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High-Frequency Foreign Exchange Rate Behavior on the Arrival of Macroeconomic News

- The Impact of Swedish and U.S. News on USD/SEK Returns

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Abstract

This paper studies the high-frequency behavior of the USD/SEK currency pair on the arrival of macroeconomic news emanating from Sweden and the United States. By using exchange rate data sampled at one minute-by-minute quotations and market expectations from the Bloomberg Terminal, the study finds systematic effects of news on exchange rate returns. The majority of news is immediately incorporated into the price of the exchange rate, consistent with the efficient market hypothesis. The reactions of the USD/SEK currency pair to unexpected changes are broadly consistent with the predictions in a central bank reaction function and in a portfolio balance model. Further, the direction in which news push the exchange rate is in general stable during the sample period 2008-2018. Finally, some news persists to influence the exchange rate over a twelve-hour horizon when emanating from Sweden, whereas the effect of U.S. news quickly weakens and disappears into the noise in the intraday FX fluctuations.

Keywords: Macroeconomic News; Foreign Exchange Rate; High-Frequency Data; Expectations

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1 Introduction

The understanding of how news arrives at prices is fundamental in financial economics. The price discovery process is dynamic and as new information reach the market, a rapid adjustment of market prices takes place to reach a new equilibrium (Yan & Zivot, 2007). How market participants act on unexpected information, and what information is considered relevant to asset pricing, are questions in which a consensus is difficult to reach.

The attention from academics to event-studies about how market expectations affects asset returns can be traced back to at least the study by Frenkel (1981), and has since been subject to extensive research. Fama's (1970) Efficient Market Hypothesis [EMH] asserting that prices reflect all current available information has been the main basis under investigation. Early research focused to a great extent on U.S. news to measure its impact on aggregate stock returns or bond yields. As historical financial data became available at higher frequency and market expectations covered more regions, studies of how news impact the foreign exchange [FX] emerged.

This paper studies the high-frequency behavior of the USD/SEK currency pair on the arrival of macroeconomic news emanating from Sweden and the United States. The sample period covers the period 2008-2018, where different types of economic indicators are considered: prices, real output, the industrial sector, cyclical indicators, net exports and employment. Survey data is collected from the Bloomberg Terminal where market participants in those two countries reveal their expectations to upcoming macroeconomic events.

The main issue under investigation is whether one can trace systematic effects of macroeconomic news on USD/SEK returns. Macroeconomic 'news', 'surprises' or 'unexpected changes' are defined as the difference between the actual and the expected value. Four tests are constructed to elucidate the impact of news on exchange rate returns. The first two tests examine the immediate impact of news on exchange rate returns. How the news affect the exchange rate depends on market participant's beliefs regarding the models of exchange rate determination and the way central banks responds to unexpected changes (Almeida, Goodhart & Payne, 1998). The third test examines if the direction in which news push the exchange rate are stable over time. The discernible effect of news on the exchange rate could weaken if the financial market conditions experience considerable variation. The fourth test examines the persistence effect of

news on exchange rate returns by increasing the time horizons after the release of new data. The persistence effect of news on the exchange rate could depend on if the market finds the news to be relevant to the fundamentals of the exchange rate.

The contributions to existing studies within this field of research are threefold. First, to the author's knowledge, it is the first study investigating if Swedish news systematically has an impact on the exchange rate. Second, the study is conducted with high-frequency exchange data whereas previous research to a great extent utilized less frequent data. This enables a precise examination of exchange rate dynamics around the news. Third, as electronic trading, and also algorithmic trading, in the foreign exchange market continuously increase, this study provides up-to-date evidence of high-frequency FX reactions on the arrival of news.

The outline of this paper is as follows. Section two introduces alternative theoretical models, discusses results from previous research and introduces some characteristics of high-frequency FX trading. The third section presents the data collected to the conduct the empirical study. Section four introduces the methodology to perform the empirical study. In section five, results from the empirical study are reported. Section six concludes the study and assesses proposals for further research.

2 Theory and Literature Review

2.1 Models of Exchange Rate Determination

The standard models of exchange rate determination predict certain factors as general determinants of the exchange rate: inflation rates, interest rates, real output and money supplies (Engel & West, 2005). There are several models of exchange rate determination and how they differ is in the assumptions they make about how those factors affect the exchange rate. The traditional flow model and the asset market models are common models of exchange rate determination. There are several forms of asset market models; two well-known in the literature are the monetary model and the portfolio balance model.

The traditional flow model asserts exchange rate equilibrium when current account imbalances are matched with capital flow in the other direction (Pearce, 1983). The traditional flow model asserts that an increase in inflation depreciates the currency as demands of foreign goods rises (Pearce, 1983). An increase in real output result in depreciation of the exchange rate as higher demand on foreign goods, services and assets, raise import and reduce the current account (Hoffman & Schlagenhauf, 1985). Domestic and foreign assets are treated as imperfect substitutes, so that an increase in the domestic interest rate, *ceteris paribus*, result in capital inflow and exchange rate appreciation (Pearce, 1983).

The inadequacy of the traditional flow model to explain short-run FX fluctuations and the idea that news is a key element affecting the exchange rate resulted in a new approach; asset market models (Hoffman & Schlagenhauf, 1985). Asset market models of exchange rate determination relies on, like other asset classes, that the exchange rate can be thought of as the discounted present value of fundamentals (Sarno & Schmeling, 2014). The fundamentals of the exchange rate include the four general determinants of the exchange rate (Engel & West, 2005). There are several forms of asset market models, and they are categorized by the assumptions they make about the substitutability between domestic and foreign assets (Hoffman & Schlagenhauf, 1985). The monetary model assumes that domestic and foreign assets are perfect substitutes whereas the portfolio balance model relaxes the assumption that domestic and foreign assets are perfect substitutes (Hoffman & Schlagenhauf, 1985). The monetary model and the portfolio balance model share the predictions of how an increase in inflation and real output impact the exchange rate, although, the logic behind differs, why a separate introduction of the two models are presented below.

The monetary model of exchange rate determination relies on that the exchange rate is determined by relative supply and demand of money (Pearce, 1983). In the monetary model, money is considered as the sole asset. Hence, all the impacts of the fundamentals on the exchange rate are linked to changes in the supply and demand of money. An increase in inflation result in domestic exchange rate depreciation, as purchasing power parity [PPP] continuously holds (Pearce, 1983). An increase in real output alter domestic demand for money, which given fixed money supply, reduces domestic prices and appreciate the exchange rate (Hoffman & Schlagenhauf, 1985). An increase in domestic interest rates, *ceteris paribus*, is predicted to result in depreciation of the exchange rate. The reason is that a higher interest rates reflects higher expected inflation, which raise prices and depreciate the currency á la PPP (Pearce, 1983).

The portfolio balance approach proposes exchange rate determination as relying on investors balancing their portfolios between two country's assets (Simpson, Ramchander & Chaudhry, 2005). In contrast to the monetary model, PPP does not hold in the portfolio balance model since assets are not treated as perfect substitutes. An increase in inflation leads to exchange rate depreciation, caused by investors rebalancing their portfolios. The logic behind is that higher inflation increase domestic wealth and thereby increases the wealth investor holds in domestic assets (Pearce, 1983). Given that the domestic interest rate remains unchanged, this results in an imbalance in portfolios and investors demand on foreign assets increases, leading to a depreciation of the currency (Pearce, 1983). Although, the effect depends on that real interest rates fall with an increase in inflation (Pearce & Solakoglu, 2007).

In the portfolio balance model an increase in real output has an uncertain effect on the exchange rate. Some papers, which rely on the pure portfolio balance model, do not consider increases in real output to affect the exchange rate (Hoffman & Schlagenhauf, 1985; Pearce 1983). However, when the model is combined with assumptions in the monetary model, the effect of increased real output is predicted to result in exchange rate appreciation (Hoffman & Schlagenhauf, 1985). Increased real output raises the demand of domestic assets and, hence, results in appreciation of the exchange rate. Previous empirical research has noted that an increase in real output results in exchange rate appreciation in the portfolio balance model (Love & Payne, 2008; Simpson, Ramchander & Chaudhry, 2005).

In the portfolio balance model an increase in domestic interest rates is predicted to result in exchange rate appreciation (Hoffman & Schlagenhauf, 1985). Higher domestic interest rates, given imperfect substitutability between domestic and foreign assets, cause investors to rebalance their portfolios and increase their wealth held in domestic assets (Simpson, Ramchander & Chaudhry, 2005).

The portfolio balance model has predictions of how the trade balance affects the exchange rate. The reason is that the portfolio balance model includes foreign-currency denominated assets, which allows the trade balance to have an impact on the exchange rate (Pearce, 1983). Higher trade surplus is predicted to result in exchange rate appreciation as foreign investors increase their portfolio holdings in that country's currency (Pearce & Solakoglu, 2007).

2.2 The Central Bank Reaction Function

The traditional flow model and the various forms of asset market models neglect the possibility of a reaction from central banks to unexpected changes. Empirical studies have found evidence that the impact of news in the exchange market is consistent with a central bank reaction function (Andersen et al. 2003; Almeida, Goodhart & Payne, 1998; Love & Payne, 2008). In a central bank reaction function approach, an increase in inflation and real output is predicted to cause exchange rate appreciation. The reason is that the market participants expects central banks to responds on the news by raising short-term interest rates to avoid future undesirable inflation, which results in capital inflow (Almeida, Goodhart & Payne, 1998). Logically, an increase in domestic interest rates could be said to follow the same predictions and result in exchange rate appreciation. An example of a central bank reaction function is the Taylor rule (Andersen et al. 2003). The Taylor rule states that central banks raise the interbank market interest rate if the inflation rate rises above its target, and if GDP rises above its trend (Burda & Wyplosz, 2013).

The table 2.1 below gives an overview of how the arrival of news is predicted to affect the exchange rate in the theoretical models. The table displays if an increase in the factors: inflation, real output, interest rates and trade balance is predicted to cause exchange rate appreciation or depreciation. Blank cells denote the direct effect is *i)* not explicitly predicted in the model *ii)* depends on a substitution effect.

Table 2.1 The Impact of News on a Country's Exchange Rate

Prediction:	Increase in:			
Theoretical Model	**Inflation**	**Real Output**	**Interest Rates**	**Trade Balance**
Traditional Flow Model	Depreciation	Depreciation	Appreciation	Appreciation
Monetary Model	Depreciation	Appreciation	Depreciation	
Portfolio Balance Model	Depreciation	Appreciation	Appreciation	Appreciation
Central Bank Reaction Function	Appreciation	Appreciation	Appreciation	

Note, the inflation indicator included is consumer price index [CPI] inflation. The indicators of real output included is real gross domestic product [GDP] growth and industrial production.

2.3 Previous Research

How does news in CPI inflation affect the exchange rate? The results differ between previous studies. Some authors found evidence that positive news in U.S. CPI inflation resulted in dollar appreciation (Simpson, Ramchander & Chaudry, 2005). They explain their results that a positive surprise in CPI inflation increases domestic nominal interest rates according to the fisher-effect and results in capital inflow. Other studies found that positive news in U.S. CPI inflation caused dollar depreciation (Love & Payne, 2007). They argued that the U.S. results were consistent with a monetary model of exchange rate determination, as PPP holds for the U.S. Their study covered U.S. and U.K. news on USD/GBP returns during the period 1999-2000. Positive news in CPI inflation emanating from the U.K., on the other hand, caused pound appreciation, consistent with the central bank reaction function (Love & Payne, 2008). They explain their results that positive news in CPI inflation emanating from the U.K., likely would result in a hike in nominal interest rates, as Bank of England is an explicit inflation targeting central bank.

