Shooting on a Moving Target: Explaining European Bank Rates during the Interwar Period

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Abstract

This paper describes the monetary policy response of countries during the inter-war period. How did central banks react to the Great Depression? How did countries balance the externals demands of the gold standard with domestic policy pressures? What was the optimal level of international policy coordination? We use weekly data over the period 1925-1936 to estimate central bank rate reaction functions for a panel of 22 countries during the inter-war gold standard. The estimates suggest to us changing objectives for monetary policy. Countries moved away from the sole objective of convertibility and towards a more 'modern' monetary policy based on exchange rate stabilization, but not yet output stabilization or even modern price level targeting. Importantly, this move to exchange rate stabilization was accompanied by the formation of monetary policy blocs around pre-existing economic relations. Countries' interwar policy choices offer lessons for countries remaining in or choosing to join the European Monetary Union today.

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1. Introduction

With the arrival of the 10th anniversary of the European Central Bank (ECB) on June 1st, 2008 and the 10th anniversary of the Euro, which was introduced as an accounting currency on January 1st, 1999, followed by coin and note issues on January 1st, 2002, economists have taken the opportunity to look back over the past 10 years to assess the successes and failures of the Euro system.

Many scholars have lauded the accomplishments of the Euro; fostering trade and financial integration, raising living standards across Europe, and last but not least ensuring that European neighbors are now locked in a system that has secured peace and stability over the past 60 years. Supporters have also pointed to the impressive feat of the European Central Bank of establishing itself as a credible key player in international financial markets, and to the creation of the Euro as new international reserve currency that now challenges the dominance of the US dollar (Chinn and Frankel, 2007).

Skeptics of the Euro system, however, point out that the Euro system is flawed as long as the Eurozone cannot be considered an Optimum Currency Area (OCA); and as long as OCA criteria such as labor market integration remain largely unchanged. The creation of a unified monetary policy, while maintaining national political autonomy and national fiscal policies, leaves the system vulnerable and ill-fitted to swiftly respond to economic crises. Some have even speculated about the improbable but not impossible break-up of the Euro area (Eichengreen, 2007), and have pointed out that while the Euro had a positive impact on economic integration, the measurable economic effects are small, and today's Europe might not look all that different if history had taken a different course (Eichengreen and Boltho, 2008). Another aspect of European monetary policy that has drawn continuous criticism is the two-pillar strategy with its focus on economic and monetary analysis and its strong emphasis on price stability implemented by the European Central Bank. Various researches have suggested that the ECB abandon its

primary focus on price stability, citing the tradeoff between low inflation and faster growth, as well as the arbitrariness of the two percent cut-off.[1]

Over the past year, the ongoing financial crisis has prompted scholars to take a fresh look at the viability of the Eurozone. European Monetary Union (EMU) member countries have begun to question further enlargement, while aspiring members in Eastern Europe, facing large capital withdrawals and sharp declines in their domestic currency, have approached the Eurozone asking for financial support. But while the current financial crisis is often described as the first real test of the EMU, it is not the first crisis that has shaped the experience of the member countries. Put into broader context, the formation of the EMU came about as a reaction of European central banks to the 1992 exchange rate crisis. Faced with the collapse of the European Exchange Rate Mechanism in the wake of recession, a group of European countries chose to form a monetary union and deepen the process of European economic integration under way since the 1950s. However, not all member states of the European Union opted for monetary unification. Rather, Denmark, Sweden and the United Kingdom developed a novel framework for the conduct of independent monetary policy, known today as inflation targeting. This raises an important economic question: Why did some countries join the EMU when others did not? Why did the Netherlands adopt the Euro, while Sweden chose to pursue an independent monetary policy based on inflation targeting? And what might the EMU look like as a result of the ongoing financial troubles?

In this paper, we look back and compare the challenges that central banks and policymakers faced in 1992 and are facing today, with the experience of countries during the interwar years. In the interwar period, many countries struggled to redefine their monetary policies. Key issues for the interwar economies were the establishment of credibility, striking the right balance between international versus domestic policy objectives, and achieving an optimal level of international policy cooperation.[2] Countries had the choice of remaining in or leaving the interwar gold exchange standard, where the latter implied the challenge of how to design monetary policy in the face of its collapse.

[1] Compare, among others, Cecchetti and O'Sullivan, 2003.
[2] For a detailed discussion of different countries' experiences with the interwar gold standard, please refer to Eichengreen (1992).

All of these are questions that have also concerned the EMU member countries and their European neighbors for the past ten years. Moreover, they will likely continue to be discussed in the future, especially as new members aspire to join the Euro zone.

