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COVERED INTEREST ARBITRAGE: THEN VS. NOW

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ABSTRACT

We introduce a new weekly database of spot and forward US-UK exchange rates as well as interest rates to examine the integration of forward exchange markets during the classical gold standard period (1880-1914). Using threshold autoregressions (TAR), we estimate the transactions cost band of covered interest differentials (CIDs) and compare our results to studies of more recent periods. Our findings indicate that CIDs for the US-UK rate were generally larger during the classical gold standard than any period since. We argue that slower information and communications technology during the gold standard period led to fewer short-term financial flows, higher transactions costs, and larger CIDs.

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Covered Interest Arbitrage: Then Versus Now

The theory of covered interest parity (CIP) holds that the return from buying the bonds of one's domestic country should be the same as that of investing abroad, once currency risk has been covered with a forward contract. Formally, the condition may be stated as:

(1) $$\left(\frac{S_t}{F_t}\right)(1+i_t)-\left(1+i_t^*\right)=0,$$

where S_t represents the domestic currency price of foreign currency in the spot market at time t, F_t is the price of foreign currency deliverable forward at time t, i_t is the domestic interest rate at time t, and i_t^* is the corresponding interest rate abroad at time t. While in a world of perfect capital markets (1) would always equal zero, there are frictions and transactions costs that will lead to non-zero covered interest differentials (CIDs).

Since a perfectly efficient market would lead to zero CIDs, the magnitude of the differential has been an important metric of international financial market integration. The issue has been the focus of numerous studies across many countries and time periods dating back to the 1920s.[1] One period that has not been examined in detail is the classical gold standard era (1880-1913). We introduce a new weekly database of US-UK spot and forward exchange rates as well as short-term interest rates to examine the integration of forward exchange markets during the classical gold standard period. Using threshold autoregressions (TAR), we find that deviations from covered interest parity were generally larger during the classical gold standard period than any period since (except for some turbulent periods). We offer two explanations for our empirical results: (1)

technological advances since the classical gold standard have dramatically reduced the costs of information and arbitrage (Bordo et al., 1999), and (2) Compared to modern markets, the classical gold standard lacked well developed financial institutions and instruments to engage in covered interest arbitrage.

We begin the paper with a survey of the previous literature on CIP. This is followed by a discussion of the new database and the methodology employed in the empirical analysis. Then we discuss the empirical results and the implications of our findings for future studies of CIP.

II. Previous Literature on CIP

While CIP was not stated as a formal condition in the finance literature until the twentieth century, there was evidence of foreign exchange traders engaging in covered interest arbitrage in the 1800s (Peel and Taylor, 2002). Early commentators described how deviations from the "parity" condition created profit opportunities for foreign exchange speculators. Clare, for example, provides a late nineteenth and early twentieth century-account of arbitrage activity in forward exchange markets.

> "The relationship that has been referred to as existing between the fluctuations of the exchanges and those of money is in the nature of cause and effect, and the link which brings them into connection-the agency that transmutes a rise or fall in the price of foreign bills into a like move of discount rates-is gold, the ebb and flow on which…is itself regulated by demand and supply of means of remittance. As might be expected, it is when specie-point is within measurable distance that this connection is most apparent, but at all times some semblance of agreement is traceable between the respective price waves, and it may be laid down as a general rule that discount tends to harden on a decline of the exchanges and to weaken on an advance" (quoted in Peck, 1998, p. 292).

Keynes (1923) gave the first formal definition of covered interest parity (CIP), verbally describing condition (1). He, and later Einzig (1937), hypothesized that deviations from CIP during the inter-war years would not be arbitraged away unless they reached one-half percent per annum. They argued that the funds available for forward exchange were inelastically supplied because of lending limits imposed by banks.

While there was a literature on covered interest parity in the inter-war period, empirical testing of equation (1) did not begin until the late 1960s. There are two main strategies for testing CIP. One strategy employs regression analysis and utilizes the following model (Branson, 1969; Marston, 1976; Cosandier and Liang, 1981):

(2) $$\left[\left(\frac{F_t - S_t}{S_t}\right)\right] = \alpha + \beta\left(i_t - i_t^*\right) + \varepsilon_t,$$

where ε_t is the regression error. CIP implies that α=0 and β=1 in equation (2). Although some studies have found that α is significantly different from zero, the result does not necessarily violate CIP, as a positive constant may simply reflect transaction costs. The parity condition does require β to equal 1, and most studies have found this to be the case. Taylor (1987), however, points out that even if equation (2) holds, this is not strong evidence of covered interest parity. The regression errors may be quite large, and represent unexploited arbitrage opportunities. Taylor argues that a regression using equation (2) may indicate that CIP held on average over a given time period, but not at any particular point in time.

