(0.16)}{0.06}\, a + \underset{(0.03)}{0.56}\, y \qquad (14)$$
$$\qquad\qquad\quad (0.04)$$

HAC standard errors are shown in parentheses. With a p-value of 0.067, the coefficient on wealth is significant at the 10 %, but not the 5 % level.[9] Applying transformation (9), this results in an MPC out of asset wealth of only approximately 0.8 Swiss centime, which is significantly lower than the results in SCHMID (2013). Those suggested an estimate of $\pi$ of 0.422 over the sample period 1981 to 2009, resulting in an MPC out of asset wealth of 5.9 Swiss centime.[10] There are two reasons why the estimate has come down: First, the sample is extended by 3 years and now ends in 2012 instead of 2009. Second, there was a conceptional revision of the national accounts (ESA2010) in Switzerland/Europe in

8 Results are provided in the working paper version of this study (GALLI, 2016a).

9 It is notable that the sum of the coefficients on wealth and income are quite far from summing up to unity as should roughly be the case conventionally. A possible reason for this could be that certain consumption expenditures are not captured in the national accounts data. Another possible reason is that people leave wealth to their descendants, and thus, their lifetime consumption does not equal the sum of income and wealth.

10 The results were obtained using DOLS with $K=6$. However, reducing $K$ to 4 is not responsible for the lowering of the coefficient on wealth.

2014, which incorporated substantially revised series for consumption, disposable income and wealth.[11]

Given the baseline cointegrating vector, the estimated long-run equilibrium path of consumption compared to actual consumption and the related cointegrating residual cay are shown in Figure 6. It is obvious that most of the time, consumption fluctuated only temporarily around the equilibrium implied by the cointegrating relationship. The only period where deviations were somewhat more long lasting and larger was in the first part of 2000. From 2000 to 2002, wealth decreased significantly due to the dot-com stock market crash. Disposable income also dropped. Consumption, however, reacted only modestly and overshot relative to its equilibrium level. Driven by the looser monetary policy in the U.S., the stock markets and wealth started to pick up again, and disposable income grew very robustly, while consumption more or less continued growing at around average rates. Eventually, consumption was back at its equilibrium level in 2006.

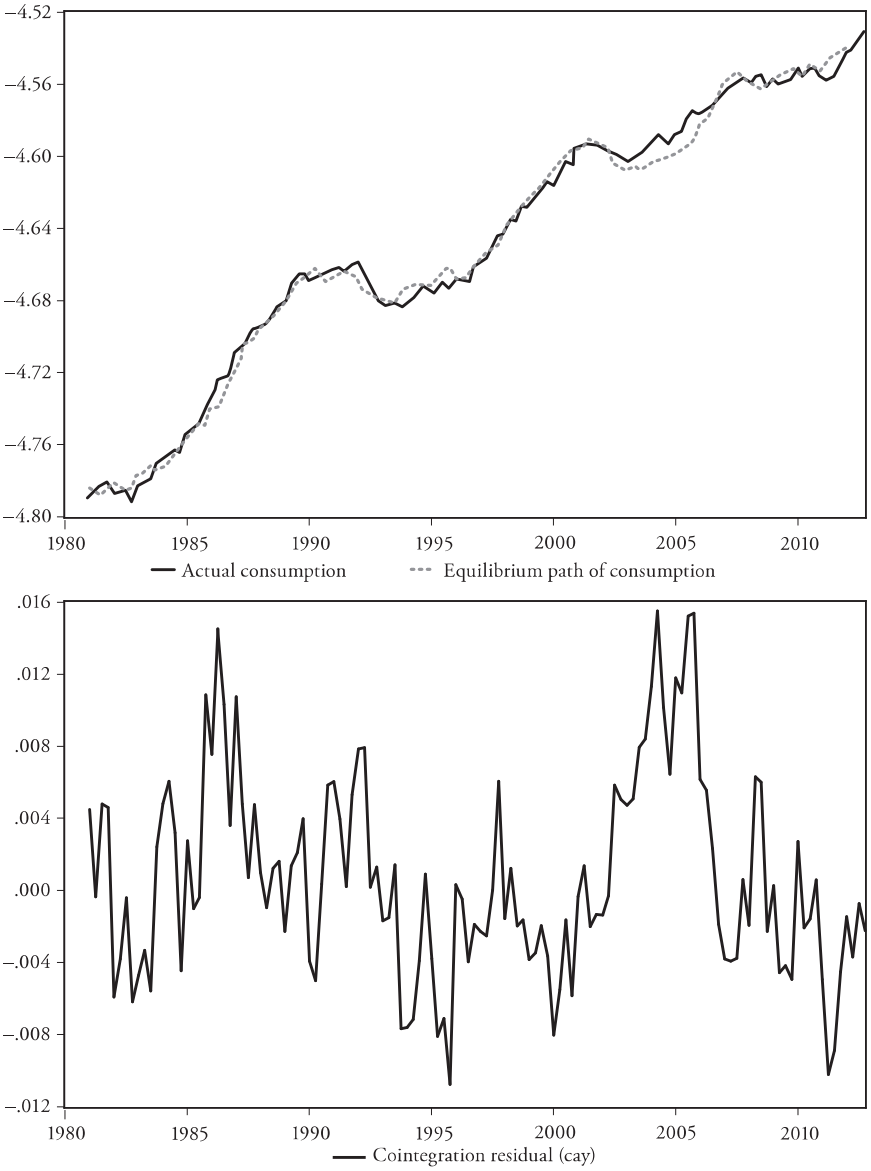
However, because the cointegrating coefficient on wealth is fairly low in the baseline case, indicating that consumption hardly reacted to wealth changes over the estimation period, the cay residual mainly reflects developments in income and consumption, but not wealth.

The outcome of wealth effects on consumption being hardly present could be due to the developments in the 2000s, where Swiss private consumption hardly reacted to major changes in wealth. One reason for this lack of response in consumption could be that in this period, developments in the stock markets and wealth were mainly caused by external and not domestic events. In contrast, the wealth decrease in the early 1990s, to which consumption showed some response, was driven by the domestic housing crash. The influence of the 2000s on the results will be discussed in section 5.2.

To check if the finding of hardly any wealth effects is sensitive to the econometric technique that was used, I re-estimate the cointegration vector using alternative specifications and cointegration methods. As a first alternative, I use (a) Full information Maximum Likelihood (FIML) from Johansen (1988) and estimate a vector error-correction model (VECM) among consumption, income and wealth by maximum likelihood. Furthermore, to test the robustness of the DOLS results to the choice of the number of leads and lags, $K$, I apply DOLS with (b) one and (c) eight leads and lags instead of four in the baseline case. Finally, I also use (d) the Phillips-Loretan method (PL) from Phillips and Loretan (1991), where the dynamic OLS equation is augmented by lags of the

11 Such a conceptional revision of national accounts occurs roughly every 15 years.

**Figure 6: Equilibrium Consumption and Cay Residual from the Baseline Estimation**




*Note:* The top panel shows the actual level of consumption (solid line) and the cointegration-implied equilibrium level of consumption (dashed line) implied by the baseline cointegrating vector, both in real per capita terms. The bottom panel shows the corresponsive cointegrating residual, *cay*.

**Table 1: Estimation of the Cointegrating Vector: Different Methods**

| | FIML | DOLS(1) | DOLS(4) | DOLS(8) | PL |
|---|---|---|---|---|---|
| Wealth | –0.07 | 0.08 | 0.06 | 0.09 | 0.07 |
| | (0.06) | (0.03) | (0.03) | (0.05) | (0.04) |
| Income | 0.73 | 0.54 | 0.56 | 0.53 | 0.55 |
| | (0.08) | (0.04) | (0.04) | (0.06) | (0.06) |
| Intercept | –1.34 | –2.05 | –1.98 | –2.08 | –2.04 |
| | | (0.13) | (0.16) | (0.20) | (0.20) |

*Notes:* Standard errors in parentheses; HAC standard errors used for DOLS.

cointegrating residual and estimated by non-linear least squares. As shown in Phillips and Loretan (1991), this results in more-precise coefficient estimates and better t-ratios in small samples.[12]

The estimation results using the different estimation techniques are shown in Table 1. Overall, the results for the cointegration vector across different estimation techniques do not differ substantially.[13] FIML shifts the coefficients slightly from wealth toward income. All results have in common that wealth effects hardly seem to be present because the coefficients on wealth are either comparatively small or not significant.

