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## **The effect of exchange rate appreciation on growth: The case of Switzerland**

### **Abstract**

The Swiss franc has had a reputation as a safe haven investment for decades, due to stable economic and political conditions in Switzerland. As a result, capital inflow has been high during times of financial stress around the world, in turn causing appreciating pressure on the real exchange rate. The financial crisis of 2008 was such a period, forcing the Swiss National Bank to peg the Swiss franc to the euro. When the peg was dropped, in January 2015, the markets were shocked and the exchange rate soared in relation to both the euro and the US dollar. This paper examines the effects this dramatic appreciation may have on Switzerland's rate of output growth, as well as on exports and imports. While the empirical results conclude a negative effect is to be anticipated, circumstances with possible dampening effects are discussed.

*Key words: exchange rate, overvaluation, Switzerland*

**Table of contents**

- 1 INTRODUCTION ..... 3
- 2 BACKGROUND..... 5
  - 2.1 *The Swiss Franc as a safe haven currency* ..... 5
    - 2.1.1 A brief history ..... 5
    - 2.1.2 Recent events ..... 6
  - 2.2 *Switzerland as an exporting nation* ..... 9
- 3 GROWTH AND THE REAL EXCHANGE RATE – A THEORETICAL FRAMEWORK ..... 10
- 4 EMPIRICAL ANALYSIS ..... 13
  - 4.1 *Model* ..... 13
  - 4.2 *Data* ..... 15
    - 4.2.1 Sources ..... 15
    - 4.2.2 Data presentation ..... 16
  - 4.3 *Results* ..... 17
    - 4.3.1 Implications for trade ..... 21
- 5 CONCLUDING REMARKS ..... 24
- 6 REFERENCES ..... 25
  - 6.1 *Printed sources* ..... 25
  - 6.2 *Electronic sources* ..... 30

## 1 Introduction

On January 15<sup>th</sup> 2015, the Swiss National Bank (SNB) announced that the cap on the Swiss franc (CHF), no longer was to be enforced. The ceiling on the exchange rate had since September 6<sup>th</sup> 2011 pegged the franc to the euro at a maximum rate of 1.20. The markets were taken by surprise causing turmoil in which the Swiss franc soared and the Swiss stock market plunged (IMF(a), 2015). Axel Weber, the chairman of UBS, were among those who considered the decision sound (Barkin, 2015), while Swatch Chief Executive Nils Hayek called it a "tsunami", considering shares of the global watch brand fell 16 % after the announcement (Jolly & Irwin, 2015).

In the first few hectic hours on January 15<sup>th</sup>, the CHF appreciated some 40 % against the euro and almost 28 % against the US dollar (p.32, IMF(a), 2015; Forgione, 2015), keeping in mind that movements around 2 % are regarded as large within foreign exchange markets (Inman, 2015). Jean-Pierre Danthine, Vice President of the SNB, acknowledged a few years earlier that "when financial forces push a currency so far away from its fundamental value so quickly, the consequences are very real" (p.10, Danthine, 2011).

How Switzerland will handle the coming challenges and how quickly markets adjust to the new conditions is yet to be seen. What will the consequences of the dramatic real exchange rate appreciation be for Swiss economic outlook, in terms of output growth? This question is of central significance, and therefore the cardinal issue of interest in this paper.

A currency is generally considered to possess safe haven properties when negatively correlated, or uncorrelated, with global equity volatility and/or provides hedging benefits in times of unusual stress by appreciating when market risk increases (Rinaldo & Söderlind 2010; Kohler, 2010). The Swiss Franc has been found to inhibit such properties, causing massive financial inflows to the Swiss financial system during periods of high market risk (de Carvalho Fihlo & Reinout, 2015).

In the aftermath of the global financial crisis of 2008, the Swiss Franc's status as a safe haven placement, and the capital inflows that followed, put exorbitant pressure on the

exchange rate. In just four years the CHF appreciated from 1,61 EUR/CHF on January 1<sup>st</sup> 2007 to 1,25 EUR/CHF on the same date 2011 (ECB, 2015). According to the SNB, “the current massive overvaluation of the Swiss Franc poses an acute threat to the Swiss economy and carries the risk of a deflationary development”. In an attempt to counteract, the SNB on September 6<sup>th</sup> 2011 imposed a ceiling on the CHF on 1,20 per Euro and declared to “enforce this rate with the outmost determination and [the SNB] is prepared to buy foreign currency in unlimited quantities” (SNB(a), 2011).

As the euro continued to depreciate, the SNB indeed were forced to purchase enormous amounts of foreign currency for the ceiling to hold (p.43-51, SNB(a), 2015). Recently, the euro has depreciated against the US dollar, in turn weakening the Swiss Franc. Therefore, “the SNB concluded that enforcing and maintaining the minimum exchange rate for the Swiss franc against the euro is no longer justified” (SNB(b), 2015). Some mean SNB’s decision-making were highly influenced by expectations of large quantitative easing packages from the European Central Bank (ECB), which would further depreciate the euro against the Swiss franc (Spence, 2015).

As only a few months have past since the ceiling pegging the Swiss Franc to the euro was abandoned, a historical approach is the most suited to establish the possible future outcomes for Swiss growth. Switzerland is a small, open economy highly dependent on its export sector (FDFAb, 2015), and it is therefore highly relevant to review the possible effects the exchange rate may have on exports as well as imports, as complement to output.

My research shows that Swiss output growth will be negatively affected by the large recent appreciation of the Swiss Franc, however, the decline is not very large. There may also be dampening effects such as the economic recovery in Europe. Although no statistically confirmed effects are found regarding the effect on imports or exports, a discussion on the possible outcomes in the light of Switzerland’s highly sophisticated export basket can provide interesting points and subjects for further future research.

