

The British foreign exchange reserves puzzle

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Abstract

The British foreign exchange reserves decreased by 40 percent during the period August 1996-December 1999 although the Pound Sterling is considered a floating exchange rate since it left the EMS in 1992. Since changes in the level of foreign exchange reserves are usually taken as indicators for foreign exchange interventions in the economic literature we investigate the case of the British reserves in detail. While the Pound Sterling has appreciated strongly against the Deutsch mark in this period its exchange rate versus the US dollar has remained comparatively stable. However, the Bank of England has denied any interventions in the foreign exchange markets. We find that transactions for the government, such as repayments of Treasury bonds, account for a large part of the decrease in reserves. Valuation changes due to exchange rate fluctuations can explain only a small fraction of the decrease. This result shows that variability in official reserves is not necessarily associated with foreign exchange intervention. However, even after estimating the effects of exchange rate fluctuations and interest earnings and correcting for government transactions we still find a considerable decrease in the UK reserves that is not explained by either the Bank of England or HM Treasury.

JEL-Classification: E58, F31, F33

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Non-technical summary

According to pure textbook economics floating exchange rate regimes are characterised by relatively high volatility in the exchange rate and relatively low volatility in the level of foreign exchange reserves. This classification is widely used in several recent research papers in which exchange rate policies of different countries are analysed. With this background the case of the British Pound Sterling presents an interesting one to study. Although Sterling is considered a floating exchange rate since it left the EMS in 1992 the level of UK foreign exchange reserves decreased by 40 percent during the period August/September 1996 – December 1999 while at the same time the Pound Sterling/US Dollar exchange rate has been very stable. This is what we call the “British foreign exchange reserve puzzle“ in this paper.

Volatility in the level of foreign exchange reserves is often referred to as an indication for intervention operations. Indeed we find that monthly changes in the level of UK reserves are weakly negatively correlated with monthly changes in the Sterling/US Dollar exchange rate, which would support the theory that the central bank has intervened to avoid a weakening of the Pound versus the US Dollar. However, the Bank of England has strongly denied any interventions in the foreign exchange markets. Therefore we analyse the determinants of the decrease in the level of foreign exchange reserves in detail.

To this end the effects of valuation changes of the currency components of the reserve stock are estimated and interest earnings calculated. The analysis of the foreign exchange reserves for the period August 1996-December 1999 as published in the IMF International Financial Statistics yields the following results:

- Estimated valuation changes due to exchange rate fluctuations can explain only a small fraction of the decrease of the reserve stock.
- A rough estimate shows that if interest earnings on the reserve stock are taken into account and thus are subtracted from the reserves the actual decrease in the level of reserves appears to be even larger.
- Government transactions (mostly repayments of government bonds) account for the largest fraction of the reserve decrease.
- After taking account of these factors we still find a difference of about 4,7 billion US dollars that remains unexplained. According to the Bank of England this difference should not be taken as an indication for market intervention.

The conclusions that are drawn from the analysis are the following:

- First of all it is shown that variability in the official reserves of a country is not necessarily associated with intervention operations. The case of the British reserves shows that transactions for the government account for a large part of the decrease in reserves. Hence it seems to be inappropriate to take reserve variability as a measure for exchange rate targeting without analysing the determinants for the variations (as it is often found in recent research).
- Although the exchange rate of Pound Sterling versus the US dollar has been very stable we could not find clear evidence for intervention operations using monthly reserve data. However, even after estimating the valuation effects from exchange rate changes, taking account of estimated interest earnings and adding up the published transactions for the government there remains a difference of around 4,7 billion US dollars that is left unexplained.

1. Introduction

The analysis of exchange rate regimes has been an issue in several recent research papers. One important result of these studies is that several countries do actually pursue a different exchange rate regime than that which is officially declared in the statistics of the IMF (see Levy Yeyati/Sturzenegger (1999), Calvo/Reinhart (2000), Reinhart (2000)). More precisely, it seems that countries who say they float mostly do stabilise their exchange rate. Reinhart thus concludes that „...the so-called ‘demise of fixed exchange rates’ is a myth.“ (Reinhart, 2000: 65-66).

Among other factors these studies use the variability of the exchange rate as well as the variability of foreign exchange reserves as indicators for the actually pursued exchange rate regime of a country.¹ Theory predicts that in a floating exchange rate regime the variability of the exchange rate is relatively high and the variability of foreign exchange reserves is relatively low. For countries that do not let their currency float one would expect more variability in reserves: „In the context of less-than-freely-floating exchange rates, purchases and sales of international reserves are routinely a means for smoothing exchange rate fluctuations...“ (Calvo/Reinhart, 2000: 13).

In their study, Calvo/Reinhart surprisingly find that countries which declare to let their exchange rate float have a higher variability in their reserve stock than countries with a limited flexibility regime. Thus they conclude: „Countries that say they allow their exchange rate to float mostly do not – there seems to be an epidemic case of ‘fear of floating’.“ (Calvo/Reinhart, 2000: 2)

With this background the case of the United Kingdom presents a particularly interesting one to study. After Sterling left the EMS in September 1992 it has been officially declared as a floating exchange rate. Nevertheless between August 1996 and December 1999 official reserves decreased substantially (about 40 percent). On the other hand the Sterling/US dollar exchange rate exhibited a remarkably low variability (especially when compared with the large appreciation of Sterling against the Deutsch mark in this period). These two observations seem to contrast the common view that a floating exchange rate regime is characterised by high volatility in the exchange rate and low volatility in the level of reserves.

Pure textbook economics would suggest that this indicates a stabilisation of the Sterling/US dollar exchange rate by using foreign exchange intervention. Indeed a sale of its foreign exchange reserves seems to be in line with a strategy to prevent Sterling from depreciating against the US dollar (as have other European currencies during this period). However, the Bank of England explicitly states in its reports that it has not intervened in the foreign exchange market. Nevertheless, it seems appropriate to ask for the reasons of this decrease in reserves because as Kearney/MacDonald (1986) write: “Insofar as official pronouncements often seek to influence the behaviour of economic agents rather than to enlighten them, it would seem prudent to base any conclusions reached upon the evidence of what the authorities have actually done.” (p. 348).

The aim of this paper is to contribute to the recent discussion about exchange rate regimes. Taking the case of the UK as example it analyses to what extent variability in foreign exchange reserves is associated with measures to stabilise exchange rates. The result will shed light on the usefulness of reserve variability as an appropriate indicator for classifying exchange rate regimes.

To this end the determinants of the recent decline of UK reserves are analysed. Using data from the IMF International Financial Statistics as well as reports of the Bank of England we

¹ Other variables that are used in these studies include interest rate volatility, volatility in base money and commodity price volatility.

find that most of the reserves were used for government transactions such as repayments of Treasury bonds. Only a small fraction of the reserve decline can be attributed to changes in the valuation of the foreign currency holdings. If interest earnings on the reserve stock are subtracted from the level of foreign exchange reserves the decline appears to be even larger than the IFS numbers suggest.

The following chapter will give a short description of the recent history of the Pound Sterling. Chapter 3 will provide arguments for a stabilisation of the Sterling/US dollar exchange rate. Chapter 4 will then analyse the movements in the reserve stock. Chapter 5 concludes.

2. History of UK exchange rate regimes and the recent behaviour of Sterling

According to George (1998), the Governor of the Bank of England, there have been two periods since the breakdown of Bretton Woods in which the Sterling exchange rate was targeted.

