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Federal Reserve Bank of Chicago

Did Adhering to the Gold Standard Reduce the Cost of Capital?

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Did Adhering to the Gold Standard Reduce the Cost of Capital?

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Abstract: A commonly cited benefit of the pre-World War One gold standard is that it reduced the cost of international borrowing by signaling a country's commitment to financial probity. Using a newly constructed data set that consists of more than 55,000 monthly sovereign bond returns, we test if gold-standard adherence was negatively correlated with the cost of capital. Conditional on UK risk factors, we find no evidence that the bonds issued by countries off gold earned systematically higher excess returns than the bonds issued by countries on gold. Our results are robust to allowing betas to differ across bonds issued by countries off- and on-gold; to including proxies that capture the effect of fiscal, monetary, and trade shocks on the commitment to gold; and to controlling for the effect of membership in the British Empire.

Key words: Gold standard; sovereign borrowing costs; country risk premium.

JEL classifications: F33; G15; N23.

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The views expressed in the paper represent the authors' own and should not be attributed to Federal Reserve Bank of Chicago, The Federal Reserve System or the Bank of Canada.

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1. Introduction

The gold standard before 1914 is generally considered to be a prime example of an exchange rate regime's ability to confer credibility on a country's macroeconomic policy. The "good-housekeeping seal of approval" interpretation of the gold standard postulates that gold convertibility ensured that the government acted consistently over time, so that adherence to gold served as a signal of financial probity. According to this view, countries that always maintained convertibility or suspended it only during widely agreed-upon circumstances (such as war) should have been rewarded with lower borrowing costs.

Despite its sharp prediction, economists have reached conflicting conclusions about the effect of gold-standard adherence on sovereign borrowing costs. In their seminal study, Bordo and Rockoff (1996) compare the coupon yields (coupon-price ratios) of sovereign bonds issued by nine countries and find substantial cross-country variation in pre-World War One yields. They attribute the yield differences to differing commitment to gold. These findings are consistent with the country studies of Martin-Acena (1993) and Sussman and Yafeh (2000), and were confirmed in a larger cross-section of countries by Obstfeld and Taylor (2003). The reduction in borrowing costs associated with adhering to gold is estimated to be about 30-40 basis points per year (Bordo and Rockoff 1996; and Obstfeld and Taylor 2003)

On the other hand, Ferguson and Schularick (2006) find no evidence that the capital market rewarded gold-standard adherence and conclude that membership in the British Empire was key to reducing borrowing costs. Clemens and Williamson (2004) examine capital flows rather than bond yields and present evidence that gold-standard adherence was only marginally important compared to fundamental determinants of capital productivity. Flandreau and Zumer (2004) conclude that adhering to the gold standard had a negligible influence on coupon yields, conditional on other covariates intended to capture the effect of fiscal and monetary policy on sovereign borrowing costs. They argue that international lenders focused on variables that forecast a country's ability to repay its external debt and that these forecasts assigned little weight to the exchange-rate regime. Mitchener and Weidenmier (2009) compare within-country coupon yields of bonds with and without gold clauses and conclude that the international capital market placed little weight on gold-standard adherence.

The crux of the empirical disagreement can be traced to differences in the available data. In contrast to today, sovereign borrowers during the gold-standard era issued debt with different maturities and at infrequent intervals. As a result, a typical 19th century sovereign borrower had only a handful of maturities trading at any given time, making it impossible to compare a cross-section of bonds with matched maturities. To complicate matters further, most countries issued bonds with stochastic maturity schedules that make it impossible to compute yield-to-maturity and prevent direct comparisons of yields across countries.

Data limitations have forced past researchers to infer borrowing costs by comparing the coupon yield of bonds at different points of the yield curve. Typically, a single representative bond is chosen for each country based on availability, liquidity, or the amount outstanding. The coupon yield is observed for as long as possible, after which another representative bond is chosen. Because bonds with the same (unobserved) discount rate can have very different coupon yields attributable to differences in time to maturity or coupon amounts, there is no guarantee that the observed differences in the coupon yield of bonds with different maturities actually are due to differences in the exchange-rate regime rather than the term structure of the borrower's external debt. In light of these challenges, it is not surprising that authors using different representative bonds have arrived at conflicting conclusions.

Because it is unlikely that a consensus can be reached with the existing data, we propose a test of the good-housekeeping hypothesis based on a new and much larger sample of realized holding-period returns. With over 55,000 bond returns, the size of our new data set represents an almost 40-fold increase in the cross-section of available bond prices.¹ Our data set consists of every regularly quoted sovereign bond from the official quotation list of the London Stock Exchange between 1870 and 1907. We avoid the difficulty of inferring discount rates from the coupon yield of bonds with different times to maturity by collecting monthly price data and calculating realized holding-period returns. Using holding-period returns is a new way to measure the cost of capital in tests of the good-housekeeping hypothesis, but it is very

¹ To our knowledge, the two largest previous samples of 19th century sovereign bond prices are the data sets available from Global Financial Data (GFD) used by Obstfeld and Taylor (2003) and the one constructed by Ferguson and Schularick (2006). GFD contains 892 annual observations while Ferguson and Schularick's data set contains 1461 annual observations.

common in asset-pricing tests that try to account for cross-sectional differences in expected bond returns to ex-ante observable characteristics.

We find that adherence to the gold standard did not reduce the cost of capital. Across a variety of specifications and samples, there is no systematic link between a country adhering to gold and the risk-adjusted return of its sovereign debt. Conditional on British risk factors, the returns of bonds issued by countries on and off gold are statistically indistinguishable from one another. We also examine almost 20,000 bond returns from countries that switch their exchange rate regime and do not find systematic differences in the sensitivity of the returns to pervasive risk factors across regimes. Our findings cast doubt upon the good-housekeeping hypothesis and support the conclusion reached by Flandreau and Zumer (2004) that gold-standard adherence did not have an economically important effect on the cost of capital.

Section 2 discusses the logic of the gold standard as a repeated game. Section 3 examines the close parallels between tests of the good-housekeeping hypothesis and asset-pricing tests designed to detect differences in mean returns across securities. Section 4 describes the empirical specification, methods, and data we use to test the good-housekeeping hypothesis. Section 5 reports the results and a set of robustness tests.

2. The Gold Standard as a Repeated Game

Bordo and Kydland (1995) model the gold standard as a credible commitment mechanism that evolved to overcome the time-inconsistency problem associated with international borrowing. Borrowers and lenders in the international capital market play a repeated game in which the government chooses a mix of borrowing, taxation, and inflation to minimize the deadweight loss for a given level of revenue. The government's ability to print money and inflate away the nominal value of external debt creates an incentive problem when it only cares about the welfare of its residents (Bohn 1991). Foreign lenders recognize the distorted incentives of the borrowing country and are unwilling to lend funds without a credible commitment that the government will repay the real value of its debt.