The remainder of this paper will be organized as follows. Section 2 provides a background to the Swiss Franc and its history as a strong currency, as well as portraying Switzerland as an exporting nation. This section intends to supply a context for

understanding the reasons behind the recent appreciation, as well as the underlying factors for the analysis of the results. Section 3 lays the theoretical foundation for the empirical analysis, aimed to shed light on previous research on the area and provide a discussion on possible effects of exchange rate appreciation on Swiss output and trade growth. Thenceforth, section 4 contains the empirical part of the paper. The section initially defines the model used, thereafter presents the empirical results and discusses the implications for the Swiss growth and trade development. Lastly, section 5 concludes the study.

## **2 Background**

### **2.1 The Swiss Franc as a safe haven currency**

#### ***2.1.1 A brief history***

The Swiss Franc (CHF) was introduced as the monetary unit of Switzerland after the passing of the Federal Coinage Act in 1850 (FDF, 2015). Before then, the different cantons all produced local monies, although some 80 % of the some 8000 different coins in circulation were foreign, brought back by mercenaries. Although different private money-issuing institutions issued francs, the money-issuing power was eventually concentrated to one bank in order to control the money supply. Officially, the Swiss National Bank through national vote assumed its position as central bank in 1907 after the Federal Act on the Swiss National Bank had taken effect a few months earlier (SNB, 2014).

After the First World War, the SNB managed to bring their war-induced high inflation to a stable level faster than many other countries. As most other European nations struggled with instable monetary conditions during the 1920's, Switzerland could begin to evolve into the financial safe haven it is known as today. Political and economic instability continued throughout Europe in the 1930's, which favored the Swiss financial system. Especially large were the capital flows from the United States and France during this time (p. 70-73, Abegg, 2007).

For centuries, Switzerland has held a neutral stance in armed conflicts, meaning the country will not take active part in conflicts unless attacked (Aeschimann et al, 1998).

Though Swiss neutrality in practice has been up for discussion, especially regarding its actions during WWII (e.g. Vagts, 1997), the country has not had any armed conflicts within its borders since the 19<sup>th</sup> century. This induced more stable political and economic conditions, which in combination with its geographical location, multilingualism and commitment to a free market are important explanatory factors to the Swiss success (Linder, 1985; Ikle, 1972).

Low inflation, low real exchange rate volatility and well-developed financial institutions further proved Swiss banks attractive for foreign investors. The secure and secretive nature of the Swiss banking system, low corporate taxes and efficient capital markets continue to attract foreign investors to the country. The banking sector along with the insurance sector today amount to 11 % of the country's GDP in value added (FDFAb, 2015)

### ***2.1.2 Recent events***

The global financial crisis of 2008 commenced when financiers issued large amounts of sub-prime mortgage loans in the United States, highly overvalued due to the housing price bubble that started in 2001 and peaked in 2005. These mortgage loans were then pooled together, creating allegedly low-risk securities, and sold as packages to large banks. The pooled mortgages were in turn used to back collateralized debt obligations (CDOs) created by the banks. As investors found interest rates to be low and stable, they borrowed money to amplify their investments, assuming that the returns on the risky investments would be larger than the cost of the loans (Bianco, 2008).

When the American housing market turned, however, the value of mortgage-backed securities delapsed and supposedly safe CDOs proved more or less worthless. The effects of the slumping housing market quickly rippled through to the money market. Trust-issues crippled the short-term credit system, paralyzed banks and financial institutions and causing those most dependent on it to collapse (Bianco, 2008).

Due to increased globalization and interlinking between countries and financial institutions, the effects of the crisis rapidly spread from the US to Europe. These effects were in some states magnified by pending housing bubbles, e.g. in Ireland and Spain

(Moghadam, 2009). Posteriorly, these events have entailed the ongoing Eurozone crisis, mainly ascribable to high national debt in several member states (Simon & Hausner, 2012).

As uncertainty spread through the markets, investors sought safe-haven placements. As the previous historical review showed, the Swiss economy is found stable and safe for investment in times of turmoil (Danthine, 2011). Figure 1 shows increased capital flows in the service sector, within both trade and financial companies, following the volatile years of the financial crisis. Compared to the capital inflows to the manufacturing sector with no such distinct upward trend, pictured in figure 2, it is evident how capital from investors surged into the Swiss financial sector.

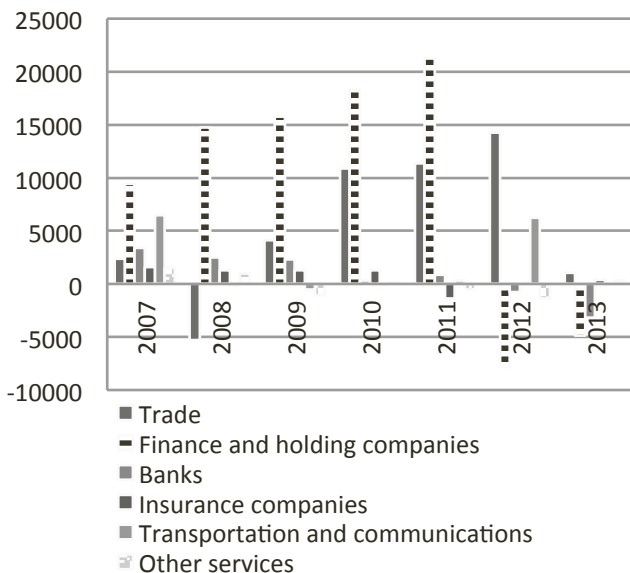


Fig. 1 Capital inflow (CHF millions) from service sector (SNB(d), 2015)

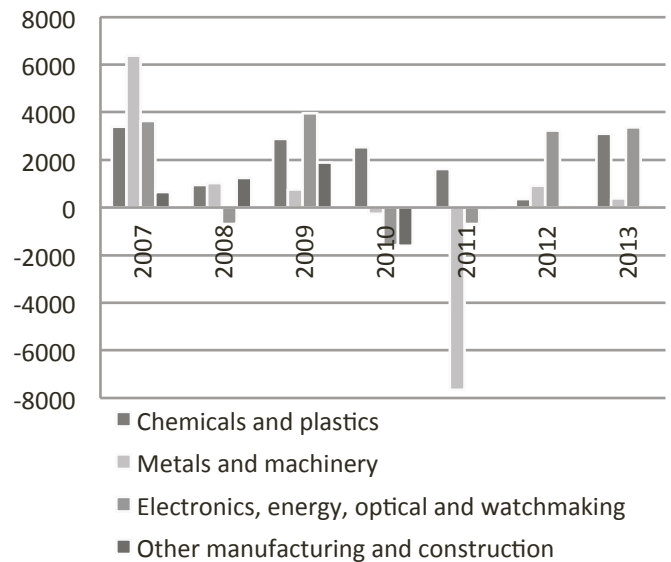


Fig. 2 Capital inflow (CHF millions) from goods sector (SNB(d), 2015)