A convenient starting point for a theoretical analysis is the monetary policy trilemma. Policymakers in open economies face a macroeconomic trilemma, as they are confronted with three typically desirable, yet contradictory, objectives: first to stabilize the exchange rate, second to enjoy free international capital mobility, and third to engage in monetary policy oriented towards domestic goals such as output stabilization or price level stabilization. Over time, the constraints implied by this trilemma were typically binding, with some qualifications, as shown in Obstfeld et al. (2004a). However, when countries faced major macroeconomic shocks, they often proved reluctant to let exchange rates float and/or impose capital controls. There is evidence for a 'fear of floating' among smaller or less developed countries that might stem from both, a lack of credibility and a country's heavy dependency on international trade and foreign capital (Calvo and Reinhart 2002). Hence, in spite of growing domestic pressure for a reorientation of monetary policy away from multilateral exchange rate stabilization and towards unilateral objectives such as output stabilization, countries may opt for a third way: the formation of monetary policy blocks along the lines of Optimum Currency Areas.

Three specific questions stand at the center of our analysis: what were the key monetary policy objectives to which interwar countries subjected their policy, and how did these targets change in response to the Great Depression? Second, do we observe the formation of monetary policy blocks over time, either with the rise of the gold standard or with its demise? And third, what factors determined the selection of countries into these blocks?

In our empirical analysis we focus on the determinants of central bank rates over the period 1925 to 1936 and explore how these determinants changed over time. This approach obviously implies several simplifications. On the one hand side, bank rates might only imperfectly reflect a central bank's reaction, given other policy instruments. On the other side, various policy objectives can motivate similar reaction function. However, several authors have stressed the relevance of bank rates during the interwar period before us (among others Eichengreen et al. 1985). Given data availability and

given the major shocks during the period under investigation, our main aim here is not to test hypotheses based in theory, but rather to explore patterns in the data in order to develop new hypotheses.

In a first step we estimate central bank reaction functions for our sample countries, following a simple empirical framework based on Tullio and Wolters (2007). We extend this framework to take domestic policy objectives into account. Next, we explore whether central bank reaction functions differed across countries, especially if some countries behaved like "anchor countries" in the sense of Alesina, Barro and Tenreyro (2002). We first use Granger Causality tests to identify potential "anchors" and then re-estimate reaction functions for these countries and the rest for our sample separately. This strategy allows us to test for the idea that monetary policy blocks formed around these existing economic relations with anchor countries. Finally, in a third step we explore the factors that determined a country's selection into one of these policy blocks.

The rest of our paper is organized as follows. In section two we start with some brief historical background on monetary policy in the interwar period. In section three we describe our main data and the empirical approach by Tullio and Wolters (2007). This section also contains the basic analysis of reaction functions. In section four we explore whether there were "anchor" countries that can be separated from others and re-estimate the reaction functions including possible effects from adherence to a monetary policy block. In section five, we explore the factors that determined a country's selection into one policy block rather than another. Section six concludes.

2. Some Background on the Interwar Period

The interwar period between the two world wars (1919-1939) was a defining era for modern macroeconomics. It was then, that many countries transitioned to independent central banks and began formulating monetary policy in the modern sense. Coming from the stability of the pre-war classical gold standard, the countries in the inter-war period struggled to re-establish an international monetary system. The changing political environment and the economic shocks of the 1920s and 1930s, made it difficult to commit to the goal of exchange rate stability, and put the priorities of maintaining an

international exchange rate arrangement over domestic challenges such as low economic growth and high unemployment. The result of this dichotomy between domestic and international policy goals was the creation of the inter-war gold exchange standard, a modified gold standard system that in essence only lasted for a mere six years between 1925 and 1931 before it collapsed into a world of trade and currency blocks.

Prior to 1925, many countries struggled with hyperinflation and high volatility of exchange rates. Despite the disruptions caused by WWI, there was widespread agreement in 1919 that a new international monetary system should be created, again based on fixed exchange rate and anchored to gold. However, the return to such a system was complicated by the burden of reparation payments and the entangled web of accumulated debts that remained from the War (Feinstein et al, 1997). Many countries were in dire need of international support to finance reconstruction. As the US was the only country that was in a position to provide financial assistance, the center of power had quietly shifted from London to New York (Kindleberger, 1976). Additionally, several countries feared that a return to gold at the old exchange rate parities would bring widespread deflation. The inter-war gold standard emerged as an ad hoc compromise, after Britain had decided to return to gold at the pre-war parity in April of 1925. Other countries followed, and by the end of the year, many countries had once again adopted gold as their monetary anchor.

There were important policy differences between the inter-war and the classical gold standard, aimed at remedying the threat of deflation. The interwar gold standard operated as an exchange standard system based on key currencies. Only the currencies of the center countries were directly pegged to gold. Countries on the periphery pegged their currencies to the currencies of the center countries and also held their reserves partially in gold and partially in the currencies of the center countries. This allowed a one-time expansion of the world money stock. Adopting the gold standard brought stability to the international financial markets and introduced a brief period of economic growth. Nevertheless the system could not repeat the classical gold standard's success, and its problems soon became apparent.

