

# Disentangling Supply and Demand: Swiss Monetary Policy During the Financial Crisis

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**T**his paper provides an empirical investigation into the possibility of a credit crunch in Switzerland during and after the financial crisis and the subsequent sovereign debt crisis in the Eurozone from 2007 to 2013. In order to differentiate between credit demand and credit supply I employ a dynamic (dis)equilibrium model. The results suggest that a credit crunch did not occur in Switzerland during the financial crisis or the following Eurozone crisis. My results show that growth in domestic credit slowed at the end of 2010, ending a period of significant credit growth. This is particularly true in the domestic construction sector. From the onset of the financial crisis a steady expansion in domestic credit supply is observed, which I attribute to timely rescue and re-capitalization of banks; the strong and appreciating Swiss franc; and generally sound macroeconomic fundamentals with low unemployment, low inflation, and a skilled labor force among others. It is possible that Switzerland's exceptional performance vis-à-vis its European peers during the crisis period is largely due to, but not limited to, effective and timely policy interventions and monetary policy adjustments of the Swiss National Bank (SNB).

## I. INTRODUCTION

The collapse of the US sub-prime mortgage market in 2007 signaled the beginning of what has come to be known as the worst financial crisis since 1929 (Baldwin and Wyplosz 2012). The crisis in the US housing market sent a shockwave through the financial sector culminating in the bankruptcy of Lehman Brothers, the fourth largest investment bank in the US. The fallout from the collapse of Lehman had devastating effects on the national and international economy, with US trade and industrial production

falling sharply and world output contracting for the first time since World War II (International Monetary Fund (IMF) 2009). The financial crisis soon spread to Europe and resulted in a large wave of bank rescue operations by European governments starting in 2007, as well as enormous liquidity injections by their central banks. UK mortgage lender Northern Rock was among the first victims of the crisis ending in collapse and nationalization, followed by IKB Deutsche Industriebank in Germany, which re-

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quired a buy-out of close to €3.5 billion from KfW Bankengruppe (Kirchfeld and Buergin 2007). Similarly, BNP Paribas in France closed its three investment funds after a “complete evaporation of liquidity” (BNP Paribas 2009). As of June 2009, EU banks had incurred losses of nearly €290 billion (European Commission, 2009). The most important policy measures to remedy the situation of ailing banks and plummeting economies involved recapitalization of banks and transmission of liquidity to the real economy. From the onset of the crisis, the European Central Bank (ECB) resorted to unconventional monetary policy measures which included: buying up asset-backed securities; loan guarantee schemes for troubled banks; and the provision of low-cost funding for investors, with up to €270 billion funds from the member states and €3.2 trillion<sup>1</sup> for further recapitalization of banks in the EU (European Commission 2009).

In the face of recessionary periods, fears of liquidity freezes that may lead to a credit crunch became a real concern. The definition of credit crunch used in this paper follows Friedman (1991), stating that it constitutes a crisis in bank lending, specifically when the economy incurs a shock that leads to a sudden sharp decline in credit supply and excess in credit demand at the prevailing interest rate.

While there is a significant body of research that focuses on the effects of the financial crisis on the dynamics of credit supply and demand in various EU countries, empirical analysis of the Swiss credit market is still missing.

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<sup>1</sup> Total approved public intervention measures for EU 27 countries and include capital injections into EU banks, guarantees on bank liabilities, relief of impaired assets, and liquidity and bank funding support (European Commission 2009).

This paper fills the gap in the existing literature by examining whether the financial crisis had a significant impact on the course of domestic lending to enterprises in Switzerland, and whether the crisis led to a possible credit crunch consistent with my stated definition.

Switzerland is a particularly interesting case due, in part, to its small open economy and a large highly interconnected financial sector with two systemically important financial institutions (SIFI), regarded as “too-big-to-fail” banks. Throughout the financial crisis Switzerland encountered its own unique set of challenges both domestically and outside its borders. Despite entering recession in the last quarters of 2008 and experiencing extreme currency appreciation due to the large inflow of foreign capital, fast recovery from the crisis and relatively stable domestic credit conditions make the Swiss case worth the analysis. Switzerland’s exceptional performance, as argued in this paper, owes largely to effective and timely sequencing of monetary policy and public support, particularly that of the Swiss National Bank (SNB). In addition and not surprisingly, Switzerland’s sound macroeconomic fundamentals built up preceding the crisis period, as discussed in detail in the following sections, played a significant stabilizing role in its smooth recovery. This research aims to contribute to the crisis literature by providing a “good practice” scenario in terms of the role of monetary policy in stabilizing the domestic credit conditions and the overall economic performance during the crisis.

## II. LITERATURE REVIEW

There is no agreed upon definition for a “credit crunch” and it is used interchangeably with terms such as credit squeeze, credit crisis,

credit slowdown, and credit rationing. The classic definition of credit crunch comes from Bernanke and Lown (1991) where the authors define it as a “significant leftward shift in the supply curve for bank loans, holding constant both the safe real interest rate and the quality of the potential borrowers” (207). Friedman (1991) later issued a comment on Bernanke and Lown’s paper, claiming that a leftward shift in the supply of credit resulting from more than usual tight monetary policy ignores the severity of the credit crunch. He points out the fact that credit crunch episodes entail a significant reduction of credit allocated through alternative lending channels, which is contrary to Bernanke and Lown’s argument that lending by other institutions expands during credit crunch episodes. In this paper, I adopt Friedman’s position, with credit crunch defined as a crisis in bank lending and alternative lending institutions (1991).