Capital inflows of this magnitude cause appreciating pressure on the real exchange rate, and so the Swiss Franc appreciated (de Carvalho Fihlo & Reinout, 2015). Figure 3 illustrates the EUR/CHF and USD/CHF movements following the crisis years, elucidating the massive overvaluation of the real exchange rate caused by the capital inflow.

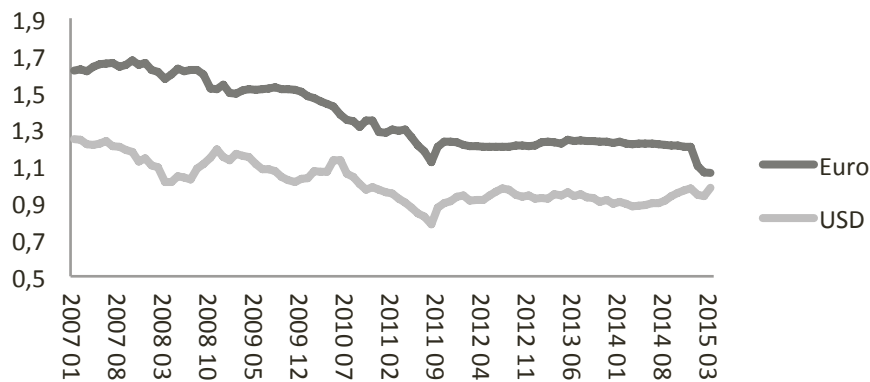


Fig. 3: Monthly average of foreign currency/CHF, (SNB(e), 2015).

To restrain the dramatic appreciation, the SNB announced a capping of the Swiss Franc against the Euro at a 1,20 EUR/CHF, on September 6<sup>th</sup> 2011. As stated in the introduction, the SNB claimed the massive overvaluation of the Swiss Franc “an acute threat to the Swiss economy”, and vouched to defend the cap with all means possible (SNB(a), 2011). Unfortunately, this proved to be a difficult task. As European economic recovery moved with slow progress, the Euro continued to depreciate forcing the SNB to purchase enormous amounts of foreign currency; Euros, Sterling, US and Canadian dollars and Japanese Yen. In 2014 alone, the SNB purchased foreign currency amounting to CHF 25.8 billion to defend the minimum exchange rate, raising the total amount of reserves to CHF 561 billion (p.43-51, SNB(a), 2015).

On January 15<sup>th</sup>, the SNB shocked the markets by announcing the abandonment of the cap. According to the press release, “the minimum exchange rate was introduced during a period of exceptional overvaluation of the Swiss franc and an extremely high level of uncertainty on the financial markets. This exceptional and temporary measure protected the Swiss economy from serious harm. While the Swiss franc is still high, the overvaluation has decreased as a whole since the introduction of the minimum exchange rate.” (SNB(b), 2015) The announcement came as a surprise as the vice chairman of SNB, Jean-Pierre Danthine, in a television interview only a month before, pronounced the peg to persist as a “cornerstone of our monetary policy” (Miles & Copley, 2015).

Markets rushed, causing the CHF to soar a striking 40 % versus the Euro (p.32, International Monetary Fund, 2015), and almost 28 % versus the US dollar over the course of a few hours (Forgione, 2015), and to remaining volatile for several weeks



afterwards. The Swiss Franc has since then stabilized somewhat and was on April 30<sup>th</sup> 2015 1.05 vis-a-vis the euro (ECB, 2015).

## **2.2 Switzerland as an exporting nation**

As a country with few natural resources, Switzerland has focused on specializing in a highly skilled work force, manufacturing technology-intensive goods and, as previously described, a well-developed financial and banking system (p.17, OECD, 2006; EC, 2013). Due to "top-notch academic institutions, high spending on R&D, and strong cooperation between the academic and business worlds" Switzerland tops the Global Competitiveness Index for the sixth consecutive year 2015 showing high levels of innovation (p.12, Schwab, 2014).

Switzerland is highly dependent on its export sector. In 2013, 72.1 % of GDP originated from exports, which can be compared to an average of 42.8 % for the European Union as whole or 45.6 % for its largest trading partner Germany (OECD, 2014; FDFA(b), 2015). The majority of Swiss exported goods are high-tech finished products, with the largest specific SITC<sup>1</sup> group classifications 2011-2013 being; medicaments, watches, articles of jewelry and orthopedic appliances. The largest subgroups within the service exports sector were during the same years; royalties and license fees, travel and financial services (UN Comtrade, 2014).

Following Switzerland's high dependency on exports, it is an intuitively reasonable assumption that any positive or negative effect currency appreciation contingently has on growth may pass through exports. In fact, every second Swiss Franc is earned abroad (Danthine, 2011). As will be presented in following section, theory claim net exports to be negatively dependent on the real exchange rate. This will further be tested empirically using data for Switzerland.

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<sup>1</sup> Standard International Trade Classifications is a classification system maintained by the United Nations to categorize goods for comparability between countries, intended for analytical purposes.

### **3 Growth and the real exchange rate – a theoretical framework**

Exchange rate misalignment has for long been a subject of discussion for economists. Exchange rate misalignment refers to when the real exchange rate is overvalued or undervalued against an "equilibrium" exchange rate. When the currency has appreciated more against the "ideal" rate it is overvalued and conversely undervalued means it has depreciated more than ideally. This ideal/equilibrium is naturally a theoretical value and therefore must be subjective depending on how it is calculated (Razin & Collins, 1997)(Cottani et al, 1990).