In a next step, short-run dynamics are estimated to answer the question of which variables respond to a deviation of the cay residual from its equilibrium. For this purpose, a VAR(2) of the form

$$\begin{bmatrix}\Delta c_t\\ \Delta a_t\\ \Delta y_t\end{bmatrix} = \begin{bmatrix}\mu^c\\ \mu^a\\ \mu^y\end{bmatrix} + \mathbf{B}(L)\begin{bmatrix}\Delta c_t\\ \Delta a_t\\ \Delta y_t\end{bmatrix} + \begin{bmatrix}\gamma^c\\ \gamma^a\\ \gamma^y\end{bmatrix} cay_{t-1} + v_t \tag{15}$$

is run with $L=2$.[14] $\mathbf{B}(L)$ is a matrix polynomial that represents short-run comovement of the variables (common cycles). $[\mu^c\ \mu^a\ \mu^y]'$ are constant terms. The

12 A more detailed presentation on the different alternative approaches and the econometric implementation is provided in the working paper version of this study (Galli, 2016a).

13 The same applies to the results for the short-run reponses. These are not shown here, but provided in the working paper version of this study (Galli, 2016a).

14 To select VAR order, I estimate VARs of different lag lengths and then select the model with the smallest AIC. In this case, the best model is that with a lag length of 1. However, because the residuals of this model still show patterns of autocorrelation, I decide to add a second lag and work with a VAR(2).

responses of consumption, wealth and income to the cay residual are then given by the coefficient vector $[\gamma^c \; \gamma^a \; \gamma^y]'$. The cay residual is computed according to the baseline cointegrating vector.

For the baseline case, the results in Table 2 suggest that it is solely income that drives the cay residual back to its equilibrium. In forecasting terms, this would mean that the cay residual potentially has predictive power for future income growth.

**Table 2: Short-Run Responses to *cay* Residual from VAR(2)**

| | $\Delta c_t$ | $\Delta a_t$ | $\Delta y_t$ |
|---|---|---|---|
| $\Delta c_{t-1}$ | –0.054 | 0.543 | 0.078 |
| | (0.099) | (0.437) | (0.128) |
| $\Delta c_{t-2}$ | 0.036 | 0.279 | 0.328 |
| | (0.088) | (0.390) | (0.114) |
| $\Delta a_{t-1}$ | 0.025 | 0.032 | 0.070 |
| | (0.021) | (0.094) | (0.027) |
| $\Delta a_{t-2}$ | 0.061 | 0.018 | 0.042 |
| | (0.022) | (0.095) | (0.028) |
| $\Delta y_{t-1}$ | 0.222 | 0.261 | 0.188 |
| | (0.067) | (0.298) | (0.087) |
| $\Delta y_{t-2}$ | 0.052 | –0.214 | 0.120 |
| | (0.069) | (0.305) | (0.089) |
| $cay_{t-1}$ | –0.096 | 0.088 | 0.218 |
| | (0.062) | (0.272) | (0.080) |
| constant | 0.001 | 0.003 | 0.001 |
| | (0.000) | (0.002) | (0.000) |
| $R^2$ | 0.30 | 0.05 | 0.37 |

*Note:* Standard errors in parentheses.

### *5.2 A Break in the Cointegration Relationship*

Apart from the econometric technique, the estimation sample can also have a potentially large impact on the estimation results. In our case, e.g., as seen in section 4, the link among consumption and wealth seems to be much looser from 2000 on than in the period before. This could make the estimation results of the cointegrating vector very unstable. To test the influence of the more recent

period on the overall results, I formally specify the potential break point first, following the procedure Kurozumi (2002) and Bai (1994), using the residuals of the DOLS equation. Depending on the number of leads and lags in the DOLS specification, the break point test indicates that the potential break point in the cointegrating vector lies around 2002/3.[15]

To account for the potential break around 2002/3, the sample is split into two parts, and all cointegration tests and calculations are redone separately for 1981Q1 to 2001Q4 and for 2002Q1 to 2012Q4. The cointegration tests for these two separate time spans, shown in Table 3, suggest that the cointegrating relationship among consumption, wealth and income was quite stable over the first part of the sample. Only the L-max test of the Johansen procedure is found not to reject the null hypothesis of no cointegration, but this could also be due to a small sample problem, as Zhou (2000) showed that the Johansen cointegration test rejects the null hypothesis of no cointegration too often in small samples. Things change for the second part of the sample, where no cointegration test is able to reject the null of no cointegration at any common significance levels.

**Table 3: Cointegration Tests, p-Values**

| | 1981Q1–2001Q4 | 2002Q1–2012Q4 |
|---|---|---|
| Engle-Granger (t-stat) | 0.0011 | 0.1270 |
| Engle-Granger (z-stat) | 0.0007 | 0.1502 |
| Phillips-Ouliaris (t-stat) | 0.0009 | 0.1047 |
| Phillips-Ouliaris (z-stat) | 0.0005 | 0.1192 |
| Johansen (2 lags, trace) | 0.0323 | 0.1304 |
| Johansen (2 lags,L-max) | 0.1927 | 0.1110 |

*Notes:* Automatic SIC lag length selection for Engle-Granger; Automatic SIC lag length selection for Oullips-Ouliaris.

15 It has to be noted that by applying this break point estimation setup, I explicitly assume the existence of only one break point. However, there could be even more break points, causing the estimation of the cointegrating vector to be even more difficult. To test for the existence of multiple break points, one could apply the dynamic optimization algorithm in Bai and Perron (1998, 2003). Furthermore, a specific test for the existence of a cointegrating relationship in the presence of a structural break can be found in Carrion-I-Silvestre and Sanso (2006). It was applied, e.g., in Haug, Beyer, and Dewald (2011) to the Fisher effect. However, given the limited number of observations for the time span after our estimated break point, applying this test makes no sense in our case.

The results for the estimated cointegrating vector across the different time periods (under the assumption that cointegration is present over all time spans) are shown in Table 4. For the first part of the sample, 1981–2001, the estimates are comparatively stable, although some differences across methods are already visible. The results are also in line with those for other countries: wealth effects are present, and the coefficient on wealth is between 0.14 and 0.34, while that on income is between 0.27 and 0.47, depending on the method. Applying transformation (9), the corresponding MPC out of asset wealth is then between 2.0 and 4.8 Swiss centime.

**Table 4: Estimation of the Cointegrating Vector: Different Time Spans**

| | | FIML | DOLS(1) | DOLS(4) | DOLS(8) | PL |
|---|---|---|---|---|---|---|
| 1981Q1–2001Q4 | Wealth | 0.26 | 0.14 | 0.17 | 0.34 | 0.14 |
| | | (0.05) | (0.02) | (0.04) | (0.04) | (0.06) |
| | Income | 0.34 | 0.47 | 0.44 | 0.27 | 0.46 |
| | | (0.05) | (0.02) | (0.04) | (0.04) | (0.06) |
| | Intercept | –2.74 | –2.32 | –2.41 | –2.94 | –2.33 |
| | | | (0.09) | (0.14) | (0.14) | (0.19) |
| 2002Q1–2012Q4 | Wealth | –0.04 | 0.13 | 0.03 | 0.04 | 0.08 |
| | | (0.06) | (0.03) | (0.07) | (0.27) | (0.12) |
| | Income | 0.63 | 0.27 | 0.50 | 0.48 | 0.39 |
| | | (0.13) | (0.06) | (0.15) | (0.50) | (0.25) |
| | Intercept | –1.78 | –3.19 | –2.30 | –2.40 | –2.71 |
| | | | (0.26) | (0.58) | (1.94) | (0.99) |

*Notes:* Standard errors in parentheses; HAC standard errors used for DOLS.

For the second part of the sample, 2002–2012, the estimates are quite different from those for the first part of the sample and the results diverge more substantially across the different estimation methods. Except for DOLS(1), the coefficient on wealth is not significantly different from zero for any of the common significance levels for any method. The coefficient on income has increased for FIML, DOLS(4) and DOLS(8) but has decreased for DOLS(1) and PL. For DOLS(8) and the PL method, neither the coefficient on wealth nor the coefficient on income is significant, which may be related to small sample issues. Overall, because the cointegration tests indicate that for the second part of the sample the cointegrating relationship among consumption, wealth and income has vanished, these results may not be surprising, and they indicate that the results for the entire sample are largely driven by the second part of the sample.

