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JEL Classification: E42, F31, N10

Keywords: Monetary Systems, Balance of Payments, Price-specie flow mechanism, Real effective exchange rates (REERs)

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Introduction

Monetary systems of the Early Modern world were commodity-money systems. In Europe, they were composed mainly of gold and silver that had a market value as a commodity and a legal value as money. In the first section, we explain the functions of money, as well as the episodes of debasement for monetary reasons or fiscal reasons. In the 18th century, European bullion markets were already integrated and integration limited the range of policies that policymakers could apply. Countries could be bimetallic only if they coordinated their legal ratios. We pay special attention to the cases of England, the Dutch Republic and France, the most relevant money markets at that time.

Commodity-money was crucial for the expansion of intercontinental trade. Early Modern intercontinental trade was engaged with a steady flow of silver traveling from West to East, mainly taking the Atlantic routes and having Europe as the gear between American and Asian trade. The second section describes the main international monetary flows in the Early Modern period and relates them to East-West trade balance adjustments and monetary systems in Asia.

Commodity-money was replaced by bills of exchange to transfer funds for long distance trade and finance. In the third section, we describe the most relevant features of bills and the geography of monetary relations. The analysis of the geography of the transnational capital market shows the multilateralization of payments in mid-18th century and the progressive enlargement of the bills-of-exchange market from a European scope at mid-18th century to a worldwide scope by the time of the mid-19th century.

The collapse of mercantilism and the intercontinental expansion of the bills-of-exchange instrument influenced the global adjustment of the balance of payments. In the fourth section, we test empirically the specie-flow mechanism of balance-of-payments adjustment for the period comprised the between end of mercantilism and early liberalization of trade (1820s-1870s). To that effect, we calculate world effective exchange rates to distinguishing between adjustments driven by changes in relative prices and by changes in nominal exchange rates.

1. Monetary systems in Europe in the pre-gold standard period

Before the adoption of the gold standard as the international monetary system in the 1870s, monetary standards consisted of a variety of precious metals that served as money. Gold and silver were the commodities that performed the money functions in Europe throughout medieval times and into the modern era: store of wealth, means of payments and unit of account.[1] As a store of wealth, gold and silver were not perishable commodities and had a minor wear-and-tear, so they could be easily stored.

As a means of payments, gold and silver had a high value-to-weight so they were easily carried for transactions, and they were recognizable enough to be used among strangers. They were cast into coins of a value convenient for transactions. Because silver had a smaller value for a given weight,

[1] One exception is the case of Sweden that possessed the largest copper mine in Europe and established a copper standard in 1625. From that moment to 1776 full-bodied cooper coins circulated together with gold and silver coins, forming a tri-metallic monetary system. In 1777, the experiment ceased and a silver standard was reintroduced. Heckscher (1954). Edvinsson (2012). Outside Europe, we also find regions that developed monetary systems beyond gold and silver. In Asia, Indian and Chinese monetary systems included full-bodied cooper coins circulating together with silver and gold. Section 2 explains the specificities of the Indian and Chinese monetary systems. In West Africa, cowrie shells circulated in local marketplace transactions. Cowries were mostly imported to Africa by European traders who paid for slaves with them. Cowries also served as store of wealth and unit of account until the second half of the 19th century, when the great cowrie inflation paved the way for their replacement by colonial currencies (Hogendorn and Johnson 1986, Johnson 1997).

the joint circulation of gold and silver coins was advantageous because it provided means of payments for both large and small transactions.

On the one hand, merchants mostly used higher denominations for international payments. Gold coins such as the Florentine florin and the Venetian ducat were the most important means of payments inside Europe and between Western Europe and the Levant in Late Middle Ages (Spufford 1988: 177, 320-321). From mid-16th century, the steady expansion in the volume of international transactions encouraged the use of heavy silver coins for large payments (Cipolla 1989: 19-20). The best example is the Spanish-American piece of eight, which became the most common means of payment used in international transactions in America, Europe and Asia (Cipolla 1996).

On the other hand, low silver denominations were used mainly for small daily transactions. European monetary authorities considered that exchange rates of coins in all denominations should reflect their relative metal contents. However, coins were minted freely. So keeping the coining of the different denominations appropriately aligned with the market conditions was difficult because coining money was more costly in small rather than in large denominations. As a consequence, from the 13th to the 19th century, intermittent shortages and recurrent debasements of the smaller coins occurred. To solve this "big problem of small change", monetary authorities issued token coins for small transactions, that is, copper coins whose face value was higher than the metallic content. They were the precursor of modern fiat money (Cipolla 1956, Redish 2000, Sargent and Velde 2002).

