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ABSTRACT

We test whether fixed exchange rate regimes are ever credible in emerging markets by analyzing the behavior of short-term domestic trade bills across countries during the classical gold standard period, the most widely used hard peg in modern financial history. We exploit the fact that global capital markets were unfettered in order to identify the currency-risk component using uncovered interest parity for 17 of the largest emerging market borrowers for the period 1870-1913. We show that five years after a country joined the gold standard, the currency risk premium averaged at least 285 basis points for emerging market economies. We estimate that investors expected exchange rates to fall by roughly 28 percent even after emerging market borrowers joined the gold standard. Positive currency risk premiums that persisted long after gold standard adoption suggests that hard pegs for emerging market borrowers may never be fully credible.

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Are Hard Pegs Ever Credible in Emerging Markets? Evidence from the Classical Gold Standard

At the time of adoption of a single currency for much of Europe, many policymakers believed that exit from the Euro would not only be politically difficult, but also undesirable in the sense that the new hard peg would confer greater benefits than costs. Recently, however, rising sovereign spreads and the prospect of disorderly default among some of its members has suggested to some market participants that the best long-term option for highly-indebted countries such as Greece may be an exit from the Euro zone. The ratings agency Moody's recently declared that "a disorderly default would also increase the likelihood of Greece exiting the euro area, accompanied by a return to a deeply devalued national currency. Whilst such an event is not Moody's central scenario, the probability of it occurring is rising. In that event, the ability for Greek borrowers to repay their debt would weaken significantly, beyond that already assumed. Even taking into account the low likelihood of this scenario, its effect would be such that Moody's has concluded that the rating for any Greek covered bond could not be higher than B1."[1]

The turmoil in European sovereign debt markets has rekindled interest in understanding how market participants perceive the durability of hard pegs and the extent to which the adoption of hard pegs enhances credibility. Proponents of hard pegs argue that credible commitments to fixed exchange rates significantly reduce the premiums that emerging market countries pay to borrow in international capital markets. For example, countries may be able to borrow at lower rates if the adoption of fixed exchange rates confers credibility. Establishing regime credibility may be particularly important for emerging-market countries since their borrowing rates tend to be higher than those for high-income countries. Lower interest-rate spreads for emerging-market countries can in turn stimulate investment and economic growth (Berg and Borensztein, 2000; Schmukler and Serven, 2002).

The analysis of yield spreads is thus central to the debate about exchange-rate regime choice. In well-functioning capital markets, two of the most important risk premia for a country

[1] Moody's press release from January 23, 2012 as quoted in Simone Foxman, "Moody's: Odds Of A Greek Debt Default Disaster And Exit From The Euro Are On The Rise," *Business Insider* online.

are: (1) country risk and (2) currency risk.[2] The country risk premium represents the risk that a country will default on its debt obligations while the currency risk premium represents the compensation that an investor receives for an adverse movement in the exchange rate (Domowitz, Glen, and Madhavan, 1998). The currency risk premium is particularly relevant for the debate over exchange-rate regime choice. Advocates of hard pegs argue that they reduce the currency risk premium, and if perfectly credible, may even eliminate it altogether and hence lower borrowing costs.[3] On the other hand, if financial markets do not consider the peg to be perfectly credible, however, then the currency risk premium will remain positive (Schmukler and Serven, 2002).

In this paper, we empirically examine whether hard pegs are ever credible. We take advantage of a unique historical setting provided by the classical gold standard era to measure currency risk. The classical gold standard has several features that make it particularly suitable for our objectives. First, the period from 1870-1913 was one of unfettered capital markets. The absence of capital controls (as well as the absence of the threat of capital controls) in the classical gold standard era enables us to identify and accurately measure currency risk based on interest-parity conditions. Second, the pre-World War I gold standard is considered by many economists to be the canonical case of a widely-used hard peg.[4] Third, the financial press published high-frequency data for a large number of emerging market borrowers, permitting us to conduct empirical tests. Fourth, the gold standard period may have been a more credible hard peg (compared to modern hard pegs) because governments and the monetary authorities faced little political pressure to pursue countercyclical economic policies (Eichengreen, 1997).

To measure currency risk, we hand collected a large, new data set of monthly and weekly short-term interest rates from the period 1870-1913 for 21 countries. We then employ uncovered interest parity (UIP) to examine the interest rate differential between the UK and these 21

[2] There is a large empirical literature in international and development economics on the country-risk and/or currency-risk components of yield spreads for emerging market debt. For example, see Edwards (1984, 1986) and Sturzenegger and Powell (2003).

[3] Additionally, fixed exchange rates that are credible may reduce the probability of speculative attacks and contagion.

[4] Eichengreen (1996) suggests that one reason the classical gold standard may have been more credible peg than later fixed exchange rate systems was that central banks were able to attach priority to defending fixed exchange rates rather than pursuing countercyclical monetary policy. Obstfeld and Rogoff (1995) argue that modern hard pegs are unlikely to be credible because central banks will generally succumb to political pressure and not defend the peg when there is a sustained increase in interest rates (that lowers investment and output).

borrowers to measure currency risk.[5] Our results suggest that joining the gold club did not eliminate the interest-rate differential between short-term, gold-denominated, domestic UK trade bills UK and the trade bill of a typical emerging market borrower. For emerging market borrowers, we find that interest differentials persisted. Five years after a typical emerging market economy country joined the gold standard, the currency-risk premium averaged at least 285 basis points.

The existence and persistence of large currency risk premiums suggests that financial markets believed that these hard pegs were not fully credible. Our calculations suggest investors still considered devaluation and departure from gold a high probability event in "emerging market" economies around the world and, on average, expected exchange rates to fall 28 percent even after gold standard adoption. Data on long-term government bonds displays similarly large currency risk premia, suggesting that investors bid this risk into a wide variety of financial contracts.

The next section of the paper discusses our theoretical approach and the data we use to implement it. Section III measures currency risk premiums for the classical gold standard era, describes their time series properties, and calculates expected devaluations for emerging market countries. Section IV provides a robustness check based on long-term, sovereign bond data. The final section of the paper discusses the implications of our findings as they relate to the credibility of fixed exchange-rate regimes in general.

II. The Gold Standard and Currency Risk

A. Theoretical Approach

Bordo and Kydland (1995) provide an interpretation of the role of the gold standard as it relates to the literature on rules for policymakers. They argue that being on the gold standard tied the hands of the fiscal and monetary authorities of a country, and that a monetary rule like a

[5] Previous studies examining the gold standard have focused on country risk rather than currency risk. Bordo and Rockoff (1996) and Obstfeld and Taylor (2003) find that the gold standard lowered sovereign risk by approximately 30-40 basis points. Flandreau and Zumer (2004) find that the gold standard had no effect on sovereign yields once a broader set of economic and political variables controls are considered. Ferguson and Schularick (2006b) find that the gold standard effect disappears once the sample of sovereign borrowers is expanded to include the universe of debtors on the London market.

fixed exchange rate could serve as a credible commitment mechanism for solving the classic time-inconsistency problem (Kydland and Prescott, 1985). Government policy is said to be time inconsistent when a policy plan that is determined to be optimal and to hold indefinitely into the future is subsequently revised. For example, suppose that a government sells debt to finance a war. From an *ex ante* perspective, it is optimal for the government to service its debt obligations. However, once the bonds have been sold, it is optimal for the government to default unless there is a commitment mechanism that ties the hands of the fiscal and monetary authorities. In the absence of a commitment mechanism, it is time inconsistent for the government to repay its debt obligations. Private agents will anticipate the government's incentive to default and they will not buy bonds, forcing the government to rely on taxes or money creation. Overall, the existence of an enforcement mechanism, such as a credible threat to deny the government access to borrowing in the future, means that a socially optimal, but time inconsistent policy of borrowing can be supported as an equilibrium outcome.

Bordo and Kydland (1995) also argue that the gold standard had an escape clause. Countries could suspend specie convertibility in the event of a war or a fiscal emergency; however, after the war or extraordinary event ended, it was well understood that a country would return to specie convertibility at the pre-war parity. Generally, resumption occurred after a "reasonable" delay period during which a country would impose deflationary policies to retire fiat currency printed for war or emergency finance. The United States and France provide examples of the use of escape clauses. They fought wars in the 1860s and 1870s and issued large amounts of irredeemable paper currency and debt. At the conclusion of these wars, both countries imposed deflationary policies to restore convertibility, and both had returned to a specie standard by 1880.

B. Testable Implications

Using the theoretical insight that a fixed exchange rate regime represents a commitment rule, we examine the behavior of interest rates during the classical gold standard era in order to assess the credibility of hard pegs for emerging market borrowers. In particular, our research breaks new ground by calculating and analyzing the currency risk premium for the classical gold standard era. Previous research on the gold standard has focused almost exclusively on country

risk (also called "political risk") using long-term bonds; this measure provides an assessment of the default risk for an emerging market borrower.[6] Alternatively, our paper measures the currency risk premium, which provides an estimate of the compensation that bondholders demand in the case of an expected devaluation.