Regarding differences in the short-run responses between the two time spans, the results in Table 5 suggest that in the first part of the sample, 1981 to 2001, it was solely consumption that responded to disequilibria in the cointegration relationship. Therefore, the cay residual had predictive power for future consumption growth. This is in contrast to the results from for other countries, were it was usually wealth, or sometimes income, that responded to deviations in the cay residual. Furthermore, this also contradicts the existing results for Switzerland in Schmid (2013), where it was mainly wealth that showed responsiveness. For the more recent period, however, all estimation methods suggest that it is solely income that responds to deviations from equilibrium. This is also the case when estimating over the entire sample. In forecasting terms, this would mean that the cay residual potentially has predictive power for future income growth.[16]

**Table 5: Short-Run Dynamics: Response to Disequilibrium from VAR(2)**

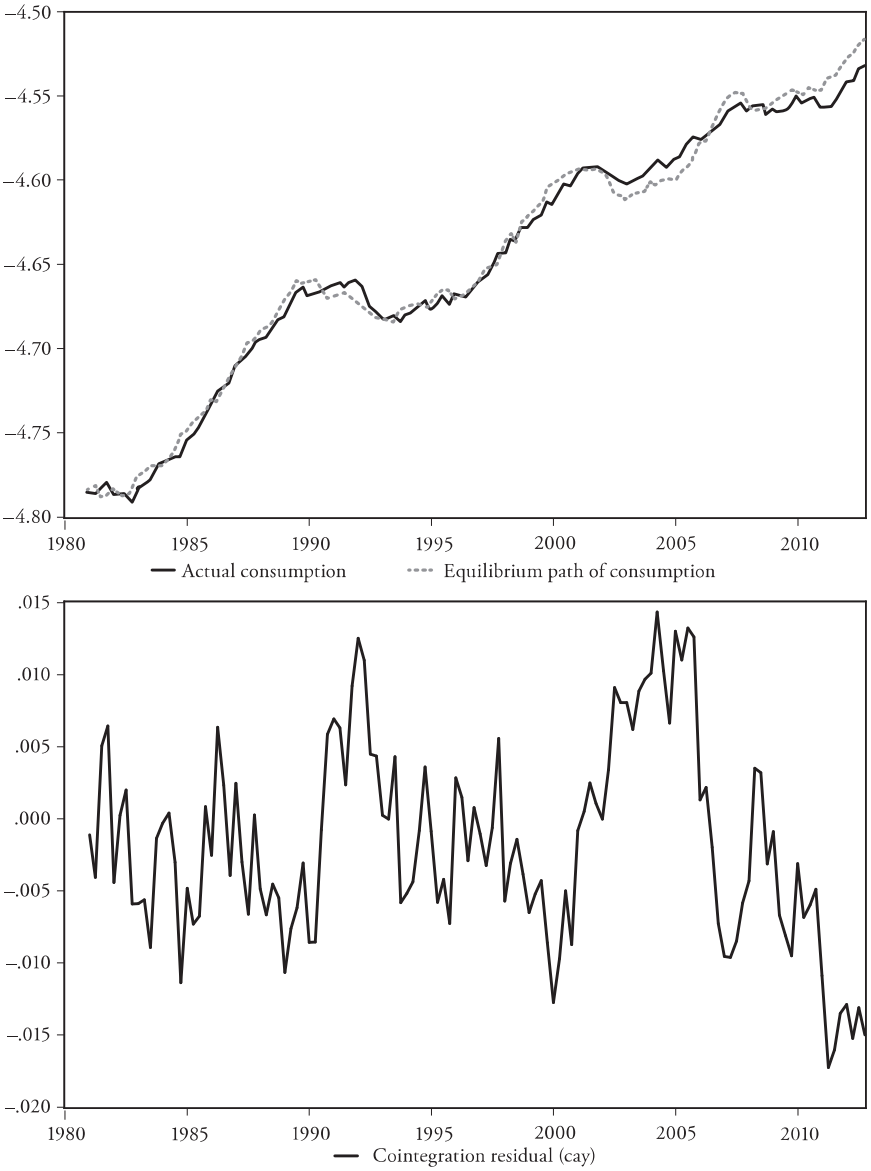
| | | FIML | DOLS(1) | DOLS(4) | DOLS(8) | PL |
|---|---|---|---|---|---|---|
| 1981Q1–2001Q4 | Consumption | –0.273 | –0.339 | –0.350 | –0.158 | –0.343 |
| | | (0.074) | (0.108) | (0.102) | (0.052) | (0.107) |
| | Wealth | 0.294 | –0.015 | 0.174 | 0.347 | 0.005 |
| | | (0.357) | (0.509) | (0.484) | (0.242) | (0.507) |
| | Income | –0.031 | 0.236 | 0.154 | –0.061 | 0.227 |
| | | (0.109) | (0.152) | (0.146) | (0.074) | (0.152) |
| 2002Q1–2012Q4 | Consumption | –0.102 | –0.295 | –0.178 | –0.189 | –0.239 |
| | | (0.137) | (0.156) | (0.151) | (0.152) | (0.156) |
| | Wealth | 0.010 | 0.130 | 0.070 | 0.084 | 0.112 |
| | | (0.573) | (0.681) | (0.641) | (0.644) | (0.671) |
| | Income | 0.590 | 0.519 | 0.627 | 0.614 | 0.598 |
| | | (0.145) | (0.190) | (0.166) | (0.169) | (0.180) |

*Notes:* Reported are the VAR coefficients on the lagged cointegration residual, standard errors in parentheses.

One could hypothetically argue that both the failure of the cointegration approaches to find a stable cointegrating relationship in the second part of the sample and the nonresponse of consumption to changes in wealth in the 2000s are merely due to longer-lasting deviations of the cointegration residual from

16 However, because for this period the cointegration coefficient on wealth is very close to zero, it is basically only the bivariate relationship between consumption and income alone that is responsible for this predictive power for future income growth.

**Figure 7: The Cay Residual Based on the 1981–2001 Cointegrating Vector**




*Note:* Shown is the cointegration residual based on the cointegrating vector resulting from a DOLS(4) estimation over the time span 1981Q1 to 2001Q4.

its equilibrium, so that the stable estimates for 1981–2001 would still apply to the time after. Under this assumption, the equilibrium level of consumption compared to its actual level and the related cay residual would look as shown in Figure 7.

These charts illustrate the differences between the 1981–2000 period and the remaining part nicely. In the first 20 years of the sample, consumption deviated only temporarily from its equilibrium level, so that the cay residual usually reverted quite quickly to zero. After 2000, however, deviations in the cay residual from its equilibrium level would have become much more persistent and much larger. Furthermore, in the most recent period, the cay residual would have fallen to a record low, indicating that the level of consumption is much too low relative to the level of wealth and income. Thus, to restore equilibrium, a huge drop of approximately 10 % in per capita wealth or many years of very strong per capita consumption growth would be necessary. However, all of this only applies if wealth effects are still present in the same way as they were until 2001.

### *5.3 Results for Separate Financial and Housing Wealth Wealth Effects*

To investigate a possible difference in the effects from the two wealth components on consumption, I split wealth into financial wealth, $a^f$, and net housing wealth, $a^h$. Thus, motivated by equation (12), the DOLS estimation equation changes to

$$\begin{aligned} c_t = {} & \alpha + \pi^{a^f} a_t^f + \pi^{a^h} a_t^h + \pi^y y_t \\ & + \sum_{k=-K}^{K} \left[ \beta^{ka^f} \Delta a_{t+k}^f + \beta^{ka^h} \Delta a_{t+k}^h + \beta^{ky} \Delta y_{t+k} \right] + v_t^{DOLS}, \end{aligned} \tag{16}$$

where the long-run equation is augmented by K leads, K lags and the contemporaneous element of the changes in financial wealth, housing wealth and income in order to soak up short-run dynamics.

For the entire sample, 1981–2012, using DOLS(4) estiamtes, this results in the following estimates:

$$c = \underset{(0.03)}{-2.11} - \underset{(0.07)}{0.03}\, a^f + \underset{(0.02)}{0.00}\, a^h + \underset{(0.15)}{0.70}\, y \tag{17}$$

Compared to the results for aggregate wealth, wealth effects have now disappeared completely at all common significance levels.

Looking at the short-run responses, only income responds to a disequilibrium in the cointegrating relationship, as was already the case in the estimations based on aggregated wealth.[17]

Across different estimation techniques, the results for separate wealth effects are very mixed and sometimes difficult to interpret, as the first row of Table 6 shows. Wealth effects either do not seem to be present (DOLS(1), DOLS(4)) or to be even negative (FIML and DOLS(8)). PL results in non-significant results. One reason for the lowering in goodness of the results when splitting wealth into its two components could be that we need a constant ratio of financial wealth to housing wealth over time to adequately estimate separate wealth effects within this setup. However, as discussed in section 3, this is not the case for Switzerland. While households held 43 % of their asset side in financial assets in 1981, this fraction increased to 63 % in 2000. In 2012, it stood at 56 %.