Finally, as a unit of account, money was the standard of measurement (the *numéraire*). Transactions were expressed in units of account, although payments were naturally made subsequently in coins (means of payments). In Western Europe, the system of account established by Charlemagne survived during the Middle Ages and Early Modern period until the introduction of the decimal system by Napoleon (and in the United Kingdom down to 1971). The standard of measure (unit of account) was the penny (*denarius*), together with its multiples, the shilling (*solidus*) of twelve pennies and the pound (*libra*) of twenty shillings (Shaw 1895, McCusker 1978, Fantacci 2008). The unit of account differed from the means of exchange because it permitted to reconcile coins of different species into a sole monetary system. The monetary authority established the legal value of both gold and silver coins in terms of the money of account. For instance, the Royal Mint of England produced no coin equivalent to the "sterling pound" until the Great Recoinage of 1816 when the accounting value of the coin sovereign was set at one pound sterling (McCusker 1978: 6). Before the 19th century, gold coins were struck in guineas and valued in pounds sterling, shillings and pence. The value of the guinea was reduced from 22 shillings to 21 shillings and 6 pence in 1699, and again to 21 shillings in 1717 (Nogues-Marco 2013: 461-462).

As we have seen in the previous example, the accounting value of coins underwent alterations in the form of debasements and reinforcements.[2] Changes of the legal relationship between the unit of account and the mean of payments responded to monetary or fiscal problems. Because precious metals were commodity-money, they had two values: the legal value defined by law and the market value defined by the market when gold and silver were traded as a commodity. Alterations of value for monetary reasons occurred when the monetary authority had to adjust the legal value of coins to their market value. When the market price of gold to silver equaled the legal ratio, the standard was bimetallic; but if the market price was lower or higher than the legal ratio, the standard was monometallic *de facto*.[3] At the end of the 17th century, the most important European money markets, such as London or Amsterdam, had already liberalized the exports of precious metals, so

[2] Experiences of European debasements are analyzed in Redish (2000), Bordo (1986), Sussman (1993), Miskimin (1964, 1984), Rolnick, Velde and Weber (1996), Pamuk (2000), Chilosi and Volckart (2010), Elgin, Karaman and Pamuk (2015)

[3] The stability of bimetallism has generated an extensive body of literature. See Locke (1696), Walras (1881), Laughlin (1885), Giffen (1892), Fisher (1894), Shaw (1895), Walker (1896), Darwin (1898), Willis (1901), Chen (1972), Garber (1986), Garber and Weisbrod (1992, chap. 8), Rolnick and Weber (1986), Friedman (1990), Redish (1990, 1995, 2000), Flandreau (1996, 1997, 2002, 2004), Oppers (1996, 2000), and Velde and Weber (2000).

one "international" (i.e., European) money market emerged and forced countries to coordinate legal ratios to preserve bimetallism.

The exception was England. It is commonly believed that Sir Isaac Newton, Master of the Mint, mistakenly overvalued gold at the Mint in 1717.[4] However, Nogues-Marco (2013) demonstrated that the London bimetallic ratio remained too high not because of Newton's "mistake", but because Parliament did not alter the monetary standard of England, as Newton proposed, to adjust the legal ratio to the European market ratio. Parliament decided "*that no Alteration be made in the Standard of the Gold and Silver Coins of this Kingdom, in Fineness, Weight or Denomination*".[5] Therefore, England switched to a *de facto* gold standard in the 18th century. No change was made in the legal value of money after 1717 and finally England adopted the gold standard *de jure* in 1816.

The accounting value of coins suffered alterations also for fiscal reasons. In this case, the monetary authority reduced the metal content of the coins by decreasing their weight or fineness, while maintaining their nominal value in terms of the unit of account. The reduction of the quantity of precious metal in each coin was collected as a minting tax denominated seigniorage. When the rulers found that their fiscal resources were constrained, they often exploited their mints to produce greater seigniorage revenues. It was especially true in times of war (Munro 2012:6). Debasement for fiscal reasons provided a short-term source of revenues, but considerable debasements could lead to a loss of public confidence in the currency or result in a chaotic circulation.

This was the case of the Dutch Republic. The Dutch monetary system was decentralized, the Republic had multiple provincial mints rather than a national one. Ordinances made each province's mint output legal tender in the whole republic. If a province debased its coins to increase seigniorage, those debased coins would migrate to the other provinces. Decentralization caused monetary conditions to deteriorate. Large coins traded at a premium; old, clipped and worn out ones remained in circulation for a long time; foreign coins were introduced into circulation; and in the end the mints themselves were tempted to strike "inferior" coins (Dehing and 'T Hart 1997: 39-41; De Vries and Van der Woude 1997: 81-82; Polak 1998: 16-17, 63-68; Quinn and Roberds 2009, 2012).

