# Wealth Effects on Consumption in Switzerland

Frank Schmid[a]

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## 1. Introduction

The large variations in wealth that could be observed during the financial crisis moved the so-called "wealth-effect" back to the center of the macroeconomic policy discussion. At the core was thus the question of how far private consumption is affected by rising or falling wealth.

The literature that builds on a wealth channel to explain changes in consumption has ever grown since the early contributions of Friedman (1957). For the United States, Lettau and Ludvigson (2004) draw a distinction between permanent changes in asset wealth and purely transitory changes. According to their results, almost all fluctuations in wealth are just transitory. These transitory changes are due to stock market fluctuations and do not have any significant effect on consumption. Koop, Potter, and Strachan (2008) criticize this conclusion of Lettau and Ludvigson (2004) that consumption does not react to transitory wealth changes. They analyze the role of model uncertainty and find that it is uncertain whether most of the fluctuations in wealth are really transitory and whether most of the fluctuations in consumption are indeed permanent. Although some support exists for the view that wealth is driven mainly by transitory fluctuations, they cannot rule out the possibility that permanent variations play a substantive role.

Models similar to the one suggested by Lettau and Ludvigson (2004) have also been estimated for other countries such as Canada in Pichette and Tremblay (2003), Australia in Fisher and Voss (2004) or Germany in Hamburg,

a This paper was completed while the author was a staff economist at the Swiss National Bank. Email: frank.schmid@sif.admin.ch. The author would like to thank Matthias Lutz, Daniel Kaufmann, Katrin Assenmacher, Signe Krogstrup, two anonymous referees as well as various seminar participants at the SNB and at the SGVS conference in Fribourg for their helpful comments and valuable discussion.

HOFFMANN, and KELLER (2008). The consensus of these recent studies so far is that wealth effects are comparatively small and long-run wealth changes rather than short-run variations matter for consumption.

This study uses a novel data set on wealth in Switzerland and, based on a vector error correction model, analyzes how a change in wealth affects consumption. On average, wealth has a significant effect on consumption. However, this only holds in the long-run. In the short-run, deviations from the equilibrium between consumption and wealth can be rather persistent and can have a duration of up to 3 years.

Compared to earlier findings in the literature, the results differ twofold: First, instead of being driven by transitory variations only, a substantial fraction of wealth changes is permanent, i.e. lasting forever. The second difference is that consumers may be slow to adapt but are not unresponsive as they react exactly to those parts of a wealth shock that are permanent. An interpretation of these results is that consumers react less to changes in wealth per se than to changes in the business cycle. Section 2 contains theoretical reflections on the consumption-wealth link and section 3 describes the Swiss data. The main results of the paper are presented in section 4. Finally, section 5 concludes.

## 2. The Common Trend in Consumption and Wealth

By log-linearizing the intertemporal budget constraint, where $R_{t+1}$ is the interest rate, $W_t$ the sum of human and non-human wealth and $C_t$ is consumption,

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

and taking a first-order Taylor expansion around the steady state, CAMPBELL and MANKIW (1989) derive an expression that relates the consumption-wealth ratio today to future consumption and future interest rates:

$$c_t - w_t = E_t \sum_{\tau=1}^{\infty} \rho^{\tau} (r_{t+\tau} - \Delta c_{t+\tau}) + \rho \frac{k}{1-\rho} \tag{2}$$

This equation says that today's consumption-wealth ratio also contains information about the expectations of financial market participants and consumers about their future rates of return and their future consumption growth rates. For example, a high consumption-wealth ratio today either implies high future expected rates of return or low future consumption growth.[1]

The problem with equation (2) is that total assets $w_t$ are not observable as they also include human capital. Lettau and Ludvigson (2001) suggest using labor income as a proxy for the return on human capital, so that $w_t = y_t + a_t$ where $a_t$ are all other assets. Under the assumption that $r_t$ and $\Delta c_t$ are stationary, equation (2) implies that consumption and wealth are cointegrated and $c_t - w_t$ is a cointegration residual. If this consumption-wealth ratio is not constant, by equation (2), the residual must either forecast changes in future rates of return on the market portfolio, future consumption growth or both.[2]

## 3. Data

The data set used in this study is novel and includes quarterly growth rates of real per capita consumption, disposable income and wealth. The series cover the period 1981.I to 2009.IV, with a total of 116 observations.[3]

Rudd and Whelan (2006) stress that one should employ measures of consumption, assets, and income that are jointly consistent with an underlying budget constraint. Consistent with this suggestion, durable goods are counted as part of consumption and are excluded from the wealth measure and all nominal variables are deflated by the same deflator, i.e. the consumption deflator.

Wealth is the difference between all receivables of private households and their liabilities. The receivables side consists of all money and deposit holdings, loans granted, share and mutual fund holdings, claims against pension funds and insurances, structured products holdings and housing wealth. The liabilities contain all mortgages and other liabilities such as consumer loans or leasing obligations. Note that the claims against pension funds consist of mandatory private pension savings that can only be used for consumption purposes after the age of retirement. Variations in these mandatory savings can influence current consumption nonetheless if a change in the value of pension funds is compensated by an off-setting change in voluntary savings. See appendix 7.1 for a detailed description of the data.

1 With annual data the parameter $\rho$ is a little less than 1 and $k$ is a constant.

2 For more details see Campbell and Mankiw (1989) and Lettau and Ludvigson (2001).

3 Note that measured total consumption data is often disaggregated into the components non-durable goods, durable goods and services. However, the level of true total consumption is unobservable as it should include also consumption of services derived by durable goods. In the literature, common practice is to proxy for total consumption by using the sum of consumption of non-durable goods and consumption of services. Due to missing data on this disaggregation prior to 1998 this proxy cannot be computed for Switzerland.