To understand how the currency risk premium relates to anticipated changes in the exchange rate, we define $I_{t,k}$ as the annualized (gross) yield (i.e., one plus the interest rate) at time *t* of risk-free short-term interest rates.[7] Let *k* denote the maturity of short-term interest rates. We define $I_{t,k}^{UK}$ as the risk-free interest rate. The total yield differential can then be written as:

$$(1) \qquad \frac{I_{t,k}}{I_{t,k}^{UK}} = \frac{I_{t,k}}{I_{t,k}^{*}} \frac{I_{t,k}^{*}}{I_{t,k}^{UK}}.$$

We can express the difference between the short-term gold interest rates between two countries as the sum of two risk premiums. Setting $i_{t,k}$ equal to the natural log of $I_{t,k}$, we find that

$$(2) \qquad (i_{t,k} - i_{t,k}^{UK}) = (i_{t,k} - i_{t,k}^{*}) + (i_{t,k}^{*} - i_{t,k}^{UK}).$$

The first-term on the right hand side equation (2) is the currency risk premium and the second term is the country risk premium. The country risk premium (or political risk) represents the risk that a country will default on its debt obligations. We set the second term in equation (2) equal to zero under the assumption that default risk for the short-term interest rates is the same for the two countries.

We now show that the currency risk premium represents the compensation that an investor requires due to the possibility of a movement in the exchange rate. First, we define the exchange rate, S_t, as the amount of local currency per unit of foreign currency. Assuming risk-neutrality, arbitrage implies that uncovered interest parity holds, such that

[6] See Bordo and Rockoff (1996), Obstfeld and Taylor (2003), Ferguson and Schularick (2006a) and Flandreau and Zumer (2004).
[7] Our derivation follows Schmukler and Serven (2002).

$$(3) \quad I_{t,k} = I^{*}_{t,k}\left[\frac{E_t S_{t+k}}{S_t}\right]^{1/k},$$

where $E_t S_{t+k}$ is the expectation at time t of the exchange rate at time $t+k$. Taking natural logarithms of the interest parity condition, we can rewrite the first term in equation (2) as

$$(4) \qquad (i_{t,k} - i^{*}_{t,k}) = \Delta s^{e}_{t,k},$$

where $\Delta s^{e}_{t,k} = \frac{1}{k}\ln\left[\frac{E_t S_{t+k}}{S_t}\right]$.

Equation (4) is an uncovered interest parity (UIP) condition where the currency risk premium equals the expected rate of change in the exchange rate under the assumption that the short-term debt instruments have zero default risk. Hence, if a country made a completely credible, non-contingent, and permanent commitment to join the gold standard, then the probability of a devaluation of the exchange rate would be zero (Obstfeld and Taylor, 2003). That is, for a country that credibly committed to the gold standard, the interest-rate differential between a country's open market rate and British trade bills should be zero. On the other hand, a persistently large spread between these two short-term interest rates once the the gold standard is introduced, would suggest that financial markets did not view the commitment to the fixed exchange rate peg as a credible.

Although using interest-parity conditions to identify the currency risk premium is conceptually straightforward, it is often empirically difficult to implement. For example, the presence of capital controls (or the expectation of capital controls) can drive a wedge between the price of short-term trade bills trading in local and foreign markets. Indeed, the widespread use of capital controls after the 1930s, has made it challenging to measure currency risk as we do here. By contrast, the classical gold standard era had unfettered capital markets that were largely free of government intervention (Eichengreen, 1996, IMF, 1997), making our period of analysis particularly well suited for testing the credibility of hard pegs.

C. Implementation

To analyze the effect of the gold standard on interest rates, we assembled a new database of high-frequency, short-term interest rates for 21 countries, roughly 250,000 observations.

Much of our data is hand-collected from contemporaneous financial publications.[8] The database includes the universe of domestic trade bills reported in *The Economist* from November 5, 1870 until June 30, 1914.[9] We supplement data from *The Economist* with short-term interest rates from *The Commercial and Financial Chronicle*, the *Manchester Guardian*, and *Global Financial data*. Domestic trade bills were the modern equivalent of bankers' acceptances, which have interest rates that approximate the yields on risk-free US Treasury bills in financial markets. Trade bills were short-term accommodation paper used to finance domestic commerce and domestic trade during the gold standard period (Neal and Weidenmier, 2003). The credit instruments were payable in domestic currency and issued in the leading money centers throughout Europe and the rest of the world, implying that the domestic trade bill is payable in gold if a country's currency is convertible into gold. On the other hand, if a country's currency was not backed by gold (i.e. it was not on the gold standard), then trade bills were payable in domestic currency (i.e., paper money if the country had fiat money or silver if a country's currency was convertible into silver). The short-term bills bills were widely regarded as liquid and risk-free or low risk debt instruments during the classical gold standard period. For countries that lacked trade bills, we use the bank rate following Bordo and Flandreau (2003). The bank rate is the short-term interest rate used by the central bank to discount trade bills for a given country. Our use of the central bank discount rate is based on the fact that central banks' discounted large number of domestic trade bills; hence, these instruments were highly liquid. Moreover, default risk associated with central banks is likely to be very low. All short-term financial instruments in our sample have 90 days maturity. The interest rates reported by the *Economist* for these 90-day instruments, however, are annualized. Appendix 1 provides details on the particular short-term interest rate used for each country.

For each country, we collected monthly or weekly quotes, whichever is the highest frequency reported by the financial press. For all non-UK countries in the sample, we use the lowest interest rate reported in the financial press for a given emerging market country to provide

[8] With the exception of India, British colonies are also not included in the sample. Ferguson and Schularick (2006a) argue that the British government guaranteed the debt obligations of its colonies so that a currency risk premium computed for these places would be downward biased and not reflect the actual premium in the absence of support from the UK.

[9] There are a few gold standard adopters for which we lack data on short term rates (Costa Rica, Ecuador, El Salvador, Nicaragua, Peru, and Turkey). Since these countries were located on the periphery and experienced trouble staying on gold, their omission means that our average estimate of currency risk for emerging market countries is likely a lower bound.

a lower bound estimate of the currency risk premium.[10] By using the lowest reported interest rate, we account for the impact of the bid-ask bounce on short-term interest rates that might increase the size of the currency risk premia because of an illiquidity premium.[11]

Convertibility under the gold standard was established by law or executive decree, although in some countries, such as France, maintenance of convertibility was left at the discretion of central banks rather than the sovereign or legislature. Table 1 presents a timeline of gold standard adoption for every country that joined the gold standard in the period 1870-1914 and had short-term interest rates. Column 1 lists the dates of gold standard adoption, defined as the date that a monetary authority for a given country initiated or resumed specie convertibility. Column 2 shows the period of gold standard adherence for the 21 sovereign borrowers. By confining our analysis to countries or colonies that remained on the gold standard for at least two years, we provide a lower bound estimate of currency risk.[12] Appendix 2 provides further information and sources for gold standard adoption dates.

III. Measuring Currency Risk Premia

To measure the currency risk premia, we calculate the interest-rate differential on short-term debt instruments by subtracting the UK trade bill from a given country or colony's interest rate on domestic trade bills. The UK serves as the base country in our sample since it is widely considered to be the leading economic and financial power of the late nineteenth and early twentieth century. Table 2 presents descriptive statistics of currency risk premia. Panels A and B report average interest-rate differentials (in basis points), for the entire period and for 10-year windows and four-year windows (or the largest available window if a country was on the gold standard for less than four years). For each country, the windows are positioned relative to the date of gold standard adoption. The fourth column of the table also displays the change in the risk premia, comparing the two-year or five-year period before adoption with the two-year or five-year period after joining gold. These windows are designed to measure long-run adherence

[10] Corwin and Schultz (2012) report that low (prices) interest rates are almost always sell trades. This means that the currency risk premium calculated using the lowest reported interest rate provides a lower bound estimate.
[11] This also assumes that the spread on the short-term interest rate for the UK, our base country, is very small or zero. The spread of the UK trade bill is averaged about 12 basis points during the classical gold standard period.
[12] The two-year decision rule eliminates short-lived attempts by Argentina, Brazil, and Greece to join the gold standard during the late nineteenth century. The estimated average currency risk premium for emerging market borrowers would be higher if these were included.

to the gold standard, noting the conclusion from theory that, after adoption, these should be approximately equal to zero if the peg is perceived by markets as credible. Figures 1 and 2 show 10-year windows (or largest available sample period) for our sample of 21 borrowers centered around the adoption date of the gold standard with weeks (or months) from that date shown on the x-axis. [13]

Panel A of Table 2 shows that the currency risk premium for France was slightly negative and hardly different from the rate on British trade bills (-9 basis points) five years after the country joined the gold standard. Panel B shows similar results for the four year window; after adoption, the currency risk premium averaged -15 basis points. The data for France suggest that markets viewed this peg as credible. Borrowing rates for Germany averaged 10 basis points in the five years after adoption. Markets also appear to have assessed a few other pegs of Western European countries as fairly credible. The currency risk premium for Belgium and Netherlands averaged 33 and 30 basis points, respectively, five years after they adopted the hard peg. The four-year windows paint a similar picture: the mean currency risk premium averaged 25 basis points for Belgium and 47 basis points for Netherlands in the two years after joining the gold standard. On the other hand, despite its level of development, our findings suggest that financial markets viewed the United States differently; its currency risk premium averaged more than 200 basis points in the five years after the United States joined the gold standard.[14] Even if we extend this analysis to cover the entire gold standard up until the outbreak of World War I, the currency risk premium for the United States averaged more than 150 basis points.

