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THE EFFECT OF MACROECONOMIC FACTORS ON STOCK PRICES OF SWISS REAL ESTATE COMPANIES

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Abstract

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Stock values of companies listed on stock exchanges could be influenced by many factors. The aim of this article is to examine existence and character of relationship between stock prices of selected Swiss real estate companies and macroeconomic fundamentals (GDP, interest rate, price level). The existence of long-run equilibrium relationship between stock prices and macroeconomic fundamentals is tested with the Johansen cointegration. The short run dynamics between the variables is examined by Vector Error Correction modelling and the Granger causality test. During the period 2005–2014 we revealed a long-run equilibrium for five of the six analyzed stocks. We also confirmed that macroeconomic variables and the interest rate in particular, can explain a long-run behavior of stock prices. By contrast, macroeconomic variables are usually short in explanation of short-run dynamics of stock prices. However, the results differ substantially among the stocks and, hence, they prevent us from drawing any general conclusion for the entire real estate sector in Switzerland.

Keywords: Stock market, real estate sector, macroeconomic variables, cointegration, Granger causality

INTRODUCTION

Studies of the relationship between macroeconomic fundamentals and stock market development and performance have a long history. Such kind of analysis is object of ongoing interest of academic economists, investors and policy makers. There is a solid economic theory behind this relationship. According to the Efficient Market Hypothesis (Fama, 1970), in an efficient market, all the relevant information about changes in macroeconomic factors are fully reflected in the current stock prices preventing investors from earning abnormal profits. Furthermore, the relationship between stock market and macroeconomic environment is analyzed from an asset-pricing perspective in which the Arbitrage Pricing Theory (Ross, 1976) was used as a framework to address the question of whether risk associated with particular macro variables is reflected in expected asset returns. In more recent literature, the Vector Auto-Regressive (VAR) model in numerous version and specifications has been applied to study the mutual relationship and interactions between stock prices and macroeconomic variables. These models have not been developed on theoretical foundations but rather pragmatically examined the relation within a given dataset.

While the existing literature provides a strong evidence on existence of linkages between stock prices and macroeconomic fundamentals a vast majority of papers have mainly focused on behavior of the general stock market indices. Therefore, the studies usually provide findings on the universal effects of changes and shocks in fundamentals. We argue that each sector in economy exhibits its own characteristics and, therefore, the stock prices or stock market indices in this particular sector may be affected by macroeconomic variables to a different extent than in other sectors of the economy.

This paper focuses on behavior of individual stocks from the real estate sector in Switzerland.

Hence, the results are particularly interesting and valuable for investors and portfolio managers as they reflect strategic (i.e. country selection), tactical (i.e. sector selection) and operative (i.e. individual stock selection) asset allocation. Although the Swiss stock market belongs among the largest and most developed stock markets worldwide it has been overlooked in the empirical literature. In 2014, the SIX Swiss Exchange was the 11th largest stock exchange with market capitalization of USD 1.52 trillion. We believe that the Swiss stock market deserves a special attention because there has been a long-time effect of the Swiss franc (CHF) status of "safe haven" currency, i.e. a currency that offers hedging value against global risk, both on average and especially in crisis periods. Since the franc was for years the safe haven currency in times of stress and uncertainty the assets denominated in CHF (including stocks listed on the Swiss exchange) was attractive for international investors. The real estate sector is worth to analyze because it experienced a gold rush era during the last 10 years. It was more and more evident in 2015 that the lengthy period of growth is drawing to a close and the traditional real estate cycle, in which excess supply replaces the long phase of rising prices, is returning.

The aim of the paper is to examine existence and character of relationship between stock prices of selected Swiss real estate companies and macroeconomic fundamentals. In particular, we test for long-term equilibrium relationships and also analyze short-term dynamics and transmission of shocks from the macroeconomic environment to the stock market. The dataset consists of the stock prices of the following corporations listed on the SIX Swiss Exchange: Allreal Holding AG (ALLN), Intershop Holding AG (ISN), PAX Anlage AG (PAXN), PSP Swiss Property AG (PSPN), Swiss Prime Site AG (SPSN) and Warteck Invest AG (WARN). The macroeconomic variables used in the estimation are GDP growth, interest rate and inflation.

REVIEW OF LITERATURE

Large number of studies have been conducted to examine the effects of macroeconomic variables on stock market. One can classify them according to three essential aspects, namely selected macroeconomic variables, methodology employed and level of development of the stock market analyzed. From the methodological point of view the one approach stems from an asset-pricing perspective in which the Arbitrage Pricing Theory (APT) or some other multi-factor asset pricing model is used to address the question of whether risk associated with particular macro variables is reflected in expected asset returns. The APT has the potential to overcome weaknesses of the Capital Asset Pricing Model (CAPM) since the APT requires less and more realistic assumptions to be generated by a simple arbitrage argument and its explanatory power is potentially better because it is a multi-factor model. However, one can find a frequently applied approach of the consumption-CAPM which concentrates on a single macro influence, particularly the growth of aggregate consumption.