**Figure 1: Consumption, Disposable Income and Net Wealth per Capita 1981–2009**

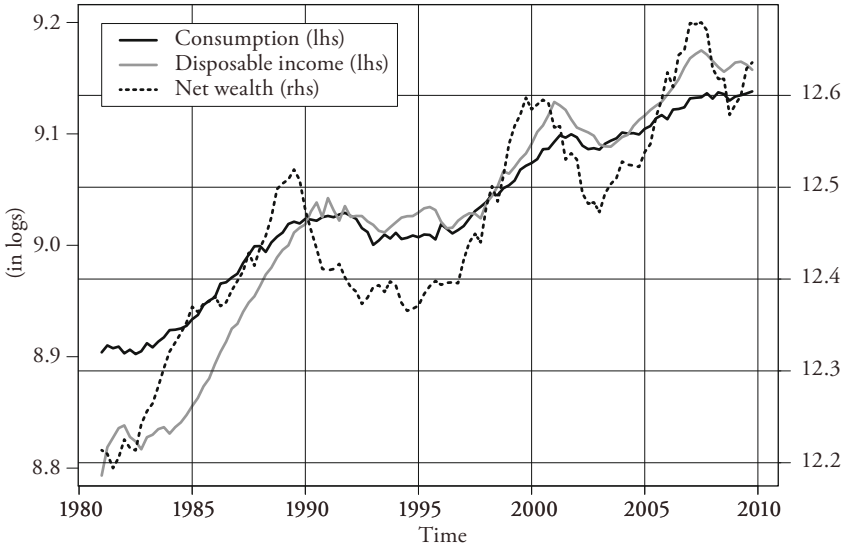
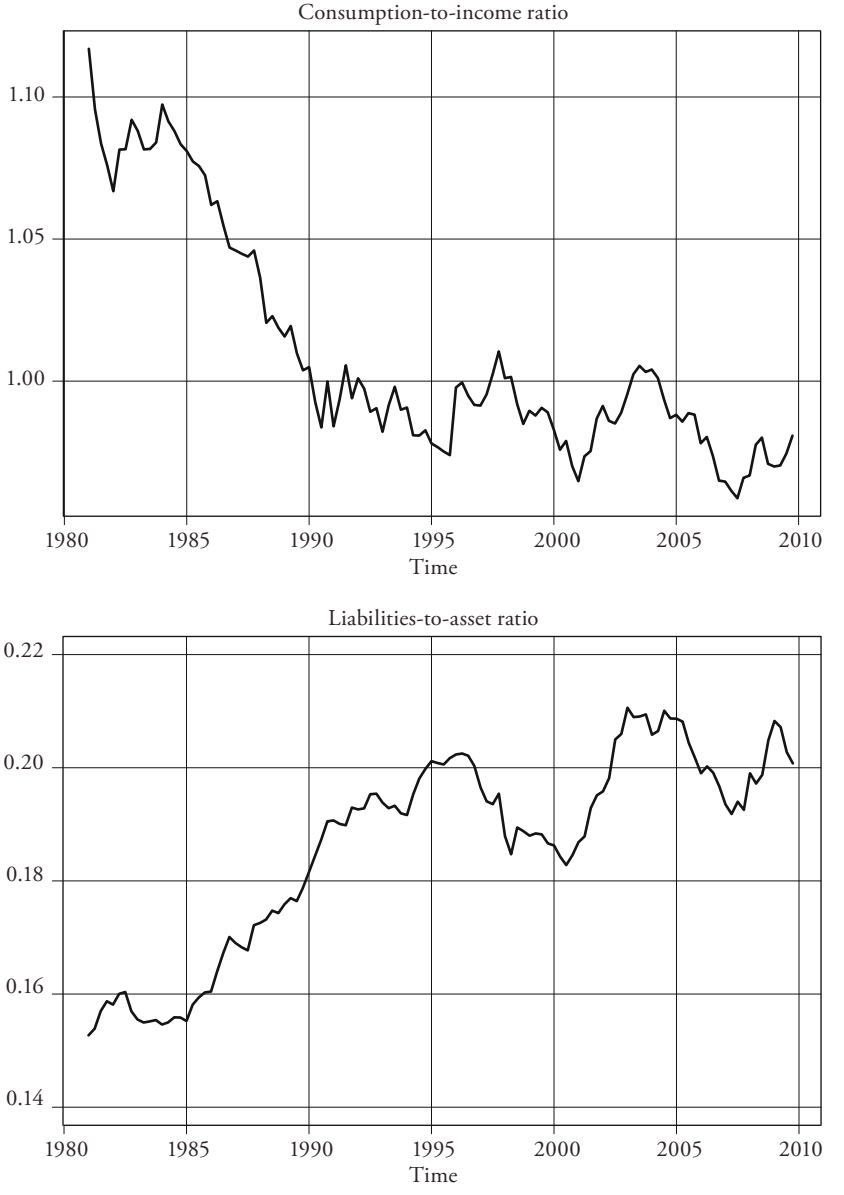



Figure 1 provides a graph of real consumption, real disposable income and real wealth per capita.[4] All time series are presented in levels and on a log-scale. Real wealth per capita in Switzerland was hit by three major declines in the 1981–2009 period, one due to a fall in Swiss housing wealth in the beginning of the 1990s and two due to the global stock market drops in 2001 and in 2008.

The two graphs in Figure 2 plot the evolution of the consumption-to-income ratio and the liability-to-asset ratio. The negatively sloped consumption-to-income ratio provides evidence that consumption grew on average at a lower rate than income in the period 1981–2009. The positively sloped liability-to-asset ratio, instead, suggests that average indebtedness of private households has risen in the 1980s but has remained around 20% since then.

4 For the same reasons advocated in HAMBURG, HOFFMANN, and KELLER (2008, p. 456), disposable income is used as the relevant measure to proxy for the return on human capital instead of merely labor income as in LETTAU and LUDVIGSON (2004). The differences between labor income and disposable income are property income and social transfers. The wealth data in Switzerland does not include property income. However, property income should be part of the budget constraint of a household and property income can to some extent also be interpreted as labor income. Note that the results in section 4 would also hold if only labor income instead of disposable income is used.

**Figure 2: Consumption-to-Income and Liabilities-to-Asset Ratios**



## 4. Empirical Analysis

This section shows results of a cointegration analysis, introduces the vector error correction model (VECM) and the adapted identification strategy to identify permanent and transitory shocks. Having identified permanent and transitory shocks, results of a variance decomposition are presented in section 4.3. Section 4.4 provides additional evidence on the consumption-wealth relationship and contains results of long-horizon regressions. The final subsection discusses the role of asymmetries. As a notation convention, *c* denotes the log of consumption, *y* log disposable income and *a* log net total assets.