Recent studies have shown currency undervaluation to be a factor encouraging growth, particularly in East Asia (see e.g. Rodrik, 2007), while overvaluation of the exchange rate has been widely acknowledged to affect economic growth negatively for decades. It does so through several channels; by misallocating resources, causing uncertainty in financial markets and undermining external competitiveness (Shabsigh & Domaç, 2001).

The real exchange rate is essentially the ratio of prices of tradable goods relative to non-tradable. Assuming prices in the rest of the world are unchanged, an increase in the real exchange rate thus infers the domestic costs of producing tradable goods increase. In relation to the rest of the world, the country's competitiveness is reduced as a result of the relatively overpriced exports (Edwards, 1989). Due to this apparent link between exchange rate misalignment and trade it is relevant not only to study the effect of overvaluation on growth directly, but the effect on exports and imports as well.

As the basic theoretical IS/LM-framework shows (see e.g. Mankiw, 2007), net exports depend negatively on the exchange rate. The empirical evidence investigating real exchange rate volatility's effect on trade in general and exports in particular is, however, ambiguous and contradictory despite the vast amount of research conducted. Some studies suggest exchange rate volatility detrimental to exports, although the results are often inconclusive or too unassertive to draw general conclusions from (see e.g. Bailey et al, 1987; Kenen & Rodrik, 1986). Other studies find a favorable interconnection between exchange rate variation and exports, while carefully noting that their findings may solely be applicable on the examined sample of countries (see e.g. Aseery & Peel, 1991).

Exchange rate misalignment need not be of volatile character, unfortunately, the empirical research on exports and currency overvaluation specifically is scarce. Those few studies made do find empirical evidence indicating that currency overvaluation to be harmful for export performance in the same way as volatility; by adversely affecting the competitiveness (Nabli & Végonzonès-Varoudakis, 2004; Jongwanich, 2009).

Empirical evidence does, however, show that a real exchange rate appreciation is detrimental for investment. Rising domestic production costs cause profit margins in the tradable goods sector to diminish, in turn creating a disincentive for investment (Bleaney & Greenaway, 2001). Investment in the non-tradable goods sector should intuitively increase as prices rise relative to imported inputs, however, studies show that the total effect is nevertheless negative (Ghura & Grennes, 1993; Cottani et al., 1990; Bleaney & Greenaway, 2001).

### **3.1 Purchasing Power Parity**

The Purchasing Power Parity (PPP) hypothesis states that the relative price between two countries should determine the exchange rate; when comparing an equal bundle of goods in common currency, the price should be the same. Empirical evidence is mixed, despite the many attempts from withstanding economists (for a summary of empirical results from 18 studies, see Taylor, 2009). While few claim that PPP does not hold in the short, or even medium run, most agree that prices seem to converge to parity in the very long run (Rogoff, 1996). Deviations from PPP imply violation against the no arbitrage-condition, in which case a profit could be made by purchasing the bundle of goods in the country with lower price level and selling it where the price level is high (Chinn, 2000).

A country with an overvalued currency, deviating from PPP parity, would according to this argumentation lose market shares as goods can be purchased cheaper elsewhere. This implies, however, that the goods are purchasable elsewhere.

Switzerland has one of the worlds most sophisticated export baskets, measured by OECD in percentage of high-technology manufactured exports (WDI, 2015). Hausman et al (2007) rank Switzerland's export basket in third place using a quantitative index ranking different traded goods in terms of their implied productivity. Bénassy-Quéré et

al (2014) acknowledge the common assumption that countries with higher-end exports are less sensitive to exchange rate variations. It could therefore be assumed that the effect on Swiss exports by exchange rate overvaluation should be lower than for countries with less high-tech exports.

The effect on the trade balance is dependent on both trade elasticity and exchange rate pass-through (Tressel & Arda, 2011). The Marshall-Lerner condition states that if the sum of export and import elasticities exceed one, a nominal exchange rate appreciation will affect the trade balance negatively;

$$\varepsilon_x + \varepsilon_m > 1$$

While Tressel and Arda (2011) and Chen (2012) empirically prove Swiss trade elasticities satisfy this condition and thus are sensitive to exchange rate appreciation, Hooper et.al. (1998) find that estimated export elasticities for Switzerland are somewhat smaller than for other industrialized economies<sup>2</sup>. The exchange rate pass-through is found to be relatively low to consumer prices, but high to import prices (Tressel & Arda, 2011)(Stultz, 2007).

During the financial crisis of 2008, world trade experienced a slump by 15 %. All Swiss industrial sectors were not affected equally by the decline in world demand. While manufactured goods, such as watches, experienced a substantial decline in exported volume, non-durable goods such as pharmaceuticals did not seem to be as affected (Auer & Sauré, 2012; Hildebrand, 2010). This is further supported by Tressel & Arda (2011), who also find export elasticities to vary not only between sectors, but also between trading partners.

SNB reports that Swiss manufacturing and service firms adapted to the appreciating Swiss Franc in 2011 by reducing their profit margins (SNB(c), 2011). This approach allow the firms to continue selling volume of their goods and services, however, the

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<sup>2</sup> While neither Chen (2012) nor Hooper et al. (1998), have been academically published, their results provide interesting insights to the discussion.

revenues decrease. According to a SNB study (SNB(b), 2011) most companies managed the reduced profit margins by cutting production costs, mainly through lay-offs or refraining from recruiting new staff.

This could have further effects on the real economy. In 2011, unemployment rose dramatically and consumer demand was low, decelerating economic recovery. Unemployment has been declining since 2012 and consumer demand is rising slowly, although below average (SNB(c), 2015), but these positive trends may be off-set if firms find themselves required to handle decreasing profit margins due to an appreciating CHF again. In turn, a course of event such as described could affect economic growth negatively, while keeping export growth constant or even growing.

