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The International Monetary System, 1844-1870:
Arbitrage, Efficiency, Liquidity

Stefano Ugolini[*]

Abstract: *This paper analyses the architecture of the international monetary system which preceded the international gold standard (1844-1870). It builds on a newly-created database made up of more than 100,000 weekly observations on exchange rates, interest rates, and bullion prices in the world's six most important financial centers of the time. Market integration, substitutability of money market instruments, choice of the correct monetary standard reference, and currency liquidity are tested; moreover, an historical analysis is run, with special reference to financial crises. Contrary to received wisdom, the results point to a trend towards increasing multipolarism in the international monetary system before 1870.*
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In chapter 2 of his celebrated work *Lombard Street*, Walter Bagehot presents some interesting remarks about the effects of the events of 1870 on the architecture of the international monetary system. He writes that

> 'Since the Franco-German war, we may be said to keep the European reserve also. [...] Formerly there were two such stores in Europe, one was the Bank of France, and the other the Bank of England. But since the suspension of specie payments by the Bank of France, its use as a reservoir of specie is at an end. [...] All exchange operations are centering more and more in London. *Formerly for many purposes Paris was a European settling-house*, but now it has ceased to be so. [...] Accordingly London has become the sole great settling-house of exchange transactions in Europe, instead of being formerly one of two' (Bagehot 1873, II.14; our emphasis)[1].

These words are in stark contrast with received wisdom, according to whom the 19th-century international monetary history almost coincides with the British one (see, for instance, Schwarz 1984). Recent research has vindicated Bagehot's comments by demonstrating the pivotal role of France's bimetallic system in equilibrating bullion fluxes between gold and silver monometallic countries before the emergence of the international gold standard (Flandreau 2004). But still much remains to be told about the mid-19th-century international monetary system. This paper aims at shedding some light on this topic.

The period taken into consideration goes from July 1844 (when the Bank of England began to enact a new discount policy due to the approval of Peel's Act) to October 1870 (when the Bank of France suspended convertibility due to the country's defeat by Prussia): we take these dates as limits as they mark, on the one hand, the rise of the Bank of England's classical 19th-century monetary policy, and on the other hand, the consecration of London as the one and only capital of the international monetary system. This period is particularly interesting for at least three reasons. First, a crucial evolution happened during these years: while in 1844 the international financial system was still fundamentally the same which had been in place since the early-modern age, in 1870 the foundations of a would-be globalized architecture had already been set. Second, three very important financial crises took place during these years (in 1847, 1857 and 1866), whose course provides us with a variety of different situations to observe. Third, two major shocks happened on the supply side of the bullion market (the discovery of gold mines in California and Australia at the end of the 1840s, and that of silver mines in Nevada at the end of the 1860s): the consequences of these shocks deeply influenced the evolution of the system, eventually leading to the birth of the international gold standard in the early 1870s.

This paper bases its analysis on a newly-created database including weekly observations on exchange rates, interest rates and bullion prices for the five most important financial centers of the time (London, Paris, Amsterdam, Hamburg, and Frankfurt). One could argue that the choice of the sample would allow to speak of a 'European' rather than an 'international' monetary system. Due to technical reasons, however, at the scrutinized epoch intercontinental monetary relations were still hardly developed, except for the (long-term) financing of trade. As a consequence, bills of exchange on extra-European places lacked liquidity and were

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[1] Similar remarks can also be found in chapter 7, where it is said that 'in 1870 the Bank of France suspended specie payments, and *from that time a new era begins*' (Bagehot 1873, VII.38; our emphasis).

generally not quoted on European markets (with the partial exception of London): the actual 'globalization' of the international monetary system came into being in later decades only. Moreover, one could wonder why a late-19th-century first-stage financial centre, i.e. Berlin, is not covered by our sample. The exclusion of Prussia's capital was dictated by the fact that bills of exchange on this city were not quoted in many of the most important centres (e.g. in London) for a long time, thus proving to be rather illiquid assets. This is indeed a result *per se*: before Germany's unification, the Prussian thaler was not an international currency as both the Hamburg mark banco and the Frankfurt gulden were. Also under this respect, 1870 really marked the beginning of a new era.

Our (relatively) high-frequency data were collected from original sources (stock exchange bulletins and specialized newspapers) and allow to detail monetary phenomena in depth. The database is made up of nearly 100,000 entries and, as far as we know, is completely unprecedented. We use these data to perform different tests, with the aim of extracting some quantitative indicators describing the architecture and the dynamics of the system. We also make use of the database in order to discuss a critical approach to the sources, and to test new methodologies of analysis of some monetary phenomena.

The remainder of the paper is organized as follows. Section 1 performs some tests of market integration, and looks for the effects of information-technological improvements on the international monetary system. Section 2 focuses on market interest rates, and tests the methodology of computation of shadow rates. Section 3 focuses on bullion prices, and discusses the use of specie prices as a substitute for ingot prices. Section 4 is dedicated to the definition of monetary standards, and to the choice of the reference par in bimetallic monetary systems. Section 5 develops the application of the target zone analytical framework to the study of bullion-based monetary systems, whose results allow to draw a series of conclusions about the historical dynamics taking place during the scrutinized period.

Section 1: Market Integration

1.1: The Test

The first test we are interested in performing concerns market integration. The degree of integration between markets can be assessed by comparing the price of the same item at the same time in different places. By definition, the exchange rate is the price of claims on a given financial centre in terms of claims on another centre. As a consequence, integration can be measured for every bilateral relation by looking at the spread between the levels of the same spot exchange rate as quoted in different financial centres at the same date. Calling $e_{A,t}^{A/B}$ the spot exchange rate between currencies A and B in place A at time t, and $e_{B,t}^{A/B}$ the spot exchange rate between A and B in place B at time t, the percentage spread $s_t^{A/B}$ will be equal to

$$s_t^{A/B} = \frac{e_{B,t}^{A/B}}{e_{A,t}^{A/B}} - 1$$

If markets are perfectly integrated, $s_t^{A/B}$ is supposed to be zero: the bigger $\left|s_t^{A/B}\right|$, the lower the degree of integration between A and B.

Measuring to what an extent money markets were integrated bears a particular relevance for the period of our concern: as a matter of fact, during these years the world experienced the most abrupt improvement in information technologies in history, i.e. the introduction of the telegraph. At the end of the 1840s information still had to be physically conveyed, and it could take many days for a letter to be carried from a country to the other; by the mid-1850s, however, all major European financial centres were already interconnected through telegraphic wires, and sending information from one place to the other had become a matter of seconds. If we suppose that lack of integration depended on information technologies, a sharp reduction in the absolute values of $s_t^{A/B}$ should be observed during the early 1850s.

In order to perform this kind of test properly, we would actually need spot exchange rates to be quoted in each financial centre on all other counterparts. However, the features of 19th-century monetary markets impose two limitations. First, up to the appearance of telegraphic payments at the beginning of the 20th century, proper *spot* exchange rates did not actually exist: as bills of exchange had to be physically transported to the other place in order to be cashed (which would still take one day or more)[2], only bills payable right at the time of arrival in the other centre were available. The price of such bills was the so-called *sight* (or *short*) exchange rate. Although very small, the theoretical difference between sight and spot exchange rates accounts for a portion of $s_t^{A/B}$, which cannot be expected to be exactly zero. Second, bilateral exchange relations among centres were not always symmetrical, and sight exchange rates were not quoted in all places for all the other ones. For instance, while all considered centres listed sight exchange rates on London, London just had sight exchange rates on Paris and Amsterdam (but only 90-day exchange rates on Hamburg and Frankfurt)[3]. As a consequence, it was impossible to perform this kind of test for four out of a total of ten bilateral relations between the five considered financial centres.

1.2: Puzzles: Hamburg Listings

Figures 1.1-6 put together sight exchange rates in both places forming every bilateral relation. We see evidence of very good integration among the old 'core' centres London, Paris and

[2] Of course, the fact that bills had to be dispatched to the place B in order to be cashed by bankers in A does not mean that bills had to be physically shipped from B in order to be sold in A: any banker in A with a correspondent in B could draw bills on B at any time. This explains why *a priori* the possibility of transmitting information by telegraph should improve integration even in the absence of standardized telegraphic payments.

[3] Up to March 1848, Paris did not list sight exchange rates on all other places, but provided two different maturities for each of them (90-day and 30-day exchange rates). The fact that two maturities were quoted gives us the possibility of extracting the underlying interest rate, and thus computing the correspondent exchange rate for any maturity: that is how we were able to construct sight exchange rates for Paris before March 1848. More information about this procedure is provided in the following section.

Amsterdam. Integration between Paris and Frankfurt is a bit weaker, but still quite good. On the contrary, a bizarre phenomenon can be observed in the case of Hamburg: sight exchange rates are constantly higher in the Hanseatic city than abroad, which means that the mark banco is overvalued by a constant there. In figure 2 we compare the spreads $s_t^{A/B}$ between Hamburg sight rates on the one side, and Paris (as in figure 1.5), Amsterdam (as in figure 1.6), and Antwerp (the only other centre for which the exercise is feasible) on the other side. We see that for all three bilateral exchange relations, spreads turn around a +0.75% quota up to 1866, and a +0.25% thereafter. We tried hard to figure out how such a situation could be possible. The first thing that comes to mind is that despite the denomination of sight exchange rates (*kurze Sicht* in German), the maturity of the bills whose price was quoted was actually longer: however, this possibility is ruled out by the tests performed in the following section, showing that shadow interest rates computed through Hamburg listings are in line with those computed through other places. We looked for an alternative explanation in the customs of the Hamburg forex market, but could not find any hint in available sources (coeval financial guidebooks and newspapers). Yet as this constant deviation is an economic nonsense, we decided to correct for it by subtracting from all Hamburg sight exchange rates (on Paris, Amsterdam, Antwerp and London) the constant percent overvaluation observed in figure 2 (0.75% from 1844 to 1866, and 0.25% from 1866 to 1870). The following results will show that such a correction works very well.

1.3: Results

In figure 3 we compare all spreads $s_t^{A/B}$ computed for the considered six bilateral exchange relations (with corrected data for Hamburg). The first result we can observe is that despite the dramatic improvement in information technologies of the early 1850s, no significant trend towards reduced spreads can be detected. The second result is that $\left|s_t^{A/B}\right|$ increases substantially during crises: as a matter of fact, figure 3 looks like a sort of 'seismograph' for the international monetary system (spikes in spreads coincide with moments of tightness like 1845, 1847-48, 1855-56, 1857, 1859, 1863-64, 1866 and 1870). We think this is tied to two factors. The first one is incertitude: in moments of panic, information asymmetries typically increase and exchange rates can deviate from their equilibrium level. The second one is flight to liquidity: when credit gets tighter the demand for cash increases, so that in the short run cash available abroad can become more expensive on both sides of every bilateral exchange connection (the price of sight bills on B gets higher in A, as well as the price of sight bills on A gets higher in B)[4]: as a result, $\left|s_t^{A/B}\right|$ has a tendency to increase during crises.

From these charts, we can conclude that in the 1840s integration among the top five international financial centres was already strong (especially among the three old 'core' centres London, Paris and Amsterdam), and that the introduction of the telegraph in the early 1850s did not play any major role in enhancing integration. Spreads between sight exchange

[4] In symbols: $e_{A,t}^{A/B}$ increases, and $e_{B,t}^{B/A}$ increases (which means that $e_{B,t}^{A/B}$ decreases).

rates for every bilateral connection between centres changed according to the general conditions of credit rather than to technological issues improving information sharing.

Section 2: Market Interest Rates

2.1: Market Interest Rates: Caveats

In order to investigate the dynamics of an international monetary system, one fundamental element to be taken into account consists of market interest rates. This factor is crucial as it represents the cost of refinancing that banks have to face on different centres. However, as the late-2008 debate on the reliability of Libor has shown, it is very difficult to get univocal data on market interest rates for one currency. This is due to the very nature of this factor: contrary to bank rates (which are applied uniformly to all loans granted by the central bank), market rates cannot have a one and only level as any loan granted by a private lender to a private customer has its own specificity (and thus its own price). As a consequence, it is possible to distinguish comparable levels of rates for homogeneous classes of borrower quality, but not to have a standard universal market interest rate for any currency[5].

Unless differently stated, 19th-century sources used to provide data for the very top-quality share of the discount market, i.e. bills of exchange drawn on first-class merchant banks. This allows for direct comparison as their quality is supposedly homogeneous. However, reported data represent only a survey of rates declared by some discount houses (the way they were collected is unclear), and thus should not be taken too literally. Moreover, available data on market rates are incomplete. Stock exchange bulletins report market interest rates in the case of Amsterdam, Frankfurt and (for some years only) Hamburg. An additional source is *The Economist* magazine, which published rates for all main international financial centres since February 1861. But many important data are still missing: prior to this date, for instance, we have no indication at all about market rates in Paris. In order to fill these gaps, we resort to the so-called *shadow* interest rates.

2.2: Shadow Interest Rates

A shadow rate is the underlying interest rate accounting for the difference between the prices of two similar bills of exchange payable on the same place at two different maturities: a survey on this methodology can be found in Flandreau et al. (2009, pp. 179-183). Calling $l_{A,t}^{A/B}$ the *long* exchange rate in A on B (i.e. the price in A at time *t* of bills of exchange payable in B

[5] Of course, interest rates also differ for classes of maturities; we pass over this point here because all data taken into consideration are homogeneous under this respect, as they refer to the standard maturity of the time (i.e. 90 days).

at time $t+n$, where n is the number of months of maturity of the asset), the annualized shadow interest rate in B at time t computed via A is equal to:

$$i_{B,t}^{A/B} = \frac{12}{n}\left(1 - \frac{l_{A,t}^{A/B}}{e_{A,t}^{A/B}}\right)$$

Shadow interest rates can be computed any time exchange rates with two maturities on one place are available. As this was often the case in mid-19th century stock exchange bulletins, we decided to extrapolate shadow rates any time the exercise was feasible, and to compare the results with available quotations of market interest rates. Flandreau and Rivière (1999) perform this same comparison in the case of Paris actual and shadow interest rates (computed via London quotations) for the period 1900-14: they find shadow rates to be constantly higher than the actual ones, which they interpret as the effect of transaction costs. Our database allows for an extension of these results, and for a general test of the shadow rate methodology on a broader scale.