Theoretical considerations as described above imply the existence of a cointegrating relationship between consumption, income and wealth. Before applying and presenting a VECM model, it is important to test whether using a VECM model is appropriate. The necessary unit root and cointegration tests are reported in the appendix. The results of these tests support the hypothesis of 1 cointegrating relationship between consumption, income and wealth.

### *4.1 VECM model*

The following VECM model is therefore applied to the data:

$$\Delta X_t = \mu + \gamma\alpha' X_{t-1} + \Gamma(L)\Delta X_{t-1} + \varepsilon_t \tag{3}$$

where $X_t$ is a vector of cointegrated variables, $\Delta X_t$ is the vector of log first differences, $\Gamma(L)$ is of finite order $K$, $\alpha$ and $\gamma$ are both of dimension $n \times R$ and of rank $r$, where $r$ is the number of cointegrating relationships. The reduced form shocks satisfy the following conditions: $E_t(\varepsilon_t) = 0$, $E_t(\varepsilon_t \varepsilon_s') = 0 \; \forall t \neq s$ and $E_t(\varepsilon_t \varepsilon_t') = \Sigma$.

The term $\alpha' X_{t-1}$ is last period's error correction term and is non-zero if last period ended in disequilibrium. In the literature, this term is also called the *cay* residual. The coefficients $\alpha = (1, -\alpha_y, -\alpha_a)$ are obtained using the STOCK and WATSON (1993) dynamic OLS procedure with 6 leads and lags of the regressors included and are presented in Table 1. $\gamma$ is the vector of coefficients, which are large for all variables that adjust immediately to a shock to restore the long-run equilibrium and which are small or zero for all variables that do not adjust when a deviation occurs. By the Granger Representation Theorem of ENGLE and GRANGER (1987) at least one of the $\gamma$ must be different from zero.

Wealth has a significant long-run effect on consumption in Switzerland. Moreover, the size of the wealth coefficient is comparable to results found in other

studies.[5] In contrast to the wealth coefficient, the income-elasticity is lower than expected, in particular for the full sample 1981–2009. This could be due to the fact that, on average, Switzerland has a high savings ratio compared to other OECD countries.[6]

**Table 1: Dynamic OLS Estimates of Long-Run Equations**

| Sample | 1981–2009 | 1990–2009 |
|---|---|---|
| Independent variable | Estimate | |
| y | 0.250*** | 0.701*** |
| a | 0.422*** | 0.153** |
| $R^2$ | 0.99 | 0.99 |

*Notes:* estimated equation $c_t = \beta_0 + \beta_1 y_t + \beta_2 a_t + \varepsilon_t$, 6 leads and lags of the first differences of $y_t$ and $a_t$ included, *** rejection of the null hypothesis at the 1% level and ** at the 5% level.

To consider the fact that the data quality pre 1990 is somewhat lower than post 1990, the dynamic OLS regression is re-run including only the 1990–2009 period. According to this subsample analysis, the long-run wealth effect in the 1990–2009 period was lower than for the entire sample but remains significant.[7]

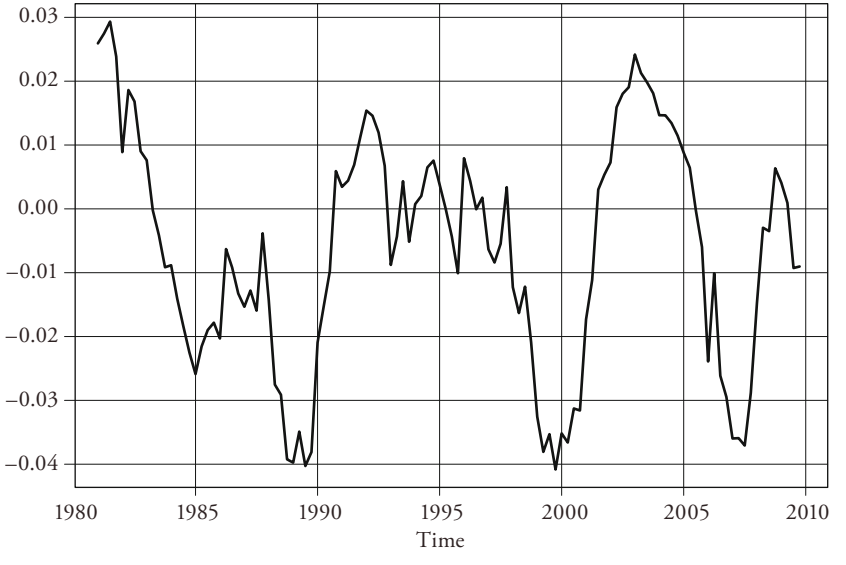
5 Different lead and lag lengths were applied, ranging from 2 to 8. The cointegrating parameter for income gets a higher estimate of around 0.5 if few leads and lags are used and the wealth coefficient decreases to 0.2. However, Lettau and Ludvigson (2004) and Panopoulou and Pittis (2004) suggest taking a larger number of leads and lags in the DOLS regressions, in particular if the cointegration errors are persistent. Furthermore, the main conclusions remain unchanged, in particular the levels of significance and the size of the wealth effect.

6 Theoretically, the sum of the coefficients should sum up to unity, a condition which in practice does not have to hold, as stressed also by Lettau and Ludvigson (2004). They claim that this may be due to the fact that consumption of durables-services is unobservable. The coefficients in Table 0 sum to 0.75 and 0.86, respectively. In an alternative DOLS regression, in which the two coefficients on *y* and *a* are explicitly restricted to sum up to 1, the income coefficient hardly changes, while the wealth coefficient rises to 0.6. However, this restriction is restrictive and not supported by a likelihood ratio test. Moreover, this low coefficient on income does not depend on the chosen lag length of the DOLS regression.

7 Regressions not included here show that among the two wealth components, financial wealth and housing wealth, (gross) housing wealth on average has a significantly stronger impact on consumption than (net) financial wealth. However, this result does not hold in the shorter sample period and depends on whether gross or net housing wealth is considered.

