Blowing against the Wind? A Narrative Approach to Central Bank Foreign Exchange Intervention

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Abstract

Studies on the effectiveness of central bank intervention yield mixed results and poorly deal with endogeneity. By using a narrative approach, this paper is the first to deal with intraday changes in market conditions to show the real effect of central bank foreign exchange intervention on exchange rates. Some studies find that intervention works in up to 80% of cases. By accounting for intraday market moving news, I find that in adverse conditions, the Bank of England only managed to influence the exchange rate in 8% of cases. I use both machine learning and human assessment to confirm the validity of the narrative assessment.

Keywords: intervention, foreign exchange, natural language processing, central bank, Bank of England.

JEL: F31, E5, N14, N24

Intervention on the foreign exchange is important. Most central banks still follow exchange rate objectives and over 80% of countries are on fixed exchange regimes (Taylor 2010; Ilzetzki, Reinhart, and Rogoff 2019). According to recent theoretical findings, intervention could be welfare-enhancing (Gabaix and Maggiori 2015; Hassan, Mertens, and Zhang 2016). Central bankers generally believe that intervention has an impact on exchange rates (Neely 2008). Academics, on the other hand, have generated contradictory findings. Most studies trying to assess intervention use daily data and struggle to deal with the endogeneity caused by intraday changes in market conditions, making it difficult to assess the effectiveness of intervention.

Our understanding of central bank intervention is limited by a lack of data, as central banks keep their intervention records secret. In this paper, I unveil hand-collected intervention data from the UK, spanning over 40 years from 1952 to 1992. The data is original as it is mainly composed of secret interventions, which were not communicated to the public (this is still how many central banks operate today). The database I created is the longest for any advanced economy. Unlike other studies on central bank intervention, which are often bound to data confidentiality, I present data that are available for replication or further study.

I find that, after accounting for some of the endogeneity problems of previous studies, foreign exchange interventions that go against market trends ("against the wind", as central bankers put it) only influence exchange rates in around 8% of cases. This is in

stark contrast to recent literature showing success rates up to 80% for foreign exchange intervention (Fratzscher et al. 2019). Almost 40% of the interventions judged successful using the previous standard methodology no longer count as successful when accounting for market conditions. Intervention is particularly ineffective when the central bank tries to reverse the direction of the exchange rate after negative news affects the currency. Bank of England intervention was more effective when trying to tame the appreciation of sterling ("restraining intervention") than when trying to avoid a depreciation of sterling ("defending intervention").

I use an event study methodology to test the effectiveness of British foreign exchange intervention between 1952 and 1992. Central bank intervention is hard to assess as it is often measured throughout one day, not accounting for any exogenous changes in market conditions. My paper deals with endogeneity by relying on narrative evidence about market conditions written by Bank of England officials. I use a narrative approach as pioneered by Romer and Romer (1989). I clearly identify days when the currency is hit by negative news that is not related to the intervention of the central bank. I get this measure by analyzing the text in daily reports written by policymakers. To test the robustness of my analysis, I rely on both an external assessment and machine learning in the form of Natural Language Processing (NLP).

When looking at recent findings on central bank intervention, it appears that the Bank of England did everything wrong. When the current literature suggests infrequent

intervention (Ito 2003; Hoshikawa 2008), the data collected in the archives of the Bank of England show that the Bank intervened almost every day. Recent findings tend to favor public over secret intervention (Burkhard and Fischer 2009; Fratzscher et al. 2019), yet all but 66 of the 8,429 interventions during this sample period were secret - less than 1% of the data collected.

In brief, the main contribution of this paper is accounting for endogeneity in assessing foreign exchange intervention. I show how the effectiveness of intervention varies depending on intraday market conditions. This is the first study to use a narrative approach to deal with longstanding endogeneity issues of central bank intervention success. The paper also offers a new database for research on central bank intervention, spanning over 40 years and available for replication.

1. Literature review

Central bank intervention can either be sterilized (with simultaneous bill purchases that leave the monetary base unaffected) or unsterilized (with no asset purchases, thus affecting the monetary base). Unsterilized intervention affects the exchange rate through changes in the money supply. These changes in turn affect the interest rate, making the currency more or less attractive to investors. The effectiveness of sterilized intervention has long been questioned and the debate is still

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ongoing.[2] The literature identifies three channels through which sterilized intervention works: portfolio-balance, signaling and coordination.

The portfolio-balance channel rests on the assumption that domestic- and foreign-currency-denominated assets are imperfect substitutes for each other (Dominguez and Frankel 1993b; Fatum 2015). Interventions that change the shares of domestic and foreign bonds in the portfolios of private investors will also change their relative prices and, by implication, the exchange rate, even when there are no concomitant changes in domestic and foreign monetary policies. The portfolio-balance channel emphasizes the imperfect substitutability of domestic and foreign bonds. An intervention by the Bank of England to support the sterling/ deutschmark rate through sales of deutschmark for sterling will reduce the share of sterling in the portfolios of private investors. This increases the price of sterling and lowers the sterling- deutschmark interest rate differential, which in turn reduces the pressure on sterling.

Signaling is another potential channel for central bank intervention (Fatum and Hutchison 1999). If central banks have "inside information" about their own preferences and intentions, then intervention may be a way of credibly signaling it.

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[2] For an overview of the literature on central bank intervention, see Sarno and Taylor (2001) and Neely (2005), more recent papers by Adler, Lisack, and Mano (2019); Adler and Mano (2018); Echavarría, Melo-Velandia, and Villamizar-Villegas (2018) and Hu et al. (2016).

Bank of England dealers knew more about monetary policy than other traders. For example, they could intervene a month before an expected interest rate change announcement to support claims in the financial press. For the signaling effect to work, the central bank needs to be credible. If the central bank does not follow through with changes to the monetary policy, the bank will lose money *ex post* as the currency moves in an unwanted direction.

Finally, sterilized intervention can work as a coordination mechanism (Reitz and Taylor 2008). When the market is thin and traders have lost confidence in the ability of macroeconomic fundamentals to inform the price, the central bank can step in and provide direction.

What about about the empirics of sterilized intervention? Whereas the previous consensus held that central bank intervention could not influence exchange rates (Dominguez and Frankel 1993; Bordo, Humpage, and Schwartz 2015), this has been challenged by more recent studies (Blanchard, Adler, and Filho 2015; Fratzscher et al. 2019). In a cross-country study analyzing 35 countries, Blanchard, Adler, and Filho (2015) demonstrate that sterilized intervention can hinder unwanted currency appreciation due to capital inflows. Fratzscher et al. (2019) argue that intervention is effective in over 80% of cases according when managing volatility. Presenting evidence from 33 countries, they argue that central bank intervention was effective in attaining the goals set by policymakers from 1995 to 2011. Interestingly,

independently of what macroeconomists may think, central bankers themselves, when surveyed, generally think that intervention is an effective way to influence exchange rates (Neely 2008).

A key contention in the literature on foreign exchange intervention is that intervention is not random but happens as a reaction to market conditions. Market conditions often shift during the day and intervention success is not exogenous to market conditions. Most articles offer solutions to tackle this endogeneity issue, but few do so convincingly. Fatum and Hutchison (2006, 392) note that the main issue of endogeneity "arises in our study (and every intervention study) since the central bank usually takes its cue to intervene on the basis of observed exchange rate movements". My paper offers a clear identification strategy to deal with these issues based on a narrative approach.

To try to mitigate endogeneity, Fatum and Hutchison (2006) group interventions into clusters and assess the effectiveness not of the total daily interventions but of a cluster. In their approach, if a central bank sells dollars for three consecutive days, their measure counts the intervention as successful if after the third day the intervention goes in the expected direction. They admit, however, that their clustering might make interventions appear more successful than they are. Fratzscher et al. (2019) use a similar method of grouping interventions in clusters. This methodology is problematic, especially if the exchange rate is considered as a

random walk in the medium term. Exogenous factors - such as the announcement of positive GDP figures when the central bank is trying to make the currency depreciate, or of diminishing reserve figures when it wants to make the currency appreciate - can make intervention seem successful, when success has little to do with the intervention itself. If a central bank intervenes for long enough and stops when the exchange rate goes in the desired direction, it will be counted as successful simply because it held out until chance (or exogenous factors) intervened. To avoid this issue, I instead assess the impact of intervention after one day; in addition, my narrative approach factors in exogenous news (on narrative approaches see Romer and Romer 1989; 1994; 2014; Monnet 2014). Using a one-day horizon is also in line with findings showing that most of the impact of intervention lasts one day (Kearns and Rigobon 2005, 31).[3]

Kearns and Rigobon (2005) use shifts by both the Bank of Japan and the Australian Central Bank from small, frequent interventions to large, infrequent interventions - which they interpret as exogenous shocks - to better understand the effectiveness of central bank intervention. The authors admit that while useful, their contribution does not completely deal with the endogeneity problem: "our estimation

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[3] Kearns and Rigobon (2005, 31) show that "almost all of the impact of an intervention occurs during the day it is conducted".

technique accounting for endogeneity is a useful contribution to the literature on central bank intervention but it is important to acknowledge its limitations".