The effect of real exchange rate overvaluation on Swiss economic growth is, as previous discussion demonstrates, is not obvious. While basic IS/LM and PPP framework indicate exchange rate appreciation will lower rates of growth, Swiss economic and industrial sector structure could provide facilitating elements. Although evidence does not appear to fully neutralize the negative effects of currency overvaluation, the empirical analysis is expected to show dampened results.

## 4 Empirical analysis

### 4.1 Model

The effect the real exchange rate has on the real economic will be examined using three different standard Ordinary Least Squares (OLS) regression models. The first model considers the effect on GDP growth, the second model the effect on export growth and the third and final model considers the effect on import growth.

$$\Delta Y_t = \alpha_1 + \alpha_2 \Delta I_{t-1} + \alpha_3 \Delta A_{t-1} + \alpha_4 IL_{t-1} + \alpha_5 IS_{t-1} + \alpha_6 \Delta HC_{t-1} + \alpha_7 \Delta E_{t-1} + \varepsilon_t$$

$$\Delta EX_t = \alpha_1 + \alpha_2 \Delta I_{t-1} + \alpha_3 \Delta A_{t-1} + \alpha_4 IL_{t-1} + \alpha_5 IS_{t-1} + \alpha_6 \Delta HC_{t-1} + \alpha_7 \Delta E_{t-1} + \varepsilon_t$$

$$\Delta IM_t = \alpha_1 + \alpha_2 \Delta I_{t-1} + \alpha_3 \Delta A_{t-1} + \alpha_4 IL_{t-1} + \alpha_5 IS_{t-1} + \alpha_6 \Delta HC_{t-1} + \alpha_7 \Delta E_{t-1} + \varepsilon_t$$

, where the dependent variables on the left-hand side are; output growth ( $\Delta Y_t$ ), export growth ( $\Delta EX_t$ ), and import growth respectively ( $\Delta IM_t$ ).

On the right-hand side of the regression we begin by including the explanatory variable of special interest; growth rate of the real exchange rate ( $\Delta E$ ). Henceforth we find both long ( $IL$ ) and short-term interest ( $IS$ ) rates as well as the investment term ( $\Delta I$ ), which represents growth in physical capital. These variables are included as the IS/LM framework assumes investment to be negatively related to output, affected by the levels of interest rates (see e.g. Mankiw, 2007). Thus, increases in interest rates are expected to show negative effects on output growth as well as export and import growth, while the investment term is anticipated to show positive effects. As discussed in previous sections, the effects of real exchange rate appreciation are ambiguous, although theory points towards a negative coefficient.

Standard endogenous growth models such as Lucas (1972) and Romer (1990)<sup>3</sup>, emphasize the role of human capital growth and technological growth respectively; hence these components are included in the model. International technological progress ( $\Delta A$ ) is included through the growth rate of total factor productivity for the United States, while a human capital index ( $\Delta HC$ ) is used to represent growth in human capital. Both of these variables are expected to show positive explanatory power relating to growth as well as export and import performance.

Lastly, the error term ( $\epsilon$ ) is assumed to be stochastic and with Gauss-Markov properties<sup>4</sup>. All explanatory variables are lagged one period, and when calculated as growth variables, the following form has been used;  $\Delta y = \log(y_t) - \log(y_{t-1})$ .

During the years 2011-2015, when the exchange rate ceiling was enforced, the CHF was very stable and its value kept in check by regulation. Therefore, the model will be tested

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<sup>3</sup> For a simpler and more convenient overview of the models, see e.g. Aghion & Howitt (1998)

<sup>4</sup> This assumption has been tested and the error term meets the set conditions.

for two time periods; 1975-2010 measuring the effect of exchange rate appreciation excluding the time of the peg, and 1975-2013 which includes the time of the peg. The difference in value of the coefficient should be quite small, but a difference is nevertheless expected.

## **4.2 Data**

### **4.2.1 Sources**

The study is based on data sampled annually between the years 1975 and 2013. The time frame is chosen with respect to data availability. All variable data, except for the human capital index variable and real exchange rate, is collected from the OECD Database. The Organisation for Economic Co-operation and Development (OECD) is an organization with 34 member states working to promote policies aimed to improve social and economic development around the world. Their database is vast and diverse and the most complete regarding collected data for developed countries.

The real exchange rate is collected from Datastream, a financial and macroeconomic database managed by Thomas Reuters featuring several indicators for over 175 countries. The real exchange rate is measured as a weighted index in a basket with Switzerland's most important trading partners to include PPP-effects.

The human capital variable is collected from the Penn World Tables 8.0, and is calculated based upon average years of schooling from the Barro-Lee Dataset as well as returns to education calculated by Psacharopoulos (1994)(Penn World Tables 8.0). The Penn World Tables is developed and maintained by University of California, Davis and the Groningen Growth Development Centre of the University of Groningen. It covers data for 167 countries between the years 1950-2011 for a number of measures. Compared to other data banks, such as the World Development Indicators, the PWT has better coverage and regularity over time.

#### 4.2.2 Data presentation

This section will visually present the data for the dependent variables and the explanatory variable of interest, the real exchange rate. The ambition is to provide the reader with an understanding of the data used for the empirical analysis.

The Swiss Franc has, as previously stated, been a strong currency historically. The index used for this paper is depicted in figure 3, recalculated to show growth rates. While the fluctuations are quite large, it is evident that growth rates are primarily positive. The extreme appreciation in the years building up to 2011 is clearly pictured, as well as the drop in real exchange growth rate, caused by the adoption of the peg.

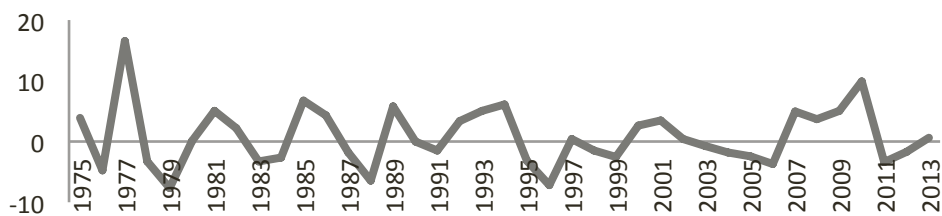


Fig. 3 CHF growth rate (percentage points) 1975-2015 (Datastream)

The positive trend is evident when examining output growth as well, which is depicted in figure 4. Switzerland suffered through a recession in the beginning of the 1990's as a result of a real estate bubble, which burst in 1989 (p.25-26, IMF, 2002). The sharp decline in growth rate is displayed below, as well as the relatively slow recovery during the following years. We can also by figure 4 see that although the dip caused by the global financial crisis in 2008 was severe, Switzerland recovered quickly. The dramatic appreciation of the CHF is the root of the subsequent drop, from which the growth rate recovered more slowly with help from the capping of the exchange rate.

