The short term behaviour of exchange rates:

A middle ground approach

Georgios Katechos

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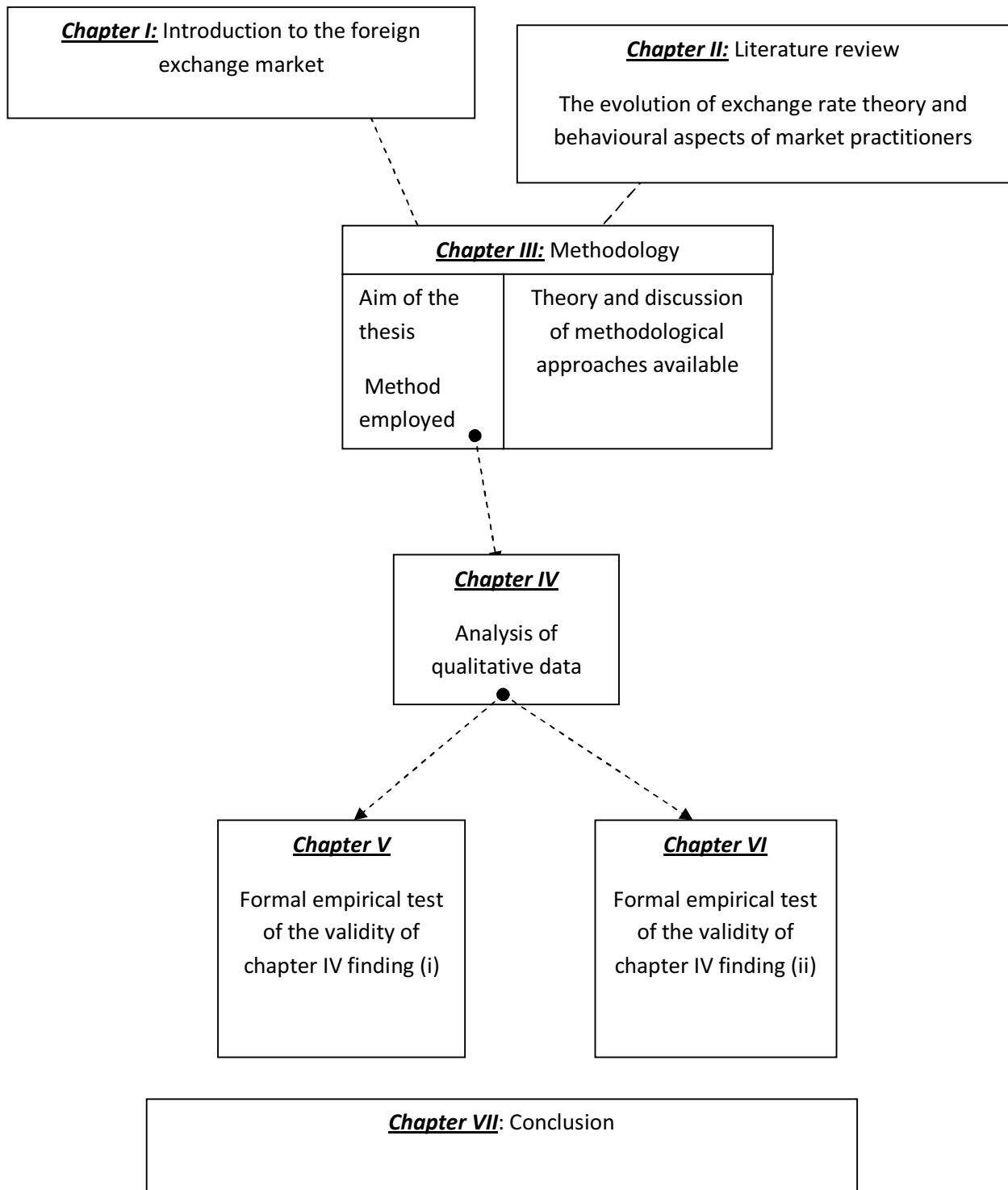
Chapter VII: Conclusion

Abstract

The understanding of the mechanism determining exchange rates is still an unsolved puzzle in the field of international economics. In the search for the underlying causes of the failure of existing approaches to explain a large proportion of short term exchange rate movements, our review of methodology literature revealed that a significant number of scholars consider the methodological approach employed by mainstream economics as a main cause for the disappointing result of established approaches. In particular, the excessive use of formal modelling and quantitative data as well as the use of oversimplified assumptions has been criticized. In response to this critique we chose to use a more pluralistic approach in our research methodology by employing both qualitative as well as quantitative data analysis. For the analysis of qualitative data, we employed an approach based on grounded theory principles, where we analyze Reuters Foreign exchange market reports. The findings of the qualitative data analysis show that, based on market practitioners commentary, there are two predominant variables affecting exchange rates. First, expectations on interest rate changes appears to be a major variable affecting currency value. An upward revision of interest rate expectations usually suggests an increase in the value of the currency concerned and vice versa. Second major variable affecting exchange rates appear to be global equity returns. In contrast to interest rates, which is a country specific variable, global equity returns is a global variable affecting currencies based on their relative interest rate levels and safe haven attributes. In particular, it is suggested that higher yielding currencies' value is positive related to global equity returns, while low/lower yielding and safe haven currencies' value is negatively related to global equity returns. The empirical test we performed to explore the relationship between exchange rates and global equity returns suggest that they are indeed linked. The sign of the relationship depends on the characteristics of the currencies examined. When equity prices increase, currencies with higher interest rates tend to appreciate, whereas currencies with lower interest rates tend to depreciate and vice versa. In addition, the strength of the relationship depends to some extent on relative interest differentials. A stronger relationship is observed when interest differentials are relatively large, while the explanatory power of the model is reduced when interest rate differentials are relatively narrow. Our study presents evidence on the role of stock markets in exchange rate determination which is considerable different to the focus of current theory. Whereas current research focuses on stock market's relative stock market returns in the respective countries, the findings of this thesis suggests that global stock market returns affect exchange rate movements based on differentiated characteristics of different currencies. Another important contribution of this thesis is that we illustrate the complexity of interactions and links among different variables. For example, whereas interest changes were seen as positively correlated to the home currency value, the relationship was seen as being reversed because of the possible effect of higher interest rates on the subprime crisis. Another example of complex links is the relationship between exchange rates and equity markets. For example, whereas the USD effective exchange rate was not related equity returns during the initial stages of the subprime crises, the strength of the relationship increased significantly when the crisis escalated and the demand for USD increased due to safe haven flows.

ii. *Introduction to the thesis*

The review of exchange rate theory and methodology literature reveals that studies on the views of market participants with regard to the workings of the foreign exchange market, and research employing pluralistic methodological approaches are still rare in the field of exchange rate economics. The aim of thesis is to explore factors affecting short term exchange rate behaviour by employing qualitative data analysis to study market practitioners' beliefs and practices and quantitative data analysis to assess the validity and generalisability of findings. This thesis consists of the following eight chapters.

In chapter I, we outline some of the recent developments in the functioning and scale of transactions undertaken in the foreign exchange markets, and to explore the characteristics and behavour of foreign exchange market participants. In chapter II, the aim is to illustrate the main developments of exchange rate theory and the evolution of exchange rate models over the last century within their historical context. In chapter III, we review the main historical developments of economic methodology and we present the aspects of economic methodology which are subject to critique, before illustrating the methodological approach employed in this thesis. In Chapter IV, the findings of qualitative data analysis are presented and discussed. In the following two chapters (chapter V and VI) we investigate, asses and discuss the validity and generalisability of these relationships. In chapter VII, we summarize our findings and discuss their importance and implications to the field of exchange rate theory.

Structure of the Thesis

Chapter I: Introduction to the foreign exchange market

Chapter II: Literature review

The evolution of exchange rate theory and behavioural aspects of market practitioners

Chapter III: Methodology

Aim of the thesis	Theory and discussion of methodological approaches available
Method employed	

Chapter IV

Analysis of qualitative data

Chapter V

Formal empirical test of the validity of chapter IV finding (i)

Chapter VI

Formal empirical test of the validity of chapter IV finding (ii)

Chapter VII: Conclusion

Chapter I

Introduction to the foreign exchange market

Chapter I: Introduction to the foreign exchange market

1. Introduction

The aim of this chapter is to introduce the reader into the main developments of exchange markets. We begin with reviewing the main characteristics of the foreign exchange market starting with a brief historical review of the main developments in the structure of the dealing processes in foreign exchange market. This will be followed by an overview of the current characteristics of the foreign exchange market, with regards to trading volumes of different foreign exchange instruments and participants. Then, we reveal how the foreign exchange market has evolved specifically noting the structure of the inter-dealer market and the expansion of trading channels now available to customers. In section 7 we present an illustration of literature examining the importance of market practitioners' behaviour on exchange rate determination.

2. A brief history of foreign exchange dealing

The basic structure of the "modern" foreign exchange markets has largely remained unaltered since the early 1930s when the first telephone brokers started, until the 1990s. The only notable change in the structure and trading processes of the foreign exchange market

occurred in the 1960s when brokers installed private networks. These private telephone networks were installed free of charge in banks by brokers. Best prices were announced by brokers at dealers' desks and when a dealer wanted to trade at those prices he placed the order via telephone. In fact, the popularity of voice brokers was still high until the mid 1980s. However it was about this time that the first of a series of significant changes started to take place. In 1987 Reuters introduced 'Reuters Dealing 2001' [D2000-1] which effectively changing the way direct trading was conducted. According to Rime (2003), the introduction of D2000-1 contributed significantly to the increase of trade volume in the foreign exchange market as it made cross border trading easier and could handle more trades simultaneously. (Rime 2003)

Developments in the foreign exchange market picked up during the 90s. It was in 1992 that electronic brokers appeared in the inter-dealer market and by the late 90s the Internet had become available to customers, providing an alternative trading channel (Rime 2003).

Whereas the introduction of electronic trading changed the way inter-dealer trading was conducted, the fact that the internet became available to customers significantly changed the interplay between customers and dealers (Sager & Taylor 2006). In addition, advances in computer and network technologies, for example, the introduction in 2002 of CLS[1] (Continuous linked settlement), and the netting[2] technology FXNet, also contributed towards the evolution and expansion of the foreign exchange market (Rime 2003).

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[1] CLS is linking payment systems of participating countries in real-time
[2] Netting is a procedure used to streamline transaction payments

3. The Foreign Exchange Market Today

The foreign exchange market is not only the world's largest financial market (Bjonnes & Rime 2005) but also the most liquid financial exchange in the world (Sager Taylor 2006). According to BIS (2010), the daily trading volume of the foreign exchange market is 3.981 trillion US dollar. According to Hau et al 2002, the trading volume of the foreign exchange market far exceeds that of equity markets. The trading volume of the New York stock exchange reaches a daily turnover of only US$75 billion. Market participants have the possibility to trade 24 hours per day, though volume and liquidity vary within the day. (Lyons 2002)

A distinctive characteristic of the foreign exchange market is that it is a decentralized and that it is an over the counter market. There are a series of reasons for the decentralized structure of the foreign exchange market. First, the advancement of telecommunications made decentralization possible by distributing customers around the world. Because customers are in different locations and time zones, there is demand for currencies 24/7. As a result, dealers need to be globally distributed operating in different time zones. (Rime 2003)

However, it is still the case that the major market-making dealers are located physical within the most important foreign exchange centres located in London, New York and Tokyo. Foreign exchange transactions are recorded as having taken place at the location of the dealer (i.e. in contrast to the origin of the bank or the customer). (Sager & Taylor 2006)

One significant characteristic of the foreign exchange market, mainly caused by its decentralized nature, is the low transparency and fragmented nature of the foreign exchange market (Rime 2003). It is possible that transactions occur at the same time at different prices (Sager Taylor 2006), while the decentralization of the market establishes a number of difficulties in observing the interaction between price and information (Dominguez, 1999, Lyons 2002b). Moreover, because of the international scope (see Hau et. al. 2002) as well as the decentralized structure of the foreign exchange market, it is difficult to regulate the market so that the market structure evolves endogenously. In fact, there are no regulatory disclosure requirement, which adds to the lack of transparency (Rime 2003). Instead, market participants agree in a set of rules as well as a set of ethical and professional standards, so that foreign exchange trading can be conducted (Hau et. al. 2002).

4. Foreign exchange market: Some key statistics

The development and growth of foreign exchange transactions is apparent from the review of market statistics covering the last fifteen years, where the overall exchange turnover increased four-fold in fifteen years.

Table 1: Global Foreign exchange turnover bill US $

	1995	1998	2001	2004	2007	2010
Daily trading volume in USD	1120	1,527	1,239	1,934	3,324	3,981

Source: BIS[3] 2004 & 2010

After the break down of the Bretton Woods agreement in the early 1970s the turnover of the foreign exchange market increased continuously driven by globalization, significant increases in customer trading in the late 80s and an increased number of banks being active in the foreign exchange market. Volumes were also fueled by the subsequent decrease of spreads[4]. (Rime (2003)

The survey of the bank of international settlement (BIS) shows a clear upward trend since 1989 that was only interrupted during the period from 1998 to 2001. According to BIS 2002, structural changes in the foreign exchange market were the main causes of this decline, 'the introduction of the euro, the growing share of electronic broking in the spot inter-bank market, consolidation in the banking industry and international concentration in the corporate sector appear to have been the main factors driving the fall in turnover' (BIS 2002:6). On the other hand, according to BIS (2004), the boost of turnover between 2001 and 2004 was caused by the growth of hedge funds and asset managers as well as the greater role that foreign exchange products played in the investment industry.

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[3] Bank of International Settlements
[4] In this context spread is the difference between buying and selling price of a currency

According to Galati & Melvin (2004), currency trading gained on popularity because of the presence of higher volatility in the foreign exchange market as well as the low returns on equity and fixed income investments. In addition, higher volatility contributed to an increase in hedging activity which further increased turnover.

Foreign exchange turnover increased also between 2007-2010, despite the recent financial crisis. According to BIS (2010), FOREX turnover increased by 20% during this period, mainly driven by an increase of 48% in spot transactions.

The geographical distribution of foreign exchange trading did not change noticeably over the last fifteen years except for a slight upward trend of the importance of the US and a slight downward trend of Japan. The UK is still the largest trading centre with a 37% global share followed by the United States (18%), Japan (6%), Singapore (5%), Hong Kong SAR (5%), Switzerland (5%), and Australia (4%). (BIS 2010)

Figure 1. Geographical distribution of foreign exchange turnover (Percentages).
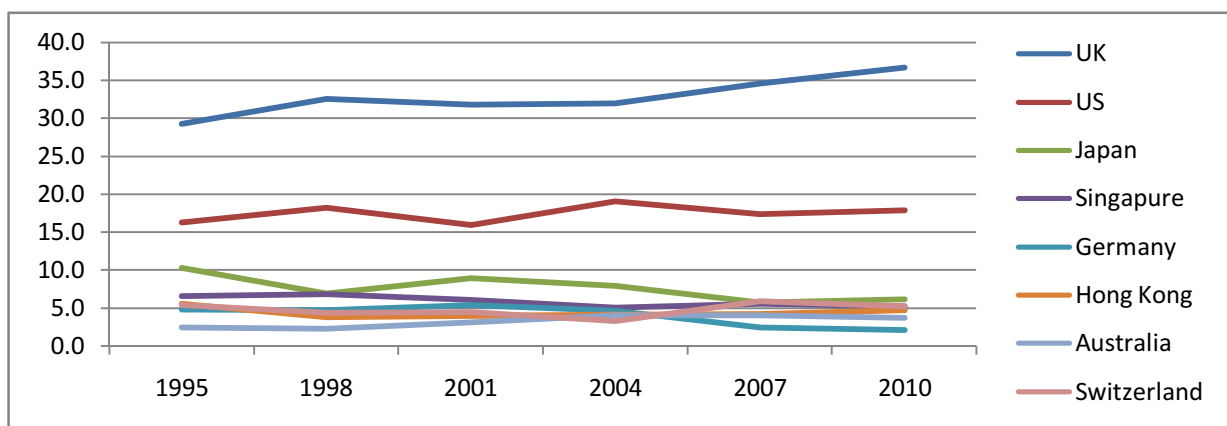
Source of data: BIS (2010)

4.2 Currency composition turnover of foreign exchange

After an initial decline of the Euro's share after release of the green paper in 1995 that launched the blueprint leading to the creation of the single currency, the share of the Euro is continuously increasing. At its introduction the market share of the Euro was significantly lower than that of the Deutsche Mark in 1992, mainly due to the reduction of intra-EMS turnover (BIS 1998). However, over the last decade the USD, GBP, JPY appear to loose market turnover share after an initial increase at the beginning of the decade with the Euro increasing its turnover share after an initial decline. (see figure 2.)

Fig 2: Currency distribution of global foreign exchange market turnover (Percentages)
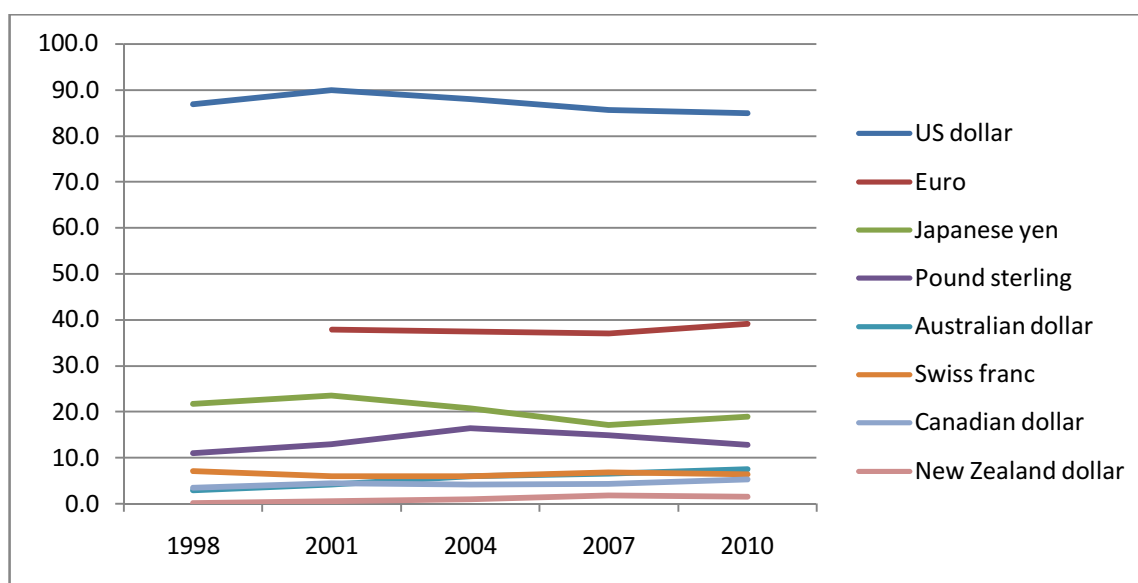
Source of data: BIS 2010

NOTE: The sum of the percentages of all currencies adds to 200%, as currencies trade in currency pairs. To illustrate this point lets consider the following example.Iif the only two currencies in the world economy were the EUR and the USD then each of these two currencies would appear in 100% of foreign exchange transactions (i.e. EUR 100% + USD 100% = 200%)

Fig 3: Global foreign exchange market turnover by currency pair (Percentages)
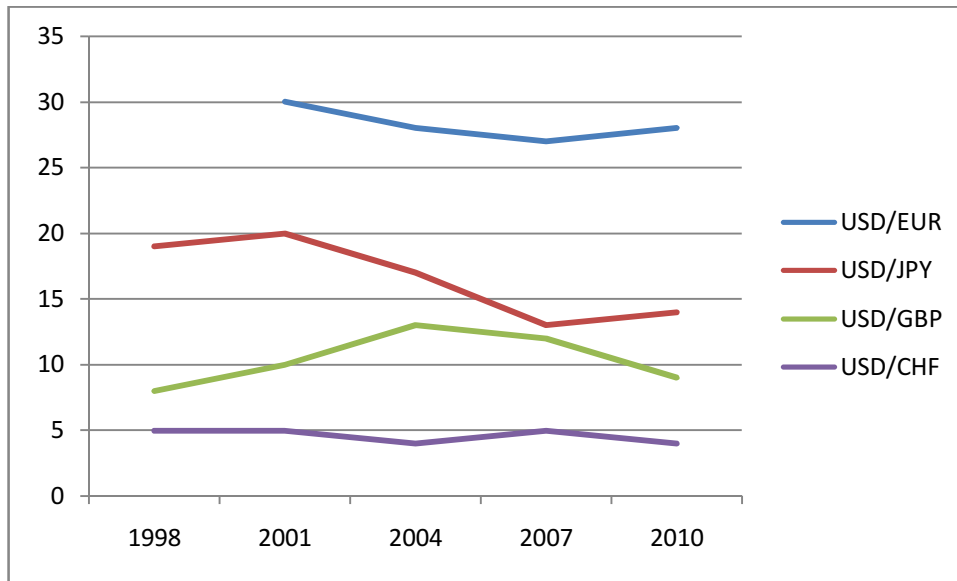
Source of data: BIS 2010

The most traded currency pair is the USD/EUR. While the proportion of USD/CHF appears to be relatively stable, USD/JPY trading volumes showed a clear reduction which has been reversed only in the last triennial survey. The trading volume of the USD/EUR appears to be a mirror image of USD/GBP trading volume. Whereas USD/EUR trading volume declined between 2001-2007 and then recovered in 2010, the USD/GBP trading volume increased initially and dropped latter.

4.3 Global Foreign exchange product composition

All foreign exchange segments follow the general upward trend of the foreign exchange market (see table 2.). Notably, the turnover of foreign exchange swaps has showed the largest

increase, surpassing the turnover of the spot market in 1995. Except for an increase in speculative investments, another cause of the increase in foreign exchange turnover relates to the large swings and increased volatility of dollar exchange rates during period 2001-2004, so that hedging-related activities and derivatives use increased.(Galati & Melvin 2004)

4.4 Spot Global foreign exchange market turnover by counterparty

Since 1998, the market share of market makers is decreasing, while the market share of other financial institutions is increasing (see figure 6). According to Sager & Taylor (2006), this is mainly due to the increasingly popularity of the foreign exchange market as a source of persistent returns and a provider of diversification benefits.

The decline of inter-dealer trade can be attributed to two main factors. First, the consolidation of the banking sector, where according to BIS (2004), the reduction of the number of banks had a dampening effect on turnover. Second, the introduction of electronic brokers reduced the need of banks to trade among themselves (BIS 2004).

Table 2: Global Foreign exchange product composition

Instrument	1998	2001	2004	2007	2010
Foreign exchange instruments	**1,527**	**1,239**	**1,934**	**3,324**	**3,981**
Spot transactions[5]	568	386	631	1,005	1,490
Outright forwards[6]	128	130	209	362	475
Foreign exchange swaps[7]	734	656	954	1,714	1,765
Currency swaps[8]	10	7	21	31	43
Options[9] and other products	87	60	119	212	207
Memo:					
Turnover at April 2010 exchange rates[4]	*1,705*	*1,505*	*2,040*	*3,370*	*3,981*
Exchange-traded derivatives[5]	*11*	*12*	*26*	*80*	*168*

Source: BIS 2010

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[5] **Spot transaction**: "single outright transaction involving the exchange of two currencies at a rate agreed on the date of the contract for value or delivery (cash settlement) within two business days. " (BIS 2010:18)

[6] **Outright forward**: " transaction involving the exchange of two currencies at a rate agreed on the date of the contract for value or delivery (cash settlement) at some time in the future (more than two business days later). This category also includes forward rate agreement (FRA) transactions, non-deliverable forwards and other forward contracts for differences. " (BIS 2010:18)

[7] **Foreign exchange swap**:" transaction which involves the actual exchange of two currencies (principal amount only) on a specific date at a rate agreed at the time of the conclusion of the contract (the short leg), and a reverse exchange of the same two currencies at a date further in the future at a rate (generally different from the rate applied to the short leg) agreed at the time of the contract (the long leg). " (BIS 2010:18)

[8] **Currency swap**: "contract which commits two counterparties to exchange streams of interest payments in different currencies for an agreed period of time and usually to exchange principal amounts in different currencies at a pre-agreed exchange rate at maturity. " (BIS 2010:18)

[9] **Currency option**:" option contract that gives the right to buy or sell a currency with another currency at a specified exchange rate during a specified period. This category also includes exotic currency options such as average rate options and barrier options." (BIS 2010:18)

Figure 4 Spot Global foreign exchange market turnover by counterparty (Percentages)
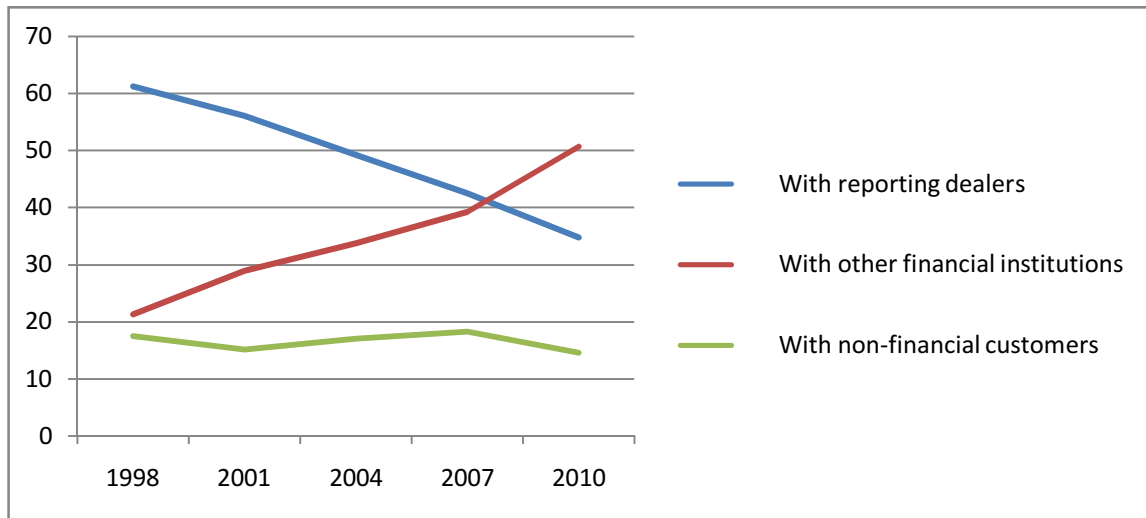
Source of data: BIS 2010

5. Inter-dealer trading

Banks participate in the inter-dealer market either for speculative purposes or to cover the trades of their customers who do not have access to the inter-dealer market (at least until 2004)[10]. Costumers contact their bank, and their bank quotes prices to the customers, then the bank turns to another bank in the inter-dealer market to cover the customer's trade. (Rime 2003)

Banks in the in the inter-dealer market, have two options when it comes to trading channels, direct trading (i.e. taking place between dealers) or brokered inter-dealer trading (Rime

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[10] Until 2004, customers did not have the option of trading either directly with each other or to trade directly in the interdealer market. Instead, customers had to trade on the quotes given by the bank with which they had established a credit line.

2003). The main tool to conduct direct inter-dealer trading is the Reuters Dealing 3000 Direct system[11] (Carpender & Wang 2003) while more recently EBS released a direct trading product called EBSTrader (Rime 2003). Alternatively, banks can trade directly with other banks over the telephone or via indirect trading which is conducted through voice or electronic brokers (e.g., Reuters Dealing 3000 Spot Matching (the successor of Dealing 2000-2), and the Electronic Brokering Service (EBS) (Carpender & Wang 2003). The key difference between direct and indirect trading is that direct trading has lower post trade transparency, because all market participants observe trades conducted via brokers, but only dealers involved observe direct trades. (Carpender & Wang 2003)

Nowadays electronic brokers constitute the main trading channel. According to Lyons (2002), 75% of the inter-dealer trading was conducted via electronic brokers in 2002. According to Sager Taylor (2006), in 2006 the two systems (i.e. EBS and Reuters) accounted for 85 per cent of total inter-bank activity, while Voice brokers and direct trading accounted for 10% and for 5% of total foreign exchange turnover respectively.

- *Direct Trading*

Direct trading has two main advantages. First, there is a lower post trade transparency. Secondly, whereas in periods of low liquidity trading possibilities through electronic brokers

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[11] Reuters Dealing 3000 Direct is the successor of Dealing 2000-1 referred in the above sections

are diminished (because of lack of limit orders[12]), there is always the possibility of direct trading (Rime 2003).

In 2004, 90% of direct inter-dealer trading were conducted through Reuters D2000-1 system (Viswanathan & Wang 2004). The system works like an instant messenger. Although this system did not revolutionize trading, it made direct trading more efficient because trade tickets were sent automatically to back offices, while the traders can have many conversations at the same time. (Rime 2003)

- *Indirect Trading*

As mentioned above, e-brokers dominate indirect trading in the inter-dealer market. Currently, there are two electronic brokers in the inter-bank market. The system launched by Reuters which was introduced in April 1992, and the system of EBS introduced in September 1993 by several major banks to counterpart the system established by Reuters. In April 1992, a group of Japanese banks launched one other e-broker system (Minex), but in December 1995 Minex was acquired by EBS. (Rime 2003)

The Foreign exchange market was one of the first to adopt e-brokers. Electronic brokers collect limit orders from different dealers and project the best bid and ask prices on a network of screens which are installed at trading desks. Dealers either put new limit orders on the system or trade on the existing orders (market order), where the system matches automatically the different counterparties. (Rime 2003)

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[12] Limit Order: An order to buy/sell a currency at a specified price or at a price which is better than the specified price.

Each bank sets credit lines with the other institutions with which it is potentially trading and as a result, each institution can observe only prices from banks that have established credit lines with this particular institution. Hence, it is important to ensure that a sufficient number of banks have set credit lines with this bank. (Ito & Hashimoto 2004)

E-brokers have two main advantages. First, e-brokers are cheaper and second, electronic brokers are much more efficient in matching orders (Rime 2003). However, there are some disadvantages in trading via e-brokers , for example, they do not offer Voice brokerage and the possibility of communicating and negotiating with the counterparty (Bjonnes & Rime 2005) and most importantly, when trading through brokers, orders are revealed to all market participants so that private information is now visible (Carpender & Wang 2003).

