Real exchange rate fluctuations under flexible exchange rate regime

The impact of the economic shocks on Swedish Krona

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ABSTRACT

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Regime; Aggregate Demand/Aggregate Supply Model; Regression
Analysis

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Problem: The extent of the Swedish krona fluctuations under flexible exchange
rate regime in response to the supply, demand, and monetary shocks

Purpose: The aim of this research study is to see which economic shocks had the
greater impact on the Swedish krona under the flexible exchange rate
regime. Precisely, were the theoretically suggest real demand and
monetary shocks significant in explaining the real exchange rate
fluctuations? And to what extent the labor productivity shock (the supply
shock) influenced the krona during the studied period?

Method: Multiple regression analysis; OLS

Results: Monetary shocks accounted for major fluctuations of the Swedish krona
since the currency was left to float freely. The real demand shocks were
found less statistically significant. Supply shocks have had negligible
impact on the Swedish krona fluctuations.
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Karina Petrova              Anastasiya Bochkareva

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Notations

SEK - Swedish Krona
USD - United States Dollar
GBP - Great Britain Pound
ECU - European Currency Unit
ERM - European Exchange Rate Mechanism
AD - Aggregate Demand
AS - Aggregate Supply
SRAS - Short-Run Aggregate Supply
LRAS - Long-run Aggregate Supply
AD/AS model - Aggregate supply/Aggregate demand model
RBC - Real Business Cycles
IS - Investment/Saving
LM - Liquidity preference /Money supply
FE - Foreign Exchange market
BoP - Balance of payments
GDP - Gross Domestic Product
CPI - Consumer Price Index
NX - Net Exports
OFF - Net Sales of Foreign Exchange
DW statistic - Durbin-Watson statistic
R^2 adj. - adjusted R^2
1. INTRODUCTION

1.1 Background
There has been raised a lot of questions in financial press and the Riksbank (the Central bank of Sweden) publications concerning the fluctuations in the real exchange rate of Swedish krona (SEK). The value of the currency has been unstable for the past years; there is an obvious trend of krona getting weaker (see Appendix A) - since 1975 it has weakened in nominal terms by approximately 90% (Heikensten, 2001).

The changes in value of the currency were caused by the alterations in economic situation within Sweden and also in the outside world. Brief look at most important events in economic history of Sweden could help to identify the time periods where the most significant fluctuations in the Swedish currency occurred. Before 1992 the value of Swedish krona was fixed and regulated by the Riksbank but after 1992, Riksbank was no longer controlling the value of the currency: it was determined by the market and therefore affected by changes in the economy.

1.1.1 Brief History of Swedish krona: from fixed to flexible exchange rate regime
The Swedish bank crisis hit in the early 1990s. Real after-tax interest rate jumped from –1% in 1989 to +5% in 1991. This increase was a result of three different impulses.

Firstly, in 1990 the Germany’s real interest rates jumped as a result of the high unification costs. Sweden had to import these high real interest rates, pushing its own interest rates even higher. (Ergungor, 2007)

Secondly, the resignation of the Finance Minister in 1990 forced the Riksbank to raise the interest rate, and gradually macroeconomic priorities have changed to focus more on the inflation.

And thirdly, the marginal tax on the capital income and the interest deductions were reduced to a flat 30% (from 50%) as part of the major tax reform in 1991. As the result, the crisis spread to the part of the money market. It affected banks and overlapped with a sharp downturn of the real estate market. (Englund, 1999)

In 1991 the Riksbank pegged Swedish krona to European Currency Unit (ECU), despite the fact that Sweden was not a member of the European Union or the European Monetary Union.
There was no obligation of European Central Banks to defend krona in case of any speculation attacks. Riksbank was the one responsible for keeping krona rate within the specific range: 7.3-7.5 SEK per ECU. (Lindberg & Lindenius, 1991)

The banking crisis coincided with the European exchange rate mechanism (ERM) crisis. The chaos on the European currency markets during the summer of 1992 spilled over to Sweden. The krona came under pressure after Finnish markka was left to float and tension rose within the ERM. This led to speculations against the krona and the Riksbank was forced to raise interest rate to 75%. Further in order to defend krona, when UK and Italy left ERM, the interest rates increased overnight to 500 %. (Englund, 1999)

Measures taken to reduce the pressure on the krona enabled the Riksbank to lower the rates to the initial level. In November, the devaluation expectations started to rise again and speculations against krona resumed. On November 19, the Riksbank increased the overnight rate to 20 %. However, this measure was not sufficient to stabilize the krona rate and within a couple of hours the Riksbank announced that the krona was left floating. (Lindberg, Söderlind, Svensson, 1993)

1.1.2 Brief History of Swedish krona: 1993-2009 Flexible Exchange rate Regime

Due to the crisis of 1990, in three years, from 1991 to 1993, output fell by about 5 %. Growth fell drastically and was negative for three years in a row (Nyberg, 2006). The krona depreciated sharply and reached its low against ECU (Euro) in April 1995. The depreciation was about 25% below its level when the fixed rate was abandoned. As a result of the development of public finance in 1994 – 1996 and due to the generally strong economic development, starting from 1995 the krona has become appreciably stronger: both long and short rates of interest have fallen. (Heikensten, 1996)

In June 1997, accompanied by turbulence which has started on Asian foreign-exchange and equity markets and spread all over the world, Swedish bond rates fall and krona depreciated (Sundaram, 2006; Sveriges Riksbank, 1998). In 1998 krona weakened again in the connection with the Russian crisis. On a 12 month basis the depreciation amounted at most to about 10 % against US dollar. This weakening of the Swedish currency was connected to the one of the largest price collapses in the modern times in commodity markets, including a barrel price of oil decrease towards 10 USD. (Heikensten, 2001)
During the years following the IT crash in 2000, however, there was slowdown in global GDP growth (including Swedish GDP) that resulted in even stronger appreciation of SEK (Sveriges Riksbank, 2007).

The terrorist attack on 11 September, 2001 led to the strong depreciation in USD (the US central bank cut its policy rate from 6.5% to 1.75%) and Swedish krona appreciation in years 2002-2004 (Persson, 2005; Sveriges Riksbank 2007).

New financial turmoil began in July 2007, which led to a short-term weakening of the krona. But it was only when the turmoil developed into an acute financial crisis in September 2008 when the exchange rate weakened considerably: the krona has weakened against US dollar by approximately 28% and against euro by approximately 13% during 2008-2009. (Sveriges Riksbank, 2009)

### 1.2 Problem specification

As mentioned, in November 1992 the Swedish krona was left to float freely, that is, it was no longer pegged to ECU, the precursor of the Euro (EUR). Since then the value of the krona against other currencies was allowed to vary and was dependent on the market forces.