In addition to the theoretically-informed analysis grounded in framework of the CAPM and APT, essentially atheoretical empirical models have also been used to elaborate the relationship between the stock market and the economy. They range from simple single-equation ones to more advanced models which recognize a two-way relationship between the stock markets and the economy. These models are not primarily based on any particular theoretical structure but are developed to capture the empirical regularity between a stock market prices or indices and limited number of macroeconomic factors in a largely more intuitive way. However, all mentioned approaches including the asset-pricing theories share the same assumption and notion that ultimately the stock market reflects development of the economy and fundamental variables so that the direction of influence is from the economy to the stock market.

This paper belongs to the group of empirical studies that primarily aims to identify and describe relationship between the stock prices and macroeconomic variables. Our ambition is neither examination of relationship between stock returns and risk nor seeking for internal value or correct price of analyzed stocks. Therefore, our models are not essentially constructed on postulates of the asset-pricing theories but they respect the main notion and apply appropriate econometric procedures. In this section, we review only literature that is relevant to the scope of the present paper. In particular, we cite here a few papers that focus solely on the Swiss stock market or include the Swiss market to a larger group of several national stock markets. To the best of our knowledge, no study analyzing relationship between stock prices of Swiss real estate companies and macroeconomic indicators has been published.

The paper closely related to our scope is Berlemann and Freese (2012) who studied various sub-segments of Swiss real estate market. They used VAR models to analyze the impulse responses of house and condominium prices, the residential rental market and various sub-segments of the market for commercial real estate to interest rate shocks. They found out that monetary policy has no significant effect on the Swiss stock market, it has also little influence on commercial property prices and that interest rates in Switzerland have significant and robust effect on house and flat prices.

Hess (2003) calculated the importance of various macroeconomic shocks for sector indices of the Swiss stock market. Based on VECM approach he analyzes variance decompositions derived from models estimated in a closed and open economy context. He used three main macroeconomic indicators (GDP, CPI, export) not only from

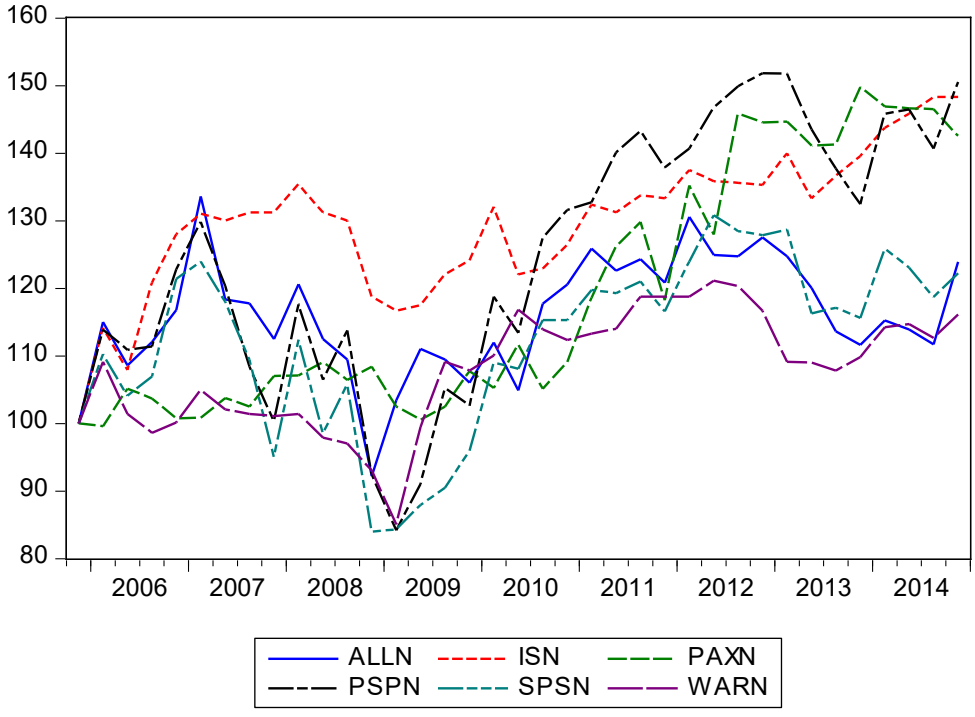
Switzerland but also from G7 countries. The results showed important divergences of stock sub-index sensitivities to innovations in various fundamental variables. Export oriented sectors expectedly react susceptibly to foreign shocks, other sectors seem to be largely unaffected.