The breakup of the inter-war regime, often dated with Britain's departure from gold in September 1931, even though some countries stayed on the gold standard until 1936, is attributed to a series of causes: first, the 'exchange' nature of the gold standard led to an inherent imbalance. The system placed pressure on the center countries to maintain their gold convertibility, but countries on the periphery, which held their reserves in the currencies of the center countries, possessed no enforcement mechanism over the center countries. As the world economy grew, and with it the demand for reserve currency, the center countries were tempted to increase their money stock. But increasing the liquidity of the reserve currency entailed the risk of a crisis of confidence for the entire system because it jeopardized the center currencies' link to gold (Triffin, 1947).

Several other problems contributed to its demise. The interwar gold standard was characterized by structural problems and persistent gold imbalances between the center countries. France and the United States had policies to sterilize gold inflows, leading to the accumulation of gold reserves in both countries. Britain, in contrast, suffered from large gold outflows. Unfortunately, the adjustment mechanism of the gold standard did not succeed in eliminating these surpluses and deficits in the balance of payments. Deficit countries were constrained by reserve losses and had to deflate in order to maintain fixed parities. Surplus countries, by contrast, allowed their foreign investments to increase without making an upward adjustment in their money supply or price levels. This led to a steady decline in world prices. These gold imbalances during the interwar years document the central banks' lack of cooperation. Whereas countries in financial difficulties could borrow from their neighbors during the classical gold standard years, this international support was no longer available in the years after the war. A gold shortage in one country could therefore turn into a crisis of confidence for the entire system, rather than being solved cooperatively. This lack of leadership was aggravated by the shift of financial power from London to New York, which eliminated England's capacity to maintain global balance through movements of its discount rate.

In the face of the global economic crisis in the early 1930s, the interwar gold standard crumbled into different currency or monetary policy blocs (Eichengreen and Irwin 1996). The first group of countries to impose exchange controls in the face of the domestic

crisis, and thereby effectively leaving the regime, included Hungary and Germany, followed by other south-central European countries in July 1931. Next was a group of countries following Britain off gold in September 1931 that included other Commonwealth members as well as the Scandinavian countries. Five countries remained on the gold standard until 1935/36, rallying around France. These included the Netherlands, Belgium, Switzerland and Poland. A key question here is which factors determined a country's selection into one block rather than another. As argued in Ritschl and Wolf (2003) the formation of these currency blocks was endogenous to trade insofar as they were formed along the lines of preexisting trade networks. Here, we will extend this analysis to include institutional and geographical factors. Countries during the interwar years were acutely aware of their neighbors' actions. For a small open economy on fixed exchange rates with open capital markets, the interest rate is determined in the world market. However, what countries are facing is not some obscure world interest rate, but a rate that is directly determined by the largest economies around. Interwar countries were aware of this process and even included this in their policy formulation. For Austria, for example, a report on the economic conditions to the League of Nations by WT Layton and Charles Rist recommended that "*The Austrian bank rate had to stay above the rate of the countries that were granting the credit and maybe even above the German rate for Austria to get the international credits that the country needs.*"[3]

While the inter-war gold standard of course differed from the EMU today, some parallels can be seen. A careful study of interwar economies can give some insights into the policy choices and challenges facing countries in the 1990s and the EMU today. In the following we focus on the key determinants for monetary policy in the interwar regime that follow from the challenges that were laid out in the previous section. In our conclusion we will draw some comparisons with the Euro.

As mentioned before, the key policy challenges that interwar economies attempted to navigate were the adherence to the gold standard which brought stability and credibility, balancing the demands of the gold standard with domestic policy pressures, and

[3] League of Nations, Reports of the Commissioner 20, Vienna 1925. For a more extensive discussion of the monetary policies of Austria, Czechoslovakia, Hungary and Poland, see Wandschneider (2009)

maintaining cooperation and the right level of coordination with neighboring or dominating countries in the region. The first two of these goals can be seen in light of the classic trilemma of monetary policy, where under open capital markets, countries have to choose between fixed exchange rates and a domestic monetary policy.[4] Under the exchange rate system of the interwar gold standard, countries attempted to balance the stability of the system with rising domestic pressures. Eichengreen (1992) and Simmons (1993), and more recently Wandschneider (2008) and Wolf (2008) have shown that the changing political landscape after World War I increased the pressure to orient monetary policy more towards domestic economic goals. If governments were willing to leave the gold standard, and would let the exchange rate depreciate, they would not be forced to compress domestic spending. However, in this case they would give up the inflation commitment and the 'good housekeeping seal of approval' that adherence to the gold standard would have entailed (Bordo, Edelstein, Rockoff, 1999).

This conflict of domestic versus external objectives extends to the European Monetary Union. With the delegation of monetary policy to the ECB in Frankfurt, EMU members have given up the monetary policy tool for domestic purposes. Nevertheless, the implementation of structural policies to support this monetary policy remains with the national governments. The policy conflicts arising from the national interest are probably the biggest challenge for the future of the EMU today (Cecchetti and O'Sullivan, 2003) and these conflicts are likely to increase the larger the number of EU, and eventually EMU member countries. But the challenge of cooperation is not the only parallel between the interwar years and the Eurozone today. Adhering to the gold standard, interwar countries committed themselves to price stability as an implicit policy target. Under the gold standard, the dominant target was to stabilize the currency price of gold (the gold parity), by managing the money supply. Since the growth of international gold stocks was limited, money supply growth kept inflation low. Hence at least in the long run price stability was a target under gold. Moreover, price stability remained a policy target even when countries left gold, but may have lost its dominance over other targets.