The flexible exchange rate can be seen as the shock absorber that helps to stabilize and protect the economy from the economic shocks. Chapple (1987) defined economic shocks as “*unexpected changes in the economic variables*” that cause the country’s economy to diverge from its initial equilibrium course. Demand and monetary shocks are driven by the fiscal (government) and monetary (Central Bank) policies contractions/expansions respectively. These alterations, normally, do not bear the “unexpected” component, but are still treated as being economic shocks, when they cause the drastic changes in the economy. While the supply (productivity) shocks, are really unpredictable by the nature.

The distinctive feature of the floating exchange rate regime is that the price of the currency alters automatically to the level that is required to bring back the supply and demand for this currency to the equilibrium level (McGregor, 1998). The equilibrium shifts due to the changes in the demand for goods and services, forcing the supply to adjust to the new level. The real exchange rate, as the country’s demand side component, is said to respond to the drastic alterations in the real money supply, foreign rate of return and government expenditure (i.e. monetary and fiscal policies) and to shift along with demand. (Gärtner, 2006, p.180)

The extent of the impact of stated variables on the real exchange rate can be of the different forces and directions. Moreover, even though, supply side of the economy is supposed to
adjust to the changes and is unable to influence the equilibrium by itself, several studies revealed that the supply shocks did account for the major fluctuations in the Swedish currency (Alexius, 2000, 2001).

Afterwards, the interest of this paper is to investigate the Swedish krona fluctuations in response to the economic shocks since the flexible exchange rate regime was adopted.

**1.3 The Aim of Thesis**

The aim of this research study is to see which economic shocks had the greater impact on the Swedish krona under the flexible exchange rate regime. Precisely, were the theoretically suggest real demand and monetary shocks significant in explaining the real exchange rate fluctuations? And to what extent the labor productivity shock (the supply shock) influenced the krona during the studied period?

**1.4 The previous researches**

Previous studies proposed different conclusions about the economic shocks and their influence on the fluctuations in the real exchange rates. Thomas’s (1997) analysis of the Swedish krona fluctuations (1979:Q1-1995:Q4) showed that currency response to the supply shocks was negligible, while real demand and monetary shocks accounted for the major amount of krona value instability. In contrast, the studies of Alexius (2000 and 2001) indicated that in the long-run (the study period 1960:1-1998:4) supply (productivity) shocks had the major impact on the krona behavior (60-90 percent). Artis and Ehrmann (2000), after analyzing the UK, Denmark, Canada, and Swedish currencies’ rates and their responses to the shocks came to the conclusion that the real exchange rates’ responses to the real economic shocks were insignificant, where the major variability was explained by the Central bank interventions, precisely, monetary shocks (the study period 1985-1995).
2 THEORETICAL BACKGROUND

2.1 Demand shocks

Demand shock is a sudden event that temporarily increases or decreases demand for goods or services. The examples of the demand shocks:

*Monetary shocks* - shocks due to the exogenous changes in the monetary policy, e.g. sharp increase/decrease in the supply of money; increases/decrease in the interest rates

*Real demand shocks* - shocks due to the extreme changes in the fiscal policy or the household spending behavior; the changes in the international trade behavior

The demand shocks shift the aggregate demand (AD) curve: when demand for a good or service increases (decreases) the price of that good or service typically increases (decreases) and this relationship is mirrored by the upward (downward) shift of the aggregate demand curve (see Figure 1 below). (Burda & Wyplosz, 2005, p.349)

2.2 Supply shocks

The radical deterioration or improvement of the production conditions in the economy is called the supply shock:

The *adverse supply* shocks - the economic transition from central planning to a market economy; sudden loss of the factors of production; the result of the natural disasters or wars; the oil price increase

The *positive supply* shock - acceleration in the technological advances; the discovery of natural resources

Supply shocks are represented by shift of the aggregate supply (AS) curve (more often the short-run aggregate supply curve, but sometimes there is a possibility for the long-run supply curve- LRAS to shift). When the shock is unfavorable (adverse) the short-run aggregate supply (SRAS) curve shifts upward which leads the increase in prices and the fall of output. The favorable supply shock will lead to the decrease in prices and the increase in output, and will shift the SRAS curve downward (see Figure 2). (Burda & Wyplosz, 2005, pp.319-323)
2.3 The flexible exchange rate regime

Under flexible exchange rate regime, the exchange rate is said to be endogenous: dependent on the market forces. The flexible exchange rate regime idea is that the price of the currency (as any other market driven price) is driven by the supply and demand forces and the only force that can have the impact on exchange rate stabilization is the monetary policy (McGregor, 1998; Caramazza & Aziz, 1998).

The theoretical models exist as a help tool to figure out what are the forces behind the supply and demand that cause the changes in the flexible real exchange rate.

2.4 Business cycles and the economic shocks

When it comes to the economic shocks it is important to have an idea what business cycles are. Business cycles are seen as the periods of extensive growths and declines of the economy, when the output fluctuates around the long-run trend (Reijnders, 2007). According to Burda & Wyplosz (2005, p.355), “the more modern and widely used view is that cycles represent the accumulation of random shocks over time”, stressing out the stochastic nature of the real shocks. The new shocks occur independently of the previous shocks and, therefore unpredictable by the nature. The impulse-propagation mechanism pioneered by Slutsky, also known as Frisch-Slutsky paradigm, transforms random shocks into more regular fluctuations (Reijnders, 2007). The shocks and their impacts are then mirrored by the drastic changes in the main economic indicators.

The Real Business Cycle (RBC) theory makes the emphasis on propagation mechanisms embodied in the productivity of the country. The RBC theory assumption is that prices are flexible and the major impacts on the economy disequilibrium have productivity shocks: drastic changes in the production conditions. (Reijnders, 2007)
Aggregate supply/Aggregate demand model (AD/AS model), on the contrary, as the other example of the impulse-propagation framework, implies that business cycles are propagated because prices are “sticky”, i.e. it takes time for the prices to adjust to the changes in the economy. Economic disequilibrium is the product of the aggregate demand shifts, where aggregate supply has to adjust in order to return the economy to the equilibrium condition. The AD/AS impulse-propagation mechanism emphasizes the importance of lags in responses of some key variables to their determinants. (Reijnders, 2007)

The benefit of the AD/AS model is in its distinction between fixed and flexible exchange rate regimes. Under the fixed regime the real exchange rate is set by the Central Bank exogenously. While, under the flexible regime the real exchange rate is an endogenous variable, i.e. it is determined by the market fluctuations. (Burda & Wyplosz, 2005, pp.305-324)

2.5 Aggregate Supply /Aggregate Demand Model - AD/AS model

The demand side of the economy is summarized in the Mundell-Fleming model. It shows the relationship between interest rate and the level of country’s output. The addition of the labor market to the Mundell-Fleming model extends it to the AD/AS model (Figure 3). Together the aggregate demand and aggregate supply determine the economic equilibrium in the country:

![Figure 3: Mundell-Fleming model and AD/AS model (inspired by Gärtner, 2006, ch.7)](image)

where IS - Investment Saving curve; LM - Liquidity preference/ Money supply curve; FE - Foreign Exchange market curve; w - wage; L - amount of labor employed, LAS-long-run supply, EAS- equilibrium aggregate supply. (cf. Gärtner, 2006, ch.6, ch.7)

The AD/AS model focuses on two macroeconomic variables - the price level (P) and the real level of output (GDP) in the economy. The price level and the output are endogenous (dependant) factors.
2.5.1 The demand side (Mudell-Flemming model)

The demand side relationship between the output and the price level is negative; implying that the rise in output demanded will result in the decrease in the price level:

\[ P = \alpha - \beta Y + \text{other factors} \]

**Formula 1:** Aggregate Demand Equation

Where, \( \alpha \) is the intercept of the AD curve with the y-axis (see figure 3, where y-axis is termed P); \( \beta \) is the slope of the AD curve. The slope indicates the amount of change in the price level due to one percent change in the output demanded. The “other factors” are the Mundell-Fleming building components, IS-LM-FE curves. Since under floating exchange rate regime, the government interventions are no longer adequate to move the AD curve, other factors that cause shifts in the demand are those that build the LM and FE curves. IS curve adjusts to the changes in the money market and the foreign exchange market and shifts afterwards to match the new equilibrium condition. (see Gärtner, 2006, ch.7)

**Liquidity preference/ Money supply (LM curve)**

The circulation of money in the economy is depicted by the LM curve, where (as described by Burda & Wyplosz, 2005, p. 241) the equilibrium condition is:

\[ \frac{M}{P} = L(i,Y) = \beta_1 Y - \beta_2 i \]

**Formula 2:** Money market equilibrium

The equilibrium is achieved where the supply of money \((M/P)\) is equal to the demand for money or liquidity preference \((L)\). The demand for money increases when the output \((Y)\) increases and falls when the interest rate \((i)\) increases. The LM framework stresses out that the interest rate needs to be adjusted when the demand and supply for money are not in the equilibrium. (Burda & Wyplosz, 2005, pp. 241-245)

**Foreign Exchange market (FE curve)**

Foreign Exchange market reflects relationships between countries caused by the international trade in goods/services and financial assets. The demand for the foreign currency rises with the demand for foreign goods and services, which leads to the increase of imports. The foreign country demand for domestic products, therefore, leads to the increased demand for the local currency and increased export. At the same time the higher foreign rate of return will cause the outflow of the domestic currency, since people will invest in foreign assets to gain profit. The same is true for the increase of the domestic rates of return, which will initiate the investments from abroad. (McGregor, 1998)
The monetary transactions with the rest of the world are depicted in the Balance of Payments. As defined (see Burda & Wyplosz, 2005, p. 38):

\[ \text{BoP} = NX(\sigma, A, A') + z(i - i^w) \]

**Formula 3:** Balance of Payments

where \( NX \) is net exports or net trade, \( A \) and \( A' \) are domestic and foreign absorption respectively, \( \sigma \) is the real exchange rate, \( z \) is the level of capital mobility, \( i \) and \( i^w \) domestic and foreign interest rates (the abbreviation “w” stands for “world” as the aggregate presentation of the foreign rates) respectively (Burda & Wyplosz, 2005, pp.243-244).

The interest rate parity condition states that \( (i - i^w) = E \), where \( E \) is the expected depreciation of the nominal exchange rate. The idea behind the parity is that if the \( i^w \) and \( E \) shift in the same direction (the small open economy assumption). The expected depreciation of the domestic currency increases together with the increase in the foreign rate of return. The parity condition can be rewritten as follows: \( i = i^w + E \). (Gärtner, 2006, p. 196)

**Investment/Saving (IS curve)**

The idea behind the IS curve is that the interest rate and GDP are determined by the propensity to save or to consume. The curve captures the market of goods and services. Under flexible exchange rate regime the IS curve will adjust to the shifts in the LM and FE curves. The position of the curve is stated by the “other factors” rather than exogenously by the demand for goods/services (the GDP components building the IS curve).

\[ Y = C + I + G + NX(\sigma, A, A') \]

**Formula 4:** Open Economy Demand of Goods/Services

where \( C, I \) and \( G \) are the Household consumption, Investments and Government expenditure on goods and services respectively. (Burda & Wyplosz, 2005, pp.232-233)

**“The other factors”**

Afterwards, “other factors” that determine the shifts in the AD curve under flexible exchange rate regime: Money Supply \((M)\), Foreign Interest Rate \((i^w)\), and expected nominal exchange rate depreciation \((E)\). Gärtner (2006, pp.176-180) summarized the AD relationships as follows:

\[ p = \alpha - \beta Y + [M(+), i^w(+), E(+)] \]

where, \((+)\) indicates that the increase in the factors will stimulate the demand for domestic products. This will shift the AD curve upwards and increase the price level.
From the LM equation (see Formula 2 under LM section):

\[ p = m - \beta_1 Y + \beta_2 i \]

and from the interest rate parity condition (see formula 3 under FE section):

\[ i = i^w + E; \text{ substituting in the above equation } i \text{ with } (i^w + E), \text{ obtain:} \]

\[ AD: p = m - \beta_1 Y + \beta_2 (i^w + E), \]

**Formula 5: Aggregate Demand**

where money supply \( m \), foreign interest rate \( i^w \), and \( E \) are in logarithms to ensure that the continuous change in these variables is required to shift the aggregate demand curve.

### 2.6 Real exchange rate and AD/AS model

The AD/AS model states that supply will adjust to the demand in the short-run (due to the “stickiness” of the prices) making the demand side deterministic to the economic equilibrium and explanatory to the real exchange rate fluctuations under flexible exchange rate regime. The important idea behind the model (under flexible exchange rate regime) is that money market, LM, and foreign exchange market, FE, determine the shifts in the aggregate demand curve and, therefore, the equilibrium in the economy. Neither fiscal policies, nor investors’ will to invest, or imports of the foreign countries’ output have the force to shift the AD curve. The real exchange rate adjusts to the new equilibrium conditions caused by the changes in the monetary policy and foreign exchange market and shifts the IS curve to match the new equilibrium. However, the government spending (the IS factor) is exogenous by itself and regulated by the government authorities’ decisions. The relationship of the exchange rate and the LM, FE, and IS factors is derived according to the AD/AS model assumptions of the sticky prices and flexible exchange rate regime, where the real exchange rate is influenced by the money supply, government expenditure and foreign rate of return (see Burda & Wyplosz, 2005, ch.13):