The rest of Continental Europe exhibits sizable currency risk premia. Austria's currency risk premium averaged a little more than 200 basis points in the five year window after the country joined the gold standard in August 1892. For Italy, the currency risk premium averaged slightly more than 150 basis points in the five years after it joined the gold standard. The currency risk premium was similar for Switzerland. For the Scandinavian countries, currency risk premia averaged more than 140 basis points for Denmark, Finland, Norway, and Sweden five years after a country joined the gold standard.

[13] Officer (1996) estimates that the costs of importing gold were 0.69 percent of parity and 0.61 percent of parity for gold exports between the United States and the United Kingdom during the classical gold standard period. The cost of transporting gold between two countries is a transactions cost that limits interest parity from holding precisely during the period 1870-1913.

[14] Lothian and Wu (2005) point out that the short-term interest rate for the United States during the classical gold standard period is the commercial paper rate, and that it might contain a credit premium . The presence of a credit premium would increase the currency risk premium for the United States.

Exchange-rate risk was also sizable in Eastern and Southern Europe. Markets asked for an additional 443, 263, and 121 basis points, respectively, for Bulgaria, Greece and Rumania in the two-year period after they adopted gold. Their premia seem to persist as well, respectively exhibiting 384, 232, and 241 basis points of currency risk five years after joining gold.

Countries in other parts of the world also show considerable currency risk after gold standard adoption. For Argentina and Japan, their currency risk premia averaged more than 400 basis points in the two-year and five-year windows after they adopted the gold standard. It was more than 700 basis points for Chile's three years on the gold standard. The currency risk premium averaged 270 basis points for Russia in the two and five years periods after the country joined the gold standard in 1897.

Table 3 shows the average currency risk premia for seven countries on the gold standard for which we have data both on the central bank discount rate and the domestic trade bill market. For each country, we then compare the currency risk premia computed using central bank discount rates with those using domestic trade bills. As shown in Table 3, the currency risk premium averaged nearly 100 basis points using the two different methodologies as a measure of the currency risk premium.

Overall, the time-series evidence suggests that the gold standard was likely credible for a small set of core European countries that included France, Germany, and the United Kingdom, the Netherlands, and Belgium. These countries had high standards of living (measured by GDP per capita) and were leading financial centers of the nineteenth century. A very different picture, however, emerges for other countries in the sample. Outside the core countries, the currency risk premium averaged more than 285 basis points five years after a country joined the gold standard with a standard deviation of 163 basis points.[15] These new estimates of currency risk appear consistent with descriptive accounts of the operation of the gold standard on the periphery, which suggest that it may have been more difficult for these countries to adhere to policies set by the core countries of the gold standard. (Bordo and Kydland 1995, Eichengreen 1996).

To provide some additional statistical evidence on the credibility of the pegs for the non-core, we regress the interest rate on the British trade bill in period t on the short-term interest rate of country *i* in period *t* and a constant term. The sample reflects the period in which the country

[15] Adding the U.S. to the set of "core" countries has the effect of raising the average for emerging market borrowers from 285 to 290 basis points.

was on the gold standard and the frequency is as listed in Table 1 as noted earlier. For our purposes, the key coefficient is the constant term which, according to theory, ought to equal zero if the country's peg is credible.

To run these tests, we first explore the time series properties of the data. As Table 4 shows, using DF-GLS tests we can reject the existence of a unit root in nearly all the countries in our sample at standard confidence intervals. For those few that do not pass the unit root test, we find additional evidence of a co-integrating relationship, suggesting stationarity in all the data series we consider. Table 5 shows that the estimated coefficients on the constant terms (measured in percentage points) are large and statistically significantly different from zero at the one-percent level in all regressions. The constant is more than 200 basis points for all countries. Argentina and Chile have constants greater than 900 basis points, while the intercept for Greece and Japan is more than 600 basis points. Finland, Norway, Rumania, Russia, and Sweden have estimated currency risk premia greater than 400 basis points. The estimated intercept for Austria, Denmark, India, and Italy is between 300 and 400 basis points. Switzerland and the United States are the most credible hard pegs among emerging markets, with respective currency risk premia of 290 and 227 basis points. The estimated coefficients on the intercept term provide further evidence that, outside the core countries of Western Europe, market participants did not perceive the gold standard as credible.

IV. Implied Devaluations for Gold Standard Adopters

An alternative way of assessing the credibility of the hard pegs is to consider whether investors believed that countries would devalue after gold standard adoption. If the size of an anticipated devaluation were close to zero, this would indicate that investors viewed the pegs as fully credible. However, if the expected devaluation deviated significantly from zero, this would indicate that markets did not expect the pegs to last.

In this section, we follow the methodology proposed in Schmukler and Serven (2002), and estimate the size of the anticipated devaluation for our sample of 17 emerging market economies. We primarily focus on *emerging* market currency risk for two reasons: (1) emerging market countries historically have had large currency risk premia; and (2) prior research on the gold standard has largely focused on the risk premia of core countries (Bordo and MacDonald,

2000). Using our assumption of risk neutrality and the definitions from Section II of the paper, we can rewrite the currency risk premium as the likelihood of an exchange rate devaluation, *p*, multiplied by the size of the expected devaluation, d_t^e:

$$(5) \quad (i_{t,k} - i_{t,k}^*) = p d_t^e .$$

Dividing the currency risk premium by the probability of a fall in the exchange-rate yields the anticipated size of the devaluation:

$$(6) \quad d_t^e = (i_{t,k} - i_{t,k}^*) / p.$$

Table 6 shows the expected size of the devaluation for each of our 17 non-core economies. The cells in the table provide country-specific estimates of the size of the expected decline in the exchange rate based on varying the probability of a hypothetical devaluation. By employing Bordo and Murshid's (2006) estimates of the likelihood of a global financial crisis during the gold standard era, it is possible to further narrow the range of the size of the anticipated decline in the exchange rate. Their research suggests that the probability of a global crisis during our sample period was somewhere between 10 and 14 percent. If we assume that each country's probability of a fall in the exchange-rate is equal to the probability of a global crisis and we use the lower end estimate of a global crisis of 10 percent, then across all emerging market economies the data suggest that markets anticipated that exchange rates would fall by an average of more than 28 percent (Column 1, Table 6). The size of the decline in the exchange rate varies significantly across our sample of 17 gold standard countries given that the standard deviation of the currency risk premium is 16 percent. We estimate expected devaluations of more than 20 percent for countries such as Argentina, Austria, Bulgaria, Chile, Greece, India, Japan, Mexico, Norway, Rumania, Russia, Sweden, and the United States.

It is certainly possible that the probability of a crisis for a particular country is higher than the incidence of a global crisis. For example, domestic economic and political factors may influence a country's willingness and ability to maintain a fixed exchange rate regime. Trade shocks are one reason why individual country crisis' probabilities could differ for small, open

economies. Since emerging market economies experienced greater terms of trade shocks during the classical gold standard era than core countries (Williamson, 2011), we therefore consider an alternative benchmark – that the probability of a financial crisis in a given country is more than double the probability of a global crisis or 25 percent. This number is based on the fact that the volatility of terms of trade shocks is approximately two and a half times greater for emerging markets than core countries (Williamson, 2010). Based on equation (6), the average maximum implied devaluation is then roughly nine percent. Here again, there is considerable variance across our sample. For countries like Austria, Brazil, Italy, and the United States, the maximum implied decline in the exchange rate was less than 10 percent; for other countries, it ranged from 12 to 55 percent.

V. Robustness Checks

The analysis of short-term data provides evidence that the hard pegs of the classical gold standard era were not credible for emerging market economies. To test for the external validity of our findings, we consider whether this lack of credibility was priced into other assets such as long-term sovereign bonds. We created a new, high-frequency database of sovereign bond yields for nine of the largest (non-colonial) sovereign debtors: Argentina, Austria, Brazil, Chile, India, Italy, Mexico, Russia, and the United States. In 1913, these nine borrowers constituted roughly 60 percent of the world's outstanding external debt.[16] We use weekly data for all but Brazil, Chile, and Italy for which monthly data are employed. The database on long-term bonds contains more than 3,100 observations. In our sample, the gold and paper bonds trade on the same domestic or international exchange, except for Chile, where the paper bonds trade on the home market (Valparaiso) and the gold bonds on an international financial market (London). Appendix 3 provides information on the long-term gold and paper debt issues for each country in our sample.