How does news in GDP growth affect the exchange rate? Previous research has found that positive news in GDP growth emanating from the U.S. cause dollar appreciation (Andersen et al. 2003; Faust et al. 2007; Love & Payne, 2003). However, the explanation of why this is the case differ between previous research. Faust et al. (2007) found that positive surprises in U.S. GDP growth caused dollar appreciation and, jointly, increases in domestic interest rates. They explain their finding that risk premium became lower to hold foreign currency denominated asset or, alternatively, an expected depreciation of dollar in the long-run. Under the Uncovered Interest Rate Parity [UIRP] with risk premium, the country with relative higher interest rate and lower

risk premium has a stronger currency, although, interest rate and risk premium use to move in contrary directions (Engel, 2016). Andersen et al. (2003) and Love and Payne (2007) explained their results that positive news in U.S. GDP growth appreciates the exchange rate as central banks are likely to respond by a hike in interest rates, consistent with the reaction function.

How does news in the trade balance affect the exchange rate? Andersen et al. (2003) found that positive surprises in U.S. trade balance caused dollar appreciation to five currencies: GBP/USD, JPY/USD, DEM/USD, CHF/USD and EUR/USD. They did not find evidence that German news in the trade balance had an impact on any of these currency pairs. Almeida, Goodhart and Payne (1998) found that positive news in U.S. trade balance resulted in appreciation of USD to DEM. As in Andersen et al (2003), they did not find surprises in the trade balance emanating from Germany to impact DEM/USD returns. The findings in the study by Pearce and Solakoglu (2007) conform to the results above that positive surprises in U.S. trade balance figures appreciate the dollar to other currencies.

How persistent are the effects of news on exchange rate returns at increased time horizons after the release of new data? The persistence effect of news on exchange rate returns can be thought of as *continued* significant effect at increased time horizons after the release when employing high-frequency FX data. To allow for comparisons between previous research and this study, some examples are provided from studies that estimated the persistence effect of news on exchange rate returns. Almeida, Goodhart and Payne (1998) found that news in U.S. CPI inflation lost effect on DEM/USD returns five minutes post-release. The news in the trade balance persisted to impact the exchange rate up to two hours post-release. The authors found surprises in two of U.S. variables, Payroll and Consumer Confidence Index, to significantly impact the exchange rate up to twelve hours post-release. To German news, surprises in Producer Price Index [PPI] numbers had an effect on DEM/USD returns up to three hours post-release, the other studied German variables lost effect around five to ten minutes post-release (Almeida, Goodhart & Payne, 1998). Pearce and Solakoglu (2007) compared the impact of U.S. news on USD/DEM and USD/YEN returns during a ten-year period between the years of 1986-1996. They found surprises in industrial production to loose effect after five minutes of time, however, news in the trade balance persisted to impact both USD/DEM and USD/JPY up to two hours post-release.

How fast is news incorporated into the price of the exchange rate? Previous research employing high-frequency FX data has found evidence that the impact of news is immediately incorporated into the price of the exchange rate. Love and Payne (2008) found the majority of studied variables to be incorporated into the price of the exchange rate immediately within the first minute of the release. An earlier paper by Ederington and Lee (1995) propose the unexpected change in a macroeconomic realization to be incorporated into prices of FX forwards already ten seconds after the release. They argue that the price evolution, caused by the unexpected change, were to be complete within fourteen seconds of time. Research examined more recent financial data contradicts on the point that the impact of news on FX returns loose effect in near minutes or hours after the release of new data. A connection has then been made between news and microstructures through a concept called order flow. Order flow is defined as buyer- and seller initiated currency transactions (Rime, Sarno & Sojli, 2010). Through this methodology, Evans and Lyon (2008) found that macroeconomic news accounted to 14 percent of daily variance changes in the FX market and 22 percent was indirectly affected as order flows increased, meaning that the arrival of macroeconomic news in sum cause 36 percent of daily price variances in FX markets.

How has the estimated explanatory power of the impact of news on exchange rate returns varied across variables and between previous studies? To allow for comparisons between previous research and this study, some examples are provided from studies estimating similar types of models and considered same types of variables. In a simple model estimating the impact of U.S. news on several currency pairs, surprises in CPI inflation and industrial production explained around ten percent of five-minutes returns. The surprise in GDP growth explained FX returns ranging anywhere from twenty to fourth percent. Further, they found that surprises in the trade balance emanating from the U.S. explained around 40 percent of five-minutes FX returns (Andersen et al. 2003). Almeida, Goodhart and Payne (1998) found the surprise in U.S. trade balance to explain around twenty percent of DEM/USD five-minute returns. Further, they found that the surprise in CPI inflation emanating from Germany explained around ten percent of DEM/USD five-minute returns.

2.4 High-Frequency FX Trading

Trading in the financial market is divided into manual or automated trading. Trades executed by humans on trading platforms characterize manual trading and automated trading is trades executed by computer algorithms without human interaction (Bank for International Settlements, 2011). Algorithm trading is characterized by the use of computer pre-programmed trading instructions (PWC, 2015). To macroeconomic events, this could mean that a computer is programmed to buy or sell a currency within a certain interval, given the outcome of actual value. Algorithms can fulfill a trade within less than a millisecond of time (Bank for International Settlements, 2011). Of 1500 FX traders, 7 percent of respondents used algorithms in their trading decisions by 2012 (Greenwich Associates, 2018). In 2016, 200 participant Institutional FX traders said they spent 12 percent of their time monitoring and trading with algorithms (JP Morgan Chase & Co, 2018).

The intraday foreign exchange fluctuations could depend on what basis market participants trade on. Then, how do FX market participants themselves perceive their daily trading decisions? Of 142 respondent FX traders, roughly 95 percent considered exchange rate movements as reflecting changes in fundamentals *irrelevant* on intraday basis. In contrast, in the long-run – 6 months or longer, roughly 90 percent of respondents considered exchange rate behavior as reflecting changes in fundamentals as *relevant.* Factors driving intraday movements of the foreign exchange rate were according to surveys inter alia: speculation, over-reaction to news and bandwagon effects (Cheung & Chinn, 2001). A Bandwagon effect in the foreign exchange market is a belief that previous movements are followed by changes in the same direction in the near future (Laopodis, 2008).

3 Data and Empirical Material

3.1 The Foreign Exchange Market

The foreign exchange is the most traded asset class worldwide with approximately 5.3 trillion dollar worth of trading each day. Spot transactions accounts to approximately 40 percent of daily transactions (PWC, 2015). Main market participants on the spot exchange market constitute of financial institutions and 95 percent of transactions are done over the counter [OTC]. Electronic trading in the foreign exchange market has increased during later years and accounts to approximately 90 percent of spot trading by 2014 (Financial Stability Board, 2014). The spot foreign exchange market is open twenty-four hours around the clock.

The daily turnover of the USD/SEK currency pair has increased in later years. In April 2010 the USD/SEK currency pair had an average daily turnover of 45 billion dollars, in April 2013 corresponding 55 billion dollars and in April 2016 that number reached 66 billion dollars. In contrast, in April 2016 the EUR/SEK currency pair had an average daily turnover of 36 billion dollars. The daily turnover of the USD/SEK currency pair has under the years 2010, 2013 and 2016 corresponded to approximately 1 percentage of global FX daily turnover (Bank for International Settlements, 2016).

3.2 Exchange Rate Data

The exchange rate data of the USD/SEK currency pair was collected from Histdata. Histdata is a website owned by a group of traders and developers providing financial data at high frequency[1]. Foreign exchange data from Histdata has been used previously in, for instance, studies of FX technical analysis (ed. Tan et al. 2015, 2017) and exchange rate dynamics around Brexit (Christianini, Dzogang and Lansdall-Welfare, 2017)

The price of the foreign exchange rate is quoted in different trading platforms. As brokers and dealers in the foreign exchange market do not operate with exactly the same data, small discrepancies in prices do appear. However, during day arbitrage in differentials would be short-lived (PWC, 2015). The reason of discrepancies in prices could thus be the result of different commissioners contributing to the data. The commissioners contributing to the data from Histdata are not submitted. To validate the reliability of the data from Histdata against FX data where commissioners contributing to the data are known, a comparison was made between that

[1] Available Online: http://www.histdata.com/download-free-forex-data/

from Thomson Reuters Eikon. Of two common financial market terminals: Bloomberg's and Thomson Reuters Eikon, only Thomson Reuters Eikon allows extracting high-frequency data i.e. higher than daily frequency. The maximum of three months historical data of the currency pair USD/SEK sampled at one minute-by-minute quotations was extracted from Thomson Reuters Eikon to compare with the data from Histdata. Approximately 100 000 observations sampled at one minute-by-minute quotations of the USD/SEK currency pair from Thomson Reuters Eikon had a correlation of 100 percent with the data from Histdata.

The raw spot FX data from Histdata was obtained divided into open, high, low and close prices. Open refers to the first price quoted at that minute, high is the highest price paid, low is the lowest price paid and close reflects the last price at that minute. In the tests, the average of high and low quotation of the exchange rate is used as dependent variable. The reason for this is to be able to capture the trading interval. Time zone of the data is Eastern Standard Time [EST] without daylight saving adjustments. The data was processed, i.e. adjusted to include daylight saving adjustments for the sample period. This was performed by, for each year, find when daylight saving time started and ended in both countries.

3.3 Survey Data

The survey data was collected from the Bloomberg Terminal in the economic analysis section. The economic analysis section functions as an economic calendar, where the actual values of economic variables are listed together with expectations. The economic calendar goes back far in time and allows extractions of historical data. By this, one could assess the difference between the actual released value and the expected value during a period and statistically investigate if the unexpected change has an impact on financial assets. An advantage of studying Swedish and U.S. news is that the authorities schedule the macroeconomic realizations a long-time ahead. The market participants then know in advance how to plan and schedule their forecasts, which facilitate when revealing their expectations. A quick look at Statistics Sweden publishing calendar by 3 March 2018, shows that the release of, for instance, November 2018 CPI numbers already is scheduled to be released the 12 December 2018 at 09:30 Central European Time [CET][2].

[2] Available Online: Statistics Sweden "Publishing Calendar"

The median in the survey of economists is treated as the expected value for given event. An economist refers to specialists representing major actors on the financial markets operating in that country. Bloomberg conducts the survey normally seven to five days prior to the release of new data. In Sweden, the following actors frequently participate in the surveys: Svenska Handelsbanken, Swedbank, Skandinaviska Enskilda Banken, Nordea and other banks and financial advisors. In the United States, actors active on the U.S. financial markets participate in the survey, for instance: JP Morgan Chase & Co, Bank of America Merill Lynch, HSBC and many more. Given that the U.S. financial market is much bigger than that of Sweden, more survey estimates are provided in the United States. As concerning the median of expectations from survey to represent market expectations this could possibly, but not necessarily, result in that median of the United States has less margin of error.