#### 2.6.1 Money supply

The increase in the supply of money shifts the LM curve downwards (Figure 4). The shift causes the reduction in the domestic interest rate and makes it lower comparing to the foreign interest rate, which leads to the negative relationship: the interest rate parity condition is deteriorated. This weakens the domestic currency, i.e. depreciates the real exchange rate because money now (with the higher foreign rate of return, \( i^w \)) flows out of the country to gain the benefits from the higher rates abroad. The reduction in the supply of money will
work in the opposite direction and appreciate the real exchange rate. (Burda & Wyplosz, 2005, p. 254)

2.6.2 Government expenditure

The increase in the government spending shifts the IS curve upwards (Figure 5). As the response to the shift, the domestic interest rate rises and becomes higher than the foreign rate of return. Consequently, the capital from abroad flows in the country and the local currency becomes stronger compared to the foreign currency. Real exchange rate appreciates. The decrease in the government expenditure works in the opposite direction. (Burda & Wyplosz, 2005, p. 253)

![Figure 4: LM shift](image1)

![Figure 5: IS shift](image2)
3 METHODOLOGY

3.1 Research Approach

The approach of analyzing the influence of the fundamental macroeconomic variables on the real exchange rate includes the theoretical backgrounds about the macroeconomic models: the AD/AS model; the supply, demand and monetary shocks impact on the country’s economy, even though that is not the straightforward approach.

The research is accompanied with self-conducted statistical analysis (regression analysis) on the degree of explanation the real exchange rate by the chosen economic shocks’ indicators. The test model is the AD/AS model and its assumptions. As the model is limited to the real demand and monetary shocks’ impact on the real exchange rate, the suggested by the RBC theory productivity shock (or supply shock) is also tested in the regression equation. As the proxy for the Swedish krona value, the real exchange rates against three major open economies were chosen: the United States of America (USA), the United Kingdom (UK), and Germany (the European Union and euro currency representative). The proxy for the demand shock consequences was the real Government Consumption Expenditure (G), the monetary shocks were mirrored in the changes of the real Money Supply (M) and supply shocks were analyzed by means of Labor Productivity (Pr).

3.2 Measuring Economic shocks

The definition of the shocks was based on the review of the Swedish economy and the impacts on it during the studied 17 years period, mentioned in the introduction. Moreover, the trend analysis of real government spending, real money supply and labor productivity was conducted (see Appendix B). The intention was to compare the actual behavior of the shocks proxies and the expected/predicted values of the factors taking into account the krona behavior at the same periods (see Appendix A). The shocks were measured according to the deviations of the predicted values of the factors from the trend line. The major deviations were treated as the shocks.

The trend analysis of the shocks’ proxies, real money supply, real government spending, and labor productivity revealed that for the studied period of 17 years the factors showed the rising trend, as well as real exchange rates. This means that, while krona was depreciating during the whole period, the economic indicators were rising.

In the third quarter of 1994 the labor productivity rose above the expectations by 7%. In the second quarter of 1995 the real money supply fell under its expected level by 5%. At the same
period krona reached its minimum since 1993, i.e. 25% depreciation below its initial equilibrium level. From the end of the 1997 and during the 1998 money supply increased by 6%, while krona fell by 10% against the US dollar. In fourth quarter of 2000 and then in fourth quarter of 2001 the real amounts of money supply increased sharply, comparing to the expected numbers, by 7% and then 11% (which was actually the major shift during the whole period). In year 2003 the government expenditure exceeded the expectations by 7% in the fourth quarter. Further, in 2004 the productivity jumped 12% above the trend followed by krona appreciation. The economy stabilized for a while until year 2008 and all the way through the financial crisis. The supply of money fell 10% below the expectation in the beginning of 2009, while labor productivity was 11% below in the precise period.

Assuming that the economic shocks have the long-lasting effect on the economy and the real exchange rate (Alexius, 2000), the impact of the shocks was analyzed through the whole 17 years period (68 quarters), but not just during the exact periods when the shocks occurred. The regression analysis was expected to reveal the extent of the explanatory power of the chosen economic shocks’ proxies towards the three real exchange rates.

### 3.3 Deriving the real exchange rate equation

After all, given that:

- the real exchange rate as the part of the IS curve, is the component of the AD equation (see Formulas 4 and 5);
- the nature of the impact of the shocks’ proxies \((M, i^w)\) under flexible exchange regime;
- RBC theory of productivity shocks impact on the economy

the real exchange rate explanatory equation can be derived as follows:

\[
RER = M - G - i^w - Pr
\]

*Formula 6: Real Exchange rate equation*

This relationship is the base for the analysis of the impact of the proxies of the economic shocks on the Swedish krona.

### 3.4 Choice of data

The data for Sweden and foreign consumer price indexes (UK CPI; USA CPI; Germany CPI) was obtained from the Organization for Economic Co-operation and Development (OECD) Main Economic Indicators (MEI) online database. The nominal exchange rates were taken
Real Exchange Rate Fluctuations

from the Riksbank webpage, and Swedish macroeconomic indicators were found in Statistiska Centralbyrån (Swedish statistics, SCB) online database. All the data was taken quarterly, and transformed into natural logarithms ($Ln$).

Dependent Variable:

- Real exchange rate: nominal exchange rate of krona against other currencies (USD, GBP, and EUR) times the ratio of foreign and Swedish CPIs. The choice of the currencies against Swedish krona was based on the trade weights. According to the Total Competitiveness Weights index (TCW index presented by the Riksbank with 21 main trading partner countries weights), the USA, the UK, and Germany all together account for 45% of total weights.

The choice of independent variables is based on the nature of the flexible exchange rate regime suggested by the AD/AS model:

- Real Government consumption expenditure, current prices, SEK millions: Government consumption expenditure divided by CPI (2005=100).
- Real supply of money, current prices, SEK millions: M (bank notes and coins in circulation) divided by CPI (2005=100).
- Labor productivity: GDP at market prices (current prices, SEK millions, production approach) divided by hours worked

3.5 Restrictions

3.5.1 Time period

The period is limited to 17 years, since the aim was to analyze the Swedish krona fluctuations during the period when the currency was left to float freely (was no longer pegged to ECU), from 1993Q:1 until 2009Q:4.

The quarterly data is used for the analysis. The quarter covers the short time period and is considered to show frequent and comprehensive observations during the period of 17 years.

3.5.2 Domestic versus foreign economic indicators

The domestic (Swedish) economic indicators were used to explain the real exchange rates fluctuations. They are considered to absorb and reflect the changes in the economy abroad, since Sweden is the small open economy. The foreign rate of return is not taken into account in the analysis. Moreover, the interest rate parity equilibrium condition implies the adjustment
of the local interest rate to the foreign rate of return, and is assumed, therefore, to be mirrored in the domestic real money supply in this analysis.