When looking only at the sample before the break, 1981–2001, shown in the second row of Table 6, DOLS(1) and DOLS(4) indicate cointegration coefficients on financial wealth that are roughly double the size as that on housing wealth. However, because the consumption-to-financial wealth ratio is only approximately half of the consumption-to-housing wealth ratio over that time period, the resulting MPCs out of the two wealth components would be roughly the same: approximately two Swiss centime each. Looking at other methods, DOLS(8) sees much higher wealth effects, which mostly come from the financial wealth side. The same finding was already present for aggregate asset wealth. However, given that this method attributes a negative MPC to income, the results are dubious. The caveat in terms of reliability of the result applies to FIML (very negative wealth effects) and the PL method (no significant results at all).

For the more recent half of the sample (third row of Table 6), the results have to be treated with caution given the limited number of observations and the increased number of coefficients to be estimated, but they generally confirm the findings for the aggregate case: wealth effects no longer seem to be present.

As a last step, I also look at the short-run responses when using separate wealth measures, although I take into account the limited information content of the results due to the problems related to the estimation of the cointegrating vector when splitting up wealth. Overall, however, the results are very similar to the aggregate wealth case[18]. For the full sample, all methods attribute error-correction properties to income. Furthermore, DOLS(8) suggests that housing wealth

17 Detailed results are provided in the working paper version of this study (Galli, 2016a).
18 Detailed results are provided in the working paper version of this study (Galli, 2016a).

**Table 6: Estimation of the Cointegrating Vector: Separate Wealth**

| | | FIML | DOLS(1) | DOLS(4) | DOLS(8) | PL |
|---|---|---|---|---|---|---|
| 1981Q1–2012Q4 | Financial wealth | –0.87 | 0.05 | –0.03 | –0.18 | 0.07 |
| | | (0.17) | (0.03) | (0.07) | (0.07) | (0.13) |
| | Housing wealth | –0.22 | 0.02 | 0.00 | –0.05 | 0.02 |
| | | (0.05) | (0.01) | (0.02) | (0.02) | (0.04) |
| | Income | 2.57 | 0.52 | 0.70 | 0.99 | 0.47 |
| | | (0.36) | (0.07) | (0.15) | (0.14) | (0.29) |
| | Intercept | 5.23 | –2.11 | –1.49 | –0.54 | –2.31 |
| | | | (0.26) | (0.51) | (0.49) | (1.04) |
| 1981Q1–2001Q4 | Financial wealth | –2.13 | 0.09 | 0.14 | 0.43 | 0.09 |
| | | (0.46) | (0.03) | (0.05) | (0.18) | (0.12) |
| | Housing wealth | –0.52 | 0.05 | 0.06 | 0.14 | 0.04 |
| | | (0.16) | (0.01) | (0.02) | (0.06) | (0.04) |
| | Income | 5.47 | 0.44 | 0.35 | –0.34 | 0.43 |
| | | (1.01) | (0.06) | (0.12) | (0.38) | (0.27) |
| | Intercept | 15.76 | –2.33 | –2.69 | –5.15 | –2.44 |
| | | | (0.23) | (0.42) | (1.33) | (0.97) |
| 2002Q1–2012Q4 | Financial wealth | –1.34 | 0.11 | –0.01 | | 0.02 |
| | | (0.34) | (0.04) | (0.10) | | (0.15) |
| | Housing wealth | 0.08 | 0.04 | 0.05 | | 0.05 |
| | | (0.13) | (0.01) | (0.03) | | (0.03) |
| | Income | 1.09 | 0.24 | 0.36 | | 0.34 |
| | | (0.85) | (0.08) | (0.13) | | (0.21) |
| | Intercept | –1.35 | –3.23 | –2.84 | | –2.89 |
| | | | (0.30) | (0.53) | | (0.78) |

*Notes:* Standard errors in parentheses; HAC standard errors used for DOLS.

also drives the cay residual back into equilibrium. FIML, on the other hand, indicates that consumption also responds to disequilibria, although with an incorrect, i.e., negative, sign. This would mean that a negative residual (where consumption is too low given the level of the other relevant cointegration variables) would lead to a deceleration in consumption growth, so that the residual becomes even more negative.

For the more stable period 1981–2001, all methods except FIML indicate that consumption alone reacted to deviations in the cay residual from its equilibrium and showed error-correction properties. For the more recent period, most of the methods see income as the variable that responds to deviations in the cay residual.

## 6. Fragility Issues of the Cointegration Approach

The results of the robustness checks in the previous section confirm that while the cointegrating relationship among consumption, wealth and income was quite stable in the first part of the sample, 1981–2001, it became quite weak and unstable in the 2000s. This could be due to either a breakdown in the cointegrating relationship or to changes in the cointegrating vector. Overall, this makes a potential cointegrating vector and the responses to a disequilibrium much more difficult to estimate.

What can cause such instabilities in the theory-based cointegrating relationship among consumption, wealth and income? To find (theoretical, empirical and econometrical) answers to this question, we should revisit the motivation of the cointegrating relationship among consumption, wealth and income. As emphasized before, the theoretical foundation of the existence of a stable cointegrating relationship – which is key for the econometric framework used so far – largely depends on the variables of equation (4) and their time-series properties.

### *6.1 Stationarity Assumptions and Heterogeneity Aspects*

Focusing on theoretical stability first, a major fragility issue concerns the *stationarity assumptions*. A theoretically stable relationship between consumption and wealth relies strongly on the stationarity assumptions on the two variables of the right hand side of equation (4), the return on aggregate wealth and consumption growth, and, in particular, the expectations regarding them. Expectations on returns are especially key in the theoretical framework. Under a standard behavioral restriction on household behavior, the stationarity of the cay residual solely depends on the stationarity of expectations on future returns on aggregate wealth.

In general, these returns can be decomposed into its two components, returns on asset wealth and returns on human capital wealth. A log linearized relationship is obtained following CAMPBELL (1996):

$$r_t \approx \pi r_{a,t} + (1-\pi) r_{h,t}, \tag{18}$$

where $r_a$ is the log aggregate return on assets and $r_h$ is the log return on human capital.

For the cointegration framework to hold both returns on asset wealth and on human capital wealth (and thus, the expectations on both of them) must be individually stationary. In what follows, I focus on the stationarity of returns on

asset wealth.[19] These consist of many different types of returns, such as interest rates, capital gains, pension return schemes or returns from housing investment. The question of a permanent lowering in returns of some investment types is currently a much-debated issue.

Real, i.e. inflation-adjusted, interest rates have been trending downwards in many countries over the last decade(s), including Switzerland.[20] Real stock market returns were also somewhat lower on average after 2000 than in the period before for most countries. Furthermore, in an environment where a permanent lowering in growth expectations is discussed, expectations on stock market returns could also be expected to be permanently lower. Together with demographic changes, these developments also affect returns on another wealth component negatively: pension schemes.

Returns on real estate assets are more difficult to assets. On the one hand, gross initial rates of return on real estate investments have fallen since 2000 in Switzerland, roughly parallel to long-term interest rates. On the other hand, the increase in housing prices since the mid-2000s has led to increased performance of real estate funds and real estate property that is held for speculation reasons. Because of these opposing effects and the lack of availability of relevant data, the overall development in returns on real estate assets remains unclear.[21]

Overall, a decrease of returns (either permanent or at least temporarily since 2000) does not seem implausible, especially for returns on financial assets. In that case, the stationary implication for the cay residual would no longer hold.[22]. Furthermore, even if assuming net real estate returns have risen and household would therefore try to shift their portfolio towards real estate assets, this would, in the aggregate, not fully offset lower returns on financial assets in the aggregate,

19 For a more extensive discussion on the stationarity of the different return categories, see the working paper version of this study (Galli, 2016a).

20 See the IMF World Economic Outlook (April 2014).

21 A possibility would be to look at the user cost of capital (UCC) related to investing in housing. However, the link between the UCC, which is mostly driven by developments in interest rates and house prices) and the actual returns seems to be rather weak in Switzerland. In theory, one would expect returns, i.e., rents, to decrease (increase) in periods where UCC is low (high) due to arbitrage pressure coming from cheaper homeownership. Empirically, however, opposite patterns are present in Switzerland. Browne, Conefrey, and Kennedy (2013) found similar results for Ireland.

22 To investigate the effect of developments in interest rates on the cointegrating vector, I tried to include interest rates as a control variable in the cointegrating vector. However, even in this case there appears to be no stable cointegration among consumption, wealth and income for the post-2002 period.

given the credit constraints that some households face. In addition, such an asset portfolio reallocation would lead to changes in the aggregate MPC out of asset wealth, which results in an unstable cointegrating vector. This will be discussed in section 6.3.