Although in the long-run wealth is found to have a significant effect on consumption, the short-run effects are less clear. Figure 3 shows the cointegration residual $c_t - \alpha_y y_t - \alpha_a a_t$ for the entire sample period from 1981 to 2009. Positive residuals correspond to periods of above equilibrium consumption growth and negative residuals to periods of less than equilibrium consumption growth. According to this cointegration residual, consumption and wealth sometimes deviated from equilibrium for an extended period of time. At the beginning of such deviations from equilibrium, the gap widens markedly before it eventually returns to equilibrium. The duration of such disequilibrium phases can be up to 3 years. The fact that the disequilibrium was particularly negative at the heyday of the 1989 Swiss real estate bubble, the 2000 dot-com bubble and again in 2007 suggests that consumption growth was actually less than equilibrium during these times of inflating wealth. Section 2 gives an interpretation for why during these episodes consumers did not expand their consumption spending faster given the high levels of wealth.

**Figure 3: Cointegration Residual**




In the consumption equation of the estimated VECM in Table 2, the coefficients on lagged wealth and income growth and on the error correction term $EC_{t-1}$ are

significantly different from zero.[8] By contrast, past consumption growth does not explain current consumption growth, i.e. consumption is not serially correlated.[9] Given a positive *cay* residual, corresponding to consumption above equilibrium, the point estimate on $EC_{t-1}$ suggests that consumption adjusts immediately to deviations from the equilibrium and moves the system back to equilibrium. In contrast to Lettau and Ludvigson (2004), who find that only wealth adjusts to disequilibria, this finding is in line with macroeconomic consumption theory such as the permanent income hypothesis of Friedman (1957).

While consumers do respond immediately to unexpected changes in the disequilibrium, their speed of adjustment seems to be rather slow. The speed of adjustment is represented by the absolute value of the coefficient on the cointegration residual. This can be interpreted as the change in quarterly consumption growth that is attributable to the disequilibrium between consumption and wealth. If this adjustment to a disequilibrium was done solely by consumption, the point estimate implies that more than 4 years would be needed to restore the equilibrium.

The equilibrium is restored not only through consumption adjustments but also through changes in wealth. Above equilibrium consumption growth can therefore be restored by lower consumption growth, more rapid wealth growth or both. This is implied by the positive point estimate for the error correction term in the wealth equation in Table 2. Moreover, in contrast to the slow speed of adjustment of consumers, wealth adapts comparatively rapidly to restore the equilibrium. If the adjustment to a disequilibrium was done solely by wealth, the equilibrium would be restored after 3 quarters. Lettau and Ludvigson (2004) criticize earlier contributions that have models with only a consumption equation, as in these models consumption alone must bring the system back to the equilibrium, while in theory this could also be achieved by wealth changes, in particular through changes in asset prices. The results here confirm this criticism and highlight the need to build a VECM.

8 These estimates report results using the entire sample period.

9 The lag length of the VECM according to the information criterion BIC should be 1. However, with only 1 lag there is clear evidence of serial correlation in the residuals, particularly in the wealth equation, which is not the case anymore with 2 lags.

**Table 2: VECM Estimates**

| Regressors | Dependent variables | | |
|---|---|---|---|
| | $\Delta c_t$ | $\Delta y_t$ | $\Delta a_t$ |
| constant | 0.001** (0.04) | 0.001 (0.26) | 0.002 (0.13) |
| $\Delta c_{t-1}$ | –0.138 (0.11) | 0.266** (0.02) | 0.296 (0.77) |
| $\Delta y_{t-1}$ | 0.097 (0.17) | 0.136 (0.40) | 0.602*** (0.00) |
| $\Delta a_{t-1}$ | 0.026 (0.16) | –0.013 (0.74) | 0.217** (0.01) |
| $\Delta c_{t-2}$ | –0.043 (0.63) | 0.268** (0.02) | –0.343 (0.34) |
| $\Delta y_{t-2}$ | 0.087* (0.08) | 0.135 (0.12) | 0.165 (0.49) |
| $\Delta a_{t-2}$ | 0.051*** (0.00) | 0.043* (0.08) | 0.268*** (0.00) |
| $EC_{t-1}$ | –0.059** (0.02) | –0.029 (0.47) | 0.334*** (0.00) |
| $R^2$ | 0.31 | 0.34 | 0.21 |

*Notes:* Newey-West p-values in parenthesis, ** rejection of the null hypothesis at the 5% and *** at the 1% level.

### *4.2 Permanent and Transitory Decomposition – Theory*

As implied by the life cycle-permanent income hypothesis, the reaction of consumers to a wealth shock is likely to depend on the nature of the shock. For instance, if consumers perceive a wealth increase to be transitory, they can be expected to react differently than if a wealth shock is perceived to be permanent. In the first case, consumption may remain unchanged and equilibrium is restored after the temporary nature of the shock revealed itself. In the latter case, as consumers learn the permanent nature of the shock, they will eventually increase their level of consumption.

This and the following subsection decompose the variations in consumption, income and wealth into permanent and transitory components, with the difference between the two components being their degree of persistence. The decomposition is achieved using a method suggested in GONZALO and NG (2001). It consists of two steps, where the first step distinguishes shocks that

have permanent effects from those with transitory effects. The second step uses a Choleski decomposition to obtain a set of orthogonal shocks. According to Gonzalo and Ng (2001), a shock is said to have a permanent effect on the level of $X_t$ if $\lim_{h\to\infty} \delta E_t(X_{t+h})/\varepsilon_t^P \neq 0$ and similarly, a shock is purely transitory if $\lim_{h\to\infty} \delta E_t(X_{t+h})/\varepsilon_t^T = 0$.

Having three variables in the system and one cointegrating relationship, following Stock and Watson (1988) there are thus 2 permanent shocks and 1 transitory shock that drive the system. Assuming stationary growth rates in $X_t$, a multivariate moving-average representation exists as follows:

$$\Delta X_t = C(L)\varepsilon_t \tag{4}$$

The matrix $C(L)$ is a matrix polynomial and $\varepsilon_t$ are the innovations. Let

$$G = \begin{bmatrix} \gamma_\perp' \\ \alpha' \end{bmatrix} \tag{5}$$

with $\gamma_\perp'\gamma = 0$. Gonzalo and Ng (2001) suggest estimating $\gamma_\perp$ using the eigenvectors which are associated with the $n-r$ smallest eigenvalues of the matrix $\gamma\gamma'$. Matrix $G$ completely identifies the permanent and transitory component of $X_t$. Define $D(L) = C(L)G^{-1}$, the permanent and transitory innovations $\eta^P$ and $\eta^T$ are then:

$$\eta_t = G\varepsilon_t \tag{6}$$

This P-T decomposition implies that

$$\Delta X_t = C(L)G^{-1}G\varepsilon_t = D(L)\eta_t \tag{7}$$

Equation (7) equates growth rates in $X_t$ with long-lasting and transitory shocks $\eta_t^P$, $\eta_t^T$, from which we can estimate variance decompositions. The Gonzalo and Ng decomposition allows one to achieve this easily. Instead of a Cholesky decomposition on $cov(\hat{\varepsilon})$, a Cholesky decomposition on $cov(\hat{G}\hat{\varepsilon})$ is applied. The result is a vector of mutually uncorrelated shocks, where the following ordering is used: $c_t$, $y_t$, $a_t$.