Cantor and Wenninger examine earlier post-war credit crunches in the US and conclude that if the supply of credit does not vary directly with changes in the interest rate, then it signals credit rationing and constitutes a subset of credit crunch (1993, 33). Their definition is consistent with short-term credit rationing proposed by Stiglitz and Weiss, defined as a temporary (dis)equilibrium phenomenon triggered by an exogenous shock, that leads to sticky prices and a transitional period, during which rationing of jobs and credit occurs (1981). Credit slowdown, on the other hand, is an outcome of generally lower economic and business activity, resulting from both the demand side (weaker balance sheet of a borrower) and the supply side (changes in the bank balance sheet or changes in regulations and policies) (Cantor and Wenninger 1993).

The literature on past crises points to liquidity shocks and drops in bank capital as the most common transmission mechanisms through which financial crises affect the real economy and the dynamics of credit supply and demand (Brunnermeier 2009; Brunnermeier and Pedersen 2009). Policy responses vary accordingly depending on whether the credit crunch is originating from the supply or the demand side. If a credit crunch is resulting from shocks to the banking sector, then recapitalization of banks and opening additional channels for capital is an effective response. If the crisis is demand driven, then steps involving macroeconomic and fiscal stimulus are needed to restore borrower confidence.

Brzoza-Brzezina and Makarski (2010) examine the effects of a credit crunch on a small open economy and find a significant effect of foreign shocks on the domestic banking sector through the influence on the price of capital. In the case of the Polish economy, they conclude that the spread of the 2008 financial crisis to the banking sector led to a 1.5 percent decline in GDP. After examining 14 eastern and central European economies, which have relatively few ties to the US subprime market, Popov and Udell (2012) find clear evidence of credit tightening in the banking sectors as a result of the decline in bank equity and capital at the onset of the financial crisis. The impact of the crisis has been particularly pronounced in advanced economies in Asia, with Hong Kong and Singapore proving highly vulnerable due to its substantial interconnected financial sector and large financial institutions (IMF 2009). However, according to Fratzscher (2012), effects of the crisis on capital flows have been highly heterogeneous across countries and dependent on the quality of institutions, country risks, and macroeconomic fun-

damentals such as GDP, industrial production, trade and budget balance, unemployment rate, and public debt.

When analyzing credit market dynamics, difficulty arises in distinguishing between credit demand and credit supply since the data only show the volume of actual credit allocated to enterprises. The most commonly used model is the (dis)equilibrium model of credit supply and credit demand. It entails an econometric analysis of time series data to try to disentangle the volume of credit demand from supply to determine possible periods of excess credit demand. A (dis)equilibrium model using maximum likelihood estimation (MLE)<sup>2</sup> was first suggested by Fair and Kelejian (1974) and Maddala and Nelson (1974). Maddala and Nelson (1974) estimate credit supply and credit demand separately and state that the minimum of the two determines actual lending. Taking the actual lending as parameters of the distribution, the authors estimate the parametric values of the estimates that maximize the probability of the observed data using MLE. After deriving the estimates and constructing models for supply and demand, the authors determine the probability with which each observation belongs to the supply or the demand regime. Therefore, any prolonged decline in credit supply and excess in credit demand at the prevailing interest rate indicate periods of credit crunch.

In order to disentangle credit supply from credit demand, macroeconomic and financial variables need to be carefully chosen. Determinants of both have been studied extensively

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<sup>2</sup> Given particular parameters of the data, MLE provides estimates of the parameters that maximize the likelihood function, i.e., it provides estimates that make the observed parameters most probable.

in the literature; my final selection constitutes the result of running a number of possible combinations to arrive at the best possible fit.

Baek (2002) uses the (dis)equilibrium model of Maddala and Nelson (1974) to determine periods of credit crunch in South Korea from 1992 to 2001. On the supply side the variables he uses are lagged loans, the difference between the loan rate and the yield on corporate bonds, total deposits, the required ratio of reserves, and industrial production. On the demand side he opts for lagged loans, the difference between loan rate and yield on corporate deposits, and industrial production of previous quarters. He finds that periods of credit crunch occurred after 1995 and were caused by delayed economic reforms. As such, Baek proposes that the appropriate policy action is to clear the uncertainty by decreasing the credit risk of firms rather than forcing credit expansion on commercial banks (Baek 2002).

Čeh, Dumičić, and Krznar (2011) of the Croatian National Bank look for evidence of a credit crunch in Croatia using quarterly data from 2000 to 2011. They find that there was a credit crunch from 2008 to 2009. Interestingly, they argue that the credit crunch was caused by a surge in demand for loans rather than a shortage in the supply of credit. The authors claim that banks became increasingly risk averse and undercapitalized at the same time as the inflow of foreign capital halted due to the effects of the financial crisis. High demand was caused by earlier credit expansion and increased exposure of the domestic market to foreign capital. However, demand fell in 2009, which was followed by a period of recession. The authors identified multiple determinants of credit demand, including the nominal interest rate,

GDP and the output gap, Emerging Markets Bond Index (EMBI)<sup>3</sup> yield spread, and the Euro Interbank Offered Rate (Euribor)<sup>4</sup>. Credit supply variables include the lending capacity of the banks, GDP, the difference between lending rate and deposit rate, the volume of non-performing loans, loan-loss provision expenses, return on assets (ROA), return on equity (ROE)<sup>5</sup>, and Euribor. They conclude that the determinants of both credit supply and credit demand depend on the external economic and financial environment. Therefore, strengthening export demand emerges as the key policy action.

Schmidt and Zwick (2012) use Ordinary Least Squares (OLS), a static (dis)equilibrium model with MLE, and a dynamic (dis)equilibrium model with both MLE and Bayesian inference methods to investigate if there was a credit crunch in Germany during the financial crisis of 2008-2009. The authors use lagged loans, lagged industrial production, and lagged industrial bonds as determinants of credit demand and lagged loans, and lending capacity (annual change), interest rate spread, and share prices as determinants of credit supply. They find that there was no credit crunch in Germany during the financial crisis largely due to policy support and central bank efforts to increase the liquidity base of banks.