The following papers investigated effects of macroeconomic fundamentals in selected developed stock markets including Switzerland. Wasserfallen (1989) examined the effects of unexpected variations in many macroeconomic variables on aggregate stock price indices for Great Britain, West Germany and Switzerland. His results indicate that the effects of macroeconomic news are either very small or obscured by a low signal to noise ratio. Asperem (1989) investigated the relationship between stock indices, asset portfolios and macroeconomic variables in ten European countries. He established that employment, imports, inflation and interest rates are inversely related to stock prices. While expectations about future real activity, measures for money and the US yield curve are positively related to stock prices. The associations between stock prices and macroeconomic variables are shown to be strongest in Germany, the Netherlands, Switzerland and the UK. Nasseh and Strauss (2000) confirmed existence of significant long- run relationships between stock market prices and domestic and international economic activity in six countries – France, Germany, Italy, Netherlands, Switzerland and the UK. They found out that stock price levels are significantly related to industrial production, business surveys of manufacturing orders, short- and long-term interest rate, short-term interest rates, and production.

Two more studies focused on specific aspects of monetary policy and their impact on stock prices and/or returns. Ioannidis and Kontonikas (2007) investigated the impact of monetary policy on stock returns in 13 OECD countries, including Switzerland, over the period 1972–2002. Their results indicate that monetary policy shifts significantly affect stock returns. Concretely the results suggest that in 80 % of the countries under investigation, periods of tight money are associated with contemporaneous declines in stock market value. Caporale *et al.* (2014) examined relationship between stock market prices and Exchange rates in the USA, the UK, Canada, Japan, the euro area and Switzerland, using data on the banking crisis between 2007 and 2010. They found causality-in-variance between stock returns and exchange rate changes in the US and the opposite direction in the euro area and Japan, while there is evidence of bidirectional feedback in Switzerland and Canada.

MATERIALS AND METHODS

As far as the stock prices are concerned, we use data of six real estate companies listed on the SIX Swiss Exchange. This group does not contain all corporations from the sector, but we were forced to eliminate eight more companies because of short time series available. All data on stock revenues were retrieved from the Yahoo Finance database. Based on previous literature and economic rationale



1: *Development of stock prices of selected real estate companies (index, 2005Q4 = 100)*
Source: Yahoo Finance

we use three macroeconomic variables. They are GDP in CHF and current prices, average interest rate for new mortgages, and price level measured by the Harmonised Index of Consumer Prices (HICP). All macroeconomic variables are taken from the Eurostat Economy and Finance database and from the OECD statistical database. Our dataset cover the period 2005Q4–2014Q4 and all data time series employed are on quarterly frequency.

Before the empirical estimation we present overview of the stock prices and macroeconomic variables development along with elementary descriptive statistics. Fig. 1 depicts development of the closing stock prices of the selected real estate companies during the estimated period. For better comparison of the stock prices development we depict the prices in index. It is evident from the graph that all stocks strengthened over the period of analysis. However, one can distinguish two groups of stocks. While the group containing ISN, PAXN and PSPN strengthened of around 50 %, the group of ALLN, SPSN and WARN recorded an increase of stock prices of about 20 %. There can be seen that oscillations of stock prices of ALLN, PSPN and SPSN are very similar. The largest declines in stock prices are observable for all companies in the beginning of the global financial crisis in 2008. Moreover, ALLN, SPSN and WARN experienced a significant drop in stock prices also in 2012 and first half of 2013.

Tab. I shows descriptive statistics of the stock prices of the six selected companies. We report all the standard indicators and two computed indicators of variability, i.e. coefficient of variation (relative standard deviation) and the range. The coefficient of variation is defined as the ratio of the standard deviation to the mean. The range is calculated as the difference between maximum and minimum over the mean. The most volatile stocks over the period examined were PAXN and PSPN with the coefficient of variance around 15 %. The stock of SPSN exhibited slightly lower variance around 11 %. The remaining three stocks were considerably less volatile with the coefficient of variation around 8 %. Similar conclusions can be drawn on values of the range indicator. However, the range of the PSPN is the only one exceeding 50 %. Furthermore, we can point out that all stock prices except of PAXN are negatively skewed and only two stocks (ALLN and ISN) show an excess kurtosis and leptokurtic distribution with meaning fatter tails and lesser risk of extreme outcomes.