[4] For an application of the trilemma to the interwar gold standard, see Obstfeld, Shambaugh and Taylor, 2004.

Under the interwar regime, central banks took on the key role of maintaining and stabilizing the international system. Independent central banks were therefore complements, rather than substitutes to the fixed exchange rate regime. The classical rules of the game prescribed countries to raise interest rates in the face of reserve losses but lower rates when reserves were high. Interwar countries in fact did not subject their central banks to these policies. As Eichengreen, Watson, and Grossman (1985) have shown, Britain pursued asymmetric interest policies, raising the rate in response to losses in reserves but failing to lower the rate following reserve gains. Moreover, they found an increased sensitivity in interest changes to domestic conditions, such as the cost of domestic credit. Similarly Simmons (1996) finds evidence of violations of the rules of the game during the inter-war gold standard, when looking a panel of 15 countries. Her results show that countries with independent central banks placed more emphasis on domestic price stability than on the external adjustment process.

3. Empirical Analysis: Central Bank Reaction Functions 1925-1936

In the following, we use an unbalanced panel of data for a set of 22 interwar economies (Austria, Belgium, Bulgaria, Czechoslovakia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Romania, Sweden, Switzerland, United Kingdom and the Unites States). For these countries, we have collected weekly and monthly bank rates, monthly cover ratios, exchange rates, inflation rates (calculated as percentage change in the consumer price index), monthly indices of industrial output, and data on exchange controls. Exchange rates, exchange control data and prices are taken from the League of Nations, Annual Yearbooks, 1925-1936/37. Cover ratios, bank rates and indices of industrial output were taken from Statistisches Reichsamt, Statistik der Weltwirtschaft 1934 and 1937.

Following Tullio and Wolters (2007) we model changes in the official discount rate Δi_t of each central bank in our sample as a function of changes in the cover ratio Δc_{t-1} and the percentage deviation of the exchange rate of a country's currency with the US Dollar from its gold parity in the previous month denoted by w^E_{t-1}. The cover ratio is defined as the ratio of gold and convertible foreign exchange reserves of the central bank relative to

M_0, the circulation of banknotes and coins. Given this, we expect to find that changes in bank rates depend negatively on changes in the cover ratio, because an outflow of gold should have triggered an increase of bank rates.[5] Next, we expect that changes in bank rates depend positively on changes in deviations of the exchange rate from its gold parity, because an increase in the exchange rate indicates a devaluation of the local currency relative to the Gold dollar and hence a tendency of capital and gold to flow out of the country that should have triggered an increase in bank rates. Table 1 gives the results of this exercise, where we exclude the US from the sample and limit our attention to a balanced sample with a total of 1638 observations (21 countries over 78 months).

(Table 1a about here)

Consider Table 1, column 1. There is evidence that bank rates increased in outflows of gold and foreign exchange reserves relative to M_0 and with exchange rate deviations below gold parities. As shown in columns 2 and 3 this result holds also if we allow for country-specific random or fixed effects. However, there are changes over time. On average over our sample we do not observe a systematic response to changes in cover ratios for the period up to 1931 (this is true also if we exclude France from the sample). Instead, we always find clear evidence that bank rates react to both exchange rate deviations from gold parities and changes in cover ratios for the period 1933-1936.

These results pose more questions than they answer: why did countries apparently follow the rules of the game more closely in 1933 than before this, after most sample countries had actually left gold? In a next step, we extend the analysis by allowing bank rates to react to changes in prices and industrial production. If central banks cared about domestic economic conditions, they should have lowered interest rates in response to deflation and declines in industrial output.

[5] While we note that the opposite may not necessarily hold as countries tried to sterilize gold inflows during the interwar years (see Eichengreen et al. 1985), we don't think that this has a major impact in our case, as most European countries experienced net-outflows of gold rather than inflows over the period under consideration. We add controls for the two countries that experienced major gold inflows (France and the US).

(Table 1b about here)

As shown in table 1b, this finds empirical support only for the period 1925-1929, prior to the Great Depression when the interwar gold standard was still in operation. Again, the results seem to contradict conventional wisdom. There is little evidence that central banks followed the rules of the gold standard during the period when it was officially in operation; however we do find clear evidence for this from 1929 onwards, exactly when the gold standard started to collapse.