Our data set is unique in that, for each of these countries, it contains bond yields for both home-currency (paper) denominated bonds as well as gold- denominated bonds. Having gold and

[16] The five largest emerging market borrowers as of 1913 that were not included in our sample are Australia, Japan, Turkey, Canada, and Egypt. Australia and Canada joined the gold standard prior to the start of our sample period. We were unable to locate paper bonds for Japan, Egypt, and Turkey. Our sample of nine emerging market borrowers that joined gold between 1870 and 1913 is identical to what appeared in the seminal paper on country risk by Bordo and Rockoff (1996).

paper bonds for each country allows us to compute a measure of currency risk for long-term assets. The bonds in the sample all have a duration of at least 10 years[17]. Other than the maturity of the assets, the key difference in the analysis in this section is that we are comparing two bonds for the *same* country rather than a benchmark country; this is critical because, in using long-term bonds, we might otherwise be concerned about country risk. By using a gold bond and a paper bond for the same country to calculate currency risk, we eliminate the country risk in long-term sovereign debt obligations. Since we are focusing on the interest-rate differentials between two bonds of the same country, where the primary difference between the obligations is their currency denomination, our analysis is simpler than those interested in understanding country risk: we largely eliminate the need to control for observed and unobserved differences in sovereign-specific fundamentals.[18]

As previously noted, theory predicts that a country has a credible peg if the currency risk premium is zero.[19] However, as shown in column 3 of Table 7, five years after adoption the average currency risk premium for these nine borrowers was 415 basis points. As was true with short-term debt obligations, this provides evidence that the hard pegs of the classical gold standard period were not credible for countries on the periphery.[20]

While the descriptive statistics are informative, they only present average yield spreads before and after a country joined the gold standard. It may be the case that yield spreads declined between the pre- and post-event period, but a movement in the underlying trend is masked by using average interest-rate differentials. To provide some perspective on this question, Figures 3 and 4 show time-series plots of the currency risk premium for our sample of nine emerging market countries The vertical line in each figure denotes when a country joined the gold standard.

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[17] The sovereign debt issued by Argentina, Chile, and Mexico also contain sinking funds with lottery provisions. This might create some challenges in measuring the current yield which we will address below by comparing expected devaluations (calculated from the current yield) with data on actual devaluations.

[18] Empirical studies of sovereign risk during the gold standard have found the ratio of debt-to-revenue, budget deficit, and exports per capita to be important determinants of yield spreads (Ferguson and Schularick, 2006a; Flandreau and Zumer, 2004).

[19] Our analysis also suggests that the currency risk premium is also capturing a factor that is largely distinct from the determinants of country risk, given that the correlation between the change in the currency risk premium and the country risk premium is less than 0.20 for the seven emerging market countries with both paper and gold (sterling) bonds.

[20] The average currency risk premium for the nine sovereign borrowers declined roughly 73 basis points in the "on-gold" period of the 10-year window and more than 43 basis points in the four-year window after a country adopted the hard peg.

Figure 3 still shows large currency risk premia. In particular, the currency risk premium for Argentina, one of the largest sovereign borrowers of the late nineteenth century, declined in the years leading up to the country's adoption of the gold standard in October 1899, but it remains at approximately 1,000 basis points after the country adopted the gold standard. As shown in Figure 3, although exchange-rate risk declined Austria around the period of adoption, the currency risk premium averaged approximately 120 basis points in the five-year period after the country joined the gold standard in 1892. Figure 3 also indicates that India had a sizable currency risk premia: the interest-rate differential between the paper-rupee-denominated bonds and the gold-rupee-denominated bonds averaged 240 basis points in the five years after the British colony joined the gold club. The interest-rate differential between Mexico's home currency bonds and sterling-denominated bonds declines substantially prior to adoption, but the currency risk premium for Mexico averaged almost 500 basis points in the five-year period after the country joined the gold standard (Figure 3). For Russia, the currency risk premium shown in Figure 3 is large and appears to have changed very little over the 10-year window, averaging more than 800 basis points before and after adoption of gold in 1897. Figure 3 also shows that the currency risk premium for the United States averaged approximately 100 basis points over the entire 10-year sample period.[21]

Figure 4 shows the currency risk premium for Brazil, another large Latin American borrower. Currency risk rose from a little under 50 basis points to around 100 basis points at the time of adoption and remained at approximately 100 basis points after the country joined the gold standard. Figure 4 presents the evidence for Italy, another European emerging market economy. As it moved toward adopting the gold standard, Italy's currency risk premium declined; however, it remained between 40-60 basis points five years after adoption. Chile was on the gold standard for a shorter period compared to other countries in our sample (it joined the gold standard in 1895 and abandoned its hard peg in July 1898).[22] The currency risk premium

[21] For the United States, we used both the 4.5 percent gold bonds (due in 1891) and the 4 percent gold bonds (due in 1907) to calculate the currency risk premium. We spliced the two bond series together by subtracting 30 basis points off the 4.5 percent bonds in the period when data on the 4 percent gold bonds was not available. The 30-basis-point difference is the average yield spread differential between the 4.5 percent gold bonds and the 4 percent gold bonds.

[22] Bordo and Rockoff (1996) discuss the relationship between Chilean internal peso bonds and its sterling denominated external debt, but do not interpret the interest-rate differential as a measure of the currency risk premium and its implications for the credibility of the hard peg. Chile also briefly joined the gold club in the early to mid 1870s. However, we were unable to locate any domestic paper bonds to test the credibility of this earlier episode of gold standard commitment.

averaged more than 583 basis points while it was on the gold standard (Figure 4). This large interest-rate differential suggests that investors likely never perceived its peg to be very credible.[23]

Table 8 estimates the expected size of the devaluation of each for each of our nine emerging market borrowers using the same methodology described in Section IV. The size of the decline in the exchange rate varies significantly across our sample of nine emerging market countries. Investors anticipated that exchange rates would fall by less than 13 percent for countries like Austria, Brazil, Italy, and the United States, but would decline by more than 30 percent for countries such as Argentina, Chile, India, Mexico, and Russia. As before, our alternative baseline takes into account the possibility that domestic factors may make the probability of a crisis for an emerging market borrower higher than the probability of a global crisis. Using the alternative baseline, for countries like Austria, Brazil, Italy, and the United States, the maximum implied decline in the exchange rate was less than 10 percent; for other countries, it ranged from 12 to 55 percent. Hence, even when we use long-term bond data, we are finding substantial evidence that market participants did not view long-term commitments to the gold standard as viable.

We can take the empirical analysis of the short-term and long-term bonds one step further by investigating whether actual devaluations map into expected devaluations for many of the large emerging market borrowers. Doing so provides a useful validity check on the modeling assumptions and the outcomes generated from the model. We are able to make this comparison since most of the countries in our sample either left the gold standard or issued paper currency that traded alongside money that was explicitly or legally backed by gold. Table 9 compares the actual devaluations to the expected devaluations. Chile and Italy left the gold standard in July 1898 and May 1894, respectively. In the year following its departure from the gold standard, Chile's exchange rate was, on average, 28 percent lower against the U.S. dollar in comparison to the period when it was on the gold standard. As shown Table 6, the 28 percent depreciation is almost exactly equal to the expected depreciation. For Italy, the lira fell percent approximately 8 percent against the French franc in the six months after it abandoned specie convertibility in the summer of 1893. Fratiani and Spinelli (1990) and Tattara (2003) show that movements in the

[23] Differences in liquidity are too small to account for the large currency risk premia. Appendix Table 4 uses relative bid-ask spreads to compare the liquidity between gold and paper bonds. The analysis shows that the difference in bid-ask spreads is approximately 25 basis points for the nine countries in our sample.

lira/franc exchange rate mirrored the ratio of Italian domestic to foreign prices of rendita debt. Italy's actual depreciation is slightly larger than the expected depreciation shown in Table 5.

Argentina issued paper pesos that could only be exchanged for gold pesos at the rate of 2.27 to 1 based on the Conversion Law of 1899 (Williams, 1920). This implies that paper pesos traded at a 127 percent premium, which is consistent with more than a 100 percent devaluation. The large currency-risk premium calculated using paper and gold bonds and the observed paper-gold exchange rate suggest that Argentina's hard peg was not credible.

Austria joined the gold standard in August 1892. As pointed out by Flandreau and Komlos (2008), the Austrian exchange rate fluctuated within a narrow band around the country's mint par ratio. Indeed, the *Amsterdamsch Effectenblad* generally quoted paper florin trading at par with gold florin up until the outbreak of World War I except for the first couple of years after the country joined the gold standard in 1892. Financial markets expected Austrian currency to devalue approximately six percent prior to the outbreak of World War I, which is greater than the actual devaluation of zero percent.

Brazil established a government exchange bureau to oversee exchange-rate fluctuations after the country joined the gold standard in 1906. Shortly thereafter, the government bureau ran out of gold to redeem the paper notes and the currency began to fluctuate on the open market. On December 31, 1910, the President of Brazil issued a decree that paper notes would be converted into gold at the new rate of 16 pence per milreis instead of 15 pence per milreis (*Commerce Reports of the United States*, 1910). The nearly seven percent depreciation in the milreis is consistent with the expected depreciation estimated for Brazil shown in Table 6, where the assumed probability of devaluation is 10 percent.