The first period extends from 1987 to 1988 when the Bundesbank policy was shadowed in order to import stability. This decision was never officially declared but it was evident that the Bank of England tried to prevent the Sterling/Deutsch mark exchange rate from appreciating beyond 3 Deutsch mark/Sterling. Interest rate cuts as well as foreign exchange intervention were used to achieve this aim. Foreign exchange reserves increased nearly 300 percent in these two years which means that Sterling was sold for foreign currency to avoid appreciation.

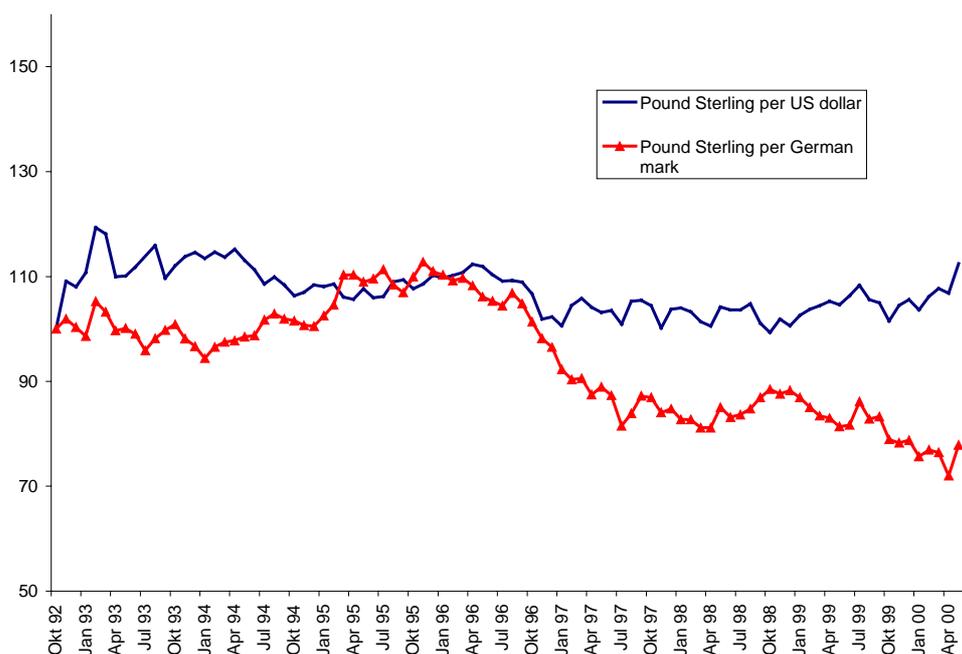
Sterling's participation in the European Monetary System from October 1990 to September 1992 can be seen as the second attempt to target the exchange rate. As is well known, the German reunification and the subsequent increases of German interest rates posed huge problems for the monetary policy of the Bank of England. The domestic economic situation in the early 1990s was not compatible with interest rate increases that would have been necessary to secure the peg to the Deutsch mark. Thus foreign exchange intervention was conducted which led to a fall of UK's international reserves of around 5 billion US dollar (equivalent to about 12 percent of the total reserve stock).

Since Sterling left the EMS its exchange rate has been considered as "independently floating" according to the classification of the IMF. This means that foreign exchange intervention is only conducted to correct "disorderly markets" whereas in a system of "managed floating" intervention is pursued regularly to target a concrete exchange rate which is not made public. More precisely, independent floating implies that any foreign exchange intervention is "aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate, rather than at establishing a level for it."²

The following chart shows the movements of the Pound Sterling against the Deutsch mark and the US dollar for the post-EMS period.

² See IMF Annual report on exchange arrangements and exchange restrictions, p. 2.

Figure 1: Pound Sterling against US dollar and Deutsch mark



Source: Datastream, own calculations. October 1992=100.

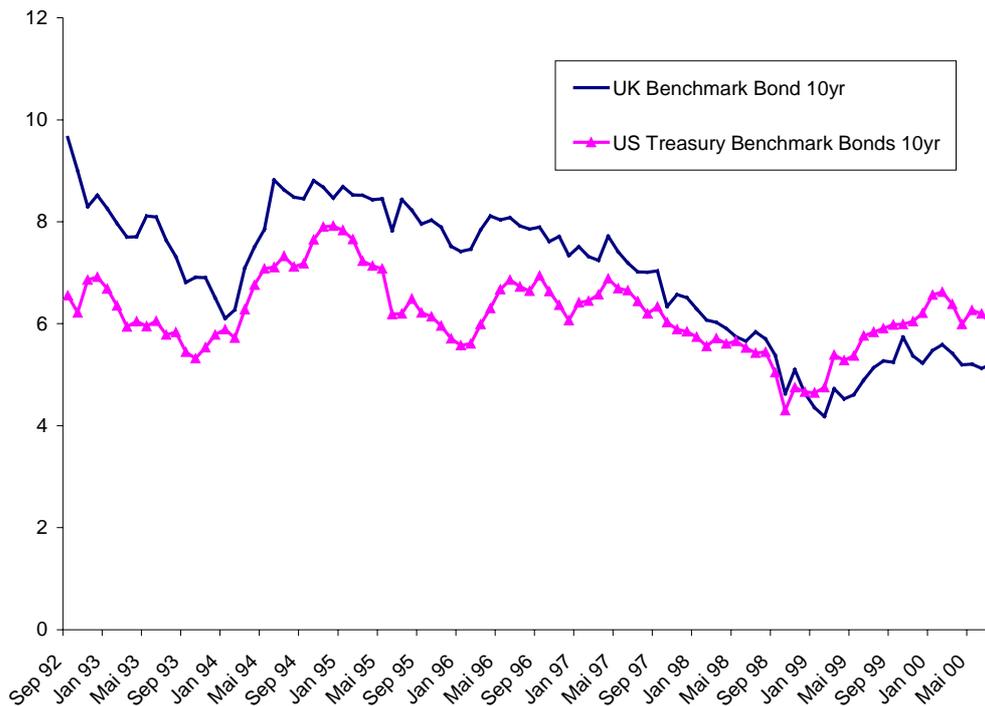
While the exchange rate versus the Deutsch Mark has appreciated substantially since 1996, the exchange rate versus the US dollar has remained very stable without any trend.

It is especially the appreciation trend against the Deutsch mark that has attracted public and academic interest. On the one hand this development contradicts the results of the uncovered interest parity. Since the UK interest rates have been consistently higher than in Germany one would have expected Sterling to depreciate in order to compensate for the interest differential (see Wadhvani, (1999)). On the other hand the Sterling exchange rate versus the Deutsch Mark reflected ideally the differences in the business cycles, as British GDP growth has been higher than German GDP growth in the second half of the 1990s.

The Sterling/US dollar exchange rate has not been in the focus of academic research recently. One reason for its relative stability might stem from the symmetry of business cycles of the US and UK and to some extent in similar movements of interest rates, as seen in the following graph. However, it is beyond the scope of this paper to analyse the determinants of the Sterling/US dollar exchange rate in detail. Instead we focus on the relationship between the behaviour of the exchange rate and the fluctuations in foreign exchange reserves.

What we call the “puzzle” in the British foreign exchange reserves is the fact that normally a declining stock of reserves is associated with a weak currency (since the central bank tries to stabilise its own currency by buying it against foreign currency). Since the Pound Sterling has been a strong currency over the last years this does not correspond to the development of its reserve stock at first sight.