In the repeated game, a government can overcome the time-inconsistency problem by adopting an easy-to-monitor policy that prevents it from devaluing its currency. The good-

housekeeping hypothesis postulates that adherence to gold served as such a mechanism. The gold-standard equilibrium strategy consists of the government committing to currency stability by standing ready to convert local currency into gold on demand. In response, the international bond market rewards the government that ties its currency to gold with a low cost of capital. The empirical implication of the good-housekeeping hypothesis is that the international capital market assigned a lower price, and demanded commensurately higher expected returns, to bonds issued by countries that did not adhere to the gold standard.

The “good-housekeeping” repeated game equilibrium relies on the capital market collectively forgoing current expected profits to punish governments that left gold. For example, if two different countries issue bonds with identical expected cash flows, the equilibrium punishment strategy requires investors to assign different prices if the countries have differing commitments to gold. Assigning different prices to the same expected cash flow creates a statistical arbitrage opportunity. Therefore, the repeated game equilibrium requires a collective action mechanism to prevent arbitrage-seeking investors from pushing the prices of otherwise identical off- and on-gold bonds together. Large institutional investors who were both sufficiently patient to play the punishment strategy and large enough to influence equilibrium prices, such as the Council of Foreign Bondholders and investment banks who underwrote bond issues, were good candidates to punish countries that abandoned the gold standard. The available archival evidence suggests that the Council was effective at both organizing lenders when borrowers defaulted and renegotiating with large borrowers like Argentina, Brazil, and Turkey (Mauro and Yafeh 2003). The test of the hypothesis that off-gold bonds earned higher risk-adjusted returns than on-gold bonds is a direct empirical test of whether these organizations were sufficiently powerful to punish cheaters.

3. Testing the Good-Housekeeping Hypothesis

The theory proposed by Bordo and Kydland makes a clear prediction: Countries were rewarded with a low discount rate if they maintain gold convertibility. But bond discount rates vary for reasons other than a country’s gold-standard adherence, and any test of the hypothesis needs to control for other determinants of a country’s risk premium. Traditional tests of the good-

housekeeping hypothesis compare the coupon yield of bonds off- and on-gold controlling for other risk factors by estimating regressions that are very similar to asset-pricing tests designed to detect cross-sectional differences in returns, conditional on other pervasive risk factors. Indeed, Bordo and Rockoff write that their empirical specification of the good-housekeeping hypothesis is “inspired by the capital asset pricing model” (Bordo and Rockoff 1996). The empirical specifications of selected tests of the good-housekeeping hypothesis are reproduced in Table 1.

All of these tests examine the effect of gold-standard adherence on risk-adjusted return by formally testing for a shift in the intercept ($\delta < 0$) of a model that controls for other determinants of the sovereign risk premium. The regression tests are formulated to detect a common difference in the mean risk-adjusted coupon yield between on- and off-gold countries.

The specifications listed in Table 1 are very similar to factor model-based asset pricing tests that cross-sectional variation in ex-ante observable characteristics generates differences in mean excess returns.² Both control for risk using factor models and test if an observable characteristic affects risk-adjusted return by examining cross-sectional differences in portfolio intercepts. Traditional tests of the good-housekeeping hypothesis and factor model based tests are thus fully consistent with each another.

Holding-period returns are a natural way to measuring borrowing costs when the number of bonds is too small to identify the yield curve or compare coupon yields at matched maturities. Like coupon-yield, holding-period returns are correlated with the unobservable discount rate and can be used to infer differences in expected returns (Campbell 1995). Unlike coupon-yield, holding-period returns include both the expected coupon yield and the expected capital gain. Many sovereign bonds during the late 19th century traded well above or below par, and rational investors surely expected capital losses or gains when purchasing these bonds. Returns take account of these expected changes.

² For example, Cornell and Green (1991), Fama and French (1993) and Elton et al. (1995)

4. Empirical Methods

We use the holding-period returns of value-weighted country portfolios to account for both maturity mismatch and embedded options. For each country, we compute the holding-period return on the value-weighted portfolio of bonds outstanding. If country i has J bonds outstanding at time t , the return of country i 's portfolio is

$$(1) \quad R_{it} = \sum_{j=1}^J w_{ijt} \times R_{ijt}$$

where w_{ijt} is the market-value weight of bond j in country i at time t ; $R_{ijt} = (P_{ijt} + C_{ijt})/P_{ijt-1}$ is the gross holding-period return of bond j in country i ; P_{ijt} is the price of the bond at time t ; and C_{ijt} is the coupon payment (if any) between time $t-1$ and time t . The return and amount outstanding of all of the bonds is directly observable, as is whether a bond is called and redeemed at par (or any other value).

We focus on holding-period returns rather than coupon yield because returns account for maturity mismatch caused by both differences in maturity and embedded options. Many sovereign bonds contained stochastic maturities due to clauses, such as redemption options that gave the borrower the right to repay the bond at par between pre-specified dates; sinking funds that committed the borrower to redeem annually a fixed portion of the debt outstanding; or lotteries in which the issuer contracted to redeem a fixed portion of the original issue at par via annual drawings. If two countries had bonds that matured at different dates, differences in observed coupon-yield could be due to observing different points on identical yield curves (term structures) rather than actual differences in yield curves. If the bond also has a stochastic maturity date, the measurement error becomes more acute.

The existence of embedded options biases the coupon-yield measures common in the good-housekeeping literature. These options create what Flandreau and Zumer (2004) call "conversion risk". Flandreau and Zumer (2004) control for conversion risk by carefully selecting bonds with coupon rates such that their conversion option that are likely to be far out-of-the-money. This strategy minimizes the measurement error problem, but, at least with our London

sample, comes at the cost of having to exclude many countries that only have bonds where the option is in or close to in-the-money.

Pre-payment risk is rare in modern-day sovereign bond markets, but quite common in the markets for mortgage backed securities, real-estate investment trusts, and corporate bonds. Studies that examine the returns of these securities face exactly the same problem that we face in our test of the good-housekeeping hypothesis: Does an observable trait explain differences in expected return? The use of holding-period returns and factor models of the type that inspired Bordo and Rockoff 's specification are commonly used to measure differences in risk adjusted returns across bond portfolios with different maturities and embedded options.³ Thus, using holding-period returns to measure sovereign borrowing costs facilitates the comparison of bonds with different, possibly stochastic, maturities and takes account of expected capital gains and losses.

4.1. Leveraged Portfolios

We test the hypothesis that expected returns differ across exchange-rate regime by forming a leveraged portfolio that mimics the return associated with purchasing all bonds issued by countries off gold and selling short all bonds issued by countries on gold.⁴ At the beginning of each holding period, all bonds are assigned either to an on-gold or off-gold portfolio. If a country adopts the gold standard, we remove that country's bonds from the off-gold portfolio and add it to the on-gold portfolio at the beginning of the next holding period, and vice versa. If the good-housekeeping hypothesis is true, the leveraged portfolio should earn a positive risk-adjusted return.

We use contemporary and modern sources to date each country's gold-standard adherence. A detailed list of the sources is reported in Appendix 2. In cases where it is difficult to determine de jure versus de facto adherence to the gold standard, we code the country as

³ Bond factor models in the spirit of Fama and French (1993) and Elton et al. (1995) typically include market, term structure, and default factors similar to our stock market (market), Consol (term structure) and corporate bond (default) factors. These models are often used to test for differences in the risk-adjusted return (alpha) of bond portfolios that have different maturities and embedded options.