2.3: Results

Figures 4.1-5 compare shadow and actual market interest rates for the five financial centres throughout the period of our concern (notice that for these computations, original and not corrected sight exchange rates were used in the case of Hamburg). A number of features emerge from these charts. To begin with, Flandreau and Rivière's (1999) finding that shadow rates are higher than actual ones is confirmed for Paris (figure 4.2); yet this is not always the case for other places. More generally, even though all computed shadow rates typically follow the same trends, there can be sensible differences among them. This must be related to differences in market microstructures (or maybe tied to quality issues: our starting assumption of homogeneous quality of assets is perhaps not always applicable), but we are unable to cope with this question at this stage. On the whole, this seems coherent with the problems underlined by Flandreau et al. (2009, pp. 193-195) when they compare shadow rates computed via different foreign places.

One general trend can be observed on all charts: differences among shadow rates increase dramatically during crises. We think this is due to a temporary inversion of the yield curve of the foreign currency as traded in the domestic market. In case of tightness, the price of very-short-term claims on a foreign centre can become extraordinarily higher in the short run: as a result, the difference between $e_{A,t}^{A/B}$ and $l_{A,t}^{A/B}$ can temporarily increase even if the three-month foreign interest rate is unchanged, and the shadow rate can thus become higher than the actual three-month market rate (case 1).

But the opposite phenomenon, i.e. a temporary steepening of the yield curve of the foreign currency as traded in the domestic market, can as well be observed. Imagine a situation in which an exogenous shock provokes a short-lived capital flight from place B to place A. In this circumstance, $e_{A,t}^{A/B}$ can temporarily decrease even if both $l_{A,t}^{A/B}$ and the three-month foreign rate remain unchanged: as a consequence, in the short run the shadow rate $i_{B,t}^{A/B}$ can get lower than the actual three-month market rate (case 2). Two examples concerning London

rates (figure 4.1) will help clarify the matter. In March 1848, we see that the shadow rate on London computed via Paris skyrocketed: panic sparked by the revolution provoked a run on pounds in France, which increased $e_{A,t}^{A/B}$ and triggered an explosion of $i_{B,t}^{A/B}$ despite unchanged three-month market rates in Britain (case 1). Much to the contrary, during the Overend Gurney crisis of 1866 the shadow rate on London computed via Paris increased much less than the actual three-month market rate: bad news from Britain led to a sell-off of pounds in France decreasing $e_{A,t}^{A/B}$ and making the increase of $i_{B,t}^{A/B}$ less than proportional (case 2).
To sum up, shadow interest rates can act as a substitute for missing market rates, but with two caveats: it must be taken into account that 1) some microstructural factors allowing for some constant deviations of shadow rates from actual ones can exist, and that 2) in moments of monetary tensions, shadow rates can wander substantially from actual ones. Unfortunately, this latter point deprives this methodology of one of its most interesting potentialities, i.e. providing more information to the analysis of crises.
Taking both caveats into account, we tried to reconstruct complete series of market interest rates for the scrutinized five financial centres. We proceeded as follows: a) whenever available, we used direct quotations reported by stock exchange bulletins; b) we filled the gaps for the period after February 1861 via the data published by *The Economist*;[6] and c) we completed the picture by resorting to the shadow rate series that looks closest to the previous ones when comparison is possible[7]. Results are shown in figure 5. As open to criticism as these series can be, they nonetheless provide us with a good picture of what was going on in the international monetary system in the period of our interest. We shall make us of them in section 5 in order to get some further results.

Section 3: Bullion Prices

3.1: Ingot and Specie Prices

Another crucial factor to be taken into account for the study of 19th-century monetary systems consists of bullion prices. Before 1873, two precious metals were invested with a full monetary role on the international stage: as a consequence, gold and silver were transacted (and their prices were quoted) in every financial centre. We shall focus on the question of monetary standards in the following section. In this section, we shall rather investigate a different point: provided that domestic markets were integrated, could there be more than one price for gold or silver in the same place?
The question is less paradoxical than it may sound. As a matter of fact, before the 19th century the quotation of precious metals in ingots was exceedingly rare: this could be tied to legal

[6] Data published by *The Economist* prove to be rather reliable: they generally coincide with those reported by stock exchange bulletins, although with some exceptions (especially in the case of Frankfurt: figure 4.5).
[7] Shadow rate series mainly used to complete our interest rate series were Hamburg in the case of London and Paris, and Paris in the case of Hamburg.

issues (such as bullionist regulation), but also to technical ones (greater difficulty to assess the fineness of bars with respect to species, whose quality was supposed to be more standardized). In order to reconstruct bullion prices, historians are often obliged to extract them from prices of gold and silver species, which were more commonly reported by stock exchange bulletins. Yet due to a series of factors (costs of shipping, minting or melting, arbitrage risks, exchange rates, legal restrictions and so on), it is possible that species are not perfect substitutes for bars: their supply and demand can vary independently of the supply and demand of the precious metal they are made of. As a consequence, their price can deviate from the price of pure metal within an arbitrage band whose limits are determined by all transaction costs.

Of course, this is trivial. The real question is: how wide can this arbitrage band be? The larger the width of the band, the lesser the reliability of specie prices as a substitute for pure metal prices. Trying to assess this by estimating the arbitrage points would be an impossible task, as available information is not enough to construct such series. The method we propose is simpler: it just consists of comparing the different prices of bullion on the same place as they can be derived from listed prices of both ingots and species. The underlying hypothesis is that domestic markets are efficient: as we have already seen, markets were integrated internationally, so there is no reason for them not to be integrated locally. Under this condition, no enduring violation of the arbitrage points should take place: as a consequence, the deviation of specie prices from the bar price should give us an idea of the possible width of the band.

Being an age of transition from early-modern to contemporary systems, the period we are taking into consideration is an ideal candidate for performing this kind of exercise: as a matter of fact, both ingot and specie prices for both metals were reported by stock exchange bulletins of all financial centres of the time. But before proceeding, we shall focus on a couple of specific cases helping us understand the dynamics of bullion markets.

3.2: The 'Strange Case' of Silver Dollars

Figures 6.1-2 compare prices of silver in bars and in a particular type of specie (the Mexican, or 'new' dollar) on the London and Paris markets. We see that prices of silver in both forms are more or less the same for many years, but since 1853 dollars tend to become more expensive than the silver they contain: during two long periods (1859-61 and 1862-65) the relative appreciation reaches impressive levels (up to 12% at their peak in London), to disappear completely after 1866. How could that be possible?

As a matter of fact, the silver dollar was a very special kind of specie. This is proved by the fact that even nowadays the currencies of a huge portion of extra-European countries still bear the name of this specie (known as *dollar* in former British colonies, *peso* in Latin America, *yen* in Japan, and *yuan* in China). For more than two centuries, the output of Spanish-American silver mines had been mostly transformed into this specie by local mints. As these mines covered by far the largest share of the world silver production, since the 16th century dollars became the standard medium of exchange of intercontinental trade. After securing independence from Spain, South American states (and especially the largest silver producer, i.e. Mexico) continued to struck dollars, although a number of debasements took place. But despite the progressive deterioration of their quality, 'new' dollars gradually replaced the 'old' ones as the commonest medium of exchange in intercontinental transactions. As late as 1875, a financial guidebook reported that 'dollars play a crucial role in the monetary circulation of not only Spanish colonies and Latin American republics, but also the Indies, China, Asian and African Mediterranean states, etc.' (Lemale 1875, p. 205)[8].

While the supply of dollars to Europe depended on the production of South American mints, the demand for them mostly depended on the conditions of Eurasian trade. As a considerable lapse of time was needed to meet additional demand in Asia with additional supply from America, serious mismatches could take place in the dollar market, with prices increasing consequently. At the time of the first peak in dollar prices in 1854 (figure 6.1), *The Economist* repeatedly imputed the phenomenon to a spike in British imports from Chinese seaports (which had to be paid for in silver), and called it an 'anomaly' (10th June and 29th July 1854). In 1859-61, and then in 1862-65, this anomaly assumed greater dimensions. This was due to a series of exogenous events (such as the Sepoy Mutiny in India, the Taiping Revolt in China, and the Civil War in the US) that temporarily shook the way trade fluxes were cleared in Eurasian relations, engendering an extraordinary drain of silver to Asia. It is interesting to notice that European importers tried to bypass the bottleneck in the supply of dollars by accustoming Chinese exporters to the use of silver 5-franc pieces[9], which could be purchased at a much lower price: as a consequence, during this period shipments of French species were made from Marseilles to the East. In the end, the price of dollars returned in line with their intrinsic value as soon as extraordinary silver payments to Asia ceased, i.e. after order was restored in India, China, and the US[10].

3.3: The 'Strange Case' of Gold Doubloons

Another example will help us clarify the imperfect degree of substitutability between bullion in bars and in species. Figure 7 compares prices of gold in bars and in various types of species on the Paris market. We see that despite some differences, specie prices are not much dissimilar to bar prices. Yet there is a major exception: Spanish doubloons, whose price is remarkably higher than the one of the gold they contain. Only during two periods (1848-49

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[8] This was due to the technical reasons we have already pointed at: assessing the fineness of silver in bars was more complicated and expensive, while species had a standardized quality and assays could be made quickly and randomly. As a consequence, Asian exporters preferred to be paid in dollars rather than in ingots.

[9] This is witnessed by a letter sent from Shanghai to the Governor of the Bank of France, dated 23rd April 1856. Archives Banque de France, Papiers d'Argout, 1069199608/3 [7ème: R712], No. 5.

[10] Flandreau (2004, pp. 157-178) contends the idea put forward by coeval commentators (especially by French economist Michel Chevalier) that the drain of silver from Europe to Asia taking place in the 1850s and 1860s was due to repeated shocks in Eurasian trade: he shows that bullion fluxes were not exogenous to trade fluxes, and that the ultimate cause of the drain of silver to the East were gold discoveries in the West. We do not think our findings to be inconsistent with Flandreau's. We interpret the periods in which the price of dollars skyrocketed as the only ones corresponding to actual temporary shocks, i.e. those periods during which truly exogenous events took place (such as extraordinary military expenditures in India due to the Mutiny, or hurried purchases of cotton in the Middle East due to the blockade of Confederate seaports).

and 1864-67) the price of this specie is in line with its intrinsic value. How could that be possible?
Guillén y Suárez (1846, p. 56) provides the answer: gold coins 'enjoy in Spain of a legal value in silver that they would not have anywhere else', which means that the amount of gold contained in a Spanish doubloon had a lower value than the amount of silver that could be legally exchanged against it. However, as minting was a governmental monopoly in Spain, it was impossible for arbitrageurs to bring gold to mints and make a profit from its overvaluation. Apparently, the government did not overissue in gold, and the commitment to pay in silver against gold was credible: otherwise, doubloons would not have circulated at their legal value abroad. But as soon as the credibility of this commitment collapsed, doubloons were to circulate at their intrinsic value.
This is exactly what comes out of the data. In figure 8, we compare the price of doubloons in Paris with the exchange rate on Madrid. We see that the two series are correlated: doubloons were priced in France according to their legal value. A falling exchange rate reveals a confidence crisis in Spain's monetary system: as soon as confidence faltered (as in 1848-49 and 1864-67, when the exchange rate on Madrid sunk), doubloons came to be priced in France according to their intrinsic gold content. The moral of this example is that the assumption that species could only circulate at their intrinsic value abroad does not always hold: provided that a) the commitment to overvalue them was credible and that b) their supply was limited, domestic legislation could effectively determine the international price of species as well. This allowed for the coexistence of bimetallic systems with different legal silver/gold ratios (in Spain this ratio was fixed at 15.77, while all other European bimetallist countries set it at 15.50).

3.4: The 'Bullion Band'

Now that we have seen that specie prices can deviate from bar prices for other reasons than transaction costs, we proceed to determine the possible width of the arbitrage band of bullion prices. Calling $p_{A,t}^{M,bar}$ the price of a kilogram of pure precious metal in bars in place A at time *t* and $p_{A,t}^{M,specie}$ the price of a kilogram of the same pure metal contained in a certain type of specie in place A at time *t*, the percent spread $s_{A,t}^{M}$ between the two prices will be equal to

$$s_{A,t}^{M} = \frac{p_{A,t}^{M,specie}}{p_{A,t}^{M,bar}} - 1$$

Figures 9.1-2 put together evidence on $s_{A,t}^{M}$ for both gold and silver from all our five financial centres. We excluded data for Spanish doubloons, as their price was determined by legal factors (as we have seen); on the contrary, we included data for Mexican dollars, as their value was determined by market factors only. We can see that the case of dollars, although very important, was an exception in the period of our concern[11]. Spreads $s_{A,t}^{M}$ for all other

[11] There is an apparent puzzle in figure 9.1. While the price of dollars diverged substantially from the price of silver in London and Paris during the late 1850s and early 1860s, this was not the case at all in Amsterdam and

species are smaller: if we were to determine the arbitrage band from these data (not taking dollars into account), we would set it at around a ±2% level with respect to the bar price (for both gold and silver species). But although these numbers are much smaller than those observed in the case of dollars, they are nonetheless quite large: if we were to compute bar prices from specie prices, the error to be taken into account would be sensitive. As transaction costs (such as shipping or melting costs) and regulation (such as, for instance, restrictions in the public's access to minting) were probably much heavier in the decades preceding the ones we are analysing, we can imagine that the arbitrage band surrounding the (mostly 'theoretical') bar price gets wider and wider the further we go back in time.

To sum up, prices of gold and silver species could diverge substantially from the price of their metallic content. This could be due to extraordinary factors, like a) big obstacles in solving mismatches between supply and demand (as in the case of silver dollars, whose supply was determined in America and demand in Asia), or b) the effectiveness of domestic regulation on international markets (as in the case of gold doubloons, whose price depended on the amount of silver that could be exchanged against them in Spain). Even in the presence of ordinary transaction costs, however, the difference between bar prices and specie prices could be sensitive. As a consequence, species must be considered as very imperfect substitutes for ingots.

Section 4: Monetary Standards

4.1: Method

The next exercise we have to perform is a standard tool for the analysis of bullion-based monetary systems: it consists of looking at the deviation of exchange rates from their metallic par. This simple approach dates back to the work of classical authors (e.g. Goschen 1864) and has been widely applied to the study of the international gold standard. The idea is straightforward. Exchange rates can fluctuate within a band delimited by the so-called 'gold points', whose distance from the metallic par is determined by the costs of arbitraging gold between the two places (i.e. shipping, insurance, interest loss, etc.). If the exchange rate violates the gold points, a movement of bullion is supposed to take place between the two places. Violations call for immediate adjustments: if this does not happen and the violation persists, the stability of the metallic par is bound to be put under strain. As a consequence, the deviation of exchange rates from their par provides us with a lot of information about the relative position of one currency with respect to the other ones.

