Bachelor Thesis

Finance

What is the influence of the FED and ECB announcements in recent years on the euro-dollar exchange rate and does the state of the economy affect this influence?

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1. Introduction

In currency markets there is a continuous flood of information and, in spite of intensive research, the movement of the exchange rate to these streams of information is still not fully understood (Jansen, de Haan, 2005). In this paper the focus will be on the euro-dollar exchange rate, and on the influence of announcements of the European Central Bank and the Federal Reserve on this exchange rate.

Before its introduction, the euro was expected to be a strong currency. There were even people who hoped that the euro would compete with the dollar as the most important international currency. However, after its introduction there were some unexpected problems. Short after introduction, the euro went into a period of strong depreciation which became a serious threat to price stability in the euro area. The ECB immediately reacted by intervening in the foreign exchange market. Besides real interventions the ECB also has been very active to support the euro verbally (Jansen, de Haan, 2005), efforts to deliberately talk up the currency have not been successful in general, but there is certainly a connection between the announcements of the ECB and the euro-dollar exchange rate, especially if these announcements are followed by actions.

Recently, the world was in a big economic crisis. This crisis started with a collapse of the housing market in the US. To pay the expenses, the Federal Reserve decided to press money under the name 'quantitative easing'. This led to a highly volatile foreign exchange market and a depreciation of the dollar. But because of the huge influence of the US on the world economy, the rest of the world also got in trouble, so shortly after this quantitative easing, certain countries in Europe also got money problems, which forced the ECB to take measurements, which in turn led to a depreciation of the euro. During these episodes of uncertainty, the volatility of the euro-dollar exchange rates was high. This paper will examine what the influence of the announcements of the ECB and FED is on the euro-dollar exchange rate, and whether the same kind of announcements cause the same reaction on the euro-dollar exchange rate in different states of the economy.

This paper has the following outline: There will be a theoretical outline of the most important macroeconomic variables influencing exchange rates. After that, the influence of announcements on the exchange rate will be discussed, using the literature. Then, an empirical research, testing the influence of announcements of the ECB and FED on the euro-dollar exchange rates will be performed. To conclude the paper the research question; 'What is the influence of the FED and ECB announcements in recent years on the euro-dollar exchange rate and does the state of the economy affect this influence?' will be answered.

2. Macroeconomic variables influencing exchange rates

Many theoretical models suggest that exchange rates are determined using macroeconomic variables such as foreign and domestic money supplies, real growth rates, interest rates, price levels, and balance of international payments (Biao, Inci, 2004). Although, empirical performance of these models has proven to be poor, it seems a good starting point, to make the theoretical connections between these factors and the exchange rate to get an insight into the theoretical links before performing the data analysis. Therefore, this paper will first give an outline of what the theoretical connection is between the most important macroeconomic variables and the exchange rate.

2.1 Purchasing power parity and the exchange rate

One of the most fundamental theories of exchange rate determination is the purchasing power parity condition. This condition stands on the basis of many other theories and relationships between macroeconomic variables and the exchange rate. In essence, the purchasing power parity is a theory of long-term equilibrium exchange rates based on relative price levels of two countries. Purchasing power parity is founded on the law of one price, which implies that in the absence of transaction costs, identical goods will have the same price in different markets.

Purchasing power parity can be used in four ways: As a basis for international comparison of income and expenditures, as an equilibrium condition, as an efficient arbitrage condition and as a theory of exchange rate determination. A theory of exchange rate determination seems the most relevant in this case. This theory implies a direction of causality between the equilibrium exchange rate and domestic and foreign prices (Zhenhui, 2003).

The theory has an absolute and a relative version. The relative version seems more relevant in this case and implies that the difference in the rate of change in prices at home and abroad, so the difference in inflation rates, is equal to the percentage depreciation or appreciation of the exchange rate. Exchange rate changes are induced by changes in relative price levels between two countries. This relationship holds because the quantities of the goods in the market baskets are fixed, therefore, the only way that the cost of the basket can change is when the goods' prices change. Since price level changes represent inflation rates, this means that differential inflation rates will induce exchange rate changes. Using this explanation an increase in European prices relative to change in US prices (more rapid inflation in Europe than in the US) will cause the dollar to appreciate and the Euro to depreciate.

2.2 Productivity growth, relative prices and the exchange rate

To extend the theory of purchasing power parity, the productivity differential theory proposed by Balassa and Samuelson will be used. This theory extends the purchasing power parity theory by making a distinction between the traded and the non-traded sector. The theory asserts that higher productivity growth in the traded goods sector compared to the non-traded sector leads to increases in the relative price of non-traded goods and an appreciation of the real exchange rate (Strauss, 1997). This theory incorporates the fact that in real economies, there are many goods, which cannot be traded across borders. Therefore, the exchange rate will react to the effects of differences in the relative prices of tradable and non-tradable goods (Chong, Yordá, Taylor, 2010).

2.3 Interest rates and the exchange rate

One of the most important factors influencing the exchange rate, is the interest rate. The interest rates and exchange rates discussed are the real interest rate and the real exchange rate. Using a theoretical approach, a solid theory to start with, to relate interest rates and exchange rates, is the international fisher effect, also known as the Uncovered Interest Parity, which uses the general fisher hypothesis as a starting point. This hypothesis suggests that the real interest rate in an economy is independent of monetary variables. The international fisher effect implies that the difference in the nominal interest rate between two countries determines the movement of the nominal exchange rate between their currencies with the value of the currency of the country with the lower nominal interest rate increasing. If we add to this the assumption that real interest rates are equated across countries, then the country with the lower nominal interest rate would also have a lower rate of inflation and hence the real value of its currency would be raised over time. So, when the interest rate in the US is lower than in Europe, the international fisher effect predicts that the exchange rate of the dollar will appreciate and the other way around. However, studies, which have attempted to uncover evidence of an equilibrium based on such an approach, provided mixed results (Byrne, Nagayasu, 2010).