Most studies on intervention effectiveness fail to account for intraday news changes and simply assume that all interventions go against the wind putting them in one homogenous group. My paper shows that this is not the case and that the "wind" can change during the day. Authors themselves acknowledge that their studies rarely convincingly address endogeneity. This paper offers a new narrative approach, presented in more detail further down, to deal with the issue.

2. New confidential data

The issue with studies on central bank intervention is the lack of available data. And when data are available, it is usually only data on public intervention, though it has been shown that most central banks intervene in secret (Mohanty and Berger 2013). Various empirical studies therefore use the same datasets and focus only on countries with public intervention records such as Turkey, Colombia or Japan. Looking at secret intervention, my findings have implications for all central banks intervening in secret, which is under-researched. Note that secret intervention does not mean that the market is unaware of the intervention; it means that the central bank does not officially announce it. Dominguez (2003) suggests that traders in the 1990s usually knew that the Fed was intervening at least one hour before any news outlets would report it. In the

case of the data presented here, it is also likely that the market was aware of the Bank of England's operations as the market was composed of a few players only.

This paper presents the first long run database of intervention by an advanced economy, presenting data for over 40 years. Figure 1 presents the data in 1992-US dollars. The data offers an aggregate amount of all Bank of England intervention operations during a given day. This includes intervention in any currency. In practice interventions were mainly in dollars until 1987 and in deutschmark thereafter (see the historical section for more details).
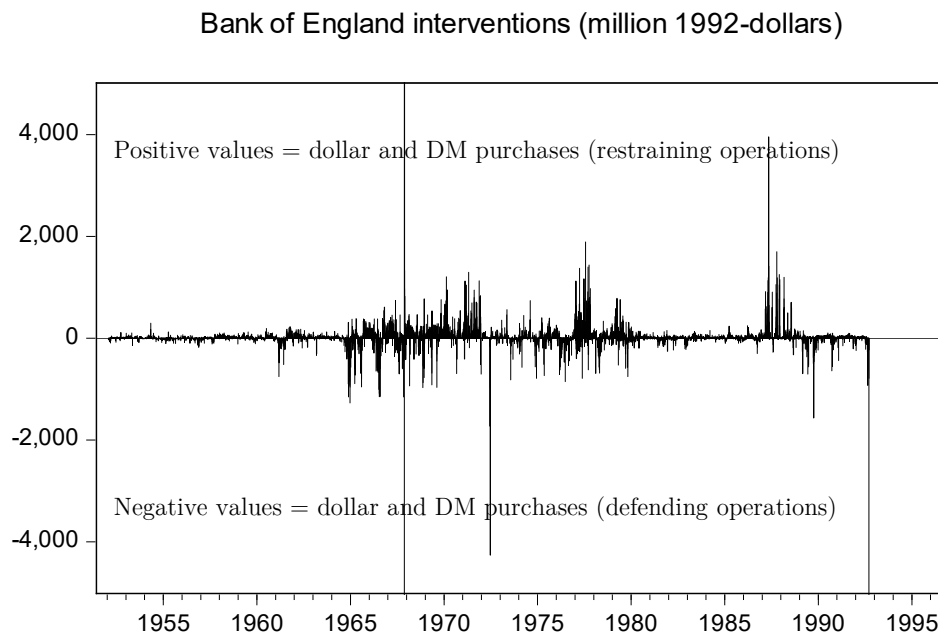
Bank of England interventions (million 1992-dollars)

Figure 1 – Intervention by the Bank of England in million of 1992-dollars. **Source**: The data have been copied from reports written with typewritters kept at the archives of the Bank of England (archive reference C8).
NOTE: The data are cropped at $1bn to improve readabilty but the figures go up to -22$bn for Black Wednesday on 16 September 1992.

The data are negative for sales and positive for purchases of foreign currency. Intervention data come from the Bank of England dealers' reports, which offer daily records.[4] The reports were written daily by the dealers of the Bank of England, foreign exchange operators who managed sterling on behalf of the government. The archive of the Bank of England kept printed copies of the reports, which I copied individually to put together my database.

Another benefit of my data is that it comes directly from policymakers, without any filter control. Published data by central banks are likely to be processed before publication and might not include all operations. It is well known to foreign exchange traders today that for example South Africa and Brazil, publish some of their operations while keeping a large unpublished derivate book. The dataset presented here is much more precise than those of the majority of studies in the field, which rely on proxies, such as changes in reserve levels or press reports.

3. Historical background 1952-1992

The postwar history of the pound can be separated into three clear phases when it comes to Bank of England operations on the foreign exchange market. From 1945 to 1987, British policymakers mainly managed the pound against the dollar; from 1987 to

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[4] Bank of England Archives, Cashier's Department: Foreign Exchange and Gold Markets – Dealers' Reports, C8.

1992, the deutschmark was the reference currency and from 1992 to today, the pound was left to float freely.

Dollar focus 1952-1987

1939-52	The foreign exchange market is mainly under the control of the state during the war and after.
January 1952	Reopening of the foreign exchange market under the Bretton Woods Fixed regime. Sterling fixed at $2.80 per pound, then $2.40 after the 1967 devaluation.
15 August 1971	Nixon shock: the US closes the gold window, in effect leaving the Bretton Woods agreement. Sterling floats.
18 December 1971	Smithsonian Agreement: 2.25% bands and new parities.
23 June 1972	The United Kingdom withdraws from the Smithsonian Agreement and starts floating (effectively a sterling devaluation).
22 September 1985	Plaza Accord: coordinated interventions to appreciate the dollar.

Deutschmark focus 1987-1992

22 February 1987	Louvre Accord: depreciates the dollar; the UK starts shadowing the deutschmark.
Early 1988	End of official deutschmark shadowing, but the deutschmark remains the main focus.
1 October 1990	Britain joins the European Exchange Rate Mechanism (ERM) with a band of +/- 6% with the ECU (and *de facto* with the deutschmark).
16 September 1992	Black Wednesday: the UK leaves the ERM, floating the pound.

The short timeline above outlines the history of these exchange rate systems from 1952 to the present day, while the appendix presents a more detailed history. Most of the time, the pound was in either in a fixed exchange rate system or in a managed float. Only in 1992 was the currency left to float freely.

Characteristics of Bank of England intervention

How did the Bank of England intervene? We turn to some of the features of past Bank of England interventions to get a better understanding of how they differed from interventions today. The next section provides an overview of why the Bank was intervening in the first place.

In the sample presented, interventions by the Bank of England were frequent and secret. Only 66 of the 8,429 interventions were publicly communicated, less than 1% of the sample. Secret intervention makes study of the Bank of England extremely relevant as most central banks today still intervene in secret as well. Surveying central bankers, Mohanty and Berger (2013) found that only 18% of central banks frequently communicated their intervention practices. This means that most central banks intervene in secret, despite the literature arguing that communicating intervention is more effective (Burkhard and Fischer 2009). The sample presented here focuses on secret central bank intervention, as it seems to be the preferred mode of intervention today.

Overall, the Bank was in the market 79.5% of the trading days from 1952 (when the foreign exchange market reopened after the war) to 1992, when it stopped trying to influence the exchange rate.

Finally, most of the Bank of England's operations were sterilized, meaning that the Bank would buy assets to offset any changes in the money in circulation (Howson 1980; 2014).

Goals of Bank of England interventions

When assessing intervention, it is essential to understand what the central bank was trying to achieve. Today as during the 2009 crisis, central banks mainly want to reduce exchange rate volatility (Fratzscher et al. 2019; Mohanty and Berger 2013; Blanchard, Adler, and Filho 2015). However, during the period observed, the goal of the Bank of England was different. Interviews with policymakers of the time and archival records show that policymakers wanted to influence the exchange rate in one direction or the other.

Although objectives change and are not set in stone, historical analysis shows clear patterns in the goals of the Bank of England. The Bank intervened either to make the exchange rate appreciate or depreciate. Below, I present several reports written by the very people intervening: Bank of England dealers. By analyzing their own assessment of interventions, the underlying goals of intervention become clear.

On April 7, 1988, as sterling was appreciating against the deutschmark, the dealers' reports read: "Sterling was mostly steady, but dipped this afternoon following a well-publicised round of co-ordinated sales by ourselves and the Bundesbank". Here the goal was to make the appreciating currency depreciate. The operation, according to the Bank, seemed successful.

On June 23, 1989, Bank of England dealers commented that "Sterling's early weakness was met by a round of well-publicised official intervention, after which the

pound drifted quietly into the weekend". The goal of the intervention was to counter sterling's weakness and the impact (as assessed by the Bank itself) was visible over the weekend.

On August 26, 1992, the reports read: "Sterling revived from overnight lows, and rose by nearly a pfennig following some overt intervention, to reach 2.80 3/8 at its best." The intention of intervention in this extract was to make sterling appreciate. The fact that dealers use positive words associated with higher exchange rates ("at its best" for a high) shows that they wanted the exchange rate to be high in this instance.

On September 16, 1992 (a day before Black Wednesday), the reports read (emphasis added): "Several rounds of overt intervention only had momentary **success**: selling pressure at the margin increased as the Bank's early morning money market round passed without a move on interest rates." Here success is defined as increasing the sterling-deutschmark exchange rate which was falling against the backdrop of a growing crisis in the ERM.

These examples show the Bank trying to move the exchange rate, up or down. The goal was not simply, as it is today, to reduce volatility, but to *push* the rate in a given direction. This is an important point to bear in mind when assessing what counts as success. Another feature emerging from reports is that the Bank was mainly worried about events taking place during the day. Intervention was used to react to either good or bad news.