Hamburg: in both centres, the quoted price of the specie was fixed. This reveals two things about these centres: that 1) there actually was no true market for dollars there (prices were unsustainably lower than abroad), and that 2) their monetary systems evolved over time (since the early 1850s we can find one only fixed price of silver, whereas before that date prices of silver species floated both in Amsterdam and in Hamburg: see below).

If we want to adapt this analytical framework to the period preceding the birth of the international gold standard, however, we find that things are more complicated: as a matter of fact, two monetary metals and three possible standards (gold monometallic, silver monometallic, and bimetallic) coexisted at one time. As suggested by Flandreau (2004, pp. 57-61), the complication can be faced by resorting to the method employed by contemporaries: computing the so-called *arbitrated pars*.

An arbitrated par is the ratio of the prices of the same asset in two different places. In a sense, an arbitrated par is not different from the above-mentioned official metallic par, which consists of the ratio of the prices of gold in two countries[12]. But there are as many arbitrated pars as available instruments of monetary arbitrage: there is one par for gold, one for silver, and even one for any specie listed on both markets (see, for instance, Tate's (1834) formulae for computing dollar and doubloon arbitrated pars). However, it is possible that an arbitrated par, although theoretically existing, cannot be used as a benchmark for exchange rates: this happens if arbitrage on the underlying asset cannot actually take place because of the illiquidity of the market for this asset in one of the two places. Take the above-mentioned case of dollars: a dollar arbitrated par between London and Amsterdam could be computed, but it was meaningless as no market for dollars actually existed in Amsterdam and thus no arbitrage could take place through this instrument between the two centres. But without having direct data on the turnover of gold and silver markets in every financial centre, how can we know which arbitrated pars should be taken as a benchmark? The question is crucial if we want to compute the deviation of exchange rates from their par. Take the case of two centres like London and Hamburg: the former is on a gold standard, the latter on a silver standard. Which arbitrated par should be taken into account (the one for gold, the one for silver, or both)?

What we propose is a graphical analysis: for every bilateral exchange relation between places A and B, we construct a chart juxtaposing 1) the gold (bar) arbitrated par $p^G_{A,t}/p^G_{B,t}$; 2) the silver (bar) arbitrated par $p^S_{A,t}/p^S_{B,t}$; 3) the sight exchange rate on B in A $e^{A/B}_{A,t}$; and 4) the sight exchange rate on A in B $e^{A/B}_{B,t}$[13]. The idea is that observing the actual path of exchange rates with respect to the two arbitrated pars can help us understand the degree of activity of the bullion market: if an exchange rate deviates constantly and sensitively from one of the pars, this means that the par is ineffective as arbitrage on the underlying metal is not taking place.

[12] Conceptually, the difference lies in the fact that an arbitrated par is the ratio of market prices, while the official par is the ratio of legal prices. But as Flandreau (2004, pp. 4-5) points out, legal prices (such as the bank purchase price in London) were only a floor for market prices, which could fluctuate up to a ceiling (for instance, a bank selling price) that not always existed. The interesting question is that in monometallic systems, the allowed band of fluctuation for the market price of the standard metal apparently shrank over time (as we have already observed in the case of Amsterdam and Hamburg): this very fact actually annihilated the difference between official and arbitrated pars. But as long as the market price of the standard metal differed from the legal price, arbitrated rather than official pars should be used as the correct benchmark for exchange rates.

[13] As we have already pointed out, both sight exchange rates are not always available. Sight exchange rates in Hamburg used here are the corrected ones (see above).

4.2: Results

Figures 10.1-10 display results for all ten bilateral exchange relations. The picture emerging from these charts is not always univocal. Sometimes, exchange rates fluctuate within the corridor between the two arbitrated pars: this is the case of the London/Paris relation (figure 10.1: this corresponds to the bimetallic mechanics described by Flandreau 2004, pp. 57-61), but also of the Hamburg/Paris (figure 10.6) and London/Hamburg relations (figure 10.3: this result is interesting, as the two places are on different monometallic standards). Sometimes, the gold par is clearly not representative of an actual arbitrage opportunity: this is the case of the London/Amsterdam (figure 10.2), Paris/Amsterdam (figure 10.5) and Amsterdam/Frankfurt relations (figure 10.9). Sometimes, the situation evolves over time, as in the case of the London/Frankfurt (figure 10.4), Frankfurt/Paris (figure 10.7) and Frankfurt/Hamburg relations (figure 10.10): while in the 1840s gold pars run very far from exchange rates, in the following years they generally keep pace with the path of the other factors[14]. Sometimes, the situation is rather unclear, as in the case of the Amsterdam/Hamburg relation (figure 10.8)[15].

The criteria we adopted to cope with these findings are the following. Many problems emerged for arbitrated pars computed via Amsterdam and Frankfurt gold prices: as a consequence, we assumed that a negligible market for gold existed in these two centres, and always referred to silver pars for all bilateral relations including them. On the contrary, we found evidence of an important gold market in the other silver standard centre, i.e. Hamburg, and in the bimetallic centre, i.e. Paris: as a consequence, we took gold pars as a benchmark for exchange rates between London, Paris and Hamburg. Notice that this is consistent with data reported by *The Economist*, which always published gold arbitrated pars between London and these two places in its *Bankers' Gazette* section. The application of these criteria is summarized in table 1[16].

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[14] This seems to point to a problem in the quotation of gold in Frankfurt in the 1840s. However, our analysis of bullion prices in this place did not show any particular feature in the way bar gold was listed (see figure 9.2). As a consequence, we think this was due to scarce trading volumes for gold in this place. This is consistent with Seyd (1868, p. 315), who says that Frankfurt 'is not a large market for bullion'.

[15] Notice that this is the only real 'fixed' par for silver (at least for a remarkable part of the period): this is consistent with our previous observation that in Amsterdam and Hamburg the corridor within which prices of bar silver are allowed to fluctuate was shrinking over the period (see below).

[16] The fact that these criteria are reasonable is evidenced by some additional computations (we do not report them here for brevity's sake): we have run tests illustrated in the following section using both arbitrated parities for all bilateral exchange relationships. The results definitely confirmed the choice of the par we had previously done thanks to our graphical analysis: the chosen par always produced a clearer NW-SE distribution of observations (see below).

	FRF	NLG	HHM	FFG
GBP	*Gold (Silver)*	*Silver*	*Gold (Silver)*	*Silver*
FRF		*Silver*	*Gold (Silver)*	*Silver*
NLG			*Silver*	*Silver*
HHM				*Silver*

Table 1:
Effective arbitrated pars for each bilateral exchange relation

To sum up, in bullion-based monetary systems as many arbitrated pars as monetary instruments of arbitrage did exist: however, not all of them were effective, depending on the liquidity of the market for the underlying instrument. Under the international gold standard (when silver had lost its role as a monetary metal), only gold (bar) arbitrated pars were effective. In the preceding decades, however, in many cases gold arbitrated pars were not the actual benchmark around which exchange rates fluctuated. As all main financial centres were closely integrated, we do not think this to be due to market inefficiency, but to the illiquidity of the gold market in some of these centres. If this assumption holds, then we can conclude that in the mid-19th century silver still played a much more important role than gold as an international monetary metal.

Section 5: Risk Premia and the Dynamics of the International Monetary System

5.1: The Target Zone Approach

We have seen that in bullion-based systems, exchange rates are allowed to fluctuate within a band determined by bullion import and export points. There are many similarities between this situation and modern target zones; as a consequence, many contributions have applied the framework emerged from target zone theory to the analysis of a bullion-based system such as the international gold standard (Eichengreen and Flandreau 1997). Our aim here is to extend these methods to the study of the mid-19th-century international monetary system, and to build on these results in order to get new insights on the dynamics of exchange rates during this period.

Flandreau and Komlos (2006, pp. 6-8) survey the literature on target zones and exchange rate determination. They recall that under the conditions of 1) agents' rationality and 2) monetary policy credibility, speculation must be mean-reverting towards the central par: as a consequence, there must be 'a downward-sloping relation between the location of the exchange rate within the band and the expected rate of currency depreciation' (as shown in figure 11). They suggest that the best measure of the expected rate of currency depreciation is the forward premium, deriving from the difference between forward and spot exchange rates. But forward exchange rates did not exist in the mid-19th century[17]. As a consequence, we are obliged to resort to a more classical tool: adding the condition of 3) uncovered interest rate parity (UIP), we measure the expected rate of currency depreciation by the interest rate differential.

For every bilateral exchange relation, we construct a chart of the kind of figure 11, where we put a) on the horizontal axis, the exchange rate deviation from the (arbitrated) par, or

$$s_t^{Par^{A/B}} = \frac{e_t^{A/B}}{\left(\frac{p_{A,t}^M}{p_{B,t}^M}\right)} - 1$$

and b) on the vertical axis, the expected rate of currency depreciation, which is equal (if the UIP holds) to the (market) interest rate differential, or

$$\frac{E_t\left(e_{t+1}^{A/B}\right)}{e_t^{A/B}} - 1 = i_{A,t} - i_{B,t}$$

Results are shown in figures 12.1-10. Despite all caveats tied to the reliability of the underlying data series (as we have said in the previous sections, market interest rate series were partially derived from shadow rates, and a choice had to be made about the arbitrated par to be taken as a benchmark), the relation between exchange rates and interest rate differentials always has the predicted downward-sloping configuration. Does this mean that the assumptions of 1) agents' rationality, 2) commitment credibility, and 3) UIP are all supported by empirical evidence? This would be a particularly striking result for what concerns the third assumption: as a matter of fact, the UIP condition is a very restrictive one, which has generally been rejected in the case of 20th-century data (Isard 2006).

5.2: Developments: The Risk Premium

The relation we are focusing on can be written as

$$i_{A,t} - i_{B,t} = \alpha + \beta s_t^{Par^{A/B}} + \varepsilon$$

and UIP would imply that $\alpha = 0$. However, figures 12.1-10 suggest that the Y-intercept of this function never equals zero: sometimes the difference is rather negligible, but sometimes it is significant (as in the case of the Paris-Frankfurt relation: see figure 12.7). Moreover, figures 12.1-10 are very long term results (26 years): if we divide the period into smaller samples the picture changes substantially, and a neat evolution can be observed in the size of this difference over time (see, for instance, the Paris-London relation: figure 13).

[17] While forward prices for commodities or securities have always existed (Weber 2008), forward exchange rates did not appear until the late 19th century; what is more, before the First World War the only currencies for which forward exchange rates are available were the unconvertible ones (such as the Austrian gulden, i.e. the case analysed by Flandreau and Komlos 2006). This fact conveys two ideas: first, the credibility of the convertibility commitment of the most important currencies was indeed very high; and second, 19th-century forex markets were not the most important stage of international speculation as they are nowadays, in a regime of flexible rates (Lyons 2001).

We think that this phenomenon should not be imputed to an error ε, but to a parameter α playing a role in the equation determining the expected rate of currency depreciation, which should be rewritten as

$$\frac{E_t\left(e_{t+1}^{A/B}\right)}{e_t^{A/B}} - 1 = \left(i_{A,t} - i_{B,t}\right) - \alpha_t^{A/B}$$

Note that this $\alpha_t^{A/B}$ is not an *ex-post* prediction error of future exchange rates, but an *ex-ante* expected deviation of future exchange rates from the UIP condition: it derives from the fact that this condition abstracts from all kinds of credit risks (Keynes 1923). $\left|\alpha_t^{A/B}\right|$ is a measure of how much agents expect future exchange rates not to behave as they would in a risk-free environment: the bigger $\left|\alpha_t^{A/B}\right|$, the greater the lack of future correction of current interest rates disparities. In other words, $\alpha_t^{A/B}$ is the interest rate spread at which no arbitrage will take place between currency A and currency B at time *t*: the equilibrium level of $i_{A,t}$ for which no changes in the exchange rate are expected (i.e. $E_t\left(e_{t+1}^{A/B}\right) = e_t^{A/B}$) will be given by

$$i_{A,t}^{eq} = i_{B,t}^{eq} + \alpha_t^{A/B}$$

When $\alpha_t^{A/B} > 0$, $i_{A,t}^{eq}$ is higher than the level it would assume if the UIP condition held, which means that A is perceived as riskier than B; on the contrary, when $\alpha_t^{A/B} < 0$, $i_{A,t}^{eq}$ is lower than the level it would assume if the UIP condition held, which means that A is perceived as safer than B. As a consequence, we call $\alpha_t^{A/B}$ the *risk premium* of currency A with respect to currency B at time *t*.

5.3: Computing the Risk Premium

Assessing the fluctuations of the risk premia of one currency with respect to the other ones would provide us with much precious information about the historical dynamics taking place within the international monetary system: it would tell us which currencies are expected to overperform the other ones, giving a direct measure of the relative strength of each currency and an indirect measure of capital movements from one place to the other. But computing risk premia is not a straightforward operation. $\alpha_t^{A/B}$ is defined as the Y-intercept of the linear regression of $\left(i_{A,t} - i_{B,t}\right)$ on $s_t^{Par^{A/B}}$: the smaller the number of observations, the greater the degree of imperfection of the measurement. Yet the bigger the number of observations, the poorer the utility of the computed value in order to understand the evolution of risk premia over time.

In order to reconcile these two opposite needs, we propose the following method: for every time *t*, we compute $\alpha_{t-30,\dots,t+30}^{A/B}$ as the Y-intercept of the above-mentioned linear regression for an interval of data going from *(t – 30)* to *(t + 30)*, i.e. sixty weeks. In a sense, $\alpha_{t-30,\dots,t+30}^{A/B}$ is a sort of 'moving average' of all $\alpha^{A/B}$ within a period of thirty weeks before and thirty weeks after the time of the considered observation: this allows us to have a sense of the general trends taking place in that moment, without losing too much in terms of the quality of measurement.

For every currency taken into exam, figures 14.1-5 compare bilateral risk premia $\alpha_{t-30,\ldots,t+30}^{A/B}$ with respect to all other scrutinized currencies. Charts should be read as follows: if the risk premium is positive, the currency is expected to underperform with respect to the UIP prediction (which means that it is inherently weak, and that capital are is mostly leaving the country); on the contrary, if the risk premium is negative, the currency is expected to overperform with respect to the UIP prediction (which means that it is inherently strong, and that capital is mostly pouring on to the country). The results are encouraging: trends in different bilateral risk premia tend to coincide (e.g. if $\alpha_{t-30,\ldots,t+30}^{A/B} > 0$, in most cases also $\alpha_{t-30,\ldots,t+30}^{A/C} > 0$ and $\alpha_{t-30,\ldots,t+30}^{A/D} > 0$)[18]. This is a strong hint at the fact that the proposed methodology works.