2.4 The foreign and domestic money supplies and the exchange rate

To relate the money supply with the exchange rate, there has to be made a connection between the money supply and the interest rate first. The money supply as such, doesn't influence the interest rate, and therefore the exchange rate, but there is proof for high correlation between sudden changes in the money supply and the interest rate. There are two hypothesis offered to explain this high correlation. The first hypothesis predicts that an unexpected increase in the money supply leads agents to expect the FED to respond by tightening in order to prevent the money stock from growing faster than planned. This anticipation will lead to higher real interest rates because agents bid aggressively for funds in the spot market. According to Urich and Wachtel (1984), this hypothesis is called the 'policy anticipation hypothesis'. The second interpretation, which can be called 'monetarist', predicts that, in response to an unexpected increase in the money supply, agents are viewed as revising upward their estimates of the expected rate of inflation, therefore the inflation premium build into the real interest rate is

adjusted. The presumption is that the impact on the real rate is small compared to the change in the inflation premium. Both interpretations predict the same response, namely that a sudden increase in the money supply will cause the interest rate to rise and the other way around, but they use data from different markets (Cornell, 1982). When the connection between the money supply and interest rate is made, the relationship between the interest rate and exchange rate can be used to determine the effect on the exchange rate.

2.5 The balance of payments and the exchange rate

To create a linkage between the balance of payments and the exchange rate, the portfolio-balance model can be used. According to the portfolio-balance model, the relative quantities of the various assets and of the rate of accumulation of these assets have first order effects on the exchange rate. Implementation of this model is difficult because of limited availability of data on the various quantities of the assets that would be relevant to include in the portfolio-balance model. However, since the rate of accumulation of assets equals the current account of the balance of payments, the model provides a dynamic linkage between the balance of payments and the exchange rate (Frenkel, Mussa, 1984).

This theory is a little obsolete, but it is on the basis of the relationship between the balance of payments and the exchange rate. However, recently, economists move away from this fundamental theory and tend to move towards optimization theories to determine the movements of the exchange rate. According to optimization models, exchange rate changes are due to shifts in technology and tastes. These factors are difficult to determine for economist, therefore, conclusions of these types of research usually are that the exchange rate could as easily move up as down (Frankel, 1983).

To summarize, the theories discussed in this chapter are the most fundamental theories to create linkages between different macroeconomic variables and the exchange rate. They do not explain the complicated exchange rate dynamics of recent years completely. However, it is important to have a fundamental understanding of the most important theories underlying exchange rate dynamics, to be able to explain the complicated relationship between the euro-dollar exchange rate and different macroeconomic variables. Therefore, this summary is a good starting point to make a connection between macroeconomic variables and the euro-dollar exchange rate.

3. The influence of announcements on the exchange rate

To examine the influence of announcements of the ECB and the Federal Reserve on the exchange rate, the news approach will be used. The news approach states that if currency markets are efficient, only unexpected information (news) has an influence on the exchange rate (Jansen, de Haan, 2005). A split has to be made between comments of the European Central Bank (ECB) and the Federal Reserve (FED) and whether these announcements have a long-run or a short-run effect. In this paper, the focus will be on the short-run effect of news on the exchange rate. The exchange rate is a variable, which reacts extremely fast on important announcements, therefore, the data used to examine the influence, will be daily.

Firstly, the distinction between comments of the ECB and the Federal Reserve will be examined. According to Ehrmann and Fratzscher (2005) news about the US economy has a larger impact on exchange rates than news from the euro area. This is mainly because of the relatively greater importance of the US economy, but it is also explained by the fact that US announcements are usually released earlier than comparable euro area announcements. This gives US announcements higher news content (Ehrmann, Fratzscher, 2005).

In chapter two there is a detailed outline of the macroeconomic variables influencing the exchange rate, but there are only certain factors on which the ECB and Federal Reserve have an influence. The focus in this paper will be on the only factor, which the ECB and the FED directly influence, which is the interest rate. It is by far the most important monetary policy instrument used by the central banks to pursue their most important goal: maintaining price stability. Maintaining stable prices on a sustained basis is a crucial pre-condition for increasing economic welfare and the growth potential of an economy. One benefit of maintained price stability is an improved transparency of the price mechanism, because when prices are stable people can recognize changes in relative prices, without being confused by changes in the overall price level. This allows them to make well-informed consumption and investment decisions. Another advantage is that stable prices reduce the inflation risk premium in interest rates. Stable prices also avoid unproductive activities to hedge against the negative impact of inflation or deflation. On top of that, stable prices reduce distortions of inflation or deflation, which can exacerbate the distortionary impact on economic behavior and social security systems and stable prices prevent an arbitrary redistribution of wealth and income as a result of unexpected inflation or deflation. The quantitative goal of the FED and ECB is that prices should not grow more than 2% over 1 year and that inflation rates should be below, but close to, 2% over the medium term.

How can a statement suggesting an interest rate change affect the exchange rate? There are a few reasons why a statement suggesting, for example, higher interest rates may affect the exchange rate. These reasons affect the exchange rate via three possible channels: an investor channel, an inflation channel and a growth channel. According to the investor channel, higher interest rates make buying European securities more attractive, which will induce demand for the Euro. The

inflation channel works through prices. If a central bank raises the interest rate, this will put downward pressure on inflation, assuming that PPP holds, this will lead to an appreciation of the euro. The growth channel is the only channel, which predicts a negative relationship between statements on a higher interest rate and the exchange rate, because higher interest rates hinder investments, and thus hinder growth, and this will lead to a weaker currency. In the case of interest rates, there is also evidence of an asymmetric response, because comments indicating an interest rate rise cause the exchange rate to move while comments indicating lower interest rates do not (Jansen, de Haan, 2005).

In the empirical part of this paper there will be examined whether the state of the economy also influences the reaction and movement of the exchange rate. In this paper, the focus will be on the economic crisis in recent years as a certain state of the economy. There is already evidence suggesting that the effects of news on exchange rate are asymmetric in that they depend on market conditions. More precisely, when there is a high degree of market uncertainty, and previous news did not provide a clear signal about the direction of the economy, news releases have a particularly large effect on exchange rates. Exchange rates also tend to react more strongly to news when previous exchange rate volatility has been high (Ehrmann, Fretzscher, 2005).

4. Data

As mentioned before, the empirical research will focus on the relationship between announcements of the FED and ECB regarding the interest rate and the magnitude of these announcements. Therefore, the dataset used will be structured as follows; Date, exchange rate, dummy ECB (announcement (1); no announcement (0)), value interest rate ECB, dummy FED (announcement (1); no announcement (0)), value interest rate FED. The collected data is daily data from the last 10 years. The dataset contains data from 19/4/2001 - 19/4/2011. The exchange rate used, is the euro-dollar exchange rate, which means ... $ / 1 €.