4. Does central bank intervention work? Half a century of daily foreign exchange intervention under scrutiny

This section assesses the intervention performance of the Bank of England based on confidential data presented here for the first time. Few papers measuring central bank intervention effectiveness deal with endogeneity in a convincing manner. To better tackle endogeneity, I use a novel narrative approach, detailed below. The advantage of looking into history is that the reasoning behind the intervention decisions of policymakers is available. The Bank of England recently changed its information access policy and now opens most of its archival documents to researchers after a 20-year period. As the last intervention occurred in 1992, we have recently gained access to the reasoning of central bankers as they were intervening. As a narrative approach can contain some subjective assessment, the robustness section uses both human- and machine-based techniques to control for potential subjectivity in my assessment.

Assessing intervention success – An event study on over 10,000 trading days

Most studies on central bank intervention effectiveness either use GARCH and other similar models to assess the effect of central bank interventions on market volatility, or they rely on event study methodologies to assess the effect of the policy on the exchange rate. GARCH models mainly deal with volatility, when the question here is to understand whether intervention can influence the direction of the exchange rate. Event studies are more appropriate than traditional regression approaches because of the

stochastic properties of intervention and exchange rate data: intervention occurs in bursts and the exchange rate changes frequently in a martingale-like fashion. This makes parametric approaches (such as regression analysis) unfit to properly assess the effectiveness of the policy.

The appendix presents alternative regressions to the approach taken here. Table 7 in the appendix offers a simple parametric approach and shows that using a naïve regression, intervention can be understood as having the opposite effect to the intended one. When accounting for intraday factors as outlined in the narrative approach below, the regression in Table 9 yields similar results to the event study approach. Details of parametric approach can be found in the regression tables in the appendix. As most studies on intervention effectiveness use event studies, the analysis presented here will offer results that easily can be compared to other findings.

This methodology relies on three intervention success criteria (SC) and is inspired by a methodology by Bordo, Humpage, and Schwartz (2015). SC_1 measures whether intervention leads to an appreciation/depreciation of sterling against the dollar (later deutschmark) between the previous day's market close and the current day's market close. SC_2 measures whether the exchange rate depreciates/appreciates less after intervention between the day's market close and the previous day's market close than it did over the immediately preceding period (also called smoothing). The final criterion,

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SC$_3$, combines the first two. The three criteria take the form of a binary variable and are formalized in the equations below:

$$SC_1 = \begin{cases} 1 & \begin{cases} if\ I_t > 0, and\ \Delta S_t < 0, \\ or \\ if\ I_t < 0, and\ \Delta S_t > 0 \end{cases} \\ 0 & otherwise \end{cases}$$

$$SC_2 = \begin{cases} 1 & \begin{cases} if\ I_t > 0, and\ \Delta S_{t-1} > 0\ and\ \Delta S_t\ \geq 0, and\ \Delta S_t < \Delta S_{t-1} \\ or \\ if\ I_t < 0, and\ \Delta S_{t-1} < 0\ and\ \Delta S_t\ \leq 0, and\ \Delta S_t > \Delta S_{t-1} \end{cases} \\ 0 & otherwise \end{cases}$$

$$SC_3 = \begin{cases} 1 & SC_1 = 1\ or\ SC_2 = 1 \\ 0 & otherwise \end{cases}$$

where I_t designates foreign exchange intervention on day t. Positive values are purchase of foreign exchange (called restraining interventions) and negative values are sales of foreign exchange (defending interventions). A purchase is expressed as $I_t > 0$ and a sale as $I_t < 0$. ΔS_t is the difference between the closing rate on the day of the intervention and the closing rate the day before the intervention. It shows the effect of the intervention on the exchange rate during the day.

The focus on the daily effect is only during one day. This is justified by the type of intervention by the Bank of England, which was on the market most days as explained above. As we have seen, Kearns and Rigobon (2005, 31) show that most of the impact

of an intervention occurs during the day it is conducted. This underpins the choice of focusing on the day of the intervention itself.

As shown in the historical section above (and more in detail in the appendix), the Bank of England focused on the dollar until February 1987 and the deutschmark thereafter. To account for this clear difference in policy, the sample is divided into two subsamples: a dollar sample from the opening of the foreign exchange market from February 1952 to February 1987. After the Louvre Accord of February 1987, the British foreign exchange policy focuses mainly on the deutschmark and this is the second sample. After Black Wednesday crisis in September 1992, intervention by the Bank of England stopped. Table 1 below is separated into the three success criteria presented above as well as into defending and restraining interventions.

	Day count	Reversing exchange rate (SC1)		Smoothing appreciation or depreciation (SC2)		Total success (SC3, sum of SC1 and SC2)	
		Success count	Percentage of successful intervention	Success count	Percentage of successful intervention	Success count	Percentage of successful intervention
Dollar intervention (1952-1987)							
Defending interventions	2298	434	19%	465	20%	899	39%
Restraining interventions	4817	1211	25%	794	16%	2005	42%
Deutschmark intervention (1987-1992)							
Defending interventions	357	102	29%	61	17%	163	46%
Restraining interventions	957	327	34%	179	19%	506	53%

Table 1 – Intervention success according to the three criteria presented above.

Note that these "success" rates do not imply causality; it could be that some of these "successes" are due to other factors. The Bank could be trying to make the exchange appreciate on the same day that improved GDP figures are published. In this case, the intervention would be counted as successful, but the success would not only be due to intervention but also more likely due to the GDP figures. The next section deals with this endogeneity problem. But as stressed in the literature review, despite running robustness checks, most studies on the topic rely on these success rates and simply run robustness checks to see if they lie within a realistic frame.

The Bank was more successful in restraining than defending interventions, that is, it was more successful when it tried to tame sterling than bolster it. This holds true for all three success criteria in both the deutschmark and dollar periods. The intuition is that markets take a central bank more seriously when it is intervening with its own currency, which is available in unlimited amounts, than when intervening with scarce dollar or deutschmark reserves.

These results compare with other findings in the literature. For example, using the same methodology, Bordo, Humpage, and Schwartz (2015) found that the Federal Reserve was successful in reversing the deutschmark/dollar exchange rate 29% of the time, which happens to be the same number as the results of my study for deutschmark/sterling. However, they found higher success rates on the yen/dollar exchange rate, going up to 70%. Fratzscher et al. (2019), using a different methodology,

found that from 1995 to 2011, countries in free floating regimes could manage to reverse

exchange rates (the equivalent of SC1) in 61% of the episodes. This is higher than the

24% reversal rates in this paper, which is likely due to the fact that the Bank of England

intervened more frequently, leading to less success. Their paper also uses a different

sample and a somewhat different methodology.[5] As these results are purely descriptive,

they do not offer any way to deal with endogeneity. The next section presents a narrative

approach to deal with these issues.

Narrative approach – Reading the policymakers' mind

When trying to assess the performance of foreign exchange intervention,

economists are faced with a challenge. Intervention occurs within a specific context where

policymakers react to adverse market conditions (what central bankers call "leaning

against the wind"). If the exchange rate is depreciating because of poor trade figures, for

example, it is likely that intervention will be less effective than if the central bank

intervenes on a day with more positive news associated with the currency. Similarly, if

traders are bullish about the currency, because of a positive GDP forecast for example,

it will be more difficult for the central bank to tame an increase in the currency. This

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[5] The sample in Fratzscher et al. (2019) is over 76% of restraining interventions where my sample contains 69% of restraining interventions. Regarding methodological differences, Fratzscher et al. (2019) use several days events, which has certain advantages but can lead to endogeneity problems as it becomes hard to see if intervention was successful because of central bank operations or because of normal changes in the exchange rate. The next section tackles this endogeneity issue in more detail.

paper is one of the first to explicitly deal with this issue by using a narrative approach and providing clear counterfactuals.[6] Using daily records of policymakers over a period of almost 10 years, I compare intervention in favorable (with the wind) and unfavorable conditions (against the wind). Note that the terminology can be slightly misleading as "good news" for the currency, is favorable to the central bank if it is trying to make the currency appreciate (as good news makes the currency appreciate), and unfavorable if it is trying to make it depreciate. I therefore use the terminology intervening "against the wind" (or against the market trend) and "with the wind" (with the market trend).

Starting in April 1986, the foreign exchange dealers of the Bank of England changed the way they reported their activity on the market. They started to provide a small paragraph assessing the situation of the pound for every trading day. These memos were sent to the Treasury (remember that at the time the Treasury was in charge of monetary and exchange rate policy in the UK, not the Bank of England). They concisely list whether any exogenous factors were putting pressure on the sterling exchange rate during the day. Table 2 below provides some examples and Table 6 in the appendix presents a broader sample.

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[6] Narrative approaches have been used for other questions but this paper is the first to use the methodology in the context of foreign exchange intervention. For more on narrative approaches, see Romer and Romer (1989, 1994, 2014) or Monnet (2014).