Figure 2: US versus UK long term interest rates

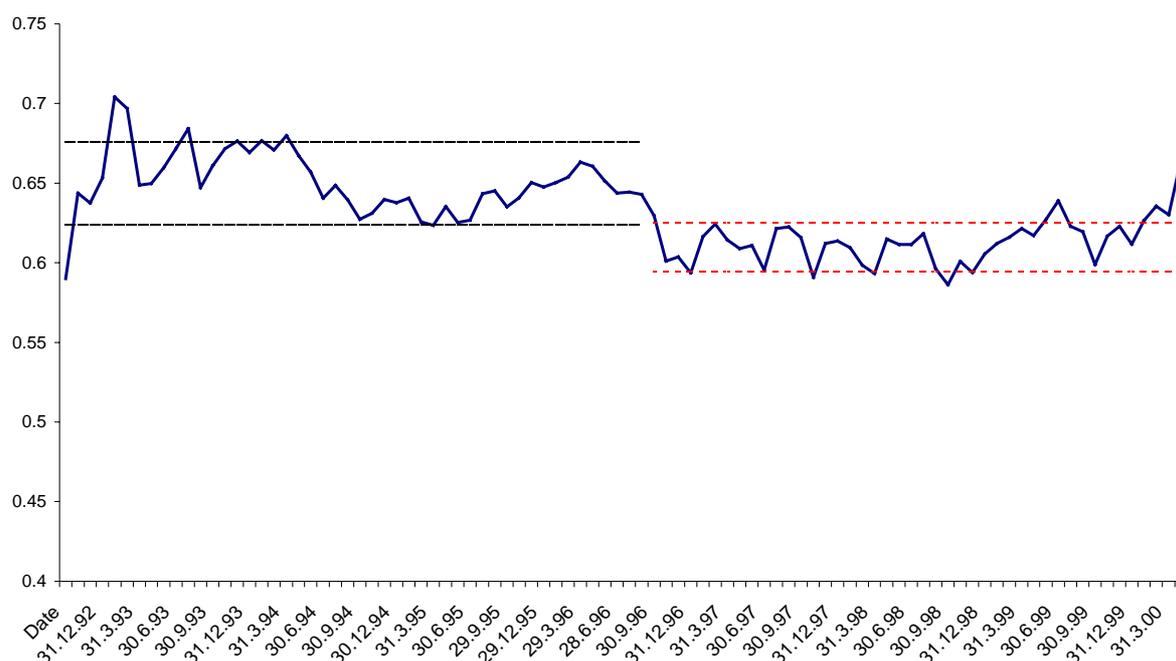


Source: Datastream

Given that the Deutsch mark (and the Euro from 1999 on) has depreciated to a similar extent against the US dollar as well as against Sterling since mid-1995, the cross rate of both, which is the Sterling/US dollar exchange rate, should have a tendency to remain stable during this period. But this logic presupposes that the driving force of the foreign exchange market for Sterling is the Sterling/Deutsch Mark exchange rate. Why should not the Sterling/US dollar exchange rate determine the Sterling/Deutsch Mark exchange rate instead? And figure 1 suggests that the Sterling/US dollar did also exhibit low variability during the period from end-1992 until mid-1995, when the US dollar had a tendency to depreciate against the Deutsch Mark.

To illustrate the stability of the Sterling/US dollar exchange rate we attempt to capture the movements of the exchange rate inside a target band (see figure 3). From end-1992 until September 1996 a band of +/- 4 percent around a central parity of 0,65 GBP/USD is plotted. For the period from September 1996 until end-1999 a central parity of 0,61 GBP/USD is taken and plotted inside a band of +/- 2,5 percent (for comparison: the EMS target zones before 1993 were +/- 2,25 percent, after 1993 they were +/- 15 percent). The central parities are chosen ad hoc to capture most of the exchange rate variations.

Figure 3: Pound Sterling/US dollar exchange rate with target bands



Source: Datastream, own calculations

The result of this experiment is astonishing. One would expect such a low variability within narrow bands in countries that have limited flexibility exchange rate regimes. A first theoretical justification for the choice of currency bands is found in Krugman (1991). Given that the currency bands are credible and thus would be defended by the central bank, Krugman shows that rational market participants would keep the exchange rate automatically inside the currency bands. This behaviour is known as stabilising speculation which contrasts the view that speculation is destabilising. However, the model presupposes that the central bank announces a central parity as well as target zones for the exchange rate. Both these assumptions are not valid for the Pound Sterling after it left the EMS. Neither has the Bank of England announced a target zone nor did it make intervention operations public.

Bhattacharya/Weller (1992) construct a model which explains why central banks might be tempted not to reveal its exchange rate target. They argue that sterilised intervention is only an effective policy tool if the market does not know the target of the central bank.

The findings of Dominguez (1998) also indicate that secret interventions have an influence on exchange rate variability. However, she concludes that “secret interventions were generally found to increase volatility”. This result would contradict the assumption that the Bank of England successfully pursued secret interventions to hold the Sterling/US dollar exchange rate in its target zones.

On the other hand target zones have been criticised especially after Sterling left the EMS in 1992. It was argued that target zones provide a riskless opportunity for speculators to bet against the central bank which is forced to defend the exchange rate band. After the currency bands of the EMS were widened to +/- 15 percent around the central parity the variability of exchange rates declined substantially. This would be an indication that a floating system can stabilise exchange rates.

Given the fact that the Pound Sterling appreciated immensely against the Deutsch mark/Euro one would expect that any potential intervention would be aimed at countering this trend.

However, this would have demanded a purchase of foreign currency (Deutsch mark) and a sale of Pound Sterling and thus an increase in the level of reserves. A decline of reserves, on the contrary, indicates that Pound Sterling has been bought against foreign currency. It seems unlikely that Pound Sterling has been bought against Deutsch mark/Euro as this would only have supported the strength of Sterling. Nevertheless there might have been reasons for a sale of US dollars versus Pound Sterling in order to prevent Sterling from depreciating against the US currency. The following chapter thus tries to find some arguments that would justify such a behaviour.

3. Benefits of a stable Pound Sterling/US dollar exchange rate for the UK

At first sight it would be more reasonable for Great Britain to promote a stable exchange rate versus the European currencies, especially the Deutsch mark and the Euro. More than half of the British trade is done with the European Union whereas only about 15 percent of total trade volume is conducted with North America. Thus a stable Sterling/Deutsch mark exchange rate would promote trade relationship with continental Europe and would also make inflation forecast for the central bank easier. Recent press articles especially focus on the disadvantages of the strong Sterling versus the Euro for British exports and for foreign direct investment in Great Britain.

However, there are also good reasons why Great Britain should be concerned with its exchange rate with the United States.

The political debate in Britain often focuses on the relationship to the European Union. It is still not clear whether a majority of the British population is voting for joining the European Monetary Union. But clearly this idea has many opponents. In the last years, especially since the beginning of EMU, it might have been in the interest of the government not to be associated with a depreciating Deutsch mark or Euro and therefore to peg Sterling to the US dollar. The decision about exchange rate policy is still located with the government, even after the independence of the Bank of England in 1997.

Studies show that the exchange rate of Sterling has also been an important factor for British voters. Hibbs (1982) estimates popularity functions for governments in USA, Germany and UK. He finds that only in Great Britain the exchange rate has a significant impact on the popularity of the government. Interestingly it is especially the relative performance of the pound versus the US dollar which is important for voters. He states that "in Britain's domestic political life it [the Sterling/US dollar exchange rate] has been viewed as an index of the nation's international 'prestige'." (Hibbs (1982): 437).

The reasoning that the British government is concerned with the exchange rate of Sterling is strengthened by studies about the intervention policy of the Bank of England. Almekinders/Eijffinger (1991) survey the empirical literature about central bank intervention and state that several studies found that the Bank of England tends to be more concerned with a weak exchange rate than with a strong one: "...the Bank of England is found to have assigned systematically more weight to countering depreciations of the effective exchange rate of the pound and depreciations of the pound vis-à-vis the U.S. dollar." (Almekinders/Eijffinger (1991): 655). This historical behaviour might explain why the Bank of England did not counter the appreciation against the Deutsch mark (Euro) and would also support the assumption that it prevented the Pound Sterling from depreciating against the US dollar by selling foreign exchange reserves and buying own currency.