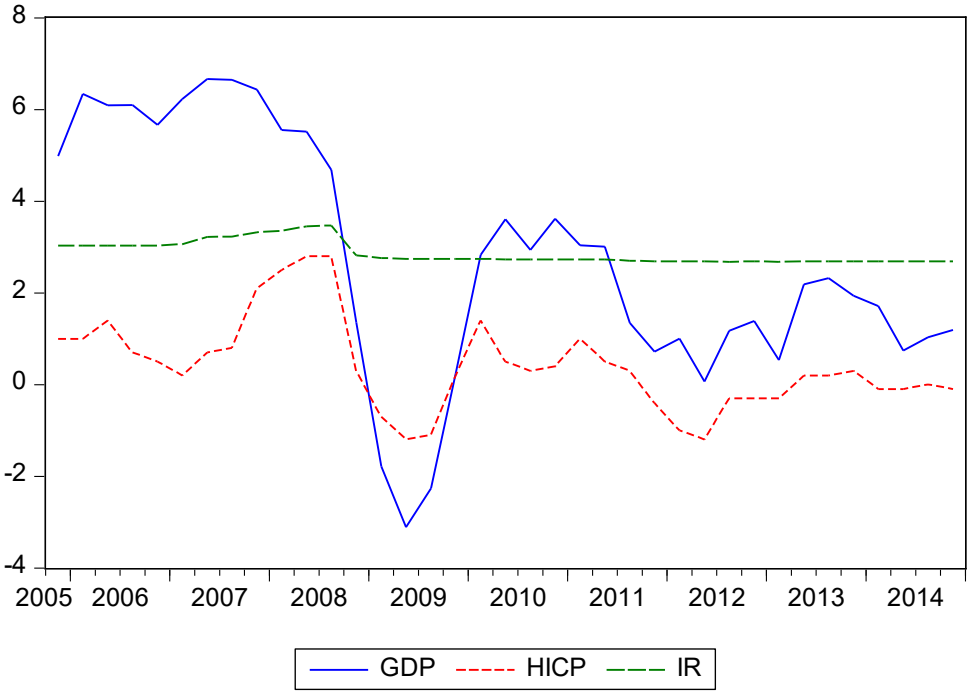
Fig. 2 demonstrates behavior of selected macroeconomic variables, namely GDP growth rate, HICP inflation and interest rate. Although we use the GDP in current prices and value of the HICP index in our models and empirical estimations Fig. 2 depicts GDP growth rate and inflation rate which are better indicators for illustration of the macroeconomic environment during the period of estimation. While the interest rate exhibits very stable development the inflation rate and GDP growth are typical by high fluctuations. The GDP growth and inflation seem to co-move tightly especially during the crisis and post-crisis period. One can register a remarkable decline in the GDP growth and inflation rates particularly in 2009 when the global financial crisis culminated. Both macroeconomic indicators dropped substantially to negative values with minimum at –3.1 % for GDP growth and –1.2 % for inflation in the second quarter of 2009. The economy of Switzerland followed a post-crisis development path similar to other European developed economies. After a rebound in GDP growth as well as inflation in 2010 and first half of 2011 the economy slowed down again in the following year. Although some signs of recovery are evident in the last year of examination period it should be reminded that the Swiss National Bank suddenly announced in January 2015 that it would no longer hold CHF at a fixed exchange rate with the euro. Subsequently, the franc soared substantially making considerable pressures on competitiveness of the Swiss economy.

The descriptive statistics of the macroeconomic variables is provided in Tab. II. The reported values generally confirm that volatility of macroeconomic variables is rather standard and universally lower than volatility of the stock prices. While the GDP and HICP are macroeconomic variables with negative skewness and kurtosis lower than three, the interest

I: *Descriptive statistics of stock prices*

	C_ALLN	C_ISN	C_PAXN	C_PSPN	C_SPSN	C_WARN
Mean	128.2995	311.6554	905.9459	71.0932	67.0097	1608.6130
Median	127.5000	315.0000	830.0000	72.6500	69.0500	1624.4700
Maximum	147.8180	356.0000	1140.0000	86.5500	78.1358	1803.1600
Minimum	102.0420	240.0000	758.0000	48.0000	50.1491	1266.1300
Std. Dev.	9.6276	25.2656	138.1859	11.0346	7.6776	126.6547
Coeff. Var.	0.0750	0.0811	0.1525	0.1552	0.1146	0.0787
Range	0.3568	0.3722	0.4217	0.5422	0.4177	0.3338
Skewness	–0.3515	–0.6228	0.5382	–0.2802	–0.7073	–0.5038
Kurtosis	3.1922	3.5764	1.5959	1.9407	2.5879	2.7293

Source: Authors' calculations



2: *Development of selected macroeconomic variables (in %)*
Source: Eurostat Economy and Finance database and OECD database

rate is positively skewed and shows kurtosis higher than three.