These data are invaluable as they not only list exogenous factors influencing the exchange rate (say, the publication of a large trade deficit) but also how the market perceived this in comparison to expectations. This is essential information as bad market news for a currency, such as a large trade deficit, could actually lead to the currency's appreciation if the market was expecting worse figures. Being at the center of the foreign exchange market and in daily contact with all the main foreign exchange dealers, Bank of England employees had a good overview of what the market was expecting. They not only noted any market-moving news but also detailed how it compared to market expectations. The data are accurate as they were recorded at the end of the trading day. The information is also superior to any information that can be found in newspapers as the dealers spoke to investments banks daily and had access to insider information, and they usually knew before other dealers if there would be changes in the Bank Rate. The reports are consistent and constant which makes them ideal for our purposes.

I classify the dealers' assessment of market conditions into three categories depending on the news regarding the value of sterling. Each day either displays good news for the currency (for example better trade figures than the market expected), neutral news (no significant news or change in conditions), or bad news (for example worse than expected unemployment figures).

Note that these news reports include an assessment by the policymakers of whether the news goes with or against expectations. For example, an increase in unemployment

of one percentage point can be good news if the market expected an increase of two percentage points. Similarly, a decrease in the trade deficit can be bad news if the market expected a bigger decrease. Table 2 below shows examples of the three types of news as expressed by dealers. The Bank of England dealers are also aware of aspects that technical traders observe, for example a psychological threshold of 3DM per sterling. Other technical traders known as chartists would also look at momentum and sell after a certain number of days of currency increase, or other such rules familiar to Bank of England dealers. These subtleties were also noted by the Bank of England dealers in their records.

	Examples of key sentences
GOOD NEWS for sterling	"Sterling benefited from the weekend opinion polls and press comment" "The dollar and sterling both gained on German interest rate rumours" "After an uncertain start, sterling came into strong demand from Europe during the morning, helped by the trade figures." "Sterling was pulled higher by the strong dollar" "[…] moved steadily higher after the better than expected trade figures" "Sterling was in good demand, helped by the reassuring PPI data and a perception that the recovery is 'on track'."
NEUTRAL or NO NEWS	"The markets were again quiet" "Sterling was on the sidelines for most of the day"
BAD NEWS for sterling	"New York continues to take a more bearish view of sterling, where more weight is given to devaluation rumours." "There was also some short covering in front of tomorrow's Mansion House speech by the Chancellor" "Dealers were unimpressed by the CBI survey and sterling tended to move lower with the dollar" "{sterling} tended to soften along with the dollar, and failed to benefit from better than expected output data (industrial production +0.8%, manufacturing +0.6%)" "Sterling ignored better than expected Q2 GDP figures and struggled {…}"

Table 2 – Examples of good, neutral and bad news for the pound. The assessment is done by the author and the robustness section shows assessment by different methods. Table 6 in the appendix shows twenty randomly selected full quotes from reports with their coding. Source: Bank of England archives, Dealers' reports, reference C8.

These reports are valuable as they show how better than expected news does not always influence the exchange rate as expected in statements such as "Sterling ignored better than expected Q2 GDP figures" (Dealers' Report, July 22, 1994). The dealers report not only general market expectations, which they gather from their daily market interactions, but also how the different news items are reflected in intraday price changes.

To see exactly how the choices were made, Table 6 in the appendix shows the choices I made on a random sample from the reports. I use content analysis to assess the dealers' reports on market conditions. Content analysis includes a wide series of tool to extract meaning from text (Krippendorff 2018; Neuendorf 2016). I read each paragraph on market conditions and I assessed whether the general conditions indicated good conditions for the currency of intervention (mainly sterling/deutschmark over the period when reports are available). Data were then coded into a dummy variable: value 1 for positive news (meant to lead to an appreciation of the currency); 0 for days with unclear trends or little market activity; and -1 for days with adverse news (leading to depreciations). I then classified interventions by whether they went *with* the market trend, were done *without* clear market trend or were done *against* the market trend. Note that good news about a currency makes it easier to intervene to bolster its value, but makes it harder to intervene to restrain its rise.

As content analysis entails a portion of subjective judgment, the robustness section below offers several ways of controlling for potential subjectivity. The first was by replacing my personal judgement with a machine learning algorithm; the second, using Amazon Mechanical Turk (MTurk) to make third parties assess the same paragraphs I assessed.
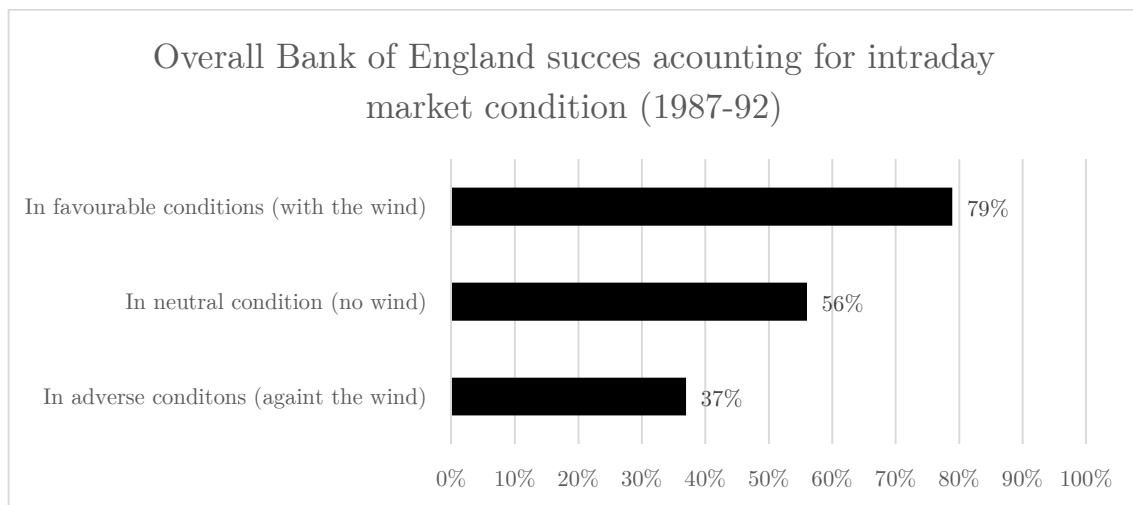
Overall Bank of England succes acounting for intraday market condition (1987-92)

Condition	Success
In favourable conditions (with the wind)	79%
In neutral condition (no wind)	56%
In adverse conditons (againt the wind)	37%

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Figure 2 – Intervention success taking into account market conditions.

Figure 2 shows the headline success rate (SC3) according to whether interventions were going with the market, without any significant market direction, or against the market as explained above. The figure shows how interventions are less successful when they go against market conditions. This is expected. However, most studies on intervention effectiveness miss this distinction and measure all interventions as one homogenous group, often assuming that all intervention systematically go against the wind. This sample shows that this assumption is wrong: almost half of the Bank of England's interventions during 1986-92 were not going against market forces. The overall

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success rate of 33% for interventions going against market trends can be compared to the benchmark rate of 51%, obtained in the previous section when not discriminating for market conditions. Put differently, almost 40% of the interventions that were judged successful using the previous standard methodology now no longer count as successful when accounting for market conditions.

		Against the wind	No Wind	With the wind
Defending intervention	Reversing (SC1)	8%	42%	66%
	Smoothing (SC2)	19%	16%	14%
	Either reversing or smoothing (SC3)	27%	58%	80%
Restraining intervention	Reversing (SC1)	18%	34%	72%
	Smoothing (SC2)	23%	20%	5%
	Either reversing or smoothing (SC3)	41%	55%	77%

Table 3 – Intervention success by success criteria (see previous section for details).

Table 3 looks at the results in more detail and breaks them down according to the different success criteria presented in the previous section, and separates restraining from defending interventions. One particularly striking number is the 8% success rate when the Bank of England was supporting the pound in adverse market conditions. This is in striking contrast with studies finding success rates of 80% on overall samples, even when accounting for differences in datasets and methodologies.

Similarly, when the currency was appreciating due to good news exogenous to Bank actions, trying to tame the bullish market proved more difficult: The Bank only managed

to reverse an appreciation in 18% of the cases. My findings also need to be placed in context. The Bank of England was intervening frequently during this sample which is different from the practice of central banks today that tend to intervene in smaller batches (see Fratzscher et al. 2019). Literature on foreign exchange intervention in Japan has shown that more frequent interventions are less successful.

It remains that the findings in this section give a clear word of caution when looking at the effect of intervention over one day (or several days). Without a clear indication of the direction of trading during the day (the wind), success rates of interventions can vary wildly. By accounting for trading conditions, I show that intervention seems to be much less successful when going against market conditions.

Testing the robustness of the narrative approach – Humans and machines

A frequent criticism to narrative approaches is their subjectivity. What one researcher might classify a certain way, another might do differently. To mitigate the issue, I use two forms of robustness check. First I use Amazon Mechanical Turk (MTurk) to have third party subjects replicate my assessment. Second, I use a machine learning algorithm to see whether my results are consistent. Neither of these methodologies offer the same richness of data analysis as the narrative approach, but they do enable confirmation that the results are unbiased. These two checks do not measur temporality. When I assessed the direction of the wind by reading the dealers' reports, I specifically made sure that news affecting the currency occurred at the end of the day. For example,

if the day started with positive news but ended with negative news, I would record it as a negative day, as this had the most impact on the closing exchange rate. The machine learning algorithm on the other hand does only looks at the overall sentiment in the extracts. Equally, as I did brief assessors on Amazon Mechanical Turk to look for news at the end of the day, it is unclear whether all assessors understood this instruction well. However, despite the shortcomings of these tests, they both confirm that the choices made in my assessment are not arbitrary.