4.1 Summary Statistics

To summarize the data, an outline of a couple of important summary statistics about the dataset is given below:

Summary Statistics: Exchange Rate

	N	Minimum	Maximum	Mean	Std. Deviation
euro dollar exchange rate	2609	,83850	1,59985	1,2421858	,18113266
Valid N (listwise)	2609				

Summary Statistics: Value Interest Rate ECB

	N	Minimum	Maximum	Mean	Std. Deviation
Interest rate ECB	2609	,25	3,75	1,6089	1,03592
Valid N (listwise)	2609				

Summary Statistics: Value Interest Rate FED

	N	Minimum	Maximum	Mean	Std. Deviation
Interest rate FED	2609	,25	5,25	2,2482	1,72768
Valid N (listwise)	2609				

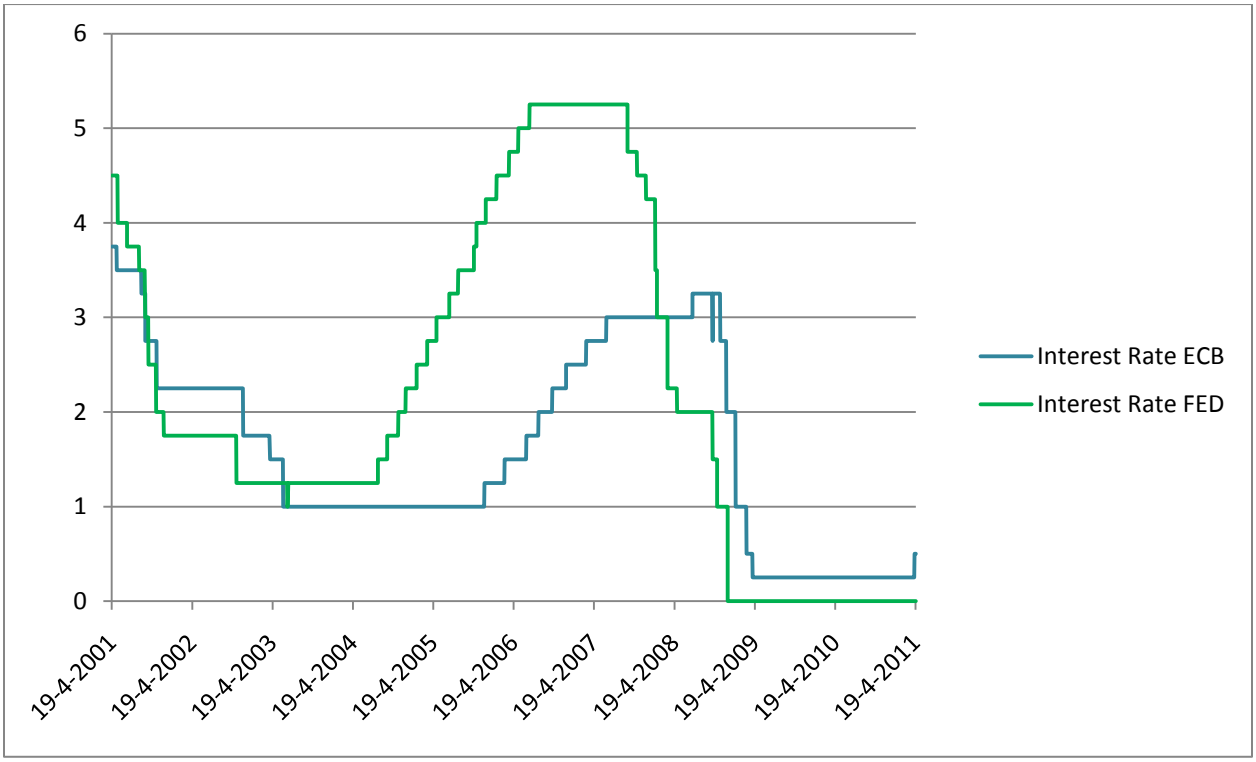
So, the dataset used contains 2609 days of data, the lowest exchange rate in the period from 19/4/2001 - 19/4/2011 was 0,83850 Euro per Dollar and the highest exchange rate was 1, 59985. The mean of the exchange rate in this period was 1,2421858 with a standard deviation of 0,18113266.

The lowest interest rate for the FED and ECB in this period was 0,25, and the highest interest rate for the ECB was 3,75, and for the FED 5,25. The means of the interest rates are respectively 1,6089 and 2,2482 with standard deviations of 1,03592 and 1,72768, which shows that the interest rate of the FED is higher in general, but also has higher deviations.

4.2 Graphs

To obtain a fast and easy insight in the dataset, graphs will be used. Graphs are an easy and intuitive way to show relationships between variables and visualization helps to give a clear overview of the dataset used.

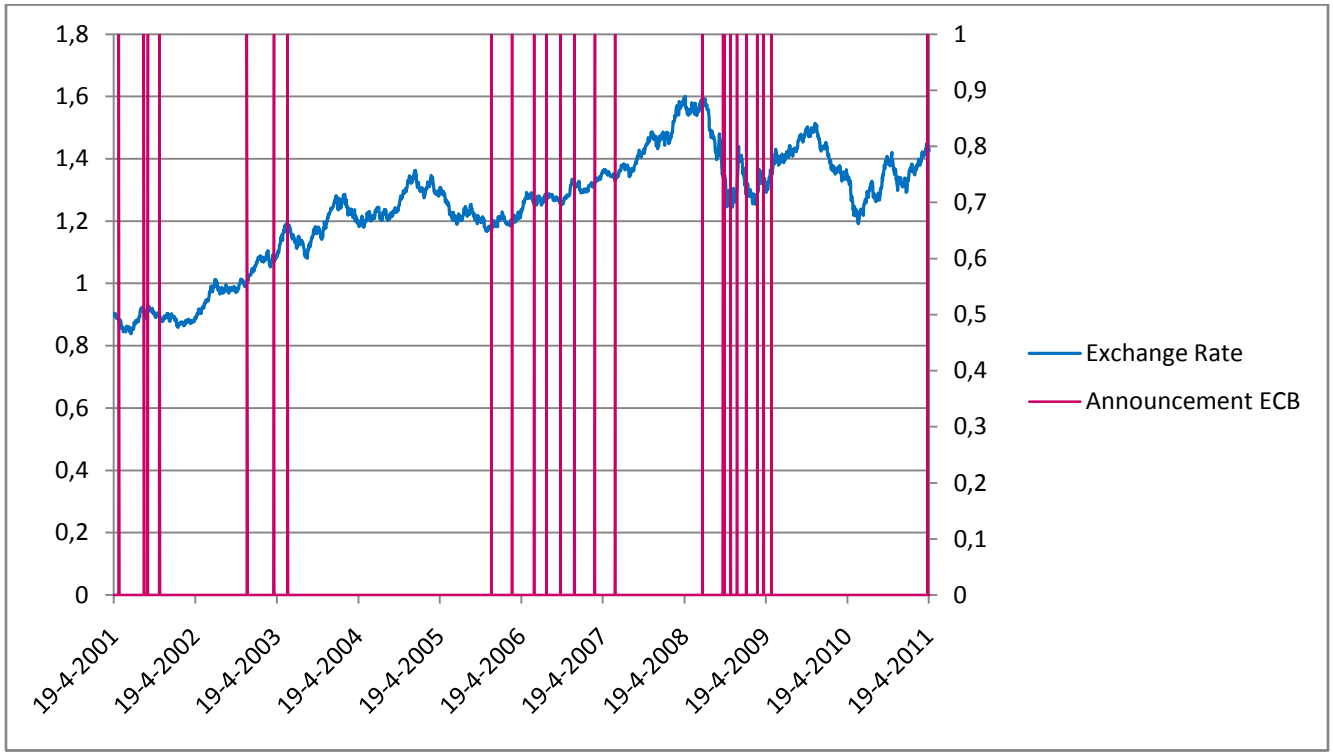
The first graph will show the movements of the interest rate during the 10 years of the analysis from the ECB and the FED:



The most important conclusion that can be drawn out of this graph is that the FED is deciding in what direction the interest rate is going to move and that the ECB reacts on these changes later,

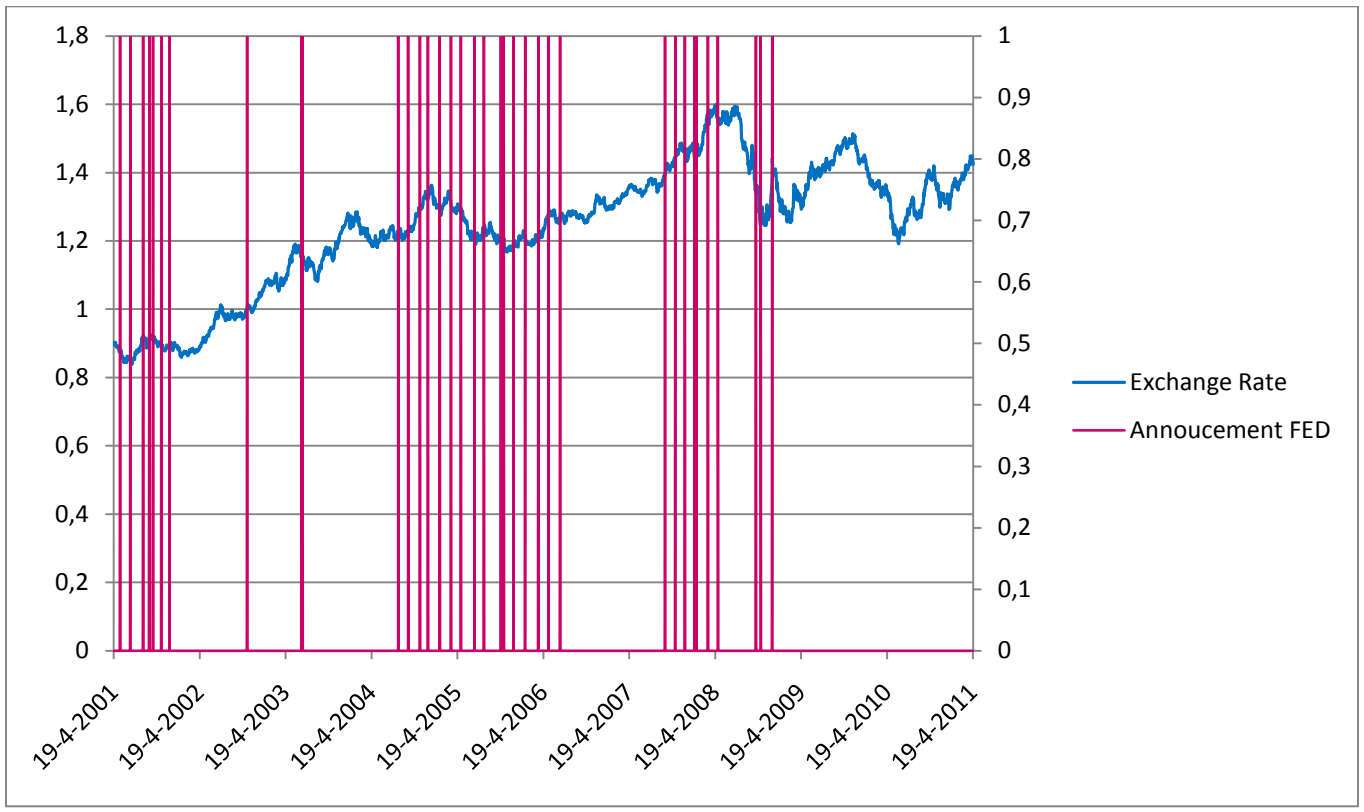
by announcing a comparable change. However, the magnitude of the changes of the ECB usually is a little smaller than the magnitude of the changes of the FED. The fact that the FED is the most important decider of the interest rate is important because this creates the expectation that the announcements of the FED regarding interest rates are more relevant, because usually the ECB reacts on this announcement by announcing a comparable change.

The second graph will combine the exchange rate and the dummy variable of announcements of the ECB (0 = no announcement; 1 = announcement):



In this graph the straight lines show the moments of the announcements of the ECB and the other line shows the exchange rate. This graph shows that there seems to be a reaction of the exchange rate after an announcement of the ECB. However, it is hard to see very clearly because the data is daily and the reaction is expected to be shortly after the announcement, this is hard to see in a graph covering 10 years of daily data. The graph does give a clear overview of the moments of the announcement of the ECB regarding interest rates and the movement of the exchange rate in-between these announcements.

This same kind of graph can be drawn for announcements of the FED regarding interest rates and the exchange rate.



This graph also shows that there seems to be a reaction of the exchange rate after an announcement of the FED, but also in this graph it is hard to see because the graph is covering 10 years of daily data.