There are several options of financial markets terminals – systems that provide trusted and relevant financial data. Some well known are the Bloomberg Terminal, Thomson Reuters Eikon and S&P Global Market Intelligence. In this paper survey estimates are considered solely from the Bloomberg Terminal. As a consequent some major market makers estimates that subscribes to other terminals may be neglected. Nonetheless, statistics from Financial Times (2018) indicates that Bloomberg had a major market share of the different financial market terminals viewed as percentage of revenue share in 2016. Bloomberg Terminals accounted to 33 percent of worldwide market share, Thomson Reuters Eikon 23 percent, S&P Global Market Intelligence 6 percent, Factset 4 percent and others 34 percent. Potentially, major banks and financial institutions subscribe on several different systems. Further, during the sample period of study, numbers of subscribers of the Bloomberg Terminal have trended upwards. In 2008 around 280 000 had Bloomberg Terminals installed, and in the year of 2018 that number increased to slightly above 320 000 daily users (Financial Times, 2017).

The survey by Bloomberg is conducted normally five to seven days prior to the release of new data. The expectations to the approaching macroeconomic events are then established. If new information reaches the market between the conduct of survey and the release of variables, this could potentially result in an errors-in-variable problem, which biases the coefficient toward zero. However, the Bloomberg survey has been widely used in this field of research and the unexpected change has proved to significantly impact different asset classes (Dungey, McKenzie and Smith, 2009; Fatum and Scholnick, 2006, 2008). Chen, Jiang and Wang (2012) performed a study to examine differences between the Bloomberg survey and that from Briefing. Their study

revealed that tests based on the Bloomberg survey had greater effect of the two on trading activity and asset returns around the release of economic figures in the U.S.

The table 3.1 and 3.2 below contains some characteristics of the survey data to facilitate the interpretation of test results. The first column displays the macroeconomic variable[3]. The second column displays the unit of measurement of that variable. The third column contains the mean of the actual value for that variable during the sample period. The fourth column contains the average of the survey expected values of the variable during the sample period. The fifth column shows the standard deviation of the actual and the expected error series, i.e. standard deviation of the actual and the survey expected differential series. The sixth column displays how many economists on average that participate in the Bloomberg survey in the releases of that variable[4]. Seventh column shows how many times the market underestimated the actual value, in percentage of total expectation error series. Column eight displays how many times market overestimated the actual value, in percentage of total expectation error series. Ninth column is number of observations to each macroeconomic variable, that is, number of expectation error series. The observations when variables came in line with market expectations are not included. According to the EMH, only the unexpected information should have an impact on prices. To prove that news is unbiased, a test that the mean of the expectation error series is zero could be tested (Funke and Matsuda, 2002). The last column display t-statistics to the tests, indicating that we cannot reject the null hypothesis at the five percent level to all variables.

The figure 3.1 and 3.2 display the difference between the actual and the expected value of each variable and to each country during the sample period. The figures provide a quick overview if the market systematically had higher expectation errors during a specific period. If the line is positive, the market underestimated the actual value. If the line is below zero, the market overestimated the actual value.

[3] Three different vintages of GDP growth are announced in the U.S. The different vintages are treated as separate series, as in Andersen et al. (2003).
[4] The number of participants in the survey varies between each release and amongst the variables. The number of survey estimates was collected from that of September's release each year. The average was then calculated per variable.

Table 3.1 Properties Survey Data, Sweden

Macroeconomic Variable	Unit	Mean A	Mean S	Std.dev	Nr.F	A>E	A<E	OBS	t-stat
CPI Inflation	% YoY Change	0.96 %	0.98 %	0.19 %	14	53 %	47 %	80	-0.743
GDP Growth	% QoQ Ann. Ch.	1.70 %	1.50 %	1.00 %	10	56 %	44 %	36	1.061
Industrial Production	% MoM Change	-0.10 %	0.30 %	2.00 %	7	44 %	56 %	101	-1.436
PMI Manufacturing	Index Value	53.36	53.14	2.44	7	51 %	49 %	104	0.868
Trade Balance	Billion SEK	5.50	5.28	4.47	3	46 %	54 %	69	0.513
Unemployment Rate	% Level	7.58 %	7.63 %	0.32 %	9	46 %	54 %	82	-1.184

Source: Bloomberg

Notes:
A = Actual value.
S = Survey expected value.
Std.dev = Standard deviation of the expectation error series.
F = Average number of participants in the survey during the sample period.
A>E = The market underestimated the actual value (percentage of total observations).
A<E = The market overestimated the actual value (percentage of total observations).
OBS. = Number of observations (expectation error series).
t-stat = Test if the mean of the expectation error series is significantly different from zero.

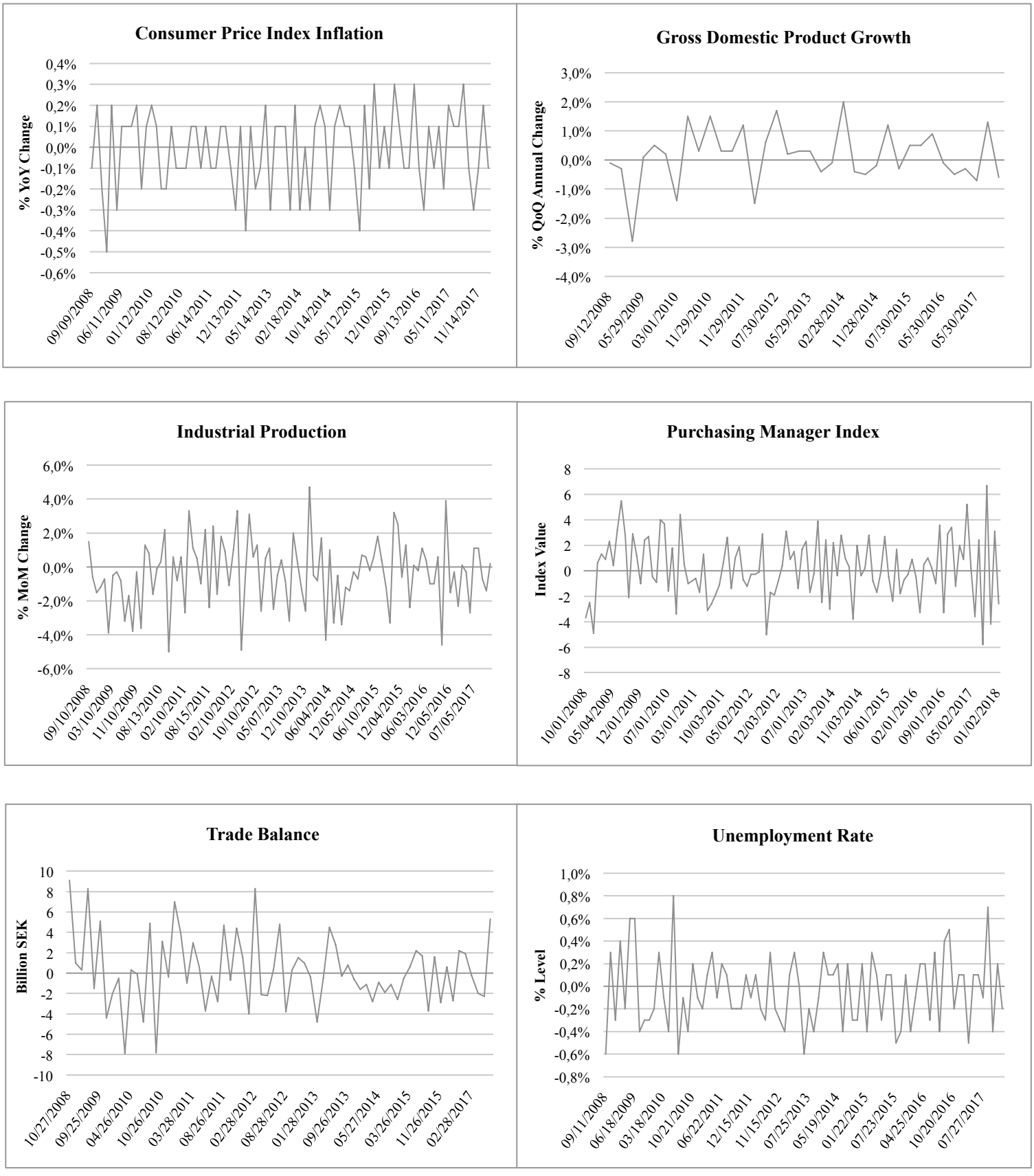
Table 3.2 Properties Survey Data, the United States

Macroeconomic Variable	Unit	Mean A	Mean S	Std.dev	Nr.F	A>E	A<E	OBS	t-stat
CPI Inflation	% YoY Change	1.43 %	1.46 %	0.16 %	41	45 %	55 %	74	-1.406
GDP Growth Advanced	% QoQ Ann. Ch.	1.56 %	1.62 %	0.67 %	77	38 %	62 %	34	-0.563
GDP Growth Preliminary	% QoQ Ann. Ch.	1.65 %	1.62 %	0.37 %	77	55 %	45 %	31	0.439
GDP Growth Final	% QoQ Ann. Ch.	1.70 %	1.72 %	0.37 %	77	56 %	44 %	32	-0.239
Industrial Production	% MoM Change	0.08 %	0.15 %	0.45 %	78	44 %	56 %	100	-1.704
PMI Manufacturing	Index Value	52.73	52.48	1.79	79	59 %	41 %	110	1.437
Trade Balance	Billion $	-42.39	-42.50	3.85	69	51 %	49 %	93	0.272
Unemployment Rate	% Level	7.47 %	7.52 %	0.19 %	82	41 %	59 %	73	-1.853

Source: Bloomberg

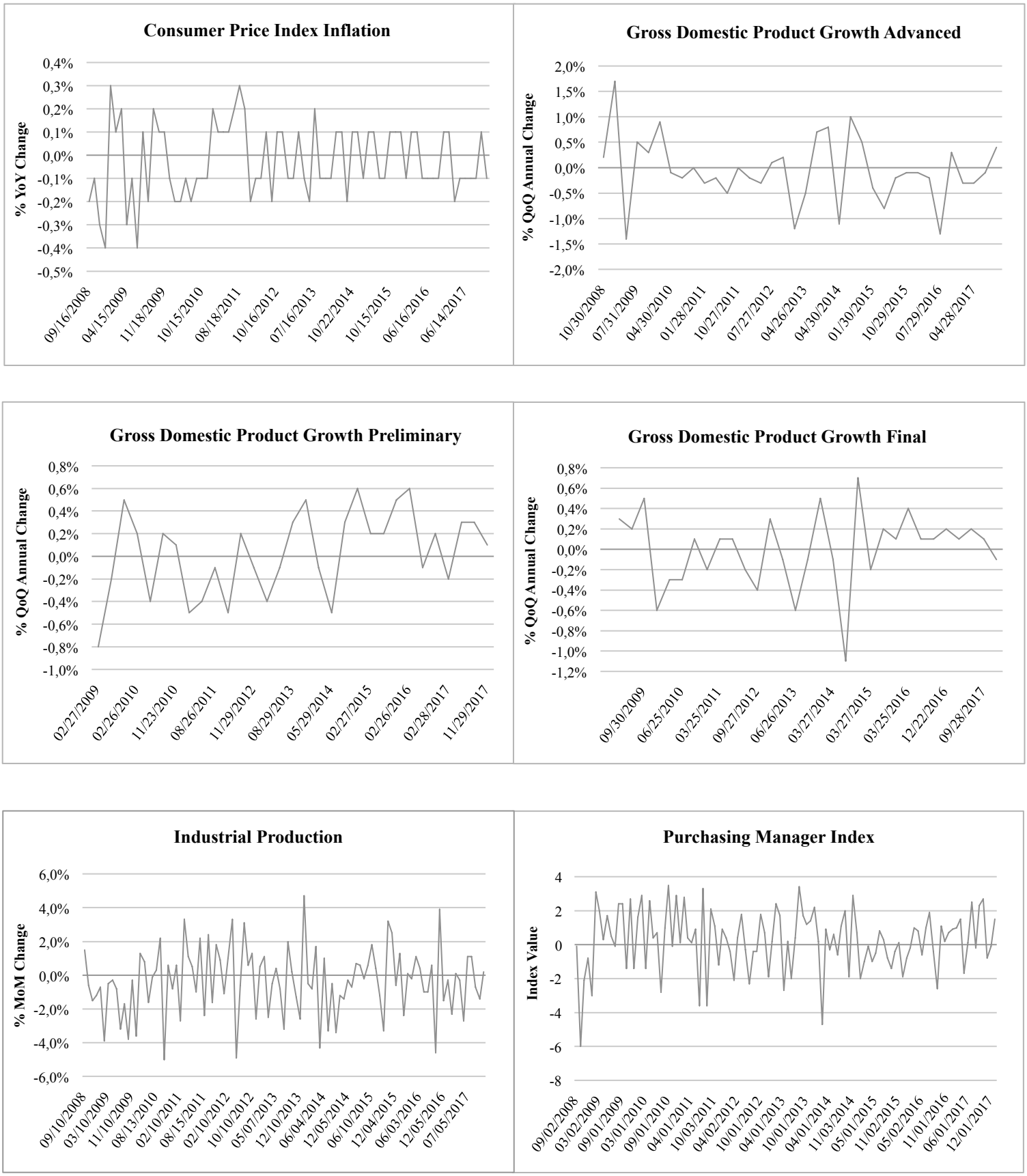
Notes:
A = Actual value.
S = Survey expected value.
Std.dev = Standard deviation of the expectation error series.
F = Average number of participants in the survey during the sample period.
A>E = The market underestimated the actual value (percentage of total observations).
A<E = The market overestimated the actual value (percentage of total observations).
OBS. = Number of observations (expectation error series).
t-stat = Test if the mean of the expectation error series is significantly different from zero.