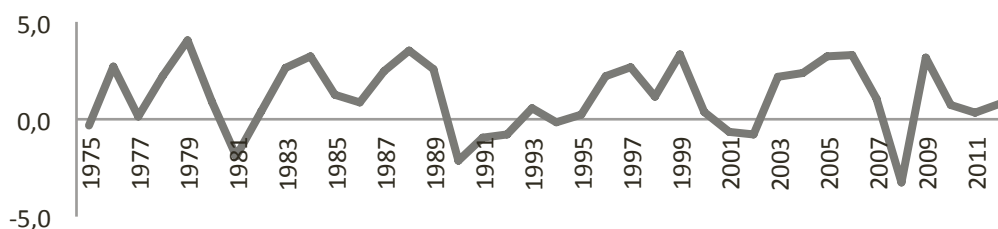


Fig. 4 Growth in GDP per worker (percentage points) 1975-2013 (OECD)



In figure 5, the value of imports and exports are illustrated for the whole period 1975-2013. The two follow each other closely throughout the years, with only small differentiations in growth rates. Up until the 1990's the development is quite volatile, however, the last decade both exports and imports have grown with highly positive rates. The financial crisis of 2008 can be seen as a sharp decline, although the rates are back at pre-crisis levels within two years.



Fig. 5 Growth in imports and exports (percentage points) 1975-2013 (OECD)

Graphically it is obvious that despite the CHF appreciation during the complete period of examination, GDP, exports and imports have all continued to grow as well, with sharp declines in growth rates only in temporary states of crisis. The presented figures have illustrated the data used for the empirical analysis, the results of which will be presented in the next section.

### 4.3 Results

The results of the regressions are presented in Table 1. The first column specifies the explanatory variables, where the variable of interest, the real exchange rate, is highlighted. The second column displays the results concerning the effects on growth, the third column the effects on growth and the fourth column presents the effects on exports. Each column is divided in two sub-columns, showing the results for each variable for both time periods; 1975-2010 and 1975-2013.

**Table 1: Results**

Variable	Growth		Imports		Exports	
	1975-2010	1975-2013	1975-2010	1975-2014	1975-2010	1975-2014
<i>Time period</i>	1975-2010	1975-2013	1975-2010	1975-2014	1975-2010	1975-2014
<i>Investment</i>	-0.032 (0.07)	-0.00 (0.06)	-0.33 (0.47)	-0.18 (0.43)	-0.35 (0.47)	-0.26 (0.42)
<i>Total factor productivity (US)</i>	0.35* (0.15)	0.29* (0.14)	1.80 (1.04)	1.60 (0.11)	1.22 (1.03)	1.12 (0.98)
<i>Long-term interest rates</i>	0.16 (0.53)	0.69 (0.43)	0.81 (3.82)	3.26 (2.91)	-0.04 (3.75)	1.23 (2.84)
<i>Short-term interest rates</i>	-0.54* (0.25)	-0.73** (0.22)	-1.84 (1.79)	-2.72 (1.54)	-0.55 (1.76)	-1.04 (1.51)
<i>Human capital index</i>	0.16* (0.06)	0.15* (0.06)	0.28 (0.44)	0.23 (0.43)	-0.18 (0.44)	-0.19 (0.43)
<i>Exchange rate</i>	-0.12* (0.05)	-0.14** (0.05)	0.26 (0.38)	0.13 (0.35)	0.02 (0.38)	-0.03 (0.34)
<i>R-squared</i>	0.66	0.63	0.30	0.14	0.13	0.13
<i>Durbin-Watson</i>	1.72	1.91	1.88	1.86	-1.67	1.71
<i>Breusch-Pagan-Godfrey Heteroskedasticity</i>	0.55	0.44	0.93	0.94	0.94	0.97
<i>Breusch-Godfrey Serial Correlation LM</i>	0.76	0.80	0.75	0.51	0.51	0.36
<i>Number of observations</i>	36	39	36	40	36	40

\*= significant at the 5 % level

\*\* = significant at the 1 % level

According to the results, the exchange rate does have an empirically supported negative effect on output growth in both time periods. Following an exchange rate appreciation of 1 %, the rate of growth would decrease with 0.12 % and 0.14 % respectively. While the results imply the effect of exchange rate appreciation to have worsened marginally as a result of the adoption of the peg, it could be an effect of the lengthening of the time period. In a sample of 39 observations, a loss of three observations may affect the results. As the level of significance increased when the time period increased from 1975-2010 to 1975-2013, the decrease from 0.12 % to 0.14 % should be carefully interpreted.

Total factor productivity, short-term interest rates and the human capital index do all have significantly secured effect on growth, while investment and long-term interest rates do not. As these variables were included in the model as control variables, this does not induce any serious issues - although the results are surprising. On the other hand; these variables involve long lagging effects and a one-year lag may thus be too short to show fully significant effects on growth.

When the ceiling was removed on January 15<sup>th</sup>, 2015, the Franc appreciated an astounding 40 % in just one day (p.32, IMF(a), 2015). The markets were shocked and after the press release from SNB, the Swiss Franc rushed from a value of 1.20 EUR/CHF to 0.85 EUR/CHF in the most chaotic hours, hence settling at 1.03 at 19.00 GMT (Baghdjian & Koltowitz, 2015). Figure 6 below illustrates the movements of the Franc during the first quarter of 2015, displaying an unusually dramatic course of events in the world of foreign exchange markets. After the first day sans peg, the CHF continued to decrease relative to the euro, reaching its lowest point at 0.98 on January 23<sup>rd</sup>.