⁴ To be clear, we formulate the test in this way not because we think a 19th century investor formed a leveraged portfolio of sovereign bonds based on gold-standard adherence but because doing so allows us to test for a difference in mean returns across the two exchange-rate regimes.

adhering to gold from the de jure convertibility date. In many cases, we are able to date gold-standard adherence quite precisely, identifying the month and sometimes even the day on which a country adopted or abandoned convertibility. In the cases where we can only identify the year in which a country adopted the gold standard, we date gold-standard adherence from January 1 of that year.

It is important to stress that because of how we date gold-standard adherence, our benchmark regressions are biased toward finding evidence in favor of the good-housekeeping hypothesis. The London capital market may have anticipated switches in gold-standard adherence and repriced bonds in response to the change in expectations. If the good housekeeping hypothesis is true, the bonds issued by countries off gold that switch to being on gold experience a capital gain as the market reprices their bonds at a lower discount rate. If the market anticipates the switch from off to on, the returns of the off gold portfolio are high even before the date of official convertibility. Similarly, the bonds issued by countries on gold that switch off experience a capital loss as the market reprices their bonds at a higher discount rate. Again, if the market anticipates such a switch, the returns of the on-gold portfolio are low even before the country official abandons convertibility. Thus, the returns of the off-gold portfolio are biased upward because of our dating procedure while the returns of the on-gold portfolio are biased downward. The two effects bias the returns of the leveraged portfolio upward. By sorting bonds into off- and on-gold portfolios and using this dating procedure, we extend the good-housekeeping hypothesis every advantage in the empirical test.⁵

4.2. Empirical Specification

We form a leveraged portfolio by computing the returns of a portfolio that is long in the bonds issued by countries off gold and short in the bonds issued by countries on gold. If the two portfolios were equally risky and the market punished bonds issued by countries off gold, this strategy would have generated positive excess returns.

⁵ In an early draft, we controlled for anticipation effects by forming perfect-foresight portfolios. We assigned bonds to the off- and on-gold portfolios up to two years before the actual change in status occurred. Our conclusion that gold-standard adherence did not affect sovereign borrowing costs is robust to this alternative coding scheme. These results are available upon request.

The key words are “equally risky”. Investors during the late 19th century almost surely demanded compensation for risks beyond those embodied in gold-standard adherence. If exposure to other risk factors differed across portfolios, differences in realized return may be due to exposure to the other risks and not exclusively due to differences in gold-standard adherence.

We control for risk with a factor pricing model that compares the return of a test portfolio to that of a similarly risky portfolio of British financial assets. We estimate the regression

$$(2) \quad R_{it} - R_{ft} = \alpha_i + \beta_1(R_{con,t} - R_{ft}) + \beta_2(R_{SM,t} - R_{ft}) + \beta_3(R_{BM,t} - R_{ft}) + \varepsilon_t$$

where R_{it} is the time t return of portfolio i ; $R_{con,t}$ is the time t return on the UK government consol; $R_{SM,t}$ is the return on the value-weighted portfolio of all British equities at time t ; and $R_{BM,t}$ is the value-weighted portfolio of UK corporate bonds. We use the London banker’s bill rate as a proxy for the risk-free rate R_{ft} .

α_i is called Jensen’s alpha after Jensen (1967), who proposed using it to measure a portfolio’s return controlling for risk. Alpha measures the difference between portfolio i ’s return and the return of the portfolio of British securities with percentage weights β_1 invested in the UK government consol, β_2 invested in the value-weighted UK stock market portfolio, β_3 invested in the value-weighted British bond market portfolio and $1 - \beta_1 - \beta_2 - \beta_3$ invested in the London banker’s bill.

We estimate the excess return of the leveraged portfolio with the regression equation:

$$(3) \quad R_{off,t} - R_{on,t} = \alpha + \tilde{\beta}_1(R_{con,t} - R_{ft}) + \tilde{\beta}_2(R_{SM,t} - R_{ft}) + \tilde{\beta}_3(R_{BM,t} - R_{ft}) + \varepsilon_t$$

where $\tilde{\beta}_k = \tilde{\beta}_{off,k} - \tilde{\beta}_{on,k}$ by construction. The betas of the leveraged portfolio in equation (3) are equal to the difference in the sensitivities of the off-gold and on-gold portfolios to fluctuations in the UK risk factors. A test of the good-housekeeping hypothesis amounts to the test that alpha is greater than zero.

An advantage of this test is that it addresses the problem that countries did not leave gold randomly. If a country wanted to remain on gold but was forced off due to a negative business-cycle shock, we need to distinguish between excess returns due to exposure to business-cycle risk and the repeated game punishment. If business-cycle shocks are correlated across countries, UK investors could have legitimately demand higher expected returns as compensation for bearing greater business-cycle risk. In this case, the good-housekeeping hypothesis could be false but the returns of the bonds issued by countries on gold would be lower because they were less exposed to British business-cycle risk. By comparing foreign returns to this control group of similarly risky UK securities, we disentangle the two effects and can test if investors demanded a premium due to gold-standard adherence or business-cycle risk.

4.3. Data

These methods necessarily require monthly return data from a large cross-section of sovereign bonds. We collect a sample of sovereign and colonial bonds trading on the London Stock Exchange between 1870 and 1907. Our data set consists of the bid and ask prices and coupon payments for every foreign government bond regularly quoted on the Exchange. The data represent a broad cross-section of bonds issued by countries both on and off gold (Figure 1). The prices are sampled every 28-days from the official Friday quotation list published in the *Money Market Review* and the *Economist*.⁶ We use the price and coupon data to compute a time series of 28-day holding-period returns corrected for sovereign defaults.⁷ Appendix 1 contains more information about the underlying data.

4.4. Sample of Countries

In addition to the challenges associated with consistently measuring the sovereign cost of capital during the late 19th century, a possible explanation for the lack of consensus among

⁶ The holding period is 28-days because our sources published the London Stock Exchange published official bid and ask prices every Friday. We sampled them every 4 weeks.

⁷ We use the Council of Foreign Bondholders, Winkler (1933), Suter (1990), and default data provided by Obstfeld and Taylor (2003) to date periods of default.

previous tests of the good-housekeeping hypothesis is that each study uses a different sample. Since our sample of countries spans those considered in previous studies, we can examine the effect of varying sample countries. We conduct our tests on our full sample of countries as well as on subsamples corresponding to those used in Bordo and Rockoff (1996), Bordo and Schwartz (1999), Obstfeld and Taylor (2003), and Flandreau and Zumer (2004). The countries in these subsamples are listed in Appendix 2.