When comparing these two graphs, it becomes clear that the announcements of the FED and ECB regarding interest rates are usually around the same time. In the beginning of the investigated period, in 2001 and 2002, there were a lot of announcements. After that a period of almost no announcement follows, but in 2005 and 2006, there are again a lot of announcements. Again a period of almost no announcements follows, but in 2008 and 2009 there are a lot of announcements. Recently, there have not been a lot of announcements. In general, the FED makes more announcements than the ECB, which indicates that the FED changes the interest rate more often.

4.3 Intuitive explanation

The empirical research will be performed because there is an expected relationship between announcements of the FED an ECB regarding interest rates and the exchange rate, or in other words, the expectation is that the exchange rate will react on announcements of the FED and ECB regarding the interest rate. However, there is uncertainty about the moment the exchange rate will react to these announcements. There are a couple of possibilities, including: 2 or more days before the announcement, one day before the announcement, on the day of the announcement, the day after the announcement, or 2 or more days after the announcement. Therefore, research will also have to show when the strongest reaction takes place. The expectation is that there is also a difference between announcements of the FED, and announcements of the ECB and their relative importance and influence on the exchange rate. The expectation after the theoretical part of the research is that the announcements of the FED are relatively more important and will have a stronger effect on the exchange rate than announcements of the ECB.

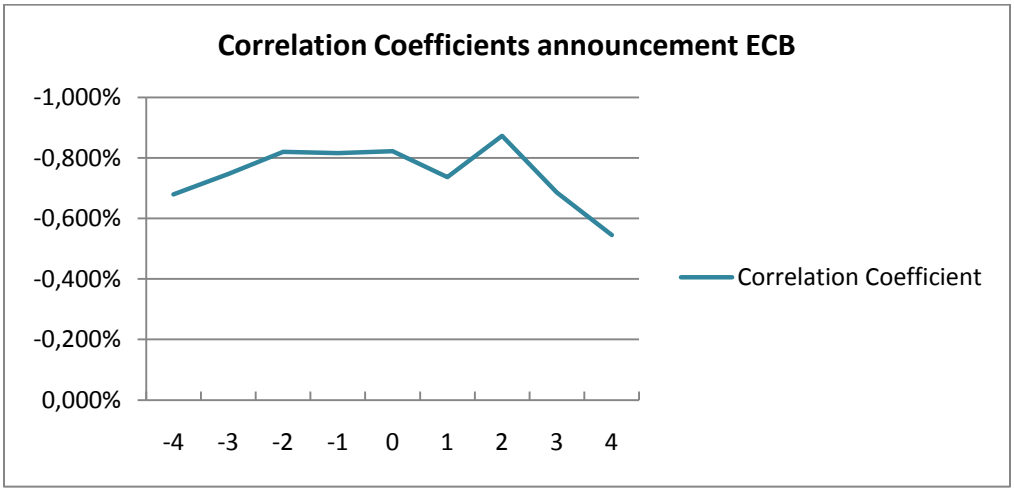
Another part of the research is to investigate, whether there is a difference in the reaction of a change in the interest rate on the exchange rate in different states of the economy. To research this part, the recent crisis will be used as an episode of economic uncertainty, and the years before the crisis will be used as an episode of economic stability/growth. The expectation is that in episodes of economic uncertainty the announcements of the ECB and FED regarding a change in the interest rate will have a bigger effect on the exchange rate, but it is hard to say, because there has not been much research done yet on this relationship during the recent financial crisis.

4.4 Correlation

One of the easiest and fastest ways to show whether there is a (strong) relationship between variables is by using Pearson's correlation coefficients. The correlation coefficients will show whether there is correlation between a change in the interest rate and the exchange rate, 2 or more days before the announcement, one day before the announcement, on the day of the announcement, one day after the announcement and 2 or more days after the announcement. The relationship examined will be the one between the dummy variable (0 = no announcement, 1 = announcement) and the exchange rate.

Firstly, the announcements of the ECB will be examined:

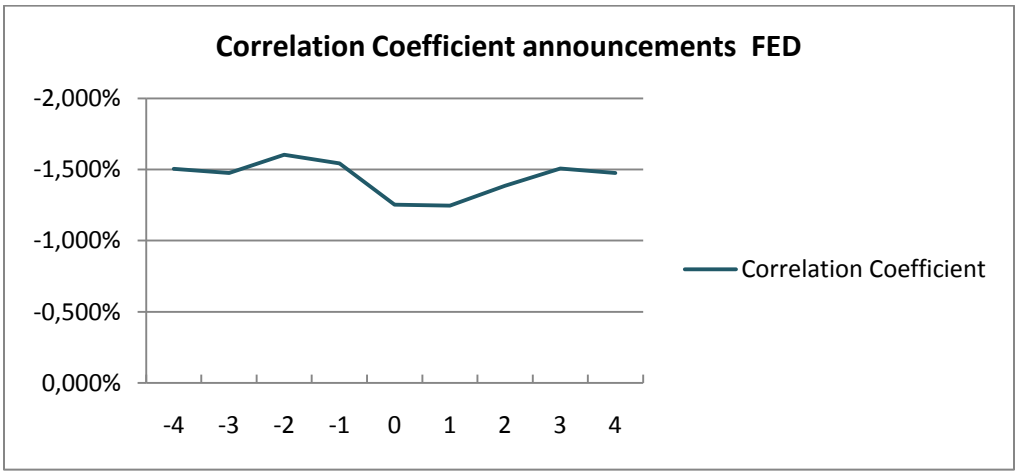
days around announcements ECB	Correlation Coefficient
-4	-0,679%
-3	-0,747%
-2	-0,819%
-1	-0,816%
0	-0,822%
1	-0,736%
2	-0,873%
3	-0,685%
4	-0,545%



This table and graph prove that the relationship between announcements and the exchange rate several days before, on and after the announcement is insignificant (r = -0,008725767, sample size=2609 gives p= 0.656). The highest correlation coefficient is 2 days after the announcement, but because the correlation coefficients are insignificant this is not very strong proof for this relationship. These results do show that apparently the moment of an announcement with value 1 is negatively correlated with the exchange rate, which indicates that usually after an announcement the euro-dollar exchange rate will decrease, but again this evidence is not very strong because of the insignificance of the coefficients. The graph does not show a clear pattern of on which days around the announcement correlation is the highest.