Because of the monetary chaos, the Bank of Amsterdam (*Amsterdamsche Wisselbank*) was established in 1609 upon the request of several merchants who complained about confusion regarding currency. The Bank acted as guarantor for the legal standard, eliminating uncertainty about the intrinsic value of coins and protecting creditors against debasement (Gillard 2004, Quinn and Roberds 2009, 2012). The bank received money on deposit, provided settlement through a giro system, and traded in coined money and bullion (Vilar 1974: 252; Dehing and 'T Hart 1997: 46-47, Van der Wee 1977, 342 and 346-47).

The main policy objective of the Bank was to stabilize the market price of its money relative to large-denomination "trade coins" circulating among merchants in Amsterdam. The Bank created bank money, denominated bank *guilder*, which was backed predominantly by trade coins, current *guilder*. Bank money almost always circulated at a premium (called the *agio*) to the current money (Quinn and Roberds 2016:64). The Bank of Amsterdam stabilized bank money at a level compatible with market prices, preserving Amsterdam in an effective bimetallic standard (Nogues-Marco 2013). Bimetallism could collapse in one place, such as London, and succeed in another, such as Amsterdam. Indeed, Amsterdam bank currency, the bank *guilder*, became the European reserve currency until the Bank became insolvent at the end of the 18th century and was liquidated after the Napoleonic period (Jonker 1996).

[4] Jastram 1977: 12-13; Cooper 1987: 44-45; Kindleberger 1993: 60; Redish 1990: 789-90; Eichengreen 1996: 12, Feavearyear 1931: 142-43

[5] *The History and Proceedings of the House of Lords*, pp. 75-76, Parliamentary Papers.

The French monetary system also suffered alterations of the accounting value of coins for fiscal reasons. It is especially noteworthy the experiment undertaken between 1716 and 1720, the so-called John Law's "system". The system was a combination of a fiscal component (involving an operation in public finance) and a monetary component (involving fiat money). The state of French finances had been dismal due to the War of Spanish Succession. Law's system was intended to be a radical restructuring of French public finances based on the development of two institutions. First, in 1716, he established a privately owned bank that issued bank notes. Originally, they were convertible in a specific number of coins of a given weight and fineness. But from the end of 1718, bank notes were denominated in units of account. Second, in 1717, Law created a trading company, whose shares were publicly traded, and whose purpose shifted from colonial development and overseas trading to management of public funds. In order to refinance the national debt, the company doubled its equity and the new shares were sold in exchange for government bonds. From 1719 to 1720, the Bank and the Company merged and the company reimbursed the whole national debt. Gold and silver coins stopped being legal tender and bank notes became the sole currency. Finally, Law pegged the price of shares at a fixed price above its market level in bank notes, leading to a massive issue of banknotes in exchange for shares. The exchange rate on the *livre* began to fall and Law reduced the account value of bank notes instead of withdrawing them. Once the price of shares collapsed, in 1720, there was a bank run, and the inconvertible notes depreciated. From 1721 to 1723, a massive cleanup operation dismantled Law's system. Gold and silver were restored as currency and in 1724 an abrupt deflationary policy revalued the debt, returning France's debt burden to roughly the level where it stood before Law. The first full-scale attempt to move from a commodity-money system to a permanent fiat currency in Europe had failed (Velde 2008).

During the 18th century, France consolidated as an outstanding money market in continental Europe and eventually replaced Amsterdam as the center of bimetallism in the 19th century. Like Amsterdam in the 18th century, France successfully preserved an effective bimetallic standard. The French monetary system's attempt to fix the market ratio during the 19th century was successful because shocks to gold or silver supplies led to smooth arbitrage. For instance, during the Gold Rush after 1848, France imported gold and exported silver, but French circulation was large enough to buffer the shock (Flandreau 2004). French bimetallism in the mid-19th century was, thus, another example of the stability of bimetallism. However, European monetary systems shifted from the bimetallic standard to the gold standard in the third quarter of the 19th century. Once the main countries pegged their currencies to gold, small countries had the incentive to adopt the gold standard to prevent the exchange rate to fluctuate against the gold world because the wider the exchange rate fluctuations, the greater the disruption to international trade and finance (Meissner 2005).