4.5. Country Weights

It is also important to guard against the possibility that our conclusions are driven by outliers. Some countries have much larger bond issues than others and any conclusions should be robust to our weighting scheme. To address this problem, we form both value-weighted and equally weighted portfolios. The value-weighted portfolio weights each bond by its market value. For example, if the market value of all Argentine bonds is ten times that of Danish bonds, the returns of Argentine bonds receive ten times the weight of returns of Danish bonds in the value-weighted portfolio. Thus, weighting returns by the market value of the debt outstanding weights large bonds issues more heavily. The equally weighted portfolio examines if large borrowers drive our conclusions; it consists of individual country portfolios.⁸ If there are N countries in the sample, the return of each country portfolio receives a weight of $1/N$. This weighting scheme minimizes the effect of the returns of bonds issued by large borrowers.

5. Empirical Results

Table 2 reports the individual regression results for the off- and on-gold value- and equally weighted portfolios. It also reports the regression results for the leveraged portfolio in equation (3) that is long the off-gold portfolio and short the on-gold portfolio. The table shows that the British factor model does well in accounting for the variation in off- and on-gold portfolio returns. The adjusted R-squared statistics are respectable for monthly data – between 10-20%. When one forms the leveraged portfolio by taking the difference between the off- and on-gold portfolios, the R-squared statistics are low, which suggests that the returns from the leveraged

⁸ Each country portfolio is itself value-weighted.

portfolio are approximately white noise. This finding is what one expects under the null hypothesis that the gold standard was not a determinant of sovereign borrowing costs. Sorting bonds into off- and on-gold portfolios should not generate systematically higher returns, after controlling for the UK market factors.

Unconditionally, the difference between the mean return of off-gold and on-gold bonds was 1.4-1.6% per year, depending on the weighting scheme. This evidence seems to suggest the presence of a gold premium: Off-gold bonds paid higher returns to induce investors to hold them because they were perceived to be riskier. But projecting the returns on the market factors shows that the difference in risk-adjusted returns, measured by the alphas, are economically small, statistically insignificant, and has the sign opposite to that predicted by the good-housekeeping hypothesis.

The betas obtained from the leveraged portfolio indicate that the off-gold bond portfolio is more sensitive to fluctuations in the UK government consol index and the British corporate bond index. This evidence indicates that the higher unconditional mean return of the off-gold portfolio compared to the on-gold portfolio is attributable to the portfolio's greater exposure to the risk associated with fluctuations in the UK risk factors. Thus, going long on bonds issued by countries off gold and shorting bonds issued by countries on gold would have generated positive returns, but the excess returns represented compensation for bearing more risk associated with fluctuations in the UK market factors rather failing to adhere to the gold standard.

To examine the sensitivity of this conclusion to changing the sample, Table 3 reports the regression results for leveraged off-gold minus on-gold portfolios using different subsamples of countries. Depending on the sample, sovereign off-gold bonds generated an average return between 1.6-2.5% higher per year than the return generated by bonds on gold. Again, the excess return is primarily attributable to differences in exposure to business-cycle risk rather than market punishment for not adhering to gold. Once we control for market risk by comparing the leveraged portfolios to similarly risky British securities, the excess returns vanish. The alphas of the leveraged portfolios decrease in size and, in all cases, are not statistically different from zero. In two out of the five country samples, the sign of the alphas

contradict the empirical implication of the good-housekeeping hypothesis in that the alphas are negative. In both the full sample and the Obstfeld-Taylor sample, off-gold bonds earned smaller risk-adjusted returns than on-gold bonds.

The betas in Panel A are positive, with only one exception. In general, the off-gold portfolio is more sensitive to movements in the returns of UK government consol, stock, and corporate bond indices than the on-gold portfolios, suggesting that the higher unconditional returns associated with holding the off-gold bonds were compensation for bearing risk. UK investors demanded a premium to bear this additional risk, but it did not reflect punishment for abandoning gold. That the alphas are close to zero implies that a portfolio of British shares and bonds with the same exposure to the UK indices would generate statistically identical returns. Because the UK securities were not being punished for violating the rules of the gold standard, the average excess return is compensation for bearing business-cycle risk.

The alphas reported in Table 3 indicate that portfolios selected based on gold-standard adherence do not outperform portfolios of UK securities with the same exposure to business-cycle risk. However, a test that alpha equals zero is a joint test of the good-housekeeping hypothesis and the risk and return model implied by the excess return regression. To be certain that the small alphas are not due to model misspecification, we compare the alphas of the leveraged portfolios to the alpha based on selecting bonds randomly.

Expected alpha will equal zero if the British portfolios do a good job of capturing consumption risk. But if the model is misspecified, the expected alpha of a random portfolio will be different from zero. Our concern is a misspecified model in which a random portfolio would have negative alpha. In that case, the portfolio selected using gold-standard adherence could have an alpha statistically indistinguishable from zero and yet still significantly outperform randomly selected portfolios. This finding would cast doubt on the null hypothesis that gold-standard adherence does not matter for sovereign borrowing costs.

To address this possibility, we compare the returns generated by the leveraged gold portfolio to portfolios selected at random. For each subsample in Table 3, we compute excess return portfolios by randomly assigning the same sample of securities to one of two portfolios. Bonds are assigned in the same proportion as the proportion of gold-standard adherence. We

compute 1000 random portfolios and report the proportion of times the portfolio selected using the gold standard criterion earns a higher excess return than a portfolio selected at random.

For example, in the value-weighted Bordo-Rockoff sample of sovereign bonds, 56% of the observed returns were returns of bonds on the gold-standard. We compute an excess return portfolio from the same sample of countries by randomly buying 44% of the bonds each period and shorting the other 56%. We then calculate the random portfolio's alpha and compare it to the alpha of the gold-sorted portfolio. We repeat the random selection 1000 times. The result is 1000 sample alphas corresponding to the risk-adjusted return of 1000 randomly selected portfolios. By comparing the number of times that the leveraged portfolio generated positive excess returns with the number of times that a randomly selected portfolio generated positive excess return, we are able to see whether sorting bonds by gold-standard adherence results in higher returns than one would expect from sorting bonds into portfolios randomly.

Table 3 reports the proportion of times the leveraged gold-sorted portfolios beat portfolios formed at random, or what we call the "success rate". The results are consistent with the conclusion that gold-standard adherence did not matter for the excess returns of sovereign bonds. In the full sample, sorting sovereign bonds into value-weighted portfolios based on gold would have earned greater excess returns than sorting bonds randomly only 24.1% of the time. Although the success rate exceeds 50% for the Bordo-Rockoff and Flandreau-Zumer samples, it is less than 50% for the Obstfeld-Taylor sample. The Obstfeld-Taylor sample contains more countries than the Bordo-Rockoff and Flandreau-Zumer samples but fewer than are contained in the full sample, indicating that some of the disagreement about the effect of gold on borrowing costs may be attributable to the set of countries being studied. Overall, portfolios selected by gold-standard adherence do no better than portfolios selected at random.

Taken together, these pieces of evidence all point in the same direction. Differences in bond returns represented compensation for exposure to British risk factors and did not reflect a gold premium.