Mexico joined the gold standard in 1905, but continued to issue and use silver and gold coins while on the gold standard. In 1905, the government altered the mint par ratio between gold and silver by reducing the value of silver by 50 percent. This decision temporarily stabilized the peso, improved the country's trade balance, and promoted capital inflows as shown by the large decline in the country's currency risk premium. On the other hand, the 50 percent decline in the gold value of the silver peso demonstrated a willingness of the Mexican government to debase its currency, a decision that ultimately created inflationary pressure and contributed to the downfall of Porfirio Diaz (Hart, 2010).

India joined the gold standard in 1897. Paper notes issued by the government were largely backed by silver rather than gold. This accounted for India's large currency risk premium. The interest-rate differential between paper and gold bonds began to disappear only after the British government agreed to guarantee the conversion of Indian silver into gold (*Appleton's Encyclopedia*, 1900; Keynes, 1913). At this time, India's exchange rate is no longer an emerging market currency given that its commitment to the gold standard was backed by the British government and their sterling reserves. The fact that the British government was willing to step in and support Indian currency suggests that England was concerned about the exchange-rate risk associated with holding paper rupees.

Russia issued paper and gold bonds that traded on the Amsterdam exchange. The *Amsterdamsch Effectenblad* occasionally printed price quotes for the paper-gold rouble exchange rate. Based on these data, paper roubles traded at a 50 percent discount relative to the gold rouble, a figure that is consistent with the expected depreciation calculated in Table 6 (using the assumption of a market-based probability of a devaluation between 10 and 25 percent). Finally, the United States also issued gold and paper bonds during the classical gold period. The existence of a positive currency risk premium reflects "silver risk" – the possibility that the United States would adopt a bimetallic standard during the period 1870-1896. Calomiris (1988, 1992) and Hallwood et. al. (2000) find that expectations of a depreciation of the US dollar were quite small during the early to mid-1890s.

VI. Conclusion

Are emerging market pegs ever credible? Our contribution is to examine this question in a historical setting that permits identification and testing of exchange-rate regime credibility. Between 1870 and 1913, the gold standard was widely adopted, even by countries on the periphery. Given its global reach, the classical gold standard thus represents the most widely used peg in modern financial history. Previous studies have noted that the regime appeared credible, at least among core countries, but prior research has largely ignored whether the system was credible on the periphery. Though previous scholarship has examined country-specific risk, it has not explicitly tested for currency risk. As we demonstrate, currency risk provides a

straightforward way of capturing the markets' beliefs as to whether a country will maintain its pegged exchange rate.

We take avantage of the fact that from 1870-1913 capital markets were unfettered. Since governments did not impose capital controls, we are able to identify currency risk premia using a straightforward methodology based on interest parity conditions. Under the assumption that UIP held for this period, short-term interest rate differentials between an emerging market economy and the UK indicate the presence of currency risk.

Using a new database of weekly and monthly short-term domestic trade bills, we analyze the currency risk premium for a sample of 17 emerging market borrowers during the gold standard period. The empirical analysis suggests that the currency risk premium averaged more than 285 basis points in the five-years after a country joined the gold standard for non-core countries. The large and persistent currency risk premium for emerging market countries implies that markets expected their exchange rates to depreciate on average by approximately 28 percent. We find that there are large currency risk premia regardless of whether we use domestic trade bills or central bank discount rates. We further tested the external validity of our findings by considering a second market – long-term sovereign bonds – and verify (using a unique database of gold and paper bonds) that large currency risk premia exist for a sample of nine, large sovereign borrowers. Our findings that expected devaluations largely map onto actual devaluations suggests that our empirical estimates of currency risk appear to match market beliefs: financial market participants appear to have believed that emerging market pegs were not credible during the classical gold standard period.

Scholars have noted commitments to exchange rate pegs were perhaps easier to maintain during the classical gold standard period than later international monetary regimes since domestic policy goals like full employment were more easily subverted to the maintenance of external balance (Eichengreen, 1997). Monetary and fiscal policy could be used to reinforce the commitments to pegs. Given the political pressure that most governments face today to respond to business cycle downturns with countercyclical monetary and fiscal policy, our results suggest that hard pegs are likely to be even less credible today.

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Table 1

Timeline of Gold Standard Adoption and Adherence

Country	Date of Adoption	Dates of Adherence
Argentina	October 31, 1899	10/31/1899-8/2/1914
Austria	August 2, 1892	8/2/1892-8/4/1914
Belgium	November 5, 1878	11/5/1878-1914
Brazil	December 22, 1906	12/22/1906-12/12/1914
Bulgaria	November 24, 1902	11/24/1902-10/10/1912
Chile	June 1, 1895	6/1/1895-7/11/1898
Denmark	May 27, 1873	5/27/1873-12/1914
Netherlands	June 6, 1875	6/6/1875-7/31/1914
Finland	January 1, 1878	1/1/1878-8/1914
France	November 5, 1878	11/5/1878-8/5/1914
Germany	October 19, 1871	10/1/1871-8/ /1914
Greece	March 19, 1910	3/19/1910-12/1914
India	January 1, 1898	1/1/1898-9/5/1914
Italy	March 1, 1883	3/1/1883-12/22/1894
Japan	October 1, 1897	10/1/1897-1914
Mexico	May 1, 1905	5/1/1905-1913
Norway	June 4, 1873	6/4/1873-8/4/1914
Rumania	April 14, 1890	4/14/1890-1914
Russia	January 3, 1897	1/3/1897-7/1914
Sweden	May 30, 1873	3/30/1873-1914
Switzerland	December 20, 1878	12/20/1878-1914
United States	January 1, 1879	1/1/1879-9/7/1917

Table 2. Currency Risk Premia
Panel A: 10-Year Windows

Country	Whole Period	Pre-Gold	On Gold	Change	Observations	Data Frequency
Argentina	528	633	425	-208	121	M
Austria	145	81	208	127	521	W
Belgium	18	3	33	30	521	W
Bulgaria	407	429	384	-45	521	W
Chile	652	595	744	149	423*	W
Denmark	136	125	147	22	121	M
Netherlands	13	-4	30	34	521	W
Finland	119	84	154	70	521	W
France	-25	-41	-9	32	521	W
Germany	47	85	10	-75	521	W
Greece	243	251	232	-19	121	M
India	320	387	252	-135	521	W
Italy	130	104	156	52	521	W
Japan	444	434	453	19	121	M
Mexico	516	546	468	-78	398**	W
Norway	165	105	225	120	121	M
Rumania	232	223	241	18	521	W
Russia	312	345	270	-75	458	W
Sweden	165	123	206	83	121	M
Switzerland	72	59	82	23	473	W
USA	187	173	201	28	521	W
Average	229.81	225.71	233.9	8.19		

M=monthly, W=weekly,*Data sample constrained by adherence to gold standard; **sample size constrained by availability of newspaper

Table 2. Currency Risk Premia
Panel B: 4-Year Windows

Country	Whole Period	Pre-Gold	On Gold	Change	Observations	Data Frequency
Argentina	502	579	428	151	49	M
Austria	133	105	160	56	209	W
Belgium	-3	-31	25	56	209	W
Bulgaria	445	448	443	-5	209	W
Chile	771	727	814	87	209	W
Denmark	53	89	18	-71	49	M
Netherlands	20	-7	47	40	209	W
Finland	201	190	211	21	209	W
France	-61	-107	-15	92	209	W
Germany	62	123	2	-121	209	W
Greece	276	290	263	-27	49	M
India	438	485	391	-93	209	W
Italy	78	55	101	46	209	W
Japan	460	469	452	17	49	M
Mexico	517	596	438	158	209	W
Norway	32	-24	86	110	49	M
Rumania	189	257	121	-156	209	W
Russia	312	441	270	171	209	W
Sweden	69	39	98	59	49	M
Switzerland	73	29	116	87	209	W
USA	188	132	243	112	209	W
Average	226.43	232.62	224.38	37.62		

M=monthly, W=weekly

Table 3. Comparing Risk Premia Using Bank Rates and Open Market Rates in the First Five Years after a Country Joined the Gold Standard

Country	Open Market Rate	Bank Rate
Austria	208	170
Belgium	33	32
Netherlands	30	23
France	-9	-13
Germany	10	72
Italy	156	183
Russia	270	231
Average	100	100

Table 4.DF-GLS Unit Root Test

Country	**Test Statistics (lags)**
Argentina	-1.741 (1)
Austria	-2.854* (16)
Belgium	-3.154** (1)
Bulgaria	-2.131 (1)
Chile	-1.421 (1)
Denmark	-2.739* (15)
Netherlands	-3.884*** (6)
Finland	-2.758* (3)
France	-4.731*** (13)
Germany	-5.722*** (16)
Greece	-1.00 (1)
India	-4.047*** (2)
Italy	-3.436*** (4)
Japan	-1.921 (1)
Norway	-3.081** (9)
Rumania	-2.681* (1)
Russia	-2.162 (1)
Sweden	-2.670* (4)
Switzerland	-4.623*** (9)
UK	-5.922*** (16)
USA	-4.063*** (14)