Furthermore, the real exchange rate of Swedish krona and European currency until year 1999 includes the predecessor of the Euro, ECU values in the analysis. As Euro replaced ECU at the value 1:1, there expected to be no bias in the results.

3.5.3 Purchasing Power Parity and inflation
Purchasing Power Parity (PPP) assumption of the real exchange rate stationary fluctuations around the constant equilibrium level was rejected by empirical studies, as the equilibrium appears to change over time (Alexius, 2000). The evidence of the Swedish krona trend of getting weaker since 1975 and never returning back to the initial equilibrium strengthens the previous empirical findings and neglects the PPP assumption.

Moreover, PPP suggests that the currency will have the depreciating trend, when the inflation rate is high compared to the rest of the world (Burda & Wyplosz, 2005, p.193). Since 1993 the target inflation was established to 2 % plus/minus one percentage point. The evidence showed that the rate of inflation was on average even lower than the target, around 1,125% during the given time period of 17 years (calculated by using CPI index changes). The explanation of the real exchange rate fluctuations from the inflation perspective was also ignored in this study paper.

3.6 Statistical limitations

3.6.1 Statistics versus theoretical background
Statistical results do not always mirror the theoretical backgrounds or even contradict them. The economic shocks are unpredictable by the nature and can act in different directions, and therefore, it is difficult to put them on the theory.

3.6.2 The analysis relevance
Since the economic shocks have the impact on the economy, this impact was mirrored in the main economic indicators, which reflect the activities inside the economy. Consequently, the explanatory power of the economic variables towards the real exchange rate fluctuations was considered to be relevant in showing the economic shocks effects.

3.6.3 Logarithmic transformation
Non-linear relationships among the dependent and independent variables were expressed as linear among their logarithms. To achieve the better fit of the data to the regression line, the regression variables (dependent and independent ones) were transformed to the natural
logarithms. Natural logarithms were applied for the continuous growth rates, which was considered to be desirable for the time series data. The logarithmic transformation took the following general form:

\[ \ln Y = \ln \alpha + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \ln e \]

where \( \beta \) coefficients are interpreted as the elasticity of \( Y \) with respect to \( X \).

This transformation was expected to make the residuals normally distributed, to reduce the heteroscedasticity (possibility of having different variances of the variables) and convert exponential trends to the linear trend. Moreover, the transformation was needed to get the best possible \( R^2 \), adj.\( R^2 \), t-statistic, DW-statistic, and smooth the multicollinearity (high correlation) between the independent variables.

### 3.6.4 Level of significance

The analysis and statistics are considered to have significant explanatory power at least at 5% (or lower) level, which is traditionally used in the regression analysis.

### 3.7 Multiple Regression analysis

The regression analysis was conducted in the statistical software Minitab. The program is easy to use; it provides the complete set of statistical tools, including descriptive statistics, hypothesis tests, confidence intervals, normality tests, regression and time series analysis. Minitab also provides the possibility to see the regression results by means of plots and graphs.

According to Barrow (1996, p. 220) the regression analysis is a good tool to measure the influence of the exogenous variables upon the endogenous one and to assess the level of significance of each independent variable. Moreover, the direction of the causality is presupposed to be from the explanatory variables towards the dependant one, which is applicable in this study paper, since the nature of the causality direction was dictated by the theoretical background.

Regression analysis is a tool to generate the linear equation that shows the statistical relationship between the variables, where one variable is dependent and the others are expected to be explanatory. The equation where the explanatory power is spread across several variables is the multiple regression equation. The equation has the following presentation:

\[ \sigma = \alpha + \beta_1 g + \beta_2 m + \beta_3 pr + e \]

Formula 7: Regression Equation
where, the dependent variable $\sigma$ is the natural logarithm of the real exchange rate. The explanatory variables are: $(g)$ - the natural logarithm of the real government expenditure, $(m)$ - the natural logarithm of the real money supply, $(pr)$ - the natural logarithm of the labor productivity. The error component $(e)$ reflects the other (out of the scope of the regression analysis) factors that might influence $\sigma$. Coefficient $\alpha$ is the estimate of how $\sigma$ would look if the regression’s independent variables were zero (the y-intercept of the regression line). Coefficient $\beta_1$ shows the elasticity of the real exchange rates with respect to the government spending (i.e. the percentage change of $\sigma$ due to 1% change in $g$, given that the real money supply and labor productivity remained constant). The same explanation stands for the $\beta_2$ and $\beta_3$ coefficients. According to the theory, the signs of $\beta_1$ and $\beta_3$ estimates were expected to be negative, while the $\beta_2$ sign was expected to be positive. The sign of the $\beta$ coefficients shows the direction of the relationship between the dependent and independent variables. The (+) sign means that the real exchange rate is supposed to increase in response to the increase in the supply of money (i.e. weakening the krona). The (-) sign on contrary shows that real exchange rate decreases when government spending and labor productivity rise (strengthening the krona).

### 3.7.1 Ordinary least squares

Ordinary least squares (OLS) is the method used by the regression analysis, where the idea is in deriving the equation by minimizing the sum of squared residuals. If plotting it on the graph, than the OLS method minimizes the distance between the residuals and the estimated regression line. According to Barrow (1996, p.227), “OLS provides useful point estimates of the parameters (the true values $\alpha$ and $\beta$).... among the class of linear, unbiased estimators, OLS has the minimum variance.” OLS is built on the several assumptions. The most important in the multiple regression analysis assumptions, which cannot be violated in order to get the unbiased estimates, are:

1. The Residuals are homoscedastic, i.e. variance of the residuals is constant. Failure of this assumption will result in the biased results of the tests of hypotheses.
2. The Residuals are independently distributed (no autocorrelation). Failure of this assumption will result in the overestimation of the t-test statistics.
3. There is no multicollinearity between the independent variables, i.e. absence of the perfect correlation. Failure of this assumption will result in the biased results of the tests of hypotheses.

4. Residuals are normally distributed. If this assumption is violated, then the use of t-distribution and t-test statistics is invalid. (Osborne & Waters, 2002)

3.7.2 T-statistic
The null hypothesis of the t-statistic test is that all the β coefficients are equal to zero. The p (probability) value of the t-statistic shows the relevance of this test at different levels of significance. In this analysis, if the p-value is less than 5% the t-statistic is considered to be significant and the null hypothesis (β = 0) is rejected, meaning that the particular variable in the equation was not taken by chance and does affect the dependent variable (p value = 0.000 indicates the 100% explanatory power of the variable).

3.7.3 R² and adjusted R²
R² is the correlation coefficient, or coefficient of determination. It is used as the analytical tool to see the ‘goodness-of-fit’ of the regression line (how close are the observation to the line). In other words, it is an indicator of how well the government spending, the money supply and the labor productivity explain the variation of the real exchange rates, but not some other factors represented by the error term. Adjusted R² (R²adj.) is almost the same estimate, but it takes into account the possibility of the other variables being added to the regression (which lessens the degrees of freedom), and gives more precise determination coefficient for the existing equation.