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3 EMBI is an index developed by JPMorgan to track the return on bonds/foreign currency denominated external debts in emerging market economies and consists of a set of three indices: EMBI+, EMBI Global, EMBI Global Diversified.

4 Euribor is a daily interbank interest rate at which Eurozone banks lend funds to each other.

5 ROA and ROE measure the profitability of the financial institution and its efficiency at turning profits for its stockholders.

### III. DYNAMICS OF SUPPLY AND DEMAND IN THE SWISS CREDIT MARKET

The Swiss economy is characterized by a large banking sector with 4.36 trillion Swiss francs (CHF) worth of assets, which is eight times the annual GDP and represents the highest bank asset to GDP ratio in the G10<sup>6</sup> countries as of 2009 (Swiss National Bank (SNB) 2009). The banking sector is dominated by two banks, UBS and Credit Suisse, which supply over 34 percent of all domestic loans, followed by Cantonal banks with 32 percent (SNB 2009). There was a significant cause for alarm from the onset of the crisis since the two big banks, particularly UBS, had made substantial investments in the US housing market. UBS reported losses of 53.1 billion USD and Credit Suisse 17.1 billion USD (SNB 2010). Contrary to the SIFIs, the regional, cooperative (Raiffeisen), and cantonal banks that focused on domestic lending experienced little to no impact of the crisis. According to SNB, domestically focused banks have built up large reserves before the financial crisis with excess capital of 3.5 to 5 percent in relation to their balance sheet (SNB 2009, 38). In October 2008, as a response to the deteriorating situation at UBS and Credit Suisse, the Swiss National Bank, the Swiss Government, and the Swiss Financial Market Supervisory Authority (FINMA) put forward a rescue package worth 60 billion USD for UBS and increased the capital base of Credit Suisse. To maintain a steady supply of credit, SNB further lowered the target rate of Swiss

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6 G10 countries jointly participate in the General Agreement to Borrow (GAB) where governments and central banks of these countries grant access to IMF to borrow funds in certain circumstances. G10 countries include Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Sweden, UK, and US. Switzerland joined in 1964, becoming the eleventh member; however the name has not been modified.

franc Libor to between 0 and 0.75 percent as of March 2009, offered repo operations at longer maturities, and purchased Swiss corporate bonds and large amounts of foreign currency to slow down the overvaluation of the Swiss franc (SNB 2009). Fearing a drop in demand, two fiscal stimulus packages were put forward in November 2008 and February 2009 (SNB 2009).

Before the introduction of the first stimulus package, SNB's balance sheet increased nearly twofold from 2007 to 2008 and continued to expand well after the crisis, hitting almost 80 percent of GDP in 2012 (see Appendix Figure 3). In addition, the safe haven<sup>7</sup> effect created downward pressure on consumer prices and a sharp appreciation of the franc, which on the one hand led to increased domestic consumption and, coupled with low interest rates, to strong domestic demand. On the other hand, if such a trend was to continue it would in the medium- to long-term have decreased the international competitiveness of the franc, hurt export industries, and potentially led the housing market to overheat.

In order to relieve pressure from the franc, SNB began purchasing large amounts of foreign currency starting in 2009 through 2010 (SNB 2012). The drastic measure was taken in September 2011 when SNB set a minimum exchange rate of 1.20 CHF against the euro as a response to further appreciation of the Swiss franc. The chairman of the Governing Board of the SNB,

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<sup>7</sup> In an environment of increased risk-aversion and high uncertainty as it happened during the financial crisis and crisis in the Eurozone, investors flee risky assets and turn towards safer investments, even if it means low profitability. As such, demand for Swiss franc and franc denominated assets rose substantially during the crisis period leading to extreme appreciation of the currency.

Thomas Jordan, stated that SNB was prepared to enforce this minimum rate through unlimited foreign currency purchases, where necessary (SNB 2012). Alongside the measures to weaken the Swiss franc, SNB began taking active steps to reduce the risks in the real estate and mortgage markets, including restrictions on the type of collateral used for mortgage loans, a permanent adjustment to risk-weight of commercial bank loans,<sup>8</sup> and macro-prudential instruments in the form of a counter-cyclical capital buffer (SNB 2012). In the meantime, the debt crisis in the Eurozone continued to persist throughout 2012, pushing investors to flee from crisis-hit domestic markets to the stability of the Swiss economy. The currency floor created a temporary stop to the euro's free-fall against the Swiss franc and provided an extent of certainty for the export industries in the short term (Simon and Hausner 2012). However, costs associated with maintaining a currency peg are extremely high and unsustainable in the long run, not only for SNB, which holds a large amount of euros while the crisis in the Eurozone continues to deepen, but also for the Swiss economy as a whole with export losing profit and domestic producers losing competitiveness against imports. As such, after almost three years of maintaining the minimum exchange rate, SNB abandoned the peg in January 2015, which led to the franc to surge by almost 39 percent against the euro (*Financial Times* 2015).

Despite these efforts, Switzerland did enter a recession, with its GDP contracting in the third quarter of 2008 (see Appendix Figure 1). Furthermore, the number of registered small and medium sized enterprise (SME) bankrupt-

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<sup>8</sup> For instance, by replacing riskier loans (higher weight) with safer ones, such as government bonds (Cohen 2013 27).

cies and insolvencies increased from 4,315 in 2007 to 6,255 in 2010 (Organization for Economic Cooperation and Development (OECD) 2012). According to SNB data, the profitability of Swiss banks in this period shrank by 11.16 percent in 2008 and by 13.60 percent in 2009.