2. Overseas silver flows, West-East balance-of-trade adjustments and monetary systems in Asia (1700-1800)

During the Early Modern period, intercontinental trade had a counterpart in a steady flow of precious metals traveling from West to East. Between 1500 and 1800, nearly 85% of the world's silver and more than 70% of the world's gold was produced in America and large amounts were systematically transferred from America to Asia (Barret 1990, TePaske 2010, Palma and Silva 2017, Freire Costa et al. 2020). There were several routes to transfer American precious metals to Asia, with Europe being the major transshipment region. First, Western Europe imported grain, timber and furs from the Baltic in exchange for wine, textiles and precious metals. Then, the Baltic sold precious metals to the East in exchange for Persian silk and other luxury commodities from the Middle East. Second, the Levant route of European trade through the Mediterranean also resulted in an outflow of precious metals to purchase Eastern spices through the Red Sea and the Persian Gulf. Third, the Cape Route, used by Europeans to purchase spices, silk, tea and cotton textiles also generated a

steady outflow of precious metals. Finally, American precious metals, mainly silver, reached Asia directly via Manila, where it was exchanged for silk and other luxury Chinese goods (Findlay and O'Rourke 2007, Attman 1983, TePaske 1983, De Vries 2003, Von Glahn 1996).

Asia was the final destination of precious metals flows, but the trade imbalances paid with these flows did not correct even over the long run, despite the steady flow of bullion. How can we explain the persistence of these disequilibria? The traditional interpretation states that the inflow of bullion did not increase Asian prices even though these countries absorbed prodigious amounts of precious metals. This assumption is based on the logic of the Hume's price-specie flow mechanism to adjust the balance of payments, that is, European persistent trade deficits happened because precious metals flows did not lead to a higher price level in Asia that would had reduced its exports and increased its imports. Scholars have considered that prices did not increase in Asia because precious metals were hoarded as a store of wealth or transformed into jewelry (Braudel 1979, Kindleberger 1989 and Blitz 1967).

However, according to Chaudhuri (1982) the traditional explanation is speculative because it does not have empirical support since imported precious metals became money in India and was used as a means of payment in China (Prakash 2005, Von Glahn 1996). An alternative explanation is that prices did not move up because the influx of precious metal into Asia was also accompanied by an expansion of the monetary sector at the expense of the barter and subsistence sector (Blitz 1967: 47; Habib 1982: 366; Prakash 2005: 15, Von Glahn 1996: 432).

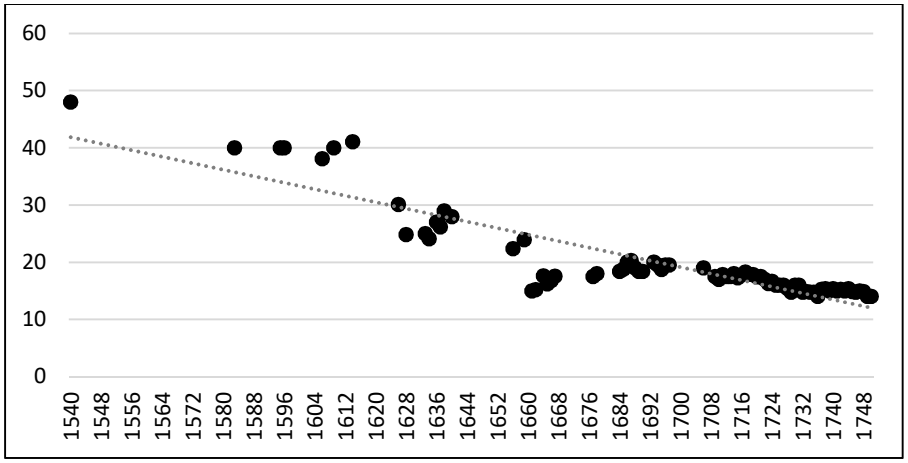
Flynn and Giráldez (2002, 2004) and Flynn (2012) have given a different explanation. According to these scholars, silver should not be considered as money but as a commodity. They argue that there was no imbalance of trade between Europe and Asia for which monetary resources had to flow in compensation. Silver flows were just the result of arbitrage that responded to profitability. Merchants simply purchased silver where it was cheap (Europe) and shipped it to where it was expensive (Asia). Arbitrage between Europe and Asia (China) had two phases, that is, one from 1540s to the 1640s, by which time gold-silver bimetallic ratios had converged around the world, and a second phase, from around 1700 until the 1750s, when global silver prices had converged a second time. Similarly, Palma and Silva (2017) argue that the gold-silver price ratio was 6:1 in China and it was between 11:1 and 12:1 in Europe when the silver from America began to be available in Europe, which suggest large arbitrage gains, even under the prevailing transport technology and institutional settings.