6 .Customer Trading

Although banks are the largest players of the foreign exchange market, customers are the main source of demand and trading in the inter-dealer market (Rime 2003). Customers of the foreign exchange market are Central Banks, financial institutions (for example, hedge funds) as well as importers and exporters. Customers, until recently, did not have any access to the inter-bank market and did not have the possibility to trade with each other (Rime 2003), while voice trading constituted still the main trading channel for customers (Sager & Taylor

2006). However, in more recent years, significant changes occurred when customers gained access to the brokered inter-dealer market, while multi-dealer platforms improved transparency and price competition significantly

In the late 90s a series of nonbank customer sites were launched (e.g. Deal4Free (1996), IFX Markets 1999), Hot SpotFX (February 2001), OANDA (March 2001). Non bank customer trading emerged in the form of internet sites that set up crossing networks, where the site is the counterparty to all trades. Crossing networks are trading systems that have no price discovery because they do not have sufficient limit orders and so they depend on the inter-dealer market. Although those sites offer competitive pricing it is only available for small size trades so that those sites focus mainly on small customers. (Rime 2003)

The first attempt by banks to counteract non-bank customer sites was to establish their own trading platforms and in the late 1990s, when the first of these were launched with limited take up by customers. As a result, the first multi-dealer platforms were introduced which allowed customers to receive quotes from different banks, so that the best bid-ask prices can be chosen. Currenex and FX connect were the first to introduce such a platform in April 2000 with banks later introducing their own platforms (i.e. Fxall and Atriax) (Chaboud & Weinberg, 2002). Atriax was launched by the top dealing banks (eg Citibank, Deutsche Bank, and J. P. Morgan Chase) while FXall was launched by a group of smaller banks. At the beginning, the market share of these sites was limited (less than 10 percent). The Atriax system was closed down so that two of its members joined the FXAll system (i.e. Citibank and J. P. Morgan Chase) (Lyons 2002). The market share has grown rapidly and in 2004 FXAll reported a rise of 104% (annual total 4.9 trillion$) with FX Connect having similar

results (Sager & Taylor 2006). Banks participate now in several multi-bank portals in addition to their own single bank portals with the consequence that trading cost for customers has been reduced significantly (Rime 2003).

On September 2004, EBS announced that Hedge funds, which are customers of one of the five banks that have signed up to EBS's prime brokerage Service (i.e. Barclayscapital, JP Morgan Chase, Deutsche Bank, HSBC, Royal Bank of Scotland), will be offered access to the inter-dealer market through the EBS system. (Johnson 2004)

According to King et al (2011), the fast paced development of electronic trading over the last years has transformed the foreign exchange market by increasing transparency and enabling new players to enter the market.

According to Heath and Whitelaw (2011), the greater access of customers to trading platforms and the consequently reduced transaction cost led to a significant increase in the activity of customers such as hedge funds and non financial institutions.

The development of electronic trading also attracted new typologies of customers and trading strategies. Besides a significant increase of retail customers participation in the foreign exchange market, automated trading techniques (i.e. algorithmic traders) significantly increased their presence in the FOREX market. As a result, financial trading increased from 10% in 1998 to 50% in 2010. (King et al 2011)

7. *The role of Market Participants in exchange rate determination*

In this section we present a summary of empirical evidence and research regarding the behaviour, strategies employed, and importance (measured by participants impact on exchange rates) of different typologies of market participants. According to rational expectation models, there should be no impact of actual trades on exchange rates, thus exchange rates, like other asset prices, should be driven by the expectation of future fundamentals (Lyons 2001). Empirical evidence however suggests that order flows affect exchange rates, at least in the short term. As a result, the various types of foreign exchange "players" have variable impact on prices according to the information that their trades carry and the market power they can exert.

In the following sections we are describing the typologies of different market participants, the different investment strategies employed, their beliefs on the workings of the foreign exchange markets, and examine their impact on exchange rate determination.

Typologies of the main market participants

Market participants of the foreign exchange market can be divided into two main categories, market makers and customers. Although market makers have the largest market share in the foreign exchange market, customers influence the market too. According to Fan and Lyons

(2002:160), 'inter-dealer trading is in a sense derivative: it is the demands of non-dealer customers that represent underlying demand for currencies in the real economy'

7.1 Market Makers

7.1.1 The role of dealers

Market makers (i.e. dealers) have two distinctive roles. First, they act as intermediates and provide liquidity and second, they take speculative positions. Market makers have the biggest share of trading in the foreign exchange market. One possible explanation for the large volumes of trade in the inter-dealer market could be excessive speculation (Frankel and Froot 1990). However, the so-called 'hot potato trading' theory has been gaining on popularity as an explanation of the large trading volumes of market makers. 'Hot potato trading' refers to the process of dealers repeatedly passing their inventory imbalances to each other.

According to Burnham (1991):'*[When hit with an incoming order, a currency dealer] seeks to restore its own equilibrium by going to another market maker or the broker for a two way price. A game of 'hot potato' has begun … It is this search process for a counterparty who is willing to accept a new currency position that accounts for a good deal of the volume in the foreign exchange market.'*

Dealers affect prices in two ways, directly by changing their quotes, and indirectly through the impact of their trades. Traders are well informed about trading activity as they can observe costumer flows in advance of other market participants. It should be noted that according to research results (see: Lyons, 1997 and Bjønnes & Rime, 2005), there are considerable profit margins in foreign exchange market making. However, there is no consensus, whether profits originate from speculative positions taken by the dealer or from intermediation (profit as a result of the retention of the spread). Lyons (1997), studied the trades of a dealer over a period of one week. The dealer averaged a trade volume of 1 billion USD per day and a profit of 100.000 USDs per day. According to Lyons (1997), the results of his study suggest that intermediation is a much more important source of profits than speculation. He observes that about 90 per cent of the dealer's profits could be explained by the retention of 1 basis point of the spread. According to Lyons (1997), dealer's speculative positions not only did not generate any profits but also were the source of losses. However, according to the study of Bjønnes & Rime (2005), active position taking represents an important share of trading profits for most of the dealers they observed in their study. Dealers use the interdealer market not only to offload unwanted positions that were caused by costumer trades, but also to establish profitable speculative positions (Bjønnes & Rime 2005).

According to empirical findings, a main characteristic of dealers in the Foreign exchange market is the strong mean reversion of their inventories. According to Lyons (1997), the half-lives of the dealer's positions were only 10 minutes, while the half lives in the equity market are about one week.

The short half-lives of dealer's inventory positions are supported by findings of Bjønnes & Rime (2005). According to Bjønnes & Rime (2005), half-lives of dealer inventories range from less than a minute to fifteen minutes indicating strong inventory control management.

According to Lyons (1995), there apply different rules regarding intraday trading limits and overnight limits. At the studied bank, as well as in most major banks, there is no intraday limit on senior dealers. However, dealers communicate large trades (trades above 50 million USD) to their immediate supervisor. In contrast, most banks impose overnight limits on their dealers. The overnight limit of most banks on a single dealer's open position is about $75 million. Most dealers, however, close their day with a zero net position because carrying an open position means monitoring it through the evening, which is certainly an unattractive option after a long trading day. (Lyons 1995)

Whereas short half lives of dealer's inventory positions are considered a stylized fact, there is no consensus about the techniques that are used to maintain strong inventory control. According to inventory control models, if a dealer has a surplus of one currency he will adjust the price of that currency to attract buyers to balance his inventory,

This process is known as "price shading" (Lyons 1997). This strategy is the only possibility in a single dealer market. However, a dealer in a multiple dealer market (as the foreign exchange market) can balance his inventory by trading with other dealers. (Bjønnes & Rime 2005)

According to Lyons (1995), there is strong evidence of price shading. Exchange rates adjust three-quarters of a pip for every $10 million of net open position, although the observed dealer uses as well the interdealer market to cover positions (Lyons 1995). On the other hand, Bjønnes & Rime (2005), find no evidence of price shading. They suggest the mean reverting behaviour of dealer's inventories is not achieved through the change of prices that dealers quote (i.e. price shading) as suggested by inventory models. In addition, according to Yao (1998), there is no evidence of price shading in the interdealer market as a tool of inventory control. According to Yao (1998), dealers prefer to unwind unwanted position through the brokered interdealer market, as price shading signals a dealer's position and further reveals information from his proprietary order flow information. Instead dealers prefer to cover open positions through trades at quotes of other dealers. Because of the depth and the low transparency of the foreign exchange market, a dealer gets the best prices, so that price impacts of such outgoing trades are reduced to a minimum.

According to Yao (1998) dealers with little customer business (e.g. the dealer observed by Lyons 1995), is likely to shade quotes to manage his inventory, thus he has no information that will be revealed. On the other hand, a dealer with significant costumer business will not choose to shade prices to protect his information.

7.1.2 The impact of interdealer trading on exchange rates

According to Evans and Lyons (2002), using direct inter-dealer trades and examining 5 minute frequencies, daily inter-dealer order flow explains 60% and 40% of DM/USD and JPY/USD exchange rate changes respectively. According to Evans and Lyons (2002)

> *'For the deutsche mark/dollar spot market as a whole, we find that $1 billion of net dollar purchases increases the deutsche mark price of a dollar by 0.5 percent.'*
> (Lyons, 2002, p-170)

The significant role of inter-dealer order flows is confirmed by the study of Carpender and Wang (2003). According to Carpender and Wang (2003), by examining direct inter-bank trades, there is a significant correlation between direct incoming trades and exchange rate change. However, by investigating brokered transactions, they find that the impact of inter-dealer order flow is insignificant (Carpender and Wang 2003).

According to Danielsson et al (2002)

'order flows can be used to explain and forecast rates at very high frequencies'

Danielsson et al (2002:18)

Danielsson et al (2002), observe that the intra–day relationship between brokered inter-dealer order flows and exchange rates changes is very strong for the EUR/USD, USD/JPY, EUR/GBP and GBP/USD exchange rates. And yet, according to Danielsson et al (2002), order flows do not provide very valuable exchange rate forecasts above frequencies of one hour. Moreover, at daily or weekly horizons, the explanatory power of brokered inter-dealer order flow decreases for the EUR/GBP and GBP/USD exchange rates. Moreover, findings suggest that exchange rate changes for EUR/GBP and GBP/USD are strongly affected by EUR/USD order flow but not by their own order flow.

7.1.3 Dealer Behaviour and Beliefs

In this section the results of two surveys conducted by Cheung et al (2004) and Cheung & Chinn (2000), which investigate dealers' beliefs in US and UK respectively will be presented.

The Bid ask spread

According to Cheung et. al. (2004), there is a market norm that rules the exchange rate spread. The market norm strongly influences the spread. Practitioners of the foreign exchange market indicate that the ability to maintain a tight bid-ask spread is seen as a sign of a good trader. (Cheung et. Al. 2004)

However, according to Cheung et al (2000), profits do not appear as the predominant factor for conforming to the market norm for bid ask spreads. Instead, the most important factor for conforming to the market norm is the dealer's desire to maintain and to establish fair and equal trading relationships and to maintain a good market image. According to the study, the main reason for departing from the market norm regarding bid ask spreads is a volatile and thin market.

The importance of Macroeconomic factors as determinants of exchange rates

According to Cheung et al (2004), market dealers consider short term movements of exchange rates to be determined by non fundamental factors. The most frequent cited factors that are believed to affect short term exchange rates are over-reaction as well as speculative and bandwagon effects. As a result, according to Cheung et al (2004), it is not surprising that macroeconomic models fail. Moreover, according to dealers, manipulation by hedge funds and institutional investors and to a smaller extent manipulation by trading banks seems to affect exchange rates as well (Cheung & Chinn 2000) & (Cheung et al 2004).

In addition, market participants believe that technical analysis has only limited effect on short- and medium-run exchange rates. However, at longer horizons, fundamentals[13] become more and more important as a determinant of exchange rates. (Cheung & Chinn 2000)

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[13] However, there is no consensus among dealers what exactly fundamentals are, as they are variously described by practitioners themselves (Cheung & Chinn 2000)

In particular, dealers believe that fundamentals have a considerable effect on exchange rates on time horizons of over 6 months, which is much shorter than the time horizon suggested by empirical literature (Cheung et al 2004).

While market practitioners consider purchasing power parity as a relevant determinant of a currency's 'fundamental value', it is not used in their trading calculations when attempting to estimate the fundamental value of a currency. (Cheung et al 2004)

Although Purchasing Power Parity is embodied in nearly every modern model of open economy, the survey confirms the widespread impression that traders view purchasing power parity as a relevant determinant of exchange rates only in the very long run (Cheung & Chinn 2000). On the other hand, dealers believe that exchange rate movements are determined by a whole set of variables which includes other fundamentals. (Cheung et al 2004)

Exchange rate trends. Are they predictable?

According to Cheung & Chinn (2000), the predictability of exchange rates is viewed as rather low. Furthermore, there is little difference among the different time horizons indicating that dealers view the predictability of exchange rates as equal independent from the forecasting horizon.

Is speculation believed to be destabilizing?

Although both speculation and central bank intervention are believed to increase exchange rate volatility, dealers believe that both speculation and central bank intervention are contributing so that exchange rates are moving toward their long run values. In other words, although speculation is seen as increasing volatility in the short term, it is also seen as the mean of bringing exchange rates into alignment with fundamentals and as a provider of market liquidity. (Cheung et al 2004)

7.2 Foreign exchange market customers

This section examines the trading strategies and market impact of market participants other than dealers (i.e. customers). Customers of the foreign exchange market can be categorized as non bank financial institutions, non financial corporations and central banks.

7.2.1 Non Bank Financial institutions

The category of Non-bank financial institutions consists of hedge funds, mutual funds, insurance companies, commodity trading advisors (CTAs) and brokering services. A detailed breakdown of market shares of financial institutions is not publically available, however,

according to Sager and Taylor (2006), asset management firms and hedge funds account each for approximately one third of non-bank financial customer trades, while for the remaining part of customer flows of financial institutions account Central banks, Commodity Trading Advisors (CTAs) and individual customers. Non bank financial institutions participate in the foreign exchange market in order to access foreign asset markets and/or to make speculative profits by exploiting fluctuations in exchange rates. Because capital flows and in particular portfolio flows appear to occur in herds (Froot et al 2001), non bank financial institutions can exhibit significant impact on exchange rates. (Carpender and Wang 2003)

According to Galati & Melvin (2004), the activity of institutional investors experienced significant growth over the last years. Pension funds, insurance companies and mutual funds played an increasingly important role in the foreign exchange market. Moreover, the number and the overall size of hedge funds has increased significantly. According to Galati & Melvin (2004), hedge funds and other institutional investors, in their attempts to achieve higher yields, followed over the last years interest rate differentials based strategies. In other words, these players increasingly borrowed from low yielding currencies while taking long positions in high yield currencies hopping to exploit forward bias.

The extensive use of leverage[14] is believed to be another reason non bank financial institutions exhibit significant market impact. With the use of leverage, market participants, mainly hedge funds, are able to have a greater impact than the impact the nominal value of their assets under management would had otherwise suggested. The fact that foreign exchange markets are not regulated trading strategies (for example, leveraged arbitrage

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[14] Leverage enables market participants to execute trades of significant size with the use of small amounts of equity.

trades) which are not available in other markets, increasing the impact of market participants (Carpender and Wang 2003). Aside from strategies based on interest differentials mentioned above there are a variety of trading strategies employed by different categories of market players. According to Sager and Taylor (2006), hedge funds and currency managers use mainly quantified trading rules; these rules are based on theoretical relationships between economic variables, publicly available information and exchange rates.

According to Sager and Taylor (2006), most CTAs use solely technical analysis. Technical trading involves trading rules based on historical price innovation (e.g. Chartism, support and resistance levels, moving average cross-over levels, over-bought and over-sold indicators) and has no theoretical economic interpretation. Although it seems that such behaviour is irrational, empirical evidence suggest that technical analysis is profitable. However, technical traders represent also an important source of forecasting errors (see noise traders and Taylor et al., 2001).

Approaches based on the analysis of qualitative data are also popular for the formation of foreign exchange strategies employed by financial institutions. Some portfolio managers employ trading strategies based on qualitative interpretation of fundamentals, recognizing the fact that not all events can be quantified. The success of qualitative approaches depends heavily on the ability of the portfolio manager to interpret correctly new information. (Taylor et al., 2001)

- *Hedge funds*

One of the most influential typologies of players in the foreign exchange market is that of hedge funds. Hedge fund managers usually run with a short-term investment horizon of about one to three months and make extensive use of leverage (Sager and Taylor 2006). After the market moves made by George Soros on the GBP in the early 1990s and the Asian crisis in 1997, hedge funds have received a reputation suggesting that those funds present a main source of market manipulation (see Fung & Hsieh 2000).

However, according to Eichengreen et al. (1998), the largest single hedge fund manages less that 10 billion USD and hedge funds as a whole manage about 100 to 200 billion USD. As a result, according to Eichengreen et al. (1998), it is very unlikely that they manipulate the market more than banks and insurance companies, given that hedge funds have much less capital compared to other large market participants. According to Fung & Hsieh (2000), though some events were found to be affected by hedge funds (e.g. ERM Crisis in 1992, the European bond market rally in 1993 and the decline in 1994), other events where not found to be manipulated by hedge funds (for example, the stock market crash in 1987, the Mexican Peso Crisis of 1994, and the Asian Currency Crisis of 1997). (Fung & Hsieh 2000)

According to Fan and Lyons (2003), in their study which reviewed the factors driving the 10 per cent drop in the JPY/USD exchange rate that occurred in a single day in 1998, they find that hedge funds were not the trigger of the collapse. The trigger was the portfolio shift of financial institutions like mutual funds, pension funds, and insurance companies. In contrast,

hedge funds were found to be providers of liquidity (net buyers of dollars). Fung & Hsieh (2000) suggest that it is unlikely that hedge funds manipulate the market because according to the results of their study: a) hedge funds did not use positive feedback trading, b) hedge funds have separate trading strategies and unrelated trades, and c) hedge funds usually did not act as a group. According to Eichengreen et. al. (1998), hedge funds act independently because they do not want to disclose their trading positions.

According to Fung & Hsieh (2000), the unwinding of leveraged trades caused market disruption. In other words, it is not hedge funds *per se* but the nature of their strategies that causes disruption (Fung & Hsieh 2000). Sager and Taylor (2006) argue that hedge funds are among the quickest to respond to significant data innovations. However, given that hedge funds use leverage, shifts in portfolios of hedge funds represent a much larger proportion of assets compared to other customers. As a result sudden shifts of hedge funds amplify shocks in the foreign exchange market in periods of increased volatility (Geithner, 2004). In addition, hedge funds concentrate sales into periods of low trading volume to gain maximum of market impact (Rankin 1999). Moreover, according to Sager and Taylor (2006), hedge funds are adding to the noise surrounding their positions and so that their subsequent price impact is magnified. According to Sager and Taylor 2006, hedge fund traders often trade against their own positions with small trades, in order to encourage dealers to adopt similar positions before reversing their positions with much larger trade volumes. Corsetti,et al (2001) examine the market impact of large traders and in particular hedge funds. Large traders' impact on the market depends on the size and the reputation of the trader, the quality of information transmitted by the trader, and the ability of the trader to signal his/her positions to other market participants. (Corsetti,et al 2001)

7.2.2 Central Banks

According to Sager and Taylor (2006), Central banks are the most informed category of customers. Central banks are well placed to observe, in advance of other market players, changes in fundamental and variables relevant to their own currency, and have access to best intraday order flow information in their sector of the foreign exchange market. As a result, central bank foreign exchange activity is closely observed by market participants, as it represents the best source of private information. Information that includes information related to prospective market intervention and changes in the currency composition of official foreign exchange reserves (Sager and Taylor 2006).

7.3 Non financial corporations

The category of Non-financial corporations' includes those that engage in the foreign exchange market for their foreign direct investment, the repatriation of profits from foreign subsidiaries, their trading and transaction purposes, and reflect a country's trade balance of payment. In contrast to the previously mentioned categories, non financial corporations' do not engage in short-term currency speculations. Given that international trade accounts for about 1% of all foreign exchange transactions (Euromoney, 2002) the trading volume of non financial corporations and their market impact is relative small. (Carpender and Wang, 2003)

7.4 The impact of Customer Order flows on exchange rate behaviour

As already noted customer trading is considered as the main cause of inter-dealer trading and as a result, it might be expected that customer trading significantly affects exchange rates. For Bjonnes and Rime (2002):

'customers' order flow contribute significantly to exchange rate changes, supporting the importance of these flows' (Bjonnes and Rime (2002:1)

According to Carpender and Wang (2003), by using tick-by-tick data to examine the relationship between the dealer's pricing decisions and his current and previous trades, there is a direct link between subsequent exchange rate changes and transactions by different categories of market participants (Carpender and Wang 2003). Furthermore, different categories of market participants appear to have different degrees of impact. Carpender and Wang (2003), using spot FX transactions of a major Australian bank, find that central banks have the greatest price impact followed by non-bank financial institutions (e.g. hedge funds and mutual funds). In this study the price impact of trades by non-bank financial institutions is significant with buying pressure by non bank financial institutions of a currency resulting in appreciation of this currency while selling pressure resulting in a depreciaion of this currency. According to Lyons (2001). leveraged as well as unleveraged financial institutions have significantly price impacts using monthly frequencies.

On the other hand, trades by non-financial corporations appear to have the smallest impact on pricing. Carpender and Wang (2003), observe that although non-financial corporations have a positive impact, they have the smallest impact on exchange rates compared to other market participants, and that in the case of the AUD the impact is not statisticaly significant. However, according to Bjonnes et al (2005:176), 'If flows of one group of participants are positively correlated with changes in the foreign exchange rate, we will see a negative correlation for another group, or groups, of participants.' Accoding to Osler (2006), it can be considered as a stylized fact that commercial (i.e. non bank customers) customer order flows are negatively related to exchange rate movements. Supportive evidence is presented by Lyons (2001) Evans & Lyons' (2004) Marsh and O'Rourke's (2005), Mende et al.'s (2005) Bjonnes et al.'s (2005) (Osler, 2006).

According to findings of Fun and Lyons (2002), although, exchange-rate movements at high-frequency are usually associated with order flows from financial institutions, extreme low frequency currency fluctuations are associated with non financial customers order flows. Moreover, according to Carpender and Wang (2003), when investigating the impact of different market participants it is important to distinguish between small and large traders. According to Carpender and Wang (2003), only the biggest players (the top 25%) of each category have a significant impact on exchange rates.

Furthermore, according to studies of Bjonnes & Rime (2005), Yao (1998), Mende and Menkhoff (2006), there is little evidence of price shading (i.e. price adjustment) after customer order flows. Those studies suggest that dealers are reluctant to adjust prices after

customer trades in order to protect their private information and Mende and Menkhoff (2006) suggests that price discovery occurs in the inderdealer market.

Central banks are well informed market participants and so we could expect central bank positions to have a significant impact on exchange rates as their trades transmit information about the future state of the economy. However according to Taylor (1982) and Obstfeld (1990), central bank interventions are ineffective as the limited market power of central banks is confirmed by currency crises in the 1990s. For Carpender and Wang (2003), central bank intervention does not affect the exchange rate of the EUR, although this finding could be due to the fact that the central bank interventions examined in this study were neither from the European central bank nor from the Federal Reserve Bank.

On the other hand, recent microstructure studies suggest that although the effect of intervention is short lived it is also significant. According to Payne and Vitale (2002), who employ intraday transaction data issued by the Swiss central bank (SNB), a purchase of USD50 million by the SNB increases the value of the USD by 30 basis points, with the exchange rate adjusting during a 15-minute interval before and after the transaction. Carpender and Wang (2003), using spot FX transactions of a major Australian bank, suggest that Central bank intervention has greater impact than inter-dealer trading, non bank financial institutions and non financial customers. Central bank trades have the greatest impact of all market participants in the case of the AUD. A purchase of AUD 10 million leads to an increase in the AUD exchange rate of 3.2 basis points in the following minutes (Carpender and Wang, 2003). For Dominguez (1998), intervention operations lead to a general increase in exchange rate volatility and this is particularly true for secret interventions. Secret

interventions are those that are undertaken without notification and with the exception of those interventions that took place in the mid-1980s which reduced exchange rate volatility, volatility all other periods seem to have increased as a result of Central Bank intervention (Dominguez 1998).

Central bank interventions affect the behaviour of other market participants as well. For example, Sager and Taylor 2006, note that important portfolio shifts, from the USD to the EUR, occurred during 2003 – 2004 following central bank interventions. Anusha and Chari (2002), suggests that traders' perceptions about the fundamentals can be affected by their interpretation of the signal communicated by central bank activities so that pricing responses in the inter-bank market change according to Central Bank behaviour. Moreover, according to Biene et al (2002), regardless of whether central bank interventions are expected or unexpected, central bank interventions increases forecast heterogeneity among different market participants and concludes that not only official interventions moves market opinions but also moves market opinions in different ways across different markets.

8. Conclusion

Developments in the foreign exchange market affect aspects of the economy such as competiveness, international trade, international capital flows, credit worthiness etc. Consequently, gaining a deeper understanding of the mechanism determining currency values is not only of academic interest but also of crucial importance to policy makers.

In this introductory chapter we have outlined some of the recent developments in the functioning and scale of transactions undertaken in the foreign exchange markets. Recent technological development (for example, the development of electronic trading platforms) and lower perceived returns in equity markets, appear to have lead to continuously increasing trading volumes in the foreign exchange market. In particular, trading volume of financial institutions (non dealers), facilitated by technological advancements, saw a sixfold increase over the last decade, changing the landscape of a previously dealer dominated market and suggesting an increasing role of financial players in the determination of exchange rates.

Mainstream exchange rate theory examines exchange rate determination as if it occurred as a result of homogeneous market player actions (whether dealers or customers). This chapter highlights the changing structure of the foreign exchange market where players with different motivations, objectives, and knowledge of the market determine prices. The changes in the structure of the foreign exchange market identified will serve in the formation of the research aims and methods of this thesis.

Chapter II

Literature review

Chapter II: Literature review

1.Introduction

In this chapter we review the main literature, that is, theories that have, over a period of time, been employed to explain the determination of exchange rates. We start with trade-flow approaches followed by modern asset models, recent approaches of exchange rate behaviour.

2.Trade flow approaches

Before the monetary approach emphasis of the 1970s, the predominant approach of exchange rates determination was the international trade flow approach (Husted & Melvin 2003). The Trade Flow approach emphasized the equilibrium value of the Balance of Payments as the main determinant of exchange rates (Vitale 2003). According to this view, countries with current account trade surpluses should have an appreciating currency, whereas the currency of countries with trade deficits should depreciate (Husted & Melvin 2003). The trade flow approach emphasized the trade of goods and services, whereas international capital flows were ignored. The main reason for ignoring capital flows, were the strict capital controls in place until the end of World War II (Van Marrewijk 2005).

The trade flow era can be divided in two distinctive approaches. The classical and the Keynesian approaches.

In the Pre World War I period, when international trade was based on the Gold Standard, and immediately after WWI, the classical paradigm was the predominant approach.

In the classical approach, national price levels were adjusted either through gold movements or through exchange rates adjustments depending on the exchange regime (Gehrels 1957). Equilibrium was achieved through gold movements and the price specie mechanism.

During World War I, the need of governments to fund the war lead to abandonment of the gold standard by most countries. The resulting inflation led to the development of Purchasing Power Parity theory by Cassel. However, in the 20s and 30s the old paradigms were strongly criticized. As a result, alternative approaches were proposed especially during the Keynesian revolution. Early Keynesian approaches were developed by Marshall, Harberger and Alexander focusing on the importance of import-export elasticities and the multiplier (Sarno & Taylor 2002).

2.1 The Classical Approach

2.1.1 Introduction

The dominant paradigm to economics and trade balances until the First World War was the Classical[15] paradigm. According to this view, the global economy is a self regulated system in which adjustment of national price levels and free flows of goods and inputs restore rapidly national balances of payments and equilibrium in the economic system. (Obstfeld 2000)

2.1.2 The Gold Standard period

Because of the fact that major countries, in the pre World War I era, were on the Gold Standard, Hume's price specie mechanism was used to explain how the balance of payment remains in equilibrium.

The fundamental underpinning of the price specie mechanism was the 'quantity of money' theory as developed by Hume in the 18th century and Riccardo in the beginning of the 19th

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[15] The term 'Classical' in this text is used in the similar way as it is used in Keynes (1936) 'General Theory' (i.e. including classical as well as neoclassical economics) and excluding economists whose theories confront with the classical views.

century. According to the quantity of money theory prices were depended on the quantity of money.

According to Willis (1896:418), 'Since the volume of commodities, in the world cannot be instantly increased or diminished, a change in the number of counters or pledges can have no influence upon commodities…change in the number of counters would directly result in an opposite change in the value of each counter or unit of money'.

In other words, when the quantity of money increases, prices were believed to increase as well, whereas when the quantity of money decreases, prices were believed to decrease. Hume developed the concept to the form in which it was commonly accepted and was the first to develop the concept of the money neutrality[16]. (Ekelund & Hebert 1990)

By integrating the quantity of money theory in international trade in Hume's price specie mechanism, the balance of payment equilibrium was explained as follows:

If one country had a balance of trade deficit, then the accompanying gold outflow[17] would reduce the quantity of money (because of the Gold Standard). Based on the 'quantity of money' theory, prices of domestic products would decline. As a result, it was assumed that

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[16] The concepts of 'money neutrality' and 'quantity of money' were developed mainly as a result of John Law's experiment. Law believed that an increase of money supply leads to wealth. However, when he increased the supply of money the system collapsed. That led Hume, Smith, and Ricardo etc to believe that the essence of the economy is its labour and its natural resources while money is just a mean of transactions. (Ekelund & Hebert 1990)

[17] During the 'Gold Standard' period most international settlement were conducted through gold payments

the country would experience an increase of exports and a decline of imports (i.e. domestic products more attractive) so that the trade balance gains again its equilibrium. (Viner 1930)

2.1.3 Purchasing Power Parity

Immediately after the First Wold War, when extensive inflation was observed, the Purchasing Power Parity theory (PPP) gained on popularity.

The term Purchasing Power Parity was introduced by the Swedish economist Gustav Cassel in 1918, although the origins of the underlying concept can be traced back in writings of the fifteenth century (Sarno & Taylor 2002), Cassel contributed significantly to its popularity (Ellis 1945). PPP has deep roots in the 'quantity of money' theory and did not confront with the classical approach.