4. Testing for Asymmetries

Our previous analysis was based on the very strict (but common) assumption, that countries' central banks followed in principle the same reaction function. There is plenty of anecdotal evidence that is at odds with this assumption. To start with, the Bank of England had most probably more discretion in setting interest rates than the Bank of Poland, for example. Next, as indicated above, a country like Austria or Hungary might have been more directly influenced by changes in bank rates in Germany than say changes in bank rates in England. To explore such asymmetries in reaction functions, we first estimate a large unrestricted VAR based on weekly rather than monthly central bank rates over all sample countries over the period 1925-1929 and compute generalized impulse response functions following Pesaran and Shin (1998). Based on this, we run a complete series of Granger Causality tests to identify central banks that affected the bank rates of other countries but were not systematically affected by any other country except its own lagged bank rates. Results from the Granger causality tests are reported in Table 2.

(Table 2 about here)

These results clearly identify some countries that had a relatively pronounced effect on others. In addition to the United States and Great Britain, which the economic history literature identifies as policy leaders at the time, especially German and France do not react to other countries but have massive effects on others. In the following analysis we therefore use, Germany, France, the UK and US as possible anchor countries for bank policy.

Based on this evidence let us reformulate our question from section 3: what factors affected changes in the bank rates of these anchor countries and how in turn did these changes affect bank rates in other European countries, controlling for cover ratios, exchange rates and domestic conditions? Table 3 shows the reaction functions for each of the anchor countries (except the US, where exchange rate deviations are not defined).

(Table 3 about here)

We see that reaction functions differed widely. The strongest responses to changes in cover rates can be seen for Germany prior to 1932, reflecting desperate attempts of the Reichsbank to limit the loss of gold and foreign exchange in the crisis of 1931, but also earlier during the crisis of 1927. In stark contrast, France did not follow the rules of the game during the interwar years and apparently not only sterilized inflows of gold but even increased bank rates during in reaction to gold inflows. At the same time there is evidence for attempts to stabilize prices (Bordo and Hautcour, 2007). Yet another picture emerges for the UK. There is little evidence that the Bank of England responded to changes in the cover ratio or exchange rates by changes in bank rates, except during the period 1929-32, in response the devaluation of the pound was briefly countered by an increase in bank rates after September 1931. Moreover, this is the only period when the Bank of England reacted to changes in the price level.

As indicated by the VARs and Granger Causality tests, other central banks responded

systematically to bank rates in these anchor countries. Hence, we now explore the reaction functions of the non-center countries, explicitly taking the role of the center countries into account. We first included all four anchor countries, with and without time interactions as additional explanatory variables in the regression. The results can be seen in Table 4.

(Table 4 about here)

The results show that especially Britain, but also the US and Germany exerted considerable influence over other countries and clearly emerge as anchors. We further included specific country pairs in the regressions, again interacted with time dummies. These results (not reported here) also confirm the emergence of anchors and give a clear suggestion of bloc building. Blocs of monetary policy emerged along the lines of political alignments and trade relationships. For example, the Scandinavian countries, Sweden, Denmark and Norway strongly align with the UK, especially in the crisis and post-crisis episode. Central European countries, such as Austria use Germany as an anchor and this relationship can be observed throughout the whole time period. The US is only a weak anchor for some countries, such as the Netherlands in post gold standard years, confirming its slow emergence as the world international center in the inter-war period. Our results mirror a recent discussion of the Swedish example by Straumann and Woitek (2008).

5. Probit Analysis of Bloc Selection

In this section, we analyze the critical economic elements for the selection of the currency blocs. Following Eichengreen and Irwin (1995) we know that existing trade relationships played an important role. Based on Wandschneider (2008) and Wolf (2008) we also know that in addition to the pattern of trade integration, deflationary pressures, the experience of banking crises, the cover ratio, which determines a country's further ability to defend gold, unemployment and political pressures determined a country's decision to leave the gold standard. We therefore assume that these variables also influenced the decision of which currency bloc to join. In the following, we test a

country's decision to join the Sterling bloc, the Reichsmark bloc or remain within the Gold bloc, using bivariate probit anlysis. In addition to geographic factors that might have influenced this decision, we control for trade, a common inflation experience, as well as the volatility of exchange rates among potential bloc members.

Let $P(Z) = PR\ (D = 1 \mid Z)$ denote the probability or propensity score of participation in a currency arrangement conditional on Z. To estimate the propensity score, Persson (2001) and similarly Barro and Tenreyro (2003) suggest using the geographical characteristics of the gravity model. However, this potentially misses the most important driving force of self-selection into currency arrangements, namely the level of bilateral trade integration among the future members of an arrangement. Using only the gravity variables implies that by definition trade integration unexplained in a gravity model will not be taken into account. However, since the work of Hamilton and Winters (1992), Frankel and Wei (1993), and Baldwin (1994), the gravity model has become the standard tool for assessing the degree of economic integration between countries. Deviations between observed and predicted trade may therefore be interpreted as a proxy for economic integration beyond the gravity model itself. Hence, the inclusion of trade after controlling for gravity variables should allow us to estimate how trade integration affects the probability to join into currency arrangements.