The hypothesis of precious metal arbitrage has been recently tested by Nogues-Marco (2019a), who collected data on the price of silver and gold in London and Asia (India and China) from 1664 to 1800 from the archive of the East India Company (EIC). Her results show that it was not profitable to export silver from London to Asia because the exchange rate was defined according to the silver arbitrated par, that is, the relative market price of silver between centers. There were episodes of arbitrage by which the EIC exported silver to China in exchange for gold for profit, but the vast majority of silver was exported without profit to pay for imports. Silver moved from Europe to Asia to compensate payments resulting from large and persistent trade disequilibria (Krishna 1924, Chaudhuri 1978, Prakash 1985, 1986).

The last interpretation is that silver influx did not increase prices, but silver depreciated relative to copper (Braudel 1979 (I): 417, Flynn 1984: 409, Habib 1987: 141-142, Cartier 1981). Monetary system in India was tri-metallic, composed of gold, silver and copper coins. Indian authorities did not standardize the legal value of coins in different metals into a common unit of account as in the European monetary systems. The exchange rate between gold-silver and silver-copper was determined by market conditions in India (Habib 1987: 157). Figure 1 shows the exchange rate between copper and silver for Agra and East Rajasthan from 1540 to 1750. We can observe the *rupee* (silver coin) depreciation in *dams* (copper coin) in the long run. In 1540, one *rupee* was exchanged for 48 *dams*; in 1583, the exchange rate was 1:40; in 1640, it was 1:28 and, in 1750, it had been reduced

to 1: 14. The depreciation of the copper price of silver was more intense from the early to the mid-17th century than in the first half of the 18th century, when the Portuguese had lost their monopoly status as the Dutch and English penetrated the Indian Ocean.

Figure 1. Copper value of silver, Agra and East Rajasthan, 1540-1750 (*dams*/*rupee*)

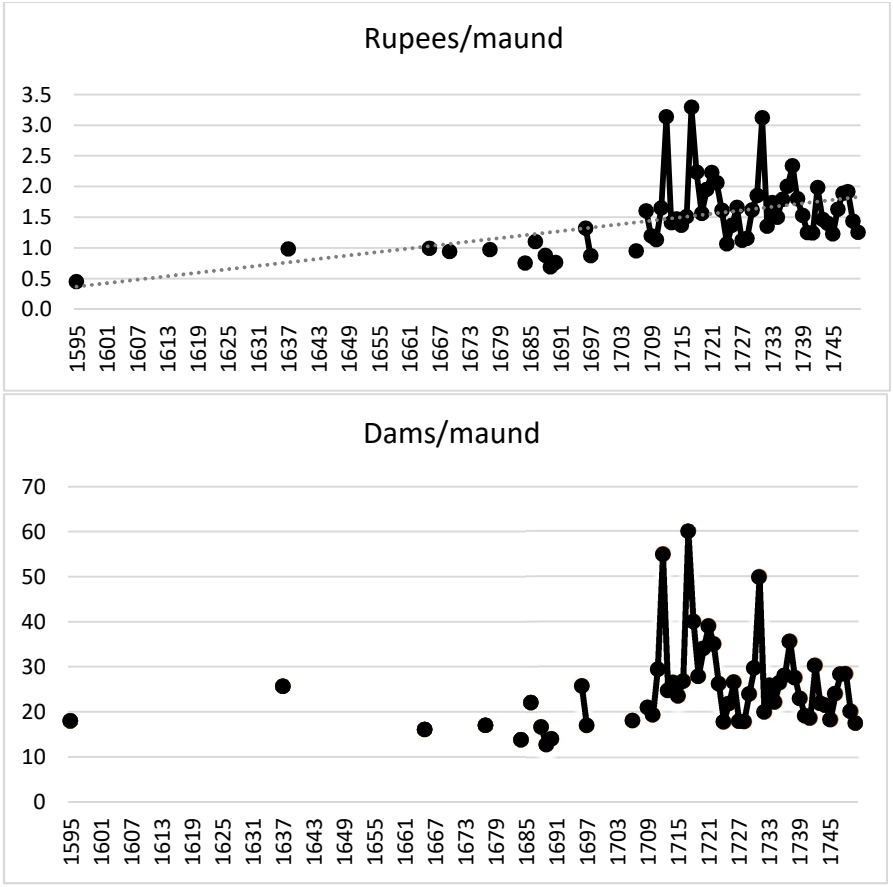


Source: Habib (1982: 370) and (1987: 146-149). The *dam* was debased in 1663-64, when the weight of the lighter *dam* was reduced to 2/3 of the standard weight, according to Habib (1987: 140). In this figure, we expressed the price of silver in standard *dam*s (copper coins of 323 grains) for the whole period (Habib 1987: 150).