According to Bernard & Dempsey (1935:180), 'One can scarcely be a purchasing power parity theorist without first being a rather thorogoing quantity theorist'. PPP theory basically added a tool to the classical approach in explaining exchange rate movements of inconvertible money.

According to Cassel (1918:413) :

'the rate of exchange between two countries is primarily determined by the quotient between the internal purchasing power against the goods of the money of each country. ... At every moment the real parity between two countries is represented by this quotient between the purchasing power of the money in the one country and the other. I propose to call this parity the purchasing power parity'

In other words, according to Cassel (1918), the exchange rate represents the difference of the internal purchasing power of money in different countries. If this is not the case the arbitrager's will buy goods from the cheaper country and sell them to the more expensive country so that the exchange rate adjusts. (Ternborgh 1926)

The theory of Purchasing Power Parity went through many revisions and modifications and was reworked by many economists (see Ternborgh 1926) as well as by Cassel himself (Angel 1925).

In it absolute form[18], PPP states that if prices are expressed in terms of one currency, then the same good should have the same price among all countries (Sarno & Taylor 2002). However, absolute PPP was criticized because of its restrictive assumptions. In its relative form, PPP states that the rate of change of the exchange rate between two currencies should equal the difference between the inflation rates of these two countries, relaxing some of the original assumptions. However, the more relaxed assumptions of relative PPP were criticized

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[18] Absolute form of PPP was the original concept as proposed by Gustav Cassel (1918).

as well. Terborgh (1926) asked the following question: 'May not the forces which maintain a certain divergence of absolute price levels under the original equilibrium condition so alter as time goes on that a different ratio of price levels becomes necessary to maintain for each country an even balance of payments?' and he concludes that 'there seems to be no reason why the forces which at any given time produce a certain pattern of price level relationship among different countries may not so alter as to require another pattern' (Terborgh 1926:201)

At the same time, many economists advocated the PPP approach. According to Machlup (1939), it was obvious that while changes in tastes and productivity affect exchange rates, large changes in inflation and price levels have a greater impact on exchange rates. 'nothing is more capable of altering supply and demand conditions and, thus, the exchange rate of a country, than inflation.' (Machlup 1939:396)

2.2 Alternative approaches to the balance of payment, the Keynesian revolution, and the introduction of capital flows

2.2.1 Introduction

During the interwar period, the classical approach could not explain the new economic phenomena, so that the Classical approach was loosing on importance (Obstfeld 2000).

Economic destabilizations and crises after World War I, triggered a series of alternative theories that attempted to explain exchange rates and balance of payment movements. Economist at that time had to deal with and to explain economic events such as the hyperinflation in Germany, the stock market crash in New York and the Great depression that followed.

Especially, the great depression influenced significant economic thought. According to Ayres (1946:112) 'the great depression has had many effects. But in the field of ideas no other is comparable to this one'. According to Ayres (1946) the rapid development of the Keynesian revolution coincides with events of the Great depression in such a way that its rapid growth and popularization would be unexplainable if the great depression is not taken into account.

 Thus, a few years after the WWI, the old paradigms were criticized and gradually replaced or complemented by Keynesian approaches to exchange rate determination. In the beginning the elasticities approach was developed by Marshall, Robinson and Lerner (Hirschman 1949) to investigate the effect of devaluation on the balance of payments. The Elasticities approach captures how supply and demand for foreign exchange and foreign goods is affected by exchange rate movements by examining the role of price elasticities, quotas, tariffs and foreign competition (Machlup 1939). Later, the foreign trade multiplier developed by Robinson, Salant, Metzler, Malchup and the absorption approach were introduced by Alexander (Gehrels 1957).

2.2.2 The introduction of capital flows

After decades of tight restrictions on international financial capital flows imposed by governments, restrictions which persisted at the start of the century progressively gave way to the liberalization of financial capital flows (Husted & Melvin 2003).

'One of the most dramatic developments in the post war period has been the increase of international investment and the growth of a truly translational system of financial intermediation.' (Kouri 1978:122)

One of the first to recognize and incorporate these developments in international financial markets was Ronald Mundell. According to Mundell (1963) 'the world is still a closed economy, but its regions and countries are becoming increasingly open….The international economic climate has changed in the direction of financial integration and this has important implications for economic policy.' (Mundell 1963:445)

The model developed by Mundell in 1963 and Fleming in 1962 is based on the idea that the output level depends on demand changes and that the interest rate responds to asset market changes and imbalances.

There are different versions of the Mundell - Flemming model that account for small and large economies as well as fixed and flexible exchange rates. For simplicity, only the base

line model will be illustrated in this chapter. The base line model assumes a small open economy with fixed prices and interest rates that are determined by international interest rates, that is, the interest rate of the small economy cannot influence world interest rates.

The base line model, in its floating exchange rate version, suggests that an increase in a country's money supply would cause a depreciation of the currency. The reasoning is as follows: An increase in money supply[19] causes downward pressure on interest rates with the result that capital outflows will cause the exchange rate to depreciate. The depreciated currency will help to improve the trade balance so that income rises and with increased income the community will hold the additional money so that equilibrium is regained and capital outflows come to an end. On the other hand, an expansionary fiscal policy causes the exchange rate to appreciate. The reasoning is that by issuing bonds to fund the increased amount of government spending this would increase interest rates causing capital inflows that appreciate the currency. (Mundell 1963)

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[19] Increase of money supply by purchasing securities by the central banks will increase bank's reserves and as a result put downward pressure on interest rates (Mundell 1963)

3. Modern Asset models and rational expectations

'The asset market theory of exchange rates recognizes that exchange rates are relative prices of assets determined in organized markets where prices can be adjusted on a moment-to-moment basis to whatever "the market" regards as currently appropriate price' (Frankel and Mussa 1980:375)

In order to explain the volatility that was observed after the introduction of floating exchange rates economists moved away from flow analysis to asset model. The difference between flow approaches and asset approaches can be explained as follows. In trade flow approaches, price is a function of supply and demand which changes because of changes in taste, income etc and changes of technology. Most importantly, in trade flow approaches, large price changes cannot be explained without significant trade volumes (Halwood & MacDonald 2000).

On the other hand, in asset models, prices change because the market changes its perception with regard to the value of an asset. The change of the perceived value is caused in by the arrival of new information related to the asset. The two most important implications of the asset approach are that expectations of future exchange rates play an important role and that markets are considered to be efficient (Halwood & MacDonald 2000). The main asset models are the Flexible Price Monetary Approach, the sticky Monetary Approach (Dornbusch model), and the Portfolio Balance Approach.

3.1 Flexible Price Monetary Approach (FPMA)

The FPMA suggests that the exchange rate is a function of relative money supply. In FPMA, rational expectation and accuracy of market information play an important role (Hoontrakul 1999). A basic hypothesis of FPMA is the perfect capital substitutability, which according to the monetary approach means that domestic and foreign bonds are equivalent and can be excluded from the analysis (Vitale 2003). According to FPMA bond holders do not require a premium to hold foreign bonds and uncovered interest rate parity[20] holds in FPMA models (Husted & Melvin 2003). The FPMA also assumes perfectly flexible prices such that Purchasing Power Parity holds at all time (Vitale 2003). As such FPMA can be described as an extension of PPP.

An increase in money supply leads to depreciation through increased price levels and PPP whereas an increase of money demand leads to appreciation. For example, increased income will inflate the demand for anything so that the demand for money also increases. Introducing expectations into the model has the following implications. If, for example, an increase of money supply is perceived as temporary, then the exchange rate will be little affected. On the other hand, if it is expected that money supply increases further, then the exchange rate will depreciate even more than the initial increase of money supply. An implication is that

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[20] **Uncovered Interest Rate Parity (UCIRP):** the belief that the difference between the expected future exchange rate and the current spot exchange rate is equal to the interest rate spread between two assets with different currency denominations. UCIRP is based on **Fisher Open Hypothesis** popularized by Irving Fisher (1867-1947) that real interest rates should be equal for all currencies. (Hoontrakul 1999)

unpredictable of monetary policy leads to unstable exchange rates and excess volatility. (Halwood & MacDonald 2000)

However, according to Shafer et.al. (1983), by 1975 it was becoming clear that purchasing power parity was not well maintained and that changes over time in real exchange rates were greater than those under fixed rates.

3.2 Sticky Price Monetary Model (Dornbusch model)

Although the flexible price assumption was the predominant approach in the early 1970s, its poor empirical results led to the development of the sticky price model (Sarno 2002). The Keynesian assumption of price stickiness which was abandoned during the beginning of 1970s inflationary environment was revived again (Shafer 1983). If goods prices are not perfectly flexible (i.e. they are sticky) then Purchasing Power Parity holds only in the long-run (Vitale 2003). The 'overshooting' model was originally developed in 1976 by Dornbusch and considers prices to be fixed in short run, similar to Keynes's rigid price assumption. In this case, the interest rate becomes the main variable in the model and the assumption of PPP is relaxed. As a result, according to the Sticky price model, PPP holds only in the long term while Interest Parity holds at all the time (Hoontrakul 1999).

Dornbusch (1976) attempted in his article to merge rational expectations with the large volatility that was observed and described a macroeconomic model that could explain the observed volatility but was consistent with rational expectations. The Dorbusch model can be summarized as follows: Following a monetary expansion, the increase of the nominal

quantity of money leads to disequilibrium at the initial exchange rate and good prices. Assuming sticky prices, the interest rate will fall[21] and because of reduced interest rates, the exchange rate is expected to depreciate. The reduced interest rate and the anticipation of a depreciating currency lead to a reduced attractiveness of domestic assets. Hence, leading to a capital outflow and finally to a depreciation of the currency. The extent of depreciation of the currency has to be enough so that an appreciation of the currency is expected and uncovered interest parity holds (i.e. appreciation is equal to interest differentials). (Dornbusch 1976)

However empirical evidence shows that the practical applicability of the 'overshooting model is limited. For example, Backus (1984) finds large deviations in his study when testing the model.

3.3 Portfolio Balance Approach (PBA)

The developed of the PBA is mainly attributed to Branson 1968, McKinnon 1969, Dornbush 1980 and Kouri 1976. The main element of PBA and the main difference, to the above mentioned models, is that this approach considers assets as being imperfectly (thus accounting for the empirical failure of UIP) substitutable and that exchange rates are determined by relative supplies of domestic and foreign bonds as well as domestic and foreign money. An important contribution of theory arises out of the assumption of the imperfect substitutability of assets. With imperfect substitutability investors have preferences for distributing their portfolio over the assets of different countries and require different

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[21] Money demand is a function of income and interest rates. Because income and prices are observed to remain unaltered immediately after a monetary expansion, the factor that has to increase money demand is interest rate.

premiums to be paid on assets of different countries. As a result, in contrast to the monetarist approach, uncovered Interest Rate Parity will not hold because risk premiums will exist in the market. (Hoontrakul 1999)

The PBA model investigates the relationship between wealth, asset supply and exchange rates and a basic assumption of PBA is that money demand does not only depend on income but also on wealth. A shift in wealth caused by a current account surplus increases money demand, reduces prices, and appreciates the currency. On the other hand, an unanticipated increase of supply of bonds because of a budget deficit, will result in a depreciation of the currency[22] (Dorbusch et al 1980).

Although Dornbusch et al (1980) employed PBM to explain the Deutsche Mark appreciation, this model finds little empirical evidence to support it. For example, according to Boughton (1984), forecasting performance through PBA is only slightly better than the random walk model.

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[22] Assuming domestic bonds and money are closer substitutes compared to domestic bonds and foreign bonds.

4.   *Recent Developments in Exchange rate Theory*

After the seminal paper by Meese & Rogoff (1983), evidence showing the difficulties of explaining exchange rates using economic fundamentals has accumulated (Cheung & Wong 2000). As a result, a series of alternative theories of exchange rate determination that attempt to contribute to the understanding of exchange rate movements have been developed over the last years. The new approaches can be divided in two main categories: those that assume rational behaviour of agents and consistent with rational expectations hypothesis and those acknowledging the existence of non rational or bounded rational participants. The failure of fundamentals was one of the main causes that encouraged the development of microstructure approaches to exchange rates (Sarno & Taylor 2001). Furthermore, other social sciences such as psychology have been incorporated into economics to give additional insights to exchange rate behaviour. Finally, the new open economy macroeconomic approach attempts to eliminate the shortcoming of previous macroeconomic models by introducing specific micro foundations in a macroeconomic model.

4.1 Microstructure Economics

The interest in the foreign exchange microstructure grew significantly over the last years given the limited empirical success of standard macroeconomic exchange rate models. (Cheung & Wong 2000)

The new micro approach to exchange rates is a new model that is based on microeconomics and in particular on microstructure finance. The main element, that distinguishes this approach from the other approaches mentioned above, is that it relaxes three basic assumptions of mainstream economics. Microstructure approaches are separated from asset and rational expectations approaches by acknowledging a) the existence of dispersed information (i.e. information that is not available to all participants), b) the heterogeneity of market participants and c) the significant role of institutions (e.g. trade mechanisms) in the foreign exchange market. (Lyons 2001)

Macroeconomic models consider as unimportant the process of trading in the foreign exchange market. On the other hand, the micro approach considers the process of trading as a part of the procedure by which the relevant information determines the exchange rate. (Evans 2005b)

According to Evans (2005) the two main ideas behind the micro approach are:

a) The spot exchange rate determined by dealers at a point in time. However, individual dealers do not quote prices based on their own private information because of the fear of arbitrage. (Evans 2005)

b) Because dealers use their private information to initiate trades with other dealers, they provide them with information. In other words, dealers acquire information through the orders they receive from other dealers. (Evans 2005)

The microstructure approach literature and research is mainly concerned with issues such as the implications of order flow and the transmission of information between market participants (Sanro 2002), and the implications of the heterogeneity of agent's expectation on exchange rate volatility and foreign exchange trade volume.(Sarno & Taylor 2001)

According to Evans (2005) recent theoretical work on exchange rates emphasises the importance of heterogeneity among agents. Traditional models assume that agents differ in the same way (i.e. symmetrical). However, according to Evans and Lyons (2005), traders in the foreign exchange (FX) market are rather different. They have different motivations, different degrees of risk aversion, and different investment horizons. (Evans and Lyons 2005)

The hallmark of the microstructure approach is the study of order flow as a determinant of exchange rates (Lyons 2000). In the study of order flows a fundamentally different approach to exchange rates movements has been applied. (Evans and Lyons 2002)

In microstructure studies, order flow is defined according to their direction of the trade with the reference point being initiator of the transaction. For example, when a participants takes the initiative to contact another market participant (e.g. a dealer) to buy USDs, this transaction is recorded a buying order for the USD. Even though there is a seller and a buyer in each transaction, the transaction for a particular currency is recorded as a buying or a

selling order depending on whether the 'initiator' of the transaction bought or sold this particular currency.

In asset models, order flow has no role (Lyons 2001). As it has been explained in section 3, asset models price assets according to the expectations of the participants. There is no trade needed to alter the price of an asset.

However, the models that are used in microstructure approaches include order flow as a medium that conveys information, instead of using only macroeconomic determinants. According to study results, order flows explain the majority of exchange rate fluctuations. (Evans and Lyons 2002)

According to Evans (2005), quotes may be adjusted by dealers according to new public information through announcements as well as based on orders they receive from customers and/or other dealers. Through order flow, dispersed information concerning the economy affect dealer quotes and hence the exchange rate. (Evans 2005)

According to Evans and Lyons (2002), order flows explain about 60 per cent of DM/USD daily changes and about 40% Yen/USD changes.

4.2 Behavioural Finance

In the 1990s, part of the focus of academic literature shifted away from econometric analysis and started developing models of human psychology and adapting them to financial markets. (Shiller 2002).

According to Thaler (2000:79):

"Economics can be distinguished from other social science by the belief that most (all?) behaviour can be explained by assuming that agents have stable, well-defined preferences and make rational choices consistent with those preferences in markets that eventually clear"

The behavioural finance approach is attempting to explain exchange movements and in particular anomalies in exchange rate behaviour. Anomalies are classified as difficult to rationalize empirical results of investor's behaviour (Frankel & Froot 1990). According to Barber and Odean (1999), the essence of behavioural finance is to relax traditional assumptions of financial economics by incorporating systematic human divergence from rationality into theories of economics and finance.

Economists explain anomalies in financial markets usually by assuming changing risk premiums. On the other hand, studies of behavioural finance literature reject the above

assumption in many instances and support the view that such anomalies are due to market inefficiencies. (Frankel & Froot 1990)

The efficient markets theory reached its height in the 1970s (Shiller 2002). Economists argued for decades about the "Homo Economicus", in other words an absolute logical agent, who is always able to make the most rational financial choice (AMP 1999).

However, the assumption that individual agents have the ability to store all the knowledge and to process all available information is unrealistic. According to De Grauwe et al (2005), it seems unreasonable to assume that an individual brain is capable to master the complex way the world works.

According to Shiller (2002), the most well known anomaly that is observed in foreign exchange markets is that of excess volatility. Excess volatility appears scarcely to have been explained by mainstream economists. The anomaly of excess volatility is a much more important problem for Efficient Market Hypothesis than other financial anomalies. As a result, according to many academics the efficient market hypothesis would be called into question if most of the volatility in financial markets remains unexplained. According to the behavioural finance approach, the phenomenon of excess volatility seems to indicate that changes in prices occur not because of changing fundamental, but because of causes such as 'animal spirits', mass psychology, etc. (Shiller 2002)

According to behavioural finance theory biases that affect investor's decisions are:

➢ Prospect theory: Prospect theory refers to the observation that peoples' attitude towards risk is not the same in the case of losses and gains, while extremely improbable events are treated as if they are impossible and extremely probable events as if they are certain. In other words, people underestimate small probabilities. According to Shiller (1997), Prospect theory had more impact than any other behavioural theory thus it explained the failure of expected utility theory to predict human behaviour. Prospect has been employed by Frydman et al (2009), to explain deviations from PPP.

➢ Disposition effect: The disposition effect refers to the phenomenon that investors are quick to sell past winners while they hold on past losers. One possible explanation could be presented by the Regret Theory (i.e. Regret and Cognitive Dissonance). Regret and Cognitive Dissonance refers to investors' tendency to feel the pain of regret when they make errors. Regret theory may be interpreted as implying that investors avoid selling assets that have gone down in order not to finalize the error they have made and not to feel the regret. According to the traditional model the present price of an asset shouldn't affect the investors' decision to sell it (AMP 1999). They sell assets that have gone up in order to not regret failing to do so before the asset later falls, if it falls (Shiller 1997).

However, according to Oconnell (2003), there is no evidence of the disposition effect in the foreign exchange. In contrast to equity markets, there is a strong tendency of sell losers so the loss is limited in the foreign exchange market.

➢ Herding behaviour: herding behaviour is the phenomenon of following the trend. According to Frankel (1986), has often been observed in the foreign exchange market.

➢ Overreaction and underreaction: The evidence about whether exchange rates overreact or underreact in a systematic way is controversial. Larson & Madura (2001) studied exchange rates changes following extreme 1-day fluctuations for currencies in industrialized and emerging markets. Fluctuations were classified into two groups according to whether they were caused by political or economical events. The result showed that currencies overreact in emerging markets and underreact for currencies in industrial markets. Moreover, according to Larson & Madura (2001), there is evidence that fluctuation after political events tend stronger toward overreaction than fluctuations that are caused by economic events. According to Larson & Madura (2001), the results suggest that undefined events (e.g. political events) are associated with uncertainty and result in overreaction.(Larson & Madura 2001)

However, there are arguments in opposition to the Behavioural Finance approach. For example, Fama (1998) outlines two basic pitfalls. First, they argue that the anomalies that

were discovered tended to be in the same extent underreaction as overreaction and second that the anomalies tended to disappear with time or as methodology of the studies changed.

4.3 New Open Economy Macroeconomics

After the publication of the Redux model by Obsteld and Rogoff in 1995, a group of academics and researchers are working on a new approach on foreign exchange rates. The common element of the new models is the introduction of nominal rigidities and market imperfections in a macroeconomic model with specified microfoundations. (Lane 2001)

According to Obstfeld, 'the most recent synthesis of earlier approaches combines monopolistic procedures with nominal rigidities in a dynamic context with forward-looking economic actors'. (Obstfeld 2001:21)

Monopolistic competition is a common microfoundation that is incorporated to analyze price setting behaviours in an open economy (Bergin 2001). The new open economy macroeconomics literature focuses on shocks to money supply, and demonstrates how such shocks can explain fluctuations in the current account and exchange rate (Bergin 2001).

The original model of this approach is the Redux model. The Redux baseline model as illustrated by Obstfeld and Rogoff (1995) is a two country model that allows for nominal price rigidity and imperfect competition. (Sarno 2002)

The baseline Redux model can be described as follows: If money supply increases, then interest rates will fall and the exchange rate will depreciate, with prices being sticky in the short run. As a result, demand for domestic goods will increase and cause output to increase. Output is going to increase even with prices being fixed as monopolistic firms always price above marginal cost. The result is that world demand shifts towards domestic goods and creates a current account surplus as well as an increase of income. The current account surplus leads to an increased holding of foreign assets domestic residents. In turn, home residents experiencing higher wealth, shift from work to leisure and reduce output. (Lane 2001)

However, after the fundamental work of Obstfeld and Rogoff (1995), a series of modifications have been introduced in the original model, extending the theory in different directions. These modifications refer mainly to new microfoundations that have been introduced. Some of the most important microfoundations are illustrated below:

➢ Sticky Wages: while prices are sticky some academics argue that wages should be considered as sticky as well (Lane 1999).

- ➤ Staggering: price stickiness causes prices to jump in large steps. Introducing staggering is a alternative way (compared to smooth adjustment) to introduce sticky prices (Lane 1999)

- ➤ Pricing to market: a modification that assumes that firms establish different prices in home and foreign market (Lane 1999).

- ➤ Consumption preferences: although according to the original Redux model there is no distinction between preference in consumption of home and foreign produced goods, other studies introduce preferences in consumption between home and foreign produced goods (Lane 1999).

- ➤ Capital: according to some academics adding capital to the analysis is important as reduced interest rates caused by monetary shocks could initiate an increase of investments. (Lane 1999)

Other modifications include the analysis of financial market structure, international policy interdependence, uncertainty, and market structure (Lane 1999)

According to Bergin (2001) empirical results are supportive in general for the New Open Economy approach in forecasting some macroeconomic variables such as output and price levels, but the evidence is very poor when it comes to forecast nominal and real exchange rates. (Bergin 2001)

4.4 Bubbles: Noise Traders and Rational Bubbles

An approach explaining the presence of bubbles in the foreign exchange market in particular is the noise trader approach. According to Menkhoff (1998) the noise trading approach is the most significant alternative to the efficient market hypothesis.

According to Frankel and Froot (1986), the bubble that emerged from 1981-85[23] was caused by the market shifting weight from fundamental to technical analysis, because fundamentals performed poorly at this period. After the publication of this article a series of models that illustrated how nonfoundamendal traders are causing bubbles emerged(e.g. De long et.al.1989) (Sarno 2001). In 1990, Andrei Shleifer and Lawrence Summers presented a simpler non-technical version of the above models and developed an intuitively convincing understanding of the noise trading approach. (Menkhoff 1998).

According to Frankel and Froot (1990:183) 'it has long been remarked that if there exist traders who tend to forecast by extrapolating recent trends (i.e., who have "bandwagon expectations"), then their actions can exacerbate swings in the exchange rate'.

 The unifying characteristic of those models is that they consider at least two kinds of traders with different forecasts (Sarno 2001). More specific, fully-rational arbitrageurs and not-fully-rational noise traders. (Menkhoff 1998).

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[23] There was a strong dollar appreciation during this period

The reason behind noise trading is that some investors have beliefs that are not fully in alignment with fundamental news (Menkhoff 1998). According to de Long et al (1989), there is considerable evidence that investors don't follow the rules suggested by economists.

Moreover, according to Grimaldi & De Grauwe (2003), the fact that some traders have beliefs that rely on technical analysis does not makes them irrational, thus plenty of evidence suggests the profitability of technical analysis. According to Grimaldi & De Grauwe (2003), they just acknowledge the fact that they are not able to deal with the complexity of all available information. Technical indicators may provide market participants with signals regarding market sentiment and liquidity (trading volume indicators).

The results of noise trader models suggest that steady evolution is interrupted by bubbles. (Sarno 2001). The main restriction limiting the effectiveness of arbitrage (so that bubbles are avoided) is derived from the short horizons of arbitrageurs (Menkhoff 1998). According to noise trader models, bubbles are created because short term rational investors carry the risk that they have to liquidate their position when noise traders have pushed exchange rates further away from fundamentals than it was initial the case (De Long et al 1989). Moreover, investors' arbitrage ability is restricted even if they have infinite investment horizons because of risk aversion (De Long et al 1989). As a result, prices can diverge significantly from fundamental values even in the absence of fundamental risk (De Long et al 1989).

According to Mark & Wu (1998), there is promising evidence that noise trader models provide explanation of forward discount bias in the foreign exchange market.

4.5 Non Linear models

The limited success of models assuming a linear relationship between exchange rates and fundamentals led to the employment of nonlinear models (for example: Taylor et al l (2001), Altavilla and De Grauwe (2005), Sarno, et al (2004), Bec et al (2010). According to Altavilla & De Grauwe (2010), the literature examining the nonlinear relationship between exchange rates and fundamentals shows promising results.

Nonlinear models have been increasingly employed to examine Purchasing power parity theory. According to Lo & Morley (2010), researchers employ nonlinear models to investigate PPP and to explore the possibility that deviation from the theory have arisen due model misspecifications.

According to Lo and Morley (2011:1), "Specifically, linear time series models restrict the degree of adjustment of real exchange rates to their PPP levels to be the same at all points of time. However, basic theory suggests that transaction costs can affect when PPP is effective and when it is not. Hence, nonlinear models that allow for regime-switching behaviour in real exchange rates may be more appropriate to study PPP"

Lo & Morley (2010) investigate whether real exchange rates of G7 countries exhibit a nonlinear behaviour. The findings of the study suggest that even though nonlinearity is supported for most currency pairs this is not always the case.

According to Altavilla & De Grauwe 2010,empirical evidence suggest that whereas linear models dominate in the short run, non linear models outperform them in the long term and in cases where deviations from equilibrium are large.

Lo (2008), compares the predictive performance of linear and non linear models in modelling deviations from PPP. The study suggests that that nonlinear dynamics are indeed supported by empirical evidence.

Beckman (2011) explores the role of prices and nominal exchange rates in the nonlinear behaviour of real exchange rates. The results suggest that that nominal exchange rate movements cause real exchange rates to convert nonlinearly to PPP and that the half life of real exchange rate shocks are shorter than previously believed.

According to Normany (2009), empirical data provides sufficient evidence to suggest that non linear models may indeed provide a solution to the PPP puzzle. According to these findings, half lives of real exchange rates towards PPP are short enough when measured with nonlinear models to suggest a resolution to the puzzle.

5. Conclusion

During the last century, a diverse range of approaches have been employed in order to explain exchange rate fluctuations. Exchange rates theory evolved gradually from the trade flow centric approaches to modern asset models, where rational expectations about of fundamentals play the central role. However, over the last few decades assuming rationality of market participants has been criticized (see behavioural finance, noise trader models).
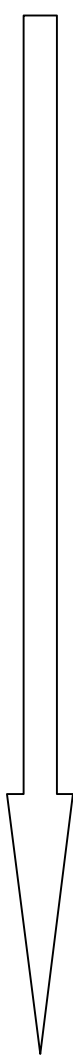
However, most of those attempts have not been successful in explaining exchange rate fluctuations. According to studies of Meese and Rogoff (1983), Frankel, 1984; Frankel and Rose (1995), Boughton, 1987, Cheung et al (2002) no model is successful in explaining exchange rates movements in the short or medium term and according to Sager & Taylor (2006:81), 'the quality of shorter-term exchange rate models and forecasts continues to be an occupational hazard of the international financial economist'

Though macro analysis was the workhorse of foreign exchange research, in recent years there has been a considerable shift to micro analysis and the exploration of behavioural patterns of market participants. Micro-foundations are increasingly incorporated in exchange rate theory, while microstructure analysis contributed significantly to the understanding of short term exchange rate behaviour. During the last years, after data of actual trades has been made available, the behaviour of foreign exchange dealers has been investigated (see table 1. for an illustration of each theory's contribution to the evolution of exchange rate theory) . Although

such research is still limited, due to limited availability of data, it provides some insight in trading strategies applied by dealers. Moreover, the evidence shown in this chapter I suggests that market practitioners such as central banks, commercial & investment banks, investment funds etc have a significant impact on exchange rates. However, studies on behavioural aspects of market practitioners that cannot be revealed by examining order flows are still rare, especially for practitioners other than market makers

In addition, our presentation of the features of foreign exchange market in chapter I revealed a strong in market share of market participants not classified as 'dealers' (note: In 2007 the market share financial institutions surpassed the share of inter dealer trading). However, current research focuses mainly on quantifiable behavioural aspect of dealers. While findings derived from the few studies employing dealers' views have been illustrated in section 7.1.3 (Chapter I), we believe that there is significant scope for the utilisation of narratives. By investigating the prevailing paradigm of a wide range of market practitioners (i.e. not only dealers), current norms, rules, strategies, and practices can be examined, revealing novel insights of the underlying mechanisms of exchange rate determination.

Table 1.

TIME	**Trade flow approaches** *The Classical Approach* *Purchasing Power Parity* *Keynesian revolution*
	Introduction of capital flows *Mundell and Fleming model*
	Modern Asset models: From flows to stocks, the introduction of rational expectations *Monetary models*
	Relaxing assumptions *Sticky Price Monetary Model (relaxing the assumption of flexible prices)* *Portfolio Balance Approach (PBA) (relaxing the assumption of perfect asset substitutability)*
	Introduction of non rational behaviour *Behavioural Finance* *Noise Trader approaches*
	Introduction of market imperfections *New Open Economy Macroeconomics*
	Introduction of detailed FOREX market structure characteristics *Microstructure Economics*
	Introduction of complex exchange rate behaviour *Non Linear models*

Chapter III

Methodology

"Methodology systematizes man's curiosity"

Cadwell (1982:2)

1. <u>Introduction</u>

According to Blaug (1980:266) Economic methodology 'is that branch of economics where we examine the ways in which economists justify their theories and the reasons they offer for preferring one theory over another; methodology is both a descriptive discipline – this is what most economist do – and a prescriptive one – this is what most economists should do to advance economics'

In line with the above quote the purpose of this chapter is to illustrate the methodological approach followed in this thesis as well as to justify the use of the employed methods.