Amazon Mechanical Turk

Amazon Mechanical Turk (MTurk) is frequently used in research in psychology, marketing and experimental economics. For example, Ambuehl, Niederle, and Roth (2015) use MTurk to question participants' willingness to take part in a medical trial depending on the size of compensation. The quality of the results obtained is variable, but the advantage is that the workers are unbiased as they are only presented with the text from the dealers' reports to analyze and have no stake in the study.

I randomly selected 100 excerpts from the dealers' reports out of the 1,679 trading days I coded as good, neutral or bad. I then copied the text of these 100 dealer's reports into a document so that they are available in digital form. The respondents on Amazon Mechanical Turk are asked to perform what can be referred to as sentiment analysis. They are asked to assess whether the Bank of England dealer perceived market conditions as good, bad, or neutral for sterling. Detailed instructions can be found in the

appendix. Each statement is reviewed by 10 different workers on Amazon Mechanical Turk. The answers take the form of a dummy variable taking value 1 for good news, 0 for no news and -1 for bad news, just as for my assessment. I then take the mode (most frequent answer) of these 10 observations and compare it with my answer. Using the mode controls for the variability in the answers of different respondents and weeds out lower quality responses while using the consensus.[7] On average, each respondent spent 50 seconds per abstract and was given up to 2 minutes to respond. Extracts in Table 6 compares my assessment with that of the 10 reviewers for the 20 first statements.

Table 4 below measures the agreement on the randomly selected sample. Just by chance, agreeing with one of the three choices (1, 0 or -1) should be 33%. Agreement rates of 77% for positive assessments and 57% for negative assessment are unlikely to be random, whereas the agreement rates for neutral situation are not clearly better than random. While these results do not categorically attest to the objectivity of the analysis, they still show significant overlap for both my positive and negative assessments and those of both MTurk and the nltk algorithm.

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[7] Taking the average and rounding it up leads to similar answers but is less precise as it includes responses from respondents who might not have read the question.

	Positive assessment	Neutral assessment	Negative assessment	Total
My assessment	31	41	28	100
Most common answer by 10 MTurk reviewers (mode)	51	26	23	100
Agreement rate	77%	37%	57%	
N = 100 text samples				

Table 4 – comparing answers by MTurk and the author.

Natural Language Processing algorithm

As a second form of robustness check, I use sentiment analysis done by an algorithm. Natural Language Process (NLP) is a set of techniques that use computational power to analyze large datasets of natural language. The field recently blossomed with advances in machine learning, allowing for a much better understanding of human language. I use a Python script named natural language toolkit (or nltk in short) set up by Bird, Klein, and Loper (2009). This algorithm is widely used. For example Yu, Duan, and Cao (2013) use it to show how social media influence stock returns more than traditional news outlets. Each of the 100 digitized statements presented above are analyzed with the algorithm. Unlike my assessment or the one done by MTurk assessors, the algorithm does not provide a dummy, but a score from -1 (negative sentiment) to 1 (positive sentiment).

Table 5 below compares my assessment with the one made by both nltk and MTurk and Figure 3 in the appendix shows a heatmap of the different answers. All the reports

I assessed as negative are also assessed as negative by both nltk and MTurk on average (as the negative coefficient shows). Similarly, the positive assessments by both other techniques also yield higher average responses than the two other groups. When it comes to neutral assessment, it seems that my assessment was more negative than both other assessment methods (as all my neutral assessments where more often assessed as positive by the two other methodologies). Note that the fact that there is disagreement between manual analysis and NLP measures is not a surprise and has been documented in the literature (Jongeling et al. 2017).

	Average score – nltk algorithm	Average score – Amazon Mechanical Turk mode	Average author score
Assessed as bad by the author	-0.08	-0.36	-1
Assessed as neutral by the author	0.12	0.44	0
Assessed as good by the author	0.23	0.70	1

Table 5 – correlation matrix of answers of the author, MTurk and the nltk algorithm. The color coding is from green (good news) to red (bad news).

What accounts for differences in assessment? A few examples will give us a better overview of some of the issues. "Sterling was quiet and sluggish after some light, technical selling at the opening". I rated the statement neutrally; the modal MTurk response was -1; and the nltk algorithm scored it -0.40. I gave this statement a neutral score because there seemed to have been little market activity - as suggested by the word "quiet" (as

the dealers often reported). The nltk algorithm, however, saw the statement as negative, potentially picking up on negative keywords like "sluggish". MTurk responses were surprisingly homogenous, with 8 of 10 saying that the statement was negative, and only 2 labelling it as neutral.

A statement I deemed to be neutral but the other systems deemed positive reads: "Sterling remained quietly on the sidelines and gained ground in effective terms despite a further erosion in oil prices." Here the MTurk consensus was 1 and the nltk algorithm granted a 0.69 score. Here again the justification for the 0 rating was that the market was mainly quiet, meaning that any news or action by the central bank would be likely to move the exchange rate, unlike if there was clear market activity due to specific news moving the price. These examples show that the assessment retains a certain amount of subjective judgement. However, unlike other narrative approaches that rely on the reader trusting the assessor, here I have endeavored to benchmark and cross-check my own judgement against assessments gleaned from two very different approaches. Table 5 shows that on average my assessment was confirmed by both the algorithm and the external assessors.

5. Conclusion

Most studies assessing central bank intervention fail to account for exogenous shocks occurring during the day of central bank intervention. Therefore, they overstate the impact of central bank intervention, mistaking it for markets simply picking up on exogenous news. Not controlling for the intraday conditions of the currency is problematic when assessing intervention success. Placebo tests often used in the literature only partially address the issue. Good market news (or even bad news that is less bad than expected) can lead a test to show intervention success when it is only changes in market conditions.

Presenting a novel dataset spanning over 40 years, this paper uses a narrative approach to tackle the endogeneity issue. By reading the daily reports of policymakers at the time, I show how news affecting the exchange rate during the day can influence intervention outcomes. Far from the intervention success rates of 80% in certain studies, I show that when controlling for market conditions, success rates drop as low as 8%. In particular, I show that the Bank of England performs particularly poorly when trying to make sterling appreciate in negative market conditions.

6. Appendix

Extract of Amazon Mechanical Turk assessment

Randomly selected date	Text	Most common answer by 10 reviewers (mode)	My assessment
18/11/1986	Sterling was steady and market quiet.	1	0
10/12/1986	Sterling was very quiet but was helped by the stronger dollar this afternoon.	1	0
18/12/1986	Sterling was steady against the dollar but therefore lost a little ground in cross-rate terms.	-1	0
22/01/1987	Sterling remained on the sidelines	0	0
12/2/1987	Sterling remained quietly on the sidelines and gained ground in effective terms despite a further erosion in oil prices.	1	0
26/02/1987	Sterling steadied as the oil price climbed back above $16 per barrel.	1	1
18/03/1987	Sterling encountered steady demand throughout the day reflecting the favourable response to the budget and the hope that the 1/2% cut in Base rates might leave scope for another reduction soon.	1	1
16/04/1987	Sterling was helped by the stronger dollar and opened firmer in effective and cross rate terms, but was little changed during the day.	0	0
13/05/1987	Sterling was on the sidelines, but was pulled up against third currencies by the stronger dollar.	1	0
29/05/1987	Sterling was on the sidelines but encountered some data commercial demand and touched DM2.97 1/8 at 5 o'clock.	0	0
16/06/1987	Sterling rallied on the better than expected PSBR data (negative borrowing of £374 mn against an expected requirement of £800 mn), but eased against the firmer dollar this afternoon.	1	1
9/7/1987	Sterling was steady in quiet conditions.	1	0
28/07/1987	Sterling was also quiet, but benefited from the encouraging CBI survey.	1	1
25/08/1987	Sterling weakened generally today as the market focused on the recent falls in oil prices and concerns grew about next week's trade figures. Outward investment flows also contributed to the fall but the market was throughout very orderly.	-1	-1

23/09/1987	Sterling firmed against the easier dollar but met no significant upward pressure despite the publication of a bullish CBI survey.	0	0
25/09/1987	Sterling was mostly on the sidelines but enjoyed underlying support as a result of the wider interest differentials against European currencies.	1	1
24/02/1988	Sterling remained quiet but with a firm undertone.	0	0
17/03/1988	Sterling opened on a firm note in the absence of expected official sales at DM3.10 but fell following the Bank's signal of a 1/2% cut in Base Rates. However, good underlying demand led to a partial recovery, and this afternoon the pound regained further ground helped by the firmer dollar.	1	1
26/04/1988	Sterling opened softer after easing in New York last night, but recovered on Middle East demand this morning.	1	0
10/5/1988	Sterling was actively traded in a good two-way market with profit-taking after Yesterday's rise balanced by renewed demand above DM3.15 3/4.	1	0