Prices of Indian commodities could be expressed in copper or in silver as both were means of exchange in India. At the end of the 16th century, prices were reported in copper, silver or gold, depending on the commodity considered. For example, food grains, vegetables, *ghee* (clarified butter), milk, yogurt, sweetmeats, spices and Indian fruits were defined in copper. Sheep, goats and foreign fruits were priced in silver. Cheaper textiles had prices in copper, but the more expensive in silver. The most expensive varieties of silk and cotton cloth were priced in gold (Habib 1987: 145). The influx of silver from Europe not only caused the value of silver in copper to depreciate, but also gradually displaced copper as the unit of account for some ordinary transactions. At the end of the 17th century, while copper continued as the most important currency medium, food grains were priced in silver while *ghee* and *gur* (jaggery) were priced in copper (Habib 1987: 154). Figure 2 reports prices of wheat in silver and copper respectively. We can see that although copper prices did not rise, prices show a significant upward trend when they are measured in silver.[6]

[6] These results are based on the price of wheat for Agra and the region of East Rajasthan. However, they might not extend to all commodities and centres. For example, Prakash (1994: 70-71) does not find a significant increase of the price of rice, wheat, *ghee* and sugar in Bengal during the period 1657-1714, measured in silver (*rupees*/*maunds*). Contrary to this result, Datta (2000: 444-445) shows a significant upward trend in the price of rice, *ghee* and oil in Lower Bengal during the period 1700-1800, measured in silver (*rupees*/*maunds*).

Figure 2. Price of wheat, Agra and East Rajasthan, 1595-1750

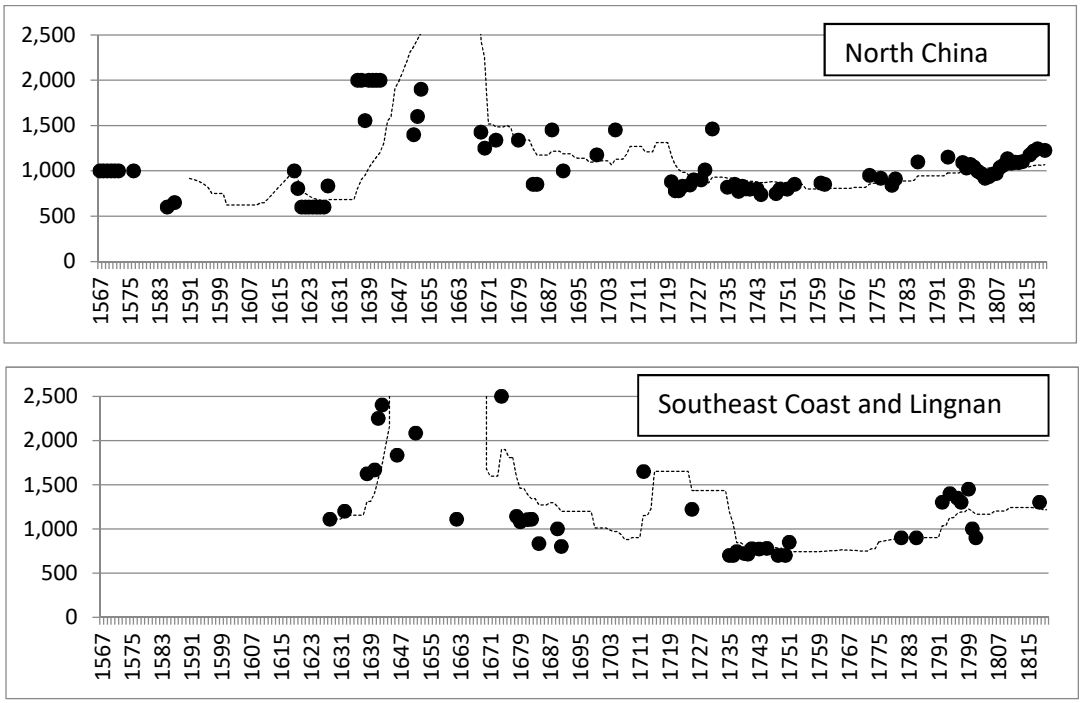


Source: prices of wheat in Agra for 1595, 1673 and 1670 from Habib (1982: 373). Wheat flour was been converted to wheat considering the reduction of 10% in weight when converting wheat to flour (Habib 1982: 373). We collected the price of wheat in East Rajasthan from 1665 to 1750 (single average of prices in Amber, Chatsu, Dausa, Lalsot, Bahatri, Malarna) from Nurul Hasan and Gupta (1967). Silver prices were transformed to copper prices using the exchange rate between *rupees* and *dams* (Figure 1). We use the *Maund* of 40 *seers* (Gupta and Moosvi 1973: 185)