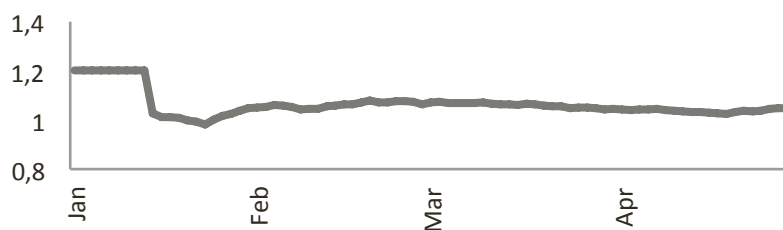


Fig. 6 EUR/CHF January 1st - April 30th 2015 (ECB(a), 2015)

From the beginning of March, the markets began to adjust to the situation and the Franc stabilized somewhat. On April 30<sup>th</sup> it had increased (depreciated) to 1.05 against the Euro.

The movements on account of the release of the peg resulted in an 18.4 % appreciation from the capped value to its highest value on January 23<sup>rd</sup>. The empirical results of this study imply that the growth rate in Switzerland subsequently will decrease by 2.58 %. With a GDP growth rate of 1.9 % in 2013 and 2.0 % during 2014 (SECO(a), 2015), these are clearly detrimental results for Swiss economic outlook.

Switzerland's State Secretariat of Economic Affairs (henceforth SECO), revised their projections for growth 2015 and 2016 in a press release (SECO(b), 2015). A collation of the two forecasts is illustrated in figure 7, displaying the adverse effects the abandonment of the cap has had on anticipated growth. In contrast to projections released in December 2014, the expected output growth rate was in March cut by 1.2 percentage points for 2015 and 0.6 percentage points for 2016.

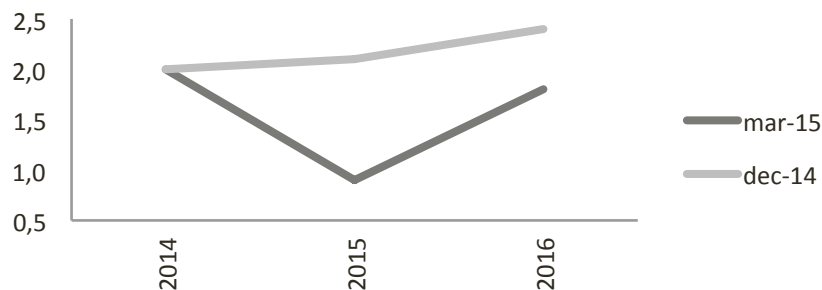


Fig. 7 Projections for growth (percentage points) (SECO(b), 2015)

The revisions displayed in figure 7 further confirm the pessimistic results gained from the empirical analysis. Projections have not yet been made for 2017, the empirical results thus imply that further negative effects are to be seen compared to the scenario where the CHF was held at 1.20 EUR/CHF.

However, there are effects not included in this study that could have dampening effects on the negative outlook. Oil prices have been declining since mid-2014, resulting in

higher disposable incomes (SECO(b), 2015). Hence, increased domestic consumer spending may subdue the loss in competitiveness caused by the appreciation. The abandonment of the maximum exchange rate was combined with lowered interest rates, as an attempt to counteract the effect of the exchange rate appreciation and to fuel consumption (SNB(b), 2015). If this attempt proves successful, the growth rate outlook may move towards the prognosis by SECO.

It is worth to keep in mind that while these effects may prove positive for the growth rate, both a fall in oil prices and lowered interest rates increase the risk for deflationary development in Switzerland (SNB(c), 2015)(IMF(b), 2015). Exchange rate appreciation and its effect on consumer prices is beyond the scope of this study, although it would be interesting to further examine the relationship between the two.

#### ***4.3.1 Implications for trade***

The effect of exchange rate variation on exports is not significant in either time period, and neither is the effect on imports. This could be due to some explanatory variable not included in the used model, or because part of the data is volatile. As none of the other explanatory variables have significant effects either, it is likely that the model is inconclusive.

Although the results were not significant, the coefficients size regarding real exchange rate variation's effect on imports and exports are worth noting. The coefficient for the effect of real exchange rate appreciation imports is positive for both time periods, while decreasing marginally from 0,26 to 0,13 when including the time of the cap. The sign as well as the decrease corresponds to presupposed behavior; imports increase when the real exchange rate appreciates as they become more affordable relative to domestically produced goods. When the cap was implemented, the exchange rate was brought down to 1.20 EUR/CHF and thereby decreasing the range in relative price between imports and domestically produced goods. As a result, the rate of growth for imports decreased.

In summary; when the time period of the cap is included, the effect of exchange rate appreciation is smaller than when the time period is not included.

The results suggest that imports will increase by 2.39 % due to the CHF appreciation of 18.4 %. The rise in imports could imply an adverse affect on production of non-tradable goods, as theory proposes.

The coefficients regarding the effect of exchange rate variation on export performance are all the more surprising, as negative values were anticipated. The coefficient for the first time period 1975-2010, however, has the marginally positive value of 0.02. This implies, keeping in mind that the results are not significantly established, that excluding the time of the cap an exchange rate appreciation would have a, very small, positive effect on export.

These results are consistent with Auer and Sauré (2012), and imply that although Swiss exports have been proven sensitive to exchange rate appreciation, the net effect is not as negative as expected.

When the effect on exports is regressed with respect to the longer time period 1975-2013, where the cap is included, the coefficient acquires the negative value of -0.03. Again, the results are not empirically established with satisfying significance, meaning the value of the coefficient should not be interpreted absolutely. The change from positive to negative coefficient is all the same noteworthy.

The same press release previously mentioned by SECO, also included revised projections regarding export performance (SECO(b), 2015). SECO adjusts their prognosis with - 3.4 and - 1.0-percentage points for 2015 and 2016 respectively. The projections made in December 2014 and March 2015 are illustrated for comparison in figure 8.