Furthermore, the Bank of England pursues a monetary policy of inflation targeting since it left the EMS. In the context of this framework a depreciating currency is a possible threat to price stability via its effect on import prices. This fact also adds to the argument that the central

bank should be more concerned with a depreciating Sterling versus the US dollar than with Sterling appreciating against the Deutsch mark.

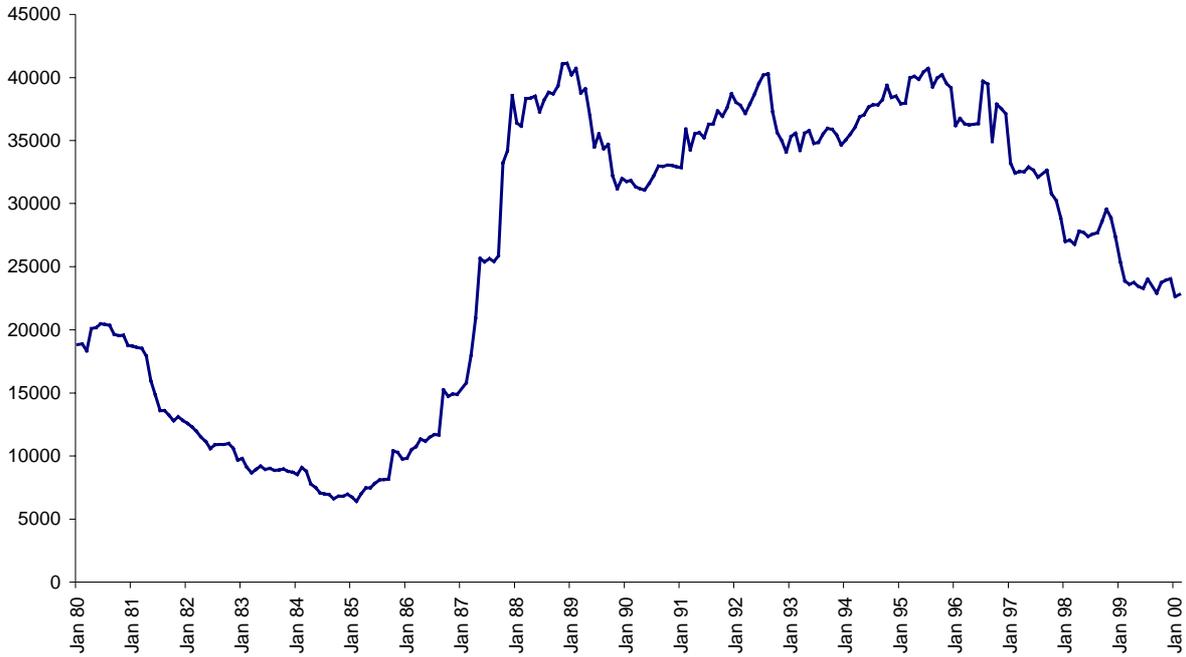
Altogether the above arguments show that the stable Sterling/US dollar exchange rate is in the interest of the UK. The question now remains if there are indications that the exchange rate has been stabilised by foreign exchange interventions. The following chapter will therefore analyse the determinants of the recent decline in the reserve stock.

4. Analysis of the UK foreign exchange reserves

Generally, total international reserves of a country comprise their holdings of foreign exchange, gold, Special Drawing Rights and IMF Reserves. For the following analysis reserves will be defined as foreign exchange only.³ As mentioned in Wollmershäuser (2000), for an analysis of intervention transactions gold is not relevant, Special Drawing Rights are relatively unimportant and IMF reserves do not fluctuate a lot.

The following figure shows the UK foreign exchange reserves since 1980 in billion US dollars. The dramatic increase in the years 1987/88 and the fluctuations at the beginning of the 90s can be explained with attempts of exchange rate targeting (see chapter 2). The decrease in the last three years from 39 billion to 24 billion US dollars, which corresponds to nearly 40 percent lacks a plausible explanation so far.

Figure 4: UK official foreign exchange reserves in billion US dollars



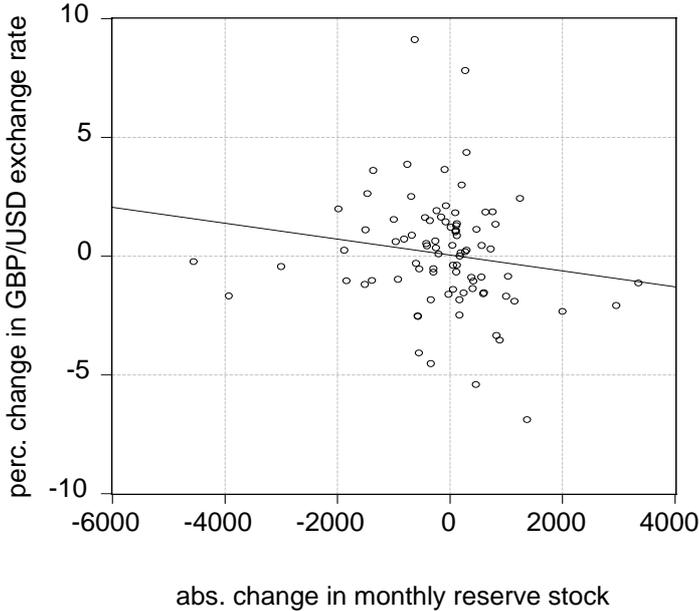
Source: IFS (line 1d.d)

Given the fact that high variability in reserves has historically been a sign for exchange rate targeting in Great Britain a first assumption can be drawn that reserves were used to stabilise the Sterling/US dollar exchange rate. More precisely, it seems plausible to sell foreign exchange and buy Sterling to avoid a depreciation of the own currency. Such an intervention behaviour is called “leaning against the wind” and means that the central bank “attempts to move an exchange rate in the opposite direction from its current trend...”

³ Monthly reserve data are taken from International Financial Statistics (Foreign Exchange line 1d.d).

(Dominguez/Frankel, 1993: 63). This strategy would confirm the aforementioned empirical studies that found the Bank of England tended to counter depreciations more than appreciations of the Pound Sterling. The following graph therefore plots changes in the level of foreign exchange reserves against changes in the Sterling/US dollar exchange rate for the period October 1992-February 2000. The horizontal axis shows monthly absolute changes in foreign exchange reserves in billion US dollars and the vertical axis shows monthly percentage changes of the exchange rate (an increase in the exchange rate means a depreciation of Pound Sterling). The regression line has a negative slope which means that a decrease in reserves is associated with a depreciating exchange rate and vice versa. This result would be broadly in line with the strategy of leaning-against-the-wind.

Figure 5: Changes in reserve stock versus changes in GBP/USD exchange rate



Source: Datastream. Data period: Oct. 1992-Dec. 1999.

However, it needs to be said that this analysis has clear limitations. At first, the correlation coefficient is only $-0,159$. Secondly, in order to measure exactly the dimension of foreign exchange interventions it would be necessary to look at daily changes in foreign reserves. Monthly data can only serve as proxies.⁴ On the other hand it should also be noted that a change in foreign exchange reserves is not necessarily associated with an intervention in the foreign exchange market. Interest earnings and valuation changes due to fluctuations in exchange rates also have an impact on the level of a country’s reserve stock (see Wollmershäuser, 2000). Furthermore not all interventions are associated with changes in the level of reserves.⁵

Above all the Bank of England repeatedly stated in her quarterly reports for the period 1997-1999: “No intervention operations were undertaken [...] with either the Government’s reserves or the Bank of England’s holdings. Should intervention in the foreign exchange market be

⁴ Consider that a central bank intervenes twice in one month: it sells foreign exchange in the first week and buys the same amount of foreign exchange in the last week. Monthly data would indicate a constant level of reserves (as IFS data are always end-of-month) and intervention would not be evident.