### *4.3 Permanent and Transitory Decomposition – Results*

Figure 4 depicts the fraction of $h$-step ahead forecast errors for the growth rates of consumption, income and wealth that can be attributed to the two permanent shocks combined and to the single transitory shock.[10] For consumption and income almost the entire variance is due to the two permanent shocks. Within this model, consumers thus hardly react to transitory shocks..

**Table 3: Forecast Error Variance Decomposition (Details)**

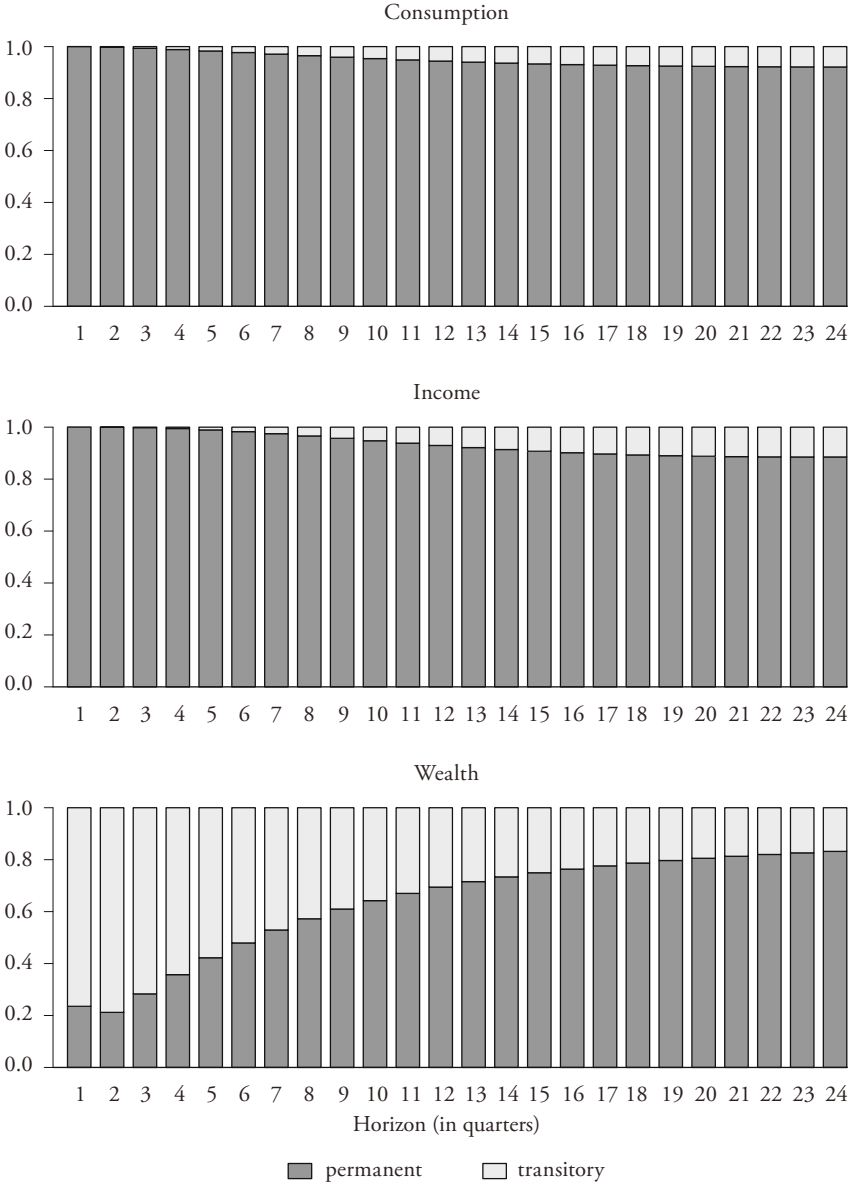
| Variable | Permanent shock 1 | Permanent shock 2 | Transitory shock |
|---|---|---|---|
| $\Delta c_{t+1} - E_t \Delta c_{t+1}$ | 100% | 0% | 0% |
| $\Delta y_{t+1} - E_t \Delta y_{t+1}$ | 2.1% | 97.8% | 0% |
| $\Delta a_{t+1} - E_t \Delta a_{t+1}$ | 3.4% | 9.4% | 87.2% |
| $\Delta c_{t+24} - E_t \Delta c_{t+24}$ | 86.6% | 4.6% | 8.8% |
| $\Delta y_{t+24} - E_t \Delta y_{t+24}$ | 58.9% | 27.3% | 13.7% |
| $\Delta a_{t+24} - E_t \Delta a_{t+24}$ | 65.4% | 16.1% | 18.5% |

This finding explains why actual consumption growth was less than equilibrium consumption growth during the times of rapid wealth increases in 1989, 2000 and again in 2007: consumers perceived large parts of those wealth increases as transitory. Indeed, for short horizons the majority of the variance in wealth is attributable to the transitory shock. For the longer horizons, though, the permanent shocks increasingly gain importance. Beyond the 8 quarter horizon permanent shocks explain more than 50% of the variance, a fraction which rises to more then 80% at the 24 quarter horizon. To identify the two permanent shocks separately and more clearly, more detailed results are necessary.

According to Table 3, which contains the detailed results of the forecast error variance decomposition, the first permanent shock has by assumption an immediate impact on consumption. All other shocks are by assumption ruled out to have a contemporaneous impact on consumption. These assumptions are binding only initially and are necessary for identification purposes. In the long-run,

10 GONZALO and NG (2001) recommend that one should restrict the elements in $\gamma$ to 0 which are insignificantly different from 0 at the 5% level. In the application here, $\gamma_y$ is set to 0.