Table 6 – First 20 extract randomly selected from the dealers' reports. The two columns on the left show first the mode of the Amazon Mechanical Turk assessment (-1 being negative, 0 neutral and 1 positive) and then my assessment of the extract.
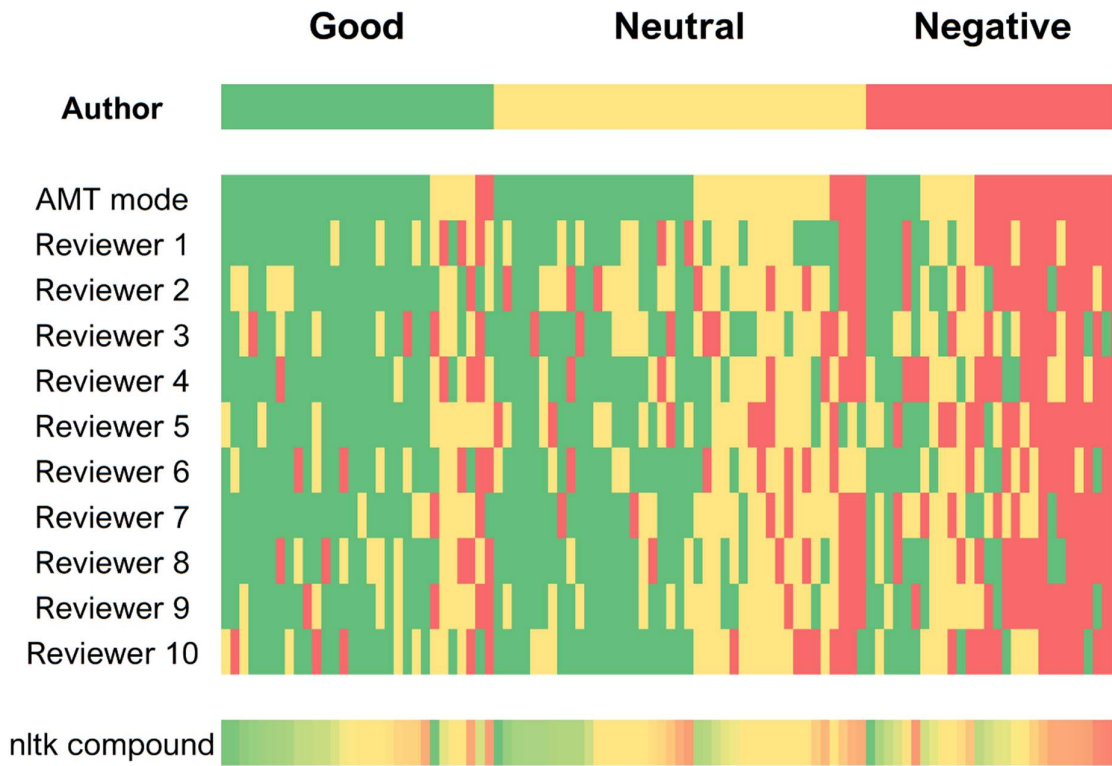
Sample answers heatmap

Figure 3 − Heat map of answers by the author, MTurk reviewers and the nltk algorithm. The scale has three colours using green for positive, yellow for neutral and red for negative. See text for how the answers were collected.

Robustness – parametric approach

Most studies on central bank intervention rely on event studies to assess the impact of intervention on the exchange rate. This section presents the same result as in the paper relying on regression analysis highlighting some of the shortcomings of this approach and offers ways to mitigate them.

When running the regression analysis in its simple from, using intervention as an explanatory variable and interest rate differential as a control, results show that the bigger the intervention, the less it affects the exchange rate. The positive coefficient in Table 7 means that when the Bank of England is buying dollars (also known as restraining intervention), the exchange rate tends to appreciate (instead of the goal of the policy which would be depreciation). And when the Bank sells dollar to try to improve the exchange rate, the opposite happens and the exchange rate depreciates.

This shows the issue with regression analysis. When looking for an overall effect on the whole sample, larger interventions in times of crisis tend to drive the results. For example on Black Wednesday, the Bank of England spent $22bn in one day but the exchange rate still kept on depreciating. Even when removing the larger outliers, the fact remains that regression analysis shows that on average, the bigger the intervention, the greater the opposite of the wanted effect is to occur. The event study proposed mitigates this challenge by giving a success measure for each intervention episode as opposed to an average result driven by larger values..

Dependent variable – change in exchange rate		
	Dollar period (1952-1987)	Deutschmark period (1987-1992)
Intercept	-0.00056*** (0.000101)	-0.001126 (0.000828)
Intervention in billion $	0.029*** (0.00150)	0.0125*** (0.00168)
Interest rate differential	0.000163*** (0.000034)	0.000122 (0.000119)
Adjusted R²	0.05	0.04
Observations	8131	1452

Table 7

Even if the intervention variable is replaced with a dummy variable comparing restraining and defending intervention to the days with no intervention, the results still show that intervention to increase the value of the currency has the opposite effect (result in Table 8 below) . In other words, on average, interventions usually have the opposite effect on the exchange rate. But this does not take into account that intervention can actually have an effect on some occasions and not on others, which the event study analysis allows for.

Dependent variable – change in exchange rate		
	Dollar period (1952-1987)	Deutschmark period (1987-1992)
Intercept	-0.000586*** (0.000178)	-0.001826 (0.001167)
Restraining intervention (1/0)	0.001524*** (0.000199)	0.002487*** (0.000961)
Defending intervention (1/0)	-0.002794*** (0.000227)	-0.005275*** (0.001059)
Interest rate differential	0.0002*** (0.000003)	0.000211* (0.000116)
Adjusted R^2	0.07	
Observations	8131	1452

Table 8

If a simple parametric approaches yields contradicting results, using variables from the narrative approach gives a more convincing picture. Table 9 below is echoing Table 3 in the paper. They both break down intervention success depending on the direction of the wind. Table 9 uses a regression whereas Table 3 uses the event study methodology.

The results in Table 9 show that when going with the wind, the central bank achieved the wanted effect of intervention. However, when going against the wind, the average effect of intervention goes against what the central bank wanted.

| Dependent variable – change in exchange rate	
	1987-1992
Intercept	0.0006 (0.0008)
Defending intervention in billion dollar:	
Against the wind (Intervention x dummy for bad news)	0.041*** (0.003)
With no wind (Intervention x dummy for neutral news)	0.007 (0.016)
With the wind (Intervention x dummy for good news)	-0.017** (0.008)
Restraining intervention in billion dollar:	
Against the wind (Intervention x dummy for good news)	0.007*** (0.002)
With no wind (Intervention x dummy for neutral news)	-0.0001 (0.010)
With the wind (Intervention x dummy for bad news)	-0.205*** (0.029)
Adjusted R²	0.12
Observations	1452

Table 9

Distribution of the different assessment methods

The next three charts show the distribution of the classifications of the dealers' reports into negative (-1), neutral (0) or good (1) news. The first chart displays my classification, the second Amazon Mechanical Turk and the third the nltk natural language processing algorithm.