5.1. Robustness Check: Gold-Standard Adherence and Betas

Differences between the returns of bonds issued by countries on gold and those issued by countries off gold appear to be explained by differences in their betas. The finding that the betas differ with gold-standard adherence is not new. For example, Bordo and Rockoff (1996) and Obstfeld and Taylor (2003) both observe that the countries' market betas appear to vary with gold-standard adherence. Neither set of authors formally tests for differences in the betas by allowing them to vary with gold-standard adherence, but both point out that countries on gold tend to have smaller betas than those off gold over their respective samples.⁹ Thus, it is possible that gold-standard adherence and the betas are correlated with one another. In that case, adhering to gold could reduce the cost of capital by reducing the beta of a country's bonds. The international capital market may have viewed bonds issued by countries on gold as less sensitive to business-cycle risk than those issued by countries off gold, so that a country could lower its cost of capital by adhering to gold.

To examine this possibility, we estimate the equation for the subset of our individual bonds that change their gold status:

(4)

$$R_{it} - R_{ft} = \alpha_i + \beta_1(R_{con,t} - R_{ft}) + \beta_2(R_{SM,t} - R_{ft}) + \beta_3(R_{BM,t} - R_{ft}) + \delta_1(R_{con,t} - R_{ft}) \\ \times GS_{it} + \delta_2(R_{SM,t} - R_{ft}) \times GS_{it} + \delta_3(R_{BM,t} - R_{ft}) \times GS_{it} + \varepsilon_{it}$$

where all of the variables are defined as before; and GS_{it} is an interaction dummy variable equal to 1 if the issuing country is on gold at time t . The regression produces three interaction coefficients equal to the difference between the beta on gold and the beta off gold.

To ensure that differences in the three betas are identified, we need a set of countries whose bonds trade while the issuing country is both on and off gold. Our data set contains 86 such bonds. We estimate 86 separate time series regressions which result in 258 ($= 3 \times 86$) interaction coefficients. Figure 2 shows the histogram of the t -statistics from the interaction

⁹ In addition, Ferguson and Schularick (2006) find that differences in mean coupon yields between Empire and non-Empire bonds disappear when they control for market risk and that the betas of Empire bonds are smaller than the betas of non-Empire bonds.

coefficients. The distribution of interaction coefficients is symmetric and centered on zero. 15 of the 258 (5.8%) are statistically different from zero at the 5% significance level and 22 (8.5%) at the 10% significance level. Using the Simes (1986) modified Bonferroni test, we cannot reject the joint null hypothesis that all interaction coefficient are jointly equal to zero. While the difference in returns between the off- and on-gold portfolios can be explained by differences in the betas, the differences in betas do not appear to be attributable to gold-standard adherence. The result is what one would expect if gold-standard adherence had no effect on the cost of capital.

5.2. Sensitivity Analysis

5.2.1. Fiscal, Monetary, and Trade Controls

Gold-standard adherence may act as a proxy for following prudent fiscal and monetary policies, as proposed by Flandreau and Zumer (2004). It is therefore important to test if gold reduces sovereign borrowing costs, conditional on covariates that capture the risks associated with weak fiscal and monetary policies. In addition, other studies of the good-housekeeping hypothesis have included macroeconomic controls like the lagged inflation rate and the deficit-GDP ratio to detect deviations from the commitment to gold (Bordo and Rockoff 1996; and Obstfeld and Taylor 2003). Including covariates to capture these risks in the factor model also facilitates comparison with these other studies.

We control for fiscal, monetary, and trade shocks by forming factor-mimicking portfolios using data on the deficit-GDP ratio, annual inflation, and the export-GDP ratio that are available for 22 countries.¹⁰ Columns 1-3 in Table 4 show that including the factor-mimicking portfolios has no effect on the conclusions. The off-gold minus on-gold portfolio alpha remains indistinguishable from zero.

¹⁰ Fama and French (1995) and Daniel and Titman (1997) use an identical procedure to evaluate the effect of size and value characteristics on equity returns. We form the factor-mimicking portfolios in the following way. First, at the beginning of each year we sort countries into three mutually exclusive categories (high, medium, and low) based on the value of each characteristic. The high category contains the top one-third of countries while the low category contains the bottom one-third of countries. Second, we use the bonds issued by countries in the high and low categories to form value-weighted portfolios. Third, we compute a factor-mimicking portfolio by forming a leveraged high minus low (HML) portfolios for each of the three macroeconomic variables. For example, the deficit HML portfolio is the portfolio formed by buying sovereign bonds in the top one-third of the deficit-GDP category and selling short the sovereign bonds in the bottom one-third of the deficit-GDP category.

5.2.2. Controlling for the Empire Effect

Accominotti et al. (2010) demonstrate that dummy variables regression tests of the effect of membership in the British Empire on borrowing costs are potentially misspecified. They show that pooling bonds issued by British colonies with bonds issued by independent countries can lead to biased parameter estimates and misleading inferences in yield-spread regressions. To ensure that our conclusions about the effect of gold standard adherence on sovereign borrowing costs are robust, we exclude the British colonies from the portfolio sorts and re-run our test on the subset of bonds that were issued by independent countries.

Columns 4-6 in Table 4 report the alphas and betas obtained from forming off- and on-gold portfolios for the set of independent countries in our sample (i.e., bonds not issued by British colonies). The unconditional difference between on-gold and off-gold bond returns shrinks when we exclude colonial bonds and the risk-adjusted returns of the off-gold minus on-gold portfolio decreases. Importantly, the main result that gold-standard adherence is uncorrelated with risk-adjusted return is unaffected when the colonial bonds are omitted.

6. Conclusion

Using a comprehensive new data set, we find no evidence in favor of the good-housekeeping hypothesis. Although the bonds issued by countries off of gold did earn higher unconditional returns than the bonds of countries on gold, this difference vanishes once we control for exposure to common risk factors. This evidence rejects the good housekeeping hypothesis and is consistent with Flandreau and Zumer's (2004) finding that the effect of gold standard adherence on borrowing costs vanishes with the inclusion of other explanatory variables that capture default risk.

This conclusion is robust. We find no evidence of a gold-standard effect in any of the sub samples of countries included in previous studies. The results are not sensitive to adding fiscal, monetary, and trade controls to account for macroeconomic shocks that can affect the commitment to gold. Finally, omitting the British colonies from the benchmark specification does alter our conclusions.

These results shed light on the perceived benefits of the classical gold standard in particular and fixed exchange-rate regimes more generally. A widely cited benefit of the gold standard – arguably the most credible fixed exchange-rate regime in modern history – is that it reduced borrowing costs. Whatever other benefits a credibly fixed exchange-rate regime confers on its adherents, the international capital market did not reward gold-standard adherence with a lower cost of capital.