***denotes significance at the 10 percent level;**denotes significance at the 5 percent level; ***denotes significance at the 1 percent level**

Table 5. Currency Risk Regressions

Country	Constant	UK Interest Rate	R-squared	Obs
Argentina	9.20***	-0.400***	.150	265
	(0.192)	(0.054)		
Austria	3.001***	0.295***	.231	1117
	(0.050)	(0.016)		
Bulgaria	7.558***	-0.077***	.016	475
	(0.018)	(0.018)		
Chile	9.498***	-0.155*	.023	163
	(0.153)	(0.081)		
Denmark	3.472***	0.268***	.093	487
	(0.137)	(0.041)		
Finland	4.395***	0.168***	.073	1504
	(0.058)	(0.018)		
Greece	6.092***	0.063*	.061	45
	(0.150)	(0.037)		
India	3.976***	0.424***	.033	835
	(0.276)	(0.070)		
Italy	3.029***	0.342***	.333	1609
	(0.037)	(0.011)		
Japan	6.939***	-0.025	.0005	375
	(0.165)	(0.049)		
Norway	4.441***	0.115***	.023	487
	(.124)	(.037)		
Rumania	4.721***	0.237***	.067	1237
	(0.093)	(0.030)		
Russia	4.643***	0.255***	.091	886
	(0.101)	(0.030)		
Sweden	4.180***	0.180***	.069	487
	(0.109)	(0.032)		
Switzerland	2.906***	0.350***	.284	1828
	(0.039)	(0.012)		
USA	2.274***	0.783***	0.145	2191
	(0.144)	(0.045)		

***denotes significance at the 10 percent level;**denotes significance at the 5 percent level; ***denotes significance at the 1 percent level**

Table 6. Implied Devaluation of Gold Standard Adopters: Assumed Probability of Devaluation

Country	10%	25%	50%	75%	90%
Argentina	42.50	17.00	8.50	5.67	4.72
Austria	20.80	8.32	4.16	2.77	2.31
Bulgaria	38.40	15.36	7.68	5.12	4.27
Chile	74.40	29.76	14.88	9.92	8.27
Denmark	14.70	5.88	2.94	1.96	1.63
Finland	15.40	6.16	3.08	2.05	1.71
Greece	23.20	9.28	4.64	3.09	2.58
India	25.20	10.08	5.04	3.36	2.80
Italy	15.60	6.24	3.12	2.08	1.73
Japan	45.30	18.12	9.06	6.04	5.03
Mexico	46.80	18.72	9.36	6.24	5.20
Norway	22.50	9.00	4.50	3.00	2.50
Rumania	24.10	9.64	4.82	3.21	2.68
Russia	27.00	10.80	5.40	3.60	3.00
Sweden	20.60	8.24	4.12	2.75	2.29
Switzerland	8.20	3.28	1.64	1.09	0.91
USA	20.10	8.04	4.02	2.68	2.23
Average	**28.52**	**11.41**	**5.70**	**3.08**	**3.17**

Table 7. Measuring the Currency Risk Premium

10-Year Windows

Country	Whole Period (1)	Pre-Gold (2)	On Gold (3)	Observations (5)
Argentina	1286.63	1465.26	1107.95	521
Austria	240.31	260.856	219.649	521
Brazil*	89.50	79.45	99.67	71
India	256.47	282.47	245.46	371
Italy*	89.27	124.19	60.54	111
Mexico	582.70	709.13	489.38	452
Russia	820.43	820.02	820.77	510
United States	102.02	95.46	108.57	521
Chile*	581.13	580.11	583.19	79
Country Average	**449.83**	**490.77**	**415.02**	

Note: * indicates monthly data.

Table 8. Implied Devaluations for Gold Standard Adopters

(Percent)

	Assumed Probability of Devaluation				
Country	10%	25%	50%	75%	90%
Argentina	110.8	55.4	22.2	14.8	12.3
Austria	12.6	6.3	2.5	1.7	1.4
Brazil	10.0	5.0	2.0	1.3	1.1
India	24.5	12.3	4.9	3.3	2.7
Italy	6.1	3.0	1.2	0.8	0.7
Mexico	48.9	24.5	9.8	6.5	5.4
Russia	81.3	40.6	16.3	10.8	9.0
United States	6.1	3.0	1.2	0.8	0.7
Chile	58.3	29.2	11.7	7.8	6.5
Average Size of Devaluation	**39.8**	**19.9**	**8.0**	**5.3**	**4.4**

Notes: Under the assumption of risk neutrality, the maximum implied devaluation is computed by dividing the average value of the currency risk premium in the five-year period after joining the gold standard by the assumed probability of a devaluation.

Table 9. Actual versus Expected Devaluation

Country	Actual Devaluation	Expected Devaluation
Argentina	122	55.4
Austria	0	6.3
Brazil	7	4.1
India	NA	12.3
Italy	8	3.0
Mexico	50	24.5
Russia	50	41.0
United States	0	5.4
Chile	28	29.0

Notes: See the text for calculations used for expected devaluations. For Argentina, actual devaluation is determined by the 1899 Law of Conversion that legally set the exchange rate between paper and gold pesos at 2.22 to one. The actual devaluation for Austria, Chile, Italy, Russia, and the United States is determined by the market exchange rate. The actual devaluation for Brazil and Mexico is determined by the change in the mint par ratio.