This chapter is structured into a number of sections the first of which reviews the main historical developments of economics and economic methodology. Following on from this review we investigate aspects of economic methodology which are subject to critique and present a response. We then turn to illustrate different epistemological and methodological approaches and present the justification for the chosen approach of this thesis. Finally, we present in detail the method we use in order to achieve our research objectives.

2. Methodology employed in Economics

In this section the early history of economics as a science and economic methodology will be reviewed.

2.1 Early development of Economics

Although economic related issues were investigated since ancient times (for example Xenophon, Aristotle), it was not until the 18th century that economics became an independent discipline.

According to Alvey (1999:53) 'the "scientification" of economics … has led to a separation of economics from its ethical roots. The "mainstream economics" of the twentieth century fully accepts this separation. Economic theory is seen as a positive science which has to analyse and to explain the mechanisms of economic processes…. Important as ethical valuations ("ought"-statements) may be, they should not form part of the economist's research programme.'

The separation of economics from its ethical roots occurred because of a professionalisation of economics and the use of methods employed in natural science. Consequently, economics

became detached from moral science and became more of a technical science. A major milestone in the distinction of economics from moral philosophy were the contributions of Adam Smith and Ricardo who established economics as a separate science. (Alvey 1999)

According to Ricardo, 'It is not the province of the Political Economist to advise: He is to tell you how to become rich, but he is not to advise you to prefer riches to indolence, or indolence to riches.' (Alvey 1999:59)

Consequently economics evolved from a normative discipline accounting to a positivistic approach excluding moral issues and relying on the principles of deductive logic in line with other hard sciences where moral issues have no place.

2.2 The methodology of economics

Economics has been influenced by all major developments in the philosophy of science (Boylan & O'Gorman 1995).

According to Hausman (1989), up to the 30s deductivism was the main method used by economists, which was a continuation of the methodology proposed by John Stuart Mill. At that time dominant methodological viewpoint was based on methodological individualism, as

well as the self evident nature of the basic assumptions that formed the base of economic theory (Cadwell 1982:99).

According to Boylan & O'Gorman 1995, John Stuart Mill believed that since the world is complex and a variety of factors influence economic outcomes, experimentation is impossible. Furthermore, inductive methods should be used only as a first step to establish first laws (for example, psychological laws). As a result, economics should follow deductive methods. Moreover, John Stuart Mill believed that there are no universal laws in economics but only tendencies. Because these tendencies are subject to many random factors the implications that are predicted by laws will not always be realized. (Boylan & O'Gorman 1995)

Although neoclassical economics brought significant changes in economic theory, there was some continuation in respect of methodology used. In both approaches the empirical failure of economic premises does not call them into question. (Boylan & O'Gorman 1995)

However, the deductive method as applied was strongly criticized when logical positivism was introduced in economics in the 30s by Terence Hutchison. (Cadwell 1982)

Positivism, was the predominant epistemological theory of the 19th century in a variety of sciences (biology, ethics, medicine etc) (Boylan & O'Gorman 1995), where empirical verification was a central element (Katouzian 1980)[24].

According to Boylan & O'Gorman (1995), Hutchison argued that theoretical economics have no testable implications and that theory should be confirmed by empirical data. Moreover, he criticized economics for excessive use of ceteris paribus clauses and the reduction of complex situations to simplified cases by successive approximations. (Boylan & O'Gorman 1995)

According to Katouzian, Hutchison 'attacked the armchair theorising and advocated the use of statistical evidence' (Katouzian 1980:42)

A response to this critique, was a period of intense empirical research attempting to test fundamental economic proposition of neoclassical economics (Boylan & O'Gorman 1995). In addition, government administrators and economists began to collect economic data (Katouzian 1980).

In 1953, Friedman's work "The Methodology of Positive Economics" was published and changed the prevailing paradigm regarding the importance and the role of empirical verification.

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[24] In contrast to self evident assumptions which were mainly employed until then.

"The Methodology of Positive Economics" by Friedman (1953), is considered to be the most influential work in economic methodology. In contrast to Hutchison, Friedman suggested that not all parts of a theory should be confirmed by empirical data. He suggested that the realism of a theory's assumptions is irrelevant. On the contrary, a theory should be judged based on the predictive power for the kind of phenomenon for which the theory has been designed. According to Friedman the validity of a theory is not a function of the realism of its assumptions but solely a function of the frequency that its predictions are confirmed by empirical data. (Rotwein 1959)

According to Friedman (1953), the confusing role of assumption has caused significant damage on the development of economics. According to Friedman (1953), any theory asserts that some factors are not important in order to understand a phenomenon. Therefore theories are presented *'as if'* they explain within the context of a simplified world and assumptions that do not affect the predictive outcomes have to be chosen, since, according to Friedman, assumption cannot be tested whereas predictions can. For instance, it is not important for a theory that assumes perfect market competition whether a market is perfectly competitive, as long as firms behave 'as if' there is perfect competition, so that the predictions of the theory are confirmed by empirical evidence. According to Friedman (1953), complete realism is unachievable, and a theory can only be evaluated based on its predications. In other words, a theory is realistic enough if it produces satisfactory predictions or predictions better than alternative theories. (Friedman 1953)

In contrast to the significant development in economic methodology of the 30s and 50s the following decades were not characterized by such developments. According to Boland

(1982), since the 60s economic methodology was more of interest for philosopher of science than for economist.

The development that characterized the 60s was the rapid expansion of quantitative methods. Until the 60s only few universities offered a major in quantitative methods. However, since 1965, all graduates of economics are expected to be proficient in econometrics. (Schachter 1973)

2.3 The methodology of Mainstream Economics

After illustrating the major evolutionary steps in economic methodology we turn now to examine the predominant approach of mainstream economics.

According to Lawson (1997) mainstream neoclassical economics is positivist. According to Jo (2004), mainstream neoclassical economics is mainly based on positivist and empiricist philosophy. As such neoclassical economics examines phenomena assuming that the world consists of atomistic events while individual facts exist only when they are perceived by senses.

Atomistic events refers to the view that the society consists of interactions by individuals based on their own economic interest. In other words, society is seen as the sum of individuals and individuals are characterized by hedonistic behaviour (i.e. homo economicus). According to Jo (2004), this is reflected in the economic rationality assumption which is commonly taken by neoclassical economists. In neoclassical economics both inductive and deductive methods are widely used. (Jo2004)

Moreover, because, as positivists, neoclassical economists consider as reality only events that are observed without value judgments, quantitative data is used because it is considered to represent the real world. (Jo 2004)

However, according to Walters & Young (2001), economics do not follow only positivist approaches, as many fundamental principles are established by introspection, which is not consistent with positivism, and there is no particular view on significance of observations. However, Walters & Young agree with the previous argument to the extent that 'Neoclassical economics is often identified with a particular method of analysing problems in terms of rational agents. ' (Walters and Young 2001:490)

The tendency of neoclassical economics to analyse phenomena based on the assumption of individual rational agents is evident in the methodology of exchange rate economics. The author, the methodology of exchange rate economics can be best described as a positivist approach where the relation of economic variables is studied by assuming the presence of rational agents.

However, over time aspects of methodological approaches changed. For instance, the extent of idealistic assumptions has been reduced. New macroeconomics incorporate increasingly realistic microfoundations (for example, pricing to market), while microstructure studies acknowledge the presence of dispersed information and heterogeneity of agents.

3. The Critique

In recent decades, mainstream economics has been strongly criticized.

According to Lawson (1997:3)

'Contemporary academic economics is not in a healthy state…This unhappy situation, moreover appears to be increasingly recognized both inside and outside of the academy'

The 60s was the decade where positivist economics reached its peak, however in the 70 these approaches have been questioned and critically engaged. According to Leontief (1971), the obsession with hypothetical imaginary reality, instead of observable reality, as if theorizing, lower rated empirical analysis compared to mathematical reasoning, and uninvestigated

assumption about economic agent behaviour, caused a crisis in economic science. (Blaug 1987)

In particular, the central role of formal mathematical analysis and simplified assumptions such as that of rational expectations has been strongly criticized.

This section illustrates the main elements of economic methodology which are often subject to critique. First, arguments against excessive formal modeling will be illustrated. We turn then to issues regarding the use of simplified and idealized assumption before presenting argument regarding the use of qualitative data. Finally we present our respond to the above issues.

3.1 Formal modeling

The excessive adoption of formal techniques of analysis is one of the main points of critiques to mainstream economic practice.

Formal techniques of analysis gained on popularity in the 1930s, when mathematical economists caught the imagination of policy makers and theorists and gradually replaced less rigorous techniques. (Hodgson 1998)

Even thought the use of empirical models was still very limited, the formal approach adopted by some scholars has been not without criticism.

For example, Keynes general theory was considered to contain considerable mathematical work, in which macroeconomic relationships were simplified so that a fairly mathematical model could be created (for example, IS-LM model, Hicks 1937). (Backhouse 1995)

Especially the tendency to simplify cause effect relationships, and to ignore the complexity of these relationships in a real word context was seen as a misleading practice.

Schumpeter criticized Keynes for simplification and 'the habit of piling a heavy load of practical conclusion upon a tenuous groundwork, which was unequal to it yet seemed in its simplicity not only attractive but also convincing' (Schumpeter 1954:1171)

Although mathematical formalism is seen by many scholars as an essential element for the progress of economic science (e.g. Krugman 1998) other emphasize the limitations of such an approach (e.g.Backhouse 1998).

Critical realism takes a critical stance on the use of formal (mostly mathematical) modelling in economics. The main critique of critical realists on positivism is that constant conjunctions

of events such as whenever x then y depend upon closure conditions (conditions typically found under experimental control). However, it is argued, that the social world is a open system where closure conditions do not exist.

According to Wilson 'In this vein, critical realists claim that the mathematical methods of analysis used in mainstream economics are closed system methods, which presuppose a ubiquity of social closures, whereas, in reality, such closures do not appear to exist.' Wilson (2005:220)

In contrast to neoclassical economics, most heterodox approaches view the economy as an open system that is difficult to be modelled so that more pluralistic methodological approaches are applied.

According to Dow (2000), the pluralism of heterodox economics arises from an understanding of the nature of the economy as an open system. If the economy is viewed as an open system no model is considered to be able to capture the complexity of an open system. Some parts of the reality may be able to be captured by a model contributing to our understanding. However those segments are only parts of the whole, so that the model should be supplemented by additional methods, 'our understanding derived from the model may usefully be supplemented by knowledge arrived at using additional methods.' (Dow 2000:162)

Although most scholars acknowledge that some level of abstraction is an essential element to theory building, the extensive degree at which mainstream scholars abstract from the real world is seen by some as counterproductive.

According to Hodgson (1998), a degree of abstraction and simplification is needed to deal with the complexity of the real world; however it is possible to highlight some key processes. For instance, the theory of price formation can be formulated by studying the specific procedure of different institution and creating theories relevant to each type of institutions. All aspects of institutions that are relevant to price formation have to be investigated (for example, what routines used for price calculation, what are the strategies regarding competitive strategy, what information is available, what routines govern the acquisition of information and how those relate to market structure). (Hodgson 1998)

According to Lawson (1997), though all models are by definition abstract, the abstraction must be concerned not with idealized but with real processes.

Another point of criticism is the tendency of economists to ignore qualitative factors shaping behaviour and causing casual relationships to brake down.

According to Lawson, positivism by presuming that observations can be described by quantitative relationships directed economists to ignore issues relevant to economic agents behaviour and economic systems such as human intention, knowledge, and emotions.

Furthermore, underlying realities that shape economic phenomena are short lived and changing, so that quantitative methods fail to provide results. (Schmid & Thompson 1999)

Consequently, an integrated approach where qualitative as well quantitative data is employed in order to gain a better understanding of how the economy operates has been frequently suggested.

According to Morgan (2001), narratives and models are not incompatible. While models are useful to simplify and gain some understanding of the real world, stories contribute to the understanding of this complexity. According to Morgan (2001), 'the suggestion we might take from the literature on narrative as a cognitive instrument is that in using the model to tell stories about the world, we are able to grasp not only the model as a whole, but we are also in some way trying to re-grasp the complexity of the real whole world and the typical elements in it.' (Morgan 2001:380)

3.2 Simplified assumptions and rational expectations

A result of the tendency of mainstream economics to engage in excessive formal modelling is the adoption of idealized and simplified assumptions.

According to Viskovatoff 'The strange tendency of mainstream economists to engage in mathematical modelling – based on assumptions the empirical status of which is not investigated – can be characterized only in negative terms' Viskovatoff (2003:409)

In section 2 it was highlighted that a basic element of mainstream economics is that a phenomenon is analysed by assuming individual agents.

According to Blaug (1980:266), methodological individualism is the 'view that social theories must be grounded in the attitudes and behaviour of individuals, as opposed to "methodological holism" which asserts that social theories must be grounded in behaviour of irreducible groups of individuals'

However, methodological individualism does not allow explanations which involve non individualist decision makers such as institutions. (Boland 2003:28)

According to Lawson (1997), social structure (positions, rules, relations) makes a difference in action of individual and as such is real (separate entity), and is not a mere construction of individuals. At the same time, social structure depends on human beings (if human beings disappeared so would social structure). In their activities human being draw upon social structure and the in turn social structure is reproduced or transformed. According to Lawson (1997), individuals occupy positions within a social structure (for example, worker/boss, teacher/student) so that collective/group interests and group action may conflict with individual interest.

An assumption of mainstream economics that has been widely criticized is that of rational agents.

The rationality postulate is the main element of economic analysis (Hogarth and Reder 1986: 2, Sugden 1991: 751, Foley 1998:23)

According to Modigliani (1977), 'It has not taken very long for the profession to accept the message set forth in Muth's (1961) seminal contribution in those cases where the paradigm was clearly relevant, as in the analysis and modelling of speculative markets.' (In: Grela 2005:9)

The rational expectation hypothesis was introduced by Muth (1961) in order to explain the formation of expectations when future events are not known.

Muth suggested that expectation should be the same as the respective economic theories suggest, that information is rare so that it can't be wasted and that it should be impossible to systematically outperform theories. (Muth 1961)

Muth observes 'expectations of firms (or more generally, the subjective probability distribution of outcomes) tend to be distributed, for the same information set, about the predictions of the theory' (Muth 1961:316)

For Grela (2005), 'The "rational expectations" debate can be summarized in a few words by saying that the REH was presented in NCM as an abstract and simple hypothesis, and then was criticized by Keynesians for being unreal and simplistic' (Grela 2005:2)

According to Muth (1961), the REH did not describe accurately individual behaviour, but is significant because of its usefulness and generality.

However, for Tobin 1972, it was completely unreal to assume that individual expectations were consistent with predictions of econometric models as only a few specialists are able to understand them. (Fernandez-Grela 2005)

Stiglitz (1991), observes that game theorists conduct their analysis assuming small degree(s) of irrationality and reveal that equilibria depend on those small irrationalities. According to Stiglitz (1991), this research illustrates that economists must examine the actual behaviour of individuals, whether they behaviour is consistent with rationality or not. (Conlisk 1996)

On the other hand, the counterargument made is that nobody assumes that people are rational but that they act *as if* they are rational and that they learn to behave more rationally. However, according to Conlisk (1996), empirical evidence shows that sometimes they behave *as if* they were rational but sometimes they do not. (Conlisk 1996)

Moreover, according to Hodgson, 'The very act of learning means that not all information is possessed and rationality is compromised or ruled out.' (Hodgson, 1998:175)

For Lawson (1985), the outcome of all possible choices of humans is unavailable so that behaviour cannot be determined based on that knowledge. Consequently, behaviour and choices depend on localized interpretations and knowledge of participants so that choices are not infinitely deep in time as proposed by mainstream economics.

3.3 Qualitative and quantitative research methods

Another point of critical intervention is the fact that qualitative data is often rejected by economist as a useful tool of scientific investigation.

Quantitative research is empirical research, where the data is in form of numbers, whereas qualitative research is empirical research where information is textual (Punch 1998).

Qualitative data and generally non hard data is usually avoided by mainstream economists as they tend to argue that "watch what I do, not what I say". (Cheung & Chinn 2000)

Economists are thus sceptical regarding narratives provided by agents, and respond that it is preferable to study behaviour instead of what they say, especially where subjects do not have an incentive to discuss the truth. (Blinder 1991)

According to Gherardis & Turner (1987), 'The message… is that quantitative work is courageous, hard biting, hard work. Collecting hard data means making hard decisions, taking no nonsense, hardening one's heart to weaklings, building on hardcore of material, using hard words to press on to hard won results which often carry with them promises of hard cash for future research and career prospects . By contrast soft data [are] weak, unstable, impressible, squashy and sensual.' (Goulding 2002:11)

On the other hand interpretive researches argue that positivism in social science is a pseudo science, inflexible, myopic, mechanistic, outdated and limited to testing old theories at the expense of developing new. (Goulding 2002:11)

Furthermore, during last decade there was a shift among social researchers towards qualitative research, while it is increasingly applied in the commercial world. (Goulding 2002)

According to Blinder (1991), though many economists suggest that not much can be learned by asking economic players, because they have a limited understanding of the working of the economy, if those players are asked appropriate questions they would be able to respond.

Detailed case studies and samples unrepresentative of the population have problems such as that they do not provide useful statistical information. However according to Blinder (1991), they are not reasons to reject interviews as theory and econometrics have their own limitations. According to Blinder 'we should remember that theory and econometrics have their limitations too. Theoretical deductions are often untested or, worse yet, un-testable. Econometric evidence is often equivocal and/or subject to methodological dispute. The imperfect knowledge we can pick up from interviews and questionnaires should therefore not be compared to some epistemological ideal, but to the imperfect knowledge that non-experimental scientists can deduce theoretically or glean from econometric studies. By this more reasonable standard of evidence, data culled from interviews look admissible.' (Blinder 1991:91)

Lawson (1985), observes that instead of abstract modeling researches could use the insights of people that have significant practical experience and are very often ready to do interviews so that social phenomena are studied within their social context.

Schmid & Thompson suggest that economists should avoid assuming behaviour, but instead they should design appropriate questioners to investigate their behaviour and motivations. 'Yet, why should putting words in people's mouths be preferable to trying to interpret what they say, even if shaped by what is asked?' Schmid & Thompson (1999:1164),

4. Methodological approaches available to the researcher

In this section different methodological approaches will be illustrated and the research methods of this thesis will be explained. First, we present the main epistemological views. We turn then to illustrate arguments regarding inductive and deductive research approaches before presenting research strategies available.

4.1 Epistemology

There are three main epistemological views available to a social researcher: Positivism, Realism and Interpretivism.

i)   Positivism

The term positivism was originally introduced by Comte at the beginning of the nineteenth Century.

The term positivism, like most terms that describe ideas, has acquired a number of different meanings as the central concepts have evolved and have been integrated with other ideas. (Walters & Young 2001)

According to Bryman, 'The doctrine of positivism is extremely difficult to pit downward therefore to outline in a precise manner, because it is used in a number of different ways by authors' (Bryman 2003:p13)

In the nineteenth century the meaning of the term is broadly consistent with Comte's emphasis on the significance of observation, in contrast to religious and introspective sources of knowledge, as the basis of human knowledge. At the beginning of the twentieth century, the concept was extended due to the growth of the new logical analysis of Whitehead & Russell (1910–13). Logical positivists attempted to establish a formal link between theories (i.e. our understanding of the world) and empirical evidence. (Walters & Young 2001)

The essence of this approach is that propositions that do not correspond to empirical evidence would be classified as meaningless eliminating metaphysical concepts. However, according

to Walters & Young (2001:487), 'It quickly became evident that no correspondence rules could be produced that could empirically substantiate the central propositions of scientific theories'. As a result, logical positivism would not only eliminate metaphysics but also scientific knowledge. The response of positivist to this critique was to abandon criteria of verifiability and replace them with criteria of Popper's falsifiability. (Walters & Young 2001)

Popper's falsifiability suggests that there it is impossible to prove a theory as correct (i.e. verifiability) but only that a theory is false. (Boylan & O'Gorman 1995)

In positivism the assumption is that the researcher neither affects nor is affected by the subject of research (Remenyi et al 1998). According to Blumberg et al (2005:19), in positivism 'Knowledge develops by investigating the social reality through observing objective facts' and for Bisman, 'Positivism is a highly objectivist view of a common, single reality.' (Bisman 2002:5)

As a result, Positivists suggest that social scientists should work 'with a observable social reality and that the end product of a research can be law like generalisation similar to those produced by the physical and natural science'. (Remenyi et al., 1998:32)

Positivists argue that only events that can be perceived by our senses are real, so that reality is independed of our though. Casual explanations and generalisability are core elements of positivism. On the other hand, instrumentalism (e.g. Friedman), a branch of positivism,

consider predictive power as the most important element of a theory, not explanatory power. (Bisman 2002)

Positivist studies are usually based on preceding theories, and attempt to establish relationships between cause and effect. According to positivists the world can be reduced to a set of general laws so that individual behaviour is insignificant. (Bisman 2002)

Because of positivism requirement of generalisability, quantitative methods are used and are usually highly structured in order to facilitate replication (Gill and Johnson 1997).

Studies that follow a positivist approach use statistical methods to assess theories (Bisman 2002) and the validity of theories is judged by its ability to explain or predict different phenomena ((Gill and Johnson 1997).

ii)   Phenomenology

According to Blumberg et.al. 'Interpretivists research social phenomena by making sense of how people interpret the social world' Blumberg et.al. (2005:18).

Saunders (2007), notes that interpretivism is an epistemology that advocates the necessity for the researcher to understand differences between humans in their role as social actors (in contrast to positivism that considers differences among individuals as insignificant). As in the theatre actors play a role according to their interpretations or to that of their directors, humans play a role in their real life according to their interpretation of their every day social roles and act according to the meaning that we give to them.

Hence, because interpretations have effect on action, the meaning humans give to their interpretations is significant and needs to be investigated. (Bryman & Bell 2003)

Interpretivism is widely based on Phenomenology and for Remenyi, the objective of phenomenological research is to discover 'the details of the situation to understand the reality or perhaps a reality working behind them' (Remenyi 1998:35)

For instance, according to Schein (1992), organisational culture is operating at three levels. Level one consists of visible symbols of what the organisation is (for example, open plan offices). Level two consists of espoused values fund (for example, in mission statements). Level three consists of understanding the culture. According to Schein (1992), only a phenomenological approach enables us to investigate this third level and to comprehend more completely the values and behaviour.

Phenomenological researchers are critical about analytic/deductive approaches investigating in a descriptive way conscious phenomena by analysing the way experiences and things appear themselves. (Sanders 1982)

Phenomenologists argue that the social world is too complex for definitive laws which are established in physical science and thus support the use of qualitative research strategies. (Saunders 2000)

For Bogdan & Taylor 'in order to grasp the meanings of a persons behaviour the phenomenologist attempts to see things from that persons point of view'. (Bogdan & Taylor 1974:13-14)

iii)   Critical realism

Critical realist philosophy has gained on significance in economics since the early 1980s. Lawson (1997, 2003) has been the main exponent leading the development of a critical realist philosophy in Economics. (Wilson 2005)

According to Wilson (2005), critical realism has gained prominence among Marxists, post-Keynesians, evolutionary economics and could play a more significant role in institutionalism in the future.

Critical realism shares with positivism the belief that there is an external reality to which scientists direct their attention (there is a reality separate from our description of it). (Bryman 2003 p15)

However critical realists believe that there is a generative mechanism of observable events that is not observable, where according to Lawson (1997: 21), 'the world is comprised not only of events and states of affairs and our experiences or impressions, but also of underlying structures, powers, mechanisms and tendencies that exist.' (Lawson 1997:21). For instance a bicycle, as a structure, has the power to provide a ride even it is parked in a garage. In other words, those powers exist whether they are exercised or not. (Lawson 1997)

According to Bhaskar, 'We will only be able to understand-and so change- the social world if we identify the structures at work that generate those events and discourses… These structures are not spontaneously apparent in the observable pattern of events; they can only be identified through the practical and theoretical work of the social science'. (Bryman 2003:15)

Thus for Lawson, 'in many cases we can infer of a things potential from a knowledge of its structure.' (Lawson 1997:21)

As a result the aim of critical realist research is the 'identification of underlying generative mechanisms and structures which cause actions and events which are then experienced

empirically (Wollin 1996:1). In contrast to positivism generalisations in critical realism are concerned with probabilistic truth, not absolute truth. (Bisman 2002)

In order to investigate these generative mechanisms that qualitative as well quantitative research methods are seen as appropriate and viewed by critical realists as complementary. (Healy & Perry 2000)

Furthermore, 'Both naturalistic methods such as case studies, and unstructured or semi-structured in depth interviews are acceptable and appropriate within the paradigm, as are statistical analyses, such as those derived from structural equation

modelling and other techniques' (Perry et al 1997[25])

Whereas qualitative approaches offer depth and richness quantitative analysis may be used in order to examine the generalisability of found patterns so that research eventually starts as inductive enabling propositions to be formed and followed by a deductive approach. (Bisman 2002)

In contrast to positivist studies, critical realist would recognise the importance of multilevel study (for example, individual, group, organization) and acknowledge that the world is changing so that generalisability is limited. (Saunders 2007:105)

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[25] In: Bisman (2002:10)

4.2 Inductivism vs. Deductivism

There are two main approaches when it comes to discovery of knowledge, Induction and Deduction.

To illustrate an inductive approach we can consider the following example. A researcher, after observing white 200 swans, suggests that all swans are white. It should be noted that in induction the evidence does not prove the conclusion. Inductive arguments may have true premises but we can never be certain that the conclusion derived from them is also true. (Pheby 1988)

When induction is used, theory is a result of empirical data (Bryman and Bell 2003, Saunders et al 2007).

According to Boland 'inductivism is the methodological doctrine that assert that any justification of ones knowledge must be logically based only on experiential evidence consisting of particular or singular observation statement, that is, one must justify his or her knowledge using only verifiable knowledge that have been verified by experience' (Boland 1982:14)

Inductivism is associated with the work of Sir Francis Bacon who promoted inductivism as a reaction to the deductivism of the period. According to Bacon, the disadvantage of deduction

is that we get from an argument only what we feed in. On the other hand, according to Bacon[26], 'By approaching our investigation with an open mind and not entertaining any expectations as to the likely results, we may be close to achieve objectivity'

Inductive approaches can thus be distinguished in two main categories, a)enumerative and b) eliminative forms. Enumerative, is the type of induction where a number of similar observations are gathered together and some more general conclusions are drawn. On the other hand, eliminative induction is the type of induction where the differences rather than the similarities between particular observations are important (for example, observing swans in different countries). By applying eliminative induction (i.e. studying under different circumstances) we can outline causes that affect the phenomenon studied by eliminating circumstances that have no effect on the phenomenon. (Pheby 1988)

However, there are pitfalls associated with induction. Inductive approaches rely on past evidence. According to Boland (1982), Humes suggested that there is no logical justification if knowledge is based on inductive proofs and that past evidence can be used only to tell as about the past but not the future. This pitfall is widely known as the problem of induction. (Boland 1982

In contrast to inductive approaches were theory is a result of using empirical data, in deductive approaches empirical data follows theory. It involves the development of a theory that is subject to a rigorous test. Deduction, (in contrast to inductive approaches that usually

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[26] In Pheby (1988:4)

employ qualitative data (Bryman 2003)) attempts to explain casual relationships between variables, and usually involves the collection of quantitative data. (Saunders 2007)

An important complement to deductive argument is the widespread use of mathematics. (Pheby 1988)

In contrast to inductive arguments that may have true premises but we can never be certain that the conclusion derived from them is also true, in deductive reasoning, if all premises are true, then the conclusion is also true. (Pheby 1988)

An extreme form of deductive reasoning is deductivism. Whereas, deduction can be employed to facilitate statistical analysis and testing, deductivism rejects any empirical data as it is considered to be too transitory and hence worthless. (Pheby 1988)

According to Robson (2002) there are five stages usually found in deductive research:

1. Deducinng a hypothesis from the theory

2. Indicating how the concepts or variables will be measured

3. Testing the hypothesis

4. Examining the outcome of inquiry (confirm or not)

5. If necessary modifying the theory

According to Bryman & Bell (2003), deductive approaches contain usually induction in their last step, as inductive approaches contain deduction, when the researcher collects further data to establish the condition on which the theory holds. A strategy of using systematically both approaches is called iterative and involves waving back and forth between data and theory. (Bryman & Bell 2003)

According to Pheby, 'Just as excessive mathematisation of economics can lead to 'theory without measurement' a number of critics have felt that macroeconomics has, to some extent, become an example of' ' measurement without theory' ' (Pheby 1988:21)

According to Pheby (1988), a proper response to the problem of induction is to interpret our empirical results with care and never claim too much of them.(Pheby 1988 p11)

5. Research designs available to the researcher

According to Yin, 'A research design is a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers) about these questions. Between "here" and "there" may be found a number of major steps, including the collection and analysis of relevant data' (Yin 1994:20)

There are different research strategies available to a social researcher. In this section the main characteristics and application of different strategies will be illustrated.

i) Experiments

Experiments investigate whether a change in one in one variable produces a change in an other variable (Hakim 2000 p136 in Saunders 2000)

There are two main categories of experiments. Experiments can be conducted either in the field or in laboratories, where greater control over the context within the experiment occurs is exercised.

Usually in an experiment two groups of participants are formed (experimental group and control group), the experimental group will be manipulated by intervening in a particular

way, and any difference between experimental and control group for the dependent variable is attributed to the intervention. (Saunders 2007)

Because experiments are used, within social science mainly in psychology studies, they have been widely employed in behavioural finance research.

By employing experimentation a series of theories such as the Prospect theory: (e.g. Kahneman and Tversky 1979, Benartzi and Thaler 1996), Anchoring: (e.g. Tversky and Kahneman 1974, Shafir et al 1997), Overconfidence (Fischhoff et al 1977), Disjunction effect: (Tversky and Shafir 1992),and The Irrelevance of History (Fischhoff 1975) have been developed.

Although experiments have proven useful as an investigative psychological tool, these were found to be not compatible with the methodological objectives of our thesis. Experiments take place in isolated environments, whereas our objective is to investigate the "real world" behavioural patterns and practices with regard to exchange rate behaviour.

ii) Surveys

Surveys are usually associated with a deductive approach. Surveys involve large amount of data obtained by using questioners administered to a sample, while the use of standardized data allows simple comparison (Saunders 2007).