3.7.4 Durbin-Watson statistic (DW)
The measure of autocorrelation is the DW-statistic. The DW-statistic is compared with lower and upper limits in the DW-statistic table, taking into account the number of the explanatory variables and the sample size. The values of DW-statistic below the lower limit indicate the presence of the autocorrelation, high values (above the upper limit) tell about negative autocorrelation. The low DW values (positive autocorrelation in the residuals) are unfavorable for the t-statistic results, as they overestimate the real statistics, though do not have the impact on the signs in the regression equation. (Barrow, 1996, p.254)

For this analysis the favorable DW-statistic is expected to be 1.5 and higher (the upper limit from the DW-statistic table with three explanatory variables and sample size of 68 observations), indicating absence of the autocorrelation in the residuals. Minitab calculates the
DW-statistic for the lagged values automatically. Though, in the analysis it is assumed that autocorrelation does not significantly deteriorate t-statistics when the probability values of t-statistic are much less than 5%, or ideally 0.000 (the Minitab identification).

### 3.7.5 Time lags

The real exchange rate is the ratio of the price indexes. AD/AS model stresses the assumption that it takes time for the prices to adjust to the changes in the economy. Therefore, the time lags were put on the three real exchange rates in the regression analysis to identify how long it has taken krona to respond to the economic shocks and whether the lagged relationships had more correlation for the period from 1993Q:1 until 2009Q:4. The lags representing 1 quarter, 2 quarters and 3 quarters from year 1993 were tested separately one by one in attempt to find the most perfect combination of the taken lag of the dependent variable and the independent variables.

### 3.7.6 Best subsets regression

The best subsets regression is an automated procedure to identify the best combination of the specified explanatory variables. In this analysis this is a tool to check the eliminated by the AD/AS model under flexible exchange rate regime supply side shock. The supply shock, specified by the Real Business Cycles theory, is labor productivity rapid growths and unexpected slowdowns. Minitab examines all possible subsets of the predictors, beginning with all models containing one predictor, and then all models containing two predictors, and so on. The statistics that confirm the best subset of the explanatory factors are S (standard deviation), adjusted R² and Mallows’ Cp. Mallows’ Cp statistic is used by Minitab as a helpful tool to choose the best out of competing regression models making the choice between the most significant regression explanatory variables and testing them in set of combinations. The Mallows’ Cp value should be as close as possible to the number of explanatory variables plus constant (for example if there are 3 explanatory variables and a constant, then the ideal Mallows’ Cp is 4). S measures the spread of the residuals from the mean. The larger the S, the more spread is the set of the chosen variables and, accordingly, the less is the explanatory power of the model. R² adj. as was previously stated is the measure of how well the set of explanatory variables determines the dependable variable.
4 THE REGRESSION ESTIMATES AND ANALYSIS

The three original multiple regressions and nine regressions with the lagged dependent variable were conducted by means of Minitab, where the only variable that was substituted from regression to regression, was real exchange rate (SEK/USD; SEK/GBP; SEK/EUR) and the lagged values of the real exchange rate (1, 2, 3 quarters):

<table>
<thead>
<tr>
<th>Regression equations</th>
<th>SEK/EUR</th>
<th>SEK/USD</th>
<th>SEK/GBP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original</td>
<td>$\sigma = 1.17 + 0.364g - 0.259m + 0.089pr$</td>
<td>$\sigma = -5.43 - 0.564g + 1.75m - 0.296pr$</td>
<td>$\sigma = -3.34 - 0.509g + 1.42m - 0.077pr$</td>
</tr>
<tr>
<td>1Quarter lag</td>
<td>$\sigma = 0.924 + 0.413g - 0.269m + 0.0512 pr$</td>
<td>$\sigma = -6.08 - 0.460g + 1.74m - 0.351pr$</td>
<td>$\sigma = -3.85 - 0.409g + 1.40m - 0.116pr$</td>
</tr>
<tr>
<td>2Quarter lags</td>
<td>$\sigma = 1.53 + 0.295g - 0.242m + 0.113pr$</td>
<td>$\sigma = -5.80 - 0.522g + 1.76m - 0.297pr$</td>
<td>$\sigma = -3.97 - 0.337g + 1.34m - 0.115pr$</td>
</tr>
<tr>
<td>3Quarter lags</td>
<td>$\sigma = 1.10 + 0.365g - 0.244m + 0.0461pr$</td>
<td>$\sigma = -5.89 - 0.513g + 1.76m - 0.296pr$</td>
<td>$\sigma = -3.64 - 0.327g + 1.27m - 0.0632pr$</td>
</tr>
</tbody>
</table>

Figure 6: Regression equations

The OLS assumptions were checked in order not to get the biased estimates. The residuals were homoscedastic and normally distributed. The independent variables were not perfectly correlated (Minitab calculates the multicollinearity measure, Variance inflation factor (VIF), automatically: the number greater than 10 is the evidence of the presence of multicollinearity. The VIF values in this analysis were close to 6). The autocorrelation assumption will be discussed later on in the analysis results.

The regression coefficients show by how much percent the real exchange rates changed due to 1 percentage change in the explanatory variables. The major percentage increase in the SEK/USD (1, 76%) and SEK/GBP (1, 42%) was achieved due to increase of real money supply, and in the SEK/EUR equation - due to increase in real government expenditure (0, 413%). The impact of labor productivity was found to be negligible, according to the equations’ coefficients. Moreover, the signs are exactly as they were expected to be in SEK/USD and SEK/GBP cases: “-” for real government spending and labor productivity (the increase in these variables is supposed to strengthen krona) and “+” for money supply indicating the inverse relationship, as is proposed by the AD/AS model and flexible exchange rate regime. In case of the SEK/EUR real exchange rate the exactly opposite signs were obtained, which contradicts the theoretical expectations and two previous results (SEK/USD, SEK/GBP). The comparison of the trend analysis of the SEK/EUR with two other real exchange rates (see Appendix A) showed that, while SEK/USD and SEK/GBP behavior was of a similar spread around the trend line (which explains the same fluctuations’ directions),
the SEK/EUR magnitudes were more inconsistent and sharp. Moreover, while krona was drastically depreciating against USD and GBP from 1998 until 2002, it was on contrary appreciating towards European currency during the same period. The German government expenditure trend revealed (see Appendix D), that since the drastic drop in the government spending in 1998 the factor was diminishing during the studied period, on contrary to the rising Swedish government expenditure. It was additionally found out that when tested with the German government expenditure, the response of the SEK/EUR was of the correct direction (the expected signs were achieved) at 1% level of significance. This circumstance probably brought bias in signs in the original regression analysis, since it affected the European currency behavior more than the domestic factors affected krona.