Next, the announcements of the FED will be examined:

Days around announcement FED	Correlation Coefficient
-4	-1,504%
-3	-1,476%
-2	-1,603%
-1	-1,544%
0	-1,254%
1	-1,247%
2	-1,386%
3	-1,507%
4	-1,475%



This table and graph prove that the correlation between announcements of the FED and the exchange rate is about two times stronger than the correlation between announcements of the ECB and the exchange rate. But again, the relationship is insignificant ($r = -1{,}603\%$, $n = 2609$, $p = 0.4131$), so this is not very strong proof. The highest correlation coefficient is 2 days before the announcement, which may indicate more speculation when the announcements are from the FED than when they are from the ECB. And the correlation coefficients are, as well as by the ECB negative, which indicates a decrease of the euro-dollar exchange rate around the time of an announcement. Again there is not a very clear pattern of on which days around the announcement the correlation is the highest and if it decreases around this point. The next step is to perform some regression analyses, to get a clear insight in the exact effect.

5. Regression

To perform a regression analysis it is very important to import the right variables into the model to make sure the results are meaningful. The variable that has the biggest influence on the exchange rate this day is, of course, the exchange rate of the previous day. The exchange rate does not change suddenly from 0.5 to, for example, 1.5. Therefore, the exchange rate today is very dependent on the exchange rate the previous day. So, my dependent variable the exchange rate today (exchange rate t) should be connected to the first independent variable, the exchange rate the previous day (exchange rate t-1). After that, the research variable can be implemented into the model. Because the goal is not only to investigate the reaction on an announcement, but also on the direction and magnitude of the announcement, the input will be the change in the interest rate on the day of an announcement. In this way the direction and magnitude of the change in the interest rate, is taken into account. This means that the value on the day of an announcement will not be 1, like the dummy variable, but it will be the change in the interest rate, so for example -0.25 (for a 0.25& decrease in the interest rate). The final equation becomes:

Exchange rate (t) = α + β1 x exchange rate (t-1) + β2 x change in interest rate (t-1) + Ut (error term)

When this equation is inputted in a statistical program, using the entire dataset, and using the change in interest rate for the ECB, these are the results:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00825194

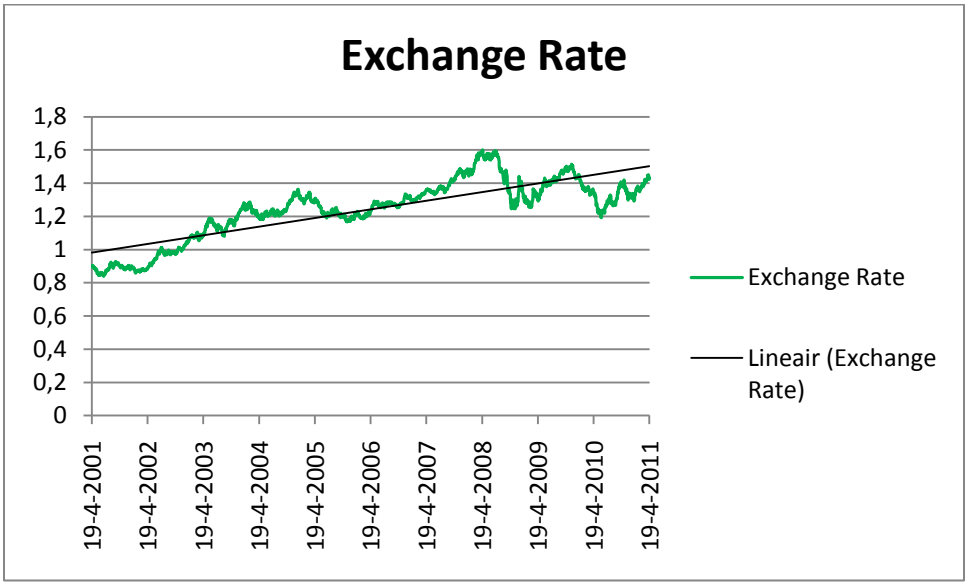
Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,755	,079
	Euro-Dollar exchange rate	,999	,001	,999	1118,333	,000
	Change in interest rate ECB	-,011	,004	-,002	-2,709	,007

Out of these results, the following equation can be obtained:

Exchange rate (t) = 0.002 + 0.999 x exchange rate (t-1) - 0.011 x change in interest rate ECB (t-1) + Ut (error term)

The R-square of this result is 0.998, which indicates a very reliable result. Because, the closer R-square is to 1, the more the equation is capable of predicting the right result. However, this R-square is mainly because of the β1 variable of the exchange rate of the previous day, so it is not representative for the research variable β2, showing the change in the interest rate. This equation shows a very big dependence of the exchange rate today, on the exchange rate the previous day. 0.999 (very close to 1) of the exchange rate the previous day explains the exchange rate today. This fact combined with the standard error of 0.001 gives an explosive relationship. This would mean that in the investigated period there must have been a kind of trend in the development of the exchange rate. By drawing a graph, it becomes clear whether this is the case:



In this graph it becomes clear that, apparently, in the investigated period the trend of the development of the exchange rate was an increasing linear trend. This declares why the β1 is very close to 1, with a very small standard error.

The next term is the investigated term. The results show that the change in the interest rate on the day of the announcement has a negative impact on the exchange rate the next day. This means that there are less Dollars necessary to buy 1 Euro. So, when the interest rate increases by 1% there are -0.011 or 1.1 dollar cents less necessary to buy 1 Euro, which denotes a weaker Euro. This conclusion is in line with the growth channel theory discussed in chapter 3. This theory suggests that higher interest rates hinder investments, and therefore hinder growth and this will

lead to a weaker currency. The standard error of this β2 is 0.004 which denotes a significant result. Because -0.011 +/- 2 x 0.004 (β2 +/- 2 x std. error) is different from zero, which means that there is a significant effect of the change in the interest rate on the exchange rate.

Next the same analysis will be performed for the change in the interest rate of the FED:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00826281

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,861	,063
	Euro-Dollar exchange rate	,998	,001	,999	1117,550	,000
	Change in interest rate FED	-,002	,004	,000	-,688	,491

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.002 + 0.998 x exchange rate (t-1) - 0.002 x change in interest rate FED (t-1) + Ut (error term)

The R-square of this result is again 0.998, but this is again mainly because of the high dependence of the exchange rate today on the exchange rate the previous day. So, this number is not very informative. The equation has more or less the same constant, very small, insignificant term of 0.002 and has more or less the same dependence of the exchange rate today on the exchange rate the previous day. The only big difference lies in the investigated term. The results show again a negative relationship of the exchange rate today on the announcement of the change in the interest rate the previous day, but this beta is much smaller (about 6 times) then the beta of the change in interest rate of the ECB. The beta is that small, that it is not significant, because of the same standard error of 0.004 (0.002 +/- 0.004 is touching 0, so this beta is not significant).