5.3: Results

Figures 14.1-5 tell us a lot about the historical dynamics taking place in the international monetary system: we shall now look them into detail currency by currency.

5.3.1: British Pound

Rather surprisingly, during the celebrated mid-Victorian age (often depicted as the apex of the British economic predominance over the world) the U.K. currency was hardly perceived as a safe haven from money market participants: as a matter of fact, risk premia on the pound remained positive for a large part of the period (figure 14.1). The moment of super-liquidity which followed the enforcement of Peel's Act (coinciding with the 'rail mania', fuelled by unprecedentedly low interest rates) came to an end with the 1847 crisis; from 1847 to 1858, the pound suffered from positive risk premia with respect to silver-based currencies. We think this was tied to the sudden decrease in gold prices of the early 1850s, after which the average value of the pound with respect to silver-convertible currencies lowered by around 3% (figures 10.2-4): this is a trifle for nowadays' standards, but it was perceived as a shock for a bullion-based system in which 'any depreciation, however small—even the liability to depreciation without its reality—is enough to disorder exchange transactions', as 'they are calculated to such an extremity of fineness that the change of a decimal may be fatal, and may turn a profit into a loss' (Bagehot 1873, II.14). As a consequence, the fear of further gold depreciations probably played a role in producing positive risk premia for the pound during the 1850s. In the early 1860s, the international political disturbances we have already hinted at put the U.K. economy under strain, producing large fluctuations in interest rates (figure 5): this instability materialized into high alphas. Later on, the Overend Gurney crisis represented a huge shock for the British financial system, which is known to have produced a capital flight from London to Paris (reflected by the large interest rate differential between the two centres): as a consequence, from 1866 to 1870 the French franc came to be perceived as a safer currency than the pound.

[18] Of course this is not always possible as, by definition, $\alpha_{t-30,\ldots,t+30}^{A/B} = -\alpha_{t-30,\ldots,t+30}^{B/A}$.

5.3.2: French Franc

France's currency is the one experiencing the most striking evolution during the period of our concern (figure 14.2). As a matter of fact, up to 1865 the franc was clearly perceived as the most risky currency among the most important international ones: this was probably tied to the country's traditional political instability, and to the relatively low liquidity of the Paris money market (average interest rates were generally higher in Paris than in all other scrutinized centres: figure 5)[19]. The Overend Gurney crisis produced an earthquake in the hierarchy of the international monetary system. Paris stayed completely untouched by the crisis – which suggests that a capital flight to France was taking place. All of the sudden, the franc became the most liquid international currency, enjoying negative risk premia with respect to all other ones. This came to an end in September 1870, when the French army was defeated by the Prussians: the big shock represented by the war and its consequences (military occupation of the country, revolution in Paris, suspension of convertibility etc.) destroyed for good the short-lived primacy of the franc.

5.3.3: Dutch Gulden

The case of the Netherlands' currency is quite interesting, as it is the one most closely tied to the events taking place on the international bullion market. In order to understand the situation, we have to recall briefly some historical events. Up to 1847, the country had a bimetallic system; due to a high official silver/gold ratio, though, the only full-body coins circulating were gold species. In November 1847 the parliament passed a bill abolishing the coinage of gold pieces, and authorising the government to withdraw these coins from circulation. At the beginning of 1850, information on the actual extent of gold discoveries in California and Australia arrived in Europe. Fearing future depreciations, in June the Dutch government hastily withdrew gold from circulation and started selling it on the Paris market. As a consequence of this move, the price of gold collapsed and the Dutch suffered heavy losses (Belgique: Chambre des Représentants 1859, pp. 20-22). Some international commentator (such as French economist Léon Faucher) blamed the Netherlands for having generated an undue panic on the bullion market (gold prices recovered in 1851 after the cessation of Dutch sales, and the actual effects of discoveries started to be felt from late 1852 only: see figure 7); in order to justify itself, The Hague even promoted the publication of a book in French (Vrolik 1853, pp. 1-2) disclaiming its responsibilities. In the end, the Netherlands became the first country to adopt a pure silver standard and to completely wipe out gold from circulation: as a consequence, the general sentiment about the gulden came to be tied to the one about silver (figure 14.3). This accounts for the negative values assumed by risk premia for this currency throughout the 1850s and early 1860s (up to 1850 the currency had suffered from positive alphas, except for some months during the 1847-48 international

[19] As we have already pointed out, it is probable that (for some unclear reasons) the Paris shadow interest rate as computed from foreign places is somewhat higher than the actual one. As we used shadow rates as substitutes for actual market rates for the period before 1861, it is possible that our series of Paris rates is a bit higher than it should. However, we do not think this phenomenon to change our picture substantially: risk premia for the French franc remain clearly positive also for the period between 1861 and 1865, when the rates published by *The Economist* were used.

crisis). Interestingly enough, when in the late 1860s new silver discoveries in Nevada changed the outlook about this metal, the gulden became the worst performer within our sample.

5.3.4: Hamburg Mark Banco

The mark banco was the unit of account in which claims on the Hamburg giro bank were denominated, and was thus just an 'imaginary' currency; in 1846, however, the bank committed to buy and sell silver to depositors at a fixed price, thus *de facto* anchoring the mark banco to this metal (Seyd 1868, p. 316). But while the silver value of the Dutch gulden could not be changed in the short run (full-body species were struck with their value in guldens engraved on them), the silver value of the mark banco could be changed at any time (which happened to occur in 1868: the bank price of the metal was lowered, which amounted to a revaluation of the unit). As a consequence, the sentiment about the Hamburg currency was independent from the one about silver: we see that risk premia assumed either positive or negative values according to international factors (figure 14.4). During the 1850s, Hamburg experienced a financial boom that is clearly observable from negative alphas: this expansion came to an end with the 1857 crisis, which hit Hamburg harder than any other centre (articles in the *Börsen-Halle* newspaper for December 1857 provide large evidence on the shock).

5.3.5: Frankfurt Gulden

In the mid-19th-century, financial activity in Frankfurt depended more on the solidity of a position acquired in the past than on the dynamism of present ventures. As a consequence, it might seem surprising to see the Frankfurt gulden be the best performer of all scrutinised currencies in terms of risk premia (figure 14.5). However, this is coherent with the nature of the gulden, bearing all the features of a typical safe-haven currency: good liquidity (bills on Frankfurt were traded in all main financial centres), low yields (see figure 5), and low risk (Frankfurt was an independent and stable city-state). Unfortunately (although probably this is not a fortuitous accident), listings from the Frankfurt bourse are missing for the period following 1866, when the city was annexed by Prussia and lost both political and monetary independence. If these data had existed, to all likelihood we would have observed Frankfurt lose its status of safe haven as well[20].

5.4: Conclusions

Two main conclusions can be drawn from figures 14.1-5. First, the two core currencies of the system (the British pound and the French franc) were hardly perceived as safe havens by agents: on the contrary, their value was often expected to underperform with respect to the UIP condition. This was tied to the fact that both were high-yielding currencies (see figure 5),

[20] In the history of Germany, there is a strong negative correlation between the fortunes of Frankfurt and Berlin as financial centres. As a matter of fact, Berlin emerged when Frankfurt lost importance as a consequence of its annexation in 1866; but in 1945, Frankfurt was chosen as the Allies' operational centre in West Germany and all major German banks abandoned Berlin for Frankfurt, thus reviving the city's role as a financial centre (Cassis 2006).

experiencing more violent fluctuations in their domestic credit markets. On the contrary, old-established but less central financial centres (such as Amsterdam or Frankfurt) had low-yielding currencies and less volatile credit markets, making them perceived as less risky.

Second, the primacy of the British pound on the international monetary system, which became undisputed after 1870, was not a manifest destiny. On the contrary, the London market seemed to lose ground as a magnet for international short-term capital in the second half of the 1860s. This was particularly due to the effects of the 1866 crisis, whose importance has probably been underestimated by economic historians. It was a systemic crisis, in the event of which the fall of a largely interconnected, internationally renowned institution (Overend Gurney) spread general mistrust on the whole money market. Coeval commentators had this clearly in mind. On 16th June 1866 (more than one month after Overend's fall), *The Economist* published a short front article titled 'Still Ten per Cent'. It argued that the Bank of England was actually fighting the crisis with a conventional weapon: keeping extremely high discount rates, the bank was hoping to fix the liquidity shortage in London by attracting fresh capital from abroad. According to the writer, however, capital was not responding to the bank's appeal for a specific reason: the present crisis was not a conventional one. 'English credit is impaired, and no rate of interest will now enable us to borrow as easily or as effectually as in ordinary times': the reason was that 'bills on London are now suspected; we pay gold and silver where we used to pay bills, and we receive gold and silver where we used to receive bills'. Nonetheless, keeping high interest rates was the only policy that could possibly be implemented in that moment, although for a different reason: as a matter of fact, it would help 'contract the sphere of our commerce, which was based on good credit, to the smaller space suitable and necessary now that our credit is no longer what it was'. Trust in the English banking system was impaired to the point that only a real correction could put an end to the crisis.

The capital flight to France was thus substantial: perhaps for the only time in modern history, between 1866 and 1870 Paris looked able to contend London's primacy as the most important international short-term money market. Note that this is consistent with what we had found in the excerpt from *Lombard Street* quoted in our introduction: Bagehot's qualitative assessment of the pre-eminence of Paris before 1870 finds confirmation in our quantitative evidence[21]. The '*fête impériale*' abruptly came to an end because of Napoleon III's unwise decision of declaring war to Prussia. The consequences of this foolish choice were bound to reshape the international monetary system in depth.

[21] Bagehot (1873, II.14) also maintains that 'the pre-eminence of Paris partly arose from a distribution of political power': perhaps this played some role in determining the negative risk premia on the French franc observed in the second half of the 1860s. Yet as we have seen, the real structural change in the international status of the franc took place in 1866: it coincided with a major financial event (the Overend Gurney crisis) and not with any major political event.

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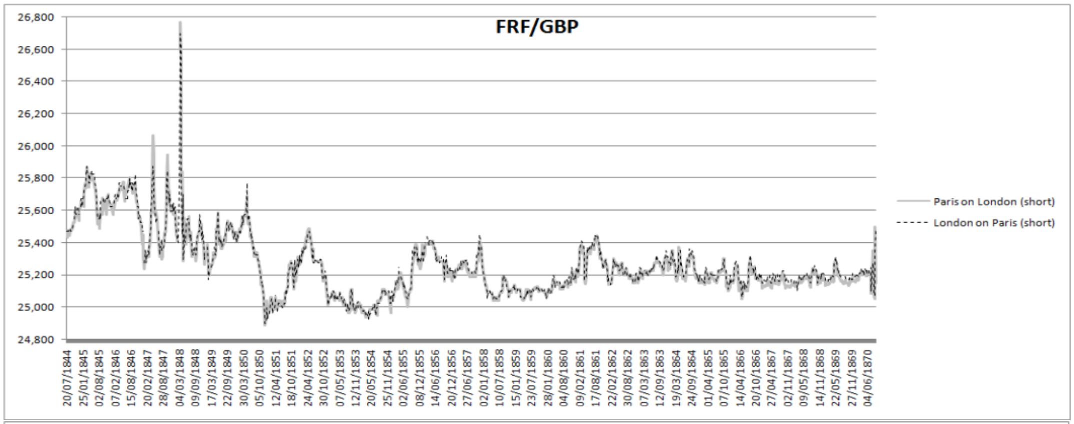
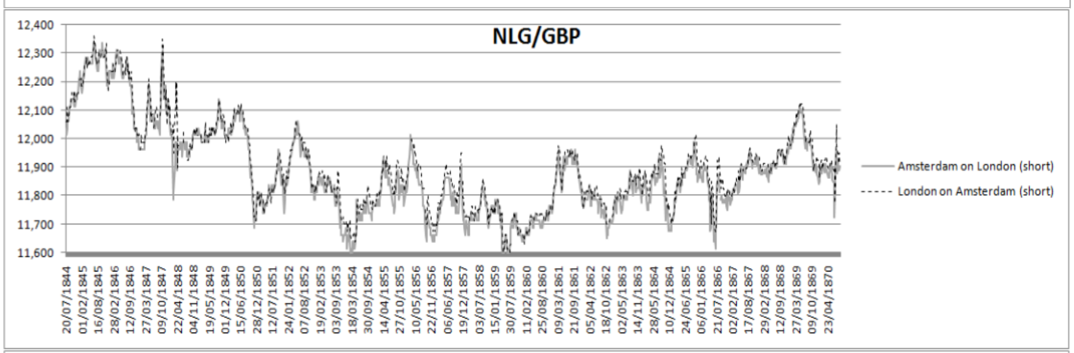
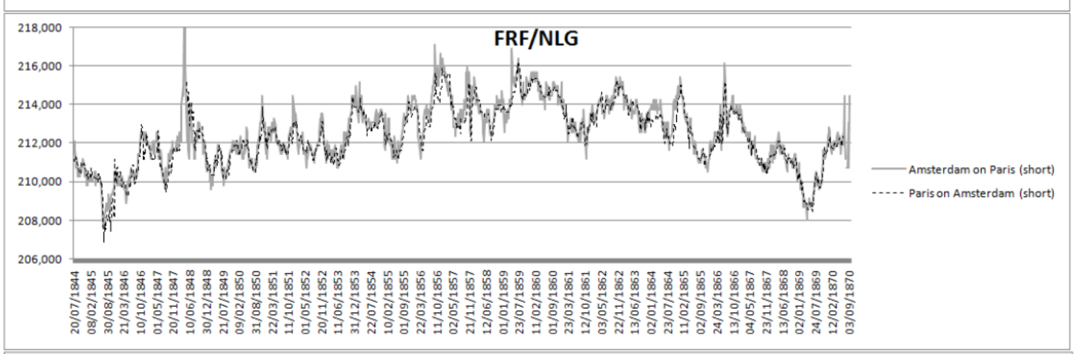
List of Abbreviations