To fix ideas, we borrow the idea of Alesina and Barro (2002) that currency arrangements typically form around anchor countries. The concept of client-anchor relationships in currency arrangements seems well adapted to the political rivalry among Europe's powers after World War I. The currency agreements and trade blocs we look at were as follows. For the classification and for further references, see Eichengreen and Irwin (1995) and Ritschl and Wolf (2003):

(i) *Gold bloc*: five countries of our sample that remained on the gold standard to 1936, namely France, the Netherlands, Belgium (to 1935), Switzerland, and Poland

(ii) *Sterling bloc*: five countries of our sample that left the gold standard in 1931/2 and tied their currencies to the British pound, namely Great Britain, Norway, Denmark, Sweden, and Finland.

(iii) *Reichsmark bloc*: seven countries of our sample formerly on the gold standard that had currency pegs to the Reichsmark around 1937/38, namely Germany, Czechoslovakia, Austria, Hungary, Romania, Bulgaria, and Greece.

To obtain the propensity scores for entering a currency arrangement, we estimate separate binary choice models for these three currency blocs. The dependent variable in each regression is the respective membership dummy for currency arrangements, FET_{ij}^{m}, defined as a time-invariant group effect or Fixed Effect on all future members of currency arrangements. For each country pair *ij*, it takes the value of one if both countries *i* and *j* will be members of the same currency arrangement in the 1930s, and zero else. The regressors are the observed bilateral trade flows of 1928, the trade with each of the three anchor countries in 1928, the usual gravity controls for potential trade, as well as the volatility of exchange rates over the period January 1925 – October 1928 and the average inflation differential over this same period. As the currency arrangements in question were all formed during or after the Great Depression, and as the Great Depression was unforeseen, trade in 1928 can safely be regarded as exogenous.

We estimate the following probit model:

(X1) $$\text{Prob}\,(FET_{ij}^{m} \mid X_{ij}\beta) = 1 - \Phi(-X_{ij}^{'}\beta),$$

where *Xij* denotes the matrix of trade flow variables and other controls for 1928, and where Φ is the cumulative distribution function of the normal distribution (Table 5).

(Table 5a,b,c about here)

The coefficients on trade with the anchor countries all have the expected signs. The level of trade integration with an anchor country in 1928 helps to predict whether another country will join into a currency arrangement anchored by that country in the 1930s. This relation holds especially for countries that traded intensely with Britain in 1928, namely the Scandinavian countries in our sample. Also, countries that traded intensively with Germany in 1928 were more likely to be members of the Reichsmark in the 1930s as countries that traded intensively with France were somewhat more likely to stay on Gold. However note that the predictive power of trade integration with France and Germany for future membership in currency blocs is much more limited (This can be seen from expectation-prediction tables, available from the authors on request.). Moreover, the results suggest that countries which experienced a high degree of exchange rate volatility prior to the Great Depression were more likely to develop a peg to the Reichsmark, reflecting the experience of Austria and Hungary.

6. Conclusion

Our paper offers a brief look at central bank reaction functions for a panel of countries during the inter-war period. The starting point for our investigation were the questions of what determined the interwar monetary policy and to what extent countries aligned their policies in monetary policy blocs. We find that during the interwar period countries moved away from the sole target of convertibility and towards a 'modern' monetary policy based on exchange rate stabilization. However, the extent of that new monetary

policy is still limited and not yet based on output stabilization or even modern price level targeting.

We also find clear evidence for the emergence of monetary blocs, following patterns of trade alignments. Countries joining the Reichsmark bloc, also shared the common experience of a high degree of exchange rate variation prior to the Great Depression.

Countries' interwar policy choices offer lessons for countries remaining in or choosing to join the European Monetary Union today. Especially facing the current financial crisis, some prospective EMU member states would like to speed up the process of membership, while other countries' plans might have been derailed for years following financial difficulty. From our research, it is clear that the experience of the Great Depression did lead to a fracturing of the gold standard, but it did not shatter all exchange rate alignments. We find that domestic factors mattered for the formulation of monetary policy, but that policies implemented by major neighbors became dominant during the crisis. In fact some countries decided to link their fates even closer, especially small countries with already tight economic relations to a major neighbor. A key selection criterion into one monetary policy bloc rather than another was the degree of trade integration with anchor countries such as the UK, France, or Germany. We conclude that countries that are currently considering membership in the EMU should get strong support from the EMU to tighten real economic relations in terms of trade and factor markets.