So far, the assumption was that the effect of a change in the interest rate on the exchange rate is noticeable at the closing exchange rate of the next day. But maybe the change in interest rate has a quicker effect, so an effect on the closing exchange rate of the same day. Using this assumption. The new equation becomes:

Exchange rate (t) = α + β1 x exchange rate (t-1) + β2 x change in interest rate (t) + Ut (error term)

Performing this regression for the ECB gives the following outcomes:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00826106

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,812	,070
	Euro-Dollar exchange rate	,999	,001	,999	1116,993	,000
	Change in interest rate ECB	-,005	,004	-,001	-1,257	,209

The equation becomes:

Exchange rate (t) = α + 0.999 x exchange rate (t-1) - 0.005 x change in interest rate ECB (t) + Ut (error term)

This result shows that for the ECB the change in interest rate has a bigger impact on the closing exchange rate of the next day, than on the day of the announcement itself. The impact it has on the day of the announcement itself is insignificant (-0.005 +/- 2 x 0.004 is touching zero). So, there is no significant relationship between the change in the interest rate and the exchange rate that same day for the ECB. The rest of the results are more or less the same (the constant, the β1) than the results of the other performed regressions.

The next step is to perform the same regression analysis for the FED:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00824779

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,833	,067
	Euro-Dollar exchange rate	,998	,001	,999	1119,587	,000
	Change in interest rate FED	-,011	,004	-,003	-3,158	,002

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.002 + 0.998 x exchange rate (t-1) - 0.011 x change in interest rate FED (t) + Ut (error term)

This result shows that the effect of a change in the interest rate for the FED is bigger on the day of the announcement itself, than on the day after the announcement. The effect of a change in the interest rate on the exchange rate, the day after the announcement of the FED was insignificant. However, the effect of a change in the interest rate on the exchange rate of the same day is significant (-0.011 +/- 2 x 0.004 is different from zero). An announcement about a change in the interest rate of the FED has a direct effect on the exchange rate the same day, and it has no significant effect the day after the announcement. The effect means that when the FED increases the interest rate by 1% the euro-dollar exchange rate will decrease by -.0.011 or 1.1 dollar cents. So, you need 1.1 dollar cents less to buy one Euro. This means a weaker Euro and a stronger Dollar. This result is surprising because you would expect a comparable relation as with the announcements of the ECB, so a negative relationship between an increase in the interest rate of the FED and the strength of the Dollar. But this result implies that when the FED increases the interest rate, the Dollar gains strength. This result is in accordance with the investor channel and inflation channel of the theory discussed in chapter 3. These theories give two different explanations for this result. According to the investor channel, higher interest rates make buying

US securities more attractive, which will induce demand for the Dollar. The inflation channel works through prices. If the FED raises the interest rate this will put downward pressure on inflation, assuming that PPP holds, this will lead to an appreciation of the Dollar.

To summarize, the announcements of the FED about a change in the interest rate have an immediate, significant effect on the exchange rate, and this effect is positive, so an increase in the interest of the FED leads to a stronger Dollar, while the announcements of the ECB do not have an immediate effect, but a significant effect the day after the announcement, and this effect is negative, so an increase in the interest rate of the ECB leads to a weaker Euro.

The next step is to perform a regression analysis to investigate an important part of my research question, namely whether there is a difference in influence, in different states of the economy. As mentioned before, the focus will be on the crisis the last couple of years and this crisis will be compared to the investigated years before the crisis. The crisis started in 2007, so the dataset will be divided into two parts, namely:

19/4/2001 - 19/12/2006 and 01/01/2007 - 19/4/2010

Again the same kind of regression analysis will be performed. The regression will only be performed for the significant results, which is for the ECB the day after the announcement of a change in the interest rate. Starting with the ECB, and the first period (so the period before the crisis), this obtains the following results:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00681099

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,242	,215
	Euro-Dollar exchange rate	,999	,001	,999	847,786	,000
	Change in interest rate ECB	-,004	,005	,000	-,734	,463

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.002 + 0.999 x exchange rate (t-1) - 0.004 x change in interest rate ECB (t-1) + Ut (error term)

These results show again the same constant and same dependence of the exchange rate today on the exchange rate the previous day. The results also show the same R-square which is not very meaningful, because the R-square is mainly this high because of the β1 and not because of the investigated variable. The influence of the change in the interest rate on the day of the announcement of the ECB has still a negative, but smaller impact on the exchange rate the next day. The beta of the investigated variable is -0.004 with a standard error of 0.005 which is an insignificant result (-0.004 +/- 2 x 0.005 is touching zero). Therefore, the conclusion out of these results is that before the crisis the change in interest rate on the day of an announcement of the ECB has no significant effect on the exchange rate the next day.

The next step is to perform the same analysis for the last couple of years (the crisis), this analysis has the following results:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,994[a]	,988	,988	,00984164

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,008	,005		1,785	,075
	Euro-Dollar exchange rate	,994	,003	,994	298,584	,000
	Change in interest rate ECB	-,014	,006	-,008	-2,359	,018

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.008 + 0.994 x exchange rate (t-1) - 0.014 x change in interest rate ECB (t-1) + Ut (error term)

This equation is a little different than the rest of the equations. Firstly, the constant is a little bigger, namely 0.008 instead of 0.002. But this new constant is still insignificant (0.008 +/- 2 x 0.005 is touching zero), which means that it should not be taken into account. The influence of the exchange rate the previous day on the exchange rate today is a little bit smaller, but still very high and significant. The R-square is again very close to 1 which is again because of the β1 and is not very informative. The investigated term has a beta of -0.014, which is the biggest beta so far. It means that when the interest rate of the ECB increases by 1, the euro-dollar exchange rate will decrease by 1.4 dollar cents, which means, you need 1.4 dollar cents less to buy 1 Euro. So, this weakens the Euro. The beta is also significant (-0.014 +/- 2 x 0.006 is different from zero). Usually the change in the interest rate is a little smaller (0.75, 0.5 or 0.25) but the effect will still be mentionable and significant.

Out of these results, the conclusion can be drawn that during the crisis of the last couple of years, an announcement of the ECB regarding a change in the interest rate has a significant effect on the exchange rate the next day, while it has no significant effect on the exchange rate the years before the crisis. This indicates that in episodes of economic uncertainty an announcement about a change in the interest rate of the ECB is of more importance than when the economy is growing.