An inherent disadvantage of surveys is that data is not wide ranging as questions that can be asked are limited so that only a small number of variables can be investigated (Saunders 2007).

Although survey approaches are not often employed by mainstream economics as economists are suspicious of what people say (see argument in section 3.3), they have been employed in microstructure studies in order to gain deeper insight into the beliefs of exchange rate dealers and to highlight those areas where the gap between dealer's and academic views are large (for example, Cheung et.al. 2004, Cheung & Chinn 2001).

Survey strategies have been also employed to facilitate to test the rational expectation and efficient market hypothesis in the foreign exchange market. According to, Chinn & Chinn & Frankel 'In recent years a new literature relying upon survey measures of exchange rate expectations has arisen' (Chinn & Frankel 1994:1). Other significant studies employing survey data are: see also Frankel & Froot (1987), Liu and Maddala (1992), Dominguez (1986), Taylor & Allen (1992)

Although surveys have been successfully employed in foreign exchange studies, they suffer from a "limitation of depth" and thus is not consistent with the objective of an in depth investigation of market participants' views.

iii) Case studies

According to Robson (2002:178), a case study is 'a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real life context using multiple sources of evidence'. As a research strategy, the case study is used in many situations to contribute to our knowledge related to political, organizational, and social phenomena. Case studies are common in political science, psychology, sociology, and economics where the structure of a country, city or industry is investigated. (Yin 1994)

A case study is the opposite of an experiment in the sense that the investigation occurs in a real world context. A case study is preferable to survey when a large number of variables have to be investigated and question of "why" are to be answered. Because case studies offer the opportunity of in depth investigations triangulation approaches can be employed. Triangulation refers to the use of different data collection techniques. (Saunders 2007)

According to Yin (1994), case studies can be distinguished as single case and multiple case studies. Single case studies involve the observation of only one phenomenon and are

preferably employed when the phenomenon is unique or extremely representative. If the phenomenon is neither unique nor extremely representative, multiple case studies are preferable. Multiple case studies involve the observation of more than one case so that findings of the previous cases can be compared to findings of following cases.

Another distinction is that of holistic versus embedded case studies. Holistic case studies view the unit as a whole whereas embedded case studies investigate the subunits as well as the unit as a whole. (Saunders 2007)

Case studies gained popularity in microstructure studies when trading data of dealing banks began to become available to researchers contributing significantly to the understanding of exchange rate and dealer behaviour.

iv)   Grounded theory

Grounded theory was first presented in the book the "The Discovery of Grounded Theory" in (1967) by Glaser and Straus. Grounded theory can be traced back to the movement interactionism. According to interactionism, individuals engage in a world which requires reflexive interaction as opposed to environmental responses. Individuals react to the environmental signals according to the meaning they hold for them. These meanings evolve from social interaction. According to Goulding (2002), 'Methodologicaly the researcher is required to enter the world of those under study in order to observe the subject's environment and the interactions and interpretations that occur' (Goulding 2002:39)

Grounded theory fills the gap between theoretically uninformed empirical studies and empirically uninformed theoretical studies (Goulding 2002). It is a research method in which theory emerges from the data (Glaser & Strauss, 1967)) as in all inductive research approaches.

However, Grounded theory is not purely inductive. According to Glaser & Strauss, 'Generating theory from data means that most hypothesis and concepts not only come from data, but are systematically worked out in relation to the data during the course of research. By contrast, the source of certain ideas, or even "models", can come from sources other than data.' (Glaser & Strauss 1967:6)

The difference in relation to purely deductive approaches is that the research doesn't begin with theory. (Strauss & Corbin, 1990: 23). The theory is derived inductively from the phenomena investigated 'thus emphasizing theory development rather than testing of a theory' (Hunt & Ropo, 1995:381).

However, the fact that no hypothesis testing occurs at the beginning doesn't mean that there is no role of existing theory.

'A researcher cannot come into a topic like this completely cold. The researcher must have some predetermined idea of the things about which the subjects will be questioned' (Parry 1998:94)

Grounded theory suggest that the researcher should study people involved in phenomena being researched, as well as bringing together a variety of sources of information (for example, company reports ,transcripts of open-ended interviews). (Parry 1998)

The identification of social processes is a central element of grounded theory. According to Hunt and Ropo (1995), 'grounded theory identifies the processes or forces that give rise to activity' (Parry 1998:91)

- *Procedures*

The Grounded theory framework involves a series of procedures such as constant comparative method of analysis and coding strategies. Constant comparative method is a central concept to Grounded theory, and refers to the process of continuously gathering and comparing data. The researcher is gathering and analyzing data, comparing new analysis with past analysis and then gathering and analysing new data in order to formulate and clarify the developing theory and the relationships of variables. (Parry 1998)

Another important element of this process is that of coding strategies. Data especially from observations and interviews has to be broken down according to its meaning to generate concepts which are put into categories. (Parry 1998)

In this step of analysis hypotheses are formed, while for the examination of these hypotheses new data is require and has to be gathered. According to Parry, 'By so doing, concepts can be made more clear and abstract, and the relationships between concepts can be confirmed'. (Parry 1998:90)

As concepts are further evaluated and included into core categories they finally form the new theory (Parry 1998).

These analytical steps of building higher levels of abstraction is called theoretical coding (Glaser,1978), so that basic social processes can be identified and a new explanatory theory formulated (Parry 1998).

- *The Dispute*

Since its inception, grounded theory has evolved and has undergone numerous transformations.

Strauss and Corbin (1990), demonstrated this break with their presentation of several coding procedures (e.g. open, axial, selective coding, techniques of comparison) that are used to advance analysis.

Ellis (1993:477) suggests that:

'Strauss has tried to provide some guidance for researchers attempting to generate theory in the form of a coding paradigm in which data are analysed in terms of conditions, interactions among the actors, strategies and tactics, and consequences'

However, overstressing of those procedures has been criticised for limiting the possibilities of the approach (Glaser, 1992).

'There are disadvantages as well as advantages with this employment. While it does provide the researcher with a high level model of organising structure for data analysis, it might be thought to be inhibiting to the open approach to theory generation that is at the heart of the original grounded theory approach... use of the coding paradigm may be restrictive and may stultify the process of full inductive theory generation.' (Ellis 1993:477)

According to Skodol-Wison and Ambler-Hutchinson (1996)[27], 'The importation of rigid rules is counterproductive to the spirit of creativity and the generation of grounded theory.'

- *'Partly' Grounded theory*

According to Parry (1998), it is questionable to what extent researchers apply the suggested interaction between gathering of data and analysis of data. In many cases the approach of grounded theory is not used and the term is used for rationalization of gathering qualitative data.

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[27] In: Goulding (1999:15)

According to Parry (1998:90) there are two types of Grounded Theory:

'a full grounded theory approach of the kind described and recommended by Glaser

and Strauss (1967) and detailed further by Glaser (1978) in which the iterative approach is

played out in full, and a 'partial' grounded theory approach in which data are collected and

then theorized upon.'

According to Parry (1998), the rigorous framework of Grounded theory accounts for the

emergence of partial Grounded theory. For instance the large requirements of time for

transcribing large numbers of interviews, and fieldwork notes are factors limiting the

researcher's ability to reflect and analyze the collected information. (Parry 1998)

- *Applications*

Grounded theory has been applied in many disciplines where qualitative research is

frequently employed (e.g. Education, Sociology etc.). Principles of grounded theory are also

employed in the field of business studies in order to provide a structured approach to

inductive research and interview data analysis. For example, in marketing research, Martin

& Woodside (2008), use grounded theory principles to map tourists' behaviour by revealing

the complexity of tourists decision making behaviour. Other examples where grounded

theory has been applied in the field of business studies are Carter et al 2004 (logistics

management) and Kempster and Parry 2011 (leadership research).

However, to the best of the author's knowledge, this is the first application of grounded theory principles to exchange rate theory.

6. The aim of this thesis

> *The aim in this thesis is to unveil aspects of the predominant paradigm of foreign exchange market participants in order to gain a better understanding of the mechanisms giving rise to short term exchange rate fluctuations.*

7. The research methodology for this thesis

- *Our response to the critique on mainstream economic methodology*

Taking into account the critique on mainstream economic methodology presented in this chapter, this thesis will employ a combination of quantitative data and narratives. Whilst we acknowledge the usefulness of quantitative techniques and formal models to simplify the complexity of the world, the addition of narratives, in order to illustrate in detail the mechanisms at work, will enable us to present a more nuanced picture of market participants views, contributing significant to the understanding of short term exchange rate behaviour. The failure of existing models to capture this information and thus make reliable predictions suggests that there is room for alternative approaches. We recognize the usefulness of qualitative data and the contribution market participants can make to our understanding of exchange rate behaviour by providing us with their valuable insights, but we also we employ

quantitative data and formal statistical test to assess the validity and generalisability of the proposed theories.

- *Epistemology of this thesis*

Although exchange rate economics employ approaches that are mainly consistent with the positivist research approach, we chose to follow an approach consistent with critical realism, where the main objective is to identify the underlying mechanisms causing patterns of exchange rate behaviour. Our review of exchange rate theory showed that current literature in the field follows a positivistic paradigm, however our review of methodological literature in this chapter presents a strong opposition to current approaches by philosophers of science. This thesis intents to address this gap. Even though there is a lack of previous research following this epistemological approach, the support this approach receives from the field of philosophy of science is sufficient to validate our chosen method. Instead of relying solely on quantitative data, we acknowledge value of qualitative data in revealing complex underlying mechanisms and structures causing exchange rates to change, by offering depth and richness to the analysis.

- *Induction vs.Deduction*

An initial inductive approach will be followed by a deductive approach which will be employed to test hypothesis derived from analysis of gathered qualitative data. The inductive part of our study (i.e. qualitative data analysis) offers the necessary depth and richness, while

the later quantitative part will offer the opportunity to examine the validity and generalisability of identified patterns.

8. The Research design of this thesis

The research design of this thesis is best described as a grounded theory approach to structure the gathered data. According to Finch (2002), novel knowledge claims can be formulated within economics by employing grounded theory procedures.

However, grounded theory procedures will not be followed in the most rigid manner in order to avoid the dangers outlined in above sections. In other words, a partial grounded theory approach will be adopted. There is however a major shortfall associated with partial grounded theory. According to Strauss and Corbin, 'the nature of relationships between categories (or concepts) is not undertaken; at least, it is not explained sufficiently in write-ups. . (Strauss and Corbin 1990:7)

The aim of the researcher is to take into account the dangers associated with a partly grounded theory method by giving detailed descriptions of the relationships of concepts.

The decisive factor for choosing a Grounded theory approach is the fact that it is compatible with the choice of epistemology of this study, while offering a structured framework to analyze qualitative data. Grounded theory approaches allow for collection of a wide source of data including both qualitative and quantitative data. Moreover it allows for an interplay between induction and deduction and most importantly it allows an in-depth investigation of foreign exchange market participants views by examining their beliefs and behavioural patterns.

First, in order to investigate market participants' views on the workings of the foreign exchange market, news reports with foreign exchange market related market commentary have been gathered. Approximately one thousand foreign exchange market commentary reports published by Reuters Group PLC over a six month period starting 1/5/2007 and ending on 31/10/2007. The particular source of news reports has been chosen because of Reuters long standing reputations for objectivity, accuracy and validity. We also examined a considerable number of news reports issued by Thomson Corporation in order to assess whether news reports issued by different providers reveal significantly different views of market participants on the foreign exchange market, however, no evidence has been found that this might be the case. The specific sample period has been chosen based on a number of factors. First, no pre-2007 reports are accessible through the Reuters website; as such a pre-2007 period did not represent a realistic alternative. Second, the chosen sample period includes both, periods of market turmoil and periods of stability, whereas most post-2007 periods are characterized by volatile markets. Hence, we are able to investigate market practitioners during both volatile and stable market conditions as well as the transmission from stability to instability. The duration of the sample period was six months as a shorter period would limit our ability to examine market practitioners views during changing market

conditions, whereas a longer period would consume considerable more time with only doubtful benefits to the additional insights obtained.

News reports concerning the foreign exchange market were easy to distinguish from other market news reports as their labeling began with the word 'FOREX'. FOREX news report (reports thereafter) are issued by Reuter on a 24 hour basis with commentary from all major financial centers. Most reports were issued from Reuters offices in London, New York and Tokyo, but included market commentary that was not specific to the issuing office's location. In fact, there was a considerable amount of repetition between reports issued within a few hours, even though these were issued by different authors in different locations. The reports included the authors description of issues concerning the foreign exchange market as well as quotes from major market practitioners such as foreign exchange strategists employed by the major commercial and investment banks, Central bank announcements, foreign exchange brokers, traders, and government officials.

The first step of the analysis was the part of the process referred to as open coding of the data. In open coding the phenomena and events found in the text are categorized, named and their properties are specified. The objective here is to create abstract concepts emerging from the descriptions in the text.

As we progressed with the process of open coding we began the part of the process referred to as axial coding. In axial coding the objective is to identify the relationships between the different categories identified during open coding. As we progressed with the analysis the

aim was to constantly examine whether the identified relationships were found again in later reports. When relationships were found not to appear at a high frequency in data and/or there appeared to be limited evidence of a significant impact, and/or appeared to be of little relevance to the aim of this study, then those relationships were omitted in further analysis. In addition, relationships that appeared frequently but were not likely to impact exchange rates in the future (i.e. events specific to the time period of investigation) have been also omitted.

We then turned to undertake the process of selective coding, where all other categories (including the relationships between the categories) are linked to the main category referred to as core category.

After identifying relationships affecting short term exchange rate behavior, based on market practitioners' views, the researcher proceeded to test the theory against empirical data in order to assess the validity and generalisability of findings. For this purpose we employed quantitative data and conducted (in most cases[28]) formal statistical tests. A detailed description of statistical analysis tools and data employed are can be found in each of the relevant chapters (Chapter V, VI).

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[28] Because the data required to conduct a formal tests for one of our identified relationships was not available, we utilized results from other studies to gain further insight on the empirical validity and generalisability of the observed relationship.

Chapter IV

Analysis of qualitative data based on Grounded Theory principles

Chapter IV: Analysis of qualitative data based on Grounded Theory principles

1. *Introduction*

In this chapter the findings of the qualitative data analysis are presented. Following grounded theory principles we analyzed approximately one thousand Reuters Foreign exchange market reports[29]. The examined reports cover the period from 1/5/07 till 30/10/07. For the analysis of those reports techniques as described in grounded theory methods have been applied. The reports were coded so that sub categories and core categories could be formed[30].

This chapter is structured into a number of sections the first of which illustrates the categories and subcategories identified during the open coding procedure. Following on from this we present the main results of the axial coding procedure, where we explain the relationships between the identified categories. We then discuss our main findings in relation to current exchange rate theory.

2. *Open coding*

Table 1. presents the main categories identified in the open coding procedure the analysis. The first column (left column) illustrates the identified categories (shown in bold) and subcategories. The second column (middle column) provides definitions of the corresponding categories while the third column (right column) shows the possible dimension of the values

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[29] All reports have been sourced from the Reuters Archive. The reports can be found in the CD on the appendix of this thesis and on the Reuters website at http://www.reuters.com/resources/archive/us/index.html

[30] For a complete list of categories and sub categories see table 1

for each category/subcategories. Note that the definitions given are in accordance to the meaning given in the analyzed reports for the purpose of this study only and might not correspond to text book definitions.

Table 1.

Categories (in bold) and subcategories	*Definition of category*	*Properties*
Currency attributes Safe heaven currencies Safe heaven flows Safe heaven countries Low yielding currencies High yielding currencies Lowest yielding currencies Highest yielding currencies	Characteristics of a currency attributed by market practitioners	High yield to low yield currencies Strong Safe haven attributes to no safe haven attributes
Interest rates Interest rate changes (monetary policy), Interest rate differentials, Government dept yields , Private dept yields, Expectations	The yield an investor is expecting to achive by investing in a certain currency	Increasing – decreasing interest rates Large – small interest rate differentials Relatively high- relatively low interest rates
Central bank signals FED target rate announcement (FED, ECB, BoE, BoJ) Central bank accompanying statement (, ECB, FED, Bernanke, Trichet: strong vigilance, accommodative) Central bank minutes Monetary policy	Announcements and information given to the public through formal and informal channels by Central banks or members of central banks	Quantifiable announcements – open to interpretations announcements
Trading behaviour Technical correction Profit taking Positions (short/long) Order flows (investors trading eg new mutual funds) Psychological crucial points Currency diversification of central bank (eg. Saudi Arabia) Central bank intervention Delayed reaction	Evidence of trading behaviour and response of exchange rates to trading behaviour which is not based on order flows and technical trading techniques, and psychological bias	Strong or Weak Evidence of trading behaviour and response of exchange rates to trading behaviour which is not based on order flows and technical trading techniques, and psychological bias

Japanese retail investors		
Fundamentals Money supply Unemployment Economy (EU, German, US, UK, Japanese) good news bad news Other fundamentals *(e.g. PMI survey* *ISM, Retail sales, Manufacturing data,* *Consumer sentiment,* *Home construction,* *Home prices housing starts, ABX subprime index)* GDP growth	Economic variables traditionally considered to be relevant by mainstream economic theory except interest rates	<u>Increase-decline</u> in the value of a variable <u>Large change-small</u> change in the value of a variable Positive/negative impact to exchange rate Interpretation of a change as good-bad
Carry trades	The process in which investors borrow a low yielding currency and invest in high yielding assets	<u>Increase-decline</u> of the extent carry trades are conducted
Risk appetite Risk aversion	The willingness or ability of investors to enter and/or hold risky assets and/or conduct risky investment strategies	<u>High- low</u> risk appetite
Subprime crisis Credit crunch Credit market news Subprime crisis to economy reaction	The financial crisis starting in the US subprime market in 2007 and developing to a major global financial crisis	Scope of crisis (<u>US vs. world</u>) Severity of crisis
Global stock market returns US stock markets returns (NYSE, NASDAQ) German Stock market returns (DAX) Japanese Stock market returns (TSE/ Nikkei) Chinese Stock market returns		<u>Positive – Negative</u> returns
Risk Equity market volatility, Forex market volatility, Financial crisis Political Instability	Volatility of financial markets and a perception of an increased likelihood of severe negative events	<u>High – low</u> levels of risk

OTHER: China-Yuan/yen relationship Inflation/equity relationship Corporate level news Inflation vs economic growth Institutional factors (e.g. stock trading tax in china) Central bank decision/policy (e.g. Saudi Arabia peg) Forex/ economy relationship	N/A	N/A

3. *Axial coding*

In this section we present the results of the axial coding procedure. Specifically, we present the categories with the strongest impact on exchange rate behaviour, describe the mechanism relating these categories with exchange rates and explain the mechanisms with which those categories are related to other categories.(note: categories and sub categories in this section are shown in bold)

3.1 Currency attributes

One of the core findings of our research is that a significant proportion of exchange rate fluctuation is explained based on differences (or perceived differences) between currencies

characteristics and their respective home countries' economic and political attributes. After analysing the reports two main attributes of currencies emerged: Safe Haven currencies and relative yield of currencies. Although there was some evidence of other attributes (for example, commodity currencies), there seemed to be only limited evidence of a strong relationship between these attributes and exchange rates during the sample period of our research.

i) Safe haven currencies

This is an attribute that characterizes traditionally 'strong' currencies such as the US dollar. According to the reports **safe haven currencies** benefit when **international instability** grows or **uncertainty** about the future increases. Events such as large market downturns (i.e. large negative **equity market** returns), and news about the subprime market crisis suggesting an increased probability for an impending severe recession, fuelled USD buying and consequently a USD appreciation. Some reports suggested a similar behaviour for the CHF, however, most comments referred to the USD. On the other hand there is less evidence suggesting that the safe haven currencies benefit from smaller **equity market** downturns or small increases in **equity** and **foreign exchange market volatility**. In other words, the relationship between safe haven currencies and equity markets is suggested to be rather conditional on large equity market downturns. Table 2 presents some indicative comments by market participants suggesting that there is a relationship between USD appreciation and crises.

Table 2.

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*"In times of **crisis**, the **dollar** is still the premier currency (**Safe haven**)"*

Peter Dunay, Investment strategist at Leeb Capital Management in New York, 10/8/07.

*"In recent weeks, the **dollar** has benefited from **safe-haven** and repatriation flows arising from heightened **risk aversion globally***"

Reuter,11/9/07

*"The dollar has shown an increased tendency of late to benefit from stress in **global equity markets**, likely a reflection of the greater allocation of U.S. investors to overseas markets in recent years ... As such, to the extent this week's China news does damage **equities globally**, the **dollar** is likely to gain back a bit more ground."*

UBS in a client note, 30/5/07

*"I expect the dollar to be relatively well-supported, and if **risk aversion** sets in you will see the dollar gaining ground against sterling, the Aussie and currencies like that,"*

Sharada Selvanathan, Currency strategist at BNP Paribas in Singapore, 31/5/07.

*"There's been some dialing down of risk (**risk aversion**) going on, and the dollar has gained from that against most G10 currencies and against currencies such as the Mexican peso"*

Dustin Reid, Currency strategist at ABN Amro in Chicago, 7/6/07

*"The rise in **risk aversion** originally sent the **low-yielding** yen to a three-month high against the dollar and a six-week high versus the euro. However, the Japanese currency's gains versus the dollar proved fleeting, with the greenback boosted by investors repatriating cash out of riskier investments [**safe haven**]....This is definitely a credit squeeze [**Subprime crisis**] and people are hoarding dollars "*

Russell LaScala, head of currency trading for Deutsche Bank in New York, 27/8/07

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

The main event triggering safe haven flows during the sample period was the **subprime crisis**. Even though the **subprime crisis** originated from the United States (which would be considered as "**bad news**" for the US economy, and would usually be interpreted by market participants as having a negative effect on USD value), the increased levels of uncertainty caused by the subprime crisis, directed investors into increasing demand for the USD. Consequently, positive USD returns were explained by market practitioners as being the result of safe haven and/or repatriation flows to the US. Interestingly, whereas the subprime crisis was initially treated as an US issue, with a negative impact on the value of the USD,

later fears for a possible effect of the crisis to other economies were seen as increasing the demand for the USD.

> *"In so far as it reflects ongoing unease about the fallout from **sub-prime** it is a U.S. problem, but if it spreads to other **global markets**, any recoil in the investor flows of recent years will be USD supportive **[safe haven]**"*
>
> *Ian Gunner, Head of FX research at Mellon Bank, 25/7/07*

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

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ii. Lower/Lowest vs. Higher/Highest yielding currencies:

Possibly the most interesting finding of this analysis is that market participants classify currencies based on their relative interest rate levels. **Lower yielding currencies** are classified those major currencies that yield relatively lower returns (i.e. lower **interest rate**) compared to other major currencies, whereas currencies with relatively high interest rates are classified as **High yielding currencies**. It is suggested that **Lower yielding currencies** similar to **safe haven currencies** showed a tendency to benefit from lower degree of **risk appetite,** whereas the value of high yielding currencies increased during times of increased **risk appetite**. Moreover, in contrast to **safe haven** currencies, where the USD is suggested to appreciate only during severe market downturns, it is suggested that those currencies are sensitive to all market fluctuation.   The above mentioned characteristic is even most pronounced in the case of the **low<u>est</u> yielding currency** (i.e. JPY) as they appear to be the

target of borrowing in order to fund other investment opportunities, while the **high<u>est</u> yielding currencies** are the main beneficiaries of those transactions. Table 4. presents some indicative comments by market participants suggesting the significance of a currency's yield classification for exchange rate determination.

Table 3.

*"The yen fell broadly and **higher yielding** currencies rose as rising stocks [**global equity markets]** pointed to increased confidence leading to a move back into the carry trade where investors sell the **low yielding** yen to fund investments in **higher yielding** assets.23/10"* *Reuters,23/10/07*   *"Against the yen **[low yielder]**, the dollar **[Higher yielder]** rose as high as 120.54 yen \<JPY=>, the highest since late February, when a surge of risk aversion boosted the yen."* *Reuters 10/5/07* *"The **risk evironment**...has generally been benign. That sort of environment on the **equities** front has continued to mean that the **higher yielding** currencies have outperformed,"* *Lehman Brothers G10 currency strategist Phyllis Papadavid 4/6/07*

"As long as global growth is good it's going to put downward pressure on the yen as the world's big funder and we've seen that again. We've seen stability in stock markets and no contagion from the decline we saw in China last week,"

Peter Frank, currency strategist at ABN AMRO, 7/6/07.

*"U.S. **equity** futures started dropping like a stone and everything else seems consistent with that -- **high-yielding** currencies are getting hit and **low yielders** are bouncing with **risk appetite** as the issue at the bottom of it"*

Adam Cole, Senior currency strategist, RBC Capital Markets26/7/07

*"A rise in energy shares [**equity markets**] also lifted U.S. stock indexes and prompted investors to wade back into carry trades that borrow yen [**low yielder**] at low **interest rates** to buy **higher-yield** assets. ... The yen is not really reacting to **fundamental factors** -- it's really the **carry trade** and **risk aversion** that's driving yen at the moment,"*

Mitul Kotecha, Head of global foreign exchange research, Calyon in London.12/9/07

*"**High-yield** currencies versus **low yielders** remain the broad themes for foreign exchange trading,"*

Nick Bennenbroek, Head currency strategist at Wells Fargo Bank in New York, 4/6/07

a) Determinants of **risk appetite/aversion**

As explained above varying degrees of **risk appetite/aversion** among investors significantly affected exchange rate behaviour during the period of investigation. **Risk appetite** is defined in the context of this thesis as the willingness of investors to take risky position in global financial markets. Risk appetite varied significantly during the period of investigation. The main causes of variations in the level of risk appetite were:

- ➢ **Global stock market returns**
- ➢ **Uncertainty, International crises, Market volatility**
- ➢ **Interest rate differential changes**

Global stock market returns appear to be the most significant determinant of risk appetite. Positive **equity market returns** indicated increased risk appetite whereas negative **equity market returns** caused declining levels of risk appetite. US, German, UK, Japanese and Chinese stock market returns seemed to be the most important determinants/indicators of risk appetite during the sample period. Causes of risk such as increasing s**tock and foreign exchange market volatility** and events increasing uncertainty such as **international financial and political crisis** as well as diminishing **interest rate differentials** appear to be the remaining factors reducing risk appetite. Table 4. presents some indicative comments by market participants suggesting that there is a relationship between equity returns and the yield classification of currencies.

Table 4.

*"Yen [**Low yielder**] trading pretty much depends on **equity markets**. European markets are up today, which is pushing the yen weaker against the dollar, [**Mid yielding**]"*

Meadows, Currency analyst at Tempus Consulting in Washington, 26/9/07

*"Primarily, the market is following stocks," "U.S. equities [**equity markets**]opened higher, but there's a bit of a reversal and that has taken some of the steam out of the dollar's rally [**Mid yielding**]"*

Greg Anderson, senior currency strategist at ABN Amro in Chicago, 31/7/07

*"The fall in dollar/yen [**High yielder**] was pretty much due to the drop in stocks [**global equity markets**]and there has been a very high correlation between the two"*

Brian Dolan, chief currency strategist, at Forex.com in Bedminster, New Jersey, 25/6/07

*"There is an unwinding of **carry trades** as **risk aversion** increases ... It started with concerns about the U.S. **subprime** markets, which prompted a sell-off in **U.S. equity markets**, which led into a sell-off in **global equity markets** and the unwinding of the **carry trade**".*

Matthew Strauss, senior currency strategist at RBC Capital Markets in Toronto, 27/6/07

*"**Equities** and **carry trade** currency pairs such as **euro/yen and dollar/yen** have risen and fallen together in recent sessions due to the perception of relatively high risk that each investment holds...But we should see more pressure on **carry trades** -- euro/yen, dollar/yen and the high-yielding currencies,"*

Reuters, 2/8/07

*"There is a bit of focus on **risk aversion**, with the global equity markets in a sell-off sentiment and we are seeing the yen and also Swiss franc firmer,"*

Niels Christensen, FX strategist at Nordea in Copenhagen, 16/9/07

*"**High-yielding** currencies such as the Australian dollar and British pound slipped as investors closed out **carry trades** due to fears that more restrictive lending standards due to the **subprime** mortgage mess could drag on global economic growth."*

Reuters,30/8/07

*"The yen [**Low yielder**]is at very weak levels which is a reflection of global **risk appetite**. It's the same old story, carry is still in force,"*

Tom Levinson, FX strategist at ING. 7/7/07

> *"**Global equity** gains have boosted **carry trades**"*
>
> *Niels From, currency strategist at Dresdner Kleinwort in Frankfurt, 20/7/07*

However, there is evidence suggesting that, because of the large interest rate differentials that could be observed during the sample period, there is only a limited impact of changing interest rate differentials on the value of **low yielding** currencies.

Table 5.

> *Switzerland raised rates **[Interest rates]** and look what dollar/Swiss did -- it went up. Swiss rates **[Interest rates]** are not high enough to get people to buy Swiss and Japanese rates **[Interest rates]** are even lower, so yen selling is likely to continue"*
>
> *Kathy Lien, chief strategist with Forex Capital Markets in New York. 14/7/07*
>
> *"Yen **[Low yielder]**buying is not likely to last long because individual investors who sell yen to buy foreign assets are not likely to stop doing so just because the BOJ raises rates **[Interest rate changes] [Interest rate differential]** by 0.25 percentage point"*
>
> *Minoru Shioiri, Senior manager at FX trading at Mitsubishi UFJ Securities, 29/5/07*

*b) The underlying mechanism linking **exchange rates** and **equity returns***

The suggested mechanism responsible for linking **equity market returns** and **exchange rates** is the **carry trade**. A **Carry trade** is an arbitrage strategy were a **low yielding currency** is borrowed in order to buy higher yielding assets (for example, assets denominated in high **yielding currencies**). It is closely related to the categories of **risk appetite, low/high yielding currencies** and **interest rates**. It appears that during our sample period, carry trades played a crucial role in the formation of exchange rate behaviour. Especially, the value of the **lowest yielding currencies** (during the period of investigation it was primary the JPY and secondary the CHF) appears to be linked closely to the extent carry trades are conducted. In turn, the extent to which **carry trades** are conducted, depends mainly on the **risk appetite** of market participants. The risk appetite, as explained above, appears to be strongly correlated with **global stock market** returns establishing a strong correlation between **global stock market returns** and value of the **lowest yielding currency** (i.e. JPY). Major beneficiaries from strengthening **global stock markets** appear to be the **highest yielding** currencies (the NZD and AUD during the period of investigation). However the effect on **highest yielding** currencies is suggested to be lower compared to the effect on the **lowest yielding** currencies, as the money borrowed from the **low yield** country is directed not only to the **highest yielding currency** but also to other assets.