After introduction of the dataset we present the methodology applied in the paper. The first step in empirical estimation is checking the stationarity of the time series. There have been a variety of proposed methods for implementing stationarity test and principally Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test have been widely used in econometric literature. Also this study executes both unit root tests to investigate whether the time series are stationary or not. Then we run the correlation analysis to determine the relationship between stock prices and macroeconomic factors.

If the series under consideration turn out to be integrated in the same order, it is possible to proceed testing for cointegration relationships between the integrated variables. In this paper, cointegration tests were carried by means of the Johansen method.

The Johansen method applies the maximum likelihood procedure to determine the presence of cointegrating vectors in non-stationary time series as a vector autoregressive (VAR):

$$\Delta Y_t = C_0 + \sum_{i=1}^{p-1} \Gamma_i \Delta Y_{t-1} + \Pi Y_{t-1} + \eta_t \qquad (1)$$

where Y_t is a vector of non-stationary (in log levels) variables, C_0 is the constant term and is the white noise term. The information on the coefficient matrix between the levels of the is decomposed as where the relevant elements the matrix are adjustment coefficients and thematrix contains the cointegrating vectors. In the framework of Johansen cointegration two likelihood ratio test

II: *Descriptive statistics of macroeconomic variables*

	GDP	HICP	IR
Mean	150043.9	100.56	2.8672
Median	151052.0	100.90	2.7300
Maximum	161407.0	102.40	3.4700
Minimum	129678.0	97.90	2.6800
Std. Dev.	8550.58	1.2017	0.2462
Coeff. Var.	0.0569	0.0120	0.0858
Range	0.2114	0.0497	0.2755
Skewness	-0.7605	-0.9317	1.2082
Kurtosis	2.7885	2.9971	3.0924

Source: Authors' calculations

statistics are specified to test for the number of cointegrating vectors. The first likelihood ratio statistics for the null hypothesis of exactly r cointegrating vectors against the alternative $r + 1$ vectors is the maximum eigenvalue statistic. The second statistic for the hypothesis of at most r cointegrating vectors against the alternative is the trace statistic.

If the variables are non-stationary and are cointegrated, the adequate method to examine the issue of causation is the Vector Error Correction Model (VECM), which is a Vector Autoregressive Model (VAR) in first differences with the addition of a vector of cointegrating residuals. Thus, this VAR system does not lose long-run information. We apply the following VECM specification:

$$\Delta y_t = \Pi y_{t-k} + \Gamma_1 \Delta y_{t-1} + \Gamma_2 \Delta y_{t-2} + \ldots + \Gamma_{k-1} \Delta y_{t-(k-1)} + u_t \quad (2)$$

In the absence of any cointegrating relationship between the variables, the standard Granger causality test would be applied to determine the direction of short-run dynamics i.e. interdependences between the stock prices and macroeconomic variables in our sample. The Granger test involves the estimation of the following equations:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{q} \beta_{1i} \Delta Y_{t-i} + \sum_{i=1}^{q} \beta_{2i} \Delta X_{t-i} + \varepsilon_{1t} \quad (3)$$

$$\Delta X_t = \phi_0 + \sum_{i=1}^{r} \phi_{1i} \Delta X_{t-i} + \sum_{i=1}^{r} \phi_{2i} \Delta Y_{t-i} + \varepsilon_{2t} \quad (4)$$

in which Y_t and X_t represent stock prices and macroeconomic variables. and are uncorrelated stationary random processes, and t denotes the time period. Failing to reject the $H_0: b_{21} = b_{22} = \ldots = b_{2q} = 0$ implies that macroeconomic fundamentals do not Granger cause stock prices. Likewise, failing to reject $H_0: j_{11} = j_{12} = \ldots = j_{1r} = 0$ suggest that stock prices do not Granger cause macroeconomic variables.

EMPIRICAL RESULTS

Correlation Analysis and the Lag Length Structure

Before we proceed with cointegration analysis, it is appropriate to calculate correlation coefficients between the stock prices and macroeconomic fundamentals and to determine the correct lag applied in the cointegration tests. The correlation matrix is shown in Tab. III. The results can be summarized into three key findings. First, while the correlation coefficients between the stock prices and GDP and stock prices and HICP are uniformly positive, the coefficients between prices of all stock and interest rate are negative. Such results are perfectly in accordance with theoretical assumptions. Whereas increasing GDP and price level should be accompanied by rising stock prices, an increasing interest rate is likely to occur along with decreasing stock prices. Second, the only macroeconomic variable that displays significant correlation coefficients regularly higher than 0.5 is the GDP. The coefficients of the two remaining macroeconomic variables are substantially lower and/or insignificant which indicates that the co-movements with stock prices are not strong. Third, there are substantial differences among individual stocks. While PAXN and WARN show statistically significant coefficients with all macroeconomic variables the stock prices of ALLN and SPSN exhibit statistically significant (at standard significance levels) correlation with only one fundamental. Although correlation and cointegration have different meaning and interpretation, it is useful to know whether cointegrated variables with long-term equilibrium relation are also correlated and move together.