**Figure 4: Forecast Error Variance Decomposition**



the first shock dominates the variation in the system, in particular the one for consumption. This shock can be interpreted as a shock to permanent income because it permanently changes the level of consumption. Moreover, as consumption and wealth both react to the same permanent income shocks, they react less to changes in wealth per se than to changes in the business cycle. The origins of such changes in the business cycle can come from many sectors of the economy, potentially also from the financial sector. In fact, in the aftermath of each of the three large asset price busts that occurred in the 1981–2009 period (1990, 2001 and 2008), the Swiss economy was hit by a recession. The second permanent shock, which by assumption has to be orthogonal to the permanent income shock, is mostly related to changes in disposable income and can be interpreted as an income redistribution shock. The automatic stabilizers built into the system such as unemployment benefits make disposable income smoother than it otherwise would be. Its long-run importance is limited as it accounts for only 27% of the variation in disposable income, while permanent income shocks explain the biggest share. Instead, the effects of an income redistribution shock are biggest in the short to medium term.

Compared to earlier results in the literature, these results can be much better reconciled with economic theory. Irrespective of the forecast horizon, LETTAU and LUDVIGSON (2004) and LETTAU and LUDVIGSON (2011) find that changes in wealth are essentially disconnected from macroeconomic aggregates such as consumption or disposable income. In their samples 88%–90% of the variance in total wealth is due to transitory shocks that are entirely unrelated to both, consumption and disposable income, and only 10%–12% due to permanent shocks. This large weight of the transitory shock for wealth growth is hard to reconcile with consumption-based asset pricing models. According to CAMPBELL (2003), the risk-free real interest rate can be written as a function of expected consumption growth, and the risk premium on risky assets can be written as a function of the assets' covariances with consumption growth. This suggests that wealth should have a non-trivial permanent component that is related to macroeconomic fundamentals, consistent with what this paper finds.

With permanent shocks explaining a non-trivial fraction of the variance in wealth, a question that arises is how do consumers disentangle merely transitory wealth shocks from permanent wealth shocks as only the latter affect consumption. BRUNNERMEIER and NAGEL (2008) find that inertia is a major driving force of household portfolio allocation. One explanation they give for this finding is that individuals are not willing to rebalance their portfolios because they perceive it as too costly in terms of forgone utility. If transitory wealth shocks reveal themselves after a while, a rationally inattentive consumer, who updates

his or her optimal consumption plan less frequently than transitory shocks typically prevail, may have another advantage apart from higher utility: she lowers the chances of misinterpreting a transitory shock as permanent. Exploring the consequences of inattentiveness for the consumption-wealth relationship is not topic of this paper and is left for future research.

### *4.4 Univariate Long-Horizon Regressions*

The finding that deviations in the common trend between $c_t$, $y_t$ and $a_t$ are not unrelated to consumption can also be confirmed by long-horizon regressions of the form $c_{t+h} - c_t = \alpha_0 + \alpha_1 EC_t + \varepsilon_t$ similar as in Hamburg, Hoffmann, and Keller (2008). The purpose of these simple long-horizon regressions is to show correlations rather than to investigate causality. Table 4 provides results of such long-horizon regressions of several financial and economic variables such as *c*, *y*, *a*, excess returns, the unemployment rate or GDP for 1, 4, 8 and 12 quarter horizons on the cointegration residual $EC_t$.

The results of these long-horizon regressions give further support to the interpretation that consumers react less to changes in wealth per se than to changes in the business cycle. Consumption-wealth disequilibria can explain particularly changes in variables related to the business cycle such as GDP or the unemployment rate, while the evidence is weak that deviations from the common trend in *c*, *y* and *a* can anticipate future inflation or asset prices. Asset price booms in certain sectors of the economy possibly attract capital and lead to increased activity and employment in these sectors. This would explain why the *cay* residual predicts variables related to the business cycle rather than asset prices as in Lettau and Ludvigson (2001).

Although they are contrasting, the results here and in Lettau and Ludvigson (2001) can both be reconciled with economic theory as it does not give a precise answer whether this cointegration residual should predict future returns or consumption growth or both. Lettau and Ludvigson (2001) claim that only wealth adjusts to disequilibria but consumption not at all and therefore their *cay* residual predicts changes in asset prices.[11]

11 In regressions not included here, trend deviation of Lettau and Ludvigson (2004) for US consumers (available as of December 2011 on the web at http://faculty.haas.berkeley.edu/lettau) does not predict excess returns for the Swiss stock market at all horizons.

**Table 4: Univariate Long-Horizon Regressions**

| Horizon $h$ | c | y | a |
|---|---|---|---|
| 1 | –0.093*** | –0.121*** | 0.068 |
| | (0.24) | (0.11) | (0.01) |
| 4 | –0.336*** | –0.655*** | –0.912*** |
| | (0.68) | (0.39) | (0.13) |
| 8 | –0.652*** | –1.306*** | –2.742*** |
| | (0.68) | (0.54) | (0.47) |
| 12 | –0.902*** | –1.601*** | –4.110*** |
| | (0.59) | (0.49) | (0.70) |
| Horizon $h$ | gdp | unemployment rate | consumption deflator |
| 1 | –0.158*** | 0.067*** | –0.051 |
| | (0.22) | (0.28) | (0.04) |
| 4 | –0.625*** | 0.276*** | –0.062 |
| | (0.38) | (0.35) | (0.01) |
| 8 | –1.068*** | 0.530*** | 0.157 |
| | (0.52) | (0.46) | (0.01) |
| 12 | –1.238*** | 0.644*** | 0.409 |
| | (0.45) | (0.43) | (0.03) |
| Horizon $h$ | spi | excess returns | interest rate |
| 1 | 0.229 | 0.373 | –14.464*** |
| | (0.00) | (0.01) | (0.22) |
| 4 | –2.186 | –2.041 | –49.121*** |
| | (0.04) | (0.03) | (0.34) |
| 8 | –5.374** | –5.229 | –73.849*** |
| | (0.10) | (0.10) | (0.34) |
| 12 | –9.069** | –8.925 | –66.098*** |
| | (0.22) | (0.21) | (0.19) |

*Notes:* Regression $R^2$ in parenthesis, *** rejection of the null hypothesis at the 1% level, ** at the 5% level and * at the 10% level, based on Newey-West-robust standard errors. Estimated equations: $x_{t+h} - x_t = \alpha_0 + \alpha_1 EC_t + \varepsilon_t$, excess returns $er_t = \Delta \log(SPI_t) - rf_t$, where $rf_t$ is the quarterly average of the daily 3-month LIBOR rates.