The second methodology measures the size of deviations from CIP. Departures from the parity condition are then compared with known sources of transactions costs to determine whether arbitrage opportunities exist. The methodology also shows how deviations change over time to provide some insight into the performance of different monetary regimes and central bank policy. Frenkel and Levich (1975) measure deviations from covered interest parity for the US-UK exchange rate for the period 1962-1967. They estimate the transactions costs for arbitrage, the 'neutral band,' to be 0.145-0.15 percent per annum. In a related paper, Frenkel and Levich (1977) estimate the transactions cost band for three periods: (1) the tranquil-1962-1967 period, (2) turbulent-1968-1969 period when England devalued the pound, and (3) the managed float, 1973-1975. They estimate the neutral bands to be 0.126-.127, 0.197-.262, and 0.92-1.03 percent per annum for the three periods, respectively.

Clinton (1988) argues that previous studies overestimate the transactions costs involved in covered interest arbitrage. Using data from November 1, 1985 to May 9, 1986, he finds that deviations should be no more than 0.06 percent per annum. He finds that 95 percent of deviations lie between ± .15 percent per annum. Taylor (1987, 1989) criticizes previous work for using time-averaged data as opposed to point-in-time data. He employs 'high quality, high frequency' and contemporaneously sampled data for spot and forward US-UK and UK-GER and Euro-deposit interest rates. He finds that there are very few profitable violations of CIP. Balke and Wohar (1998) examine daily US-UK data from January 1974 until September 1993, and find that the average CID was 0.08 percent over the period.

Peel and Taylor (2002) examine covered interest differentials during the inter-war gold standard using threshold autoregressions (TAR) and a threshold vector error-correction model (TVECM). They test the Keynes-Einzig conjecture that covered interest differentials could reach one-half percent per annum before arbitrage would take place. Peel and Taylor estimate the neutral band to be .42 percent for the US-UK exchange rate in the early 1920s. Their point estimate is not significantly different from the one-half percent figure postulated by Keynes and Einzig.

For the Classical gold standard, the literature on forward exchange markets is very small. Davis and Hughes (1960) as well as Perkins (1978) used "time" and sight bills from the New York financial markets to impute a "pure" dollar-sterling exchange rate for most of the nineteenth century. These studies did not, however, discuss cross-border financial market integration using the forward exchange market. More recently, Obstfeld and Taylor (2002) examined international financial market integration over the last 130 years using a variety of different tests.[2] One metric included a cursory investigation of CIDs for the classical and inter-war gold standards. Obstfeld and Taylor (2002, p. 39) note that their analyses represents "a first pass at the data" given that they employ time-averaged spot and 60-day forward exchange rates combined with short-term interest rates of a different maturity (3 months). Their empirical results suggest that CIDs were .19 percent for New York and London during the classical gold standard period. When compared to post-World War I exchange markets, they conjecture that "the degree of integration among core money markets achieved under the classical gold standard must be judged as truly impressive compared to conditions over the following half century or more" (Obstfeld and Taylor, 2002, p. 39).[3]

In this paper, we provide a detailed investigation of CIDs for the US-UK exchange rate during the classical gold standard period. We ask whether the trend towards increased financial market integration, as measured by CIDs, began in the 1920s or during the classical gold standard period. The analysis should provide new insight into the history of international financial market integration.

III. Data

Measuring covered interest differentials has typically meant collecting data on forward and spot contracts as well as interest rates for two countries--see equation (2). Obstfeld and Taylor (2002, p. 33), however, point out that standard forward exchange contracts were not very prevalent before 1920 (p. 33). They argue instead that CIDs can be studied by comparing the onshore and offshore interest rates using the long bill, the most liquid financial instrument used to cover exchange risk during the classical gold standard period (Margraff, 1908).