Because Johansen cointegration test is sensitive to the lag length an optimal lag structure should be chosen before running the cointegration tests. We used three different information criteria, i.e. Akaike information criterion, Schwarz information criterion and Hannan – Quinn information criterion applied on the non-differenced VAR model to select optimal lag length for every cointegration test. Based on the consensus of the three criteria we set the appropriate lag to one, i.e. one quarter as we employ time series on quarterly frequency.

Cointegration Analysis

On the basis of the above mentioned unit root tests and lag length selection criteria we performed Johansen cointegration tests to see whether there is a long-run equilibrium between the logs of stock prices and logs of macroeconomic fundamentals. The results of cointegration tests are summarized in Tab. IV. We report estimated trace statistics and maximum eigenvalue statistics for the null hypothesis of no cointegration (r = 0), one cointegration vector (r ≤ 1), two cointegration vectors (r ≤ 2) and three cointegration vectors (r ≤ 3),

III: *Correlation matrix*

	ALLN	ISN	PAXN	PSPN	SPSN	WARN
GDP	0.3439 **	0.8226 *	0.8199 *	0.6414 *	0.4322 *	0.5660 *
HICP	0.1210	0.5060 *	0.4520 *	0.2865 ***	0.0807	0.3688 **
IR	–0.1572	–0.2660	–0.5957 *	–0.4671 *	–0.2848 ***	–0.6042 *

Source: Authors' calculations
Note: *, ** and *** denote significance at 1, 5 and 10 % levels

respectively. If the cointegration is revealed we also report the estimated cointegration equation.

As it is evident from Tab. IV, the stock prices and macroeconomic variables proved to be cointegrated in five out of six models estimated. No long-run equilibrium relation between stock prices and macroeconomic variables was revealed in the ALLN model. As we require both test statistics to provide a similar outcome, in four cases we found two cointegrating vectors and in the model of PAXN we revealed three cointegrating vectors at the five percent significance level. Although stock prices of the analyzed real estate companies seem to have long-run linkages with macroeconomic variables the estimated coefficients in the cointegration equations do not allow us to draw any universal conclusion applicable to all real estate companies. However, one can register generally negative effect of all macroeconomic fundamentals. The most notable exception is the cointegration equation with ISN stock prices in which all macroeconomic variables obtained positive signs. Regarding the significance, one can see that not all estimated coefficients are statistically significant, which makes formulation on any universal conclusion for the entire real estate sector even less possible. Although there is no single cointegration equation with all coefficients estimated being significant the interest rate seems to be significant in most of the models. On the other hand, the price level measured by HIPC was recognized as significant only in one equation. The effect of GDP on stock prices turned out to be significant in four models.

Given the VEC mechanism that is embedded in the Johansen's procedure, the deviation from long-run equilibrium is corrected through a series of partial short-run adjustments. The VECM specification restricts the long-run behavior of the variables in the system to converge to their long-run relationship while allowing a wide range

IV: *Results of Johansen cointegration tests*

	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
ALLN / GDP, HICP, IR				
Trace Statistics	43.4439	24.6257	11.8227	2.3362
Max-Eigen Statistics	18.8181	12.8030	9.4865	2.3362
ISN / GDP, HICP, IR				
Trace Statistics	82.0459 *	42.9097 *	16.7096	3.8304
Max–Eigen Statistics	39.1361 *	26.2002 **	12.8792	3.8304
Equation	ISN = –129.4897 + 6.0909 GDP + 12.9330 HICP + 2.4211 IR (1.5614) (6.7714) (0.6785)			
PAXN / GDP, HICP, IR				
Trace Statistics	88.1618 *	46.3967 *	23.7639 **	7.7059
Max-Eigen Statistics	41.7651 *	22.6328 *	16.0580 **	7.7059
Equation	PAXN = 107.5980 – 0.3515 GDP – 20.3307 HICP – 2.3467 IR (1.4168) (6.2087) (0.6089)			
PSPN / GDP, HICP, IR				
Trace Statistics	86.0656 *	45.9127 *	24.2854 **	11.0157 **
Max-Eigen Statistics	40.1529 *	21.6273 **	13.2697	11.0157 **
Equation	PSPN = 226.8751 – 8.2021 GDP – 25.7248 HICP – 5.0573 IR (3.6555) (15.8096) (1.5611)			
SPSN / GDP, HICP, IR				
Trace Statistics	85.5889 *	46.6586 *	23.7655 **	10.0544 **
Max-Eigen Statistics	38.9303 *	22.8931 **	13.7110	10.0544 **
Equation	SPSN = 379.7699 – 14.4481 GDP – 42.1101 HICP – 7.3719 IR (5.6447) (23.8434) (2.3905)			
WARN / GDP, HICP, IR				
Trace Statistics	95.5985 *	45.9660 *	18.4351	4.6476
Max-Eigen Statistics	49.6325 *	27.5309 *	13.7874	4.6476
Equation	WARN = 14.5909 – 0.7842 GDP + 0.6887 HICP – 0.9091 IR (0.3714) (1.6052) (0.1624)			