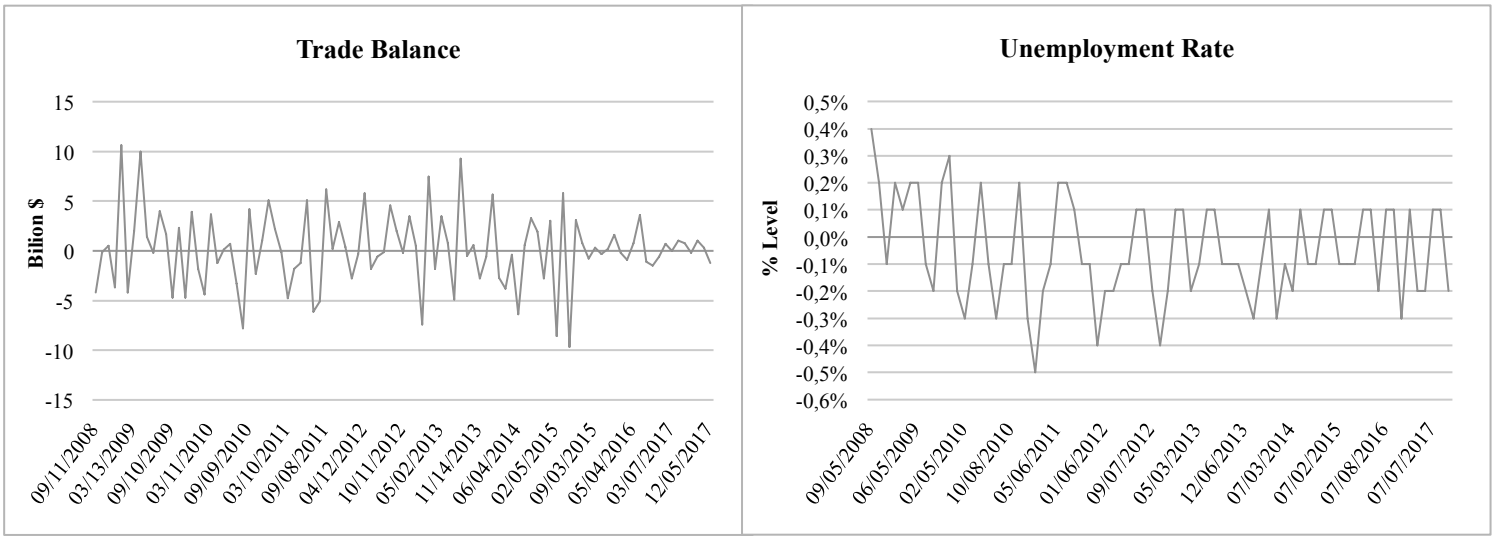
Figure 3.1 The Difference Between the Actual and the Expected Value, Sweden



Source: Bloomberg

Figure 3.2 The Difference Between the Actual and the Expected Value, the United States





Source: Bloomberg

3.3 Macroeconomic Variables

The choice of explantory macroeconomic variables has been made with respect to several aspects. First, in order to be able to link the results to the general determinants of the exchange rate, which allows an analysis based on the theoretical models. Second, comparable economic variables across countries to be able to compare the impact of Swedish and U.S. news on USD/SEK returns. Third, with respect to number of participants in Bloomberg survey. As USD/SEK is the dependent variable, the aim of the median expected estimation is to represent *market* expectations. Fourth, in the absence of a general accepted theory of the exchange rate determination, an eclectic view is considered by including different types of economic variables.

The majority of the variables are released in Sweden at 09:30 CET, and in the United States most variables are released at 08:30 Eastern Standard Time [EST]. If different types of macroeconomic variables are released on exactly the same time, which of the news will market participants pay most attention to? In most cases, the release of different types of macroeconomic variables does not coincide at the same time - nevertheless, it does happen. Previous research has adopted different methodologies to solve the issue. Balduzzi, Elton and John (2001) included a concurrent variable in the regression if variables coincided at more than 10 percent of the time during the sample period. Other studies utilized simple regressions for each expectation error series (Almeida, Goodhart & Payne, 1998; Andersen et al. 2003; Faust et al. 2007). In this study, simple regressions are estimated for each expectation error series and concurrent observations when variables coincide at the same time are excluded. Find in appendix details of excluded observations when the release of variables coincided at the same time.

The box 3.1 contains definitions of each variable used in the empirical study. All definitions are Bloomberg's, except PMI manufacturing as defined by Swedbank (2018). The definitions are applicable to both countries.

Box 3.1 Definitions Macroeconomic Variables

Consumer Price Index Inflation: Consumer prices are a measure of prices paid by consumers for a market basket of consumer goods and services. The yearly growth rates represent the inflation rate.

Gross Domestic Product Growth: Gross domestic product measures the final market value of all goods and services produced within a country. The GDP by expenditure approach measures total final expenditures (at purchasers prices), including exports less imports.

Industrial Production: Industrial production measures the output of industrial establishments in the following industries: mining and quarrying, manufacturing and public utilities. Production is based on the volume of output.

Purchasing Manager Index Manufacturing[1]: PMI Manufacturing is a business cycle indicator. A value above 50 indicates expansion while an index below 50 signals contradiction.
i) Sweden: Purchasing managers in the manufacturing industry - 200 individuals.
ii) The United States: Supply Management professionals - 300 individuals.

Trade Balance: The international trade balance measures the diffrence between the movement of merchandise trade leaving a country (exports) and entering a country (imports).

Unemployment Rate: The unemployment rate tracks the number of unemployed persons as a percentage of the labor force (the total number of employed plus unemployed)

Source: Bloomberg's definitions.
[1]: Swedbank's definition.

4 Methodology

4.1 The News Model

Let A_i denote the actual value of macroeconomic variable *i,* and E_i the median of expectations in the Bloomberg survey. Define the unexpected change, U_i as the difference between the actual and the expected value:

$$U_i = A_i - E_i$$

If the market underestimate the actual value of macroeconomic variable *i*, U_i would be positive, and if the market overestimate the actual value of macroeconomic variable *i*, U_i would be negative.

Units of measurement differ across variables, which makes it difficult to compare how the news in different types of variables impacts the exchange rate. To allow for comparisons in estimations between different variables, each observation are divided by the sample standard deviation of the expectation error series. This is a general accepted methodology in the field of research, frequently referred to as the 'standardized news function' (Andersen et al. 2007; Balduzzi, Elton & Green, 2001; Pearce & Solahoglu, 2007).

$$U_i = \frac{A_i - E_i}{\hat{\sigma}_i}$$

Where $\hat{\sigma}_i$ is the sample standard deviation of the expectation error series of that variable. Since the standard deviation is constant to all observations of that variable, the division with the sample standard deviation only affects the coefficient value. The coefficient could be interpreted as the unexpected change per unit of its standard deviation.

To all expectation error series of that macroeconomic variable: the following two simple regression models are completed separately for each country:

$$\frac{S_{0,i,t} - S_{-1,i,t}}{S_{-1,i,t}} = \beta_{0,i} + \beta_{1,i} U_{i,t} + \varepsilon_{i,t} \quad (1)$$

$$\frac{S_{5,i,t} - S_{-5,i,t}}{S_{-5,i,t}} = \beta_{0,i} + \beta_{1,i} U_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where:

i) $S_{0,i,t}$ is the average of high and low quotation of the USD/SEK currency pair within the first minute after the release of new data (time = 0). The index *i* refer to the different macroeconomic variables, i.e. CPI inflation, GDP growth, industrial production, PMI manufacturing, trade balance and the unemployment rate. The index *t* denotes the different dates and times when the variables are released.

ii) $S_{-1,i,t}$ is the average of high and low quotation of the USD/SEK currency pair 1 minute prior to the release of new data[5].

iii) $S_{5,i,t}$ is the average of high and low quotation of the USD/SEK currency pair 5 minutes after the release of new data.

iv) $S_{-5,i,t}$ is the average of high and low quotation of the USD/SEK currency pair 5 minute prior to the release of new data.

v) $\beta_{1,i,t}$ reflects the sensitivity of the USD/SEK currency pair to news in that macroeconomic variable.

vi) $U_{i,t}$ is the unexpected change in the release of that macroeconomic variable.

vii) $\varepsilon_{i,t}$ is the error term.

These two models underlie the empirical study in which the regressions follow a definite event study. The two models are not strict time-series regressions as the date of the release of variables varies from one time to another. An observation is added to the expectation error series when the variable is released and the associated return is calculated. Later the expectation error series are employed as simple regressions to each type of economic variable.

[5] Historical financial data sampled at high-frequency usually contain small gaps; occasionally the nearest quoted price is used in the tests.

4.2 The Stability Test

The directions in which news push the exchange rate could change over time. If the financial market conditions experience considerable variation, market participant's beliefs regarding the models of exchange rate determination and the way central banks respond to news could change. During 2008-2018 the world economy has suffered from a financial crisis, experienced rapid technological development and adapted to unconventional and expansive monetary policies. Imagine a trader's perception of prevailing financial market conditions in late 2008 compared to, for instance, 2016. In the year of 2008 the Federal Reserve cut the policy rate several times. 22 October 2008 the Federal Reserve Policy rate was 3.5 percent and 16 December the very same year, policy rate was down at 0.25 percent. Indeed, the policy rate is just one instance of many that could affect and change how market participants in the exchange market react on news.