The monetary system in China was *de iure* a copper monetary system, but *de facto* tri-metallic. Gold and silver were not minted, but they circulated in the form of ingots that were used as means of payments by weight. Additionally, foreign silver coins, mainly the Mexican pieces of eight, also circulated by weight (Cartier 1981: 456). Yan, Quiao and Xu (2018) have recently defined the Chinese monetary system as a multi-layer system of currencies. On the one hand, silver currencies were influenced by the changes in international politics and global economy. They circulated freely among major commercial centers, and their prices were synchronized with the international market. On the other hand, copper coins functioned as the primary form of currency in the landlocked rural areas, where the penetration of silver was very slow. Copper facilitated small transactions within the regional boundaries. The state minted copper coins at fixed face value and strictly monopolized copper coinage in the official mints. By contrast, the state adopted a *laissez-faire* attitude toward the circulation and production of silver ingots, so that their melting and casting were mostly done by private agents. Using the changes in the exchange ratio between silver and copper as a price signal, the multi-layered monetary system reduced the mutual impacts between the international market, urban areas, and rural places.

Figure 3 shows the exchange rate between copper currency (*cash*) and silver (*kuping taels*). The official exchange rate was fixed as one *tael* equal to 1,000 *cash*. The market exchange rate fluctuated according to the production of domestic copper mines, monetary debasements and reinforcements in copper coins as well as silver imports entering China as the result of a positive balance of trade (Vogel 1987). In the first half of the 16th century, the value of silver in copper depreciated more than 50% (Cartier 1981: 457). The depreciation of silver continued in the second half of the 16th century, but this trend changed after 1600 because the Chinese state debased copper coins, so the copper value of silver rose despite the greater influx of silver (Von Glahn 1996: 431, Von Glahn 2003: 191). Silver depreciated again in copper in the early 18th century. The exchange rate between both metals stabilized during the remaining of the century. Finally, at the end of the century, silver suffered an important appreciation in copper (Cartier 1981: 458, Von Glahn 2003: 191).

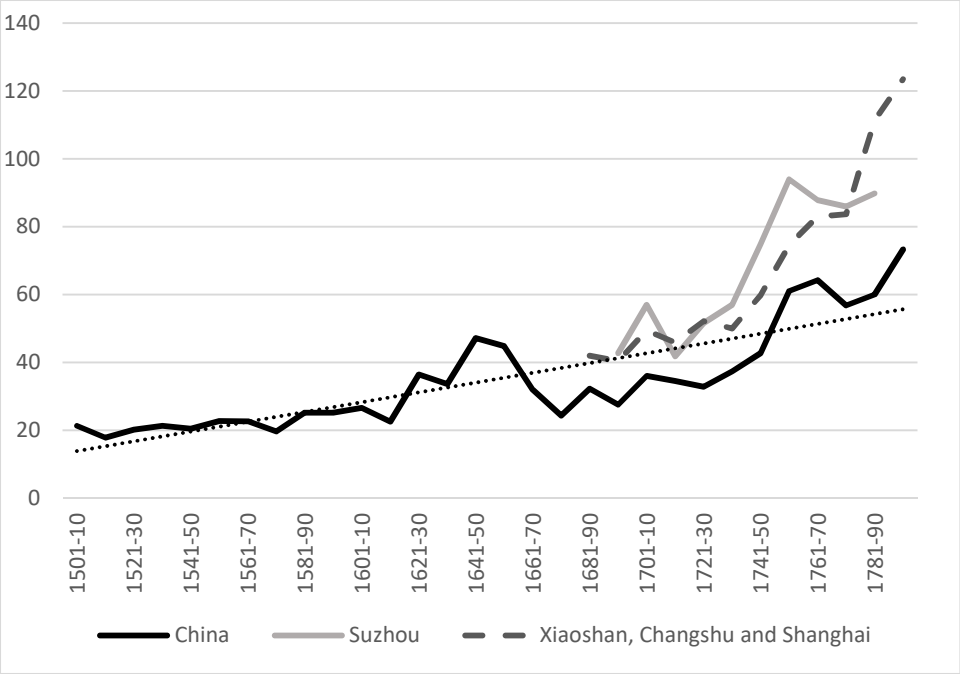
Figure 3. Copper value of silver, China, 1567-1820 (*cash*/*tael* silver)