Source: Authors' calculations

Note: * and ** denote significance at 1 % and 5 % levels. The critical value of trace statistics for the null hypothesis of no cointegration (r = 0) is 54.08 (5 % level), for the null hypothesis of at most one cointegrating relationship (r ≤ 1) is 35.19 (5 % level), for the null hypothesis of at most two cointegrating relationship (r ≤ 2) is 20.26 (5 % level) and for the null hypothesis of at most three cointegrating relationship (r ≤ 3) is 9.16 (5 % level). The critical values of Max-Eigen statistic for the same hypotheses are 28.59, 22.30, 15.89 and 9.16 (all at 5 % level). The numbers in parentheses beneath the standard error.

of short-run dynamics. Number of lags is set to one for all models and similarly with prior estimations, the optimal number was set according to Akaike information criterion. Tab. V shows the estimates of the VECM for each of the five models where cointegration appeared.

The coefficients of the error correction parameter CointEq1 are statistically significant in four models (except PAXN), which confirms that the variables included in the models show a causal relation with the respective stock prices. Statistically significant error correction parameter also demonstrates an ability of the model to explain short-run dynamics and convergence towards a long-run equilibrium. The sign of the error correction coefficient is negative in three cases (PSPN, SPSN and WARN) and positive in one case (ISN). Negative sign suggests that increase of macroeconomic fundamentals has a negative impact on stock prices and vice versa. The size of the adjustment coefficient is generally low and does not exceed 6 % for ISN, PSPN and SPSN. The only sufficiently high adjustment coefficient was obtained in the WAXN model. In particular, it clarifies that almost 35 % of deviations from the long-run equilibrium is corrected in a following quarter. The speed of correction and convergence towards the equilibrium is relatively high. Sporadically, other variables are also significant and help to explain short-run dynamics of the models.

The short-run dynamics of the system where no long-run causality appeared may be examined by performing bivariate Granger causality tests. Moreover, we apply the tests with the aim to provide additional information and results where the cointegration between stock prices and macroeconomic fundamentals exists. Granger causality test requires that all data series involved are stationary. Accordingly, we employed the first differences of all level series. The test results of Granger causality are given in Tab. VI. Number of lags was chosen applying Akaike information criterion, whilst one lag was identified as an optimal lag length in majority of cases.

The results obtained provide no support for the argument that the lagged values of changes in macroeconomic variables Granger cause variations in stock prices. The values of F -statistics suggests that not a trace of short-run dynamics can be observed between fundamentals and stock prices of all real estate companies. In fact, the Granger causality was identified in opposite direction. Stock prices of ALLN, ISN and PAXN were found to Granger cause price level measured by HICP. However, such a result is out of scope of present paper and deserves a special attention in order to find out whether it is only coincidence or there are serious consequences.

V: *Results of the Vector Error Correction Models*

	ISN	PAXN	PSPN	SPSN	WARN
CointEq1	0.0573 (0.0186) [3.0804]	-0.0020 (0.0249) [-0.0833]	-0.0507 (0.0166) [-3.0548]	-0.0265 (0.0112) [-2.3690]	-0.3487 (0.0536) [-6.4988]
Stock Price (-1)	-0.4051 (0.1653) [-2.4497]	-0.4580 (0.1671) [-2.7401]	-0.1261 (0.1679) [-0.7519]	-0.2873 (0.1825) [-1.5739]	0.0882 (0.1072) [0.8230]
GDP (-1)	-1.6543 (1.1733) [-1.4100]	1.9088 (1.4601) [1.3073]	-5.9872 (2.2283) [-2.6867]	4.8691 (2.3072) [-2.1103]	-3.8013 (0.6899) [-5.5098]
HICP (-1)	0.72687 (1.1293) [0.6436]	0.4294 (1.5159) [0.2833]	4.9928 (2.2890) [2.1812]	3.7437 (2.3785) [1.5739]	0.5525 (0.8757) [0.6309]
IR (-1)	0.4510 (0.2338) [1.9325]	0.0020 (0.2843) [0.0070]	0.9736 (0.4720) [2.0625]	0.6568 (0.5077) [1.2935]	1.0676 (0.1854) [5.7557]
R^2	0.2797	0.2687	0.3162	0.2525	0.6386
Adj. R^2	0.1836	0.1712	0.2250	0.1529	0.5904
F-statistics	2.9117	2.7557	3.4678	2.5347	13.250

Source: Authors' calculations
Note: Standard errors in round brackets and t-statistics in square brackets. All variables used in the VECM are first differenced.