### *4.5 Asymmetry Analysis*

A growing body of the recent consumption-wealth literature analyzes nonlinearities. Such nonlinearities can exist if consumers react differently to "good" or "bad" wealth shocks, advocated e.g. in Apergis and Miller (2006) or in Hassan and Barry (2000). Another reason can be herd behavior in financial markets, which may drive asset prices away from their fundamentals and thus, the consumption-wealth relationship to deviate from equilibrium (see Gabriel, Alexandre, and Bação, 2008).

An approach to analyze the possible asymmetry in the equilibrium dynamics is to allow the coefficients to vary depending on the value of a threshold variable, similar as in Enders and Siklos (2011).[12] Two possible threshold variables are considered here. The results are reported in Table 5. First, the coefficients are allowed to vary depending on the sign of wealth growth and second, the coefficients are allowed to vary depending on the sign of the cointegration residual $EC_t$.

**Table 5: Threshold VECM Estimates**

| Regressors | Dependent variables | | | observations |
|---|---|---|---|---|
| | $\Delta c_t$ | $\Delta y_t$ | $\Delta a_t$ | |
| $EC_{t-1}$ if $\Delta a_{t-1} > 0$ | –0.078*** (0.00) | –0.092*** (0.00) | 0.112** (0.04) | 72 |
| $EC_{t-1}$ if $\Delta a_{t-1} < 0$ | –0.102*** (0.00) | –0.067 (0.15) | 0.150*** (0.00) | 43 |
| $EC_{t-1}$ if $EC_{t-1} > 0$ | 0.020 (0.79) | 0.102 (0.50) | 0.178 (0.54) | 47 |
| $EC_{t-1}$ if $EC_{t-1} < 0$ | –0.032 (0.50) | –0.063 (0.39) | 0.401** (0.02) | 68 |

*Notes:* The table only reports results for the coefficients of the error correction term. The estimated VECM includes for each regime 1 lagged growth rate of all variables. Newey-West robust p-values in parenthesis, ** rejection of the null hypothesis at the 5% level and *** at the 1% level.

The coefficient of the error correction term in the consumption equation with $a_{t-1} < 0$ is bigger in absolute value than in the case with $a_{t-1} > 0$ (see the first two lines of Table 5). At first sight this seems to suggest that "bad" news affect

12 Estimating a two-regime threshold cointegration model by maximum likelihood as advocated by Hansen and Seo (2002) is beyond the scope of this paper and is left for future research.

consumption more strongly than "good" news. However, based on an F-test one cannot rule out the possibility that this difference is purely due to chance. Negative wealth changes do not affect consumption significantly differently than positive changes. This finding contradicts results in the previous literature and gives support to the linear model presented above. For example APERGIS and MILLER (2006) find that consumption is more affected by "bad" news than by "good" news.

In contrast, asymmetric behavior seems to exist depending on the sign of the cointegration residual (see lines 3 and 4 of Table 5). Wealth responds particularly strongly if consumption is below its equilibrium (i.e. case $EC_{t-1} < 0$). In this case, lower wealth restores the long-run equilibrium and, vice-versa, a wealth increase makes the wedge even bigger. An economic explanation for why this nonlinearity exists is hard to give. In the literature, herd behavior and fads among financial market participants have been suggested as explanations for periods in which misalignments of asset prices from their fundamentals seemed to have appeared. Fads are ways of excessive optimism or excessive pessimism. If investors suffer more from excessive optimism but less from excessive pessimism, this may explain why this asymmetry in the consumption-wealth ratio exists. An alternative explanation, however, may simply be that this result is merely due to the chosen sample period.[13]

## 5. Conclusion

While the link between wealth and consumption is significant in the long-run, short-run dynamics can move consumption and wealth away from equilibrium. Such periods of disequilibrium can have a duration of up to 3 years and equilibrium is restored by consumers as well as by wealth, in particular through asset prices. If these short-run equilibrium deviations are due to high past wealth growth, a drop in wealth thus helps restore the long-run equilibrium. While this adaptation process of wealth typically occurs within a few quarters, Swiss consumers are much slower to adapt.

On average, 80% of the variation in Swiss wealth that lasts for at least 24 quarters is permanent and it is only to those permanent lasting shocks that Swiss consumers eventually react, while transitory wealth changes do not affect

13 In fact, in the shorter sample from 1990–2009 this asymmetry does not exist. Note, though, that these regressions suffer from insufficient numbers of observations are thus not reported here.

consumption. Compared to results reported in earlier studies, wealth shocks are more often permanent.[14] These differences also have implications for the interpretation of the results. Because consumption and wealth both react to the same permanent shocks, consumers responds less to changes in wealth per se than to changes in the business cycle.

## Appendix

### *A.1 Detailed Data Description*

#### *Consumption*

The consumption data are seasonally adjusted estimates of private consumption. (*Source: SECO*)[15]

#### *Disposable income of private households*

Disposable income of private households is available on an annual basis. As this data series starts only in 1990, SNB internal estimates for the years 1981 to 1989 are added. Quarterly estimates are obtained using Chow-Lin with labor income as the related variable. Nominal data are first transformed into real measures and then seasonally adjusted using the Tramo-Seats method. (*Source: SFSO and SNB*)[16]

#### *Wealth*

Wealth consists of financial wealth and housing wealth:

#### *Financial wealth*

Financial wealth data (*Source: SNB*) are available on an annual basis from 1981–2009. Data for the period 1981–1998 are SNB internal estimates, which are partly gathered numbers from hardcopy prints of the relevant statistics, and for the 1999–2009 period they are the published figures of the Swiss financial accounts as of November 2010.[17] 7 subcategories can be distinguished: receivables from

14 For the US, Lettau and Ludvigson (2004) find that only 10% of the wealth variation is permanent.
15 SECO: State secretariat for economic affairs.
16 SFSO: Swiss Federal Statistical Office, SNB: Swiss National Bank.
17 See www.snb.ch/en.

money and deposit holdings, receivables from loans granted, receivables from share and fund holdings, claims against pension funds and insurances, receivables from structured products, credit liabilities and other liabilities. Quarterly estimates of these annual data were obtained using Chow-Lin with the following related indicators: quarterly money stock M3, the MSCI world index, the Swiss Performance Index (SPI), Swiss and international bond price indices and the quarterly stock of total domestic outstanding mortgages. The quarterly liabilities are deducted from gross wealth to obtain net wealth.