In terms of the course of domestic lending, monthly loan utilization data provided by SNB suggest that there was a steady growth in loans to enterprises until the beginning of the financial crisis and a strong, steady growth during the crisis, followed by a small decline in 2010 (Figure 1). However, it can also be observed that credit growth was characterized by high volatility throughout the financial crisis and the crisis in the Eurozone (Figure 2).

This suggests that fears regarding a possible credit crunch due to deflationary pressures, weak export demand from trading partners and an associated drop in domestic output, and concerns regarding the loss of bank profitability and capitalization were justified. In

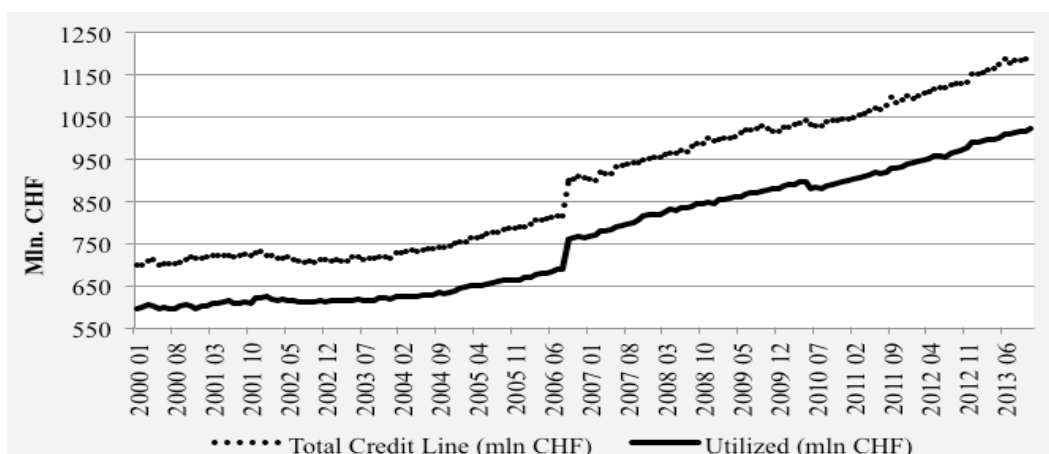
addition, the safe haven effect resulting from international capital inflow led to extreme appreciation of the Swiss franc and continued to pose a challenge throughout the financial crisis and the subsequent sovereign debt crisis in the Eurozone.

#### IV. METHODOLOGY

I employ Maddala and Nelson's (1974) (dis) equilibrium model to determine the actual credit volume by taking the minimum of estimated credit supply and credit demand. Similar to the approach Schmidt and Zwick (2012) use to analyze the German credit market, I use OLS to estimate my model<sup>9</sup>. I implement robustness checks using control variables, test for structural breaks using the Chow test, and

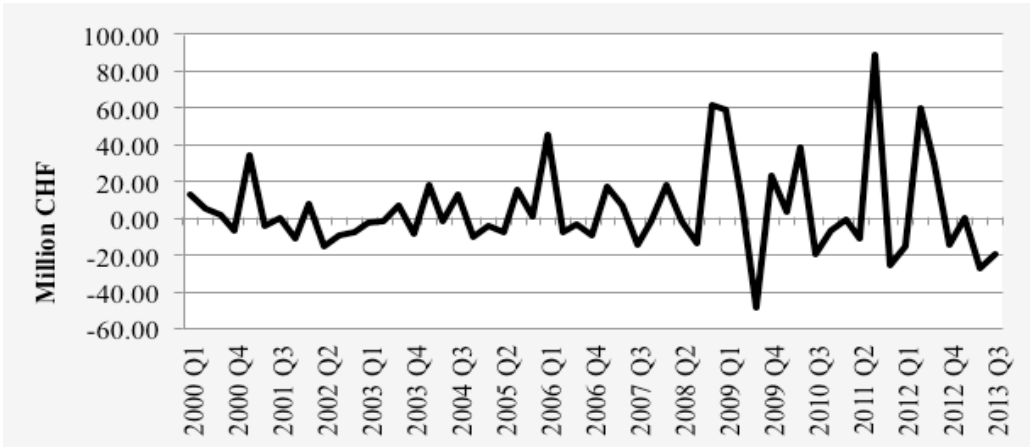
<sup>9</sup> While employing MLE approach is consistent and more common in similar studies, due to the lack of familiarity with the approach I employ the OLS method only. However, it should be noted that using MLE approach could have given different results.

**Figure 1: Total Loans to Enterprises in Switzerland**



Source: Swiss National Bank (SNB)

**Figure 2: Quarter-on-quarter Change in Lending in Switzerland for the Observed Banking Groups**



Source: Swiss National Bank (SNB)

include the necessary variables to account for breaks in the dataset.

The dependent variable in my analysis is the utilized credit volume<sup>10</sup> from 2000 to 2013 on a monthly basis derived from bank lending statistics of the Swiss National Bank (SNB). In order to reduce bias, I include a range of control variables. Determinants of credit supply and credit demand and the corresponding control variables are mostly taken from Schmidt and Zwick (2012) and Erdogan and Senfleben (2009).

The (dis)equilibrium model includes separate equations for credit supply and credit demand. The rationale is that the market does not clear

in each time period. Due to interest rate adjustment, it is always the case that either the demand is higher than supply or that supply is higher than demand. Therefore, the minimum of the two serves as the observed actual credit volume (Maddala and Nelson 1974).