VI: *Granger Causality tests*

	F-statistic	Probability
	ALLN	
GDP → ALLN	1.08205	0.3060
ALLN → GDP	1.21423	0.2787
HICP → ALLN	0.06072	0.8069
ALLN → HICP	15.6584*	0.0004
IR → ALLN	1.70914	0.2004
ALLN → IR	1.08882	0.3046
	ISN	
GDP → ISN	1.04567	0.3142
ISN → GDP	0.04856	0.8270
HICP → ISN	0.38548	0.5391
ISN → HICP	6.44588**	0.0162
IR → ISN	0.90652	0.3482
ISN → IR	0.52834	0.4726
	PAXN	
GDP → PAXN	0.08668	0.7703
PAXN → GDP	0.89865	0.3502
HICP → PAXN	1.21818	0.2779
PAXN → HICP	2.94012***	0.0961
IR → PAXN	1.44240	0.2386
PAXN → IR	0.26515	0.6101
	PSPN	
GDP → PSPN	0.12271	0.7284
PSPN → GDP	0.21030	0.6496
HICP → PSPN	2.19873	0.1479
PSPN → HICP	2.04382	0.1625
IR → PSPN	0.98564	0.3283
PSPN → IR	0.20680	0.6524
	SPSN	
GDP → SPSN	0.00924	0.9240
SPSN → GDP	0.00093	0.9758
HICP → SPSN	0.99883	0.3251
SPSN → HICP	2.57515	0.1184
IR → SPSN	0.19143	0.6647
SPSN → IR	0.36106	0.5522
	WARN	
GDP → WARN	0.14338	0.7074
WARN → GDP	1.20345	0.2808
HICP → WARN	0.34047	0.5637
WARN → HICP	0.05998	0.8081
IR → WARN	1.42329	0.2416
WARN → IR	0.18180	0.6727

Source: Authors' calculations
Note: *, ** and *** denote significance at 1, 5 and 10 % levels.

CONCLUSION

This paper examined the relation between three macroeconomic variables and stock prices of six real estate companies from Switzerland listed on the SIX Swiss Exchange. The examination period of 2005 – 2014 was typical of volatile development of GDP growth and inflation rate mostly caused by the global financial crisis and subsequent economic slowdown. On the other hand, the real estate sector went through a period of solid and gradual growth and financial markets in Switzerland were influenced by a status of CHF as a "safe haven" currency.

We used Johansen cointegration test to inspect presence of long-run equilibrium relationships between stock prices and macroeconomic fundamentals. Our conclusions were that stock prices of five Swiss real estate companies formed significant relationships with some of the macroeconomic variables. We found no company exhibiting relationship with all the variables but revealed one company whose stock prices are not cointegrated with any of the macroeconomic fundamentals (Allreal Holding AG). Since the results of cointegration tests differ among companies it is difficult to provide any general conclusion. However, one can summarize that the macroeconomic fundamentals

used in the analysis generally have a negative impact on stock prices. The most prominent predictor of the long-run developments of the Swiss real estate stock prices is the interest rate on new mortgages on stock prices with its negative impact, which is in accordance with theory and our expectations. We supplemented results on long-run equilibrium relationship with results on short-run dynamics between stock prices and macroeconomic variables employing VECM estimations and Granger causality tests. We found very rare examples of macroeconomic variable that explain changes in stock prices within the VECM framework. The speed in which the deviations from the long-run equilibrium are corrected is relatively slow with exception of Warteck Invest AG. More concretely, almost 35 % of deviations from the long-run equilibrium is corrected in a following quarter in this model. We found no example of macroeconomic variable that Granger causes stock prices. In three cases, a causality in opposite direction going from stock prices to HICP price level was recognized. The conclusions drawn from this study are beneficial in two ways. First, the paper shows whether there exist opportunities in the Swiss real estate sector for profit from inefficiencies of stock market mechanisms in the transfer and absorption of information from macroeconomic environment. Second, whether stock picking from the stock available in the Swiss real estate sector could lead to a superior earning capability.

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