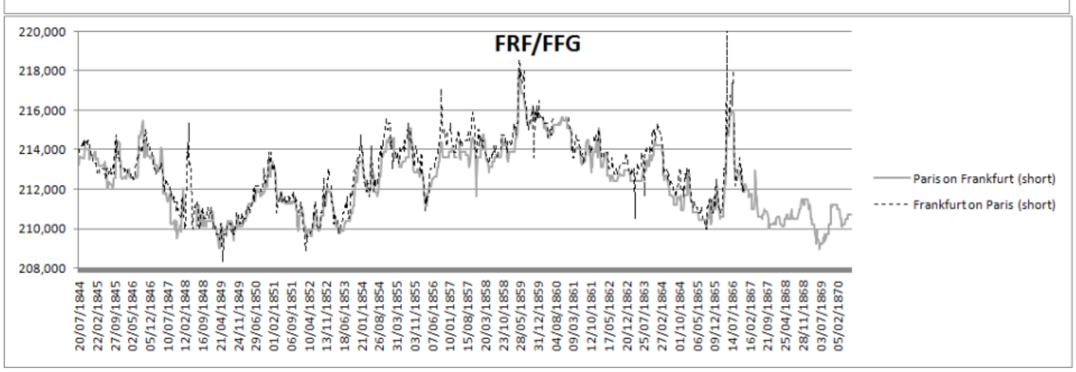
GBP: British pound
FRF: French franc
NLG: Dutch gulden
HHM: Hamburg mark banco
FFG: Frankfurt gulden
ESP: Spanish piastra forte

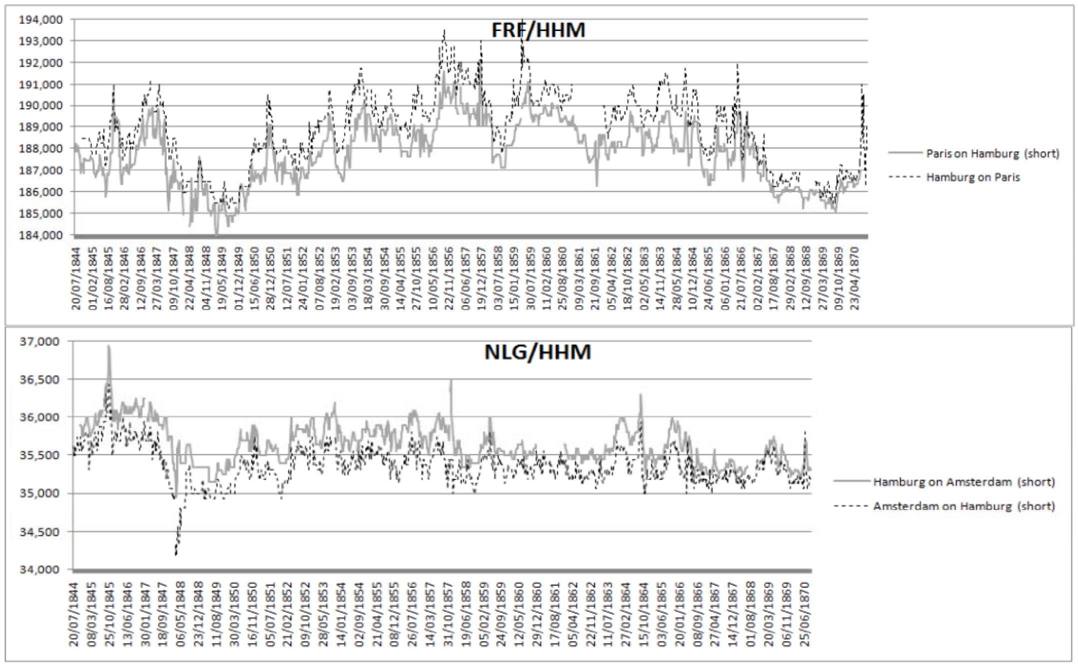
Figures


FRF/GBP
26,800
26,600
26,400
26,200
26,000
25,800
25,600
25,400
25,200
25,000
24,800
Paris on London (short)
London on Paris (short)


NLG/GBP
12,400
12,300
12,200
12,100
12,000
11,900
11,800
11,700
11,600
Amsterdam on London (short)
London on Amsterdam (short)


FRF/NLG
218,000
216,000
214,000
212,000
210,000
208,000
206,000
Amsterdam on Paris (short)
Paris on Amsterdam (short)


FRF/FFG
220,000
218,000
216,000
214,000
212,000
210,000
208,000
Paris on Frankfurt (short)
Frankfurt on Paris (short)



Figures 1.1-6: Sight exchange rates compared per bilateral exchange relation.

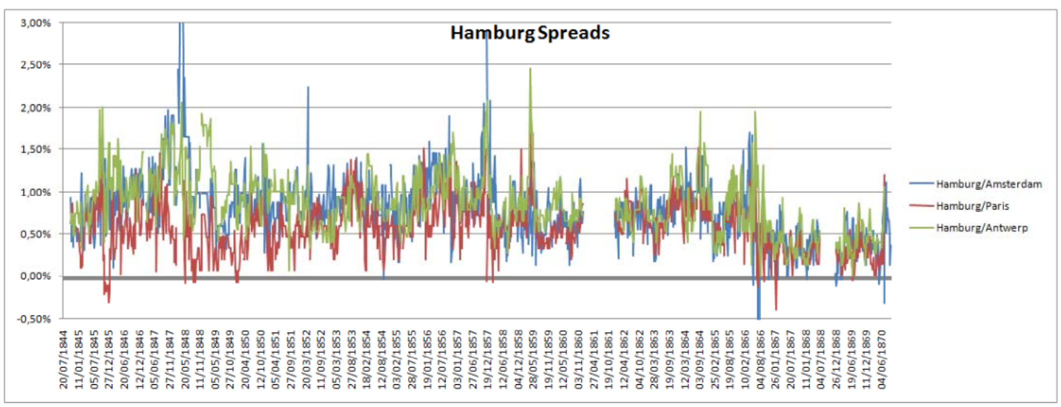


Figure 2: Sight exchange rate spreads for three bilateral exchange relations with Hamburg.

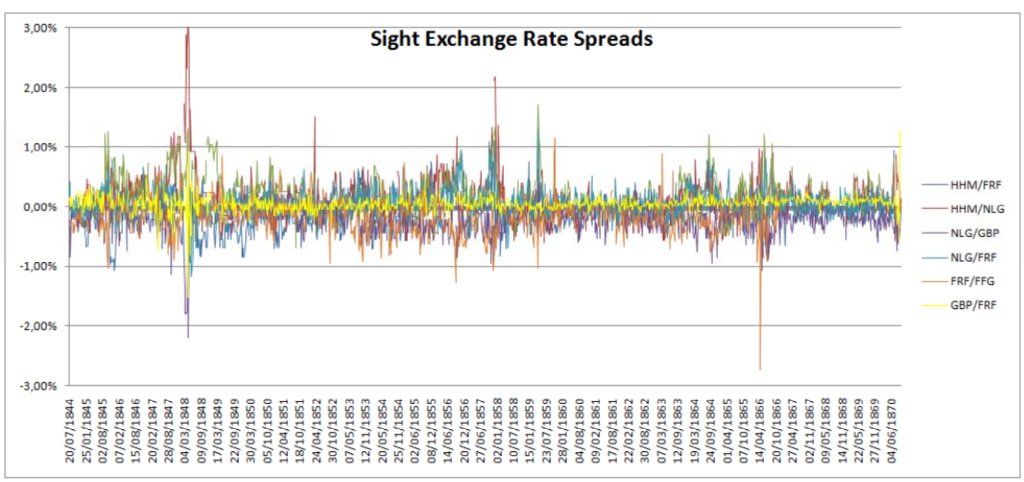
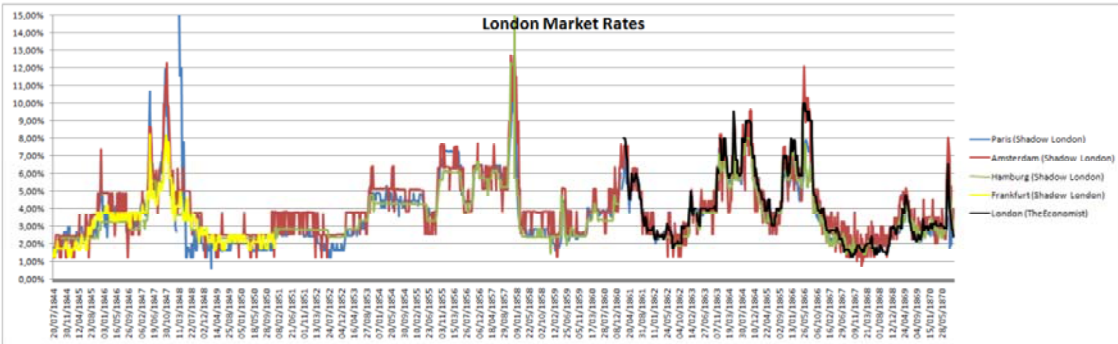
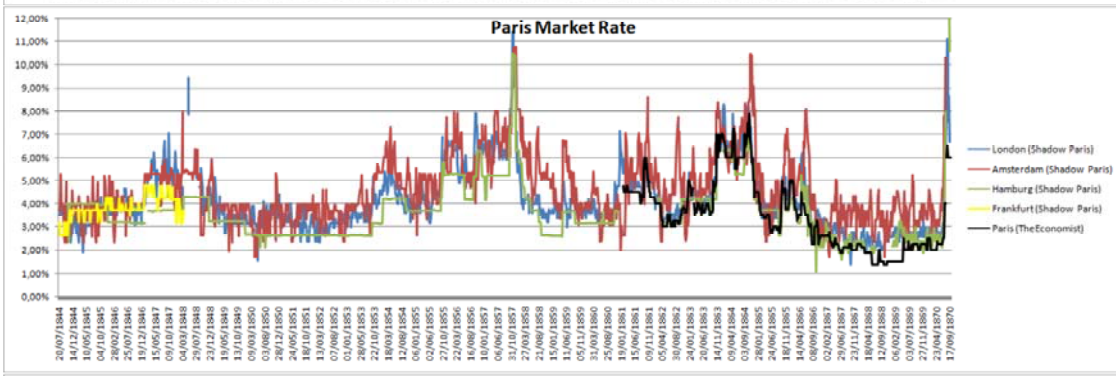
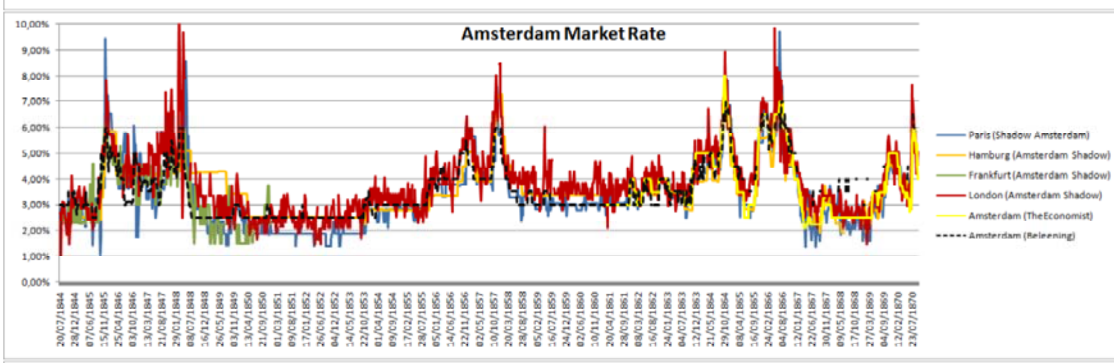
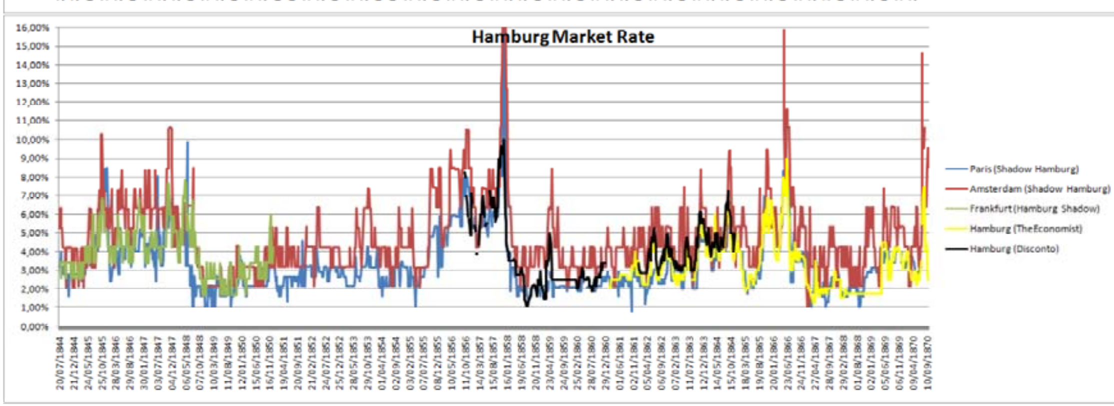


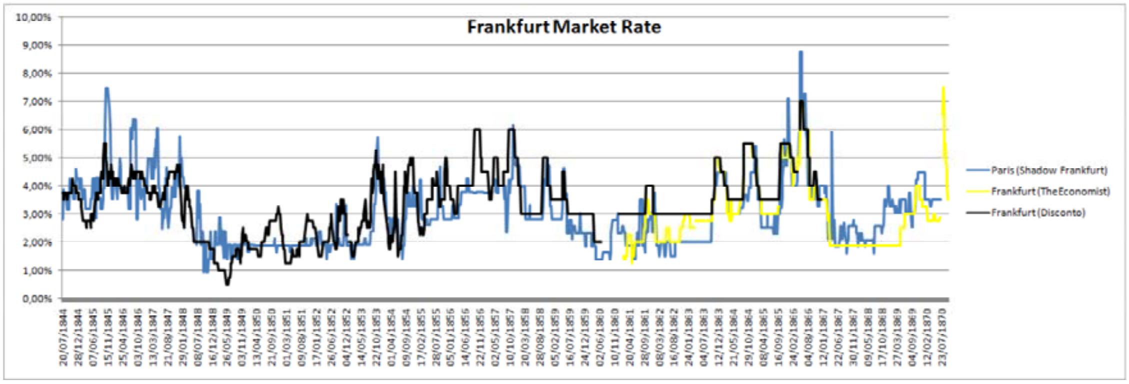
Figure 3: Sight exchange rate spreads for all six exchange bilateral relations.