Equations for the credit supply and credit demand:

$$C_t^d = X_{1t}' \beta_1 + \varepsilon_{1t}$$

$$C_t^s = X_{2t}' \beta_2 + \varepsilon_{2t}$$

$$C_t = \min (C_t^d, C_t^s)$$

Where  $C_t^d$  is credit demand;  $C_t^s$  is credit supply;  $X'$  determinants of demand and supply,  $\beta_1$  and  $\beta_2$  are coefficients to be estimated,  $\varepsilon_{1t}$  and  $\varepsilon_{2t}$  are errors and assumed to be i.i.d.  $C_t$  is the minimum of credit demand and credit supply, which determines the actual credit volume. Schmidt and Zwick (2012) estimate the dynamic version of the (dis)equilibrium model, stating that the past observations of the credit volume influence

<sup>10</sup> Includes total credit utilization by cantonal banks (share of domestic credit allocation- 32 percent), big banks (34 percent), regional banks (9 percent), Raiffeisen banks (13 percent), other banks (12 percent) and does not include credit supply by finance companies, branches of foreign banks and private bankers (SNB 2009).



actual credit volume (10). Therefore, authors included lags of the dependent variable.<sup>11</sup>

In order to estimate credit supply and credit demand on the Swiss credit market, I use the following determinants:

$$C_t^s = \beta_0 + \rho_1 C_{t-1} + \beta_1 D_t + \beta_2 Dp_t + \beta_3 \pi_t^e + \varepsilon_{1t}$$

$$C_t^d = \alpha_0 + \rho_2 C_{t-1} + \alpha_1 CLI_t + \alpha_2 SPI_t + \alpha_3 \pi_t^e + \alpha_4 i_t^l + \varepsilon_{2t}$$

The supply equation includes a number of explanatory variables:  $C_{t-1}$  represents lagged credit volume;  $D_t$  is banks' lending capacity (the more capacity banks have, the more credit they can supply);  $Dp_t$  is monthly foreign currency deposits denominated in CHF (the more deposits the banks receive, the more loans they can extend);  $\pi_t^e$  is expected inflation, which also measures general economic risks (higher inflation will result in less supply of credit).

As for the demand equation,  $C_{t-1}$  is the lagged credit volume;  $CLI_t$  is the Composite Leading Indicator (CLI) accounting for the output gap, which is the difference between actual output and potential output (a positive difference in CLI will result in more demand for credit by firms and is also a good indicator for determining future investment plans);  $SPI_t$  is the Swiss Performance Index, a stock market index

showing the performance of equity securities of companies registered in Switzerland (higher confidence and positive economic performance would mean an increase in the demand for credit);  $\pi_t^e$  is the expected inflation (credit demand would increase with higher inflation as inflation will erode the value of debt);  $i_t^l$  is the lending rate (lower lending rate would mean more demand for credit).

Data on credit utilization ( $C$ ), lending capacity of banks ( $D$ ), and deposit volume ( $Dp$ ) are taken from SNB, expected inflation ( $\pi_t^e$ ) from the Swiss Federal Statistical Office, while the Swiss Performance Index ( $SPI$ ) is compiled from monthly reports of the SIX Swiss Stock Exchange. The data on the Composite Leading Indicator ( $CLI$ ) is taken from the OECD database.

Results from the test of stationarity<sup>12</sup> show that all variables are non-stationary. Since all variables are non-stationary, I used a cointegration test for checking non-stationarity in the errors. The results from the cointegration tests on the errors suggest the null that errors in the series are non-stationary can be rejected at the 1 percent level both for supply and demand estimations.<sup>13</sup>

As shown in Figure 1, there is a sudden increase in credit between August and September 2006. According to the SNB monthly reports

<sup>11</sup> Schmidt and Zwick (2012) include lag of 4 quarters of industrial production due to the fact that "bank credits lag economic activity quite substantially" (p. 13). Walsh and Wilcox (1995) include 7 months lag of economic indicators when looking for an effect of bank credit on economic activity.

<sup>12</sup> Tests if statistical properties of the time series do not change over time. In this paper stationarity is assumed to be the order to two, where the mean, variance, and auto-covariance does not change with time.

<sup>13</sup> P-values of 0.000 for both tests.

**Table 1: Results of the Test of Stationarity**

Variables	Test Statistic	McKinnon approximate p-value for Z(t)
Utilized credit	1,326	0.9967**
Lending capacity of the banks	1,244	0.9963**
Deposit volume	-2,136	0.2303**
Expected inflation	-2,477	0.1212**
Composite Leading Indicator (CLI)	-1,350	0.6059**
Swiss Performance Index (SPI)	-0.236	0.9340**
Lending rate	-0.881	0.7942**

Note: The null hypothesis of a unit root can not be rejected at 1 percent significance based on McKinnon one-sided p-values.

this increase is due to a change in the accounting methods.<sup>14</sup> Therefore, it is necessary to check for structural breaks in the data for both supply and demand equations to determine if each series can be pooled together. I employ the Chow test for the period before and after August to September 2006 and check for a known structural break. In terms of the supply equation, I reject the null ( $p < 0.02$ ) of no difference in the estimated coefficients leading to the assumption that the estimations before the structural break and after the break are different. Since I cannot pool the series together, I include a dummy for the break and interaction of the explanatory variables with the break in the supply equation. If the structural break is not accounted for, it could lead to bias in the estimations, general unreliability of the model, and false estimates when forecasting. For the demand equation, however, I do not reject ( $p > 0.10$ ) the null of no

difference in the estimated coefficients and use it in the original form.<sup>15</sup>

## V. RESULTS

The estimation results are included in Table 2. The results of the analysis do not reflect the existence of a credit crunch in Switzerland that is consistent with Friedman's definition of credit crunch as a crisis in bank lending and alternative lending channels. In addition, there are no signs of credit rationing as firms respond fully to interest rate adjustments. The supply equation shows that there is a strong positive association between credit supply and lagged loans ( $p < 0.001$ ), as well as the lending capacity of banks ( $p < 0.001$ ). The estimated coefficient on the interaction term between the break dummy and lagged loans is negative, which indicates that with the break included in the estimation the association between lagged loans and the credit supply is different. In contrast,

<sup>14</sup> Before September 2006 only the big branches of Raiffeisen bank were recorded, afterwards all branches of Raiffeisen bank are included (SNB, March 2007).