Figure 1

Currency Risk Premium

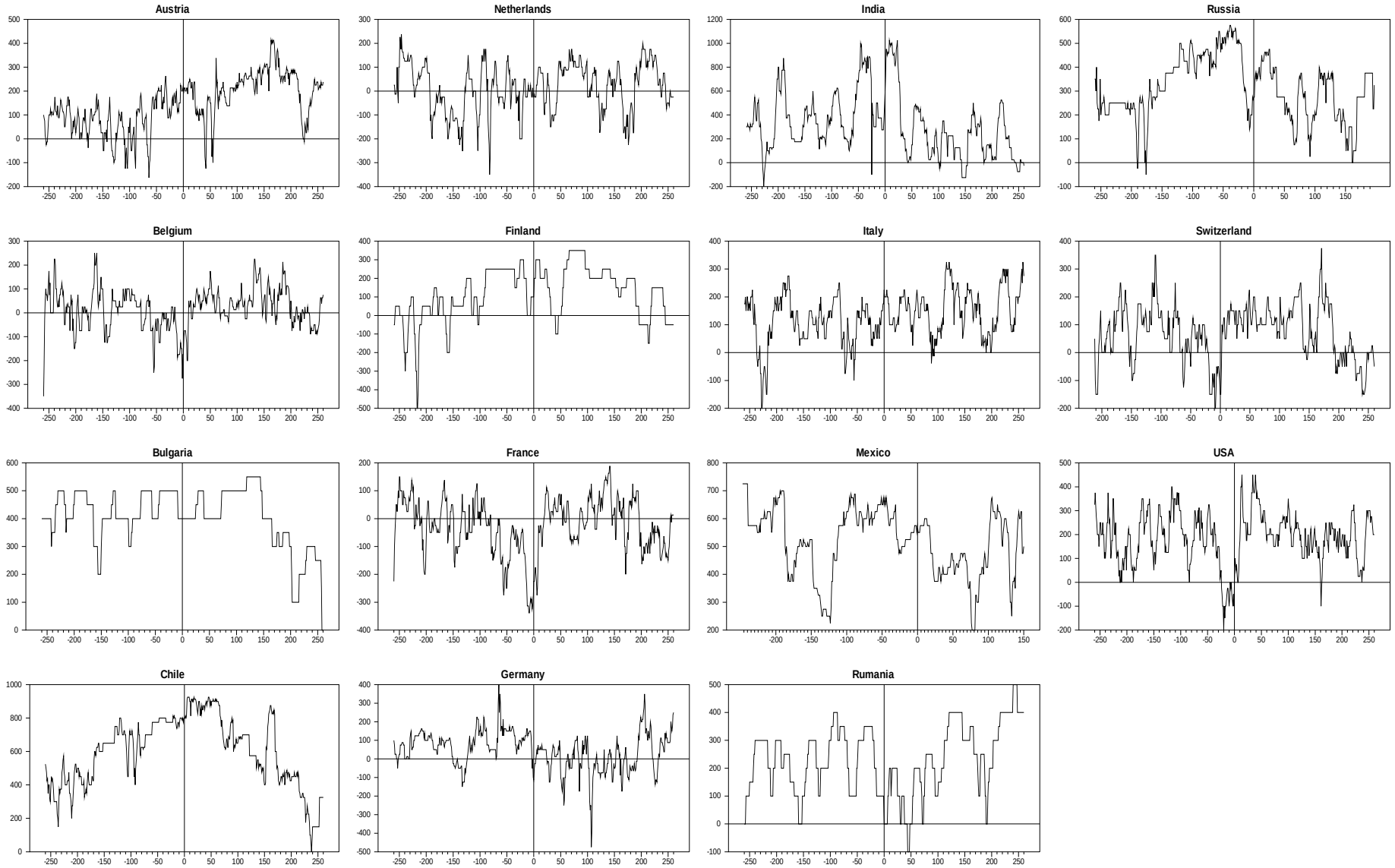


Figure 2

Currency Risk Premium

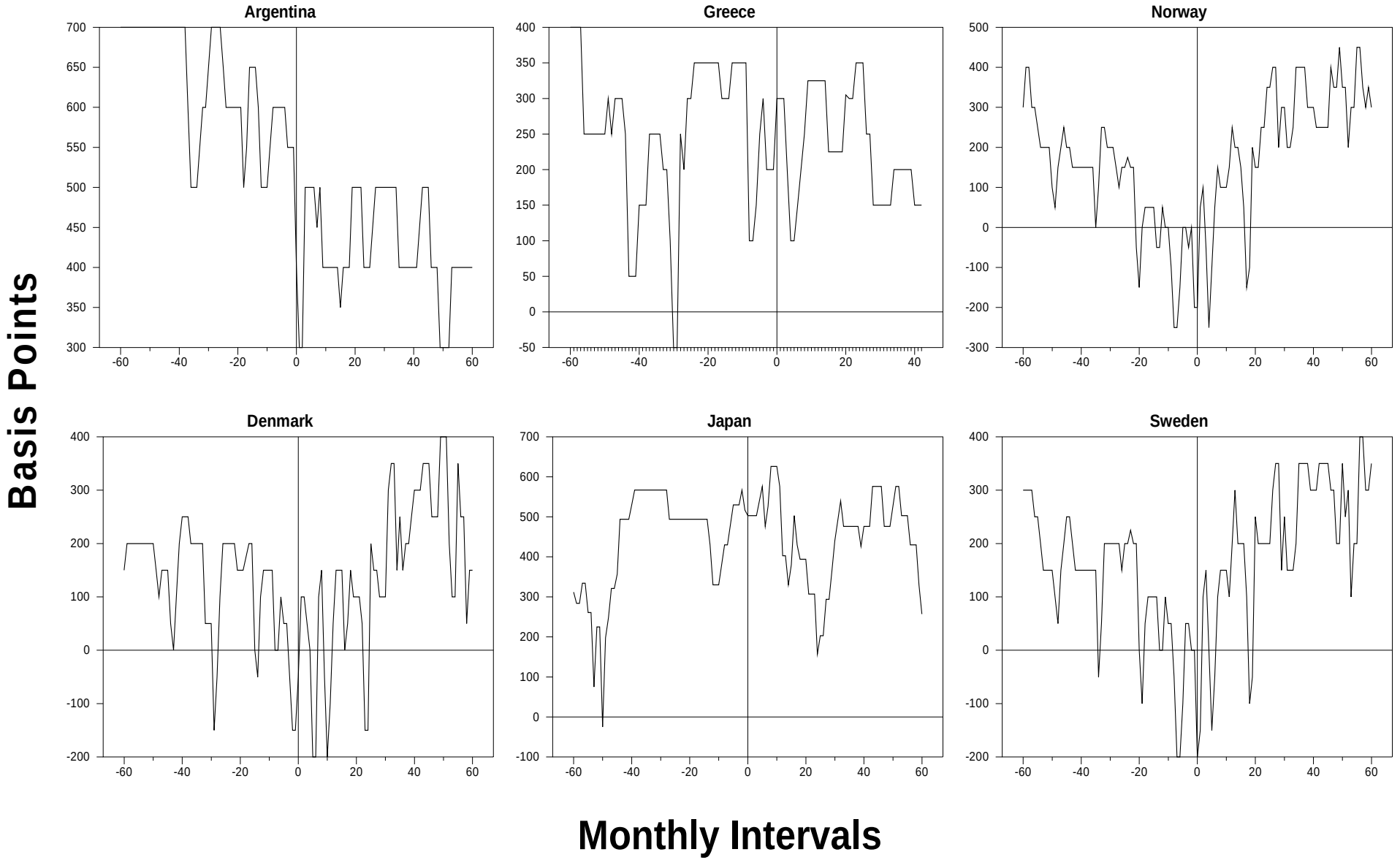


Figure 3

Currency Risk Premium

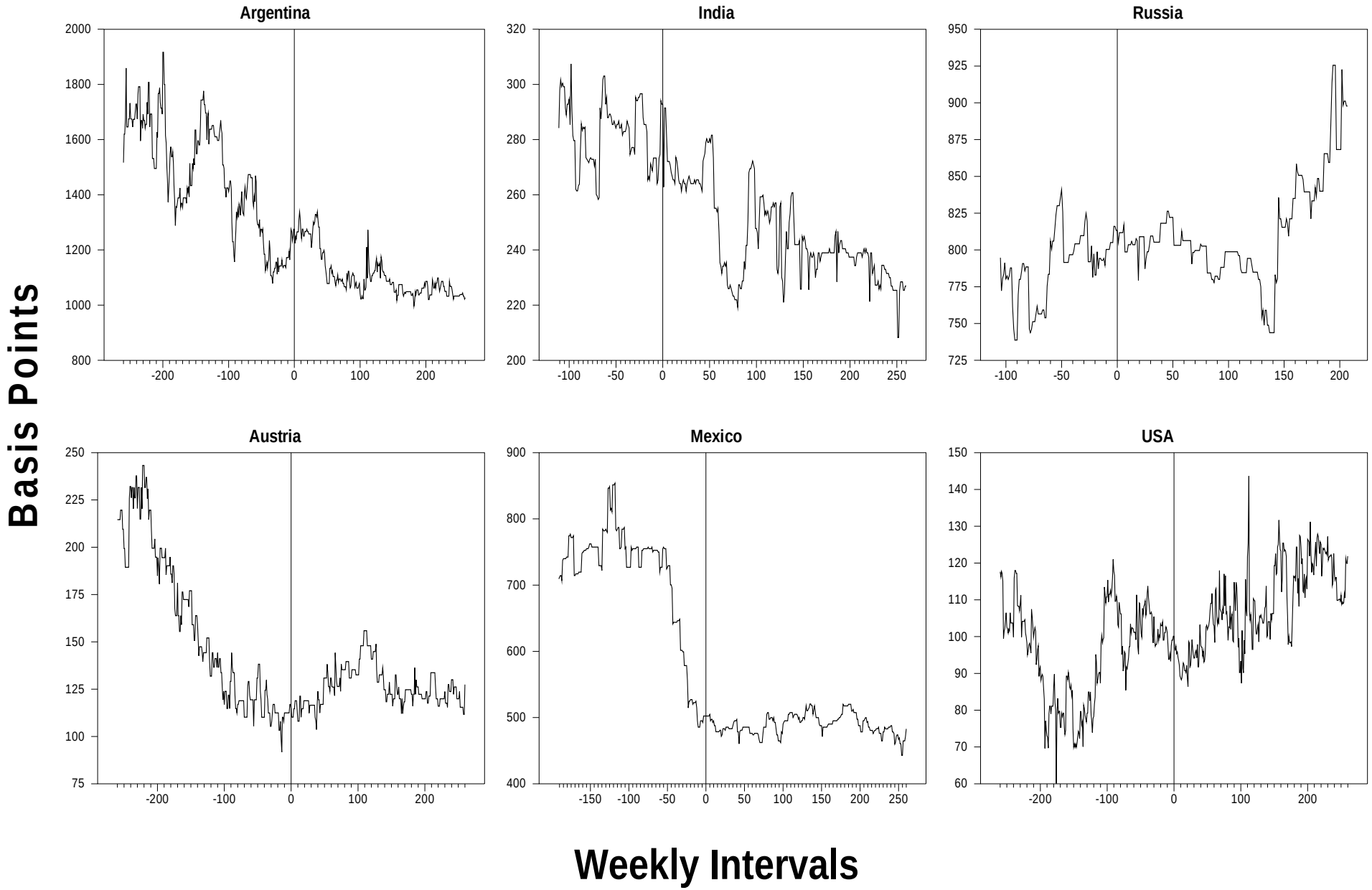
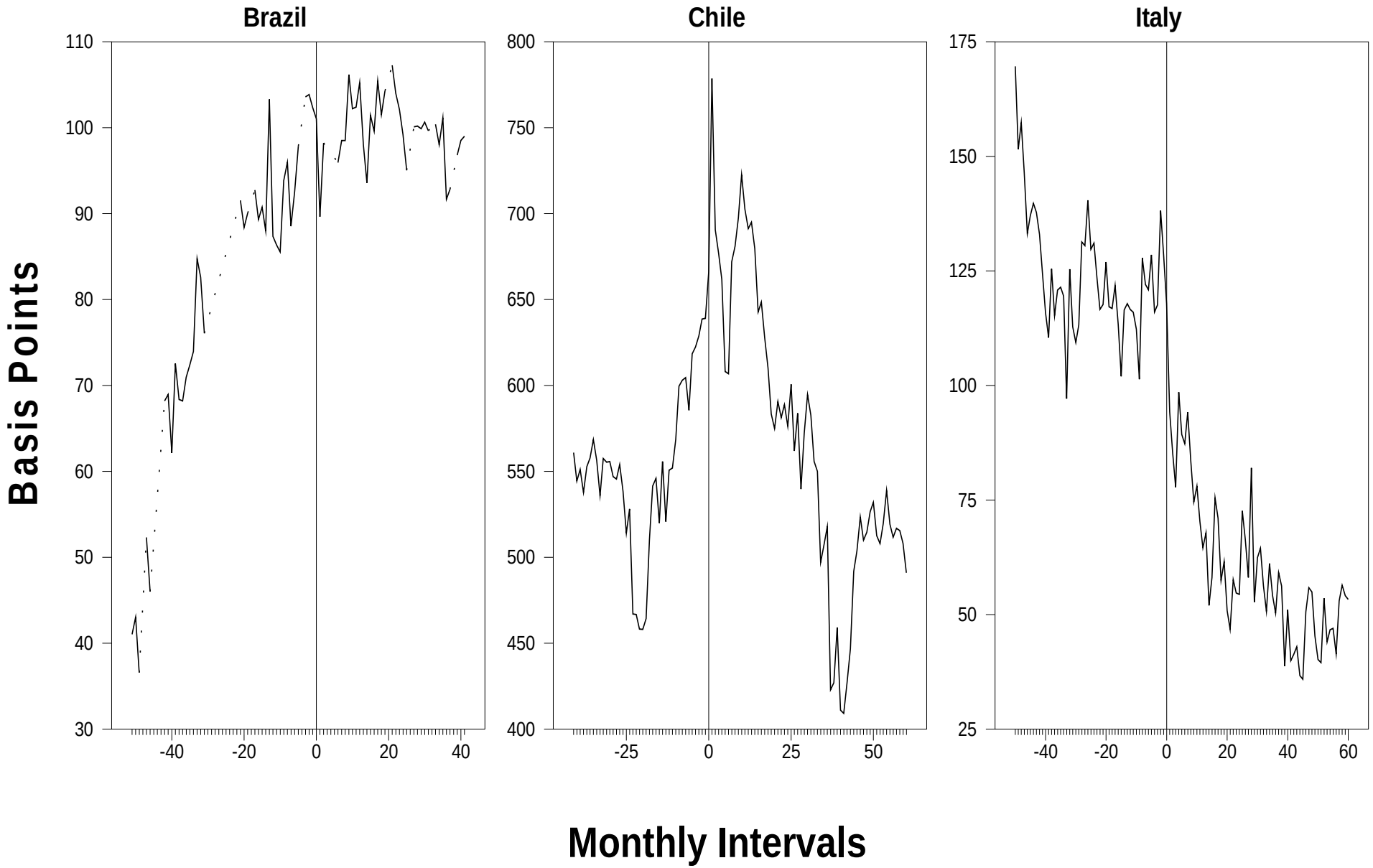