The same analysis can be performed for the FED announcements:

Starting with the period before the crisis:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,999[a]	,998	,998	,00681196

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,002	,001		1,253	,210
	Euro-Dollar exchange rate	,999	,001	,999	843,492	,000
	Change in interest rate FED	-,001	,004	,000	-,346	,729

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.002 + 0.999 x exchange rate (t-1) - 0.001 x change in interest rate FED (t) + Ut (error term)

This result shows that, the same as for the ECB, the announcements of the FED about a change in the interest rate before the crisis do not have a significant effect on the exchange rate (-0.001 +/- 2 x 0.004 is touching 0). Considering the fact, that this was the case for the ECB this result was expected. Apparently these kinds of announcements only have an effect on the exchange rate when the economy is in an episode of economic uncertainty.

Next the analysis for the FED during the crisis:

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,994[a]	,988	,988	,00981321

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	,010	,005		2,073	,038
	Euro-Dollar exchange rate	,993	,003	,993	299,492	,000
	Change in interest rate FED	-,020	,006	-,012	-3,476	,001

Out of these results the following equation can be obtained:

Exchange rate (t) = 0.010 + 0.993 x exchange rate (t-1) - 0.020 x change in interest rate FED (t) + Ut (error term)

This result shows that indeed, also for the FED, the effect of an announcement about a change in the interest rate has a significant effect on the exchange rate (-0.020 +/- 2 x 0.006 is different from zero). It is even the biggest beta so far, which means that apparently, during a crisis, an announcement of the FED about a change in the interest rate has the biggest effect on the closing exchange rate of that same day. This effect is bigger than the effect of an announcement of the ECB about a change in the interest rate on the closing exchange rate the next day. This effect means that when the FED increases the interest rate by 1%, the euro-dollar exchange rate will decrease by -.0.020 or 2 dollar cents. So, you need 2 dollar cents less to buy one Euro, so it means a weaker Euro and a stronger Dollar. This result is in accordance with the result of the general analysis of the announcements of the FED about a change in the interest rate and the exchange rate. The constant in this analysis is again a little bigger, but still insignificant, which means it should not be taken into account. And the dependence of the exchange rate today on the exchange rate the previous day is a little smaller than at the other analyses, but still very big and significant.

6. Conclusion

To conclude this paper, the research question: ' What is the influence of the FED and ECB announcements in recent years on the euro-dollar exchange rate and does the state of the economy affect this influence?' should be answered. In chapter 2 of this paper, there has been discussed several theories to relate macroeconomic theories about macroeconomic variables to the exchange rate. The focus was on the euro-dollar exchange rate but most theories can be applied to other exchange rates. Because the focus in this paper is on announcements of the ECB and the FED, the focus in chapter 3 was on what kind of influence announcements of the ECB and the FED can have on the exchange rates. The conclusion was that there is only one variable which the ECB and the FED directly influence, which is the interest rate. Therefore, the empirical research would be about how announcements about a change in the interest rate of the FED and ECB will influence the exchange rate.

By drawing graphs, calculating correlation coefficients and performing regression analyses, this empirical research led to interesting conclusions. The focus in this research was on the last 10 years, and was divided into two parts: during the crisis, and before the crisis. This division was to investigate whether the state of the economy has an influence on the effect of the change in the interest rate on the euro-dollar exchange rate. The first noticeable conclusion was drawn very simple by plotting the announcements of the FED and ECB together. It became clear that the FED is usually announcing a change in interest rate a couple of days before the ECB decides on more or less a same change in the interest rate. The two interest rates tend to move very strongly together, and the ECB is following the announcements of the FED. However the FED generally has a bit higher interest rates than the ECB. The calculated correlation coefficients were not very informative, because they did not show a significant correlation between the announcements about a change in the interest rate and the exchange rate. The only useful information was that there apparently is negative correlation between announcements and the exchange rate.

The next step was performing regression analyses. The first conclusion was that there is a significant relationship between an announcement of the ECB about a change in the interest rate and the closing euro-dollar exchange rate the next day. This relationship was negative, which indicated that a rise in the interest rate of the ECB would lead to a weaker Euro. Apparently, an announcement of the ECB needs some time to have an effect on the exchange rate. An announcement of the FED, already has a significant effect on the closing exchange rate of that same day. This relationship is positive, which means that a rise in the interest rate of the FED will lead to a stronger Dollar. It is surprising that the announcements have different effects on the exchange rate, but both relationships can be explained using common theories. Apparently, announcements of the ECB have an effect using the growth approach, which suggests that higher interest rates, hinder investments, and therefore hinder growth which leads to a weaker currency. Announcements of the FED have an effect using the investor and inflation channel. The investor

channel suggests that higher interest rates make buying US securities more attractive, which will induce demand for the Dollar. The inflation channel works through prices and suggests that, if a central bank raises the interest rate this will put downward pressure on inflation, and assuming that PPP holds, this will lead to an appreciation of the Euro.

As expected, a very important conclusion out of these results is that the US is the leading economy. The US economy has a big influence on the change in the interest rate of Europe and probably also on the changes in interest rates in the rest of the world. The euro-dollar exchange rate reacts very quickly to a change in the interest rate of the FED, which indicates a lot of immediate action when the FED announces a change. The ECB also has influence, but is dependent on the decisions of the FED, and the reaction of the announcement on the exchange rate is slower, which indicates less immediate action when the ECB announces a change.

The next part to investigate was whether there was a difference in influence in different states of the economy. Therefore, the data was split into two parts, the period before the crisis (2001-2006) and the period during the crisis (2007-now). The findings showed that there was a very clear difference between these two episodes. Both for the FED and the ECB, the announcements about a change in the interest rate only had a significant effect on the exchange rate during the crisis and not before the crisis. Therefore, there can be concluded that when the economy is in an episode of economic uncertainty a change in interest rate is picked up by people as an important signal, and therefore the exchange rate reacts to this change. While, when the economy is in an episode of economic growth or stability a change in the interest rate is perceived as not very important and the exchange rate does not react significantly to this change.

So, during episodes of economic uncertainty the FED and ECB have an important instrument that they can use to influence and 'steer' the exchange rate in a certain direction. The FED can influence the exchange rate quicker and a little more than the ECB, but the ECB can also have a significant effect. In episodes of economic growth or stability the FED and ECB cannot use this instrument in a useful way, so they are more dependent on other factors and decisions which influence the exchange rate.

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