<sup>15</sup> Given that I reject the null at around 10 percent, I carried out a robustness check by repeating the estimations including the break dummy and the interactions both for supply and demand equations. There were no significant differences in the main results.

inflation has a negligible negative association with credit supply, meaning that an increase in inflation is associated with a lower supply of loans.<sup>16</sup>

Deposit volume is introduced as a control variable in order to assess whether large capital inflows stimulated the supply of credit in Switzerland. If this were to be the case, the behavior of deposit movements could potentially dampen the impact of monetary policy channel. My results show no statistically significant relationship between deposit volume and credit supply. This supports the hypothesis that monetary policy, rather than international capital inflows, played a significant role in providing a stable supply of credit during the financial crisis and the crisis in the Eurozone.

In terms of demand, lagged values of the Composite Leading Indicator (CLI), Swiss Performance Index (SPI), lending rate, and inflation are included. Both the supply and the demand equations include a lag of half a year (two quarters) of inflation. In the demand equation CLI, SPI, and lending rate also include a lag of half a year. Lagged loans and SPI both have a significant and positive association with credit demand. This shows that when firms demand more credit, economic activity tends to grow. Finally, when the lending rate increases, firms tend to demand less credit.

In order to identify possible periods of credit crunch, Figure 3 shows the plot of the difference between estimated credit supply and

credit demand against the actual credit volume.

A marked slowdown in demand can be observed, beginning before the financial crisis and continuing through the first half of 2008. During the beginning of the crisis, however, supply kept pace with demand, with temporary excess demand in mid-2010. Excess demand owed to the fact that interest rates were lowered and reached almost 0 percent in 2010, while the Swiss franc experienced continuous appreciation. Sharp appreciation of the franc and an increase of imports in a low interest rate environment might have led to increased demand, particularly from the domestic construction sector (SNB 2010).

According to SNB (2012), banks that focused on the domestic clientele did not experience a significant impact of the crisis and continued to be well capitalized throughout the crisis and in the aftermath (23). Moreover, two big banks, UBS and Credit Suisse, received quick policy support, particularly UBS, with an emergency bailout and recapitalization. As such, banks' lending capacity continues to be positively and significantly associated in the estimation results with credit supply throughout the crisis period.

While these results do not provide evidence of a credit crunch in Switzerland, credit markets were far from functioning smoothly, as can be seen from the difference in credit demand and supply (Figure 3). However, temporary excess demand in mid-2010 constitutes a credit slowdown, rather than a credit crunch. According to Cantor and Wenninger (1993), a credit slowdown can originate from the supply side through either changes in the bank balance

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<sup>16</sup> With the pooled series inflation does not have an effect on the supply of credit.

**Table 2: Results of the Test of Stationarity**

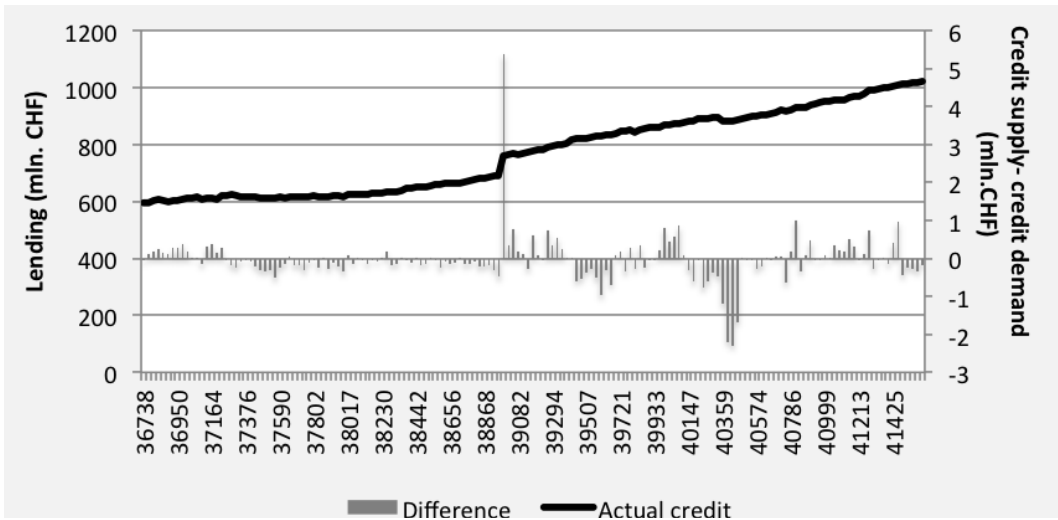
	Supply Equation	Demand Equation
Constant	14032.1 (12530)	44304.8 (44529)
Lagged Utilized credit	0.653*** (0.085)	0.985*** (0.008)
Lending capacity of banks	0.280*** (0.064)	
Deposit volume	-0.074 (1.229)	
Expected inflation (-6)	-1763+ (1066)	550.4 (788.13)
Composite Leading Indicator (-6)		-465.1 (452.51)
Swiss Performance Index (-6)		3.241** (1.210)
Lending Rate (-6)		-1843.9* (840.72)
Break	-13515.4 (13893)	
Break*Lagged Utilized Credit	-0.364*** (0.093)	
Break*Lending capacity of the banks	0.329*** (0.072)	
Break*Deposit volume	0.053 (1.229)	
Break*Expected Inflation (-6)	996.6 (1176)	
N	161	161
Adjusted R-squared	0.994	0.997
<p>Note: Standard errors in parentheses; + p&lt;0.10, * p&lt;0.05, ** p&lt;0.01, *** p&lt;0.001; In the supply equation, I included the difference between lending rate and money market rate (Erdogan and Senftleben 2009) to control for banks' moral hazard resulting from asymmetric information between borrowers and lenders (5) and did not discover statistically significant association with the amount of credit supplied; In the demand equation, I included monthly industrial production (Schmidt and Zwick 2012) to account for economic activity instead of the Composite Leading Indicator (CLI) and did not find any significant association. Volume of industrial bonds has been included to account for alternative financing channels other than bank credit financing (Schmidt and Zwick 2012) and did not find any significant association with credit demand.</p>		

sheet or regulatory and policy changes. The reason for the credit slowdown in mid-2010 might be attributed to policy changes, such as large amounts of foreign currency purchase by the SNB to relieve the pressure on the franc, as well as changing collateral requirements to prevent overextension of credit and overheating in the domestic construction market.