Apart from stationarity, a second fragility issue in terms of theoretical stability concerns *possible heterogeneity across households*, i.e., the question of the aggregate versus the individual perspective. The intertemporal budget constraint, the main relationship on which the motivation of a stable consumption-to-wealth ratio is based, may hold for each individual household, so that a stable consumption-to-wealth ratio per household may arise cross-sectionally and maybe even over time. Changes in the distribution of households, however, may lead to an aggregate consumption-to-wealth ratio that is unstable over time. The fact that individual and aggregate measures can evolve differently is also found in saving rate dynamics (although in the opposite way) as shown in ROMER (2005). HAHN and LEE (2006) pointed out that changes in the degree of heterogeneity of households over time can lead to a deterministic trend in the aggregate consumption-to-wealth ratio and, thus, in the cay residual. The fact that a representative agent may behave differently than the median household was also brought up in CARROLL (2000).

### *6.2 Empirical Problems*

Even when maintaining the theoretical concept of a stable consumption-wealth ratio over time, issues arise when it comes to empirics. For consumption, asset wealth and income, it is important to use an "accurate", i.e., intertemporal budget constraint-relevant, measure of the respective variables.

In terms of consumption, many possible measures have been used in the literature so far, such as total consumption, non-durable consumption and services or consumption excluding housing. Depending on the choice of consumption measure, the conclusions regarding a stable consumption-wealth ratio can be rather different. RUDD and WHELAN (2006), e.g., criticized Ludvigson and Lettau for working with non-durable consumption instead of total consumption, and they showed that when using total consumption, no cointegrating relationship among consumption, labor income and wealth is present in U.S. data.

Regarding wealth, the main questions are: Must human-capital wealth, i.e., its proxy income, be included? Is the return on housing wealth irrelevant, and if so, should housing wealth be excluded? What about the stock of non-durable consumption goods such as cars and other investment goods, which are usually very difficult to measure?

Finding a correct definition of income, the proxy of human-capital wealth, is even more difficult. There are several possible measures, such as disposable income, disposable non-property income, (after-tax) labor income, or the sum of after-tax labor and proprietors' income[23]. There are also constructed measures, which do not directly appear in the official national accounts, such as the Blinder-Deaton measure presented in Blinder and Deaton (1985). An important point regarding the choice of income measure is whether it should or should not include proprietors' income, as the latter may also proxy part of human-capital wealth (except for countries where proprietors' income is included in the asset wealth of households). This would imply that labor income alone is a too narrow approximation of human capital wealth, so that disposable income would be a more preferable income measure. However, disposable income also includes rental income and distributed income (often also called property income), which both actually represent returns to asset wealth, so that they are unrelated to human-capital wealth.

Working with an inappropriate measure for only one of the variables can lead to a consumption-to-wealth ratio that is empirically unstable and thus makes the econometric framework no longer feasible.

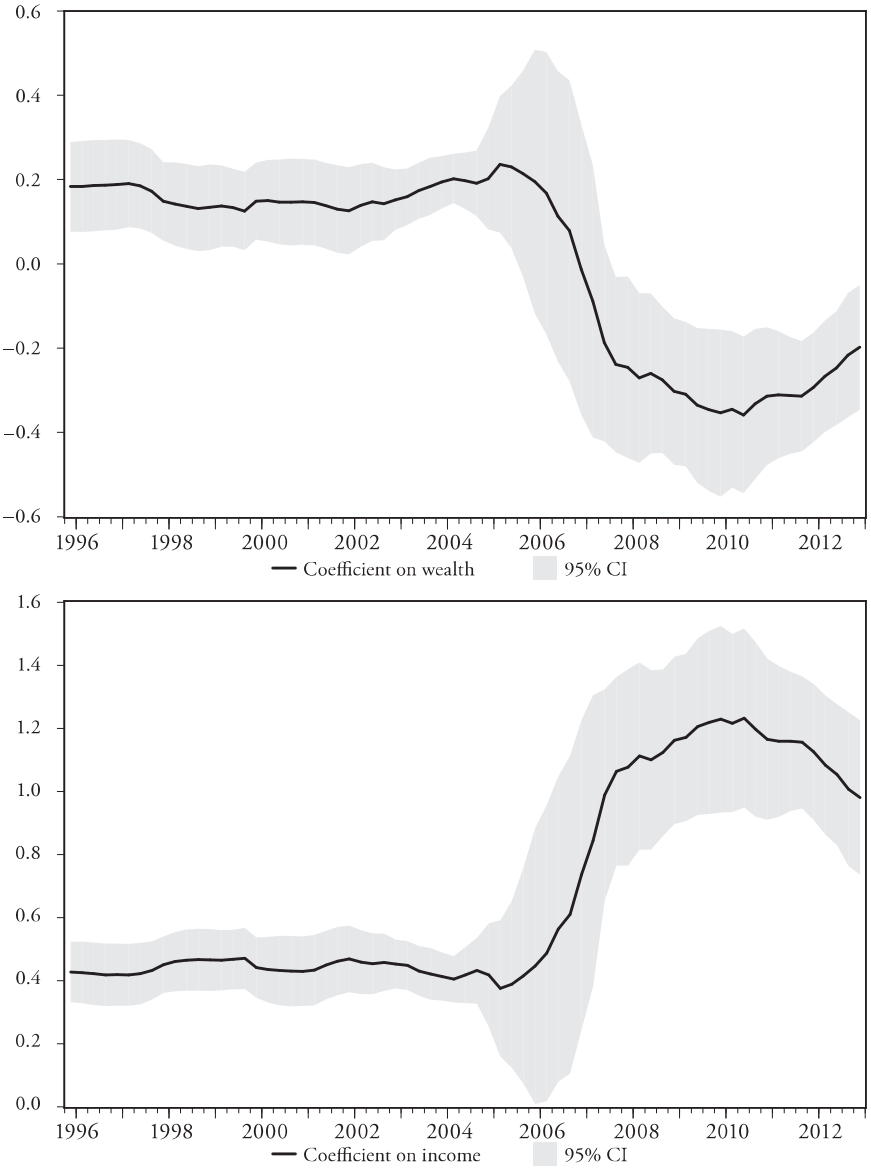
### *6.3 Estimation Issues – Changes in the Aggregate MPCs over Time*

Apart from the general cointegration issue of sample length limitations, a much more specific estimation issue that arises when trying to pin down cointegration-based wealth effects is related to potential changes in the (aggregate) marginal propensities to consume over time. A cointegrating relationship among consumption, wealth and income may exist, but the cointegrating vector, i.e., the MPCs, can change over time. Within the context of wealth effects, Hahn and Lee (2001), e.g., found substantial changes in the cointegrating vector over time when estimating the relationship among consumption, wealth and income for the case of the U.S.

Performing a similar exercise for Switzerland, using DOLS(4) estimates, we obtain the rolling and recursive estimates of the cointegration coefficients on wealth (top panel) and income (bottom panel) shown in Figures 8 and 9, respectively. We can see that after being very stable for a long time, the coefficient on wealth started to decrease around 2005, where one-third of the window consisted of observations of the 2000s. The decrease continued until 2010, before

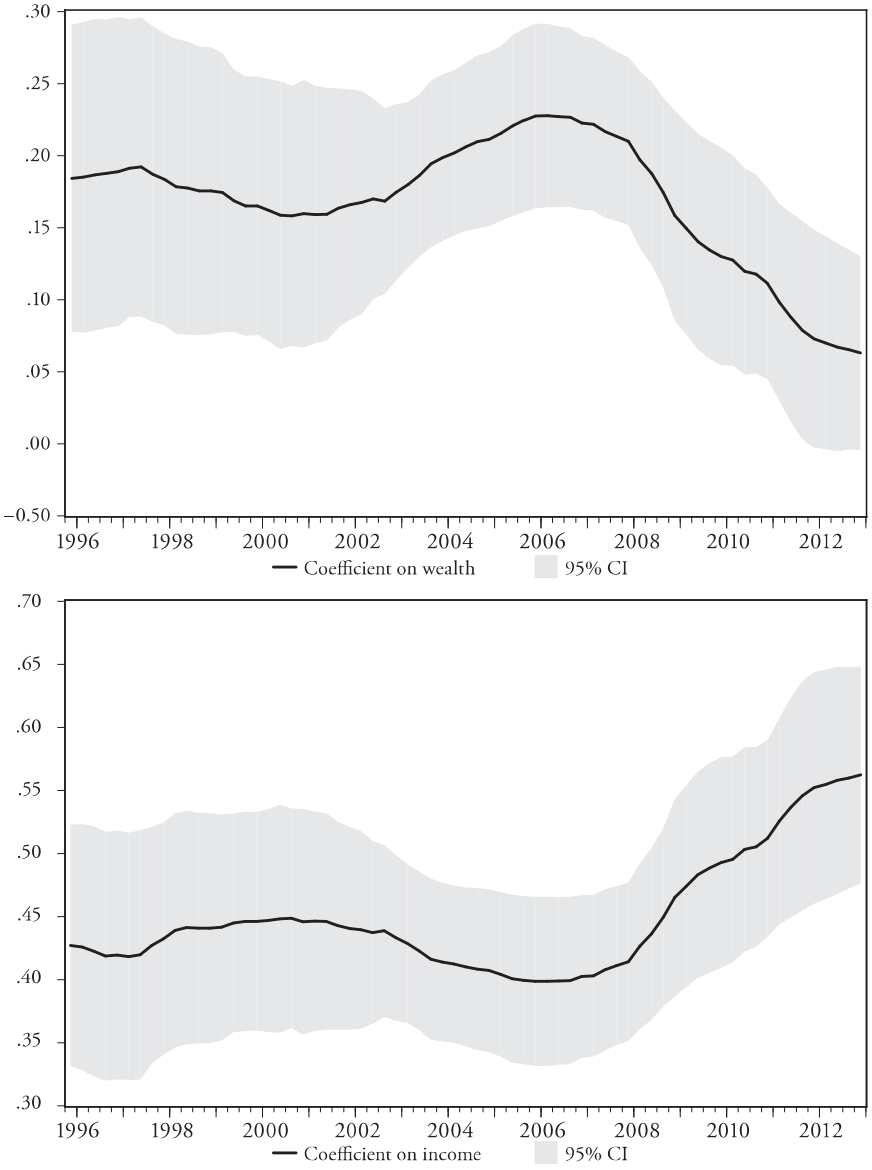
23 After-tax labor income is mainly an alternative for the U.S., where property income is not included in disposable income of households.