⁵ Dominguez/Frankel (1993) state as example „the Japanese so-called hidden reserves, which are changes in official deposits of foreign exchange with Japanese commercial banks.“ (p. 69). They are used for intervention purposes and do not affect official reserves.

undertaken the quarterly report will provide details of the amount and date of intervention and an explanation of why it was undertaken.” (Bank of England, Quarterly Report, various issues). Such a statement has to be taken seriously.

The following subchapters are therefore intended to analyse the decrease in the level of foreign exchange reserves.

4.1 The structure of UK foreign exchange reserves

The UK foreign exchange reserves consist of the government’s holdings which are held in the Exchange Equalisation Account (EEA) and the holdings of the Bank of England. The Bank of England acts as an agent for the management of the government’s account. Interventions with the holdings of the EEA are decided by HM Treasury.⁶ The holdings of the Bank of England may be used discretionary by the central bank to support its monetary policy.⁷ The official foreign exchange reserves of Great Britain that are published in the IFS only comprise the government’s holdings. This is due to the institutional division and the separate ownership of both reserves. In the following analysis both accounts will be treated separately for three reasons: First of all the aims of the government and the Bank of England may differ. Since the Bank of England is independent since 1997 and pursues a policy of inflation targeting she might be more interested in a strong currency than the government. Secondly, separate data for the Bank of England holdings were not published before December 1997. Before this date only IFS data is available which comprises only the government’s holdings in the EEA. Thirdly, the EEA and the Bank of England apply different valuation procedures for their foreign exchange holdings which makes them not easily comparable.

4.2 The reserve holdings of the Bank of England

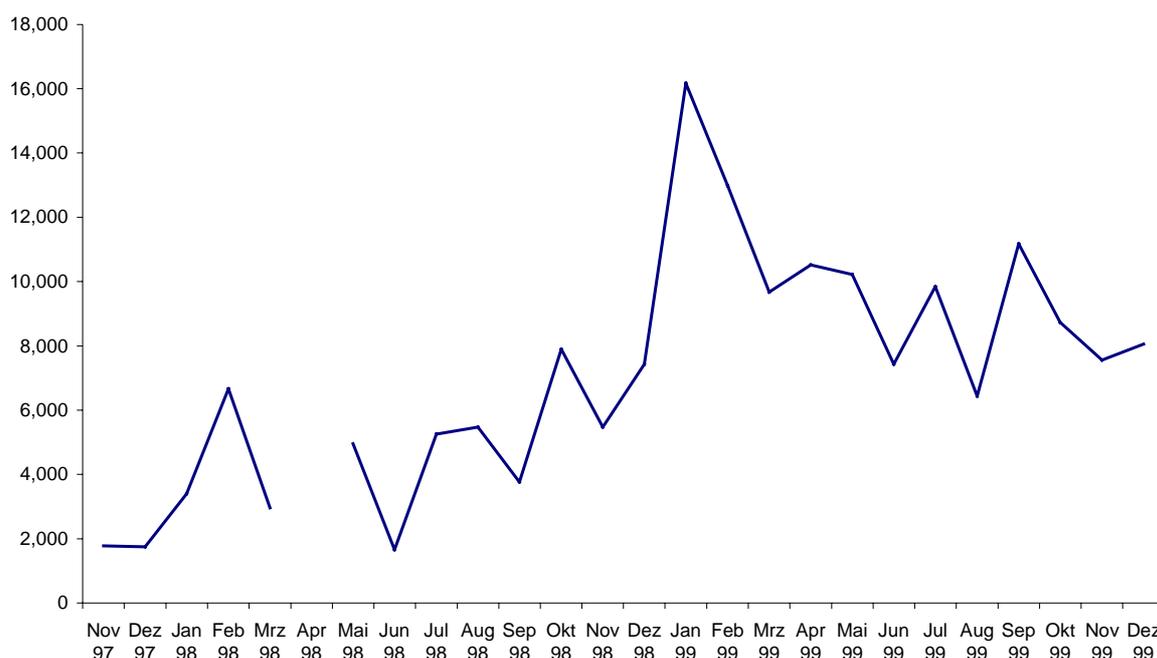
As mentioned above the reserve holdings of the Bank of England are not included in the IFS. Therefore IFS data for the UK actually underestimate the level of foreign exchange reserves of Great Britain. The level of the Bank of England holdings averages around 7 billion US dollars (compared to an average of about 30 billion US dollars in the EEA for the period 10/1996-12/1999). Nevertheless, since the average size of intervention operations is less than 200 million US dollars per day, even the Bank of England’s holdings would suffice for discretionary interventions.⁸ However, as can be seen from the following figure, the Bank of England holdings of foreign exchange do not show a similar decreasing trend as the reserves of the EEA.

⁶ This institutional framework is similar to the United States, where „the Treasury has primary responsibility for intervention while the Fed has official responsibility for monetary policy.“ (Dominguez/Frankel, 1993: 49).

⁷ See the Chancellor of the Exchequer’s letter of 6 May 1997 to the Governor of the Bank of England: „The new monetary policy framework“. All such interventions have to be sterilised.

⁸ See Dominguez/Frankel (1993), pp. 88-89 for a discussion of the scale of interventions.

Figure 6: Bank of England's foreign exchange holdings (incl. gold) in billion US dollars



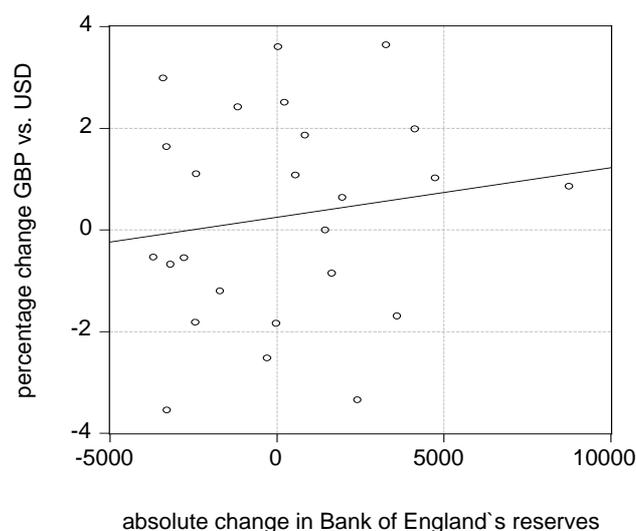
Source: Bank of England, Monetary & Financial Statistics. Data for April 1998 were not available.

The bank's holdings serve primarily for the pursuit of monetary policy. The fluctuations in the level of its reserves can, according to Bank of England reports, nearly completely be explained with the conduct of foreign exchange swaps. In the monthly press releases of the UK's official foreign exchange holdings it is said that: "These foreign exchange swaps are undertaken as a supplement to the Bank's usual money market techniques to provide sterling liquidity to the market. The operations are purely technical in nature and have no monetary policy implications."⁹ "In a foreign exchange swap, two parties exchange specific amounts of two different currencies and repay the amount of the exchange at a future date..." (Hooyman, 1994: 1). A central bank usually swaps own currency against foreign exchange and vice versa to supply or reduce liquidity to the banking system. The level of foreign exchange reserves fluctuates temporarily due to the conduct of a swap. If the central bank exchanges foreign exchange against own currency, its reserve holdings will decrease during the time of the swap. When the swap is unwound, the level of reserves of the central bank increases again to the pre-swap level. Thus the influence of foreign exchange swaps on the level of foreign exchange holdings generally is only temporary.