Author's analysis

nltk algorithm
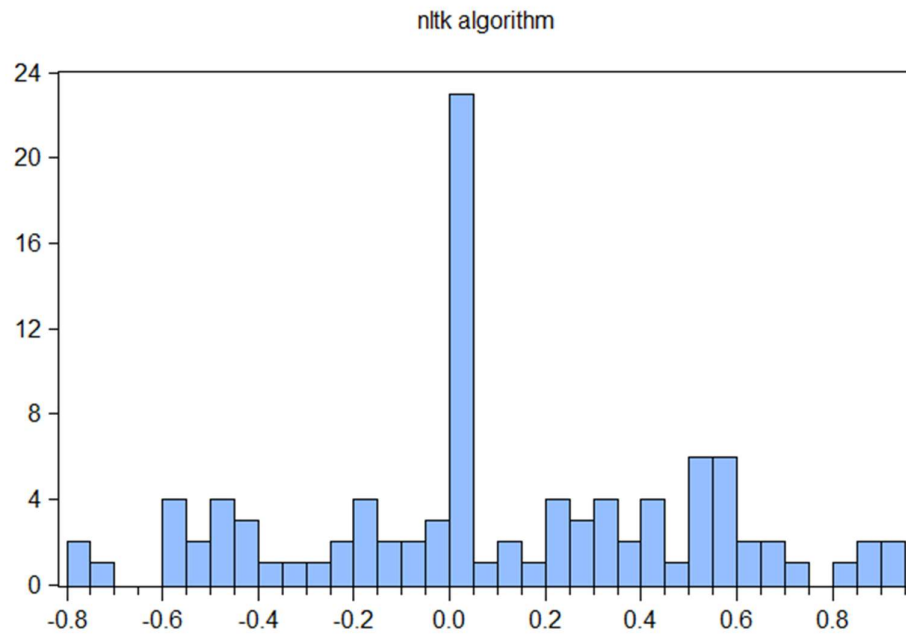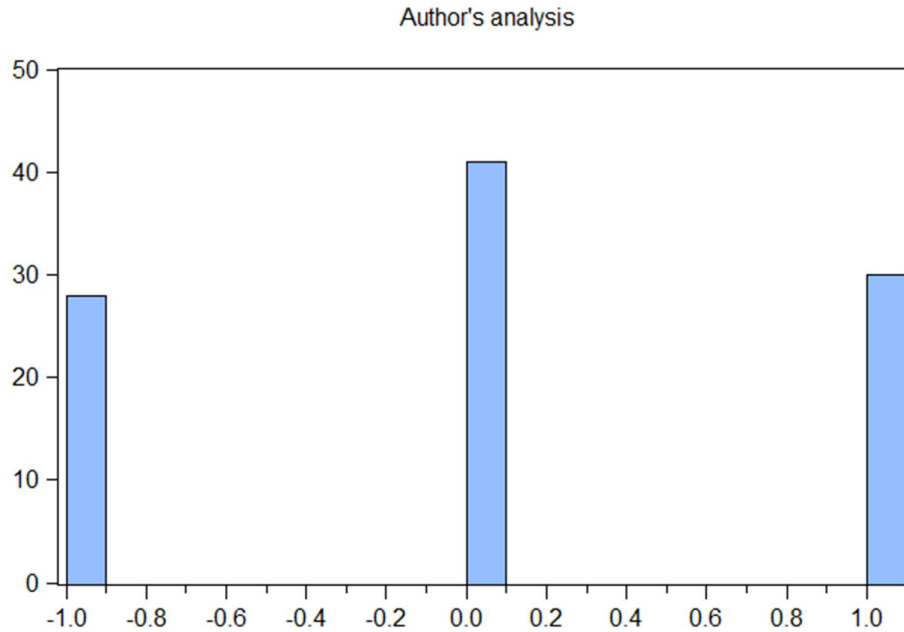
Amazon Mechanical Turk
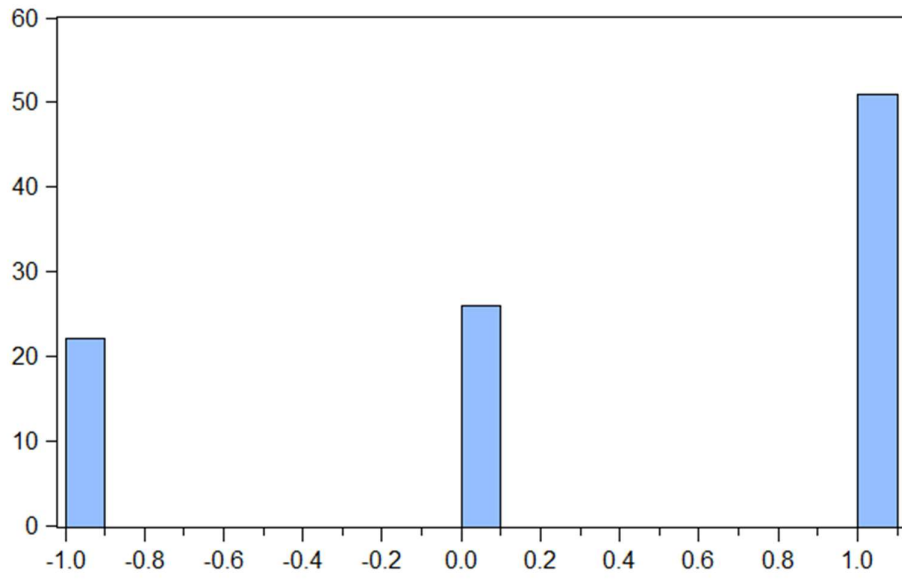
Chronology of British exchange rate arrangements, 1952-2019

To give this paper some context, below is a historical overview of sterling management from 1952 to today.

Bretton Woods system 1944-1971

The meeting of Bretton Woods in 1944 lead to a new international monetary system. During this meeting, Maynard Keynes and Harry White negotiated the future of the exchange rate system of the world. After the competitive devaluations following the breakdown of the gold standard in 1931, policymakers were keen to establish a system which would allow for the new peaceful order of the world to survive. The system was based around the dollar. All currencies within the system were fixed to the dollar with a band of 2%. The dollar was fixed to gold at $35 an ounce (Bordo 2018). Currencies experienced large fluctuations within the official exchange rate bands and the IMF allowed national central banks to manage of their national currencies. Sterling was fixed at $2.80 between 1949 and 1967, and at $2.40 between 1967 and the collapse of the system in 1971. In August 1971, Nixon closed the gold window ending the convertibility of the dollar into gold. This market the end of the Bretton Woods period.

Smithsonian Agreement, 1971

After the breakdown of the Bretton Woods system, policymakers in the US, Europe and Japan were keen to reestablish a new international monetary system. The Smithsonian Agreement was signed by G-10 nations on 18 December 1971 decided a readjustment of

most European currencies against the dollar, including the pound. It established a new 2.25% exchange rate band around the dollar. The agreement also meant that European central banks would support currencies falling close to the system's margins. The then turned into the Snake, another European currency agreement which eventually started floating free from the dollar on March 11, 1973.

Float, 1972

In June 1972, sterling was one of the first currencies to leave the agreement and the pound was floated. The float was meant to only be temporary but Britain never officially joined a fixed exchange rate system until 1990 when it joined the ERM. Despite not following a clear exchange rate target, Britain's regime was clearly a dirty float with many intervention by the Bank of England.

Plazza accord, 1985

In September 1985, France, Japan, the UK, the US and West Germany joined forces to depreciate the US dollar. This public display of commitment worked as after the press conference announcing the scheme, no intervention was needed and the dollar fell according to Paul Volcker (Schenk 2011, 404). The scheme was initiated by the United States and was meant to enhance cooperation between central banks to stabilize major currencies.

Louvre Accord and shadowing of the deutschmark, 1987

If the Plazza accord was successful, the following agreement was much less so. The Louvre accord of February 22nd, 1987 meant this time to halt the decline of the dollar. If unsuccessful for the international coordination of the dollar, the agreement initiated a shift in British intervention policy The accord marked the beginning of a one year attempt by Chancellor Nigel Lawson to

shadow the deutschmark in the hope of joining the European Exchange Rate Mechanism (ERM,

see below) later on. From this point on, intervention success in this paper is no longer measured

as the impact intervention had on the sterling/dollar currency pair but the sterling/deutschmark

pair.

In terms of operations, the Bank still mainly intervened in US dollars in 1987 but the objective

was clearly to influence the deutschmark. Only from December 1987 did the Chancellor write

to the Governor of the Bank of England to request that "From now on, all intervention to

achieve that should be in deutschemarks, and not in dollars" (James, forthcoming quoting

archives BoE, 11A21/11). If before interventions were both in dollar and deutschmark, the

policy goal was to maintain manage the deutschmark-sterling parity in priority.

The deutschmark was shadowed from the beginning of the Louvre Accord to March 1988 and

these operation proved relatively successful, mainly because most of the intervention were

restraining interventions using unlimited sterling reserves. After March 1988, the deutschmark

was still the focus of policy but monetary policy objective took a more important role

alongside with exchange rate management. It was no longer a policy of shadowing the

deutschmark.

Britain in the Exchange Rate Mechanism (ERM), 1990-1992

On October 1ˢᵗ 1992, Britain finally joined the European Exchange Rate Mechanism (ERM). It

was a system of exchange rate pegs inaugurated in 1979 to limit exchange-rate volatility in

Europe and foster regional monetary integration.[8] In the 1990s, the agreement was in fact the

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[8] See Canto (1991) for an overview of the functioning of the ERM.

antechamber of the Euro. Thatcher was reluctant to join the scheme until realizing its power

to impose more rigorous fiscal and monetary policy by fixing the exchange rate. Britain

abruptly left the scheme in September 1992 when the Bank of England lost the control of its

exchange rate. George Soros and other investors did bet that Britain would not be willing to

stay in the ERM. They borrowed heavily to short the pound and on 16 September (or Black

Wednesday), they forced the Bank to abandon its exchange rate peg. During the last day on

the peg, the Bank spent over $22bn in intervention, an amount equivalent to the 1992 annual

GDP of Croatia and Bulgaria put together.

The area of free floating, 1992-today

After this event, the Bank kept on being present in the foreign exchange market but

operations can no longer be qualified as intervention as they were no longer meant to influence

the foreign exchange market. The Bank mainly maintains a presence to buy foreign exchange

reserves which have kept on increasing since 1992. The Bank also needs a presence on the

forex market to assist the government with big foreign exchange transactions, for big

international transaction with other states or third parties (this is one of the goals of the EEA,

the governments' reserves account). The Bank only intervened twice since 1992 in a global

concerted interventions against the Euro in 2000 and against the Yen in 2011. [9]

[9] On 22 September 2000 the Bank of England intervened to buy 85 million Euro in a concerted intervention to prop up the Euro (see for example https://money.cnn.com/2000/09/22/worldbiz/euro/). And on 11 March 2011 in a concerted yen intervention after the Tohoku earthquake (C. Neely 2011).

7. References

Adler, Gustavo, Noëmie Lisack, and Rui C. Mano. 2019. 'Unveiling the Effects of Foreign Exchange Intervention: A Panel Approach'. *Emerging Markets Review*, June, 100620. https://doi.org/10.1016/j.ememar.2019.100620.

Adler, Gustavo, and Rui C. Mano. 2018. 'The Cost of Foreign Exchange Intervention: Concepts and Measurement*'. *Journal of Macroeconomics*, August. https://doi.org/10.1016/j.jmacro.2018.07.001.

Ambuehl, Sandro, Muriel Niederle, and Alvin E. Roth. 2015. 'More Money, More Problems? Can High Pay Be Coercive and Repugnant?' *The American Economic Review* 105 (5): 357–60.