London Market Rates
Paris (Shadow London)
Amsterdam (Shadow London)
Hamburg (Shadow London)
Frankfurt (Shadow London)
London (TheEconomist)


Paris Market Rate
London (Shadow Paris)
Amsterdam (Shadow Paris)
Hamburg (Shadow Paris)
Frankfurt (Shadow Paris)
Paris (TheEconomist)


Amsterdam Market Rate
Paris (Shadow Amsterdam)
Hamburg (Amsterdam Shadow)
Frankfurt (Amsterdam Shadow)
London (Amsterdam Shadow)
Amsterdam (TheEconomist)


Hamburg Market Rate
Paris (Shadow Hamburg)
Amsterdam (Shadow Hamburg)
Frankfurt (Hamburg Shadow)
Hamburg (TheEconomist)
Hamburg (Disconto)



Figures 4.1-6: Shadow and actual market interest rates.

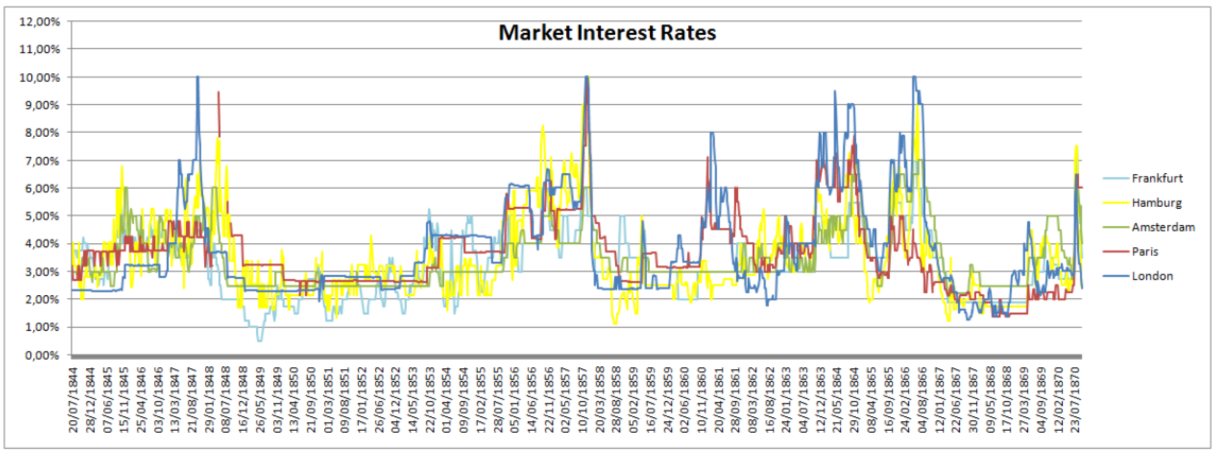
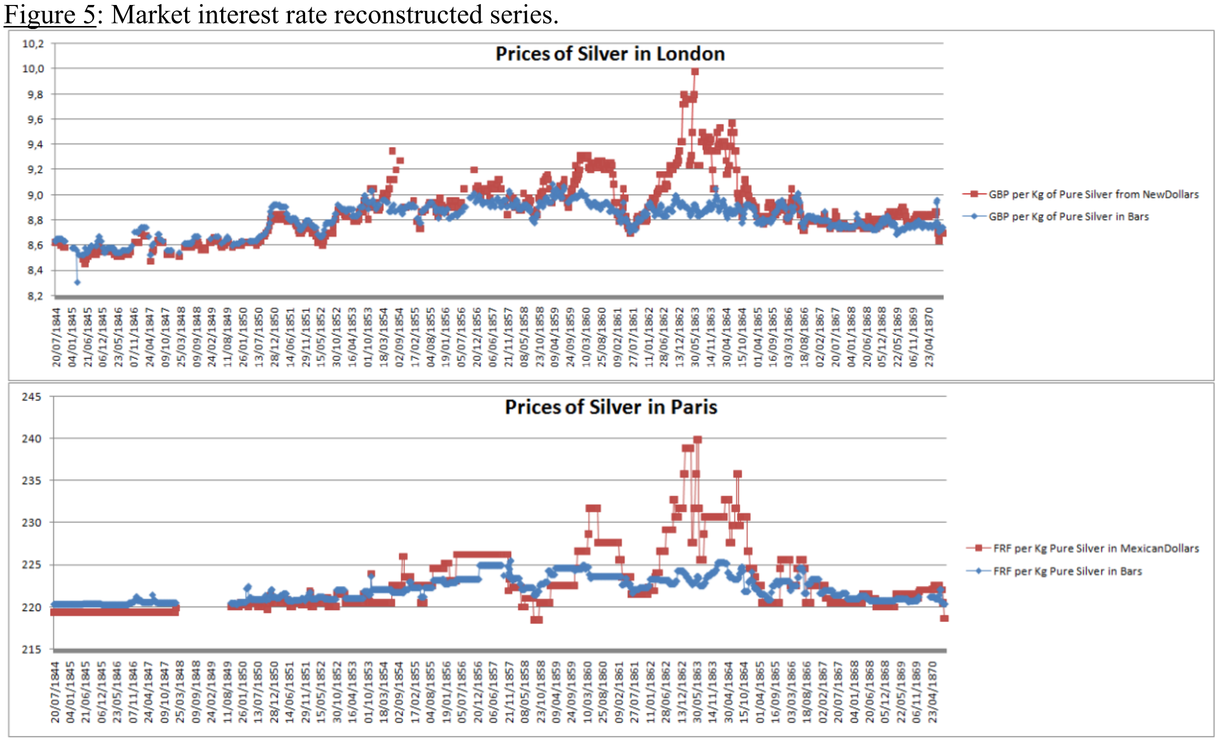


Figure 5: Market interest rate reconstructed series.



Figures 6.1-2: Prices of silver (in bars and in Mexican dollars) on the London and Paris markets.

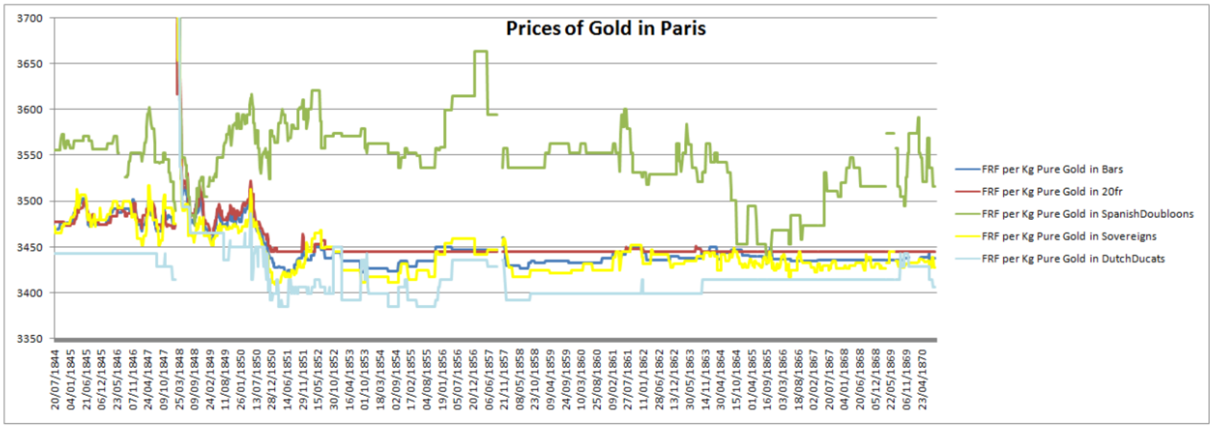


Figure 7: Prices of gold (in bars and in various species) on the Paris market.

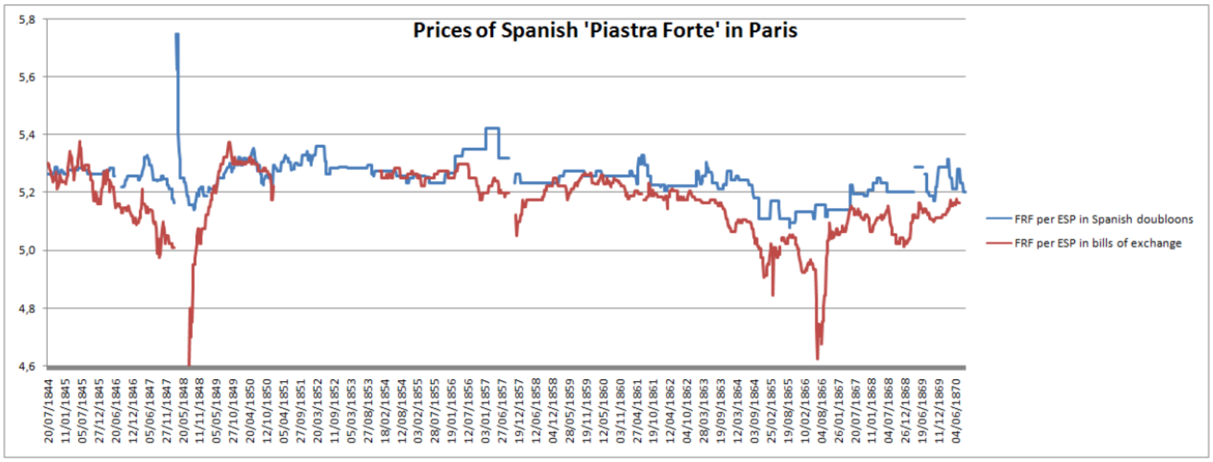
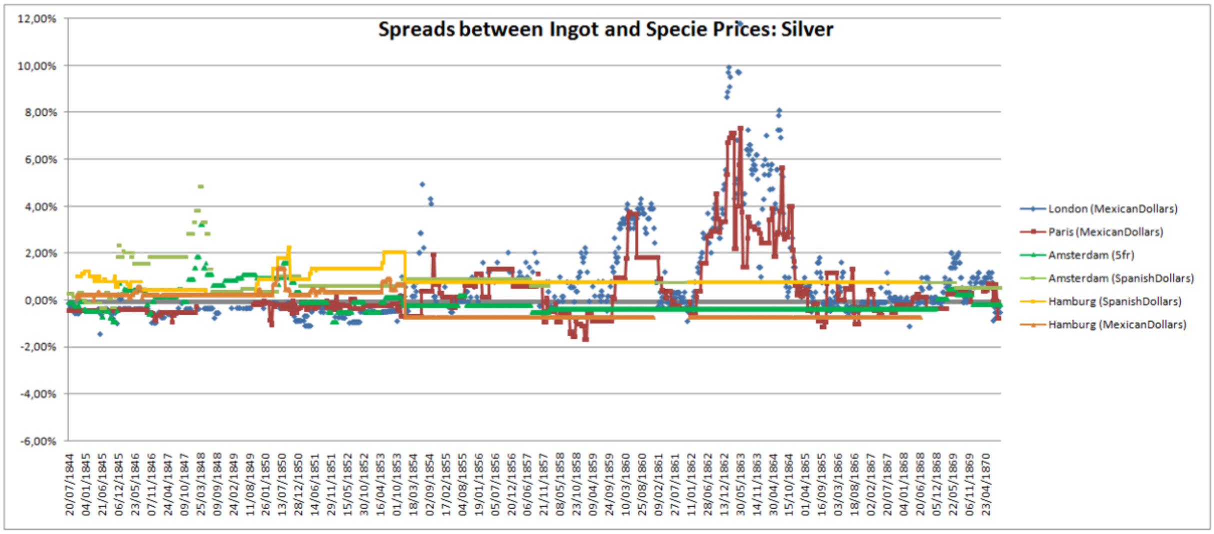
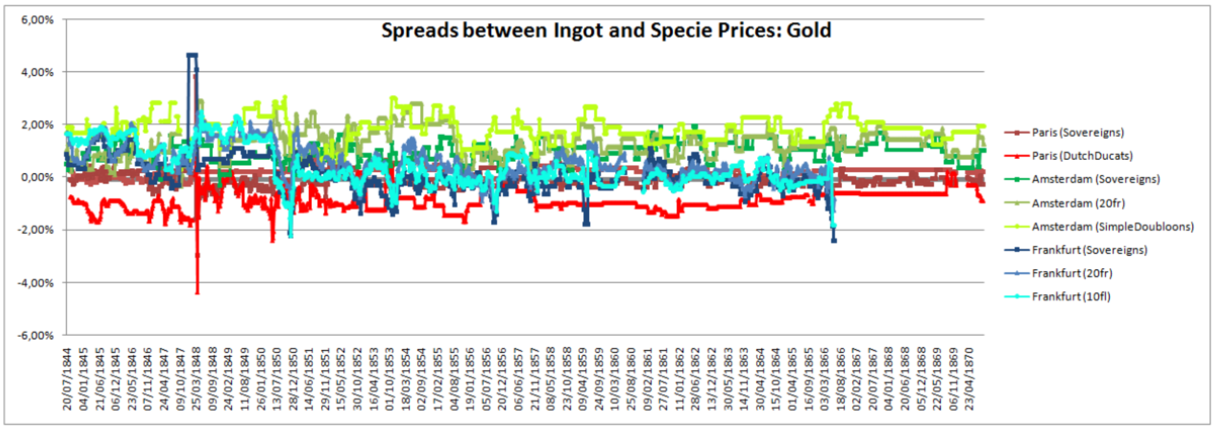
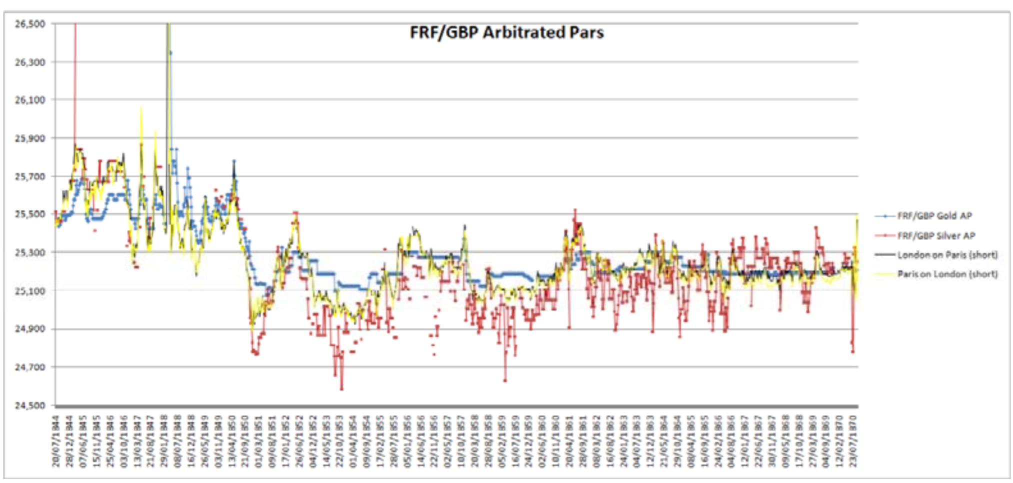


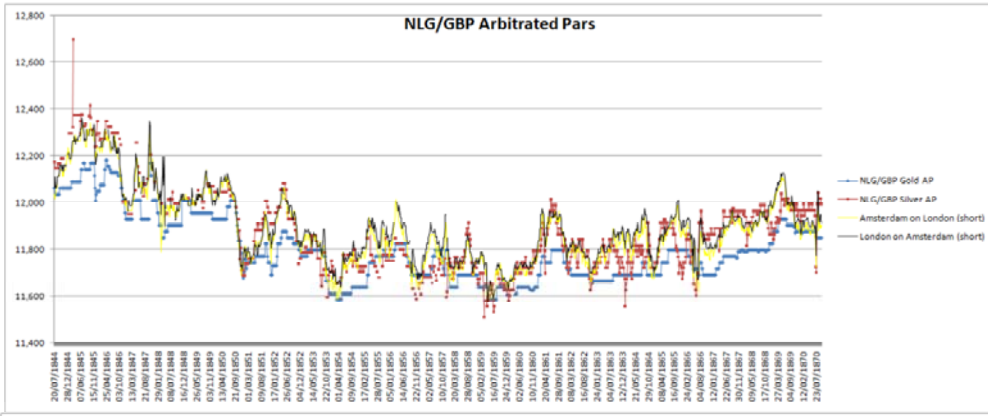
Figure 8: Prices of one Spanish piastra forte (in bills and in gold doubloons) on the Paris market.