Note that to encourage home ownership, pension funds regulation currently allows households to withdraw under certain conditions parts of their private pension funds to acquire a property. Likewise, pension wealth can also be used as a collateral to purchase the real estate property. In case of a sale of the acquired property, these funds have to be repaid to the pension fund. As of 2010, pension wealth was, after housing wealth, the second biggest wealth component and made up 30% of total net wealth.

*Housing wealth*

Housing wealth is the sum of the market values of all houses, rental apartments and condominiums held by private households.[18] The market values result as a product of the stock of all real estates (*Source: SFSO*) times their average prices. The quarterly housing prices are based on average transaction prices (*Source: IAZI real estate consulting*) and are available for the 3 categories of housing (houses, rental apartments and condominiums). Note that housing prices of the category "rental apartments" had to be estimated for the period 1981–1985. While housing prices are available at the quarterly frequency, the stock of all real estates has to be intrapolated. The exact stock of all houses, rental apartments and condominiums is known annually starting in 2000 and at a 10 year frequency before.[19] For the period pre 2000 annual stock measures of all houses, rental apartments and condominiums are intrapolated in a first step. The flow of newly built houses,

18 The published annual SNB statistic on housing wealth starting in 2000 is based on transaction prices for reference objects at the municipality level. For consistency reasons the transaction prices in this paper are based on a nation-wide average instead. This ensures that the housing wealth is estimated for the whole sample period with the same methodology, but which except for the above mentioned exception does not differ from the methodology used for the published housing wealth. The resulting differences compared to the published figures are less than 0.1% for the years 2000–2009.

19 In 1980 only the stock of inhabited real estates is known and not the uninhabited ones. To account for this fact it was assumed that the fraction of uninhabited real estates in 1980 was the same as in 1990.

rental apartments and condominiums is available at a quarterly frequency and for the whole sample period. The change in the annual stock is thus estimated to be proportional to the number of annually newly built housing units. Quarterly intrapolated stock measures for the entire period 1980–2009 can then be obtained similarly as above using the quarterly flow of newly built houses, rental apartments and condominiums.

*Consumption deflator*

All nominal variables are deflated by the private consumption deflator. (*Source: SECO*)

*Population*

The measure of population is obtained using a cubic spline on the annual total population statistics. (*Source: SFSO*)

## *A.2 Descriptive Statistics and Statistical Tests*

**Table A.1: Descriptive Statistics of Consumption, Income and Wealth**

| | $\Delta c_t$ | $\Delta y_t$ | $\Delta a_t$ |
|---|---|---|---|
| Mean | 0.2% | 0.3% | 0.4% |
| St. dev. | 0.4% | 0.7% | 1.6% |
| Max | 1.4% | 2.5% | 3.9% |
| Min | –1.1% | –1.3% | –4.1% |
| # observations $< 0$ | 33 | 35 | 43 |
| | | Correlation coefficients | |
| $\Delta c_t$ | 1 | 0.24 | 0.29 |
| $\Delta y_t$ | | 1 | 0.18 |
| $\Delta a_t$ | | | 1 |

The unit root tests in Table A.2 suggest the presence of unit roots in the levels of consumption, income and wealth. Their first differences, however, are stationary.

**Table A.2: Unit Root Tests**

| Variable | Level | | 1st difference | |
|---|---|---|---|---|
| | ADF | KPSS | ADF | KPSS |
| Consumption | –1.03 | 0.94*** | –3.92*** | 0.08 |
| Disposable income | –1.37 | 0.92*** | –3.70*** | 0.22 |
| Net wealth | –1.58 | 0.83*** | –5.27*** | 0.07 |

*Notes:* *** rejection of the null hypothesis at the 1% level.

Table A.3 provides the results of JOHANSEN (1991) and ENGLE and GRANGER (1987) tests for cointegration. The JOHANSEN (1991) tests include an intercept, but no trend, and 2 lags of the first differences. The trace test has the null hypothesis of exactly $r$ cointegrating relationships versus $s$ under the alternative, while the maximum eigenvalue test L-max tests $H_0$: $r$ versus $H_1$: $r+1$ cointegrating relationships. These tests can be rejected at the 5% level for $r=0$. As a further test, unit root tests on the residuals were performed as suggested in ENGLE and GRANGER (1987). Residuals are obtained from the following regression:

$$c_t = \alpha_0 + \alpha_1 y_t + \alpha_2 a_t + \varepsilon_t$$

The result of these tests imply stationarity in the residuals and hence support the hypothesis of 1 cointegrating relationship between consumption, income and wealth.

**Table A.3: Cointegration Tests**

| Test | $H_0$ | $c, y, a$ |
|---|---|---|
| Trace | r = 0 | 34.2** |
| | r = 1 | 8.2 |
| | r = 2 | 0.3 |
| L-max | r = 0 | 26.0*** |
| | r = 1 | 7.9 |
| | r = 2 | 0.3 |
| ADF-test | $\varepsilon \approx I(1)$ | –3.0*** |
| KPSS-test | $\varepsilon \approx I(0)$ | 0.2 |

*Notes:* ** rejection of the null hypothesis at the 5% level and *** at the 1% level.

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## SUMMARY

This paper studies the role of wealth fluctuations for aggregate consumption in Switzerland. In the long-run, wealth is found to have a significant effect on consumption. In the short-run, by contrast, the effects are less clear as consumption and wealth sometimes deviate persistently from equilibrium. Such deviations from equilibrium can have a duration of up to 3 years. If these equilibrium deviations are due to rapid wealth growth, Swiss consumers expand their consumption spending less than they could because they perceive large parts of these wealth gains as merely transitory. While they do not adapt to transitory wealth changes, they eventually react to the permanent wealth changes. On average, 80% of the variation in Swiss wealth that lasts for at least 24 quarters is permanent and it is exactly to those permanent lasting shocks that Swiss consumers react. Because consumption and wealth both react to the same permanent shocks, these results can be interpreted as evidence that consumers react less to changes in wealth per se than to changes in the business cycle.