Figure 4

Currency Risk Premium



Appendix 1. Short-term Interest Rate Data from the Gold Standard Era

Country	Short-Term Interest Rate
Argentina	Bank Rate
Austria	Domestic trade bill
Belgium	Domestic trade bill
Bulgaria	Bank Rate
Chile	Bank Rate
Denmark	Domestic trade bill
Netherlands	Domestic trade bill
Finland	Bank Rate
France	Domestic trade bill
Germany	Domestic trade bill
Greece	Bank Rate
India	Bank Rate
Italy	Domestic trade bill
Japan	Bank Rate
Mexico	Commercial Paper
Norway	Bank Rate
Rumania	Bank Rate
Russia	Domestic trade bill
Sweden	Bank Rate
Switzerland	Domestic trade bill
United States	Commercial Paper

Sources: *Commercial and Financial Chronicle*, *Economist*, *Global Financial Data*, and *Manchester Guardian*.

Appendix 2. Gold Standard Adoption Dates and Source Information

Argentina – The Law of Conversion was passed on Oct. 31, 1899 restoring convertibility (della Paolera and Taylor, 2001, p. 120).

Austria – Joined the gold standard by laws passed August 2, 1892. (Mitchell, 1898).

Brazil – "Under an act which went into effect December 22, 1906, a conversion fund was established by means of import duties collected in gold." (Monetary Systems of the Principle Countries of the World, p.8).

Chile – A new conversion law of Feb. 11, 1895 set June 1, 1895 as the day for the redemption of notes. This continued until July of 1898. (Bordo and Kydland, 1995, p. 437-438).

France – Adopted the gold standard on Nov 5, 1878 (Pick and Sedillot, 1971, p. 587).

Greece – Adopted the gold standard on March 19, 1910 (Bordo and Kydland, 1995, p.439).

India – Scheme for adopting the gold standard published the week of May 7, 1898. (IMM, December, 1898)

Italy- On April 12, 1884, the country adopted the gold standard. By 1894, it was back on a paper standard (Fratianni and Spinelli, 1997, p. 439).

Mexico- The enabling act was passed on Dec. 9, 1904, authorizing the establishment of a gold standard. On March 25, 1905, a decree promulgated the new system. The law went into effect on May 1, 1905 (Kemmerer, 1944, p. 524).

Russia – The country adopted the gold standard January 3-15, 1897 (Pick and Sedillot, 1971, p. 488).

Sweden – The country signed a convention in December 1872 instituting the gold standard (Morys, 2007, p. 41).

United States – Resumed specie convertibility following the Civil War on January 1, 1879 (Kemmerer, 1916, p. 85).

Appendix 3. Paper and Gold Sovereign Bonds during the Classical Gold Standard, 1870-1913

Panel A. Long-Term Gold Bond Issues

Issue	Lottery Provision	Size of Issue (year)	Market for Gold Bond
Argentina: 4.5% due within 39 years after they were issued	Sinking fund of 1% applied by half-yearly lottery drawings in London.	£5 million (1900)	London and other Continental Bourses
Austria: 4% gold perpetuity bonds	No	£34 million (1900)	London and other Continental Bourses
Brazil: 5% Apolices (gold perpetuity bonds)	No	105 million Mx (1900)	Rio de Janiero and Sao Paolo
Chile: 4.5% sterling bonds	Lottery drawing when the bonds fall below par or by a sinking-fund provision at the rate of .5% per annum that can be changed by the government	£722,200 (1900)	London and other Continental Bourses
India: 3.5% sterling bonds redeemable on or after 1931	No	£63 million (1900)	London
Italy: 5% gold perpetuity bonds	No	£157 million (1890)	Paris
Russia: (1822) 5% perpetuity bonds	No	£4.5 million (1895)	London
Mexico: 5% external bonds redeemable by 1945	Cumulative sinking fund with lottery drawings of .62% per annum until 1909.	£22 million (1905)	Amsterdam
United States; 4.5% gold bonds due 1891; 4 percent gold bonds due 1907.	No	£50 million (1880)	New York

Sources and notes: *Economist*, *Commercial and Financial Chronicle*, and the *Investor's Monthly Manual*. Mx is an abbreviation for Milreis.

Panel B. Long Term Paper Bond Issues

Issue	Lottery Provision	Size of Issue(year)	Foreign Markets for Paper Bonds (primary domestic market)
Argentine 7% Cedulas 'B' Currency	Sinking fund of 1% applied by lottery drawings at par.	$9.58 million (1900)	London and other Continental Bourses
Austrian 5% Perpetuity	No	£177 million (1890)	London and other Continental Bourses
Brazil 5% Apolicies	No	Mx60 million (1900)	Rio de Janiero and Sao Paolo
Chilean 8% Bonos	No	151 million gold pesos (1900)	Valparaiso
Indian 3.5% Rupee	No	Rx13 million(1900)	London
Italian 5% Perpetuity	No	Half of all government debt is in paper bonds	No (Milan)
Mexican 5% Internal	Cumulative sinking-fund of .25% by means of half-yearly lottery drawings.	$59 million	London
Russian 6% Internal paper loan	No	38.5 million paper rubles (1895)	Amsterdam
United States 6%	No	$64 million (1879)	No (New York)

Sources and notes: *Investor's Monthly Manual*, *Official Stock Exchange Intelligence, and* Llona (1990). Rx stands for Rupee. Mx stands for milreis.

Appendix 4. Relative Bid-Ask Spreads of Sovereign Bonds during the Gold Standard

(Basis Points)

Country	Paper Bond	Gold Bond	Difference in Liquidity
Argentina	67	67	0
Austria	62	50	12
Brazil*	7	52	-45
Chile	N/A	61	N/A
India	88	24	64
Italy	N/A	N/A	N/A
Mexico	48	24	24
Russia	N/A	N/A	N/A
United States**	30	4	26
Average	50	40	13.5

Notes:

*Bid-Ask Spreads for the gold bond only available from October 1906 through June 1910.
**Bid-ask spreads for the first year that the United States was on the gold standard (*Commercial and Financial Chronicle*).