Obstfeld and Taylor (2002) show how to calculate CIDs during the classical gold standard period in the New York-London market for sterling (Spalding, 1915). First, assume that b_t is a long bill (the dollar price of sterling at time t in New York deliverable in London after 60 days), and e_t is the spot New York price of sterling in New York. One way to purchase a future pound is to take out a short-term sterling loan at the price of $\left(\frac{1}{1+i_t^*}\right)$, where i_t^* is the London 60-day discount rate. A second method is to purchase a long bill on London in New York at a price in terms of current pounds sterling of b_t / e_t.

The two prices of future pounds should be equal in the absence of transactions costs and perfect capital mobility.

Perkins (1978) noticed that $(e_t / b_t - 1)$ represents an imputed "offshore" British interest rate in New York. The imputed rate can be compared with a short-term interest rate in London to measure international financial market integration. The "covered interest differential" can be written as:

$$\frac{e_t}{b_t} - (1 + i_t^*) \tag{3}$$

An important question is the appropriate UK interest rate to plug into equation (3). Obstfeld and Taylor (2002) as well as Officer (1996) argue that the 60-day London bank bill rate should be used because it is the market determined interest rate. Figure 1 presents weekly covered interest differentials for the US-UK exchange rate using the 60-day bill rate over the period of January 3, 1880 through June 27, 1914. Weekly spot and forward exchange rate data are collected from *The Commercial and Financial Chronicle* and the bank bill rate from *The Economist*. All data are sampled contemporaneously to provide a point-in-time analysis of CIDs. Figure 1 shows that CIDs were more volatile during the first half of the sample and that there is a positive bias in the time series. Obstfeld and Taylor (2002) argue that the bias reflects brokerage commissions from exchange contracts, profit margins, and the stamp duty. The stamp duty introduces an upward bias in the differential of approximately .75 percent per year. The CIDs display a tendency to fall over time, in part, because of greater competition among foreign exchange dealers that squeezed profits.

Alternatively, Perkins (1978) argues that the Bank of England's discount rate is the appropriate interest rate to impute the offshore "UK" interest rate in New York. He notes that the Brown Brothers, the largest foreign exchange dealer in the United States for most of the nineteenth century, charged customers five percent interest or the Bank of England discount rate, whichever was higher, for import letters of credit. Figure 2 shows CIDs calculated with the Bank of England discount rate. The CIDs appear nearly symmetric around zero and less volatile than the differentials computed using the market driven bank bill rate. CIDs are above the parity line at the beginning of the sample period and then fall below it in the early 1890s, only to rise above the origin in the early 1900s. The up and down pattern persists until the outbreak of World War I.

Many early references on foreign exchange also point to the Bank of England's discount rate as the relevant interest rate for covering exchange risk. Brown (1914) and Deutsch (1914) describe the effects of changes in the Bank of England's discount rate on foreign exchange rates. Shaterian (1956) notes that a New York banker buying a sterling bill must take into account the Bank of England's discount rate. For our analysis, the appropriate interest rate to employ in the study is an empirical question that can be resolved using newly developed techniques in time series econometrics. We now turn to the empirical analysis.

IV. Empirical Methodology

A TAR model will be estimated for the CIDs using the new weekly data set. Following Obstfeld and Taylor (1997, 2002), we model the CID given in (3). We denote this quantity as ϕ_t and assume that the differential behaves according to the following time series process:

(4) $$\phi_t = \alpha\phi_{t-1} + \varepsilon_t \qquad if\ \left|\phi_{t-1}\right| < \kappa$$

(5) $$\phi_t = \kappa(1-\rho) + \rho\phi_{t-1} + \varepsilon_t \qquad if\ \phi_{t-1} \geq \kappa$$

(6) $$\phi_t = -\kappa(1-\rho) + \rho\phi_{t-1} + \varepsilon_t \qquad if\ \phi_{t-1} \leq -\kappa$$

This model is known as a band-TAR model and has been employed in Balke and Fomby (1997) and Peel and Taylor (2002). When ϕ_{t-1} lies within the band dictated by κ, ϕ_t follows an autoregressive process with mean zero. However, if ϕ_{t-1} lies outside of the band, ϕ_t follows a different autoregressive process with a different mean. Simple calculations show that the process reverts to the edge of the bands when the process is in an outer regime.