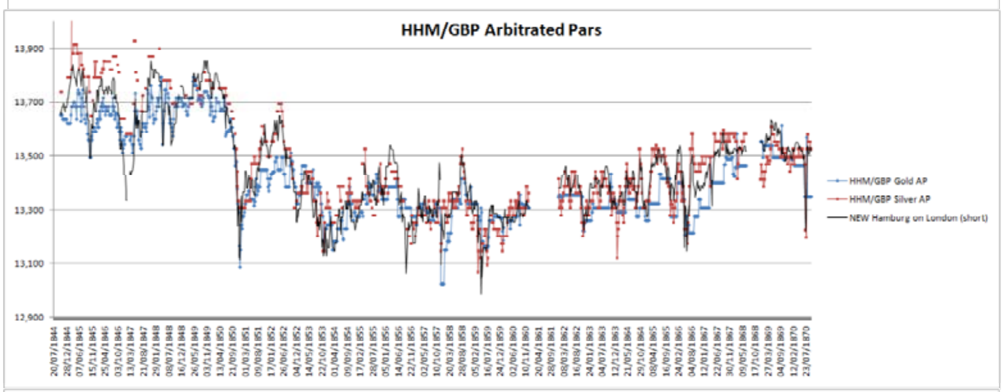


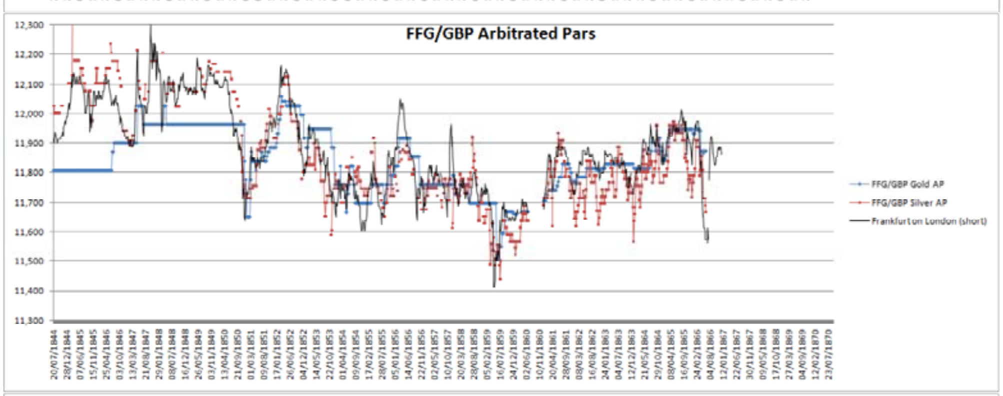


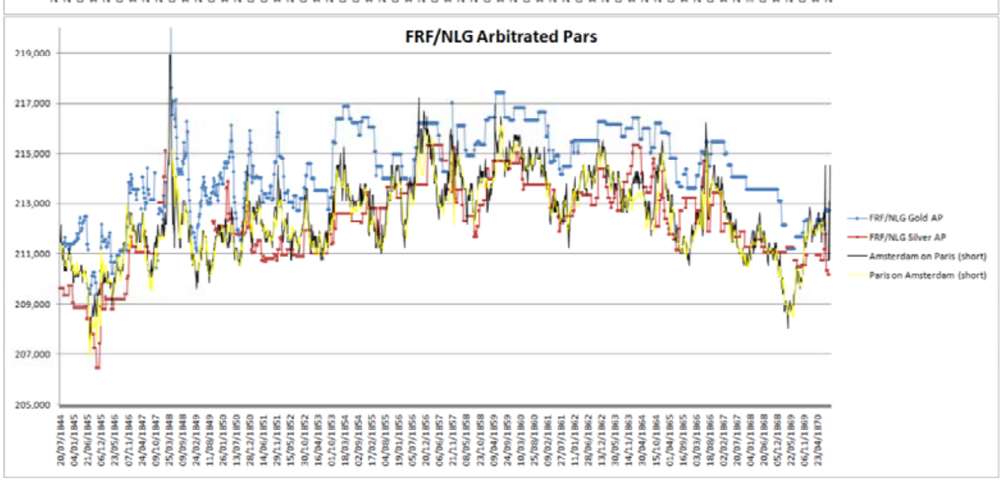
Figures 9.1-2: Spreads between bar and specie prices for silver and gold markets.

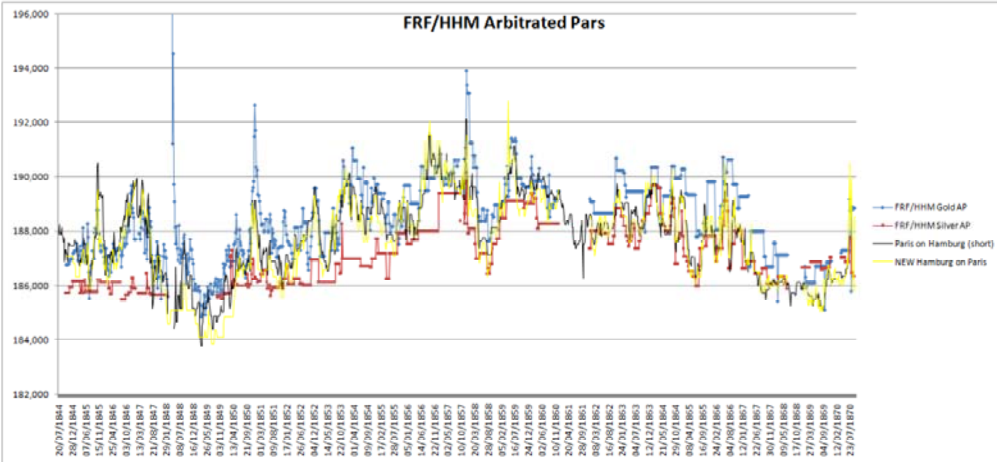


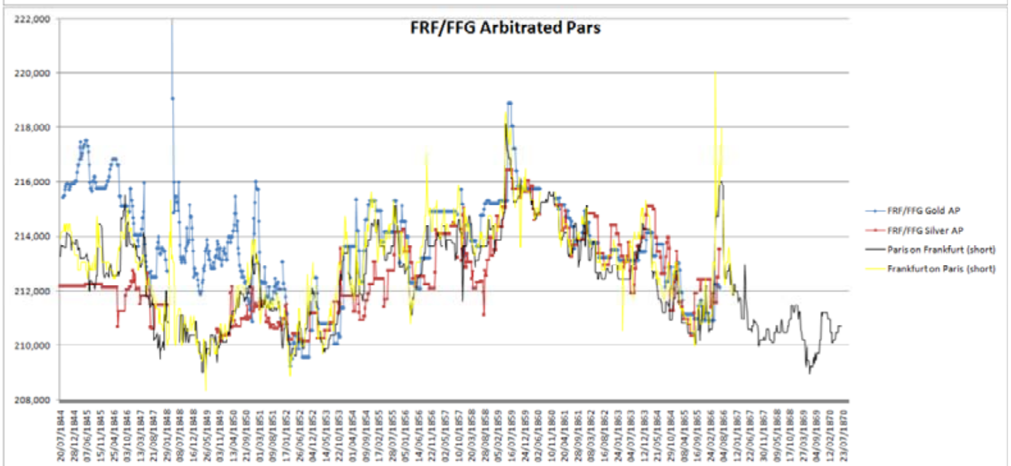

NLG/GBP Arbitrated Pars
12,800
12,600
12,400
12,200
12,000
11,800
11,600
11,400
NLG/GBP Gold AP
NLG/GBP Silver AP
Amsterdam on London (short)
London on Amsterdam (short)

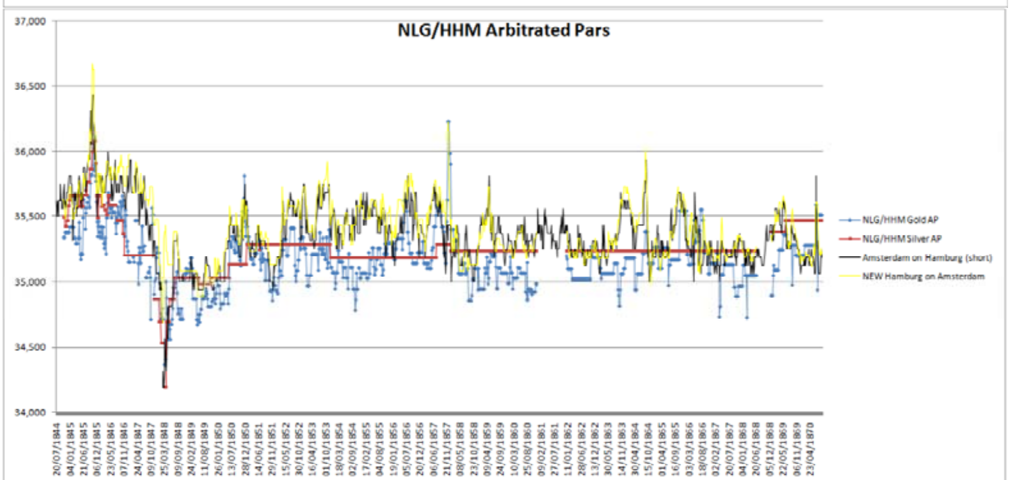

HHM/GBP Arbitrated Pars
13,900
13,700
13,500
13,300
13,100
12,900
HHM/GBP Gold AP
HHM/GBP Silver AP
NEW Hamburg on London (short)

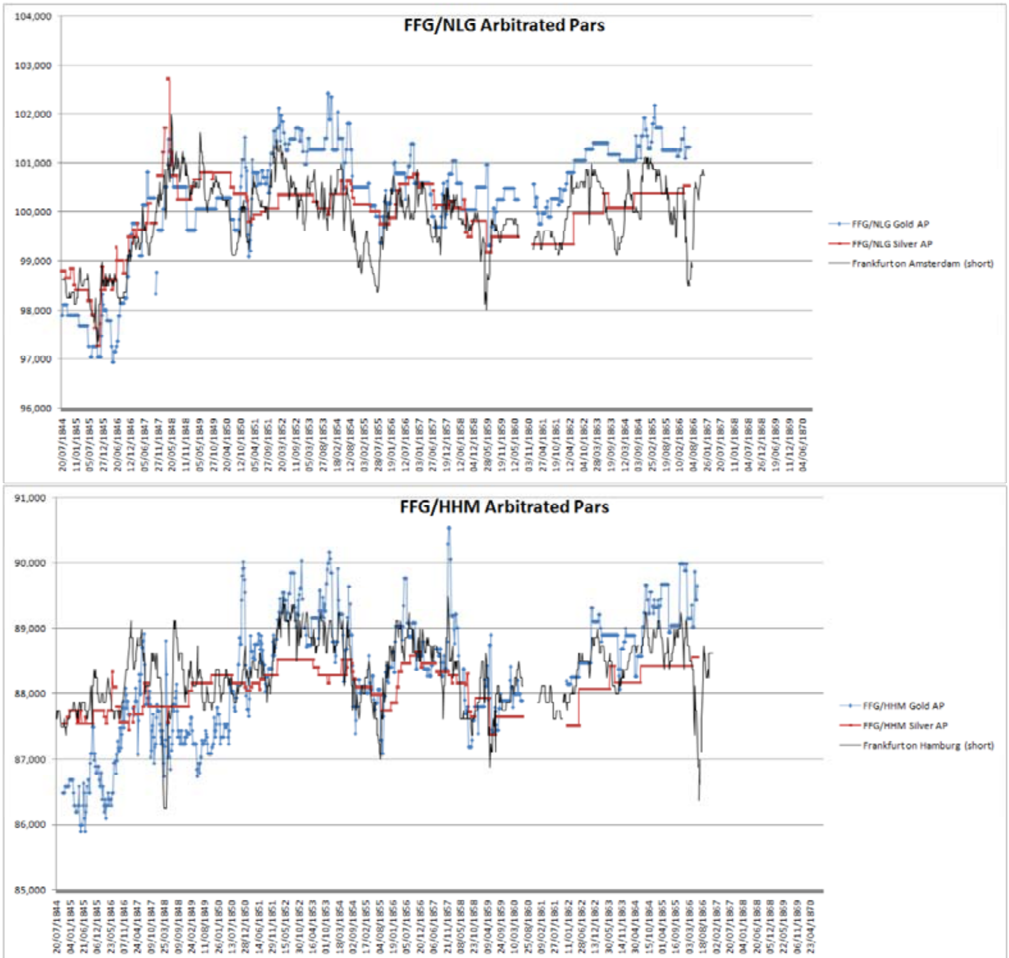

FFG/GBP Arbitrated Pars
12,300
12,200
12,100
12,000
11,900
11,800
11,700
11,600
11,500
11,400
11,300
FFG/GBP Gold AP
FFG/GBP Silver AP
Frankfurt on London (short)


FRF/NLG Arbitrated Pars
219,000
217,000
215,000
213,000
211,000
209,000
207,000
205,000
FRF/NLG Gold AP
FRF/NLG Silver AP
Amsterdam on Paris (short)
Paris on Amsterdam (short)


FRF/HHM Arbitrated Pars
FRF/HHM Gold AP
FRF/HHM Silver AP
Paris on Hamburg (short)
NEW Hamburg on Paris


FRF/FFG Arbitrated Pars
FRF/FFG Gold AP
FRF/FFG Silver AP
Paris on Frankfurt (short)
Frankfurt on Paris (short)


NLG/HHM Arbitrated Pars
NLG/HHM Gold AP
NLG/HHM Silver AP
Amsterdam on Hamburg (short)
NEW Hamburg on Amsterdam



Figures 10.1-10: Arbitrated pars and exchange rates for ten bilateral exchange relations.