## VI. DISCUSSION

In this paper I explore the possibility of a credit crunch in Switzerland from 2000 to 2013 using a dynamic (dis)equilibrium model similar to the one used by Schmidt and Zwick (2012) in their analysis of the German credit market. In order to determine actual lending, I have used explanatory variables that are commonly

**Figure 3: The Difference between Credit Supply and Credit Demand Compared to Actual Lending**



included to differentiate between credit supply and credit demand.<sup>17</sup> I have implemented robustness checks using control variables and incorporated dummy variables to account for a known structural break.

The results suggest that during the financial crisis, there were no signs of either credit crunch or credit rationing consistent with the definitions set forth in this study. On the contrary, supply closely followed demand throughout the crisis period with temporary excess demand in 2010. Lending capacity of banks continued to have a significant positive association with credit supply, suggesting that bank capitalization and lending capacity played a crucial role in the steady supply of credit. However, there was a supply-dependent credit slowdown in 2010 after a period of credit growth owing to policy changes to prevent overextension of credit as a response to

increased domestic demand and overheating in the domestic housing market. Moreover, there is no association between deposits in the banking sector and the supply of credit. This finding negates the assumption that non-policy induced effects dominated credit supply, namely large international capital inflow deposited in the Swiss banking system. These findings shed some light on the extent of the influence and the speed of monetary policy transmission to the Swiss domestic credit market, particularly regarding the dynamics of credit supply and demand during crisis times.

Switzerland's exceptional performance compared to its European peers therefore seems to owe to a combination of sound macroeconomic and fiscal fundamentals and smart and timely sequencing of monetary policy and government support, particularly on the side of the Swiss National Bank. Crucial policy responses included, but are not limited to: early bailout and recapitalization of its two big banks; lowering of the interest rate to almost 0 percent at the onset of the crisis to stimulate

<sup>17</sup> Schmidt and Zwick (2012), Erdogan and Senftleben (2009), and Čeh, Dumičić and Krznar (2011)

demand and fill-in the credit gap; and setting up an exchange rate floor, thereby helping to contain deflationary shocks and create a level of certainty for export industries.

When compared to its neighbors in the Eurozone, Switzerland continued to benefit from a firm fiscal standing during the financial crisis and the subsequent sovereign debt crisis in the Eurozone. These advantages entailed a flexible labor market, low unemployment, balanced budget, and positive trade balance, all of which might have contributed to weathering the crisis with fewer losses. This compares to Eurozone countries that experienced painful fiscal austerity measures to cut government spending, which led to rising unemployment and plummeting public health. In addition, it is worth noting that considering Eurozone countries' limited authority over monetary policy, they pursued active fiscal policy measures and instruments to overcome the crisis. While in Switzerland, monetary policy played a much more prominent role in stimulating the domestic economy and encouraging credit supply and demand.

Much can be learned from the Swiss case, particularly in terms of the speed and effectiveness of policy responses. My analysis suggests that rapid policy interventions in the form of early bank bailouts and monetary policy interventions of SNB to stabilize the franc might have had significant role in creating a faster and less volatile recovery. In particular, SNB's monetary stimulus and the accompanying decrease in interest rates—which included bank bailouts and recapitalizations—might have helped to “fill-in” the credit gap and the findings suggest a significant association between credit demand and the lending rate.

In addition, I find no supporting evidence to the possible argument that Switzerland's “lucky” position as a safe haven for international investors and associated inflow of foreign capital as deposits in its banking system might have contributed to the steady supply of credit. The results of the analysis show no significant relationship between deposits in the banking sector and credit supply, which suggests that domestic credit supply was not driven by outside factors such as an influx of foreign capital. On the contrary, the safe haven effect proved to be something of a double-edged sword. It may have led to increased domestic demand through the appreciation of the currency. On the other hand, however, it is likely to have lowered the competitiveness of export industries and contributed to overheating in the housing market.

While my results suggest that a credit crunch did not occur in Switzerland during the financial crisis or the following Eurozone crisis, there are a number of limitations to my analysis, which should be addressed by further research. First, the study employs only the OLS method to run the (dis)equilibrium model. A study relying only on OLS to estimate credit market (dis)equilibrium in Switzerland might not fully reveal additional relevant information regarding the Swiss credit market. While associated robustness checks have been implemented and results interpreted accordingly, further research should include other estimation methods, such as the dynamic and static version of Maximum Likelihood Estimation and Bayesian methods. Second, in choosing the dependent variable, the study focuses on the aggregate utilized credit of the whole banking