4.1 T-statistic

In the SEK/USD and SEK/GBP real exchange rates regressions the real money supply t-statistic was found to be significant at 1% level (see Figure 7: Summary table below). In the SEK/EUR equations the most significance was attributed to the real government spending at the same level. The t-statistic confirmed the impact of the real money supply and real government spending being statistically significant and coefficients being different from zero. The labor productivity was found to be deficient in all the cases- in original regression as well as with lagged real exchange rates. In only one case the labor productivity was found to be significant at 5% significance level - SEK/USD real exchange rate with one quarter lag.

<table>
<thead>
<tr>
<th></th>
<th>T-statistics</th>
<th>$R^2$ / $R^2_{adj.}$ (%)</th>
<th>Intercept</th>
<th>Autocorrelation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g</td>
<td>m</td>
<td>pr</td>
<td>$\alpha$</td>
</tr>
<tr>
<td>SEK/EUR</td>
<td>3.36*</td>
<td>-2.33**</td>
<td>1.3</td>
<td>51/ 48.7</td>
</tr>
<tr>
<td>1Qlag</td>
<td>3.96 *</td>
<td>-2.53*</td>
<td>0.77</td>
<td>52.2/ 49.9</td>
</tr>
<tr>
<td>2Qlag</td>
<td>2.82*</td>
<td>-2.28**</td>
<td>1.69</td>
<td>48.1/ 45.6</td>
</tr>
<tr>
<td>3Qlag</td>
<td>3.86*</td>
<td>-2.55*</td>
<td>0.76</td>
<td>50.5/ 48.0</td>
</tr>
<tr>
<td>SEK/USD</td>
<td>-2.28**</td>
<td>6.88*</td>
<td>-1.90</td>
<td>49.9/ 47.6</td>
</tr>
<tr>
<td>1Qlag</td>
<td>-1.87</td>
<td>6.92*</td>
<td>-2.24**</td>
<td>51.9/ 49.6</td>
</tr>
<tr>
<td>2Qlag</td>
<td>-2.10**</td>
<td>6.95*</td>
<td>-1.86</td>
<td>52.4/ 50.1</td>
</tr>
<tr>
<td>3Qlag</td>
<td>-2.05**</td>
<td>6.95*</td>
<td>-1.85</td>
<td>52.7/ 50.4</td>
</tr>
<tr>
<td>SEK/GBP</td>
<td>-3.66*</td>
<td>9.99*</td>
<td>-0.89</td>
<td>74.1/ 72.8</td>
</tr>
<tr>
<td>1Qlag</td>
<td>-3.05*</td>
<td>10.20*</td>
<td>-1.36</td>
<td>76.3/ 75.2</td>
</tr>
<tr>
<td>2Qlag</td>
<td>-2.43**</td>
<td>9.46*</td>
<td>-1.29</td>
<td>75.4/ 74.2</td>
</tr>
<tr>
<td>3Qlag</td>
<td>-2.24**</td>
<td>8.60*</td>
<td>-0.68</td>
<td>73.6/ 72.3</td>
</tr>
</tbody>
</table>

(**) [*] the significance at the (5%) [1%] level
(check Appendix C for the complete set of multiple regressions estimates)

Figure 7: Summary Table
4.2 R² and adjusted R²

The determination coefficient of the whole tested model was found to be significantly high in case of SEK/GBP equation - above 70%, which tells that there is less than 30% of explanatory power attributed to some other factors not included in the model. SEK/EUR and SEK/USD equations revealed that the tested model explains around 50% of variations in the real exchange rates. Though, the determination coefficient does not change significantly when placing lags on the real exchange rate, there is obviously a rising trend of R² adj. in the SEK/USD model, meaning that the explanatory power of the right-hand regression equation rises from original values to the 3 quarter lags. The other two cases indicated that it took one quarter for the real exchange rates to adjust to the changes in the independent factors: the best model was achieved with one quarter lag. After the determination power of the model starts diminishing from the origin. On average, it took real exchange rate one quarter to adjust to the changes the caused by economic shocks.

4.3 DW-statistic

The original as well as lag analysis showed that the DW-statistics are significantly small, indicating the presence of autocorrelation. According to the fact that the data in this analysis is taken quarterly (the rather frequent observations), and the changes in the values during the adjacent periods cannot vary significantly, owing to the nature of the chosen data series, the autocorrelation was expected to be positive. Though, as the t-statistic values have been found perfectly significant in most of the cases, it is assumed in this analysis that the presence of autocorrelation did not have statistically significant impact on the t-statistic values.

4.4 The best subset regression

Taking into account the fact that labor productivity was found to be statistically insignificant in all the regressions, confirming the null hypothesis of β₃ ≈ 0, the intent was to check whether it has to be included into the model at all, or the set of real government and real money supply was applicable without the proxy of the supply shock. The results indicated that the best subset in all the three cases - SEK/USD, SEK/GBP, SEK/EUR was found when all three variables were included in one model. The Mallows Cp was found to be equal to the exact number of the explanatory factors plus the intercept, 4. At the same time R² adj. and S were approximately the same for all the three factors subset as well as for the set of real government spending and real money supply only. The standard error deviation, S, was found to be 0.04-0.06 in SEK/EUR and SEK/GBP regressions, while in SEK/USD regression the S
The difference between the checking values is negligible, indicating the inconsiderable explanatory power brought to the model by labor productivity. It, therefore, can be taken out of the original model, without the bias in the regression results.

<table>
<thead>
<tr>
<th></th>
<th>Check Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEK/USD</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R² adj.</td>
</tr>
<tr>
<td>31,7%</td>
<td>22,0</td>
</tr>
<tr>
<td>11,4%</td>
<td>47,5</td>
</tr>
<tr>
<td>45,5%</td>
<td>5,6</td>
</tr>
<tr>
<td>44,2%</td>
<td>7,2</td>
</tr>
<tr>
<td>47,6%</td>
<td>4</td>
</tr>
<tr>
<td>SEK/GBP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R² adj.</td>
</tr>
<tr>
<td>32,0%</td>
<td>101,4</td>
</tr>
<tr>
<td>72,9%</td>
<td>2,8</td>
</tr>
<tr>
<td>67,7%</td>
<td>15,4</td>
</tr>
<tr>
<td>72,8%</td>
<td>4,0</td>
</tr>
<tr>
<td>SEK/EUR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R² adj.</td>
</tr>
<tr>
<td>45,5%</td>
<td>6,1</td>
</tr>
<tr>
<td>41,3%</td>
<td>11,5</td>
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<tr>
<td>48,2%</td>
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</tr>
<tr>
<td>45,2%</td>
<td>7,4</td>
</tr>
<tr>
<td>48,7%</td>
<td>4,0</td>
</tr>
</tbody>
</table>

**Figure 8**: Check Procedures Table
5 CONCLUSION

This study paper was aimed to investigate the Swedish krona behavior since the fixed exchange rate regime was abandoned and krona was left to float freely, from 1993Q:1 until 2009Q:4. The point of interest was the fact that the krona has been determined by the market forces since the change of the regime. The conducted research and regression analysis were targeted to determine the economic shocks, as market forces, that had the major impact on the three proxies of the krona value: SEK/USD, SEK/GBP, SEK/EUR real exchange rates. Relying on the theories, the three proxies of the economic shocks were included in the model as exogenous factors: real money supply and real government consumption expenditure, identified by the AD/AS model as the monetary and real demand shocks proxies respectively, and labor productivity as the supply shock, emphasized by the RBC theories.