To test if the reactions of the USD/SEK currency pair to news are stable over time and whether the discernible effect changes compared to when using the whole sample period, the news are divided into periods and estimated as separate regressions. Two years of series are grouped together to include adequately number of observations as some macroeconomic data are released only at quarterly frequency. Further, the observations from the year of 2018 are excluded to this test due to too few observations.

4.3 The Persistence Test

The impact of news on exchange rate returns at increased time horizons after the release of new data is uncertain. According to the survey of U.S. FX-traders by Cheung and Chinn (2001), the majority of respondents perceive that the full adjustment of news is incorporated into the price of the exchange rate within 1 minute of time after the release. However, in empirical research, one study found evidence that some news persisted to influence the exchange rate up to 12 hours after the release (Almeida, Goodhart & Payne, 1998).

To test the persistence effect of news on USD/SEK returns, the time horizons after the release are expanded. Holding one minute prior to release as constant, exchange rate returns are examined over following expanded time horizons after the release: 15 minutes, 30 minutes, 45 minutes, 1 hour, 2 hour, 5 hour and 12 hours. Note that it is only the news that significantly impacts the exchange rate in the first two tests that will be subject to the persistence test. If the unexpected change does not significantly impact USD/SEK returns in the first two regressions, testing its persistence counteracts the purpose.

4.4 Estimation Method

The models are estimated using ordinary least squares [OLS]. The method has its limitations when estimating the impact of news on high-frequency FX returns. Funke and Matsuda (2002) argue that generalized autoregressive conditional heteroskedasticity [GARCH] models are appropriate when investigating the impact of news on the stock market due to its characteristics of volatility clustering and asymmetric responses. Volatility clustering means that high fluctuations in prices are followed by further large changes. Asymmetric responses refer to the idea that negative news to the stock market increase volatility more than positive news (Funke & Matsuda, 2002). Fatum and Scholnick (2006) investigated news on five-minute FX returns using both GARCH and OLS estimates as robustness check and found the two methods to yield similar results.

The foreign exchange market is considered highly volatile on intraday basis. Presence of heteroskedatcity in the disturbance term could result in inefficient OLS estimates. Previous research has adopted different remedies to deal with potential heteroskedasticity. Andersen et al. (2007) estimated weighted least squares [WLS] to increase the efficiency of coefficient values. Other research employed OLS and used heteroskedasticity-consistent standard errors in the estimations (Almeida, Goodhart & Payne, 1998; Love & Payne, 2008). In the choice of OLS as estimation method, all regressions are completed using White's heteroskedasticity-consistent standard errors (White, 1980). Further, the first two regressions are subject to White's test of heteroskedasticity. Results to these tests are presented in the appendix.

The models are not strict time-series regressions, nevertheless, observations are added in sequence when variables are released and then employed as separate series. The presence of autocorrelation is a common issue in time-series data; therefore, the first two tests report Durbin-Watson statistics to all estimated coefficients (Durbin, 1970). Autocorrelation means that the disturbance term captures the influence of explanatory variables that are not included in the estimated models, which results in inefficient OLS estimates (Dougherty, 2016). As one could imagine, presence of autocorrelation in chosen regression is not quite unlikely as the exchange rate returns is exclusively estimated against the unexpected changes. High-frequency FX fluctuations depend on a myriad of factors, which is difficult to capture in regressions. The Durbin-Watson test returns values within the interval 0-4, where a value near 2 indicates no autocorrelation. A number greater than 2 indicate negative autocorrelation and a value under 2 indicates positive autocorrelation (Dougherty, 2016).

The expectation error series are tested for the presence of a unit root in the Augmented Dickey-Fuller methodology [ADF] (Dickey & Fuller, 1979). Lag lengths are chosen by Schwarz criterion. A unit root is not desirable in time series models when using OLS as it could result in inefficient coefficient estimations (Dougherty, 2016). Note, one could see in the figure 3.1 and 3.2 that the series appear to be stationary. The different figures are drawn on the observations, but without dividing by its sample standard deviation, which has no effect besides on the estimated coefficient values. However, results from a more formal method in that of the ADF methodology are presented in the appendix.

5 Results

The results from the tests are presented using estimation method OLS[6]. Coefficient value, t-statistics, coefficient of determination and Durbin-Watson statistics are reported in the first two tests. Subsequent two tests report coefficient value and t-statistics. In total 157 regressions are completed.

5.1 The Immediate Impact of News

Table 5.1 The Immediate Impact of Swedish and U.S. News on USD/SEK Returns

Results From Model (1) Presented Below[7].

	Sweden				The United States			
Macroeconomic Variable	**Coefficient**	**t-stat**	**R^2**	**D-W stat.**	**Coefficient**	**t-stat**	**R^2**	**D-W stat.**
CPI Inflation	-0.0015**	-9.153	0.597	2.412	0.0003**	4.605	0.194	1.602
GDP Growth[1]	-0.0010**	-3.534	0.372	2.407	0.0002	1.026	0.015	2.631
GDP Growth P[2]					0.0002**	3.065	0.214	2.151
GDP Growth F[3]					0.0002**	2.767	0.115	2.067
Industrial Production	-0.0006**	-9.055	0.430	1.864	0.0001**	3.527	0.096	1.920
PMI Manufacturing	-0.0006**	-6.132	0.350	2.347	0.0000	1.151	0.008	1.617
Trade Balance	-0.0001**	-2.867	0.051	1.969	0.0002**	3.575	0.181	1.982
Unemployment Rate	0.0007**	4.328	0.217	1.820	0.0004*	2.028	0.028	1.792

Notes:
Number of observations to each series is provided in table 3.1 and 3.2.
*Asterisk denotes: * $p < 0.05$, ** $p < 0.01$.*
[1]: The first row of GDP growth in the United States displays regression results to the advanced vintage. Preliminary and final vintages are not applicable to Sweden, therein blank cells.
[2]: GDP growth preliminary.
[3]: GDP growth final.

[6] All tests are completed using the Eviews econometric software.
[7] The absolute effect of news on USD/SEK returns could be interpreted as one standard deviation positive surprise in; for instance, Swedish CPI inflation, results in appreciation of SEK to USD by 0.15 percent.

Table 5.2 The Immediate Impact of Swedish and U.S. News on USD/SEK Returns

Results From Model (2) Presented Below[8].

	Sweden				The United States			
Macroeconomic Variable	**Coefficient**	**t-stat**	**R^2**	**D-W stat.**	**Coefficient**	**t-stat**	**R^2**	**D-W stat.**
CPI Inflation	-0.0022**	-11.256	0.638	2.066	0.0003**	2.627	0.069	1.542
GDP Growth[1]	-0.0019**	-4.556	0.556	2.081	0.0004	1.666	0.097	1.939
GDP Growth P[2]					0.0004**	3.241	0.237	1.894
GDP Growth F[3]					0.0002*	2.319	0.158	1.858
Industrial Production	-0.0013**	-7.845	0.437	1.889	0.0001	0.142	0.001	2.147
PMI Manufacturing	-0.0010**	-6.126	0.347	2.283	0.0000	0.297	0.000	2.176
Trade Balance	-0.0000	-0.730	0.000	2.190	0.0004**	3.336	0.106	1.970
Unemployment Rate	0.0011**	5.477	0.303	1.794	0.0003	0.983	0.000	1.597

Notes:
Number of observations to each series is provided in table 3.1 and 3.2.
*Asterisk denotes: * $p < 0.05$, ** $p < 0.01$.*
[1]: The first row of GDP growth in United States displays regression results to the advanced vintage. Preliminary and final vintages are not applicable to Sweden, therein blank cells.
[2]: GDP growth preliminary.
[3]: GDP growth final.

As seen in table 5.1 and 5.2, the general picture is a rapid impact of the majority of news on USD/SEK returns. Most of the news is incorporated into the price of the exchange rate immediately within the first minute after the release. One could see that if the news has an impact on the exchange rate within the first minute after the release, table 5.1, then it can also have an effect five minutes after the release, table 5.2. However, the opposite is not true. This conforms to previous research and imply that in order to be able to capture the immediate impact of news on exchange rate returns, one have to employ FX data sampled at one minute-by-minute quotations (Cheung & Chinn, 2001; Ederington & Lee, 1995; Love & Payne, 2008).

The estimated explanatory power of news on FX returns significantly differs between Sweden and the United States. Especially, Swedish news in CPI inflation exhibits strong explanatory power on USD/SEK returns. Previous studies found the estimated explanatory power of U.S.

[8] The Durbin-Watson statistics returned a value near 2 to the majority of variables, which indicates no autocorrelation.

news in CPI inflation on exchange rate returns to roughly 10 percent (Andersen et al. 2003), and 12 percent (Pearce & Solakoglu, 2007). In particular, previous studies found that U.S. news in the trade balance and real economic activity indicators to be especially influential on FX returns (Almeida, Goodhart & Payne, 1998; Andersen et al. 2003; Simpson, Ramchander & Chaudhry, 2005). Their findings stand in contrast to the inference in this study, which may have several reasons. First, their studies was conducted between periods before the Federal Reserve officially adopted inflation targeting. Second, they estimated the impact of U.S. news against major currency pairs viewed as percentage of total daily turnover on the FX market, such as: USD/EUR and JPY/USD[9]. In particular, the relative impact of news in U.S. trade balance figures could depend on which currency that is compared versus the USD. The effect of news in U.S. trade balance figures is consistent with the portfolio balance model, and could imply that foreign investors increase their portion of USD-denominated assets in their portfolios, as proposed by (Pearce and Solakoglu, 2007). The total money value of the currency pair USD/SEK is significantly lower than USD/EUR and JPY/USD. Thus, a positive surprise in U.S. trade balance figures could imply relatively less demand of USD-denominated assets by Swedish investors compared to European- or Japanese investors. Lastly, the discernible effect of U.S. news on the exchange rate weakens in certain periods, which will be examined in more detail in section 5.2.

Another finding that matters the comparison between the two tests and the two countries are the direction in which news in CPI inflation and GDP growth push the exchange rate. The analysis is based on the predictions in a central bank reaction function and in a monetary model (table 2.1). The news in CPI inflation is consistent with the predictions in a reaction function, whereas the news in GDP growth is consistent with both the reaction function and the monetary model. Positive surprises in CPI inflation could through a fisher-effect raise nominal interest rates, as proposed by (Simpson, Ramchander & Chaudry, 2005). If this were the dominating effect, positive news in CPI inflation results in capital inflow and appreciates the currency. The news in GDP growth causes exchange rate appreciation, which conforms to previous research (Andersen et al. 2003; Love & Payne, 2008). The central banks could respond by a hike in short-term interest rates that appreciates the exchange rate, as proposed by Andersen et al. (2003). In the monetary model, positive surprises in GDP is said to increase the demand on domestic money, which lower prices and appreciate the currency á la PPP (Pearce, 1983). However, some researchers reject PPP to hold in the short-run (Flood & Taylor, 1996; Simpson, Ramchander &

[9] In 2016 USD/EUR accounted to roughly 23 percent of global daily turnover in the FX market, whilst USD/SEK accounted to roughly 1 percent (Bank for International Settlements, 2016).

Chaudhry, 2005). In a low inflationary environment, positive news in CPI inflation leads to expectations of a monetary deceleration, which rule out PPP (Simpson, Ramchander & Chaudhry, 2005). Their argument concerns surprises in CPI inflation, although; remember that the PPP continuously holds in the monetary model. During the sample period, 2008-2018, the inflation in both Sweden and in the U.S. has been relatively low in a historical perspective. This implies that news in GDP growth on USD/SEK returns potentially can have more empirical support by the reaction function compared to the monetary model.