**Figure 8: Rolling Estimation Results for the Cointegration Coefficients**




*Note:* Shown are DOLS(4) estimates for the cointegration coefficients on asset wealth (top panel) and income (bottom panel) over a rolling 15-year window from 1981Q1–1995Q4 to 1998Q1–2012Q4 (69 windows). The date axis refers to the end point of the respective estimation window.

**Figure 9: Recursive Estimation Results for the Cointegration Coefficients**




*Note:* Shown are DOLS(4) estimates for the cointegration coefficients on asset wealth (top panel) and income (bottom panel) over an expanding window from 1981Q1–1995Q4 to 1981Q1–2012Q4 (69 windows). The date axis refers to the end point of the respective estimation window.

the coefficient slightly increased again in the very recent past. However, it is currently still in negative territory, which, economically, does not really make sense. The coefficient on income, on the other hand, underwent the opposite development. In addition to these changes in the point estimates over time, the rolling estimations also reveal significantly higher standard errors related to the coefficients on both wealth and income in the second part of the sample. This could be due to collinearity problems caused by a non-negligible extent of comovement between wealth and income over the 2000s, as is visible in Figure 3.

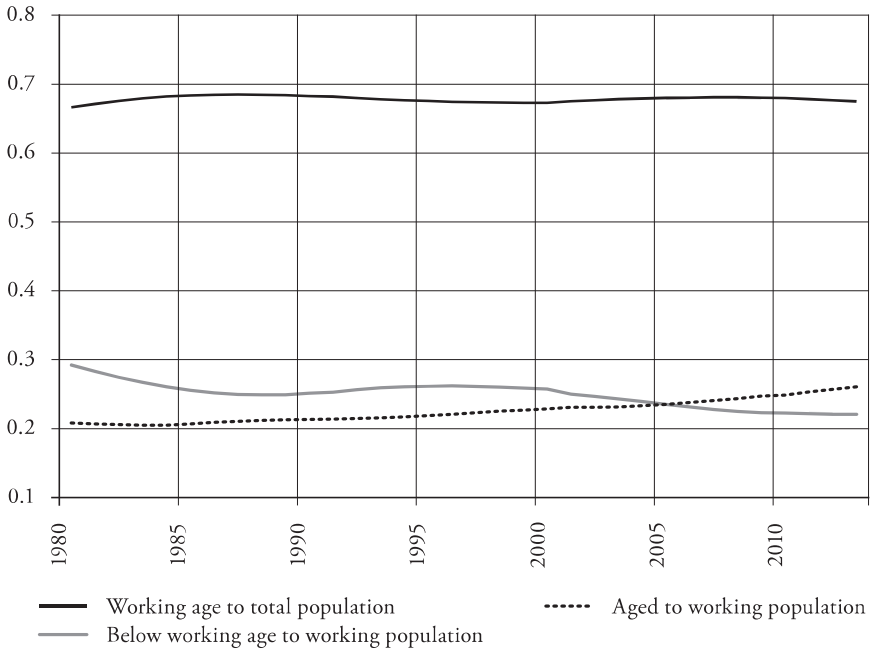
There may be several reasons for changes in the MPCs over time. One could be *institutional changes* (tax policy, pension system, demographics, composition of stock holders, new financial products), which may affect households optimizing behavior. This was also noted in POTERBA (2000). One example for Switzerland would be the extension of unemployment insurance over time. Another example would be changes in the Swiss pension system, such as the institutionalization of pension funds (pillar 2) in the mid-1980s, the increase in the retirement age of women from 62 to 64 in the first half of the 2000s and the lowering of the monthly withdrawal rate related to the pay-as-you-go occupational pension fund system (pillar 2). Worries about the pension system or developments in the housing market (e.g. an environment of an increasing house price-to-income-ratio as has been the case in Switzerland since the beginning of the 21st century) could also affect households optimization behaviour.

When changes in the aggregate MPC out of wealth appear to be mainly driven by housing wealth, this could actually be the result of *changes in credit market regulations*, particularly the mortgage market. Although there have been no explicit regulatory changes in Switzerland since 1981, several developments that were related to the housing and mortgage market may have led to changes in mortgage market conditions, such as the spatial planning act in the early 1980s, the institutionalization of pension funds and the associated increase in demand for housing assets in the mid-1980s or the bank's self-regulation measures after the housing market crisis in the early 1990s.

Also, *demographic changes* can affect the aggregate MPCs, especially changes in the ratios of working age to total population and of aged and below working age to working population. These changes are shown in Figure 10. Although the ratio of working age to total population has remained roughly constant over the sample, the composition of the non-working-age population has changed from below working age to aged persons.

Another possible reason for changes in the aggregate MPC out of asset wealth over time could be *changes in the composition of Swiss household wealth over time*. Table 7 shows two major transition periods since 1981. From 1990 to 2000, shares

**Figure 10: Population Trends in Switzerland**




and pension claims as a fraction of total wealth increased from 6 % of to 21 % and from 21 % to 32 %, respectively. On the one hand, the fraction of housing wealth decreased from 66 % to 45 % and the fraction of debt securities from 11 % to 7 %. Although all fractions remained roughly constant in the first part of the 2000s, the composition of assets underwent further changes in the most recent past. Until 2012, the fraction of shares and debt securities decreased to 14 % and 4 %, respectively. On the other hand, the fraction of housing wealth increased to 55 % in 2012. All other fractions remained roughly constant in the most recent past. Given that the MPCs out of different asset components can potentially differ, these changes in the composition of aggregate wealth can also lead to an MPC out of asset wealth that changes over time.

Changes in the aggregate MPC out of total wealth could also be caused by changes in the *distribution of wealth across Swiss households*. Rich households typically tend to spend less out of an additional amount of wealth than less-wealthy households and thus have a lower MPC out of wealth. However, the distribution of wealth across Swiss tax payers has hardly changed since 1981. The Gini coefficient increased only marginally, from 0.81 in 1981 to 0.83 in 2010.

**Table 7: Composition of Swiss Household Wealth**

| | 1981 | 1990 | 2000 | 2012 |
|---|---|---|---|---|
| Currency and deposits | 180 (22%) | 293 (21%) | 385 (18%) | 666 (22%) |
| Debt securities | 59 (7%) | 149 (11%) | 151 (7%) | 105 (4%) |
| Shares | 38 (5%) | 85 (6%) | 437 (21%) | 429 (14%) |
| Claims ag. pension funds | 138 (17%) | 296 (21%) | 669 (32%) | 887 (30%) |
| Real estate | 561 (69%) | 942 (66%) | 957 (45%) | 1653 (55%) |
| Liabilities | 159 (20%) | 347 (24%) | 485 (23%) | 736 (24%) |
| Net worth | 816 | 1418 | 2112 | 3005 |