Firstly, the analysis of studied time period revealed, that the Swedish economy was affected by the economic shocks frequently: starting from 1990s krona was forced down until 1995, then Asian and Russian crisis in 1997 and 1998 hit krona again, followed by IT crash in 2000 and terrorist attacks in the USA in 2001, finally krona depreciated in response to the financial turmoil in 2007 and has weakened even more when the financial crises in 2008 started.

Further, the trend analysis showed that the real exchange rates, the real money supply, the real government spending and the labor productivity were rising for the studied period. This means, that krona depreciated for the 17 years period, while the exogenous factors have been increasing over the time. This finding is consistent only with the real money supply impact on the real exchange rate, where the inverse relationship does exist. The fact that the krona depreciated despite the rising real government expenditure and labor productivity just strengthens the regression analysis findings.

The regression analysis disclosed that the money contractions/expansions accounted for major fluctuations in the SEK/USD and the SEK/GBP real exchange rates. The real government spending, or demand shock, was found to be statistically significant also, but to the lower extent. The role of labor productivity, or supply shock, as an explanatory factor to the Swedish krona fluctuations was negligible and had no important impact on krona when taken alone. So, for the two real exchange rates the monetary shocks accounted for the major impact on the fluctuations since krona was left to float freely. The real demand shocks were less influential, even though the government expenditure did have the statistically significant impact. The real demand shocks appreciated krona for the short periods, but never brought the
krona back to the initial condition. Hit by the monetary shocks krona was, therefore, depreciating by major amount and the weakening trend was strengthening.

Surprisingly, the signs in the SEK/EUR regressions were found to be of an opposite direction. Additionally to this fact, the role of the demand shocks dominated in this case. The possible explanation for such results is the dominating role of the foreign (German) demand shock on the real exchange rate between Swedish and European currency.

The determination power of the tested model was found to be considerably high when the one quarter lagged real exchange rate was tested against the shocks’ proxies. Though, 30%-40% of explanation power was found to be attributed to the factors not tested in this study paper. This finding is consistent with the fact that the research was narrowed to the domestic factors determination power towards the real exchange rates, which are as an international trade measure expected to be affected by both inter- and intra-country shocks. Furthermore, the theoretical model restricted the choice of the economic shocks. There is a probability that the economy was hit by the other (not tested in this study paper) shocks also, which had the significant impact on the krona fluctuations. In the real-life economy theories are not always applicable. The deviations from the expectations and predictions do occur, especially when it comes the economic shocks, which are unpredictable and can take any direction, have an unexpected impact on any economic indicator that in turn will affect the currency. The research strengthened this fact, by showing that the Swedish economy was actually hit by the several unforeseen crisis.
REFERENCES

Book and Articles


Online References


APPENDIX

Appendix A – RER Trend Analysis

**Trend Analysis SEK/EUR**

Linear Trend Model

**Trend Analysis SEK/USD**

Linear Trend Model

**Trend Analysis SEK/GBP**

Linear Trend Model
Appendix B- Real government spending; Real money supply; Labor productivity trend analysis
### Appendix C – Summary Table of Regression Analysis

<table>
<thead>
<tr>
<th>F-test</th>
<th>T-statistics</th>
<th>$R^2$ and $R^2$ adj. (%)</th>
<th>intercept ($\alpha$ (p value))</th>
<th>Autocorrelation (DW)</th>
<th>$\beta$ coefficient (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>g</td>
<td>m</td>
<td>pr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SEK/EUR</td>
<td>22.21*</td>
<td>3.36*</td>
<td>-2.33**</td>
<td>1.3</td>
<td>51/48.7</td>
</tr>
<tr>
<td>1Qlag</td>
<td>22.91*</td>
<td>3.96*</td>
<td>-2.53*</td>
<td>0.77</td>
<td>52.2/49.9</td>
</tr>
<tr>
<td>2Qlag</td>
<td>19.19*</td>
<td>2.82*</td>
<td>-2.28**</td>
<td>1.69</td>
<td>48.1/45.6</td>
</tr>
<tr>
<td>3Qlag</td>
<td>20.73*</td>
<td>3.86*</td>
<td>-2.55*</td>
<td>0.76</td>
<td>50.5/48.0</td>
</tr>
<tr>
<td>SEK/USD</td>
<td>21.25*</td>
<td>-2.28**</td>
<td>6.88*</td>
<td>-1.90</td>
<td>49.9/47.6</td>
</tr>
<tr>
<td>1Qlag</td>
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<td>-1.87</td>
<td>6.92*</td>
<td>-2.24**</td>
<td>51.9/49.6</td>
</tr>
<tr>
<td>2Qlag</td>
<td>22.75*</td>
<td>-2.10**</td>
<td>6.95*</td>
<td>-1.86</td>
<td>52.4/50.1</td>
</tr>
<tr>
<td>3Qlag</td>
<td>22.67*</td>
<td>-2.05**</td>
<td>6.95*</td>
<td>-1.85</td>
<td>52.7/50.4</td>
</tr>
<tr>
<td>SEK/GBP</td>
<td>60.92*</td>
<td>-3.66*</td>
<td>9.99*</td>
<td>-0.89</td>
<td>74.1/72.8</td>
</tr>
<tr>
<td>1Qlag</td>
<td>67.64*</td>
<td>-3.05*</td>
<td>10.20*</td>
<td>-1.36</td>
<td>76.3/75.2</td>
</tr>
<tr>
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<td>-2.43*</td>
<td>9.46*</td>
<td>-1.29</td>
<td>75.4/74.2</td>
</tr>
<tr>
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<td>56.82*</td>
<td>-2.24**</td>
<td>8.60*</td>
<td>-0.68</td>
<td>73.6/72.3</td>
</tr>
</tbody>
</table>

(**) [*] the significance at the (5%) [1%] level
Appendix D – Trend Analysis of German Government Spending

Trend Analysis Government Spending Germany (Ln)

Linear Trend Model
\[ Y_t = 5.3289 - 0.012689t \]