The theoretical models do not make explicit prediction of how news in, for instance, industrial production and PMI manufacturing impact the exchange rate. Per definition industrial production is a fraction of GDP growth, thus, news in industrial production could be said to follow the same logic as news in GDP growth. Per definition PMI manufacturing could be thought of as a pro-cycle indicator. The news in PMI manufacturing could, to some degree, be analyzed based on the same logic as news in GDP growth. Previous research have explained their results of news in several real economic activity indicators such as, for instance, GDP, industrial production and confidence indexes' based on the logic of a central bank reaction function (Andersen et al. 2003; Almeida, Goodhart & Payne, 1998; Love & Payne; 2008).

The unemployment rate is another variable that is not explicitly predicted to have an effect on the exchange rate in the theoretical models. One could find that the direction in which news in the unemployment rate push the exchange rate differ between Sweden and the United States. Assume that the market expects central banks will respond to news by adjusting short-term interest rates. The Swedish Riksbank does not officially indicate that they make policy decisions based on long-run objectives of the unemployment rate, which could imply that a hike in interest rates is not likely as a result of a positive surprise. A higher unemployment rate could result in a decline in GDP according to Okun's Law (Burda & Wyplosz, 2013. Given no reaction from the Swedish Riksbank, a positive surprise in the unemployment rate could result in exchange rate depreciation, consistent with several of the theoretical models. The Federal Reserve, on the other hand, officially indicates that they make policy decisions based on long-run objectives of the unemployment rate (Federal Reserve, 2018). A positive surprise in the unemployment rate emanating from the U.S. could imply a hike in short-term interest rates that results in dollar appreciation. This does not offset that the Okun's Law could hold to the U.S., rather, it imply that the potential reactions from the Federal Reserve could be more supportive. The finding that positive surprises in the U.S. unemployment rate cause dollar appreciation stands in contrast to

the study by (Almeida, Goodhart & Payne; 1998). However, the authors employed FX data sampled at five minute-by-minute quotations and the effect was not significant at the five-percent level, which is in accordance with this study as one could see in table 5.2.

Now look specifically on news in trade balance and compare the two tests in table 5.1 and 5.2. The news in trade balance emanating from Sweden does impact USD/SEK on the minute, but not five-minutes post-release. This conforms to previous studies that utilized FX data at five minute-by-minute quotations and estimated the impact of news in the trade balance in another country versus a currency against the dollar (Almeida, Goodhart & Payne, 1998; Andersen et al. 2003). The news in U.S. trade balance figures has an impact on USD/SEK returns in both tests. Positive surprises in the trade balance emanating from the U.S. results in dollar appreciation to other currencies, which conforms to previous research (Almeida, Goodhart & Payne, 1998; Andersen et al. 2003; Faust et al. 2007; Pearce & Solakoglu, 2007; Simpson, Ramchander & Chaudry, 2005). Positive surprises in the trade balance to result in dollar appreciation are consistent with the traditional flow model and the portfolio balance model. The rapid incorporation into prices of FX and exchange rate appreciation is unlikely to be determined by the demand for goods and services as in the traditional flow model. Moving to the portfolio balance model, a positive surprise in the trade balance could imply increased demand of assets by foreign investors in that country's currency, as suggested by Pearce and Solakoglu (2007). Specifically, in the case between Sweden and the U.S., this means that if positive news in the trade balance is announced in the U.S., Swedish investors rebalance their portfolios and increase their holdings of dollar-denominated assets. The increased demand of dollar results in appreciation of USD to SEK.

If we compare the news emanating from Sweden with the equivalent news emanating from the U.S., one could see that Swedish news has greater impact on USD/SEK returns. In the first test, news in, for instance, CPI inflation emanating from Sweden triggers a response five times higher on USD/SEK behavior than news in CPI inflation emanating from the U.S. However, one needs to remember two things. First, each observation is divided by the sample standard deviation of the expectation error series. This means that it is not possible to make a direct comparison between the sizes of coefficients without taking the standard deviation into consideration. The standard deviation of the expectation error series is significantly higher to all variables in Sweden, see table 3.1 and 3.2. This implies that a direct comparison between the estimated coefficients of Swedish and U.S. news on USD/SEK returns would overestimate the impact of

Swedish news. Second, if the reactions to news are not stable over time, the discernible effect of news on exchange rate returns weakens. Still, though, the Swedish news causes a sizeable move of the USD/SEK currency pair. One could see that the Swedish news in CPI inflation entails the largest jump on the USD/SEK currency pair, where a one standard deviation positive surprise appreciates SEK to USD by 0.22 percent in the second test. As a comparison between a previous study estimating similar models, Andersen et al. (2003) found the news in U.S. payroll to be the most influential, where a one standard deviation positive surprise appreciated USD to DEM by 0.16 percent.

In summary, this section demonstrates that the majority of news has an impact on USD/SEK returns. The direction in which news push the exchange rate is in general consistent with the predictions in a central bank reaction function and in a portfolio balance model. Moreover, Swedish news, compared to U.S. news, exhibits stronger explanatory power on USD/SEK returns.

Table 5.3

	Sweden					The United States				
Macroeconomic Variable	**2008-2009**	**2010-2011**	**2012-2013**	**2014-2015**	**2016-2017**	**2008-2009**	**2010-2011**	**2012-2013**	**2014-2015**	**2016-2017**
CPI Inflation	-0.0007**	-0.0006**	-0.0015*	-0.0021**	-0.0017**	0.0001	0.0002*	0.0004**	0.0007**	0.0011**
	(-4.597)	(-4.011)	(-2.779)	(-7.402)	(-6.142)	(0.375)	(2.402)	(4.427)	(3.636)	(4.136)
GDP Growth[1]	-0.0003	-0.0010*	-0.0007	-0.0019**	-0.0018**	-0.0003**	-0.0003	0.0002	0.0006**	0.0006**
	(-1.363)	(-3.527)	(-1.440)	(-4.477)	(-9.763)	(-5.134)	(-1.353)	(2.301)	(4.287)	(5.913)
GDP Growth Prel.						-0.0000	0.0000	0.0004	0.0005**	0.0004*
						(-0.352)	(0.512)	(1.825)	(3.448)	(2.946)
GDP Growth Final						0.0001	-0.0002	0.0014	0.0002*	0.0005*
						(0.816)	(-0.527)	(1.574)	(2.660)	(2.365)
Industrial Product.	-0.0004**	-0.0005**	-0.0009**	-0.0009**	-0.0003*	0.0000	-0.0000	0.0000	0.0003**	0.0002**
	(-3.623)	(-5.630)	(-3.685)	(-8.975)	(-1.934)	(1.387)	(-0.645)	(1.146)	(4.581)	(3.389)
PMI Manufacturing	-0.0002*	-0.0003**	-0.0011**	-0.0015**	-0.0003**	-0.0001	-0.0002	0.0001	0.0003*	0.0006**
	(-2.028)	(-4.069)	(-2.987)	(-6.352)	(-6.542)	(-0.715)	(-1.997)	(1.189)	(2.523)	(6.604)
Unemployment R.	0.0000	0.0004**	0.0011**	0.0018*	0.0006**	0.0001	0.0005*	0.0006	0.0001	0.0000
	(0.043)	(2.836)	(5.458)	(2.658)	(8.642)	(0.296)	(2.404)	(1.055)	(1.156)	(0.054)
Trade Balance	-0.0001	-0.0001*	-0.0001	-0.0000	-0.0004	0.0003*	0.0000	0.0000*	0.0002*	0.0002
	(-1.749)	(-2.682)	(-1.282)	(-0.056)	(-1.483)	(1.946)	(1.042)	(1.841)	(3.445)	(1.039)

Notes:
*Asterisk denotes: * $p < 0.05$, ** $p < 0.01$*
t-stat in brackets underneath the coefficients.
Maximum number of observations per period is 24 to variables released at monthly frequency and 8 to variables released at quarterly frequency.
[1]: The first row of GDP growth to United States displays regression results to the advanced vintage. Preliminary and final vintages are not applicable to Sweden, therein blank cells.

5.2 The Stability Test of News

In table 5.3, the news is divided into a two-year period of time. Besides this, the qualitative measures are equivalent with the first regression model. The test examines if the impact of news on the exchange rate are stable over time and whether the discernible effect changes compared to the results obtained in section 5.1.

As seen in table 5.3, the general picture is that the impact of Swedish news on USD/SEK returns is stable over time; however, the effect of U.S. news weakens in some periods. The estimated coefficients of U.S. news shifted signs in some periods. For instance, we know from the first two tests in table 5.1 and 5.2 that positive surprises in U.S. GDP growth final results in appreciation of USD to SEK. However, as seen in table 5.3, positive surprises in U.S. GDP growth final result in depreciation of USD to SEK during the period 2008-2009. This implies that the estimated coefficients of U.S. news on USD/SEK returns in the first two tests are not as effective estimated as that of the estimated coefficients of Swedish news.

From the previous section, we know that the reactions of the USD/SEK currency pair to news in CPI inflation and GDP growth is consistent with a central bank reaction function. The effect is consistent to both Sweden and the U.S. An argument was made that news in industrial production and PMI manufacturing to some degree could follow the same logic as the news in GDP. A positive surprise in CPI inflation raises the domestic interest rates through a fisher-effect (Simpson, Ramchander & Chaudry) and positive surprises in indicators of real economic activity potentially results in a hike in interest rates by central banks (Almeida, Goodhart & Payne, 1998). The impact of U.S. news in real economic activity indicators, such as GDP growth, on exchange rate returns has been explained based on the logic of a reaction function (Almeida, Goodhart & Payne; Andersen et al. 2003; Love & Payne, 2008). However, the estimated impact of surprises in U.S. inflationary indicators, such as CPI inflation, on exchange rate returns has differed across previous studies.

The impact of positive news in U.S. CPI inflation and real economic activity indicators to result in dollar appreciation became in general significant in the period of 2012-2013 and onwards. In January 2012, the Federal Reserve for the first time publicly announced an explicit inflation target (England, 2015). The Federal Open Market Committee's longer-run inflation goal of 2 percent has consisted since its announcement in January 2012 (Federal Reserve, 2017). Love and Payne (2008) argued that positive news in CPI inflation emanating from the U.K. would

appreciate the pound since Bank of England at time of study was an explicit inflation targeting central bank. Thus, the reason why positive news in U.S. CPI inflation significantly appreciates the dollar in the period 2012-2013 and onwards could be the reason that the market expect that the Federal Reserve will respond by a hike in short-term interest rates. As mentioned previously, the estimated impact of news in U.S. inflationary indicators, such as CPI inflation, on FX returns has differed across previous studies. In particular, Andersen et al. (2003) found in their study, conducted between 1992-1998, that the impact of U.S. news in real variables was more influential than nominal variables on exchange rate returns. Love and Payne (2008) studied U.S. news on USD/GBP returns during the period 1999-2000 and found dollar depreciation as a result of positive surprises in CPI inflation emanating from the U.S. Further, Almeida, Goodhart and Payne (1998) did not find evidence of news in U.S. CPI inflation to have an impact on DEM/USD returns. Their study included U.S. and German news and covered the period 1992-1994. This could imply that the discernible effect of positive U.S. news in CPI inflation to result in dollar appreciation strengthened after the Federal Reserve adopted inflation targeting in January 2012. However, the impact of news on the exchange rate could depend on current conditions on the financial markets, which complicates comparisons between studies. In the period of 2008-2009 and 2010-2011, the news in CPI inflation and real economic activity indicators loose effect on USD/SEK returns, which could be since the U.S. financial markets experienced a turbulent time.