In this paper, we interpret κ as representing some critical level which includes transactions costs. Beyond κ, arbitrage becomes profitable, and the process reverts to the edge of the band. In the TAR literature, it is sometimes, although not always the case that α is constrained to be one. Such a specification imposes the restriction that the differential follows a unit root process when inside the band. We will present estimates of both the constrained and unconstrained models.

An interesting question to ask is whether a band-TAR model is a worthwhile generalization for modeling the differential, ϕ_t. If we take our null hypothesis as ϕ_t follows a simple autoregressive process, the parameter κ becomes unnecessary, and is not identified. Standard statistical theory no longer applies in this case. In light of this problem, Hansen (1996) proposes Lagrange Multiplier tests for null hypotheses of this form and develops a simulation procedure to find p-values for each test. We employ two variants of these tests in this paper in order to support the use of a band-TAR model.

Given that a band-TAR model is estimated, it is natural to find confidence intervals for the parameters. In particular, the parameter κ has an interesting economic interpretation, and a confidence interval is a welcome addition to any point estimate we calculate. Again, standard statistical theory no longer applies to estimates of κ. Hansen (2000) provides a procedure to calculate confidence intervals for threshold parameters such as κ. To apply this procedure, we search for a threshold parameter κ over a range that contains 90% of the data. In some cases, we fail to find a 95% confidence interval within this initial range. Typically, although not always, this occurs in cases where the LM tests fail to reject the null hypothesis of no threshold effects. Such an occurrence seems natural since the absence of a threshold would imply infinitely wide confidence intervals for a threshold parameter. Hence, we provide confidence intervals only in those cases where an interval exists in the 90% range of the original data.

V. Results and Discussion

Table 1 shows the TAR results for the US-UK rate during the Classical Gold Standard period using the Bank of England discount rate. We also estimated the TAR model using the 60-day London bank bill rate but were unable to reject the null hypothesis of no TAR at the 5 and 10 percent levels of significance for the whole sample period as well as all sub-sample periods. For the classical gold standard period (1880-1914), we are unable to reject the null hypothesis of no TAR at the 5 and 10 percent levels of significance using Hansen's Sup or Average LM test. We also do not find evidence of TAR at the five or 10 percent levels of significance for the 1880-1896 sub-period. There is, however, strong evidence of TAR in the 1897-1914 sub-period. The Sup-LM and the Average LM test statistics are significant at the 5 and 1 percent levels, respectively.[4] Overall, the results point to the development of a credible modern forward exchange market during the late 1890s.

Table 2 also presents the unconstrained along with the constrained results where we force the CIDs to follow a driftless random walk inside the neutral band. This is a common restriction to test in studies of forward exchange markets because it assumes that CIDs move unpredictably within a region close to a zero differential. This simply means that arbitrage does not take place in some area around a CID of zero. Using a simple t-test, we are unable to reject the null hypothesis (H_0: α=1) that the CIDs follow a driftless random walk inside the band for all three periods at the five or 10 percent level of significance.

For purposes of comparison, Table 2 presents our results along with the average CID found in exchange rate studies of different periods. Table 2 shows that CIDs have generally fallen over time. Peel and Taylor (2002) estimate the neutral band to be .422 percent per annum during the inter-war gold standard. Frankel and Levich (1975) find that CIDs fell to about .14 percent per annum during the 1960s and increased to about 1 percent per year during the turbulent 1970s. Since the mid-1970s, CIDs have declined substantially. Clinton (1988), Balke and Wohar (1998), for example, have found that the average differential is less than .1 percent per annum for various periods covering the last 20 years.

Tables 1 and 2 also show that CIDs were larger for the classical gold standard era than other periods, except for the turbulent 1970s.[5] For the period 1880-1914, we estimate the neutral band to be .80 percent per annum, although it is not statistically significant. We also estimate the neutral band to be .94 percent per annum and insignificant for the 1880-1896 sub-period with a 95 percent confidence interval of .832 to .953 per annum. We find the neutral band to be approximately .748 (.6005 constrained) percent per annum for the sub-period 1897-1914 with a 95 percent confidence interval of 0.60 to ∞ per annum. Except for the 1970s, the point estimates and lower bounds of the 95 percent confidence intervals for the gold standard are larger than those found by studies of other periods.