According to Hooyman (1994), foreign exchange swaps "have no direct effect on the spot (or forward) exchange rate;" (p. 153). They have an indirect effect via their impact on interest rates and thus on exchange rates. Nevertheless "foreign exchange swaps might influence the exchange rate because of a strong announcement effect;" (p. 154).

⁹ The monthly press releases concerning the level of the UK official reserves is published on the website of HM Treasury at www.hm-treasury.gov.uk.

Figure 7: Change in BoE's reserves versus changes in GBP/USD exchange rate



Source: Bank of England. Data period: Dec. 1997-Dec. 1999

However, the above graph does not confirm the negative relationship between changes in absolute reserves and changes in the exchange rate that was found for the official reserves. This might also be due to data availability (the graph only includes 25 observations). Therefore we concentrate in the following on the government's reserve holdings.

4.3 The government's holdings in the Exchange Equalisation Account (EEA)

The Exchange Equalisation Account (EEA) was founded in 1932 with the aim to counter undue fluctuations in the exchange rate of Sterling. Its purpose was later extended "to secure the conservation or disposition in the national interest of the means of making payments abroad; and for purposes arising from the United Kingdom's membership of the IMF..." (Bank of England, 1999).

In order to analyse the decrease of the government's reserves the published data (taken from the IFS) will be adjusted for exchange rate changes and interest earnings. This procedure follows the analysis of Wollmershäuser (2000).¹⁰

a) The impact of exchange rate changes on the level of reserves

Contrary to other countries, the UK foreign exchange reserves are not published in terms of Pound Sterling but in US dollars. Changes in the level of its reserve stock are thus due to fluctuations of reserve currencies versus the US dollar. For an analysis of their impact it is necessary to know the currency composition of the reserve stock.

HM Treasury states in the report on the EEA for the year 1997-98: "The 'benchmark' for investing the reserves during 1997-98 [...] was the return to keeping currency exposures split 40:40:20 between US dollar, deutsche mark and yen [...]".¹¹

The currency composition of the reserve portfolio is published in the monthly statistical releases of the Bank of England. The average shares of each currency since 1997 that can be

¹⁰ Wollmershäuser (2000) analyses the foreign exchange reserves of the European System of Central Banks for the year 1999.

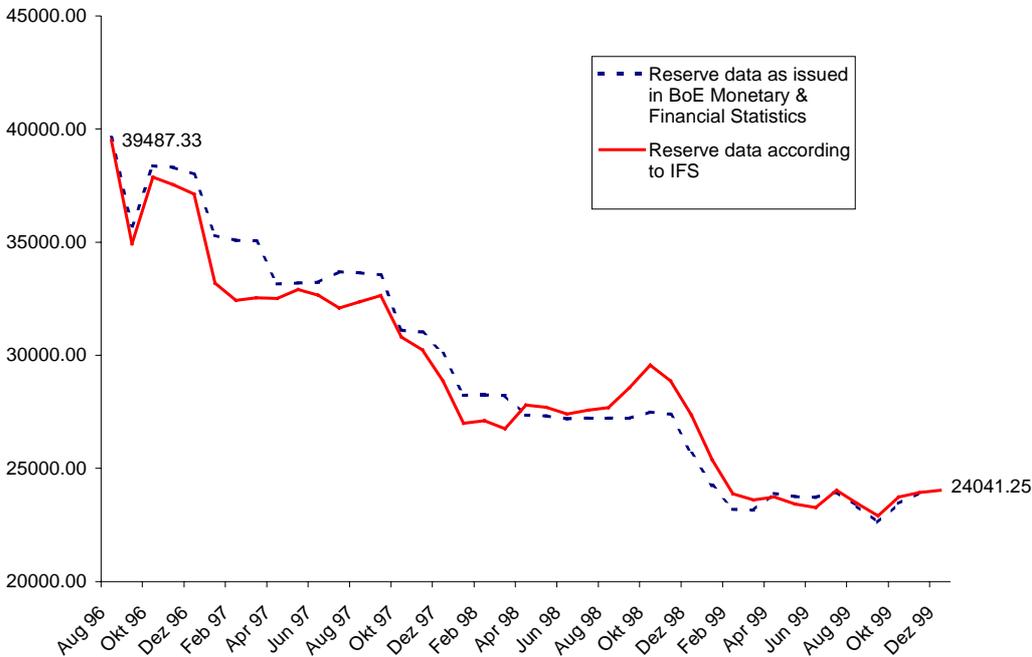
¹¹ HM Treasury (1998), p. 4

calculated from these data are roughly 40 percent US dollar, 50 percent Deutsch Mark (Euro after 1999) and about 5 percent Yen (the rest is split between other currencies).

Valuation procedures for the EEA differ from those that are used for the IFS. Thus the data that are published by HM Treasury do not exactly match the numbers of the IFS. Whereas “IFS valuation procedures call for the conversion of nondollar foreign exchange holdings in U.S. dollars at end-of-month exchange rates...” (IFS monthly report) the EEA uses so-called ‘parity rates’ to convert foreign exchange holdings into US dollars. These are calculated each year at the end of March as the average of daily exchange rates of the period January to March each year. However, if the last daily exchange rate in March is lower than this average this exchange rate is taken as parity rate.

The following figure compares the IFS foreign exchange data with the data that is published by HM Treasury to illustrate the difference.

Figure 8: IFS reserve data versus Bank of England reserve data



Source: IFS (line 1d.d), Bank of England.

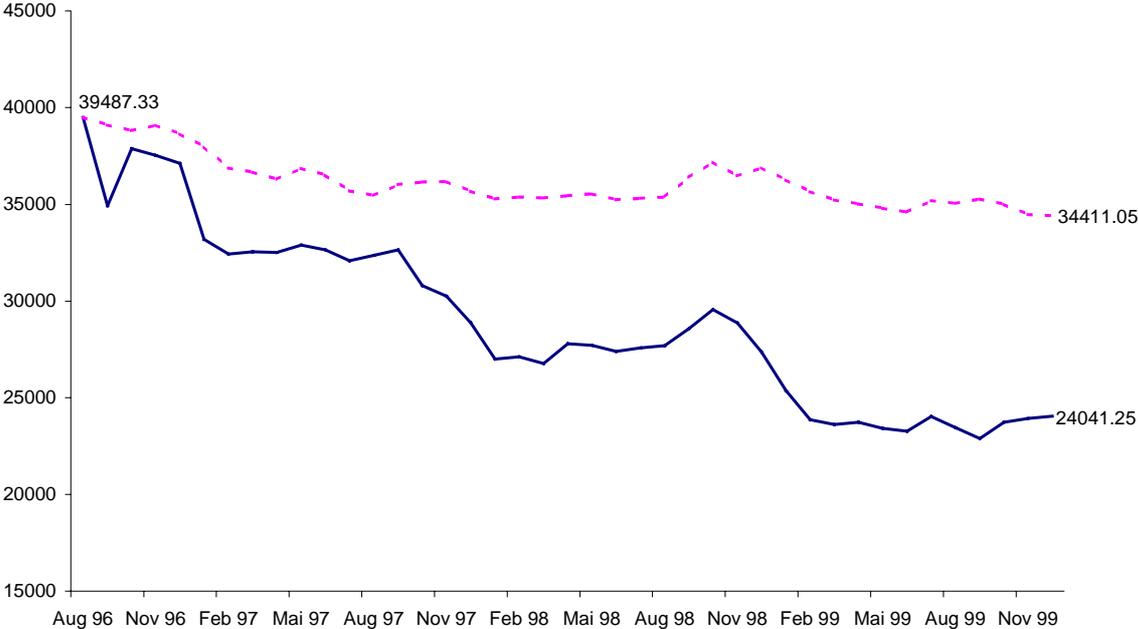
During the period March 1997 to April 1998 IFS data show a lower stock of reserves in terms of US dollar than published by HM Treasury. The parity rate in this period for the conversion of Deutsch mark holdings in the EEA was 1,677 Deutsch mark/US dollar. The actual Deutsch mark/US dollar exchange rate during that time was constantly higher than the parity rate. Due to the large share of Deutsch mark in the reserve portfolio, the reserve figures that are published in the IFS, which are based on end-of-month exchange rates, are lower. The opposite holds for the period April 1998 to April 1999 where the US dollar depreciated against the Deutsch mark and thus the use of the parity rate of 1,847 Mark/US dollar that was calculated in March 1998 underestimates the true value of the UK reserves. From July 1999 on the EEA holdings are calculated with end-of-month exchange rates which explains why they correspond to the IFS data from that time on.