The impact of positive news in Swedish CPI inflation and real economic activity indicators to result in SEK appreciation are in general significant in all periods. The Swedish Riksbank has announced and adopted inflation targeting since January 1995 (Riksbank, 2018). If the discernible impact of news strengthens when the monetary authorities have an explicit inflation target, the responses to Swedish news on USD/SEK returns in those indicators are supported by the reaction function in all periods.

The direction in which news in the unemployment rate push the exchange rate differ between Sweden and the U.S. Positive surprises in the Swedish unemployment rate results in deprecation of SEK to USD during all periods, whereas positive news in the U.S. unemployment rate appreciates the dollar. However, the effect is not significant in all periods. One reason why the news in the unemployment rate emanating from Sweden did not impact USD/SEK returns during 2008-2009 could be if the Okun's Law did not hold. Although, in all other periods, a positive surprise in the unemployment rate emanating from Sweden significantly depreciate SEK to USD.

Regarding U.S. news in the unemployment rate, an argument was made in section 5.1 that the Federal Reserve potentially responds by adjusting short-term interest rates. The discernible effect of positive U.S. news in the unemployment to result in dollar appreciation weakens in the period 2012-2013 and onwards. The Phillips Curve illustrates a negative relationship between the unemployment rate and inflation (Burda & Wyplosz, 2013). Why the U.S. news in the unemployment rate loose impact on the exchange rate could be the reason of how the market expects the Federal Reserve will handle the trade-off between the unemployment rate and inflation in policy decisions. However, the Federal Reserve could prior to January 2012 have had an implicit inflation target, why the comparison concerns the time after the public announcement of an explicit inflation target. The way market participants believe the Federal Reserve will respond to unexpected changes in the unemployment from the period 2012-2013 and onwards could differ and, thus, weakens the impact on the exchange rate.

The direction in which news in the trade balance pushes the exchange rate is consistent across both countries in all periods. Positive surprises in the trade balance results in exchange rate depreciation. The significant impact on the exchange rate does not follow a specific pattern in neither country. If market participants trade on different ideas or theories, the discernible impact of surprises in the trade balance on USD/SEK returns weakens.

In summary, this section demonstrates that the reactions of the exchange rate to news in general are stable over time. The Swedish news has a significant impact on USD/SEK returns in almost all periods, whereas the significant effect of U.S. news weakens in some years. The reactions of the USD/SEK currency pair to Swedish news are in general consistent with the predictions in a central bank reaction function in all periods. The impact of U.S. news on USD/SEK returns becomes more significant from the period of 2012-2013 and onwards, which could be since the Federal Reserve for the first time publicly announced an explicit inflation target in January 2012.

5.3 The Persistence Effect of News

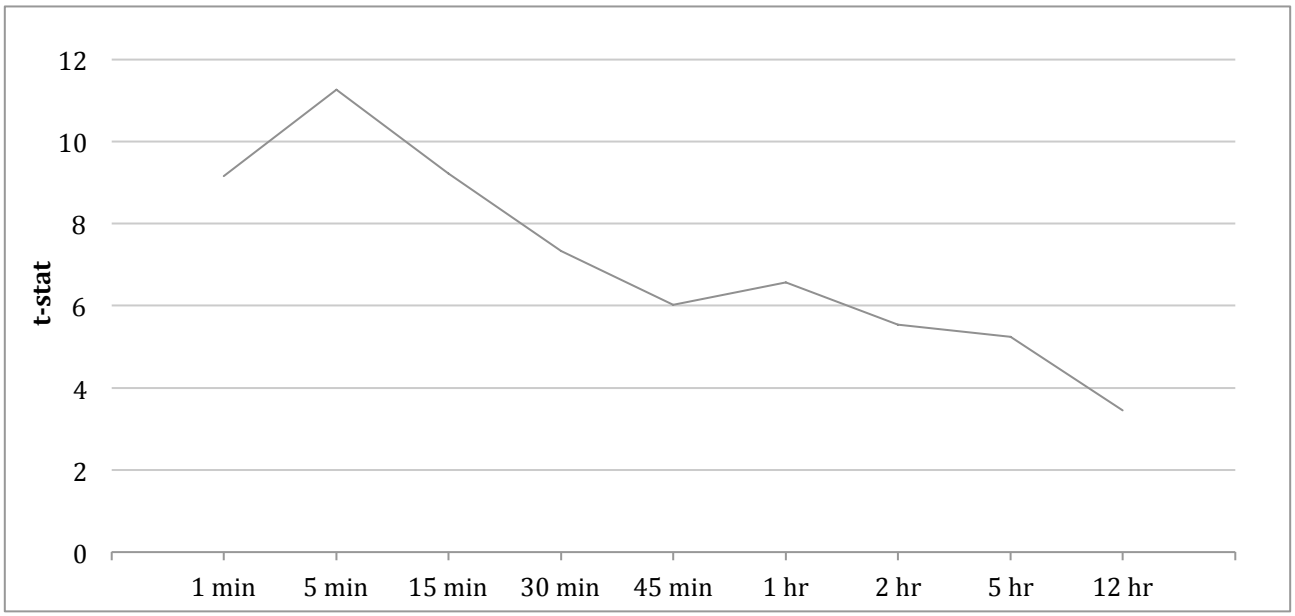
In table 5.4, the persistence effect of news on USD/SEK returns is examined by increasing the time horizons after the release of new data, holding one-minute prior to the release as constant. The persistence test is constructed to news that has a significant impact on USD/SEK returns in the first two tests. The total of observations are included in the test, as in section 5.1, since the stability test demonstrated that the directions in which news push the exchange rate in general is stable over time.

Table 5.4 The Persistence Effect of Swedish and U.S. News on USD/SEK Returns

				Sweden			
Macroeconomic Variable	**15 Min**	**30 Min**	**45 Min**	**1 hr**	**2 hr**	**5 hr**	**12 hr**
CPI Inflation	-0.0024**	-0.0023**	-0.0021**	-0.0023**	-0.0023**	-0.0025**	-0.0025**
	(-9.226)	(-7.334)	(-6.021)	(-6.568)	(-5.542)	(-5.238)	(-3.452)
GDP Growth	-0.0026**	-0.0022**	-0.0019**	-0.0021**	-0.0030**	-0.0034**	
	(-7.306)	(-4.554)	(-3.665)	(-3.538)	(-3.237)	(-3.857)	
Industrial Production	-0.0015**	-0.0014**	-0.0015**	-0.0014**	-0.0011**	-0.0010**	
	(-9.946)	(-9.070)	(-6.523)	(-6.964)	(-4.481)	(-2.637)	
PMI Manufacturing	-0.0011**	-0.0013**	-0.0014**	-0.0015**	-0.0017**	-0.0017**	-0.0033**
	(-5.639)	(-5.826)	(-5.256)	(-4.333)	(-4.379)	(-3.571)	(-3.810)
Unemployment Rate	0.0013**	0.0013**	0.0011**	0.0010**	0.0009*	0.0006	0.0015*
	(4.403)	(3.480)	(2.673)	(2.650)	(1.886)	(1.011)	(1.907)
				The United States			
Macroeconomic Variable	**15 Min**	**30 Min**	**45 Min**	**1 hr**	**2 hr**	**5 hr**	**12 hr**
CPI Inflation	0.0004**	0.0005*	0.0003	0.0003	0.0004	-0.0003	-0.0008
	(2.564)	(2.030)	(1.092)	(0.986)	(0.849)	(-0.401)	(-0.449)
GDP Growth Preliminary	0.0000	-0.0000	0.0000	0.0002	0.0003	0.0005	
	(0.351)	(-0.295)	(0.250)	(0.440)	(0.406)	(0.577)	
GDP Growth Final	0.0006**	0.0004	0.0002	0.0003	0.0004	0.0004	
	(2.643)	(1.564)	(0.589)	(0.901)	(0.978)	(0.859)	
Trade Balance	0.0004**	0.0002	0.0000	0.0001	0.0000	0.0013*	0.0018*
	(2.389)	(1.098)	(0.503)	(0.496)	(0.189)	(2.004)	(2.062)

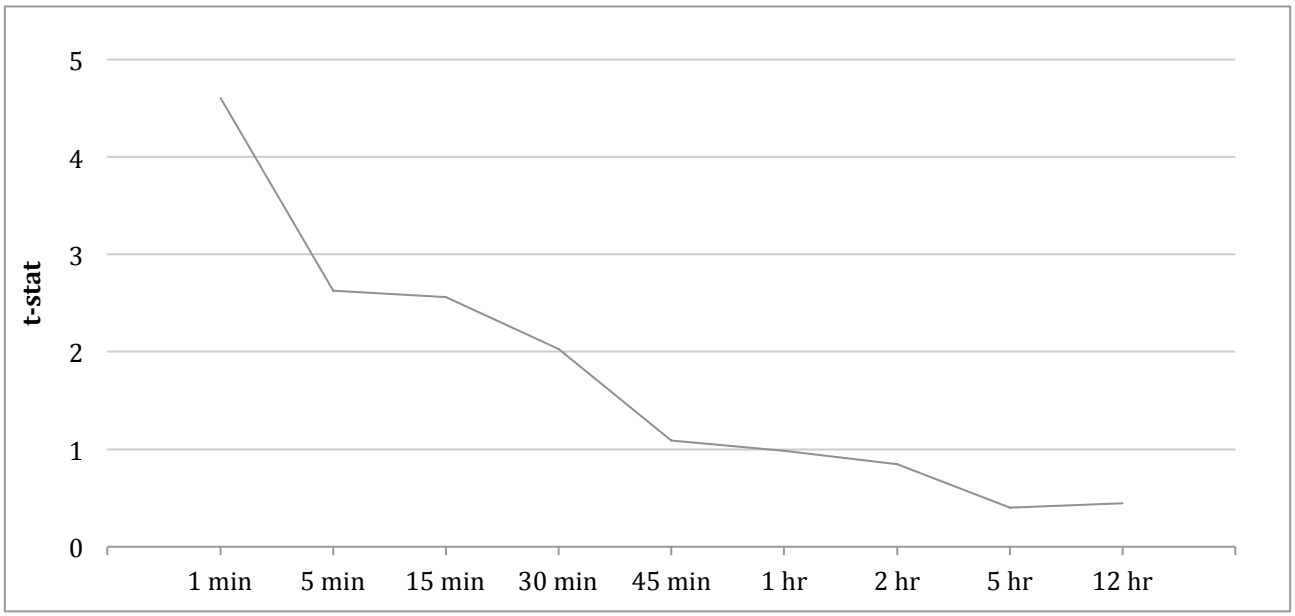
Notes:
*Asterisk denotes * $p < 0.05$, ** $p < 0.01$.*
t-stat in brackets underneath the coefficients.
Number of observations to each series is provided in table 3.1 and 3.2.
Blank cells: Limitations in FX data.

Figure 5.1 The Peristence Effect of News, Sweden CPI Inflation



Notes:
Y-axis: t-stat evolution of news in CPI inflation on USD/SEK returns.
X-axis: Minutes/hours after the release.

Figure 5.2 The Peristence Effect of News, the United States CPI Inflation



Notes:
Y-axis: t-stat evolution of news in CPI inflation on USD/SEK returns.
X-axis: Minutes/hours after the release.