Another interesting empirical finding from the classical gold standard period is the slow speed of mean reversion outside the band. Table 1 shows that the autoregressive parameter outside the band for the largest root, $\tilde{\rho}$, was approximately .9 (1 – 0.111) during the period 1897-1914. The point estimate is even larger than Peel and Taylor's

(2002) .8 estimate of the autoregressive parameter during the inter-war gold standard, although the two figures are not statistically different from one another. The evidence suggests that arbitrage in forward exchange markets was quite slow during both the classical and inter-war gold standards.

We offer two explanations for our findings that CIDs were larger during the classical gold standard and have tended to fall over time, in addition to the slow speed of arbitrage. First, a recent study by Bordo et al. (1999) shows that economic and financial integration in the late 1800s was less than that of modern times. They note that there were significantly fewer short-term financial flows between countries a century ago relative to long-term investment than today. The authors argue that a major reason for less integration in the late 1800s is technology. "It should be apparent why this information and communications technology translated into a smaller volume of short-term capital flows. Today currency traders respond almost instantaneously to minute-to-minute changes in currency values" (Bordo et al., 1999, p. 32). The implication for our study is that higher information costs reduce the ability of traders to engage in arbitrage, leading to larger CIDs.

A second factor that may explain the larger CIDs and slow mean reversion during the classical gold standard is that there were few financial institutions (compared to today) capable of handling a large volume of transactions in forward exchange. This was even true of core money centers like London and New York. Einzig (1937, p. 60) points outs that "only towards the end of the nineteenth century and during the early years of this century that a Foreign Exchange market of any size developed in London." He argues that the reason for the small number of forward exchange facilities is found in the very stability of the dollar-sterling spot rate during most of the nineteenth century. The credibility of the dollar-sterling spot rate reduced the demand for forward exchange as importers and exporters did not need to hedge their risks to lock-in profits from foreign trade.[6] Importers and exporters were probably less concerned about losing money from exchange rate fluctuations than businesses today.

A related factor is that unlike modern exchange markets (that have a variety of derivatives and options to hedge risks in exchange markets), the classical gold standard was just beginning to use innovative financial instruments that did not require the international trade of goods to carry out covered interest arbitrage. Professor Edwin Kemmerer, in his testimony to the National Monetary Commission in 1910, stated that finance bills, short-term debt instruments often used to speculate in forward exchange markets, did not appear in large quantities until the turn of the century -1900 (Goodhart, 1969).

> "Since the beginning of the present century there has been a very great development in the use of finance bills in New York City as a means of borrowing upon European account…Finance bills are drawn in considerable quantities during the two or three months preceding the crop moving demand when exchange is usually high with the expectation on the part of American bankers of covering by means of cereal and cotton bills in the fall at lower rates of exchange" (quoted in Goodhart, 1969, p. 56).

Another empirical finding is the absence of TAR during the 1880-1896 period. Figures 1-3 also show that CIDs were more volatile during this period. We believe that this result can be explained by silver risk that plagued the United States after the Civil War. The United States left the gold standard during the Civil War to print fiat money for war finance. After the war, the government retired the fiat currency so the United State could return to the gold standard. The decrease in the money supply caused deflation that increased the real debt burden for borrowers. Debtors wanted silver to become part of the money supply to increase inflation and reduce the real value of their mortgages and loans. The hopes of debtors rested on William Jennings Bryan who ran as the Democratic nominee for President of the United States on a silver platform in 1896. Hallwood et al. (2000) show that the US suffered from a peso problem in the 1890s because many currency speculators believed the US might abandon the gold standard and adopt a bimetallic system. Silver risk generated uncertainty in financial markets, preventing speculators from pushing the covered interest differential back within a narrow range.

Once fears of silver adoption subsided with Bryan's defeat in the Presidential election of 1896, however, market participants were more confident in the maintenance of mint parity. This may explain why we find significant threshold effects in the period 1897-1914. The resolution of the silver issue combined with the Gold Standard Act of 1900 (which established gold as the only monetary standard for the US) enhanced the United States' credibility in foreign exchange markets. Currency traders were now willing to take positions on both sides of forward exchange contracts and large deviations from covered interest parity were arbitraged back towards the edge of the neutral band.