Valuation changes in the Yen/US dollar exchange rate are less important in this context. First of all the share of the Japanese currency in the reserve portfolio is quite small. And secondly the average difference of the Yen/US dollar exchange rate to the parity rates was not as large

as for the Deutsch Mark/US dollar exchange rate during this period.

The fact that even with the use of parity rates the level of foreign exchange reserves has been declining since 1997 is a first indicator that valuation changes are not able to explain the total decrease. Nevertheless the following figure shows estimates for the impact that exchange rate fluctuations had on the level of reserves and compares it to the actual level.

Figure 9: Exchange rate valuation effects on the stock of UK official reserves



Source: Datastream, own calculations. It is assumed that the currency composition is held constant at 50% Deutsch mark/Euro, 45% US dollar and 5% Japanese Yen.

The dotted line shows the hypothetical development of the foreign exchange reserve level if only changes that are due to the valuation of non-US dollar holdings are taken into account. For the calculation of this line the level of reserves and its currency composition of August 1996 are held constant over time. Using this level of reserves we calculate how changes in the Deutsch mark/US dollar and Yen/US dollar exchange rates affected the total level of reserves in US dollars. The question therefore is: To what extent did exchange rate changes influence the stock of reserves?

It can be seen that the dotted line indicates a decrease which largely stems from the US dollar’s appreciation versus the Deutsch mark in this period. However, the dotted line only indicates a decrease of reserves of about 13 percent. As stated above, total reserves actually fell about 40 percent in this period. The roughly calculated difference is in the dimension of around 10 billion US dollars. This difference can not be explained by valuation changes due to exchange rate fluctuations.

b) The impact of interest earnings on the level of reserves

Foreign exchange reserves are usually invested in fixed income securities and the interest that is earned over time increases the level of reserves. From the Monetary & Financial Statistics which are published by the Bank of England on a monthly basis one can obtain information about the composition of the reserve portfolio and the maturities of the securities. On average, roughly 70 percent of reserves are held in bonds and notes, about 10 percent are invested in

the money market and the rest consists of currency deposits with other monetary authorities and banks.¹²

Assuming an average currency composition of 10 percent Yen, 40 percent US dollar and 50 percent Deutsch mark (Euro) a rough estimate yields that interest earnings for the period August 1996 to December 1999 have been in the range of 4,7 billion US dollars.¹³ However, as this calculation for simplicity does not take into account fluctuations in bond prices the result is only a rough indicator.

If these interest earnings are subtracted from the reserve stock, the decrease for the period mid-1996 to end-1999 appears to be even larger. The total decrease from August 1996 to December 1999 was 15 billion US dollars. Adding 4,7 billion US dollars for interest earnings and subtracting 5 billion US dollars due to exchange rate fluctuations still yields a decrease of 14,7 US dollars. The following chapter thus looks for further factors that might explain the decrease.

c) Further explanations for the decrease of the reserve stock

The report of HM Treasury for the period 1997/1998 states three main reasons for the decline of the reserve stock in the EEA: a falling gold price, the appreciation of Pound Sterling against the reserve currencies and the repayment of a Deutsch mark-denominated bond that had been issued by the British government. Since our analysis focuses on a definition of foreign exchange reserves that excludes gold, the decline of the gold price is not relevant in our context. Concerning exchange rate changes and their impact on the level of reserves we showed that these fluctuations (mainly the appreciation of the US dollar versus the Deutsch mark/Euro) can at most explain a third of the total decrease. Furthermore as we use the data of IFS we are not concerned with the exchange rates of the reserve currencies versus the Pound Sterling but versus the US dollar.

This leaves the repayment of the Deutsch mark bond as one explanation. Indeed if one looks at the monthly reports of the UK official reserves one finds a range of transactions that lead to movements in the level of reserves. Among these are payments or receipts from the issuance or repayment of Government Treasury Bills and Notes.¹⁴

There were several bond repayments during the period 1996-1999, for example a Deutsch mark bond in October 1997 which decreased reserves by about 3 billion US dollars. In January 1998 a Treasury bond with a value of about 1,8 billion US dollars denominated in ECU was repaid and in January 1999 1,6 billion US dollars were taken from the reserves to repay a Euro-Treasury note. Nearly all of the reported debt repayments were denominated in Euro, Ecu or Deutsch mark.

Other more regular transactions include payments for the purpose of the Exchange Cover Schemes (ECS). The ECS is a fund which grants foreign currency loans to public enterprises and authorities that were insured against exchange rate fluctuations. State enterprise that are indebted in foreign currency can sell their foreign currency to the EEA and obtain Pound Sterling in exchange. When those enterprises have to repay their foreign currency loans they

¹² See table 24.1 of monthly Monetary & Financial Statistics which can be obtained via Internet at www.bankofengland.co.uk.

¹³ The average reserve stock during this period has been 29 billion US dollars. For simplicity it is assumed that 70 percent of reserves were invested in 10-year government bonds and 30 percent in the money market. Taking the averages of long- and short-term interest rates for this period for the different currencies and assuming a currency composition of 50% Deutsch mark/Euro, 45% US dollar and 5% Japanese Yen, calculation of interest earnings result in 4,7 billion US dollars.

¹⁴ See Appendix.

can buy the necessary foreign exchange from the EEA for the same exchange rate for which they sold them to the EEA. Thus their foreign exchange risk is borne by the EEA who receives a premium for this. According to EEA reports, no new ECS-loans were granted since 1987. However, there are still outstanding loans of state enterprises that fall due and the EEA has to sell the necessary foreign exchange. These transactions also decrease the level of UK official reserves.

d) Conclusions from the above analysis of EEA reserves

A simple calculation yields the following results. Official foreign exchange reserves as published in the IFS (which correspond as mentioned above with the stock of reserves held in the EEA) show a decrease of the level of reserves of 15,5 billion US dollars for the period August 1996-December 1999. If interest earnings are taken into account, the decrease appears to be even larger. Adjusted for estimated interest earnings of about 4,7 billion US dollars, the total fall in the reserve stock is 19,7 billion US dollars. A rough estimate showed that exchange rate fluctuations account for about 5 billion US dollars (mainly explained by the US dollar's appreciation versus Deutsch mark/Euro) of this amount. This leaves a difference of 14,7 billion US dollars. Of these, nearly 10 billion US dollars are explained by government transactions as mentioned in the appendix. The difference of roughly 4,7 billion US dollars is the so-called underlying change.