As seen in table 5.4, the general picture is that Swedish news persists to impact USD/SEK returns at increased time horizons after the release. The U.S. news, on the other hand, quickly loose impact on USD/SEK returns. The figures 5.1 and 5.2 display the t-stat evolution of the impact of news in CPI inflation on USD/SEK returns.

All the Swedish news has an impact on USD/SEK returns up to 2 hours post-release. The news examined over a 12-hour time horizon, that of CPI inflation and PMI manufacturing, significantly impact the exchange rate in all periods. The sign in front of coefficients is invariant, i.e. a positive (negative) surprise appreciates (depreciates) SEK to USD in all periods. The result stands in contrast with previous research, which to a great extent assessed that the impact of news on exchange rate returns quickly weakens at increased time horizons.

The main difference between this study and previous research is the choice of studying the impact of news in a small economy, that of Sweden, and estimate the impact of news against the currency pair USD/SEK. One reason why Swedish news persists to impact USD/SEK returns could be if the unexpected changes becomes relevant to the fundamentals of the exchange rate. The survey of FX-traders by Cheung and Chinn (2001) showed that 95 percent of respondents considered daily fluctuations in the exchange market as reflecting changes in fundamentals irrelevant on intraday basis. Indeed, if this were true, evidence of news to persist to impact the exchange rate up to 12 hours after the release is unlikely. Thus, the persistence effect of Swedish news on USD/SEK returns could imply that the unexpected changes becomes relevant to the fundamentals of the exchange rate, e.g. the inflation rate, interest rates, real output and money supplies. In particular, this could imply that if positive news in, for instance, CPI inflation is announced in Sweden, then the unexpected change continues to be priced in the exchange rate. The view of the exchange rate as an asset means that the value of fundamentals is discounted at present value (Sarno & Schmeling, 2014). If market participants expect that positive news in CPI inflation potentially result in a hike in interest rates, then this long-term view could be priced in the exchange rate until new information reach the market and changes the picture.

The effect of U.S. news on USD/SEK returns quickly weakens and disappears into the noise in the daily exchange rate fluctuations. The only news that significantly impact USD/SEK returns beyond 15 minutes of time after the release is that of CPI inflation. The finding that U.S. news quickly loose impact on exchange rate returns is broadly consistent with previous research that estimated the persistence effect of news (Almeida, Goodhart & Payne, 1998; Pearce &

Solakoglu; 2007). However, as a comparison, their results indicated that news in U.S. trade balance persists to impact the exchange rate up to 2 hours post-release. As one could see in table 5.4, the news in U.S. trade balance loose effect on the USD/SEK currency pair 15 minutes after the release. The reason could be, as discussed previously, that their studies estimated the impact of U.S. news on the USD versus major currency pair's, viewed as percentage of total daily turnover on the FX market. Moreover, the survey of U.S. FX-traders by Cheung and Chinn (2001) indicated that broadly 95 percent of respondents considered the full effect of news in CPI inflation, GDP growth and trade balance to be incorporated into prices within 30 minutes after the announcement. The study provides further empirical support that the impact of U.S. news on exchange rate returns quickly weakens at increased time horizons.

In summary, Swedish news persist to impact the exchange rate at expanded time horizons after the release of new data. One reason could be that the news becomes relevant to the fundamentals of the exchange rate, which imply that the unexpected changes continues to be priced in the exchange rate until new information reach the market. The impact of U.S. news quickly weakens and disappears into the noise in the intraday FX fluctuations, which conforms to previous research.

6 Conclusions and Further Research

In this paper a study have been conducted to assess the high-frequency behavior of the USD/SEK currency pair on the arrival of macroeconomic news emanating from Sweden and the United States. The overall image is a rapid incorporation into prices and that most of the studied variables are considered relevant in the pricing of the exchange rate. Swedish news exhibits strong impact of exchange rate returns and the direction in which news push the exchange rate are stable over time. Further, Swedish news persists to impact the USD/SEK currency pair at increased time horizons after the release of new data. U.S. news demonstrates lower explanation on exchange rate returns and the discernible effect weakens in some periods. Finally, the impact of U.S. news on USD/SEK returns quickly weakens and disappears into the noise in the daily FX fluctuations.

Regarding the direction in which news push the exchange rate, the overall results conforms to previous research findings where the direction in which news push the exchange rate in general is consistent with the predictions in a central bank reaction function and in a portfolio balance model. In particular, the study provides further empirical support of the reaction function, in which the discernible effect of news on exchange rate returns may strengthens when the monetary authorities have an explicit inflation target.

An argument has been made that Swedish news persists to influence the USD/SEK currency pair at expanded time horizons after the release of new data. In theory, this could be the reason of a hike in short-term interest rates as central bank's is said to behave according to the Taylor rule. To further research it would be interesting to assess statistically if there is a connection between money market interest rates and exchange rates on the arrival of news in Sweden.

Further, it would be interesting to study if public speeches by central bank members affect the foreign exchange rate. Dovish and hawkish speeches about the perceived economic outlook could influence market behaviors. This is complicated to quantify, although, regular scheduled speeches are available to the public.

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Appendix

Macroeconomic Data, Sweden and the United States

Table A1. Macroeconomic Data, Sweden

Macrovariable	Measurement	Frequency	Rel. Lag	Source	Time	First OBS.	Last OBS.
CPI Inflation	% YoY change	Monthly	~2 weeks	SCB	09:30	09/09/2008	01/12/2018
GDP Growth	% QoQ Ann. Ch.	Quarterly	~2 months[1]	SCB	09:30	09/12/2008	11/29/2017
Industrial Production	% MoM change	Monthly	~1-2 months	SCB	09:30	09/10/2008	11/06/2017
PMI Manufacturing	Index Value	Monthly	None	Sw/SILF	08:30	10/01/2008	01/02/2018
Trade Balance	Billon SEK	Monthly	~2 months	SCB	09:30	10/27/2008	06/27/2017
Unemployment Rate	% level	Monthly	~2-3 weeks	SCB	09:30	09/11/2008	12/14/2017

Source: Bloomberg

Notes:
Acronyms:
SCB = Statistics Sweden.
Sw/SILF = Swedbank/SILF.
% QoQ Ann. Ch. = Percentage Quarter on Quarter annual change.
[1] : GDP Growth Q2 preliminary approximately 1 month lag and more complete data 3 months release lag.
Time: Central European Time (CET).
Rel.Lag = Release lag.

Table A2. Macroeconomic Data, the United States

Macrovariable	Measurement	Frequency	Rel. Lag	Source	Time	First OBS.	Last OBS.
CPI Inflation	% YoY change	Monthly	~2 weeks	BLS	08:30	09/16/2008	01/12/2018
GDP Growth A	% QoQ Ann. Ch.	Quarterly	~1 month	BEA	08:30	10/30/2008	10/27/2017
GDP Growth P	% QoQ Ann. Ch.	Quarterly	~2 months	BEA	08:30	11/25/2008	11/29/2017
GDP Growth F	% QoQ Ann. Ch.	Quarterly	~3 months	BEA	08:30	12/23/2008	12/21/2017
Industrial Production	% MoM change	Monthly	~2 weeks	FED	09:15	09/15/2008	12/15/2017
PMI Manufacturing	Index Value	Monthly	None	ISM	10:00	09/02/2008	01/03/2018
Trade Balance	Billon $	Monthly	~2-3 months	BEA	08:30	09/11/2008	12/05/2017
Unemployment Rate	% level	Monthly	Few days	BLS	08:30	09/05/2008	12/08/2017

Source: Bloomberg

Notes:
Acronyms:
BLS = Bureau of Labor Statistics.
BEA = Bureau of Economic Analysis.
FED = Federal Reserve Board.
ISM = Institute for Supply Management.
Time: Eastern Standard Time (EST).
Rel.Lag = Release lag.
GDP Growth A = GDP growth Advanced.
GDP Growth P = GDP growth Preliminary.
GDP Growth F = GDP growth Final.

Coinciding Releases of New Data, Sweden and the United States

Table A3. Coinciding Releases of New Data, Sweden 09:30 CET Announcements.

Macrovariable	CPI	GDP	Industrial Production	Trade Balance	Unemployment	**TOTAL**
CPI Inflation	80	0	4	0	10	94
GDP Growth	0	36	0	0	1	37
Industrial Production	4	0	101	0	0	105
Trade Balance	0	0	0	69	5	74
Unemployment Rate	10	1	0	5	82	98
Total	94	37	105	74	98	408

Notes:
Table reveals from horizontal headline with the left vertical row if the release of variables coincided during the sample period.
For instance: The release of CPI and industrial production coincided 5 times during the sample period. These observations to both variables were excluded in the tests.
"Total" referes to the total number of observations for each variable one would have had without coinciding with other releases at exactly the same time.

Table A4. Coinciding Releases of New Data, the United States 08:30 EST Announcements.

Macrovariable	CPI	GDP A	GDP P	GDP F	Trade Balance	Unemployment	**TOTAL**
CPI Inflation	74	0	0	0	0	0	74
GDP Growth Advanced	0	34	0	0	0	0	37
GDP Growth Preliminary	0	0	31	0	0	0	31
GDP Growth Final	0	0	0	32	0	0	32
Trade Balance	0	0	0	0	93	19	112
Unemployment Rate	0	0	0	0	19	73	92
Total	74	37	31	32	112	92	378

Notes:
Table reveals from horizontal headline with the left vertical row if the release of variables coincided during the sample period.
For instance: The release of the unemployment rate and the trade balance figures coincided 19 times during the sample period. These observations to both variables were excluded in the tests.
"Total" referes to the total number of observations for each variable one would have had without coinciding with other releases at exactly the same time.

White's Test of Heteroskedasticity

Table A5. Sweden and the United States

	Sweden		The United States	
	Reg. (1)	Reg. (2)	Reg. (1)	Reg. (2)
Macrovariable	**Prob.**	**Prob.**	**Prob.**	**Prob.**
CPI Inflation	0.0083**	0.2621	0.8949	0.6651
GDP Growth	0.0743*	0.1232	0.6447	0.3793
GDP Growth Prel.			0.7899	0.7313
GDP Growth Final			0.4618	0.2714
Industrial Production	0.8600	0.4903	0.4172	0.0269*
PMI Manufacturing	0.2548	0.0641	0.1267	0.0332*
Trade Balance	0.3366	0.9111	0.2231	0.9998
Unemployment Rate	0.3642	0.1511	0.5147	0.3068

Notes:
Reg (1) = Regression model (1).
Reg (2) = Regression model (2).
*Asterisk denotes: * $p < 0.05$, ** $p < 0.01$.*

Augmented Dickey-Fuller Test

Table A6. Sweden and the United States

	Sweden		The United States	
Macrovariable	**Level**	**First Differece**	**Level**	**First Differece**
CPI Inflation	-9.344**	-8.603**	-9.369**	-10.617**
GDP Growth	-6.984**	-6.963**	-2.152	8.611**
GDP Growth Prel.			-5.169**	-6.139**
GDP Growth Final			-6.169**	5.987**
Industrial Production	-13.361**	-9.528**	-12.066**	7.998**
PMI Manufacturing	-12.932**	8.974**	-11.140**	-8.888**
Trade Balance	-10.404**	-11.292**	-13.837**	-8.066**
Unemployment Rate	-13.293**	-8.214**	-9.028**	-7.783**

Notes:
*Asterisk denotes: * $p < 0.05$, ** $p < 0.01$.*