VI. Conclusion

How does the classical gold standard compare to other period in terms of forward market integration? This paper offers some insight into this question. We employ a new weekly database of spot and forward exchange rates and interest rates to estimate CIDs during the classical gold standard period. Applying new techniques in time series econometrics, we estimate the size of the neutral band for the US-UK exchange rate from 1880-1914. We then compare our findings to studies that have examined CIDs for other periods since the classical gold standard. Our results indicate that CIDs have had a tendency to fall over time with the gold standard period having the largest differentials. We offer two explanations for the findings. First, information traveled much slower during the gold standard period. Higher information costs led to fewer short-term financial flows, leading to larger CIDs. Forward exchange markets during the gold standard were less liquid and did not have the depth of modern ones. Second, compared to modern exchange markets, the gold standard did not have well-developed financial institutions and instruments to support a "large volume" (in the modern sense) of trading in forward markets.

[1] For a literature survey on covered interest arbitrage see Officer and Willett (1979), Taylor (1992, 1995), McCallum (1996), and Willett et al. (2003).

[2] Obstfeld and Taylor (2002) examine gross stocks of foreign capital, real interest rates, and equity and bond returns for a broad range of countries to assess global financial market integration since 1870. They conclude that financial market integration during the gold standard period rivals that of the current period.

[3] Most research on the classical gold standard has focused on the spot exchange rate. In a series of influential papers, Officer (1989, 1996) provides detailed historical and empirical evidence that the US-UK spot market was "remarkably efficient" with very few profit opportunities. Prakash and Taylor (1998) confirm Officer's (1986) analysis using TAR models.

[4] We selected the lag length on the autoregression for the TAR models on the basis of the Akaike Information Criteria (AIC). The AIC chose a lag length of 12 for the 1880-1914 period as well as the 1880-1896 sub-period. The model selection criteria chose a lag length of four for the 1897-1914 period.

[5] Other turbulent periods such as World War I and the Korean War may also have had higher CIDs than the Classical Gold Standard. Unfortunately, a study of CIDs during the two wars is not very informative because of government administered price controls.

[6] Einzig's comments on the credibility of the dollar-sterling rate refer to the entire nineteenth century. For a discussion of the credibility of the classical gold standard, see Bordo and Kydland (1996), and Bordo and Rockoff (1996).

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Table 1

TAR Results, Bank of England Discount Rate

Time Period	**1880-1914**	**1880-1896**	**1897-1914**
Sup LM p-value	0.286	0.410	0.0180**
Avg. LM p-value	0.252	0.494	0.010***
$\tilde{\kappa}$ **(constrained)**	0.803	0.940	0.6005
$\hat{\kappa}$ **(unconstrained)**	0.803	0.940	0.747
95% CI	(0.780, ∞)[a]	(0.832,0.953)	(0.600,∞)[a]
t-stat for α=1	-0.040	0.005	0.215
$\tilde{\rho}$	1-0.110	1-0.105	1-0.111
(std. error)	(0.051)	(0.053)	(0.043)
Observations	1800	887	912

**denotes significance at the 5 percent level.
***denotes significance at the 1 percent level.

[a] If no upper bound for the confidence interval is found in the lower 90 percent of the data, we denote the upper bounds as infinite. Note, however, that this does not affect the lower bound, and there is no reason to expect any symmetry in the confidence intervals constructed using Hansen's (2000) technique.

Table 2

Empirical Results of Covered Interest Arbitrage

Study	Time Period	Estimated Size of Neutral Band (% Per Annum) (95% Confidence Intervals)
Classical Gold Standard	1880-1914	0.803 (.780, ∞)
Classical Gold Standard (sub-sample)	1880-1896	0.940 (0.832, 0.953)
Classical Gold Standard (sub-sample)	1897-1914	0.748 (0.600, ∞)
Peel and Taylor (2002)	1922-1925	0.422 (0.409, 0.518)
Frenkel and Levich (1975)	1962-1967	0.126-0.127[b]
Frenkel and Levich (1977)	1968-1969	0.197-0.262[b]
Frenkel and Levich (1977)	1973-1975	0.92-1.03[b]
Clinton (1988)	Nov. 1985 - May 1986	0.15[c]
Balke-Wohar (1998)	Jan. 1974 - Sept. 1993	0.08[d]

[b] Frenkel and Levich (1975, 1977) calculate quasi-confidence intervals by determining the percentage deviation that bounds 95 percent of the CIDs.

[c] Clinton (1988) derives his estimates of the neutral band using bid-ask spreads. He finds that 95 percent of the CIDs for the US-UK rate lie between ± .15 percent per annum.