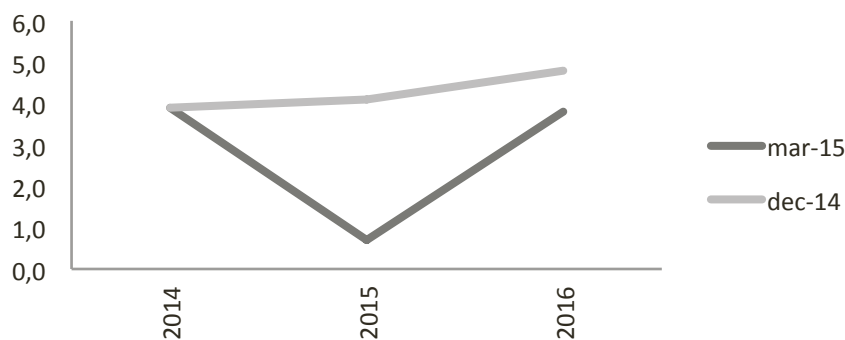


Fig. 8 Projections for exports (percentage points) (SECO(b), 2015)

The adjustments of the prognosis are substantially larger than the 0.55 % reduction in export growth rate suggested by this study. This could be a result of measurement issues. Exports were for this study measured in value and current prices although by volume and/or in constant prices would have been preferred. While the negative effect on export volume due to worsened competitiveness is still topical, an appreciated exchange rate denotes higher revenues per tradable good sold. The net effect on the export value growth rate when the exchange rate appreciates is therefore dependent of which effect is dominant; the loss of competitiveness or the gain in revenues. This complex of problems is acknowledged by Chen (2012) as well, whilst finding an empirically significant negative effect by real exchange rate appreciation on export growth in value.

Auer and Sauré (2012) examine how Swiss exports could continue to increase despite the CHF appreciating during the five-year period leading up to October 2010. The authors find European economic recovery to be the main factor dampening the negative effects caused by the appreciation, while claiming Switzerland still lost 35 billion CHF in revenue compared to a scenario where the CHF had stayed at its October 2005 value.

Their findings may be applicable to the situation at hand, as well. The ECB published their revised economic projections for 2015 - 2017 on 19<sup>th</sup> of March 2015 (ECB, 2015). Contrary to SECO's revisions, the March 2015 prognosis for Europe is somewhat more optimistic than anticipated in December 2014. Figure 9 and 10 illustrate these projections.

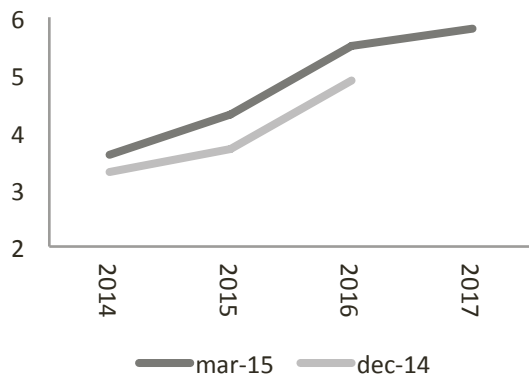


Fig. 9: Forecast of import growth performance (percentage points) in the Euro Area (ECB(b), 2015)

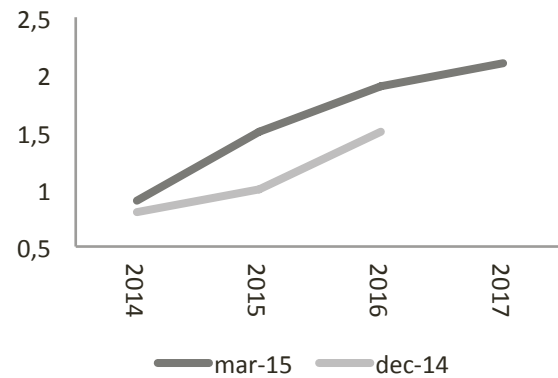


Fig. 10: Forecast of GDP growth performance (percentage points) in the Euro Area (ECB(b), 2015)

While Swiss exports are experiencing a downturn, the effects could be subdued by its trading partners ascent, as during the appreciation of 2011. This effect may be understated in SECO's prognosis, indicating the actual eventuation to be more in the lines of this study's empirical results.

This does not only apply to the European Union area, as Switzerland's fastest growing trading partners measured in volumes are rapidly emerging markets such as the BRICs (Brazil, Russia, India and China)(Tressel & Arda, 2011). While emerging markets in general, and China in particular, are projected to have a slowdown in growth rates during 2015 and 2016, emerging markets and developing countries still account for 70 % of projected global growth in 2015 (IMF(b), 2015). The total combined effect on Swiss export growth performance is therefore dependent on which dominates; the positive effect of growing markets as a larger share of Swiss export partners, or the negative effect of slower growth in this region.

## 5 Concluding remarks

On January 15th, 2015, the SNB announced the peg on the Swiss franc to the euro, was to be abandoned. As a result, the markets rushed and the CHF appreciated dramatically. This paper has attempted to shed light on the possible consequences for Swiss output growth, both directly and through the effect of real exchange appreciation on imports and exports.



The results show empirically significant negative effects on the rate of output growth, implying a decline of 2.58 % in growth rate is to be expected. The results are further supported by projections made by SECO, although the anticipated effect by SECO is not as negative. This could be due to dampening effects not included in this study, such as declining oil prices and lowered Swiss interest rates.

The effect of exchange rate appreciation was not significant on imports nor exports, however, positive effects on imports and negative on exports are suggested. While positive effects on imports are supported by theory, there may be circumstances subduing the negative effects on exports. The economic recovery in the Euro Area and emerging markets increasing share of Swiss export destinations could explain why Swiss exports may not be as hurt as theory suggests – an argument supported by Auer and Sauré (2012).

In conclusion the effects on economic growth caused by real exchange appreciation in Switzerland are somewhat ambiguous. A negative total effect is expected, while the cost in terms of output growth rate will require further research when more recent data becomes available.

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