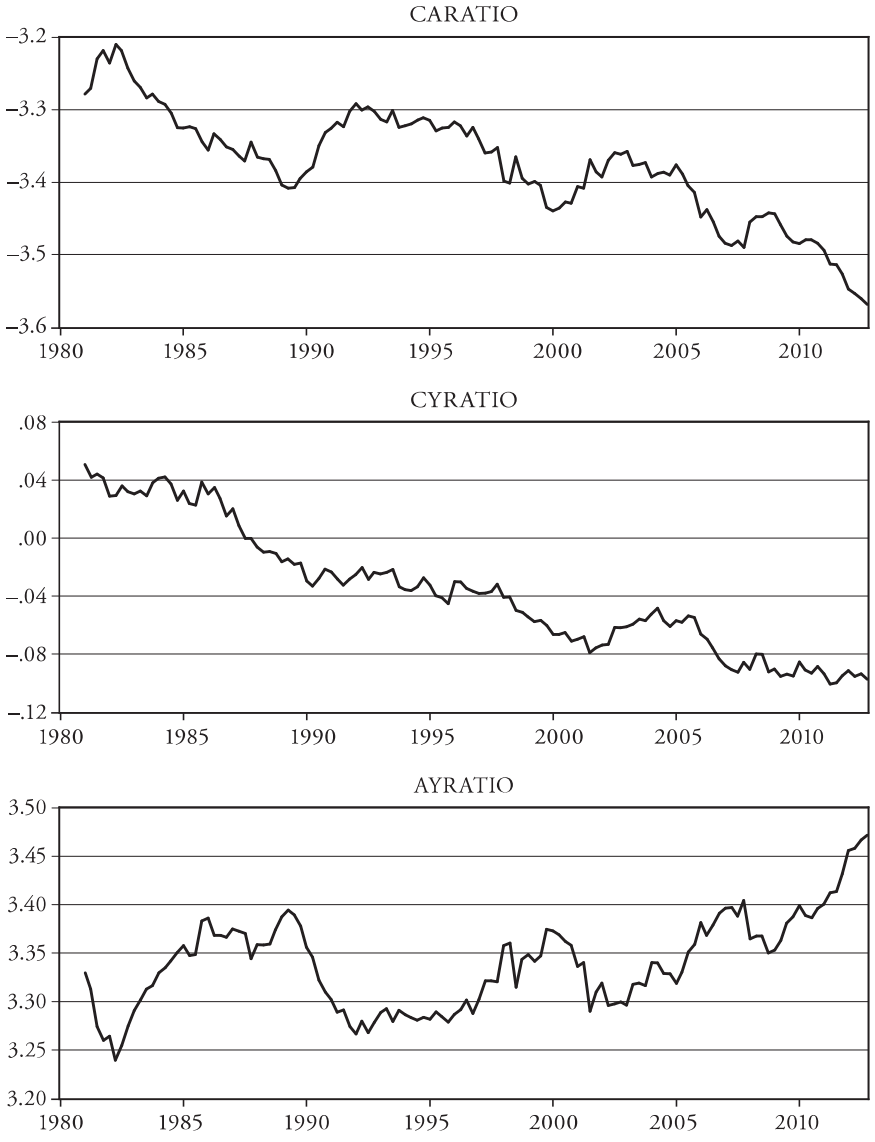
*Notes:* In Billion Swiss francs; shares of total net worth in parenthesis. *Source:* Swiss National Bank, own calculations.

Another possible reason for changes in the aggregate MPC could be *changes in inflation expectations*. As shown in ROSENBLATT-WISCH and SCHEUFELE (2015), households' inflation expectations have turned significantly and permanently lower in Switzerland, from approximately 3% in the 1980s and 1990s to slightly below 1% since 2000. DOEPKE and SCHNEIDER (2006) showed empirically that in terms of wealth gains, debtors benefit and creditors suffer from higher inflation expectations. BACHMANN, BERG, and SIMS (2015) provide evidence that in the zero lower bound period, "a one percentage point increase in expected inflation (…) reduces households probability of having a positive attitude towards spending by about 0.5 percentage points" (p. 1). Therefore, this would at least partly imply a lower MPC out of asset wealth in Switzerland in the more recent past than in the 1980s and 1990s.

### *6.4 The cay Residual as a Result of Two Separate Cointegrating Relationships*

Changes in the MPCs out of wealth and income would result in one or more breaks in the ratio of consumption-to-aggregate wealth. This issue can also be related to a point that was brought up by HOFFMANN (2006) and that also illustrates the fragility of the cay residual as a proxy of the aggregate consumption-to-wealth ratio and its estimation. The author shows that the cay residual can be rewritten as linear combinations of approximations of the so-called "great ratios", namely, *ca* (consumption-to-asset wealth ratio), *cy* (consumption-to-income ratio) and *ay* (assets-to-income ratio), e.g., $cay = \pi ca + (1 - \pi)cy$.

**Figure 11: The Great Ratios for Switzerland (in logs)**




*Note:* Shown are the consumption-to-asset wealth ratio (CARATIO, top panel), the consumption-to-income ratio (CYRATIO, center panel) and the asset wealth-to-income ratio (AYRATIO, bottom panel) for Switzerland over the 1981Q1 to 2012Q4 period.

Therefore, the cay residual as an approximation of the consumption-to-wealth ratio is conceptually the product of two separate cointegrating relationships. Because the framework of Ludvigson and Lettau assumes that these shares are stable, it follows that the great ratios need to be individually stationary for the whole framework to hold.

However, HOFFMANN (2006) showed that for the U.S., a linear trend, and even a break in the trend, needs to be included to have the cointegration tests reject the hypothesis of non-stationarity for all ratios. Otherwise, only one cointegrating relationship is found among the three variables.

For Switzerland, the great ratios are shown in Figure 11. We can see that all of them are trending downward. While stationarity tests indicate that the consumption-to-income ratio is trend stationary, the consumption-to-asset ratio is not.[24]

For the consumption-to-asset wealth ratio (top panel) and the consumption-to-income ratio (center panel), a downward trend seems to already be present since 1980. This suggests, as already noted earlier, that a potential break in the cay framework or the breakdown of this framework is related to developments in wealth, and not income. Similar findings regarding breaks in the great ratios and the cointegrating relationship of the involved variables can be found in ATTFIELD and TEMPLE (2010), who argue that the reasons for these breaks are changes in the underlying "deep" parameters that determine the long-run means of the ratios, a feature the cointegration approach is not robust to.

Eventually, most of the mentioned concerns regarding the cointegration approach to estimating wealth effects on consumption result in an omitted variable problem, meaning that the three variables of consumption, income and wealth are unable to capture changes in fundamental variables of the economy, such as changes in income expectations, interest rates or the unemployment rate. However, it has to be mentioned that even when controlling for any these variables, the results do not become more stable for the case of Switzerland.

## 7. Conclusions

Using the cointegration approach to estimating wealth effects, this study showed that when estimating over the whole sample period of 1981–2012, wealth effects seem to be hardly present in Switzerland. However, this result is largely driven by the most recent past, during which consumption did not respond to several

24 The results are not shown here but are available upon request.

major changes in wealth. Estimates over the more stable time span of 1981–2001 indicate that the MPC out of asset wealth was approximately 2.0 to 4.8 Swiss centime for this period. Regarding short-run dynamics, it was solely consumption that showed responsiveness to disequilibria. However, for the more recent past, 2002–2012, these regularities and the relationship among consumption, wealth and income in general have become much weaker and more difficult to pin down. Most estimation methods suggest that wealth effects have completely disappeared. Furthermore, the results show that it is now income, not consumption, that responds to disequilibria.

The finding that the most recent past has had a strong impact on the overall results (hardly any wealth effects present in Switzerland) makes these results much less reliable.

This study also showed that separating aggregate wealth effects into effects coming from (a) changes in financial wealth and (b) changes in housing wealth is difficult within the cointegration approach and that the results depend on the estimation method (at least in the case of Switzerland). Dynamic OLS estimates indicate that the MPC out of financial wealth and out of housing wealth were approximately the same over the stable sample period, 1981–2001.

As outlined in this paper, the separability problem and the mentioned general estimation problems for the recent past can both potentially be attributed to several fragility issues related to the use of a cointegration approach to estimating wealth effects: the possible violation of the stationarity assumption, heterogeneity problems, the importance of working with empirically "accurate" measures for all variables, and estimation issues such as changes in the MPCs out of wealth and income over time.

Overall, given the limited amount of data points, it is difficult to judge whether the latest developments in the cointegration behavior among consumption, wealth and income for Switzerland only reflect a change in the cointegrating vector or whether they point to a complete breakdown of the relationship among consumption, wealth and income. Nevertheless, given my results and the mentioned fragility issues related to the cointegration approach, it seems reasonable to search for an alternative way to estimate wealth effects and not solely rely on the estimates coming from cointegration approaches. Such an alternative was presented in Slacalek (2009), Carroll, Otsuka, and Slacalek (2011) and Slacalek (2009). It is based on the assumption of consumption stickiness, motivated by both habit formation and sticky information (friction as a result of incomplete information), so that short-run effects of wealth changes on consumption become long lasting. Compared to the cointegration approach, their method, as the authors argue, has the advantage that it is much more robust to changes in the underlying

parameters including expected income growth and demographics. Furthermore, it easily allows one to estimate wealth effects out of financial wealth and housing wealth separately.