[d] Balke and Wohar (1998) find that approximately 90 percent of the CIDs for the US-UK rate lie between ± .08 percent per annum.

Figure 1
US-UK Covered Interest Differentials (with bank bill rate), 1880-1914

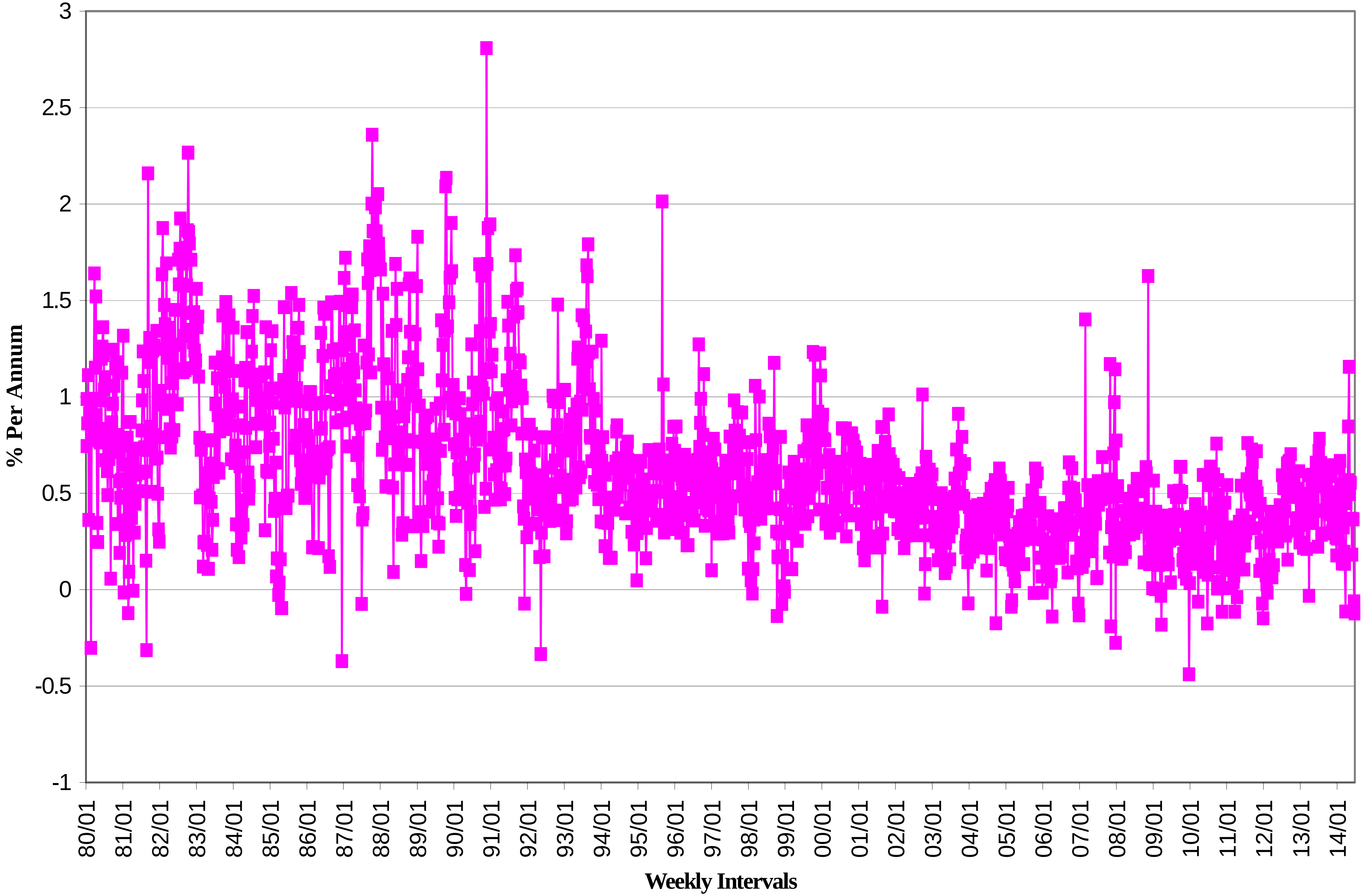

Figure 2
US-UK Covered Interest Differentials (with Bank of England discount rate), 1880-1914