Bird, Steven, Ewan Klein, and Edward Loper. 2009. *Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*. 1 edition. Beijing ; Cambridge Mass.: O'Reilly Media.

Blanchard, Olivier, Gustavo Adler, and Irineu de Carvalho Filho. 2015. 'Can Foreign Exchange Intervention Stem Exchange Rate Pressures from Global Capital Flow Shocks?' Working Paper 21427. National Bureau of Economic Research. http://www.nber.org/papers/w21427.

Bordo, Michael D. 2018. 'The Imbalances of the Bretton Woods System 1965 to 1973: U.S. Inflation, The Elephant in the Room'. Working Paper 25409. National Bureau of Economic Research. https://doi.org/10.3386/w25409.

Bordo, Michael D., Owen F. Humpage, and Anna J. Schwartz. 2015. *Strained Relations: US Foreign-Exchange Operations and Monetary Policy in the Twentieth Century*. Chicago: University of Chicago Press.

Burkhard, Lukas, and Andreas M. Fischer. 2009. 'Communicating Policy Options at the Zero Bound'. *Journal of International Money and Finance* 28 (5): 742–54. https://doi.org/10.1016/j.jimonfin.2008.06.006.

Canto, Victor A. 1991. 'FYI: Everything You Always Wanted to Know about the European Monetary System, the ECU and ERM, but Didn't Know Who to Ask'. *Financial Analysts Journal* 47 (6): 22–25.

Dominguez, Kathryn, and Jeffrey Frankel. 1993a. *Does Foreign Exchange Intervention Work?* Washington, DC: Peterson Institute for International Economics.

Dominguez, Kathryn, and Jeffrey A. Frankel. 1993b. 'Does Foreign-Exchange Intervention Matter? The Portfolio Effect'. *The American Economic Review* 83 (5): 1356–69.

Dominguez, Kathryn M. 2003. 'The Market Microstructure of Central Bank Intervention'. *Journal of International Economics* 59 (1): 25–45. https://doi.org/10.1016/S0022-1996(02)00091-0.

Echavarría, Juan J., Luis F. Melo-Velandia, and Mauricio Villamizar-Villegas. 2018. 'The Impact of Pre-Announced Day-to-Day Interventions on the Colombian Exchange Rate'. *Empirical Economics* 55 (3): 1319–36. https://doi.org/10.1007/s00181-017-1299-1.

Fatum, Rasmus. 2015. 'Foreign Exchange Intervention When Interest Rates Are Zero: Does the Portfolio Balance Channel Matter after All?' *Journal of International Money and Finance* 57 (October): 185–99. https://doi.org/10.1016/j.jimonfin.2015.07.015.

Fatum, Rasmus, and Michael Hutchison. 1999. 'Is Intervention a Signal of Future Monetary Policy? Evidence from the Federal Funds Futures Market'. *Journal of Money, Credit and Banking* 31 (1): 54–69. https://doi.org/10.2307/2601139.

———. 2006. 'Effectiveness of Official Daily Foreign Exchange Market Intervention Operations in Japan'. *Journal of International Money and Finance* 25 (2): 199–219. https://doi.org/10.1016/j.jimonfin.2005.11.007.

Fratzscher, Marcel, Oliver Gloede, Lukas Menkhoff, Lucio Sarno, and Tobias Stöhr. 2019. 'When Is Foreign Exchange Intervention Effective? Evidence from 33 Countries'. *American Economic Journal: Macroeconomics.* https://doi.org/10.1257/mac.20150317.

Gabaix, Xavier, and Matteo Maggiori. 2015. 'International Liquidity and Exchange Rate Dynamics'. *The Quarterly Journal of Economics* 130 (3): 1369–1420. https://doi.org/10.1093/qje/qjv016.

Hassan, Tarek A, Thomas M Mertens, and Tony Zhang. 2016. 'Currency Manipulation'. Working Paper 22790. National Bureau of Economic Research. https://doi.org/10.3386/w22790.

Hoshikawa, Takeshi. 2008. 'The Effect of Intervention Frequency on the Foreign Exchange Market: The Japanese Experience'. *Journal of International Money and Finance* 27 (4): 547–59. https://doi.org/10.1016/j.jimonfin.2008.01.004.

Howson, Susan. 1980. *Sterling's Managed Float: The Operations of the Exchange Equalisation Account, 1932-39.* International Finance Section, Department of Economics, Princeton University. https://www.princeton.edu/~ies/IES_Studies/S46.pdf.

———. 2014. 'Money and Monetary Policy since 1945'. In *The Cambridge Economic History of Modern Britain: Volume 2*, edited by Roderick Floud and Paul Johnson, 2 edition, 134–66. New York: Cambridge University Press.

Hu, May, Yunfeng Li, Jingjing Yang, and Chi-Chur Chao. 2016. 'Actual Intervention and Verbal Intervention in the Chinese RMB Exchange Rate'. *International Review of Economics & Finance* 43 (May): 499–508. https://doi.org/10.1016/j.iref.2016.01.011.

Ilzetzki, Ethan, Carmen M. Reinhart, and Kenneth S. Rogoff. 2019. 'Exchange Arrangements Entering the Twenty-First Century: Which Anchor Will Hold?' *The Quarterly Journal of Economics* 134 (2): 599–646.

Ito, Takatoshi. 2003. 'Is Foreign Exchange Intervention Effective? The Japanese Experiences in the 1990s'. In *Chapters*. Edward Elgar Publishing. https://ideas.repec.org/h/elg/eechap/2818_5.html.

Jongeling, Robbert, Proshanta Sarkar, Subhajit Datta, and Alexander Serebrenik. 2017. 'On Negative Results When Using Sentiment Analysis Tools for Software Engineering Research'. *Empirical Software Engineering* 22 (5): 2543–84. https://doi.org/10.1007/s10664-016-9493-x.

Kearns, Jonathan, and Roberto Rigobon. 2005. 'Identifying the Efficacy of Central Bank Interventions: Evidence from Australia and Japan'. *Journal of International Economics* 66 (1): 31–48. https://doi.org/10.1016/j.jinteco.2004.05.001.

Krippendorff, Klaus. 2018. *Content Analysis: An Introduction to Its Methodology*. Fourth edition. Los Angeles: SAGE Publications, Inc.

Mohanty, Madhusudan S., and Bat-el Berger. 2013. 'Central Bank Views on Foreign Exchange Intervention'. BIS working paper No 73.

Monnet, Eric. 2014. 'Monetary Policy without Interest Rates: Evidence from France's Golden Age (1948 to 1973) Using a Narrative Approach'. *American Economic Journal: Macroeconomics* 6 (4): 137–69. https://doi.org/10.1257/mac.6.4.137.

Neely, Christopher. 2005. 'An Analysis of Recent Studies of the Effect of Foreign Exchange Intervention'. Federal Reserve Bank of St. Louis Working Paper No. 2005-030B.

———. 2011. 'A Foreign Exchange Intervention in an Era of Restraint'. *Federal Reserve Bank of St. Louis Review*, no. 93(5) (October): 303–24.

Neely, Christopher J. 2008. 'Central Bank Authorities' Beliefs about Foreign Exchange Intervention'. *Journal of International Money and Finance* 27 (1): 1–25. https://doi.org/10.1016/j.jimonfin.2007.04.012.

Neuendorf, Kimberly A. 2016. *The Content Analysis Guidebook*. Second edition. Los Angeles: SAGE Publications, Inc.

Reitz, Stefan, and Mark P. Taylor. 2008. 'The Coordination Channel of Foreign Exchange Intervention: A Nonlinear Microstructural Analysis'. *European Economic Review* 52 (1): 55–76. https://doi.org/10.1016/j.euroecorev.2007.06.023.

Romer, Christina D., and David H. Romer. 1989. 'Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz'. In *NBER Macroeconomics Annual*, by Olivier Blanchard and Stanley Fischer, 4:121–70. Cambridge: MIT Press. https://www.journals.uchicago.edu/doi/abs/10.1086/654103.

———. 1994. 'Monetary Policy Matters'. *Journal of Monetary Economics* 34 (1): 75–88. https://doi.org/10.1016/0304-3932(94)01150-8.

———. 2014. 'The Incentive Effects of Marginal Tax Rates: Evidence from the Interwar Era'. *American Economic Journal: Economic Policy* 6 (3): 242–81. https://doi.org/10.1257/pol.6.3.242.

Sarno, Lucio, and Mark P. Taylor. 2001. 'Official Intervention in the Foreign Exchange Market: Is It Effective and, If so, How Does It Work?' *Journal of Economic Literature* 39 (3): 839–68. https://doi.org/10.1257/jel.39.3.839.

Schenk, Catherine. 2011. 'The Retirement of Sterling as a Reserve Currency after 1945: Lessons for the US Dollar?' *World Financial Review*, May. http://www.worldfinancialreview.com/.

Taylor, Alan M. 2010. 'Global Finance after the Crisis'. *Bank of England Quarterly Bulletin* 50 (4): 366–77.

Yu, Yang, Wenjing Duan, and Qing Cao. 2013. 'The Impact of Social and Conventional Media on Firm Equity Value: A Sentiment Analysis Approach'. *Decision Support Systems*, 1. Social Media Research and Applications 2. Theory and Applications of Social Networks, 55 (4): 919–26. https://doi.org/10.1016/j.dss.2012.12.028.