Table 1a: Reaction Functions

VARIABLE	MODEL 1		MODEL 2 random effects		MODEL 3 fixed effects	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Constant	9.155631	0.0172	9.155631	0.0172	0.074982	0.9861
Dummy 1929-32	-13.21433	0.0013	-13.21433	0.0013	-11.67989	0.0003
Dummy 1933-36	-11.70676	0.0030	-11.70676	0.0030	-10.53088	0.0006
Cover 1925-29	0.040016	0.3564	0.040016	0.3564	-2.005975	0.0865
Cover 1929-32	-0.464940	0.0262	-0.464940	0.0262	-2.329812	0.0001
Cover 1933-36	-0.460171	0.0357	-0.460171	0.0357	-0.404603	0.0636
Exchange rate 1925-29	-0.018004	0.0483	-0.018004	0.0483	0.177307	0.0458
Exchange rate 1929-32	-0.017930	0.3367	-0.017930	0.3367	0.200093	0.0401
Exchange rate 1933-36	0.013553	0.0007	0.013553	0.0007	0.313300	0.0239
Adj. R squared	0.020548		0.020548		0.044097	
N obs	78		78		78	

Table 1b: Reaction Functions

VARIABLE	MODEL 1		MODEL 2 random effects		MODEL 3 fixed effects	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Constant	-2.807685	0.0008	-2.807685	0.0008	0.074982	0.0030
Dummy 1929-32	-1.522312	0.4172	-1.522312	0.4172	-10.88020	0.4371
Dummy 1933-36	0.876559	0.4740	0.876559	0.4740	-1.484476	0.9837
Cover 1925-29	-0.000672	0.6078	-0.000672	0.6078	-0.027251	0.6241
Cover 1929-32	-2.642938	0.0002	-2.642938	0.0002	-0.000638	0.0001
Cover 1933-36	-0.037271	0.6142	-0.037271	0.6142	-2.710232	0.6255
X-rate 1925-29	0.015074	0.0479	0.015074	0.0479	-0.036168	0.0137
X-rate 1929-32	-0.006964	0.7080	-0.006964	0.7080	0.204642	0.0306
X-rate 1933-36	0.007958	0.0457	0.007958	0.0457	0.198928	0.0190
Inflation 1925-29	1.604984	0.0027	1.604984	0.0027	0.311056	0.0018
Inflation 1929-32	0.215015	0.7940	0.215015	0.7940	1.663348	0.6127
Inflation 1933-36	-0.395728	0.4687	-0.395728	0.4687	0.417768	0.4585
Adj. R squared	0.037418		0.037418		0.039641	
N obs	142		142		142	

Table 2: Granger Causalities (country A - read horizontal, country B - read vertical)

R stands for reject. We rejected the null hypothesis that country A does not Granger cause country B at 10%.

	AU	**BE**	**BU**	**CH**	**CZ**	**DE**	**EST**	**FI**	**FR**	**GER**	**GR**	**HU**	**IT**	**LAT**	**LIT**	**NL**	**NO**	**PL**	**PO**	**RO**	**SW**	**UK**	**US**
AU	-	R	R		R	R		R			R		R				R			R	R	R	R
BE		-						R															R
BU			-					R			R				R						R		
CH			R	-			R						R										
CZ		R			-			R		R	R								R		R		R
DE		R			R	-		R			R	R	R		R		R	R			R		R
EST			R				-						R	R			R	R				R	
FI		R				R		-			R						R				R	R	R
FR									-				R										
GER	R	R	R		R	R		R		-	R	R	R					R		R	R	R	R
GR		R				R		R			-				R			R			R		R
HU	R				R	R	R	R			R	-	R				R	R		R	R	R	R
IT			R					R			R		-		R	R					R		R
LAT		R							R		R		R	-									
LIT								R							-		R			R	R		R
NL				R				R					R		R	-			R	R	R		
NO		R			R	R		R			R		R		R		-	R			R		R
PL		R				R	R	R		R	R		R	R			R	-			R	R	
PO	R		R		R		R	R		R	R		R		R		R	R	-		R	R	
RO						R									R					-			
SW			R		R	R		R		R	R		R		R		R				-	R	
UK	R		R		R	R		R		R	R		R		R		R		R		R	-	R
US												R				R			R	R		R	-

Table 3: Reaction Functions – Anchor Countries

VARIABLE	Coeff.	Prob
Dummy 1929-32	-169.9459	0.0056
Dummy 1933-36	-125.2442	0.0857
FRCover 25-29	0.247430	0.0308
UKCover 25-29	-1.339066	0.4766
GERCover 25-29	-4.411827	0.0369
FRCover 29-32	1.193942	0.3353
UKCover 29-32	-4.092476	0.2149
GERCover29-32	-18.65318	0.0001
FRCover 33-36	0.229880	0.8326
UKCover 33-36	-0.756667	0.3356
GERCover 33-36	-0.449504	0.2482
FRExchange 25-29	-13.89975	0.0829
UKExchange 25-29	-0.091309	0.1579
GERExchange 25-29	-2.089203	0.1153
FRExchange 29-32	30.15508	0.0247
UKExchange 29-32	0.275831	0.0228
GERExchange 29-32	4.911278	0.0298
FRExchange 33-36	19.80730	0.2810
UKExchange 33-36	0.256144	0.2355
GERExchange 33-36	3.276800	0.2350
FRInflation 25-29	3.242364	0.0312
UKInflation 25-29	-0.756305	0.5872
GERInflation 25-29	7.057382	0.1075
FRInflation 29-32	-0.595737	0.5580
UKInflation 29-32	6.606281	0.1153
GERInflation 29-32	15.56793	0.1241
FRInflation 33-36	2.117324	0.5881
UKInflation 33-36	0.049876	0.9200
GERInflation 33-36	0.550442	0.3192
Adj. R squared	0.149879	
N obs	142	