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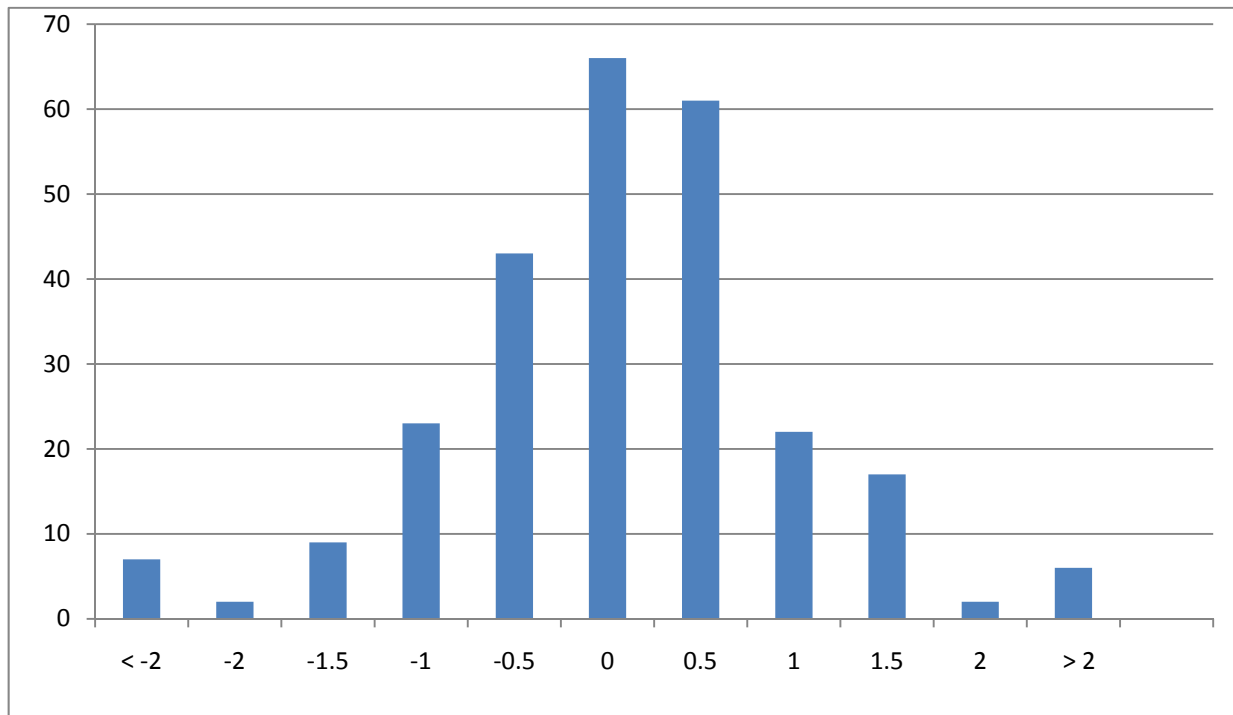
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Figure 1. Gold Standard Adherence by Country, 1870-1907

	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902	1903	1904	1905	1906	1907		
Argentina																																								
Australia																																								
Austria-Hungary																																								
Belgium																																								
Brazil																																								
British Guiana																																								
Bulgaria																																								
Canada																																								
Ceylon																																								
Chile																																								
China																																								
Colombia																																								
Costa Rica																																								
Denmark																																								
Ecuador																																								
Egypt																																								
France																																								
Germany																																								
Greece																																								
Guatemala																																								
Hawaii																																								
Honduras																																								
Hong Kong																																								
Italy																																								
Jamaica																																								
Japan																																								
Liberia																																								
Mauritius																																								
Mexico																																								
Netherlands																																								
New Zealand																																								
Nicaragua																																								
Norway																																								
Orange Free State																																								
Paraguay																																								
Peru																																								
Portugal																																								
Russia																																								
Saint Lucia																																								
Santo Domingo																																								
South Africa																																								
Spain																																								
Straits Settlements																																								
Sweden																																								
Trinidad																																								
Turkey																																								
United States																																								
Uruguay																																								
Venezuela																																								

Notes: Countries are coded by year, even if we know the month the country adopted the gold standard. For example, Austria-Hungary adopted gold on August 2, 1892, but we code it as adhering from January 1, 1892 for this table. In cases where a country adhered to the gold standard for less than a year, we code it as adhering to gold for the entire year in the table. For example, Greece adhered to gold from January 1885-September 1885. We code it as adhering to gold for all of 1885.

Figure 2. Interaction Coefficient t -statistics



Notes: The histogram reports the robust t -statistics associated with the 258 interaction terms that result from estimating equation (4) in the text for each of the 86 bonds that were traded when the issuing country was both on and off the gold standard.

Table 1. Selected Tests of the Good-Housekeeping Hypothesis

<u>Authors</u>	<u>Baseline Regression Specification</u>	<u>Controls in X'_{it}</u>
Bordo -Rockoff	$SPREAD_{it} = \alpha_i + \beta_i SPREAD_{Wt} + \delta GS_{it} + X'_{it}\gamma + \varepsilon_{it}$ $\varepsilon_{it} = \rho_i \varepsilon_{it-1} + u_{it}$	Lagged money growth Lagged deficit-GNP ratio
Obstfeld -Taylor	$SPREAD_{it} = \alpha_i + \beta_i SPREAD_{Wt} + \delta_1 DEF \times GS_{it} + \delta_2 NODEF \times GS_{it} + X'_{it}\gamma + \varepsilon_{it}$ $\varepsilon_{it} = \rho_i \varepsilon_{it-1} + u_{it}$	Lagged inflation Lagged debt-output level Export-GDP ratio Real income per capita Terms of trade British Empire dummy War dummies
Flandreau-Zumer	$SPREAD_{it} = \alpha_i + \delta GS_{it} + X'_{it}\gamma + \varepsilon_{it}$ $\varepsilon_{it} = \rho_i \varepsilon_{it-1} + u_{it}$	Interest service-revenue ratio Reserves-bank notes ratio Exports per capita Deficit-revenue ratio Exchange-rate volatility Default Memory of default Enfranchised population Political crisis dummies

Notes: $SPREAD_{it} = Yield_{it} - Yield_{UK,t}$. In Bordo and Rockoff, $SPREAD_{W,t} = Yield_{AVG,t} - Yield_{UK,t}$, where $Yield_{AVG,t}$ is the average of all coupon yields in their sample. In Obstfeld and Taylor, $SPREAD_{W,t} = Yield_{W,t} - Yield_{UK,t}$, where $Yield_{W,t}$ is the GDP-weighted average of all coupon yields in their sample.

Table 2. Excess Return Regressions: Off and On-Gold Portfolios

	<u>Value-Weighted</u>			<u>Equally Weighted</u>		
	Off Gold	On Gold	Off–On	Off Gold	On Gold	Off–On
Mean Excess Return	4.24	2.71	1.53	4.33	2.90	1.43
α	-0.11 (-0.08)	0.49 (0.72)	-0.59 (-0.44)	-0.90 (-0.51)	0.91* (1.92)	-1.80 (-1.09)
β_{CON}	0.359*** (3.97)	0.132*** (2.78)	0.227** (2.40)	0.321*** (2.60)	0.153*** (4.63)	0.168 (1.45)
β_{MKT}	0.407*** (5.00)	0.305*** (7.18)	0.101 (1.19)	0.730*** (6.57)	0.245*** (8.26)	0.485*** (4.66)
β_{CORP}	0.365*** (3.73)	0.100* (1.96)	0.265*** (2.58)	0.212 (1.58)	0.101*** (2.83)	0.111 (0.88)
\bar{R}^2	0.208	0.126	0.062	0.179	0.180	0.087

Notes: The regressions are equations (2) and (3). The mean excess return and estimated alpha are expressed in annualized percentage points. Robust *t*-statistics are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) level.