An interesting observation regarding the extent investors conduct carry trades is that it appears to depend not only on interest rate differentials but also on the overall level of global interest rates. In other words, investors might consider not only the difference between two interest rates but also the proportion of this difference to the cost of borrowing the funding currency.

> *"It may impact other **high-yielding** currencies by unnerving investors conducting **carry trade** who have become wary of rising interest rates[**Interest rate changes**] worldwide,"*
>
> *Koji Fukaya, senior currency strategist at Deutsche Bank, 11/6/07*

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

An alternative explanation could be that investors consider the impact of interest rate increases to equity market performance. In this case, an increase in world interest rates could cause a decline in equity prices and hence a reduction in investors willingness to conduct carry trades.

> *"Rate hikes [**Interest rate changes**] are also negative for equities, falls in which tend to weigh on **risk appetite**, making investors less keen to put on risky **carry trades** funded in the **low-yielding** yen."*
>
> *Reuters, 20/7/07*

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

3.2 The role of fundamentals in exchange rate determination: Findings and Discussion

3.2.1 Findings

According to the analysis of the reports **Interest rates** appear to play the most crucial role in exchange rate behaviour and it is mostly changes in interest rate levels rather than the interest rate differentials itself that are believed to have the largest impact. Relative interest rate levels are believed to affect the relationship between exchange rates and equity returns, but there is

no indication that market participants took into account interest rate differentials as an indication of expected exchange rate returns, as interest rate parity would suggest (i.e. interest rate differentials are taken into account only to predict a possible reaction to equity price and risk appetite changes). During the whole sample period, new information leading to **expectations** of rising **interest rates** is interpreted as causing the respective currency to appreciate and vice versa.

*How are **expectations** for **interest rates** formed?*

Interest rates were the only fundamental variable for which there is considerable evidence in the reports on how **expectations** about future changes are formed. Although there must have been a process of **expectations** formation for other economic variables (as the announced economic data was usually compared to expected data and not to previously announced data) there is no evidence in the reports regarding the process of how **expectations** for other variables were formed by linking current changes of variable x to future changes of variable y.

Information used to form expectations regarding interest rates can be summarized as follows:

i) **Economic data**

Economic data plays a significant role in the formation of interest rate expectations. The most significant economic variables affecting **interest rates** appear to be **inflation rate** and **employment** data. Most central banks have to ensure that the **inflation rate target** is met, Increased inflation levels is considered to put pressure on the central bank to tighten **monetary policy** and to increase base rates, whereas **lower inflation rates** would allow central banks to ease **monetary policy** (i.e. lower **interest rates**).

Employment/Unemployment appears to be the most important variable affecting interest rates besides inflation rates. It appears to be believed that central banks are especially sensitive to increased levels of **employment/unemployment,** possibly for socio-political factors. However, no explicit explanation is given in the reports regarding the reasons behind the high levels of significance attributed to employment/unemployment data. It is suggested that, reduced levels of **employment** indicate lower **interest rates,** while lower levels of unemployment indicate tightening of **monetary policy.**

Other economic data releases and news are suggested to affect **interest rate expectations** as well. In general **good news** about an economy indicated increasing **interest rates** (hence an increase in currency value), whereas **bad news** about an economy indicated easing of monetary policy (i.e. declining interest rates and a decline in currency value). Table 6. presents some indicative comments by market participants suggesting that there is a relationship between exchange rates interest rates, inflation rates and employment data.

Table 6.

> *"The **FX market** is not really focusing on the structural issues in the aftermath of the CPI data [**Inflation rate**]... The market is focused on the **interest rate** outlook."*
>
> *Ron Simpson, director of currency research, Action Economics in Tampa, Florida, 15/5 /07*

*"Jobless claims [**Unemployment**] were a little bit lower and below the average we've seen over the last year and we're seeing a downward trend and that's why we're seeing the dollar gain a little bit,"*

Camilla Sutton, currency strategist at Scotia Capital in Toronto, 17/5 /07

*"The dollar rose across the board on Monday, extenting a three-week advance driven by solid U.S. economic data that has led investors to trim expectations the Federal Reserve will cut **interest rates** this year"*

David McMahon Reuters21/5 /07

*"This morning's wholesale **inflation** data was marginally dollar positive as it highlighted lingering potential **inflation** risk and compounded the view the **Federal Reserve** will not cut **interest** rates this year"*

Alex Beuzelin, senior market analyst at Ruesch International in Washington,14/6 /07

*"The outlook for the dollar is bleak; if the **Fed** only cuts by 25 basis points [**interest rates**] the market will think that it is not reacting strongly enough, stoking fears that the economy is heading for recession which is also negative for the greenback."*

Niels From, currency strategist at Dresdner Kleinwort in Frankfurt. 12/9/07

> *"It's all about **interest rates**...Once the **Fed** starts an easing cycle, I don't believe it's ever gone one move and out. I am confident we will have more easing, at least 25 (basis points), probably another following early next year."*
>
> *Firas Askari, head currency trader at BMO Capital Markets in Toronto 24/9/07*
>
> *"The **payrolls numbers** have reduced fears that the U.S. economy is heading into recession. So to see some kind of support for the dollar at a time when dollar short positions are very high is not very surprising,"*
>
> *Michael Klawitter, currency strategist at Dresdner Kleinwort in Frankfurt, 8/10/07*
>
> *"At this stage, with the market almost fully pricing in the move and looking for an additional two cuts **[Interest rates]** by mid-2008, this result could lend the dollar some degree of support if the Fed does not indicate future easing is in the cards,"*
>
> *JP Morgan said in a research note, 31/10/07*

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

Although the above mentioned relationships appears to be consistent the throughout the sample period, when the evidence for an upcoming **subprime crises** increased, the correlation between **interest rate, inflation rate, employment** and currency value was believed to changed from positive to negative in the case of the USD.

> *"If payroll data [**Employment**] continues to be strong, with the unemployment rate low, it may suggest that the **Fed's** hands are still tied on any thoughts of easier policy ... Rather than being good for the dollar we'd actually see it as quite negative if issues like financial market tensions are pushing the **Fed** towards an ease but the development of the economy, and **inflation** in particular, restricts the **Fed's** room for manoeuvre."*
>
> *Bear Stearns said in a research note 3/8*

The rationale behind this change is that market participants believed that the situation (i.e. subrime crisis) required an easing of monetary policy to protect the economy from a deep recession, which was seen as eroding the value of the USD even more. Consequently, signs suggesting the need for monetary tightening (e.g. higher inflation and employment), were seen as factors causing the depreciation of the USD.

ii)   Central bank announcements, signals and minutes

Besides monitoring closely inflation rate and employment data, market participants monitored central bank announcements in order to form expectations regarding future interest rate changes. Especially FED (Federal reserve bank) and ECB (European central bank) meetings appeared to be of great importance, though announcements issued by the Bank of England (BoE) and the Bank of Japan (BOJ) were as well closely monitored. Most interestingly, market participants appeared to pay great attention to the wording used in statements of central bank officials as well as the voting outcome of central bank meetings in order to assess the probability of future interest rate changes. For instance phrases such as "strong vigilance" and "accommodative" (both indicating monetary tightening) by Jean-

Claude Trichet indicated the upcoming moves of the ECB. Table 7 shows some indicative comments made by market participants suggesting illustrating the importance of central bank announcements.

Table 7.

*The pound surged against the dollar after the **BoE minutes** showed that, contrary to expectations, the central bank's decision to raise rates **[Interest rates]**this month was unanimous, and some members even had considered a half percentage point rise.*

Reuters, 23/5 /07

*"An ECB rate hike to 4.0 percent has long been expected, so investors are waiting to see if the ECB drops the word "accommodative" **[Specific wording]** in describing policy from its statement as a sign the credit tightening **[Interest rates]**campaign is getting closer to an end ... Some may think that the credit tightening phase is over if the word accommodative **[Specific wording]** disappears from the statement, but I do not think that would be the case**[Interpretation of announcement]**"*

Tohru Sasaki, chief forex strategist at JPMorgan Chase in Tokyo, 6/6 /07

*"King is adding more detail on MPC thinking (**Central bank announcement]**. He has been saying over the past month or so that they want to provide greater guidance for the market in terms of what exactly they are looking at...The style of his presentation **[Interpretation of***

*announcement] was a really hawkish [**Interest rates**]one."*

Ian Gunner ,head of currency research, Mellon Bank1,2/6 /07

*"They (i.e. Fed)'ve moderated their language (**Central bank announcement**] to some degree but reading between the lines [**Interpretation of announcement**]they remain pretty hawkish[**Interest rates**]"*

Paul Mackel, senior currency strategist at HSBC, 29/7 /07

*"After seeing only one vote for lifting rates [**BOJ Minutes**] this time, the timing for next rate increase may be delayed until September or October,"*

Kengo Suzuki, currency strategist at Shinko Securities,12/7 /07

Note: Words in bracket denote categories where market participants referred to the specified category but used wording that is significantly different to the name given to the category.

3.2.2 Discussion: The relationship between Exchange rates, Interest rates and the role of other economic variables

In this section we discuss our findings explaining the relationship between exchange rates and economic fundamentals in relation to exchange rate theory & empirical evidence of other studies and examine the generalisability of the identified relationship.

- ### Theory vs. market paradigm: Exchange rates, Interest rates and inflation rates

Market commentary suggests that that interest rate changes play a significant role in short term exchange rate behaviour and appeared to be the economic variable with the strongest impact to currency values. It is suggested that an upward revision of expectations on short term interest rates (i.e. an increase in the central banks' interest rate), puts upward pressure on the value of the currency concerned and vice versa.

The role of interest rates and interest rates differentials in exchange rate behaviour is one of the most frequently investigated topics in international economics. According to the flexible price monetary models the exchange rate is believed to equalize return differences arising from interest differentials. In other words, high interest rates are believed to indicate a depreciating currency and vice versa. When introducing the assumption of sticky prices in to the model, it is suggested that the exchange rate would overshoot the equilibrium price. In this case, though uncovered interest parity still holds, an increases in interest rates causes an appreciation of the home currency. On the other hand, in Portfolio balance models, where assets from different countries are not perfect substitutes, a change in interest rates has more

than one possible effects on the exchange rate. In contrast to previous models UIP is not assumed to hold in PBA models. (see chapter II for more details)

However the most interesting observation appears not to be the effect of interest rates on exchange rates, which is as expected based on empirical evidence, but the role of other economic variables on the determination of exchange rates and interest rates.

Our findings suggest that a very wide range of news affect exchange rates. Any piece of information affecting the economy is considered. 'News' is not limited to macroeconomic variable announcements, but include everything that could have an impact on the economy (for example, political developments).

However, news items appear to affect exchange rates only because those news items affect monetary policy and short term interest rates. In other words, fundamentals and other news items are believed to affect monetary policy decision and the setting of interest rate targets rather than directly affecting exchange rate. The changes on interest rates then in turn are believed to affect exchange rates, highlighting the role of money markets (in contrast to good markets) in exchange rate determination.

This observation has considerable effects on how fundamentals affect currency values. For example, while high inflation rates would be considered as 'bad' news for the value of currency in many economic models, this is not necessarily true if market practitioners focus solely on nominal interest rates. Most central banks follow some kind of inflation targeting policy (i.e. central banks tighten monetary policy when inflationary pressure is present and

vice versa). In this case, a higher inflation implies a higher possibility of an interest rate increase, and an appreciation of the currency. Second, this observation locates the link between news and exchange rates into a new framework of analysis. If macroeconomic variables are not affecting short term exchange rates directly, but primary through monetary policy-interest rate channel, the effects of news on exchange rates depends on the framework within which monetary policy is conducted. For example, the exchange rate is going to react differently on a shock to oil prices depending on whether the central bank focuses on inflation or growth. This also explains why news on employment/unemployment are seen to have a significant impact on exchange rates even though employment/unemployment does not appear explicitly in any economic model as a determinant of exchange rates. If monetary policy is conducted solely on an inflation rate targeting then employment/unemployment announcements are going to affect exchange rates only to the extent they are affecting inflation. However, if a wider set of variables is considered such as real GDP growth, employment/unemployment, asset prices, etc those variables gain on importance because of their effect on short term interest rates, even though they have little effect on the exchange rates directly. During the sample period news items on interest rates appeared to exhibit the most significant role in the determination of exchange rates, with unemployment/employment and inflation rates following.

- *Empirical evidence*

Because there is only a very weak statistical link between fundamentals and short term exchange rate fluctuations, the mapping of the effects of fundamentals on exchange rate behaviour is particularly difficult. Although most empirical studies fail to provide a link

between exchange rates and fundamentals, there is strong evidence suggesting that exchange rate react to the unexpected element of news (i.e. revision of expectations). Because we don't have access to survey data on expectations of market participants, we use empirical findings of other studies to investigate the extent relationships outlined above are supported by empirical evidence.

Empirical studies suggest that in most cases, news suggesting an improvement of the economy lead to an appreciation of the home currency and vice versa. Dominguez (1999) finds that most large exchange rate changes occur within 10 seconds of a macroeconomic news announcement. Ito & Roley (1987), and Hogan & Melvin (1994) demonstrate that the USD responds rapid to US trade balance news. According to Almeida et al (1998), systematic short-lived news effects have been found when examining high-frequency DM/Dollar exchange rates with surprises in industrial production followed by M3, CPI and retail sales having the biggest impact on the value of the DM.

- *News on Employment*

According to our findings, the predominant view among market participants is that employment figures play a significant role in exchange rate determination. In particular it is suggested that lower unemployment leads to expectations of monetary tightening (i.e. higher interest rates) and consequently an appreciation of the currency.

According to Faust (2007), if nonfarm payrolls figure is higher by 100,000 jobs compared to what market participants expected, the USD tends to appreciate by 13 basis points against the DM/EUR. According to Almeida & Payne (1998), payroll employment data is most influential causing 31 basis points change on average to the value of the USD, while other fundamental variables such as unemployment rate, trade figures, retail sales, durable goods orders, costumer confidence, NAPM survey, average a change of only 10 basis points to the value of the USD. Hardouvelis (1988),Harris & Zabka (1995), Edison (1997), find significant correlation between dollar appreciation and non farm employment while according to Ehrmann & Fratzscher (2004) higher non-farm payroll employment, lower unemployment and a longer work week all lead to an appreciation of the USD.

- *News on Inflation*

According to our findings, market participants view high inflation as an leading indicator for monetary tightening. As such, higher inflation is expected to trigger an increase in interest rates, so that the currency appreciates.

According to Ehrmann & Fratzscher (2004), a rise in US inflation tends to lead, on average, to a depreciation of the USD, whereas, according to Almeida & Payne (1998), there is evidence that price shocks appreciate the USD. There is also evidence that the respond of the exchange rate depends on which indicator is used to measure inflation. While an increase in Producer Price Index (PPI) cause DM appreciation, an increase in Consumer Price Index (CPI) cause a depreciation of the DM (Almeida & Payne 1998).

- *News on Economic Growth*

According to our findings, the predominant view among market participants is that central banks react to slowing growth by reducing interest rates. Consequently, slower growth is seen to cause currency depreciation.

According to Almeida & Payne (1998), unexpected retail sales growth appreciates the USD and an increase in industrial production, retail sales, and trade cause DM appreciation. According to Ehrmann & Fratzscher (2004), higher GDP growth and higher consumer confidence lead to an appreciation of the USD (for instance, an unexpected growth of US GDP causes, on average, an appreciation of the USD at 0.62 per cent).

- *News on Monetary policy*

Interest rates appear to be the main focus of market participant with higher interest rates suggesting an appreciating currency.

Empirical evidence suggests that news on monetary policy have a particular strong impact. US monetary policy seems to have a significant and large effect on the USD. According to Faust et al (2007), a surprise in the fed target rate explains a significant proportion of the exchange rates variability within a 20min window.

According to Ehrmann & Fratzscher (2004) an unexpected increase of the federal funds target rate by 50 basis points causes a 0.8% appreciation of the USD against the EUR,

however, unexpected monetary policy news by the ECB appears to not affect in a significantly way the EUR/USD exchange rate.

According to Hardouvelis (1988), Harris & Zabka (1995), and Edison (1997), there is significant positive correlation between dollar appreciation and US M1, while (Ito & Roley 1987) and Hogan & Melvin (1994), demonstrate that the USD responds rapid to US money supply. According to Goodhart et al (1993), when examining high frequency USD/GBP exchange rate reactions to U.K. interest rate changes, exchange rates exhibit significant jumps after news arrivals. According to Almeida & Payne (1998), an increase in M3 causes DM appreciation, which can be explained by higher money supply, indicating increasing the possibility of an interest rate increase.

However not all studies find a strong relationship between news announcements and exchange rates. According to Ehrmann & Fratzscher (2004), although faster growth in industrial production and larger retail sales appear to affect the USD, their impact is not statistically significant. According to Faust et al (2007), the exchange rate response to CPI and PPI surprises are not statistically significant. According to findings of Ito & Roley (1987), JPY/USD exchange rates respond to US news but do not respond to Japanese macroeconomic announcements. Some studies suggest the effect of German and European news announcements is less significant compared to US announcements and only few German announcements appear to have a significant effect on exchange rates (see Andersen (2002), Ehrmann & Fratzscher (2004), Almeida & Payne (1998). Our research does not provide support for this observation. There was no obvious bias towards US news. Market

participants appeared to give the same importance to news on major economic developments around the world.

- *The issue of generalisability: To what extent is inflation targeting a fact?*

According to the evidence provided by market commentary and the generally supportive empirical evidence provided by other studies, we could conclude that inflation is seen as more or less fixed in the long run while any news putting upward pressure to inflation cause interest rates to increase (in order to control inflation) and consequently an appreciation of the home currency. However, even though some kind of price control is widely practiced by most central banks, there are significant variation.

In the 1970s most central banks conformed to broader national economical and social objectives (Mahadeva and Sterne 2000). Inflation targeting was widely introduced in the 1980s and picked up towards the end of 1990s. According to Mahadeva and Sterne 2000, in 1990 only 57% had a formal inflation targets while in 1998 the proportion of central banks having an inflation target reached 95%.

The change towards inflation rate targeting occurred for the USA in October 1979, when Paul Volker the newly appointed federal reserve chairman, clearly indicated such a move. For the Bundesbank this happened in 1979 when Germany entered the EMS. (Clarida et al 1998)

As a result the behaviour of interest rates changed significantly. According to Clarida et al (1998), central banks used to keep interest rates at or below inflation rates, however in 1979, nominal and real interest rates rose in order to control inflation.

Monetary policy framework varies not only in different time periods but alters from country to country as well. Figure 1. shows the objectives, beyond price stability, of 94 surveyed central banks.

According to Mahadeva and Sterne (2000) there are three main factors on which monetary policy framework depends on

1. Structural differences (amount of debt, commodity dependence, structure of financial sector, openness of trade, fiscal policy)
2. Nominal rigidities that affect the speed in which monetary policy affects the economy
3. Institutional arrangement (e.g. Data availability)

Figure 1. Objectives, beyond price stability, of 94 surveyed central banks
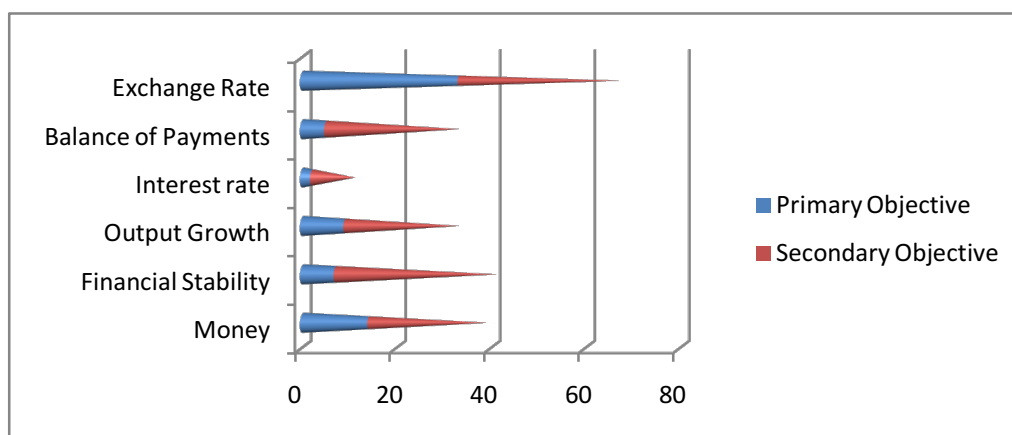
Source of data: Mahadeva and Sterne (2000)

In addition, Central banks alter their policy frameworks in response to specific economic circumstances.

According to Bernanke and Mishkin (1998:101) , 'Despite the language referring to inflation control as the primary objective of monetary policy, as we have said, inflation-targeting central banks always make room for short-run stabilization objectives, particularly with respect to output and exchange rates.'

This statement does not only indicate that the significance of the inflation target depends on current economic circumstances, but also that policy reaction depends on current exchange rate levels implying that causality runs in both directions.

According to Taylor (2009), the US did not implement the Taylor rule from 2001 to 2004. During this period the interest rate was significantly lower to what the Taylor rule and the relevant macroeconomic variables would have suggested.(see figure 2)

According to Taylor (2009: 3-4) 'These actions were thus effectively discretionary government interventions in that they deviated from the regular way of conducting policy' and according to Bernanke and Mishkin (1998), inflation rate targets are usually specified as a range by introducing an 'escape clause' to allow some flexibility in the short run.

This kind of behaviour was evident in the observations during our sample period presented in chapter IV. When the subprime crises was seen as a major thread to the economy the Fed reduced interest rates in spite of inflationary pressures.

Figure 2.

Loose fitting
Federal funds rate, actual and counterfactual, %

Source: John Taylor, "Housing and Monetary Policy", Sept 2007
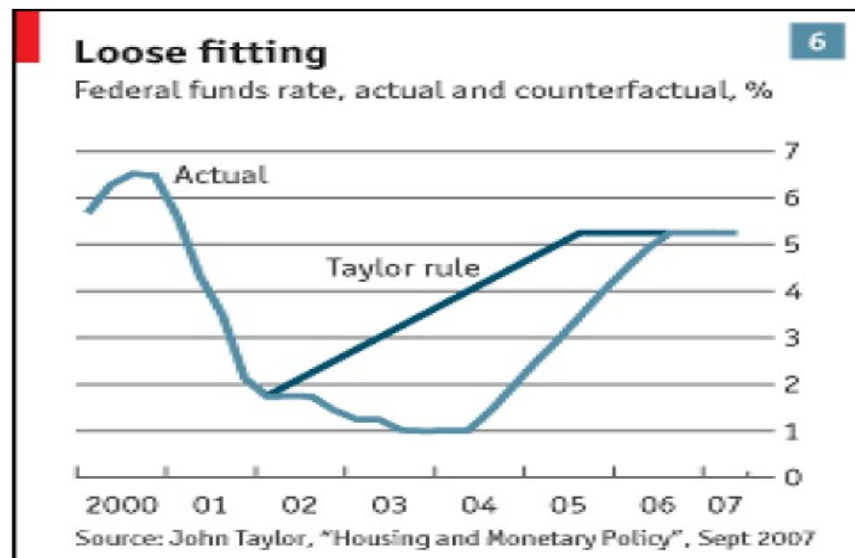
Source: Taylor (2009)

Furthermore, alternative monetary policy frameworks have been proposed, so that inflation is not the only recommended target. According to Taylor (1985), and Hall & Mankiw (1994), a nominal GDP target could simultaneously manage both, prices and output, while Cecchetti (1995) suggests that the difficulty of predicting inflation rate suggests that a nominal GDP target would achieve better economic outputs. Wray (2007) argues that a stable and low interest rate is preferable to low inflation suggesting that central banks return to the policy suggested by Keynes (i.e. low interest rates).

If central banks decided to follow the policy framework suggested above, then the reaction of exchange rates would alter radically. In this case, market participants would see interest rates as constant and inflation as variable. This would be exactly the opposite to how participants view the market during our sample period. Consequently, higher inflation would indicate lower real interest rates and a depreciation of the currency.

The above argument may explain the difficulty associated in establishing fixed theoretical relationships between fundamentals and short term exchange rate behaviour. If short run exchange rate returns depend on the monetary policy framework, objectives and context, then it is evident that a stable relationship between fundamentals and exchange rates can not be formulated, given that short term interest rate and exchange rate behaviour change according to prevailing circumstances.

However, these changes in monetary policy framework cause more problems to the academia rather than to market participant. According to Taylor (2009:3) 'The Fed used transparent language to describe the decisions, saying, for example, that interest rates would be low for "a considerable period" and that they would rise slowly at a "measured pace," which were ways of clarifying that the decisions were deviations from the rule in some sense.'

This signalling of the monetary policy framework was evident during the sample period of our study as well (see chapter IV). The signalling of monetary policy framework allows participants to update their view the mechanism determining exchange rates in relative short time.

Although, the identified relationships are supported by empirical data, the analysis of the nature of the mechanism linking exchange rates and fundamentals suggests that those relationships are subject to monetary policy priorities which in turn is subject to economic climate and policy priorities. In other words, the sign and strength of a relationship may change in response to monetary policy framework changes, so that a constant link between short term exchange rate behaviour and fundamentals cannot be established.

3.3 Other findings

- *The JPY/Yuan relationship*

Numerous reports suggest that there is a close relationship between the value of the JPY and news with regard to the Chinese Yuan. In particular, it is suggested that if news suggest an appreciation of the Chinese Yuan, investors buy the JPY instead. However, there is no reference regarding the mechanism responsible for this relationship. Though, it would be reasonable to expect the JPY to appreciate in response to a strengthening Chinese economy, because of the increased export potential of Japanese firms, we do not have an explanation as to how a tightening monetary policy in China increases the value of the JPY. (see table 8)

Table 8.

"News on Thursday that China's economic growth surged to an 11-1/2 year high in the second quarter had primed the markets for a 27 basis points rate rise, which was delivered on Friday..... With the tightly controlled Chinese yuan unable to rise much when policy is tightened, investors have traditionally bought the yen as a proxy"

Reuters, 20/7/07

"*Many analysts say moves by China resulting in accelerated yuan appreciation -- and potentially more appreciation in other Asian currencies -- often boost the yen because the Japanese unit is the most liquid and heavily traded Asian currency ... China is doing this to slow down domestic demand and because of concerns about the stock market. It will give the yen some support into next week but aside from the knee-jerk reaction we'll go back to trading patterns we've seen in previous weeks"*

Calyon head of FX research Mitul Kotecha said.18/5 /07

- *The role of order flows*

Microstructure finance suggests that order flows affect exchange rates. In particular, it is believed that it is primarily order flows that convey information about fundamentals that drive exchange rates. During the sample period it has been frequently suggested that order

flows play a significant role in exchange rate determination and that even order flows that do not convey information have a considerable impact. (see table 9)

Table 9.

"This is not about changed attitudes toward the dollar or even a reappraisal of the **fundamentals** *but more about tired positioning and a need for a 'healthy' correction* **[Other technical factors]"**

        Divyang Shah, chief strategist at Commonwealth Bank in London, 2/5 /07

"It seems over the last couple of days the SNB has allowed money market rates to trade sharply higher, maybe not providing enough liquidity and generating a bit of a squeeze on Swiss franc shorts **[liquidity driven trades]**.... *Maybe this is a sign that having 'talked the talk' over the past few weeks they (SNB) are slightly more serious. It seems that the SNB has some serious concerns over Swiss franc weakness,"*

        Chris Turner, ING head of FX strategy, 22/7 /07

Furthermore, order flows appear to be frequently triggered by exchange rate movements instead of changing fundamentals suggesting that causality runs in both directions.

Table 10.

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*"Dollar buyers at the London fix triggered **automatic sell orders** in the euro near $1.3560, which contributed to push the currency to session lows"*

Reuters, 16/5 /07

*"The downward pressure triggered some **automatic orders** to sell euros that pushed it to $1.3516 <EUR=>, a three-week low, before it edged back to $1.3527"*

Reuters, 8/5 /07

*"The breach of the **psychologically** key $1.40 level -- heralded as a pain barrier for euro zone exporters -- came in early European trade, with the move taking out key stop-loss [automatic orders] and option trading barriers and fuelling a broad-based euro rally"*

Reuters, 14/8 /07

- *From currency competition to currency wars*

The issue of currency wars was one of the main items in the G20 summit in November 2010. In 2007 however, the possibility of governments "printing money" or accepting higher levels of inflation seemed very distant.

> *"The combination of lower and less-volatile inflation worldwide has reduced inflation expectations and perceived inflation risk and resulted in a lower premium in long rates for inflation uncertainty ... I believe that these factors have been key contributors to the lower long-term yields and the flattening of yield curves, particularly in emerging markets ... Globalization, deregulation, and innovation make it easier for citizens to move their wealth out of nominal assets in the domestic currency should their government resort to an inflation tax ..... When the tax base shrinks in response to inflation, governments have a reduced incentive to resort to the inflation tax ... Globalization and innovation are genies that may prove difficult to put back in their bottles"*
>
> *Randall Kroszner, Federal Reserve Board Governor said.16/5 /07*

The comment above suggests that inflation rate control was seen as the primary objective in pre-crisis years, explaining the importance market practitioners gave to inflation rate data in order to form expectations on interest rates. In contrast, the long lasting economic downturn and sovereign debt crises of the current climate might change priorities for the conduct of monetary policy. In this case, the close link between inflation rates and exchange rates observed during the sample period might weaken considerably.