Table 4: Reaction Functions – Testing for Anchors

VARIABLE	MODEL 1		MODEL 2 Fixed Effects	
	Coeff.	Prob.	Coeff.	Prob.
Constant	-4.928427	0.0019	-12.36865	0.0052
Dummy 1929-32	3.228847	0.2611	2.640758	0.3449
Dummy 1933-36	2.085360	0.4298	1.652956	0.5584
Cover 1925-29	-0.000425	0.6972	-0.000376	0.7261
Cover 1929-32	-1.572425	0.0052	-1.610551	0.0046
Cover 1933-36	-0.048368	0.1962	-0.045065	0.2171
X-rate 1925-29	0.144547	0.0275	0.623195	0.0161
X-rate 1929-32	-0.016261	0.8756	0.499142	0.0663
X-rate 1933-36	0.079346	0.6859	0.692435	0.0812
Inflation 1925-29	1.278153	0.0055	1.348018	0.0029
Inflation 1929-32	-0.365939	0.6306	-0.297719	0.7007
Inflation 1933-36	-0.646759	0.1023	-0.580355	0.1552
Bank Rate UK	9.790215	0.0003	10.00296	0.0002
Bank Rate France	-0.728201	0.7725	-0.625351	0.7954
Bank Rate Germany	8.298437	0.0017	7.727360	0.0043
Bank Rate US	7.845023	0.0697	7.743406	0.0720
Bank Rate UK 1929-36	15.45374	0.0021	14.90515	0.0029
Bank Rate France 1929-36	1.559681	0.5669	1.448213	0.5827
Bank Rate Germany 1929-36	-8.462726	0.0264	-7.915637	0.0378
Bank Rate US 1929-36	-4.078919	0.5194	-3.772415	0.5473
Adj. R squared	0.118604		0.122108	
N obs	142		142	

Table 5a: Probit Analysis - Sterling Bloc

Dependent Variable: STR_IN
Method: ML - Binary Logit (Quadratic hill climbing)

Variable	Coefficient	Prob.
C	474.0525	0.0945
LOG(GDP_1*GDP_2)	-37.27288	0.0902
LOG(DISTANCE)	4.317609	0.0985
LOG(1+TRADE28)	16.50838	0.0904
LANGUAGE	-18.34028	1
BORDER	-5.953082	0.2838
LOG(1+TRADE28)*UK	13.12955	0.0877

S.E. of regression	0.093667
Mean dependent var	0.05848
S.D. dependent var	0.234992
Nobs	342
McFadden R-squared	0.887943

Table 5b: Probit Analysis - Reichsmark Bloc

Dependent Variable: RM_IN
Method: ML - Binary Probit (Quadratic hill climbing)

	Model 1		Model 2	
Variable	Coefficient	Prob.	Coefficient	Prob.
CONSTANT	8.181501	0.0006	11.56887	0.0076
LOG(GDP_1*GDP_2)	-0.258084	0.0709	-0.555522	0.0269
LOG(DISTANCE)	-0.839736	0.0044	-0.904679	0.1042
LOG(1+TRADE28)	-0.028656	0.8369	0.187233	0.4389
LANGUAGE	-0.246673	0.6577	-0.361272	0.6262
BORDER	0.247746	0.4312	-0.314628	0.5385
LOG(1+TRADE28)*GE	0.20292	0.0031	0.400411	0.0007
FXVAR25_28			0.847806	0.0001
AVID25_28			-0.000779	0.9975
S.E. of regression	0.2828		0.192689	
Mean dependent var	0.102339		0.073529	
S.D. dependent var	0.303538		0.261485	
Nobs	342		272	
McFadden R-squared	0.209134		0.439119	

Table 5c: Probit Analysis - Gold Bloc

Dependent Variable: GOLD_IN
Method: ML - Binary Probit (Quadratic hill climbing)

	Model 1		Model 2	
Variable	Coefficient	Prob.	Coefficient	Prob.
C	4.539375	0.0507	5.948918	0.0248
LOG(GDP_1*GDP_2)	0.009843	0.954	0.106603	0.5712
LOG(DISTANCE)	-0.992086	0.0024	-1.301099	0.0013
LOG(1+TRADE28)	-0.018904	0.9135	-0.243795	0.2625
LANGUAGE	0.576159	0.4447	1.029886	0.2739
BORDER	-0.774026	0.065	-0.66885	0.1505
FXVAR25_28			-1.082099	0.116
AVID25_28			-0.014766	0.9259
LOG(1+TRADE28)*FR	0.214234	0.0048	0.183972	0.0216
S.E. of regression	0.213145		0.233174	
Mean dependent var	0.05848		0.073529	
S.D. dependent var	0.234992		0.261485	
Nobs	342		272	
McFadden R-squared	0.246315		0.299591	

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