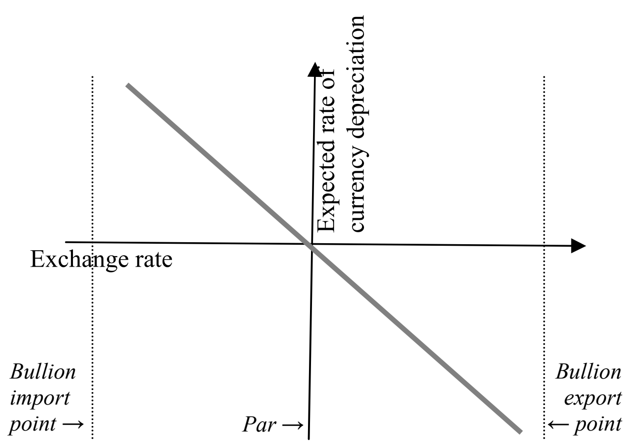
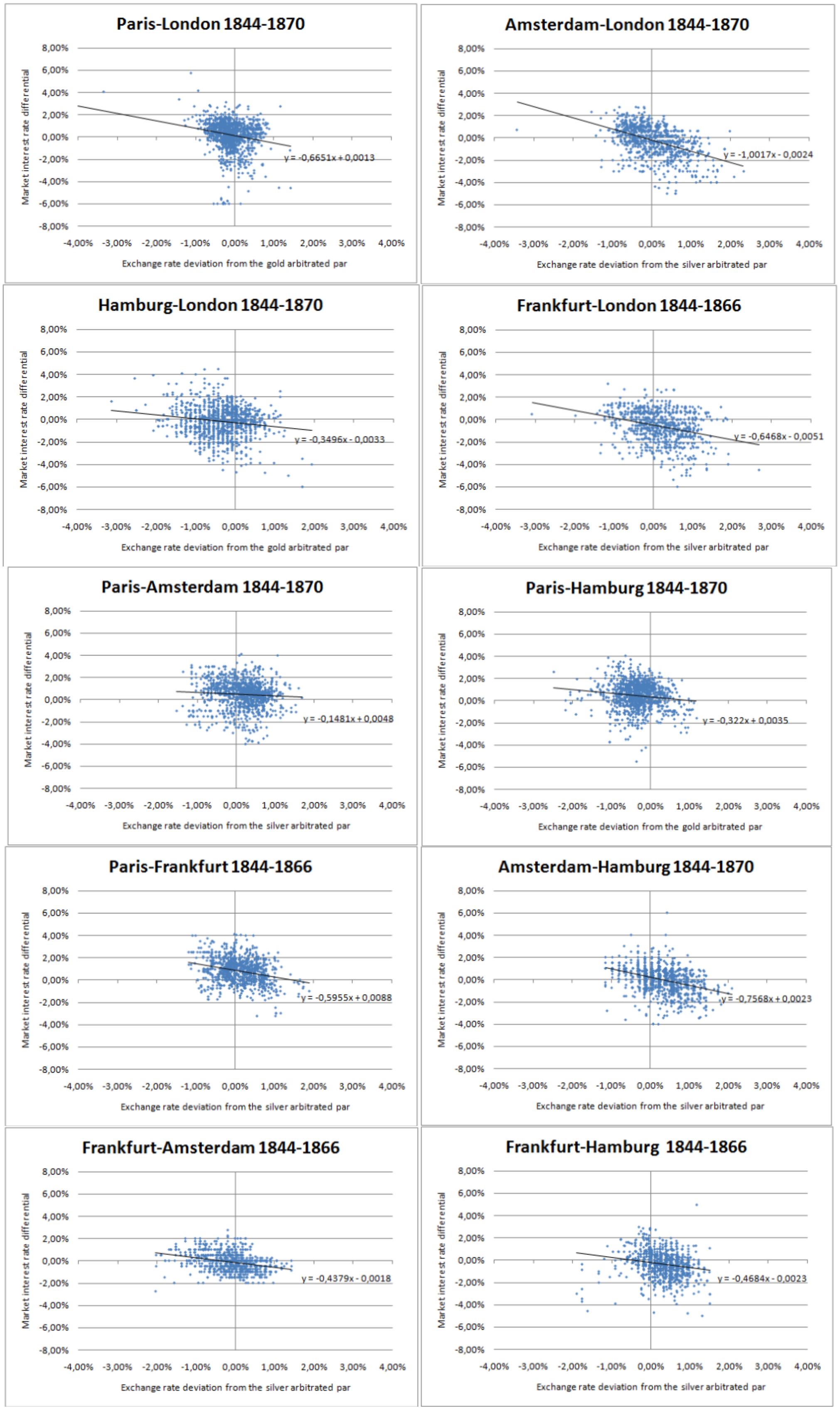


Figure 11: Exchange rates and expected currency depreciation in a bullion-based system.



Figures 12.1-10: Exchange rates and expected depreciation for ten bilateral exchange relations.

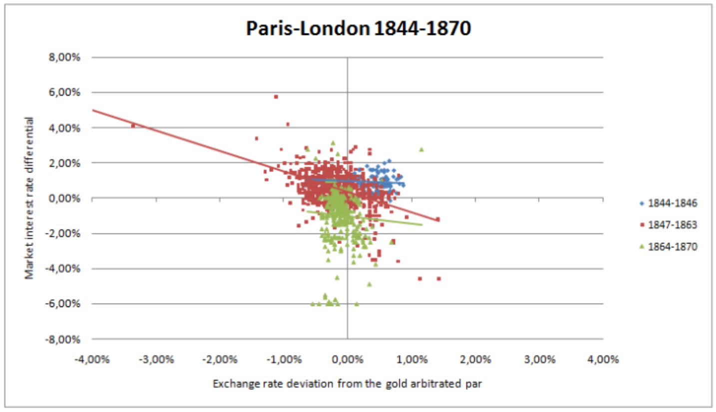
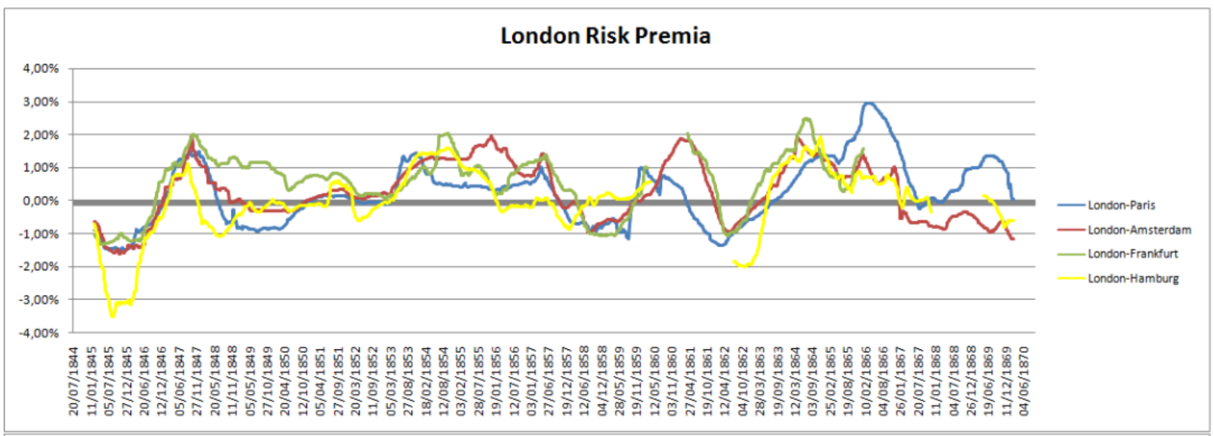
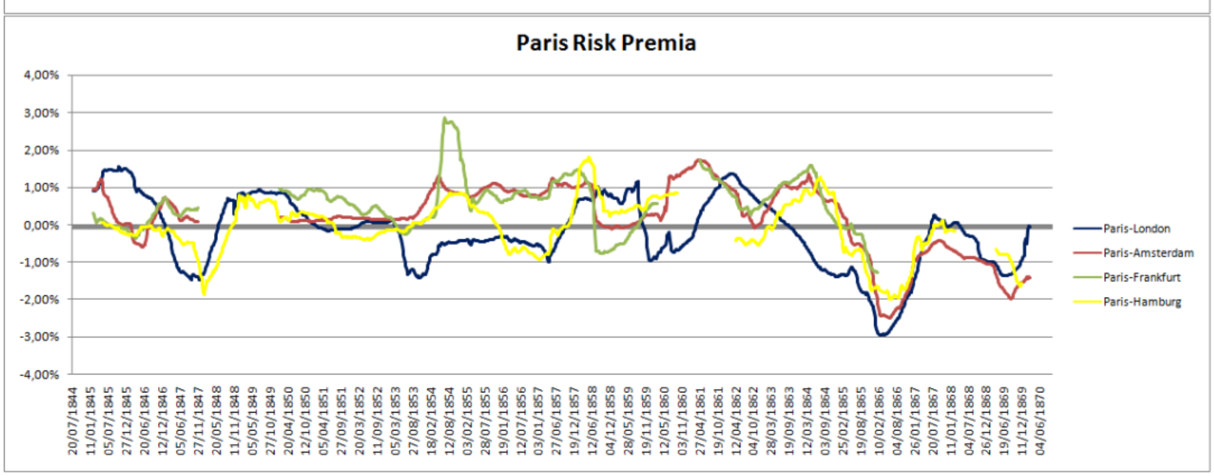
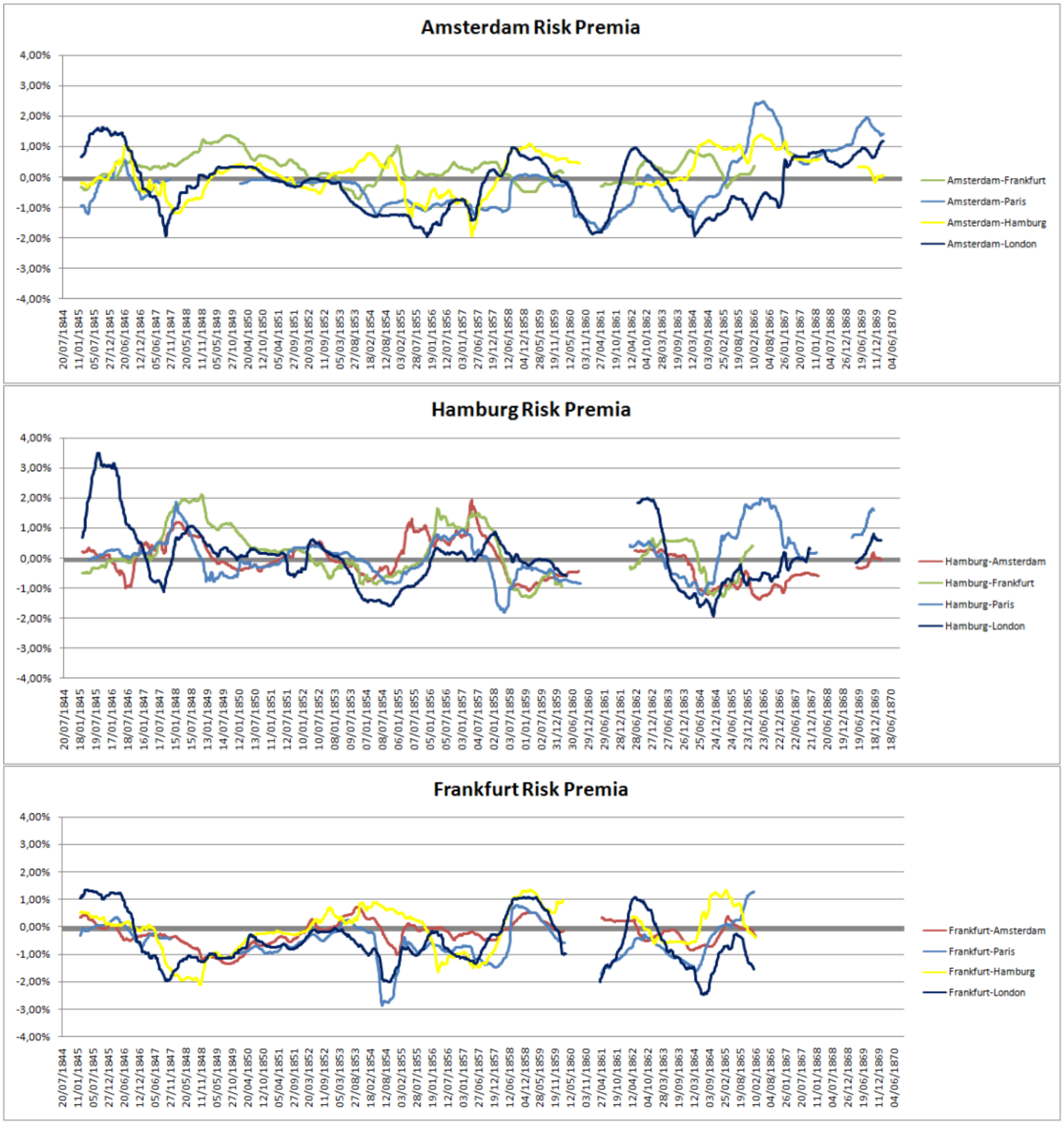


Figure 13: Exchange rates and expected depreciation for the Paris-London relation (per sub-period).







Figures 14.1-5: Risk premia on five currencies.