Table 3. Excess 28-day Return Regressions: Off-Gold Portfolio – On Gold Portfolio

Panel A: Value-Weighted						
	<u>Full</u>	<u>Bordo-Rockoff</u>	<u>Bordo-Schwartz</u>	<u>Obstfeld-Taylor</u>	<u>Flandreau-Zumer</u>	
Mean Excess Return	1.53	2.33	1.58	2.26	2.52	
α	-0.59	0.48	0.08	-0.37	0.70	
	(-0.44)	(0.34)	(0.07)	(-0.23)	(0.49)	
β_{CON}	0.227**	0.141	0.052	0.217**	0.314***	
	(2.40)	(1.45)	(0.60)	(1.99)	(3.18)	
β_{MKT}	0.101	-0.000	0.167**	0.134	-0.013	
	(1.19)	(-0.01)	(2.17)	(1.37)	(0.15)	
β_{CORP}	0.265***	0.387***	0.145	0.365***	0.272**	
	(2.58)	(3.69)	(1.56)	(3.09)	(2.54)	
\bar{R}^2	0.062	0.045	0.027	0.069	0.047	
Success Rate	24.1%	68.9%	48.4%	39.1%	78.7%	
Panel B: Equally Weighted						
	<u>Full</u>	<u>Bordo-Rockoff</u>	<u>Bordo-Schwartz</u>	<u>Obstfeld-Taylor</u>	<u>Flandreau-Zumer</u>	
Mean Excess Return	1.43	2.39	2.29	2.22	2.36	
α	-1.80	0.91	0.95	-0.39	0.39	
	(-1.09)	(0.75)	(0.82)	(-0.28)	(0.32)	
β_{CON}	0.168	0.082	0.011	0.094	0.187**	
	(1.45)	(0.97)	(0.14)	(0.97)	(2.19)	
β_{MKT}	0.485***	0.076	0.167**	0.304***	0.154**	
	(4.66)	(1.01)	(2.29)	(3.50)	(2.01)	
β_{CORP}	0.111	0.232**	0.130	0.231**	0.188**	
	(0.88)	(2.54)	(1.48)	(2.21)	(2.04)	
\bar{R}^2	0.087	0.030	0.028	0.078	0.053	
Success Rate	8.0%	78.1%	84.2%	36.2%	64.3%	

Notes: The regressions are equations (2) and (3). The mean excess return and estimated alpha are expressed in annualized percentage points. Robust *t*-statistics are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) level.

Table 4. Excess Return Regressions: Macroeconomic Risk Factors and Independent Countries

	<u>Full Sample</u>			<u>Ind. Countries</u>		
	Off Gold	On Gold	Off—On	Off Gold	On Gold	Off—On
Mean Excess Return	4.27	2.59	1.68	4.24	3.21	1.02
α	0.03 (0.02)	0.24 (0.36)	-0.21 (-0.16)	-0.11 (-0.08)	0.81 (1.01)	-0.92 (-0.65)
β_{CON}	0.345*** (3.86)	0.157*** (3.40)	0.188** (2.00)	0.359*** (3.97)	0.117** (2.07)	0.242** (2.46)
β_{MKT}	0.366*** (4.48)	0.185*** (4.39)	0.181** (2.10)	0.407*** (5.01)	0.353*** (6.98)	0.054 (0.611)
β_{CORP}	0.381*** (3.97)	0.143*** (2.89)	0.238** (-2.35)	0.365*** (3.73)	0.097 (1.59)	0.268** (2.52)
$\beta_{DEF-GDP}$	-0.061 (-1.03)	0.089*** (2.94)	-0.150** (-2.41)			
β_{INF}	-0.124*** (-2.88)	-0.053** (-2.38)	-0.071 (-1.57)			
$\beta_{EXP-GDP}$	-0.172*** (-3.75)	-0.189*** (-8.01)	0.017 (0.36)			
\bar{R}^2	0.237	0.252	0.091	0.208	0.112	0.052

Notes: The regressions are equations (2) and (3). The portfolios are value-weighted. The mean excess return and estimated alpha are expressed in annualized percentage points. The “Ind. Countries” sample includes all independent countries in our sample and excludes the British colonies. “Def-GDP”, “Inf”, and “Exp-GDP” refer to the coefficients associated with the factor-mimicking portfolios described in the text. Robust *t*-statistics are in parentheses. *** (**) (*) indicates significance at the 1% (5%) (10%) level.

Appendix 1: Sample of Countries

The data set includes 213 sovereign bonds issued by 37 non-colonial countries and 110 colonial bonds issued by 12 British colonies and possessions. The prices are sampled every 28 days from the official quotation list published in the *Money Market Review* and the *Economist* from 1866 until 1907, when the publisher ceased providing such detailed price quotations. We use the price, dividend, and coupon data to compute a time series of realized holding-period returns corrected for dividends, stock splits, and sovereign defaults. To date sovereign defaults, we rely on the annual reports issued by the Council of Foreign Bondholders, Winkler (1933), and Suter (1990). In the regressions, the time series span the period from January 1870 until December 1907 due to data constraints.

Sovereign Bond Data

The countries included in our dataset are: Argentina; Australia; Austria-Hungary; Belgium; Brazil; British Guiana; Bulgaria; Canada; Ceylon; Chile; China; Colombia; Costa Rica; Denmark; Ecuador; Egypt; France; Germany; Greece; Guatemala; Hawaii; Honduras; Hong Kong; Italy; Jamaica; Japan; Liberia; Mauritius; Mexico; Netherlands; New Zealand; Nicaragua; Norway; Orange Free State; Paraguay; Peru; Portugal; Russia; Saint Lucia; Santo Domingo; South Africa; Spain; Straits Settlements; Sweden; Trinidad; Turkey; United States; Uruguay; and Venezuela.

The British colonies and possessions are a subset of the countries in the full sample. They are: Australia; British Guiana; Canada; Ceylon; Hong Kong; Jamaica; Mauritius; New Zealand; Saint Lucia; South Africa; Straits Settlements; and Trinidad.

Subsamples

We formed subsamples of countries based upon previous work on the gold standard. We are able to mimic closely each of the samples of countries listed below.

Bordo and Rockoff (1996) : Argentina; Australia; Brazil; Canada; Chile; Italy; Portugal; Spain; and United States.

Bordo and Schwartz (1999) : Argentina; Australia; Belgium; Brazil; Canada; Chile; Denmark; Finland; Greece; Italy; Japan; Netherlands; Norway; Portugal; Sweden; and Switzerland. The four core countries are France, Germany, the UK, and the United States. We exclude Finland and Switzerland due to lack of data.

Obstfeld and Taylor (2003) : Argentina; Australia; Austria-Hungary; Brazil; Canada; Chile; Egypt; Greece; India; Italy; Japan; Mexico; New Zealand; Norway; Portugal; South Africa; Spain; Sweden; Turkey; the United States; and Uruguay.