In Galli (2016b), I apply this alternative method to the case of Switzerland. The main findings are that there seems to be a remarkably high degree of consumption stickiness in Switzerland and that, in contrast to the results obtained from the cointegration approach, Swiss consumers do actually react to changes in wealth. The MPC out of asset wealth is estimated to be approximately 6–7 Swiss centime, which is somewhere in the middle of international results in Slacalek (2009). However, for the Swiss case, this reaction takes place over a rather long period. The low pace of adjustment may partly explain why the cointegration approach fails to uncover the presence of wealth effects in the most recent past, where several major events led to rather volatile developments in Swiss household wealth.

## Bibliography

Afonso, A., and R. Sousa (2011), "Consumption, Wealth, Stock and Government Bond Returns: International Evidence," *The Manchester School*, 79.

Ando, A., and F. Modigliani (1963), "The 'Life-Cycle' Hypothesis of Saving: Aggregate Implications and Tests," *American Economic Review*, 53.

Aron, J., J.V. Duca, J. Muellbauer, K. Murata, and A. Murphy (2011), "Credit, Housing Collateral, and Consumption: Evidence from Japan, the U.K., and the U.S.," *Review of Income and Wealth*, 58.

Aron, J., J. Muellbauer, and A. Murphy (2008), "Housing Wealth, Credit Conditions and UK Consumption," 2008 European Meeting of the Econometric Society, Milan, Italy, August 27–31, 2008.

Attfield, C., and J.R. Temple (2010), "Balanced Growth and the Great Ratios: New Evidence for the US and UK," *Journal of Macroeconomics*, 32, pp. 937–956.

Bachmann, R., T.O. Berg, and E.R. Sims (2015), "Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence," *American Economic Journal: Economic Policy*, 7, pp. 1–35.

Bai, J. (1994), "Least Squares Estimation of a Shift in Linear Processes," *Journal of Time Series Analysis*, 15.

Bai, J., and P. Perron (1998), "Estimating and Testing Linear Models with Multiple Structural Changes," *Econometrica*, 66, pp. 47–78.

Bai, J., and P. Perron (2003), "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, 18, pp. 1–22.

Blinder, A. S., and A. Deaton (1985), "The Time Series Consumption Function Revisited," *Brookings Papers on Economic Activity*.

Browne, F., T. Conefrey, and G. Kennedy (2013), "Understanding Irish House Price Movements – A User Cost of Capital Approach," *Central Bank of Ireland Technical Paper*.

Brumberg, R. H., and F. Modigliani (1954), "Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data," in *Post-Keynesian Economics*, ed. by K. K. Kurihara, pp. 388–436, New Bunswick, NJ. Rutgers University Press.

Buiter, W. H. (2008), "Housing Wealth Isn't Wealth," *NBER Working Paper Series*, 14204.

Campbell, J. Y. (1996), "Understanding Risk and Return," *Journal of Political Economy*, 104, pp. 298–345.

Campbell, J. Y., and N. G. Mankiw (1989), "Consumption, Income and Interest Rates: Reinterpreting the Time Series Evidence," *NBER Macroeconomics Annual*, 4.

Carrion-I-Silvestre, J. L., and A. Sanso (2006), "Testing the Null of Cointegration with Structural Breaks," *Oxford Bulletin of Economics and Statistics*, 68.

Carroll, C. D. (2000), "Requiem for the Representative Consumer? Aggregate Implications of Microeconomic Consumption Behavior," *American Economic Review*, 90 (2), pp. 110–115.

Carroll, C. D., M. Otsuka, and J. Slacalek (2011), "How Large Are Housing and Financial Wealth Effects? A New Approach," *Journal of Money, Credit and Banking*, 43.

Congressional Budget Office (2007), "Housing Wealth and Consumer Spending," *Background Papers*.

Cooper, D., and K. Dynan (2014), "Wealth Effects and Macroeconomic Dynamics," *Journal of Economic Surveys*.

Doepke, M., and M. Schneider (2006), "Inflation and Redistribution of Nominal Wealth," *Journal of Political E*, 114(5).

Drehmann, M., and M. Juselius (2012), "Do Debt Service Costs Affect Macroeconomic and Financial Stability?," *BIS Quarterly Review*.

Fisher, L. A., and G. M. Voss (2004), "Consumption, Wealth and Expected Stock Returns in Australia," *The Economic Record*, 80, 359–372.

Friedman, M. (1957), *A Theory of the Consumption Function*. National Bureau of Economic Research, Cambridge, MA.

GALLI, A. (2016a), "How Reliable are Cointegration-Based Estimates for Wealth Effects on Consumption? Evidence from Switzerland," *SNB Working Paper Series*, 2016-03.

GALLI, A. (2016b), "Sticky Expectations and Wealth Effects on Consumption in Switzerland," *SNB Working Paper Series*, 2016-14.

HAHN, J., and H. LEE (2001), "On the Estimation of the Consumption-Wealth Ratio: Cointegrating Parameter Instability and its Implications for Stock Return Forecasting," *Working paper, University of Washington*.

HAHN, J., and H. LEE (2006), "Interpreting the Predictive Power of the Consumption-Wealth Ratio," *Journal of Empirical Finance*, 13, pp. 183–202.

HAMBURG, B., M. HOFFMANN, and J. KELLER (2008), "Consumption, wealth and business cycles in Germany," *Empirical Economics*, 34, 481–476.

HAUG, A. A., A. BEYER, and W. DEWALD (2011), "Structural Breaks and the Fisher Effect," *The B.E. Journal of Macroeconomics*, 11.

HOFFMANN, M. (2006), "Balanced Growth and Empirical Proxies of the Consumption-Wealth Ratio," *Technical Report / Universität Dortmund, SFB 475*, (26).

JOHANSEN, S. (1988), "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, 12, pp. 231–254.

KUROZUMI, E. (2002), "Testing for Stationarity with a Break," *Journal of Econometrics*, 108, 63–99.

LETTAU, M., and S. LUDVIGSON (2001), "Consumption, Aggregate Wealth, and Expected Stock Returns," *The Journal of Finance*, 56.

LETTAU, M., and S. LUDVIGSON (2004), "Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption," *American Economic Review*, 94.

LETTAU, M., and S. LUDVIGSON (2011), "Shocks and Crashes," *NBER Working Paper Series*, 16996.

LUDVIGSON, S., and C. STEINDEL (1999), "How Important is the Stock Market Effect on Consumption?," *FRBNY Economic Policy Review*.

MUELLBAUER, J. N. (2007), *Housing, Credit and Consumer Expenditure*. Jackson Hole Symposium, Federal Reserve Bank of Kansas City.

NITSCHKA, T. (2010), "International Evidence for Return Predictability and the Implications for Long-Run Covariation of the G7 Stock Markets," *German Economic Review*, 11.

PHILLIPS, P. C. B., and M. LORETAN (1991), "Estimating Long-Run Economic Equilibria," *Review of Economic Studies*, 58, pp. 407–436.

POTERBA, J. M. (2000), "Stock Market Wealth and Consumption," *Journal of Economic Perspectives*, 14, pp. 99–118.

Romer, D. (2005), *Advanced Macroeconomics*. McGraw-Hill/Irwin, 3 edn.

Rosenblatt-Wisch, R., and R. Scheufele (2015), "Quantification and Characteristics of Household Inflation Expectations in Switzerland," *Applied Economics*, 47(26), pp. 2699–2716.

Rudd, J., and K. Whelan (2006), "Empirical Proxies for the Consumption-Wealth Ratio," *Review of Economic Dynamics*, 9, pp. 34–51.

Schmid, F. (2013), "Wealth Effects on Consumption in Switzerland," *Swiss Journal of Economics and Statistics*, 149, pp. 87–110.

Slacalek, J. (2009), "What Drives Personal Consumption? The Role of Housing and Financial Wealth," *The B.E. Journal of Macroeconomics*, 9.

Sousa, R. M. (2010a), "Consumption, (Dis)Aggregate Wealth, and Asset Returns," *Journal of Empirical Finance*, 21.

Sousa, R. M. (2010b), "Wealth Effects on Consumption: Evidence from the Euro Area," *Bank and Bank Systems*, 7.

Stock, J. H., and M. W. Watson (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems," *Econometrica*, 61, pp. 783–820.

Swiss National Bank (2012),"Household Wealth 2012," http://www.snb.ch/en/iabout/stat/statpub/vph/stats/wph.

Zhou, S. (2000), "Testing Structural Hypotheses on Cointegration Relations with Small Samples," *Economic inquiry*, 38, pp. 629–640.