4. *Significance of findings*

In this section the importance of those findings in relation to existing exchange rate literature will be shown.

i) The significance of Global variables and currency attributes

Conventional wisdom in mainstream economic exchange rate models treat exchange rate movements as a result of changing differentials in economic variables (e.g. Interest rate, inflation rate, growth rate, money supply differentials etc), with no role for global variables. However, our findings suggest that market participants consider changes not only in relative values of macroeconomic variable, but also changes in global variables (e.g. global stock market returns) that affect all currencies depending on their characteristics. The study presents evidence on the role of stock markets in exchange rate determination thus adds a new dimension to current theory. Whereas current research focuses on stock markets' relative stock market returns in the respective home countries, our study suggests that global stock market returns affect global risk appetite and hence exchange rate movements based on differentiated characteristics of different currencies

ii) Risk premium

Whereas differing risk premiums are often given as an explanation of observed foreign exchange market anomalies (for example varying risk premia are frequently used as an explanation to deviation from Uncovered Interest rate

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Parity), the investigation of factors causing the varying risk premiums is still limited. Our study suggests that equity market returns might play an important role. (see chapter V for more details)

iii)   Interaction and arbitrage between different financial markets

The analysis undertaken illustrates interactions between different financial markets. We show how market participants understand the functioning of the underlying mechanisms, channels and procedures whereby equity markets affect foreign exchange markets. Moreover we illustrate the mechanisms through which fluctuations in one financial market (equity markets) are affecting other financial markets (i.e. foreign exchange markets).

iv)   Complexity of mechanisms and Conditionality of relationships

The analysis reveals the complexity of interactions among different variables. For instance, whereas economic wisdom dictates that a higher relative inflation rate should cause the home country's currency to depreciate, the effect of inflation rate on monetary policy and interest rates causes market participants to act as if higher than expected inflation rates would cause the home currency to appreciate in response to inflationary pressure. In addition, though the analysis in this thesis suggests that market participants' views on the underlying mechanism affecting exchange rate behaviour are mainly consisted among different participants during the whole period of investigation, this does not necessarily mean that the sign and

strength of relationships between economic variables and exchange rates is unaltered under changing conditions. For instance, whereas interest changes are seen as positively correlated to the home currency exchange rate, the relationship is believed to reverse because of the possible effect of high interest rates on the subprime crisis. Another example is the relationship between USD and equity markets. Whereas the value of the USD was seen as positively related before the escalation of the subprime crises, the sign of the relationship was believed to be reversed, when concerns on the crisis increased.

5. *Conclusion*

Table 11. summarizes the findings of the relationships between variables and currency value as identified in the qualitative analysis. An interesting observation is that whereas the relationship between country specific macroeconomic variables and different typologies of currencies does not depend on currency attributes, the relationship between global variables and exchange rates changes according to the characteristics of each currency. The analysis suggests that, based on market practitioners beliefs, there are two main variables affecting exchange rates. First, interest rate changes appear to be a major variable affecting currency value. An upward revision of interest rate expectations usually suggests an increase in the value of the currency concerned and vice versa (ceteris paribus). In turn, the main variables affecting interest rate expectations appear to be inflation rate and employment figures. Second, a major variable affecting exchange rates appear to be global equity returns. In contrast to interest rates, which is a country specific variable, global equity returns is a global variable affecting currencies based on their relative interest rate levels. High yielding

currencies' value is positive related to global equity returns and risk appetite while low

yielding currencies' value is negatively related to global equity returns and risk appetite. In

the next two chapters the validity and generalisability of the suggested relationships will be

tested against empirical data. Specifically, in chapter V, we assess the relationship between

relative currency yield, equity returns and exchange rates and in chapter VI, we examine the

effect of market downturns on safe haven currency value.

Table 11. Summary of Axial Coding: Relationships between categories during the sample period

Relationship between currency value and variables		Value of lower yielding currencies		Value of lowest yielding currency		Value of higher yielding currencies		Value of highest yielding currency		Value of safe haven currencies	
		Sign of correlation	Sensitivity	Sign of correlation	Sensitivity	Sign of correlation	Sensitivity	Sign of correlation	Sensitivity	Sign of correlation	Sensitivity
Country specific variables	Inflation rates	Positive	High	Positive	High	Positive	High	Positive	High	Positive	High
	Unemployment rates	Negative	High	Negative	High	Negative	High	Negative	High	Negative	High
	Interest rates	Positive	Very high	Positive	Very high	Positive	Very high	Positive	Very high	Positive	Very high
Global variables	Global stock market returns	Negative	Medium	Negative	Very high	Positive	Medium	Positive	High	Negative	Low
	Large global stock market downturns	Negative	Medium	Negative	Medium High	Positive	medium	Positive	Medium High	Negative	High

Chapter V

The role of relative interest rate levels and equity returns on exchange rate behaviour

Chapter V: *The role of relative interest rate levels and equity returns on exchange rate behaviour*

1. *Introduction*

The objective of this chapter is to explore the relationship between equity returns and exchange rates while accounting for relative interest rate levels as outlined in chapter IV. The chapter is organized as follows: In section two we illustrate literature on the relationship between equity returns and exchange rates. Then, we present and explain an alternative approach on the relationship between exchange rates and equity returns based on the findings of chapter IV. In the following section we describe the data used and econometric method employed, which is followed by an illustration of our main empirical findings. We then present a discussion on the importance of the findings with regards to existing exchange rate theory.

2. *Exchange rates and equity returns*

There are two main approaches relating exchange rates to stock prices in existing literature. The Goods market approach by Dornbusch and Fisher (1980), suggests that domestic stock prices should fall in response to increasing domestic currency value and vice versa. The rationale behind this model is as follows. When a shock causes the home currency to appreciate, then the less favourable terms of trade are going to cause a decline in local stock prices and vice versa. Assuming indirect quotation of exchange rates this represents a

negative relation between exchange rates and stock prices with causation running from exchange rates to stock prices.

The second approach is derived from the Portfolio Balance Model (PBM). It suggests that an increase in local stock prices results in growth of wealth and a subsequent increase of demand for money by investors. Because of higher domestic interest rates, foreign capital is attracted and the resulting increase in demand for local currency increases its value. Assuming indirect quotation of exchange rates this represents a positive relation between exchange rates and stock prices, with causation running from stock prices to exchange rates.

More recently, alternative approaches on the relationship between stock markets and exchange rates have been suggested. For instance, Cappiello and De Santis (2005), suggest that an arbitrage relationship between exchange rates and stock prices might exist. In particular, it is suggested that if expected equity returns of a country are higher compared to those of another country, the currency associated with the stock market with the higher expected returns is believed to depreciate and vice versa. Similar to Uncovered Interest Parity (UIP), where the exchange rate is believed to equalize return differences arising from interest differentials, in this case the exchange rate is believed to equalize equity returns in stocks denominated in different currencies.

Hau and Rey (2004) attempt to integrate the role of stock price and exchange rates into Microstructure approach framework. Hau and Rey (2004) suggest that there is a portfolio rebalancing channel where dynamic links between equity, bond and foreign exchange

markets exist. Specifically, it is suggested that when internationally located investors repatriate foreign equity wealth after a significant appreciation, the resulting capital flows cause currencies to appreciate and vice versa. This approach is closely related to microstructure theory where considerable evidence suggests that customer initiated order flows affect exchange rates[31].

Similar to other fields of exchange rate theory however, attempts to identify links between stock market returns and exchange rates fail to give a clear indication of the nature of this relationship.

According to Stavárek, 'There is theoretical consensus neither on the existence of relationship between stock prices and exchange rates nor on the direction of the relationship.' (Stavárek 2005 :141)

Ajayi and Mougoue (1996), suggest that a positive relationship of stock market returns and currency value exists only in the long term with currency values being negatively related in the short run. According to Solnik (1987), there is only a weak positive relationship whilst Kanas (2002) suggests that volatility of stock returns is a significant determinant of the volatility of exchange rate changes in US, the UK and Japan, supporting the asset approach models to exchange rates. Zapatero (1995) shows that, in fully integrated markets, the volatility of the exchange rate is explained by the volatility of the stock markets of the two countries concerned. Mishra (2004), using VAR and the Granger causality test, suggests that

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[31] For a recent review of Microstructure theory see Osler, L,C., 2008. Foreign Exchange Microstructure. Springer Encyclopedia of Complexity and System Science.

stock and currency returns are correlated but fails to establish a consistent relationship between them. Bhattacharya and Mukherjee (2003) find no casual relationship between the two variables in India. Bahmani-Oskooee & Sohrabian (1992) and Nieh & Lee (2001) find no long run relationship for the US and G-7 countries respectively, whereas Chow *et al*. (1997) find stock returns being responsive to real exchange rate changes in the long run but not in the short run.

3. *A new approach to the relationship between exchange rates and equity returns*

Mainstream approaches to exchange rates use generally a two country framework where the relationship between macroeconomic variables and exchange rates in two countries is investigated. In contrast, we consider only *one* global variable (i.e. global stock market returns) and investigate its effect on the exchange rates of currencies with differing characteristics (i.e. relative interest rate level).

The findings in chapter IV suggests that exchange rates are linked to equity returns. In particular it is believed that declining stock prices reduce risk appetite by investors and vice versa; consequently, it is suggested that the risk appetite of investors then affects the extent to which carry trade strategies are conducted. In a carry trade transaction investors borrow in a currency with low interest rates and invest in another currency with high interest rates. As such, carry trade strategies are highly leveraged and risky transactions. If the high yielding currency does not depreciate to an extent where the yield differentials are exceeded, then investors earn a profit. If Uncovered Interest Parity (UIP) were to hold, such interest arbitrage transactions would not earn any profits for investors, as the higher yielding currency would

depreciate so that arbitrage profits are eliminated. However, empirical evidence shows that UIP does not hold and interest arbitrage frequently earns considerable profits. This anomaly, also known as forward premium puzzle, is well documented in exchange rate literature[32].

Based on the above argument, the value of the currencies with lower interest rates should be negatively[33] related to global stock market returns, whereas the value of currencies with higher interest rates is positively[34] related to global stock market returns. The rationale behind our hypothesis is as follows: As investors experience negative equity returns, the resulting reduction in wealth reduces their willingness to hold risky position such as carry trades[35]. The unwinding of interest arbitrage positions induces an order flow (selling pressure for higher yielding currencies and buying pressure for lower yielding currencies) resulting in an appreciation of the low yielding currency and a depreciation of high yielding currency. In contrast to previous studies on the relationship between equity prices and exchange rates, in this case, no relative equity returns of *two* countries are considered. Instead, *one* global variable –global equity return– is believed to affect exchange rates conditionally to relative interest rate levels of currencies.

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[32] For a comprehensive review on the failure of UIP please see Sarno, L. (2005) Towards a solution to the puzzles in exchange rate economics: Where do we stand?, Canadian Journal of Economics 38, 673–708.

[33] Assuming a quotation of lower yielding currency units per one unit of higher yielding currency.

[34] Assuming a quotation of higher yielding currency units per one unit of lower yielding currency.

[35] This behaviour is consistent with decreasing absolute/relative risk aversion. According to Decreasing absolute (relative) risk aversion the amount(proportion) of wealth someone is willing to expose to risk increases as wealth increases and vice versa.

4. *Data and Method*

First, we classify currencies into three categories based on their yield characteristics. The AUD and NZD are classified as *high yielding* currencies with approx 5.2% and 6% average yield over the sample period. The JPY and CHF are classified as *low yielding* currencies with approx 0.3% and 1.5% average yield over the sample period and the USD, GBP and EUR are classified as *mid yielding* currencies with approx 3.8%, 4.8 and 2.8% average yield over the sample period[36]. We then generate three groups of currency pairs. The *H/L group* consists of exchange rates of one unit of High yielding currencies expressed in units of Low yielding currencies. The *H/M group* consists of exchange rates of one unit of High yielding currencies expressed in units of Mid yielding currency, and the *M/L group* consists of one unit off Mid yielding currencies expressed in units of Low yielding currencies.

In this study we use weekly exchange rates sourced from Thomsons Reuters Datastream for a time period from January 1999 to August 2010 for the EUR/JPY, EUR/CHF, AUD/EUR, NZD/EUR and for a time period from September 1995 to August 2010 for the USD/JPY, USD/CHF, AUD/USD, USD/NZD, NZD/JPY, AUD/JPY, AUD/CHF, NZD/CHF, GBP/JPY, GBP/CHF, AUD/GBP, NZD/GBP. We then re-estimate the results for the time period from January 1999 to August 2010 for the USD/JPY, USD/CHF, AUD/USD, USD/NZD, GBP/JPY, GBP/CHF, AUD/GBP, NZD/GBP to allow for comparisons between EUR exchange rates and non-EUR exchange rates of the H/M and M/L groups. The total of 16 currency pairs we include in our study account for more than 58 per cent of total foreign exchange market turnover[37].

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[36] Interest rate averages have been computed by using annual time series of 1 month Eurocurrency rates sourced from Thomson Reuters Datastream. The sample period for EUR interest rates is 1/1999-8/2010, and 9/1995-8/2010 for all other currencies

[37] Source: Bank of International Settlements (BIS), Triennial Central Bang Survey 2010

To capture global equity returns we use weekly time series of the FTSE All World Index in local currency terms sourced from Thomsons Reuters Datastream. The index consists of 2700 large and mid capitalization stocks, covering more than 90% of investable market capitalization[38]. By using equity returns denominated in their local currency, we avoid the factor of currency value appearing in both sides of the equation. If equity returns were denominated in USD, for example in a regression of USD denominated global stock market returns on USD/JPY exchange rate returns, then shocks to the value of the USD would affect both the USD/JPY exchange rate as well as equity returns denominated in USD. In this case, it could have been suggested that a relationship between the two variables exists even if no such relationship is present. Moreover, by using local currency denominated returns, the need for a restrictive assumption of a single home currency of investors is removed.

We use weekly data as we are convinced that daily time series are not appropriate because of noise, especially as exchange rate data and stock market indexes are usually recorded at different points in time. On the other hand, lower frequency data might not capture short term demand shifts caused by stock market fluctuation.

In order to test for stationary we perform Augmented Dickey-Fuller test to check for the presence of unit root for all currency pairs and the FTSE All World Index. The Schwarz information criterion is used to determine lag length. The results suggest that unit roots cannot be rejected at level of the time series. At first difference of the series no unit root is

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[38] Source: http://www.ftse.com/Indices/FTSE_All_World_Index_Series/index.jsp

present at 1% significance level[39]. Therefore we study the returns of the series (i.e. log first difference) instead of considering them at levels.

Following the econometric literature, we estimate the relationship between equity returns and exchange rates by employing Maximum Likelihood (ML) regressions with Generalized Autoregressive Conditional Heteroscedasticity (GARCH) [1,1] errors. We choose a ML-GARCH [1,1] framework in order to account for volatility clustering frequently observed in financial time series. If Ordinary Least Squares estimation (OLS) is used on time series where Heteroscedasticity is present, variance and standard errors estimation might be incorrect.

Bollerslev (1986), extended Autoregressive Conditional Heteroscedasticity (ARCH)[40] models to Generalized Autoregressive Conditional Heteroscedasticity models and argued that a simple GARCH model has a better fit compared to ARCH models. According to Hsieh (1989), GARCH models are successfully accounting for heteroscedasticity in most exchange rate data. We also chose ML estimation over of Least squares estimation. According to Li et al. (2002), in cases where heteroscedasticity is present, ML estimator is more efficient than OLS.

We assume that the relationship between exchange rate returns and equity returns is given by the following equation:

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[39] To save space, Augmented Dickey-Fuller test results are not shown, however they are available from the author on request.
[40] For an exposition of ARCH models see Engel (1982)

$$\Delta lnS_{ij,t} = \gamma \Delta \ln FTSE_t + \varepsilon_t \qquad\qquad (1)$$

Where $\Delta lnS_{ij,t}$ is the log first difference of the weekly nominal exchange rate of currency j

expressed as the number of units of currency i for one unit of currency j [41]and $\Delta \ln FTSE_t$ is

the first log difference of the weekly time series of the FTSE all world index in local currency

terms.

The error term has zero mean and its conditional variance equation is specified in (2):

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \qquad\qquad (2)$$

Where ε_{t-1}^2 is the lag of the squared residual from the mean equation – ARCH term– and

σ_{t-1}^2 is last period's variance forecast – GARCH term. Our findings suggest that exchange

rate returns can be characterized by GARCH models suggesting the presence of conditional

heteroscedasticity.

In order to account for possible serial correlation, we re-estimated our regression by

introducing a first order AR term to the mean regression, in all the cases where Ljung–Box Q

statistics indicated the existence of first order autocorrelation. The results of the re-estimated

regressions are shown in parentheses, though; it proved not to be significant in the estimation.

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[41] All exchange rates are quoted as one unit of higher yielding currency per units of lower yielding currency.

5. *Empirical findings*

4.1 Variance equation

All the time series models display significant α –ARCH parameters– and β –GARCH

parameters. The sum of α and β are close to one for all currency pairs and estimates of the β

parameter are very high and close to unity suggesting that volatility shocks are persistent.

(see table 1).

Table 1.

	Currency pair	ω	Std. Error	α	Std. Error	β	Std. Error	α+β
H/L	AUD/JPY	2.50E-05	6.59E-06	0.112	0.021	0.820	0.033	0.931
H/M	AUD/USD	4.97E-06	2.69E-06	0.057	0.014	0.922	0.021	0.979
M/L	GBP/JPY	9.28E-06	4.38E-06	0.100	0.016	0.872	0.026	0.972
H/L	AUD/CHF	9.25E-06	5.19E-06	0.048	0.016	0.913	0.033	0.960
H/M	NZD/USD	3.21E-06	1.21E-06	0.045	0.013	0.945	0.015	0.990
M/L	GBP/CHF	2.94E-06	1.48E-06	0.097	0.015	0.889	0.019	0.986
H/L	NZD/JPY	3.05E-05	1.22E-05	0.083	0.023	0.837	0.049	0.920
M/L	USD/JPY	1.38E-05	6.59E-06	0.086	0.025	0.845	0.052	0.931
H/M	AUD/GBP	5.18E-06	2.92E-06	0.045	0.013	0.930	0.023	0.976
H/L	NZD/CHF	1.23E-05	8.75E-06	0.033	0.015	0.919	0.044	0.952
M/L	USD/CHF	6.89E-06	5.70E-06	0.040	0.018	0.926	0.043	0.966
H/M	NZD/GBP	8.82E-06	4.47E-06	0.054	0.014	0.910	0.030	0.964
M/L	EUR/JPY	5.68E-06	2.98E-06	0.106	0.037	0.869	0.037	0.975
M/L	EUR/CHF	1.95E-06	7.12E-07	0.159	0.043	0.817	0.042	0.976
H/M	AUD/EUR	9.86E-06	9.26E-06	0.071	0.046	0.872	0.096	0.943
H/M	NZD/EUR	1.67E-05	1.10E-05	0.093	0.057	0.839	0.082	0.931

Note: This table shows the result of the variance equation for the time period from 1/1999 to 8/2010 for EUR exchange rates and 9/1995 to
8/2010 for the remaining exchange rates.

4.2 H/L Group: Results for High yielding/Low yielding currency pairs

In table 2. we present the results of exchange rates consisting of currencies which lie at the two ends of the yield spectrum of developed economies (i.e. currency pairs consisting of one unit of High yielding currencies expressed as number of units of Low yielding currencies).

Table 2.

Currency pair[42]	$Coefficient^{***}$	*Std. Error*	$Adj.R^2$
1995-2010			
AUD/JPY	0.31	0.025	0.181
AUD/CHF	0.381 (0.388)	0.019 (0.019)	0.266 (0.277)
NZD/JPY	0.283	0.024	0.150
NZD/CHF	0.348 (0.354)	0.022 (0.22)	0.220 (0.229)

Note: Columns market with *** indicate that all entries are significant at the 1 per cent level. Entries in parentheses show results where a first order AR term is introduced to adjust for autocorrelation.

Global stock market returns appear to explain a large proportion of exchange rate returns, as measured by $adj.R^2$, and all the coefficients have the correct sign as predicted by our hypothesis. High yielding currencies appreciate in value versus low yielding currencies when equity prices increase and vice versa. Although the highest yielding currency is the NZD and the lowest yielding currency the JPY (i.e. on average largest interest differentials), it appears that AUD and CHF exchange rates are more sensitive to stock market returns compared to NZD and JPY exchange rates.

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[42] Exchange rates are quoted as one unit of high yielding currency per units of low yielding currency.

4.3 Group M/L: Results for Mid yielding/Low yielding currency pairs

In table 3. we present the results of currencies pairs consisting of one unit of low yielding currency expressed as units of currencies of moderate yield.

Table 3.

Currency Pair[43]	Coefficient***	Std. Error	Adj. R^2
1995-2010			
USD/JPY	0.101 (0.103)	0.017 (0.017)	0.016 (0.019)
USD/CHF	0.12	0.017	0.014
GBP/JPY	0.082	0.022	0.029
GBP/CHF	0.127	0.015	0.073
1999-2010			
USD/JPY	0.108	0.019	0.033
USD/CHF	0.066	0.022	0.003
GBP/CHF	0.102	0.017	0.064
GBP/JPY	0.106	0.024	0.058
EUR/JPY	0.107	0.024	0.050
EUR/CHF	0.064	0.008	0.117

Note: Columns market with *** indicate that all entries are significant at the 1 per cent level. Entries in parentheses show results where a first order AR term is introduced to adjust for autocorrelation.

All results are significant at 1% level and the coefficient has the expected sign as predicted by our hypothesis. Mid yielding currencies appreciate versus low yielders when equity prices

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[43] Exchange rates are quoted as one unit of mid yielding currency per units of low yielding currency.

increase and vice versa. However, the explanatory power of our hypothesis is reduced in the case of M/L currency pairs compared to the case of H/L currency pairs. The sensitivity of exchange rates to stock market returns appears to be similar for all currency pairs though interest differential vary considerable. The hypothesis appears to explain best EUR exchange rates, whereas the explanatory power of the hypothesis is reduced in the case of USD exchange rates. The lower explanatory power of the hypothesis in the case of the USD could be explained by the 'safe heaven' characteristics of the currency, where capital inflows might dampen its depreciation in times of market downturn.

4.4 Results for High yielding/Mid yielding currency pairs (H/M)

In table 4 we present the results of currency pairs consisting of one unit of High yielding currencies expressed in number of units of mid yielding currencies.

Table 4.

Currency pair[44]	Coefficient***	Std. Error	Adj. R^2
1995-2010			
AUD/USD	0.227	0.022	0.172
NZD/USD	0.185	0.021	0.117
AUD/GBP	0.236	0.017	0.13
NZD/GBP	0.198	0.021	0.089

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[44] Exchange rates are quoted as one unit of high yielding currency per units of mid yielding currency.

1999-2010			
AUD/USD	0.278	0.025	0.215
NZD/USD	0.253	0.026	0.165
AUD/GBP	0.248	0.017	0.159
NZD/GBP	0.216	0.022	0.121
AUD/EUR	0.28 (0.286)	0.018 (0.018)	0.205 (0.218)
NZD/EUR	0.25	0.023	0.15

Note: Columns market with *** indicate that all entries are significant at the 1 per cent level. Entries in parentheses show results where a first order AR term is introduced to adjust for autocorrelation.

In the case of H/M currency pairs, the relationship between exchange rates and equity returns appears to be stronger compared to the group of M/L currency pairs but weaker compared to the group of L/H currency pairs. Mid yielding currencies depreciate versus low yielders when equity prices decrease and vice versa. The AUD appears to be slightly more sensitive to stock market movements and the hypothesis explains a larger proportion of AUD exchange rate changes compared to NZD exchange rate changes. The slightly lower sensitivity and explanatory power of the hypothesis for GBP exchange rates could be explained by the higher interest rates (i.e. on average lower interest differentials) of the GBP compared to EUR and USD interest rates. However, it is worth noting that whereas the NZD has the highest interest rates (i.e. on average the largest interest differentials in this group) it is the AUD that exhibits a higher sensitivity to equity returns (similar to the findings in section 3.1). It also appears that the hypothesis explains a larger proportion of USD exchange rate movements when the last ten years are considered rather than the last fifteen years.

4.5 Overview of empirical findings

This hypothesis explains a significant proportion of exchange rate returns, all results are statistically significant and all coefficients have the correct sign. Furthermore, it can be noted that the explanatory power of the hypothesis and the sensitivity of exchange rate returns to stock market returns increases when exchange rates consisting of currencies that lie at the two ends of the yield spectrum are considered (i.e. H/L currency pairs are more sensitive to stock market returns compared to M/L and H/M currency pairs). However, within each grouping of exchange rates, both the explanatory power of the hypothesis and sensitivity of exchange rate returns are not necessarily related to the magnitude of interest differentials.

6. *Discussion*

The empirical findings arising, contribute to two main streams of exchange rate theory. First, the above findings contribute to literature on the relationship of exchange rates and stock prices, and second, to literature on the causes of the empirical failure of UIP. In addition, significant policy implications can be derived from our results.

5.1 On the relationship of Exchange rates and Asset prices

Considering the limited empirical success of exchange rate theories, the explanatory power of this hypothesis is one of the highest in the field of exchange rate economics[45]. By changing the approach on the relationship between exchange rates and equity returns our findings show

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[45] Higher R^2 are observed in literature of the Microstructure approach to exchange rates where a significant relationship between order flow and exchange rate has been observed. However, in contrast to equity returns, order flow is not a publicly observable variable.

that it is not necessarily only national macroeconomic variables or changing macroeconomic variable differentials driving exchange rates. Our finding suggest that investors shift their demand, triggered by global shocks – in this case shocks in global equity returns–, from a currency to another based on the different characteristics of those currencies –in this case relative interest rate levels. The important departure from existing literature is that a *global* variable affects currency values in different ways according to the characteristics of the currency. According to Nieh and Lee (2001), the disparity in results on the relationship between exchange rates and equity returns could be due to differences in government policies, capital controls, and economic development stage. The analysis conducted highlight relative interest rate levels as the defining characteristic alternating currencies' reaction to stock market fluctuations. In this new alternative approach, it is perfectly possible that currency values react in different ways depending on the currencies' characteristics. It is possible that one currency's value is positively related to a variable whereas another currency's value is negatively related to the same variable[46]. In addition, this hypothesis augments the typical traditional two countries – two asset framework by by introducing global variables.

5.2 UIP and systematic risk

The analysis and findings provide evidence to suggest that departures from UIP are due to risk faced by investors. According to Brunnermeier et al. (2008), speculators are discouraged from taking arbitrage positions enforcing UIP because of the skewness of returns. In other words, there is a crash risk caused by sudden unwinding of carry trades which as a result stops investors exploiting the failure of UIP. Our findings support the idea of risk being the

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[46] Assuming that local stock market returns are correlated to global stock market returns, this observation could be also valid when local equity returns instead of global returns are considered.

factor discouraging investors to enforce UIP by suggesting international interest rate arbitrage returns are correlated to stock market return and represent a source of systematic risk. Although the sensitivity of exchange rate returns to equity returns appears to be relatively low (as measure by coefficients; see table 2,3 and 4), the skewness of returns (see Brunnermeier et. al 2008) and the leveraged nature of carry trade strategies act to amplify the risk.

According to Burniside (2008), conventional theories stressing the importance of risk premium as an explanation of the failure of UIP tells us nothing about the economic sources of risk.

The findings in this chapter suggest that the effect of equity returns on wealth plays a significant role in the presence of systematic risk.

Because of substantial levels of leverage employed by many foreign exchange market players (e.g. Hedge funds[47]), their willingness to hold interest arbitrage positions appears to exhibit a high degree of sensitivity to changes in their asset base. There are two channels through which the asset base of financial players is affected. First, during market downturns – assuming decreasing risk aversion– investors withdraw their funds causing the asset base of leveraged players to decline; second, the decline of stock prices results into a lower value of their asset base. Consequently, financial players appear to be inclined to liquidate interest arbitrage positions during economic downturns to cover withdrawals of funds and stock market loses. If financial players were not prone to unwind interest arbitrage positions in the event of a stock market downturn to keep leverage at acceptable levels or those short term fluctuations in demand had little effect on currency values, then high yielding currencies

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[47] According to Jylhä (2009), hedge funds are large carry trade players with carry trades explaining 16% of hedge fund profits.

would have less/no systematic risk[48]. As a result, investors would be free to exploit arbitrage profits without bearing systematic risk and eventually enforce UIP.

5.3 Some implications

The analysis and findings suggest that exchange rates of high yielding currencies deviate from their long run exchange rate in a counter-cyclical fashion while exchange rates of low yielding currencies deviate in a pro-cyclical fashion. Since the early 90s, most central banks adopt inflation targeting for the conduct of monetary policy. Our findings suggest that focusing solely on inflation while ignoring relative interest levels could prove to be a risky strategy. A very low interest rate compared to other developed economies, could lead to an appreciation of the currency during a global recession with negative effects on competitiveness at a point in time when competitiveness is of crucial significance. On the other hand, a large proportion of foreign currency denominated debt in combination with high domestic interest rates could prove as a hazardous combination, as depreciating currency during a global recession could lead to difficulties in servicing of foreign currency denominated debt.

Our findings have also implications for firms participating in international trade and/or international financial markets with regards to their internal and external foreign exchange exposure management. For example, if a firm wishes to reduce the negative effects of a recession, it might be desirable to allocate cash outflows/costs to a high yielding currency while cash inflows/revenues to a low yielding currency. In this case, the local currency value

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[48] According to Jylhä (2009), the flow of money to hedge is significantly affecting exchange rates and other economic variables.

of foreign receipts would increase while the local currency value of foreign payments would decline, practically allowing the firm to hedge against global market downturns. From a portfolio management perspective, the pro-cyclical nature of low yielding currency returns suggests that those currencies can provide substantial hedging benefits.

7. *Conclusion*

The findings provide empirical evidence supporting the market practitioner's view on the relationship between exchange rates and global stock market returns. The sign of the relationship is conditional to the characteristics of the currencies examined. When equity prices increase, currencies with higher interest rates tend to appreciate, whereas currencies with lower interest rates tend to depreciate in value and vice versa. In addition the strength of the relationship depends to some extent on relative interest differentials. A stronger relationship is observed when interest differentials are relatively large, while the explanatory power of the hypothesis is reduced when interest rate differentials are relatively narrow.