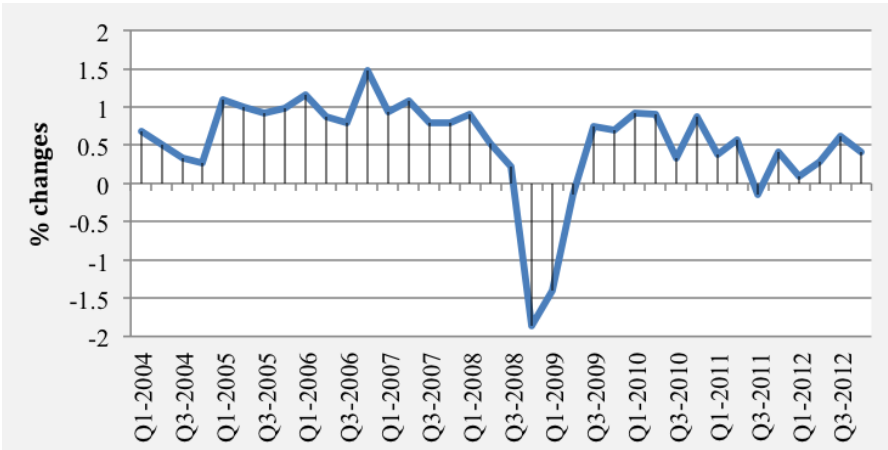
sector.<sup>18</sup> A separate analysis of the each banking group (Cantonal, regional, Raiffeisen, big banks, and other banks) should be implemented, in order to reveal more information on the impact of the financial crisis on the domestic credit supply of each banking group, particularly in the case of SIFIs. In addition, further research that builds upon this paper but focuses on credit conditions after Switzerland abandoned the currency peg in January 2015 could reveal important insights into the domestic dynamics of credit supply and credit demand and the channels through which monetary policy affects credit supply and credit demand in Switzerland.

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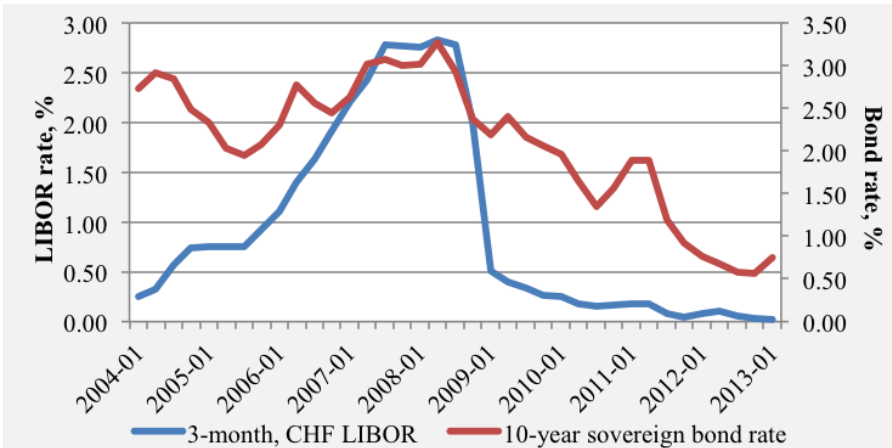
<sup>18</sup> Does not include credit supply by finance companies, branches of foreign banks and private bankers (SNB 2009).

## VII. APPENDIX

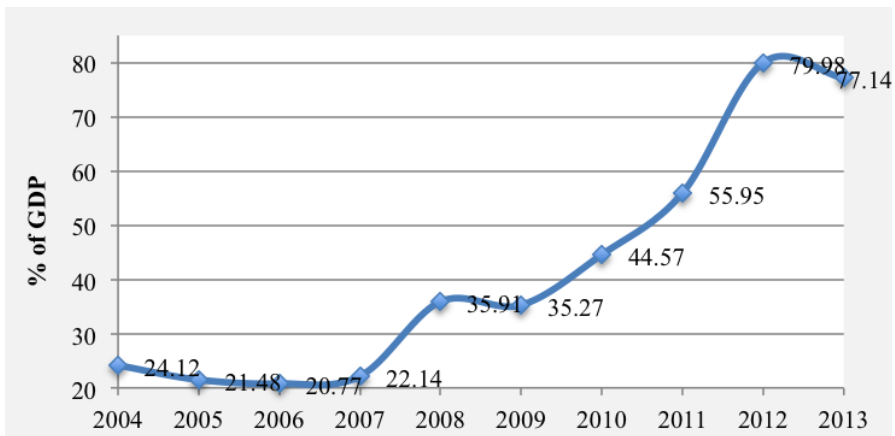
Appendix Figure 1. Swiss GDP, Quarter-on-quarter Changes



Appendix Figure 2. Interest Rates, Percent



Appendix Figure 3: SNB's Balance Sheet as Percentage of GDP

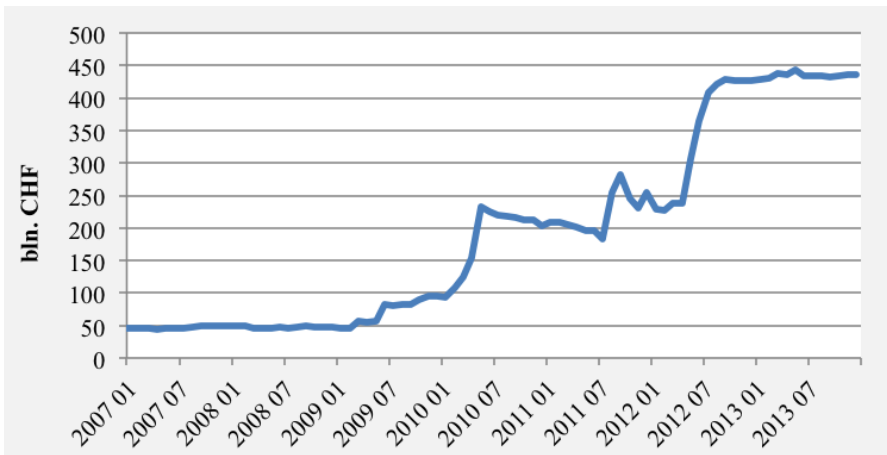




**Appendix Figure 4: EUR/CHF Exchange Rate**



**Appendix Figure 5: SNB Foreign Currency Reserves**



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