The Bank of England notes that “the underlying change is the result of a variety of transactions, both debits and credits, including, for example, transactions for Government departments, transactions with other central banks, and interest receipts and payments. For these reasons, the underlying change should not be taken as an indication of market intervention.”¹⁵

Generally foreign exchange intervention can be defined as “...any transaction or announcement by an official agent of a government that is intended to influence the value of an exchange rate or the country's stock of foreign exchange reserves.” (Dominguez/Frankel, 1993: 55). There are also broader definitions of intervention that include transactions by the central bank that are undertaken for customers such as the own government (the conversion of foreign currency debt that the government has issued by the central bank would be an example). “Although customer transactions are considered passive interventions, it is important to recognise that, since the timing of these transactions is under the discretion of the central bank, they can still serve to signal information to the market.” (Dominguez/Frankel, 1993: 65). With this broader definition in mind, the Bank of England's transactions with the government might serve to influence exchange rates.

In the past large swings in the level of UK official reserves were associated with foreign exchange intervention. Insofar it seems to be fair to analyse for which reasons reserves declined by 40 percent in the last years. According to Dominguez/Frankel (1993), “most intervention operations are not publicly announced.” (p. 59). At first sight this does seem confusing, as the effectiveness of foreign exchange interventions (especially sterilised interventions) depends largely on the signalling effect of these central bank transactions on the market. Although the analysis did not prove that the stable Sterling/US dollar exchange rate is the result of intervention by the central bank a simple scatter plot indicated that decreases in the reserve level fall together with a depreciating Sterling/US dollar exchange rate. This finding is generally compatible with an intervention strategy of leaning against the wind. However, a thorough analysis of intervention behaviour would have to use daily reserve data – monthly figures can only give indications.

¹⁵ See HM Treasury monthly press release on UK official reserves.

5. Summary and conclusions

British foreign exchange reserves decreased by 40 percent in the past years. Normally this would be a sign for a weak currency or more precisely an indication that a central bank sells foreign exchange to buy own currency and thus fights the depreciation. However, the UK Pound Sterling has not been a weak currency in recent years. On the contrary: it has been very strong against the Deutsch mark/Euro. In general this is what we mean by calling these two facts the “British foreign exchange reserves puzzle”.

It was shown that in contrast to the exchange rate of Pound Sterling against Deutsch mark, the exchange rate Sterling/US dollar has been extremely stable. This is insofar interesting as other currencies depreciated against the US dollar (Deutsch mark) or exhibited high volatility (Japanese Yen). A simple scatter plot indicated a weak negative relationship between the change in reserves and changes in the Sterling/US dollar exchange rate; an observation that is broadly in line with an intervention strategy aimed at preventing a depreciation.

An analysis of the UK foreign exchange reserves showed that the inclusion of interest earnings makes the decline larger. Exchange rate valuation changes only account for a small fraction of the total decrease. The case of Great Britain thus confirmed the following finding of Calvo/Reinhart (2000): “In principle, the variance of reserves should be zero in a pure float. In reality, however, it is not that simple, as reserves may change owing to fluctuations in valuation and the accrual of interest earnings. However, even absent these, there are other factors that influence changes in reserves.” (Calvo/Reinhart, 2000: 19). A large part of the decline is explained by transactions for the government, like repayments of government bonds and Treasury bills. However, there still remains a substantial difference that is not specifically explained. Nevertheless, HM Treasury and the Bank of England have repeatedly stated that they have not intervened in the foreign exchange market.

As we could only use monthly data for reserves it could not be proven that there have been interventions in the Pound Sterling/US dollar exchange rate by British authorities. Nevertheless, some conclusions can be drawn from the analysis.

At first, the analysis showed that the reporting of UK reserve movements is complex. There were different valuation methods for the EEA and the Bank of England’s holdings, the latter are not included in the official reserve numbers and a considerable part of the reserve changes remains unexplained. More transparency in the reporting of foreign exchange reserves would thus make statements of the central bank concerning interventions more credible. First steps in this direction have recently been taken by publishing the reserves in accordance with the methodology developed by the IMF and the G10 central banks (since July 1999).

Secondly, it was shown that government transactions account for a large part of the variability of UK international reserves. Unless these transactions serve to influence the exchange rate (“passive interventions”) this result contradicts with the view that changes in the reserve stock of a country should be taken as an indication of intervention. Taking account of the fact that there are several factors that determine changes in reserves it does not seem appropriate to simply measure exchange rate intervention by looking at changes in the monthly IFS reserve data. Besides, the case of the UK reserves showed that the official reserves do not include the holdings of the central bank and thus actually underestimate the true amount of reserves.

Thirdly, if government transactions account for such a large part of reserve variability then one can ask why these payments are not compensated by additional purchases of foreign exchange to keep the overall level of reserves constant. This would be similar to a central bank that offsets changes in the money supply that are caused by autonomous transactions by adjusting their short term interest rates.

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**Appendix: Monthly transactions in the Exchange Equalisation Fund (EEA) in million
US dollars**

		Repay- ments under ECS	EMI Swap reva- luation	Repayment of HMG debt assigned from public sector	Issuance / Repayment of Government Treasury Bills	Issuance / Repayment of Government Treasury notes	Other long term debt issuance / repayments	Other (gold/ priv- atizati on) ¹	Total transactions	Monthly change in reserves according to IFS data
1996	Sept.	-8					-3905	+148	-3764	-4558,02
	Oct.	-10	-19	-13	+1	+650	+1992		+2601	+2950,65
	Nov.	-18							-17	-344,69
	Dec.	-12			+1		-150		-161	-412,50
1997	Jan.	-146	+12	-105	+3	-2496			-2732	-3931,34
	Feb.	-16			+1				-15	-758,34
	Mar.	-7							-7	+112,01
	Apr.	-88	+237	-75	-1	+571			+644	-27
	May	-16							-16	+381
	June	-11							-11	-249
	July	-4	+44	-50	-1	+575			+564	-568
	Aug.	-13		-30	-1				-44	+291
	Sept.	-107			-1				-108	+267
	Oct.	-9	-17	-12		+568	-2982		-2452	-1839
	Nov.	-14			-1				-15	-555
	Dec.	-7			-1		-153		-161	-1369
1998	Jan.	-1	-99			-1769			-1869	-1877
	Feb.	-14							-14	+108
	Mar.	-6			+1				-5	-342
	Apr.	-8	+54		+1	+538			+585	+1031
	May	-13			+1				-12	-92
	June	-3							-3	-298
	July	-1	-38		+1	+541			+503	+174
	Aug.	-9							-9	+105
	Sept.	-6							-6	+880
	Oct.	-8			+1	+549			+542	+1000
	Nov.	-8		-1	+1				-8	-693
	Dec.	-3			+3		-155		-155	-1511
1999	Jan.	-2			+3	-1611			-1612	-1985
	Feb.	-10			+3				-7	-1504
	Mar.	-6			+2				-4	-263
	Apr.	-9			-316	+538			+213	+121
	May	-9		-1	-316				-326	-297
	June	-3			-317				-320	-159
	July	-2			-852	+527		+42	-285	+756
	Aug.	-9			-852				-861	-578
	Sept.	-8			-1066			+37	-1037	-547
	Oct.	-9				+519			+510	+828
	Nov.	-9		-1					-10	+204
	Dec.	-3					-157	+68	-92	+102
Total									-9976	-15447,23

Source: HM Treasury Press Releases (www.hm-treasury.gov.uk), International Financial Statistics; All data in million US dollars.

1) Other transactions include: foreign exchange components from privatization receipts (Sept. 1996) and valuation gains from gold sales (July/Sept./Dec. 1999).