Chapter VI

Safe haven currencies

Chapter VI: Safe haven currencies

1. Introduction

The findings in chapter IV suggest that market participants believe that exchange rates of safe haven currencies behave in a counter cyclical fashion. During our sample period, market participants attribute safe haven characteristics primary to the USD and secondary to the CHF. In particular, it is suggested that during times of market downturns and increased uncertainty, investors prefer safe haven currency denominated assets, resulting in an increase in demand for these currencies and consequently an appreciation of the value of safe haven currencies. However, it is interesting to note in the case of events affecting negatively exclusively the US economy, it is suggested that the USD is believed to depreciate. On the other hand, if events affect the whole global economy negatively, even though they might originate from the US, then market participants suggest that there would be safe haven flows towards the USD increasing the value of the currency. This chapter is structured into a number of sections the first of which reviews studies on safe haven currencies. Following we illustrate the method employed to test the real world relevance of the above views. We then present and discuss our findings.

2. *Safe haven currencies: What do we know about them?*

Safe haven currencies have been in the centre of market practitioners' attention for many decades, however, it is only recently that exchange rate theory literature shows a growing interest in this topic. According to Kaul and Sapp (2006), there is a widespread belief among market practitioners that the USD and CHF are seen as the ideal investment destination in times of high uncertainty. According to Jordan (2009), the role of the CHF as safe haven currency can be attributed to factors such as political-institutional- social-financial stability, a low inflation rate over the last 40 years, a high level of independence of the Swiss National Bank (SNB), high levels of reserves of the SNB, and a high savings ratio of Switzerland.

According to Cambell et al (2010), the value of the USD, CHF, and EUR tend to move against global equity markets. The results of this study also show that the diversification benefits of the EUR is increasing with time, suggesting that the EUR is gradually displacing the USD as a safe haven currency. According to Kugler and Weder (2004), Swiss franc bonds have a very low or negative correlation with returns of other risky assets[49]. Ronaldo and Soderlind (2010), by taking a US investor perspective (i.e. USD denominated currency values) and by using data for the 1993–2008 period, suggest that the CHF, JPY and to a smaller extent the EUR are negatively related to US equity and bond market returns.

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[49] According to Kugler and Weder (2004) this diversification benefit might be an explanation of low returns of the CHF.

The findings in chapter V suggest that the CHF and JPY have safe haven characteristics. The value of both currencies shows a significant negative relation to global equity returns. On the other hand, the findings for currencies with interest levels close to the average interest rate of developed countries (i.e. USD, EUR, GBP) are mixed. The value of these currencies is negatively related to global equity returns when measured in units of higher yielding currencies, whereas it is negatively related when measured in units of lower yielding currencies, suggesting that exchange rate behaviour depends on relative interest levels.

Because the sign and strength of the relationship may depend on characteristics of the currencies' economies, it is difficult to conclude which currencies exhibit on average a negative/positive relationship with global equity returns. In order to account for the difficulties associated with the above observation, we chose to examine possible safe haven properties of major currencies by using Effective Exchange Rates (EER). By using EERs, the value of a currency is measured by a weighted average of currencies with different attributes (for example, high/low yielding currencies, liquid/non-liquid currencies, commodity currencies, economies in different stages of development[50] etc) minimizing the effect of currency attributes on exchange rate behaviour and showing whether the value of a currency has the tendency to move on average in a pro/counter cyclical fashion. In addition, by using EER calculated by the Bank of England (BoE), instead of using a currency basket constructed by the author, possible bias of the author that could affect findings are minimized.

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[50] According to Nieh and Lee (2001), the differences in results on the relationship between exchange rates and equity returns could be due to differences in government policies, capital controls, and economic development stage of different countries.

The aim of this chapter is to test the real world validity and generalisability of market practitioners' views in respect to safe haven currencies. In particular, we explore which currencies exhibit a negative relation with global equity returns, and the extent to which this relationship is consistent over time.

According to McGuire and McCauley (2009), there are some common definitions of safe haven currencies. For example, a safe haven currency can be defined as: a currency with low risk and high liquidity, a currency which is bought in uncertain times, a currency that is un-correlated or negatively related to the reference portfolio, a currency that performs well when the reference portfolio suffers loses. For the purpose of this study we define a safe haven currency as a liquid currency, which value is either negatively related to global stock market returns or exhibits a tendency to appreciate during extreme market downturns (i.e. conditional relationship). The findings in chapter IV suggest that safe have characteristics of currencies affect exchange rate behaviour conditionally to sharp market downturns (i.e. conditional relationship). However, in order to gain a deeper understanding, we examine both, the conditional and unconditional relationship between global equity returns and safe haven currency returns.

3. *Data and Method*

In order to examine the safe haven properties of currencies we conduct three tests. The first test assesses the unconditional relationship of EERs of major currencies with global equity returns, whereas the second test investigates the extent to which different major currencies show evidence of additional hedging properties in cases of large market downturns (i.e.

conditional negative correlation). The third test explores whether there is evidence suggesting that the USD appreciates only during market downturns that are at a global scale (i.e. market downturns not affecting mainly the US economy).

For our study we chose EER[51] of the USD, CHF, JPY, GBP and EUR as these currencies account for a large part of foreign exchange transaction, are highly liquid (literature suggests that liquidity is a necessary condition for a currency to be considered a safe haven currency), and their popularity as reserve currencies[52] suggests that those currencies may have the capacity for possible safe haven properties. The sample period begins January 1980 and ends December 2009. By choosing a relatively long sample period, the robustness of this relationship over time can be examined. For example, the JPY became a low yielding currency in the mid 90s. Consequently, there should be no negative relation between JPY exchange rates and stock returns in the 80s, if this relationship is due to carry trade activity. This could suggest that safe haven characteristics are not due to institutional-economic-political factors as suggested by Jordan (2009).

We use weekly data as we are convinced that daily time series are not appropriate because of noise, especially as exchange rate data and stock market indexes are usually recorded at different points in time. On the other hand, lower frequency data might not capture short term demand shifts caused by stock market fluctuation. To capture global equity returns we use weekly time series of the MSCI All Country World Index (ACWI)[53] as a proxy for global equity returns[54]. All data used in this study has been sourced from Thomsons Reuters Datastream.

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[51] Computed by the Bank of England (BoE)

[52] The USD, EUR, GBP, JPY and the CHF are ranked as 1st, 2nd, 3rd ,4th and 5th respectively in terms of value held as reserve currencies. Source: http://www.imf.org/external/np/sta/cofer/eng/cofer.pdf

[53] The MSCI ACWI (All Country World Index) Index consists of 45 country indices comprising 24 developed and 21 emerging market country indices. source: http://www.mscibarra.com/products/indices/international_equity_indices/definitions.html#STANDARD

[54] The chose the MSCI index instead of the FTSE index employed in chapter V, because the later does not cover the whole sample period.

In order to test for stationary we perform Augmented Dickey-Fuller test to check for the presence of unit root for all EERs and the MSCI All Country World Index (ACWI). The Schwarz information criterion is used to determine lag length. The results suggest that unit roots cannot be rejected at level of the time series. At first difference of the series no unit root is present at 1% significance level[55]. Therefore we study the returns of the series (i.e. log first difference) instead of considering them at levels.

In line with the econometric method employed in the previous chapter[56], we estimate the relationship between equity returns and exchange rates by employing Maximum Likelihood (ML) regressions with Generalized Autoregressive Conditional Heteroscedasticity (GARCH) [1,1] errors. We choose a ML-GARCH [1,1] framework in order to account for volatility clustering frequently observed in financial time series.

We assume that the relationship between exchange rate returns and equity returns is given by the following equation:

$$\Delta ln S_{j,t} = \gamma \Delta \ln MSCI_t + \varepsilon_t \quad \text{(1)}$$

Where $\Delta ln S_{ij,t}$ is the log first difference of the weekly effective exchange rate of currency j. $\Delta \ln MSCI_t$ is the first log difference of the weekly time series of the MSCI ACWI in local currency terms.

[55] To save space, Augmented Dickey-Fuller test results are not shown, however they are available from the author on request.

In order to investigate how effective exchange rates react to major market downturns, we assume that the relationship between exchange rate returns and equity returns is given by the following equations:

$$\Delta lnS_{j,t} = \gamma\Delta\ln MSCI_t + \kappa D_1\Delta\ln MSCI_t + \varepsilon_t \quad (2)$$

Where $\Delta lnS_{ij,t}$ is the log first difference of the weekly effective exchange rate of currency j. D_1 is an interactive dummy variable taking the value of 1 when weekly negative returns exceed -2.5 percent (i.e. $\Delta\ln MSCI_t$ < -0.025) and 0 otherwise.

In order to investigate whether the USD switches behaviour depending on whether a crisis is US centric or global, we assume that the relationship between exchange rate returns and equity returns is given by the following equation:

$$\Delta lnS_{j,t} = \gamma\Delta\ln MSCI_t + \kappa D_2\Delta\ln MSCI_t + \varepsilon_t \quad (3)$$

Where D_2 is an interactive dummy variable taking the value of 1 when negative MSCI US returns (i.e. US equity returns) exceed -2.5% while at the same time MSCI US returns are lower to MSCI World, MSCI Germany (i.e. German equity returns) and MSCI Japan returns (i.e. Japanese equity returns). By employing this proxy dummy variable we attempt to capture events that affect the US to a larger extent compared to other major economies, and 0 otherwise.

In order to test whether the the USD switched behaviour depending on whether the recent

financial crisis was seen as US centric or global, we assume that the relationship between

exchange rate returns and equity returns is given by the following equation:

$$\Delta ln S_{j,t} = \gamma \Delta \ln MSCI_t + \kappa D_3 \Delta \ln MSCI_t + \varepsilon_t \quad (4)$$

Where D_3 is an interactive dummy variable taking the value of 1 during the peak of the recent

financial crisis (i.e. 9/2008-6/2009) and 0 otherwise (i.e. 1/2007-6/2009)[57]. In other words,

we assume that the crisis became a global phenomenon after the collapse of Lehman

Brothers. In contrast to the other regressions in this chapter, we run this test for the period of

the recent financial crisis only (i.e. 1/2007-6/2009), in order to depict a possible change in

USD exchange rate behaviour during the crisis (as suggested in chapter IV).

For mean equations 1, 2, 3, and 4, the error term has zero mean and its conditional variance

equation is specified in (5):

$$\sigma_t^2 = \omega + \alpha 1 \varepsilon_{t-1}^2 + \beta 2 \sigma_{t-1}^2 \quad (5)$$

Where ε_{t-1}^2 is the lag of the squared residual from the mean equation – ARCH term– and

σ_{t-1}^2 is last period's variance forecast – GARCH term–.

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[57] According to NBER, the recession caused by the recent financial crisis ended 6/2009. Source: Business Cycle Dating Committee, National Bureau of Economic Research, http://www.nber.org/cycles/sept2010.html

Our findings suggest that exchange rate returns can be characterized by GARCH models suggesting the presence of Conditional heteroscedasticity. All our time series models display significant 'alpha' –ARCH parameters– and 'beta' –GARCH parameters–. The sum of 'alpha' and 'beta' are close to one for all currency pairs and estimates of the β parameter are very high and close to unity suggesting that volatility shocks are persistent. In order to account for possible serial correlation, we re-estimated our regression by introducing a first and in some cases second order AR terms to the mean regression, in all the cases where Ljung–Box Q statistics indicated the existence of autocorrelation. The results of the re-estimated regressions have proven not to be significant in the estimation and therefore are not shown in the empirical findings section.

4. *Empirical Findings*

i)   *The (unconditional) relationship between safe haven currency returns and global equity returns ($\Delta \ln MSCI_t$)*

Table 1: *The relationship between weekly global equity return and effective exchange rate returns (equation 1; 1980-2009)*

1980-2009	CHF***	USD	JPY	EUR***	GBP***
Coefficient	-0.063	-0.013	-0.008	-0.022	0.027
Std error	0.005	0.010	0.014	0.008	0.010
p-value	0.000	0.207	0.563	0.005	0.006

Note: Columns market with ***, indicate entries significant at 1% level.

Over the full sample period the sensitivity of EERs to global equity returns is overall low which can be attributed to the low levels of volatility that EER exhibit. CHF and EUR returns are both negatively related providing evidence of safe haven properties. Surprisingly the JPY, which showed significant negative relation in the findings in previous studies [see: chapter V, Ronaldo and Soderlind (2007)], fails to provide evidence of a significant relationship between EER returns and equity returns. Similarly, the USD which is seen traditionally as a safe haven currency, though negatively related to equity returns, fails to provide evidence that this relationship is statistically significant at conventional levels.

-   *Splitting the sample-period into two sub-periods*

When examining sub-periods (i.e. 80-95 and 96-09), the findings are mixed. During the first sub period (1980-95), the value of the USD shows a statistically significant negative relationship with global equity returns. However, there appears to be no relationship between the CHF returns and global equity returns at conventional significance levels. Moreover, in contrast to earlier findings, the JPY appears to be positively related to equity returns explaining the absence of a relationship at conventional significance levels when the whole sample period is considered.

Table 2: *The relationship between weekly global equity return and effective exchange rate returns (equation 1; 1980-1995).*

1980-95	USD**	CHF	JPY***	EUR	GBP
Coefficient	-0.043	-0.009	0.071	-0.018	0.019
Std error	0.019	0.013	0.018	0.013	0.018
p-value	0.020	0.494	0.000	0.170	0.300

Note: Columns market with *** and ** indicate entries significant at 1% and 5% level respectively.

During the second sub-period (1996-2009), there is no negative relationship between USD returns and equity returns at conventional significance levels, explaining the absence of a relationship at conventional significance levels when the whole sample period is considered. On the other hand, CHF returns show a statistically significant negative relation to equity returns, suggesting that the existence of a statistical significant relationship (when the whole sample period is considered) is due to a strong relationship over the later years of the sample period. Similarly, JPY returns show statistically significant negative relationship when the second sub-period is considered, which is consistent with findings of previous studies. EUR returns show a statistical significant negative relation to equity returns, while there is no significant relationship between the GBP and equity returns at conventional levels.

Table 3: *The relationship between global equity return and effective exchange rate returns (equation 1; 1996-2009)*

1996-09	USD	CHF***	JPY***	EUR**	GBP**
Coefficient	0.007	-0.099	-0.081	-0.023	0.030
Std error	0.012	0.007	0.019	0.010	0.012
p-value	0.571	0.000	0.000	0.020	0.012

Note: Columns market with ***, **, indicate entries significant at 1% and 5%, level respectively.

ii)   *Conditional relationship between safe haven currency returns and global equity*

   returns

a) Relationship conditional to large equity market downturns defined as negative returns

   exceeding -2.5% (MSCI

The results in table 4., show that with the exception of the CHF, no currency demonstrates additional hedging properties (at conventional significance levels) during large market downturns for the period 1980 to 2009.

An interesting observation is that when we consider the first sub-period only (1980-95), the USD appears to have a slight tendency to depreciate[58] during large market downturns, even though it exhibits a counter cyclical behaviour under normal market conditions. Another, notable observation is that the CHF, shows evidence of conditional hedging properties (i.e. the CHF appreciates in cases of large market downturns), although there is no relationship between the CHF and global equity returns overall during this sub-period.   When turning to the second sub-period, there is a number of interesting observations. As expected (based on table 3 findings) the CHF shows additional hedging properties during large market downturns. On the other hand, the JPY which shows strong evidence of a countercyclical behaviour during this sub-period (similar to the CHF) fails to show evidence of additional hedging properties during large market downturns. Interestingly, the EUR, which showed evidence of a countercyclical behaviour during the second sub-period, not only fails to

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[58] When the two coefficients are added, the sign of the relationship turns to positive.

provide evidence of additional hedging properties in cases of large market downturns, but

shows some evidence of a tendency to depreciate during large market downturns.

Table 4: *The conditional relationship between weekly global equity return and effective exchange rate returns (equation 2; 1980-2009)*

1980-2009	GBP MSCI	CHF MSCI	EUR MSCI	USD MSCI	JPY MSCI	GBP MSCID1	CHF MSCID1	EUR MSCID1	USD MSCID1	JPY MSCID1
Coefficient	0.04	-0.05	-0.02	-0.03	0.00	-0.020	-0.020	0.010	0.030	-0.030
Std error	0.02	0.01	0.01	0.02	0.02	0.020	0.010	0.020	0.020	0.030
P-value	0.02	0.00	0.02	0.10	0.81	0.260	0.030	0.740	0.130	0.210

Table 5: *The conditional relationship between weekly global equity return and effective exchange rate returns (equation 2; 1980-1995)*

1980-1995	GBP MSCI	CHF MSCI	EUR MSCI	USD MSCI	JPY MSCI	GBP MSCI*D1	CHF MSCI*D1	EUR MSCI*D1	USD MSCI*D1	JPY MSCI*D1
Coefficient	0.038	0.016	-0.007	-0.077	0.094	-0.038	-0.053	-0.023	0.09	-0.061
Std error	0.026	0.016	0.016	0.025	0.024	0.045	0.021	-0.822	0.047	0.047
P-value	0.137	0.330	0.673	0.002	0.000	0.405	0.010	0.411	0.056	0.189

Table 6: *The conditional relationship between weekly global equity return and effective exchange rate returns (equation 2; 1996-2009)*

1996-2009	GBP MSCI	CHF MSCI	EUR MSCI	USD MSCI	JPY MSCI	GBP MSCI*D_1	CHF MSCI*D_1	EUR MSCI*D_1	USD MSCI*D_1	JPY MSCI*D_1
Coefficient	0.030	-0.088	-0.036	0.009	-0.082	0.000	-0.027	0.031	-0.005	0.002
Std error	0.021	0.012	0.014	0.020	0.030	0.026	0.014	0.019	0.023	0.038
p-value	0.152	0.000	0.010	0.651	0.006	0.999	0.057	0.102	0.818	0.948

b) The impact of large equity market downturns affecting mainly the US economy

According to findings of chapter IV, it is suggested that the safe haven properties of the USD depend on the scope of crises. In other words, when a crisis is affecting mainly the US, then the USD is believed to be positive related to equity returns. However, if a crisis is seen as a global phenomenon, then the USD is believed to be negatively related to equity returns. However, the results in table 7. suggest that the absence of a consistent negative relationship between the USD and equity returns is not explained by a tendency of the USD to depreciate when the crisis affects the US more than the rest of the world (i.e. a negative relationship during world crises being cancelled by a positive relationship during US crises). There is no evidence of a significant relationship between USD returns and global equity returns at conventional levels during events affecting mostly the US.

Table 7: *The conditional relationship between global equity return and USD effective exchange rate returns (equation 3; 1980-2009)*

1980-2009	USD
Coefficient	-0.008
Std error	0.028
p-value	0.767

c) *Altering relationship between USD returns and global equity returns during the recent financial crisis*

In order to investigate further the existence of changes in the strength and sign of the relationship between USD returns and global equity returns, we explore the exchange rate behaviour of the USD during the recent credit crunch by testing the empirical fit of equation 4. The financial crisis began in 2007 triggered by limited liquidity of the US banking system. Whereas the crisis was initially believed to affect mainly the US, spill over's to European financial institutions and the collapse of Lehman Brothers spread its implications to the rest of the world.

Whereas there appears to be no link between the USD and equity returns at the beginning of the crisis (at conventional significance levels), there is evidence of a strong negative relationship between the USD and equity returns at the zenith of the crisis.(see table 8.)

Table 8. : *The conditional relationship between global equity return and USD effective exchange rate returns during the recent financial crisis (equation 4; 1/2007-6/2009)*

1/2007-62009	Coefficient	Std error	p-value
MSCI	0.031	0.035	0.375
MSCI*D_3	-0.269	0.066	0.000

5. *Discussion*

The USD is regarded traditionally as a safe haven currency. This view is also confirmed by our analysis in chapter IV, as market commentary frequently referred to the USD, as a safe haven currency. Our empirical findings however provide mixed evidence with regard to the safe haven properties of the USD. The USD is negatively related to equity returns in the first sub-period (1980-95) as well as during the peak of the recent financial crisis. However, there is no evidence of a negative relationship during the remaining sample period. Moreover, although there is evidence of a countercyclical behaviour of the USD during the first sub-period, there was a tendency for the USD to depreciate during large market downturns between 1980 and 1995.

Over the whole sample period, CHF returns appear to be negatively related to stock market returns. However, when the unconditional relationship between the CHF and equity returns is assessed for the two sub-periods, the currency shows evidence of a relationship only in the

second sub-period (ie. 1996-2009). When investigating the conditional relationship between the CHF and equity returns (i.e. relationship conditionally to large market downturns), then the CHF shows evidence of hedging properties in both sub-periods.

The JPY switches from a statistically significant positive relationship with global equity returns in the first sub-period, to a significant negative relationship in the second sub-period. However there is no evidence suggesting that the JPY offers additional protection in the cases of large market downturns.

The EUR shows some evidence of safe haven characteristics during the second sub-period. A observation consistent with findings of previous studies, where evidence suggests that the EUR gradually strengthening its position as a safe haven currency. However the countercyclical behaviour of the EUR appears to be dampened in cases of large market downturns. In contrast to the all other currencies, the GBP fails to show any evidence of the existence of hedging proprieties.

Overall our findings suggest that there are two different patterns of exchange rate behaviour during the two sub periods. Whereas during the first sub period (1980-95), it is the USD that shows evidence of safe haven properties, it is the CHF, JPY and EUR that show evidence of safe haven characteristics during the second sub-period[59]. This contradictory behaviour may be explained for the JPY and CHF by the decline of JPY and CHF interest rates and the resulting increase in the popularity of the JPY and CHF as funding currencies for carry

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[59] However, it should be noted that the CHF is negatively related to equity returns even in the first sub-period when only large market downturns are considered.

trades. According to our findings in chapter IV and V, the negative relationship between exchange rate and equity returns may be due to the effect of equity returns on the extent investors are willing to hold risky arbitrage positions (e.g. carry trades).

An interesting observation is the sharp change in the strength of the relationship between the USD and global equity returns during the recent financial crisis, possibly in response to shifts of investors' perception with regard to the scope of the crisis. Initially, investors appear to have viewed the banking crisis as a US issue and increased demand for the EUR. As the crisis was spilling over to Europe and it became evident that the crisis was becoming a global phenomenon, investors increased demand for USD. However, the proposition of the USD appreciating during global crisis but depreciating during US crises, though appears to be supported in the case of the recent credit crunch, it is not supported by empirical evidence during the whole thirty years period.

6. *Conclusion*

Safe haven currencies are defined by literature as currencies that either show a negative relationship with portfolio returns or provide protection during significant financial crises. Our findings in chapter V suggest that lower yielding currencies are negative related to global stock market returns when their value is measured in units of higher yielding currency. Those results suggest that a) safe haven properties depend on carry trades and consequently relative interest rates and b) hedging properties depend on the relative interest rates of the currency

the value is measured of. In order to investigate which currencies have on average safe haven properties we use effective exchange rates as a proxy for currency value. In addition we use a relatively large sample period to include periods of higher global interest levels and varying levels of carry trade activity, in order to assess the extent to which currencies are negatively related to global equity returns due to long-standing institutional-economic-political factors, or due to short lived arbitrage strategies employed by investors during different periods.

Even though our findings suggest that the value of some currencies is negatively related to global equity returns, our findings also show that this strength and even the sign of this relationship varies during different sub-periods and even during the unfolding of a single event such as the credit crunch. It appears that even though some currencies exhibit safe haven characteristics (for example USD , JPY and EUR), the cause of their negative relationship with equity returns is not rooted in long lasting institutional- economic-political characteristics of countries but rather by short-lived investment strategies (e.g. carry trades) employed by investors.

Chapter VII

Conclusion

Chapter VII: Conclusion

Exchange rates theory evolved gradually from trade flow centric approaches to modern asset models such as the flexible price monetary model and the Dornbush overshooting model. Since the publication of the Redux model by Obsteld and Rogoff in 1995, part of mainstream economists attention has been directed towards a new approach on foreign exchange rates with the common element of the new models being the introduction of nominal rigidities and market imperfections in a macroeconomic model with specified microfoundations. At the same time, the interest in the Microstructure approach to exchange rate grew on importance by revealing a strong relation between order flow and exchange rates. On the other hand, part of the focus of academic literature is shifting away from mainstream economic analysis towards models of human psychology by applying them to financial markets (i.e. behavioural finance).

However, the understanding of the mechanism determining exchange rates is still an unsolved puzzle in the field of international economics. This is particularly true in regards to short term exchange rate movements.

In the search for the underlying causes of the weak performance of existing approaches, our study revealed that a significant number of scholars consider the methodology employed by mainstream economics as a main cause for the disappointing result of established approaches. In particular, the excessive use of formal modelling and quantitative data as well as the use of oversimplified assumptions have been criticized. In response to this critique we chose to use

a more pluralistic approach in our research methodology by employing both qualitative data as well as quantitative data analysis. While we acknowledge the usefulness of formal models to simplify the complexity of the world, the addition of narratives, in order to illustrate in detail the mechanisms at work, enabled us to present a more detailed picture of the mechanisms at work, contributing significant to the understanding of short term exchange rate behaviour. Instead of relying solely on quantitative data we recognize the value of qualitative data and the contribution market participants can make to our understanding of exchange rate behaviour by providing us with their valuable insights. On the other hand, we employed quantitative data and formal statistical test to assess the validity and generalisability of the proposed theories.

For the analysis of qualitative data, we employed an approach based on grounded theory principles. We analyzed Reuters Foreign exchange market reports for the period 1/5/2007 – 31/10/2007. The findings of the qualitative data analysis in this thesis showed that, based on market practitioners commentary, there are two predominant variables affecting exchange rates. First, expectations on interest rate changes appears to be a major variable affecting currency value. An upward revision of interest rate expectations usually suggests an increase in the value of the currency concerned and vice versa. In turn, the main variables affecting interest rate expectations of market participants, appear to be inflation rates and employment figures. In contrast to mainstream exchange rate theory, where higher inflation rates are seen as negative for the value of a currency, market participants suggest that higher inflation rates cause a currency to appreciate, as higher inflation implies a higher possibility of an interest rate increase, and an appreciating currency. Our search of empirical evidence on this relationship revealed that a positive relationship between interest rates, inflation rates and currency value is observed in many cases.

Second major variable affecting exchange rates appears to be global equity returns. In contrast to interest rates, which is a country specific variable, global equity returns is a global variable affecting currencies based on their relative interest rate levels. High/higher yielding currencies' value is positive related to global equity returns, while low/lower yielding currencies' value is negatively related to global equity returns. These results break significantly with conventional wisdom. The current paradigm in mainstream exchange rate models, as seen in our literature review, is treating exchange rate movements as a result of differentials in economic variables (e.g. Interest rate, inflation rate, money supply growth rate differentials etc).   However, our findings suggest that market participants consider not only changes and differentials in relative values of macroeconomic variable, but also changes of global variables (e.g. global stock market returns) affecting currencies depending on their characteristics. Relative interest rates (high yielder/low yielders) and the presence of a safe haven attributes, appear to be the two main characteristics affecting the response of a currency to global equity return changes. The empirical tests we performed to explore the conditional relationship between exchange rates and global equity returns suggest that they are indeed linked. The sign of the relationship is conditional to the characteristics of the currencies examined. When equity prices increase, currencies with higher interest rates tend to appreciate, whereas currencies with lower interest rates tend to depreciate in value and vice versa. In addition, the strength of the relationship depends to some extent on relative interest differentials. A stronger relationship is observed when interest differentials are relatively large, while the explanatory power of the model is reduced when interest rate differentials are relatively narrow. Our study presents evidence on the role of stock markets in exchange rate determination which is considerable different to the focus of current theory. Whereas current research focuses on stock market's relative stock market returns in the respective countries, the findings of this thesis suggests that global stock market returns affect global risk appetite

and hence exchange rate movements based on differentiated characteristics of different currencies. Moreover, this thesis provides insight to the issue of changing risk premiums. Whereas differing risk premiums are often given as an explanation of observed foreign exchange market anomalies and exchange rate movements, the investigation of factors causing the varying risk premiums is still limited. Our study suggests that equity market returns might play an important role, giving a possible explanation of the frequently observed failure of uncovered interest parity. Our study also highlights the importance of interactions between different financial markets. We show how market participants understand the functioning of the underlying mechanisms, channels and procedures (e.g. carry trades), whereby equity markets affect foreign exchange markets. Moreover we illustrate the mechanisms through which fluctuations in one financial market equity markets are affecting the foreign exchange market (see chapter V).

An important contribution of this thesis is that we illustrate how complex interactions among different variables might cause exchange rate bahaviour to contradict not only to conventional economic wisdom, but also to differentiate views of market participants from one period to another. For instance, although the findings of this thesis suggest that market participants' views on the underlying mechanism affecting exchange rate behaviour are mainly consisted among different participants, the suggested relationships change when economic conditions change. Whereas interest changes were seen as positively correlated to the home currency value, the relationship was seen as being reversed (i.e. negative correlation) because of the possible effect of higher interest rates on the subprime crisis. Another, example is the relationship between exchange rates and equity markets. For example, our findings in chapter VI suggest that whereas the USD effective exchange rate was not related equity returns during the initial stages of the subprime crises, the strength of

the relationship increased significantly when the crisis escalated and the demand for USD increased due to safe haven flows. According to market participants'' views, the USD gained in value only when the crisis was perceived to have significant spill over effects to the global economy. An additional factor affecting the strength and sign of relationships between variables appear to be linked to currently employed investment strategies. For example, the conduction of carry trades played a crucial role in the relationship between exchange rates and equity returns. However, the extent of which some investment strategies might change in response to factors such as changing economic conditions (e.g. the popularity of carry trades might decline as a result of a lower availability of liquidity) or changes in the perception of market participants regarding the risks attached to a particular investment strategy. A reduction in the extent of carry trades would result in the weakening of the relationship between exchange rates and equity returns. For example, the negative relationship between global equity returns and the JPY appeared only after interest rates in Japan declined. Changing institutional factors appear to be another factor affecting the way exchange rates react to different economic variables. For example, a change of a central bank's monetary policy framework from inflation rate targeting to another target would affect the relationship between inflation rates and exchange rates (see chapter IV for more details).

This study revealed not only the complex relationship between exchange rate returns and economic variables, but also examined the complex mechanisms where the increased degree of internationalisation in developed economies and the integration of financial markets experienced during the last decades appear to be playing a significant role in the formation of the underlying mechanism of exchange rate determination.

In conclusion, even if most of the above mentioned factors may have only a limited impact on currency values in the long run, with exchange rates behaving 'as if' those factors are irrelevant, our study provides significant evidence that short and medium term exchange rate behaviour are affected significantly by the prevailing paradigm and practices of market participants, hence contributing to the understanding of short term exchange rate behaviour.

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Appendix

Please find attached the CD containing the reports used in chapter IV of this thesis.