Flandreau and Zumer (2004): Argentina; Austria-Hungary; Belgium; Brazil; Denmark; France; Germany; Greece; Italy; Netherlands; Norway; Portugal; Spain; Sweden; Switzerland; and Russia. We exclude Switzerland due to lack of data.

We adopt the definition of cheater from Bordo and Schwartz's Table 1 (Bordo and Schwartz 1999). We code a country as a cheater if it suspended gold convertibility because of war, lax fiscal policy, a financial crisis, failed convertibility, or some combination of the four. The countries that fall into this category are Argentina, Brazil, Chile, Greece, Italy, and Portugal.

Appendix 2: Gold-standard adherence

Argentina: January 3, 1867-May 1876: Leaving gold in May 1876 did not result in a change in parity. July 1883-December 1884: Leaving gold in December 1884 did not result in a change of parity. October 31, 1899: Law establishing external convertibility. Source: della Paolera and Taylor (2001), pp. 25, 41, 47.

Australia: Adopted the free convertibility of currency into gold before 1870. Source: Meissner (2005).

Austria-Hungary: August 2, 1892. Source: Helfferich (1927), pp. 200.

Belgium: November 5, 1878. Source: Helfferich (1927), pp. 180.

Brazil: October 1888-October 1890. Leaving gold in October 1890 did not result in a change of parity. December 31, 1906: Conversion Office opened. Sources: Martin-Acena (2000), pp 155; and Subercaseaux (1931).

British Guiana: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Bulgaria: Did not adopt the free convertibility of currency into gold before 1914. Source: Meissner (2005).

Canada: Adopted the free convertibility of currency into gold before 1870. Newfoundland did not adopt the free convertibility of currency into gold until 1895, according to Officer (2001). We date the bonds from Newfoundland from January 1, 1895. Sources: Meissner (2005).

Ceylon: 1898. We date Ceylon as adhering to the gold standard from January 1, 1898. Source: Officer (2001).

Chile: Law passed February 11, 1895 providing for conversion from June 1, 1895. Suspended convertibility July 31, 1898. This event resulted in a change of parity. Source: Kemmerer (1926).

China: Did not adopt the free convertibility of currency into gold before 1914. Source: Bloomfield (1959).

Colombia: From 1903, Colombia has fixed gold parities, but it did not adopt a complete gold standard until 1923, when the first Kemmerer Mission intervened. We code Colombia as not

adopting the free convertibility of currency into gold before 1914. Source: Martin-Acena (2000), pp. 237.

Costa Rica: Law passed in October 1896, but currency was not convertible into gold until July 15, 1900. We date it from November 1896. Source: Young (1925), pp. 193-96.

Denmark: Agreement reached December 18, 1872. Formed monetary union with Sweden in May 1873. We date it from June 1873. Sources: Helfferich (1927), pp. 175; and Jonung (1984), pp. 367.

Ecuador: 1900. We date Ecuador as adhering to the gold standard from January 1, 1900. Source: Meissner (2005).

Egypt: 1885. We date Egypt as adhering to the gold standard from January 1, 1885. Source: Officer (2001).

France: November 5, 1878. Source: Helfferich (1927), pp. 180.

Germany: December 4, 1871. Source: Helfferich (1927), pp. 156-7.

Greece: January 1885-September 1885. This event did not result in a change of parity. Greece did not join the gold standard again until March 1910. Sources: Bordo and Schwartz (1999), pp. 251; and Lazaretou (2005).

Guatemala: Did not adopt the free convertibility of currency into gold before 1914. Source: Bulmer-Thomas (2003), pp 112.

Hawaii: Adopted the Gold Law of 1884, which made the gold coins of the United States legal tender. We date Hawaii as adhering to the gold standard from January 1, 1884. Source: Tate (1965), pp. 69.

Honduras: Did not adopt the free convertibility of currency into gold before 1914. Source: Bulmer-Thomas (2003), pp 112.

Hong Kong: Did not adopt the free convertibility of currency into gold before 1914. Source: Tom (1989).

Italy: Law establishing convertibility April 12, 1884 passed March 1, 1883. Affidavit introduced on second semester coupon payments in July 1893. Required Italians to swear rendita coupon payments received abroad did not belong to Italian citizens. Introduced incentives for lenders to redeem in Milan. This event resulted in a change in parity. Sources: Helfferich (1927), pp. 175; and Fratianni and Spinelli (1984), pp. 415.

Jamaica: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Japan: Law passed March 29, 1897 providing for conversion between October 1, 1897-July 31, 1898. Sources: Helfferich (1927), pp. 201; and Laughlin (1900).

Liberia: Pegged to US dollar at the exchange rate L\$1 = US\$1. We code it the same as the US. Source: <http://users.erols.com/kurrency/africa.htm>

Mauritius: 1898. We date Mauritius as adhering to the gold standard from January 1, 1898. Source: Officer (2001).

Mexico: Law passed December 9, 1904. Decree enforced March 25, 1905. Source: Helfferich (1927), pp. 204.

Netherlands: June 6, 1875. Source: Helfferich (1927), pp. 176.

New Zealand: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Nicaragua: Did not adopt the free convertibility of currency into gold before 1914. Sources: Bulmer-Thomas (2003), pp 115; and Young (1925), pp. 119-30; Appendix E.

Norway: Agreement reached December 18, 1872. Norway formed a monetary union with Denmark and Sweden in October 1875. Sources: Helfferich (1927), pp. 175; and Jonung (1984), pp. 367.

Orange Free State: 1870-December 14, 1899. December 15, 1899-March 14, 1900: Gold standard suspended. March 15, 1900-1910: Gold standard re-established. Source: <http://users.erols.com/kurrency/africa.htm>

Paraguay: Did not adopt the free convertibility of currency into gold before 1914. Source: Bulmer-Thomas (2003), pp 114.

Peru: Did not adopt the free convertibility of currency into gold before 1914. Source: Meissner (2005).

Portugal: 1854-May 1891. This event resulted in a change in parity. Source: Reis (2000), pp 94.

Russia: February 1897. Source: Anonymous (1897).

St. Lucia: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Santo Domingo: Did not adopt the free convertibility of currency into gold before 1914. Sources: Laughlin (1894); and Meissner (2005).

South Africa: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Spain: Suspended summer 1883 because of decline in foreign investment after January 1882 stock market crash. The precise date is vague, and we date it from the end of June 1883. Source: Martin-Acena (2000), pp 128.

Straits Settlements: 1903. We date the Straits Settlements as adhering to the gold standard from January 1, 1903. Source: Meissner (2005).

Sweden: Agreement reached December 18, 1872. Formed monetary union with Denmark in May 1873. Sources: Helfferich (1927), pp. 175; and Jonung (1984), pp. 367.

Trinidad: Adopted the free convertibility of currency into gold before 1870. Source: Officer (2001).

Turkey: 1881. We date Turkey as adhering to the gold standard from January 1, 1881 Sources: Pamuk (2000), pp. 218.

United States: January 1, 1879. Source: Officer (2001).

Uruguay: 1885. We date Uruguay as adhering to the gold standard from January 1, 1885.
Source: Meissner (2005).

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