Source: Vogel (1987, table 3). North China = Peking and Zhili Province and Ningjin (Zhili). The Ningjin series, which starts in 1798, is the most homogenous series, calculated from daily records of a store (Vogel 1987: 26, Allen *et al.* 2011: 34). Southeast Coast and Lingnan = Hubei, Hunan and Jiangxi. The dotted line is the 25-year moving average

Prices of rice can be used as a proxy to measure inflation in China. Figure 4 shows the long run series of the price of rice measured in grams of silver. The longest series, which runs from 1500 to 1800, covers the whole of China. Because we cannot assume market integration at that time, Figure 4 also plots two additional series. One represents rice prices in Suzhou (1696-1800). The other series compiles rice prices for Xiaoshan, Changshu and Shanghai (1681-1800). We can observe a similar trend in the three series. There is a significant upward trend in the price of rice for the whole period, from the early 16th to the late 18th centuries.

Figure 4. Price of rice, China, 1500-1800, decennial average (grams of silver/quintal)



Source: Data for China from Cartier (1981: 464). Data for Suzhou from Wang (1992: 40-43). The series comprises data for Suzhou City from 1696 to 1740 and Suzhou Prefecture afterwards. The last dozen years of the 18th century has been excluded because the author considers that something went wrong with the price reports for those years (Wang 1992: 49). Data for Xiaoshan (a county in the neighborhood of Hangzhou), Changshu (a county in Suzhou Prefecture), and Shanghai from Wang (1992: 40-43). Wang (1992) reported data in *kuping taels* (37.3 grams) per *shi*. We use the equivalence 1 *shi* = 78.623 kg (Lemale 1875: 113)

To sum up, available evidence on prices in India and China shows that there is a positive relationship between silver influx and inflation when we express prices in grams of silver. However, European trade deficits with Asia persisted through the 17th and 18th centuries. Our explanation for this apparent violation of normal current account adjustment is based on market structure. In the mercantilist period, trade between Europe and Asia was conducted by European chartered companies (the English. Dutch and French East India Companies) that controlled the volume of trade and prices of Asian imports in Europe to sustain high mark-ups for a very small number of commodities with low demand elasticities (Blitz 1967, Chaudhuri 1978, Bulbeck 1998, Hauser 1936). In this way, chartered trade companies prevented price convergence and, as a consequence, sustained the Euro-Asian current account deficits which were cleared with silver flows.

3. The development of the global foreign exchange market

Europe developed a foreign exchange market based on bills of exchange in the Middle Ages. A bill of exchange was a letter by which funds were transferred between distant cities. Four persons participated in the transaction: two at the city where the bill was drawn and two at the city where it was payable. They were, first, the drawee (deliverer, giver, remitter or negotiator), the person who delivered the money; second, the drawer (taker) who received the money by exchange; third, the party who paid the money by virtue of the bill drawn on him, commonly termed the payer (accepter); and fourth, the person to whom the bill was made payable, called the payee (possessor or holder). Typically, the payer and the drawer would keep accounts with each other and could offset

the payment of the bill with claims from other transactions so that only small net amounts would have to be occasionally settled (Neal 1990, De Roover 1953, Einzig 1962).

A bill was a safe and cheap financial instrument and, thus, became the most widely used instrument for international payments. The operation of exchange permitted not only the transfer of funds, but also the lending of money from the moment of the purchase of the bill to its payment. As a consequence, bills provided a useful tool to escape the regulation on interest rates. This regulation prevented interest rates from rising above a certain ceiling, which would constitute "usury". Unlike other financial instruments, which had a local circulation and were thus subject to the regulation of interest rates, bills of exchange escaped usury ceilings because the transaction took place between two distant cities. The price charged on bills of exchange was motivated, according to contemporary bankers, by the risks and efforts associated with overcoming the obstacles of foreign settlement. In practice, the price of bills was determined by the geographical distance as well as by time, so the interest rate was hidden by the exchange rate (Flandreau *et al.* 2009a, Nogues-Marco 2019b).

International trade supported the emergence of a liquid market for bills of exchange in Europe, organized along lines defined by trading relations and provided the infrastructure for financial development. The adoption of the Joint Liability Rule (JLR) facilitated the expansion of bills beyond personal networks from the early 17th century because it provided high financial protection against non-payments as all parties involved in a bill transaction (the payer, all the endorsers and the drawer) had a joint liability for the payment. As a consequence, the JLR played a major role in ameliorating fundamental information problems in long-distance trade and, turned the bill of exchange into the most important transfer instrument in a period of imperfect international enforcement (De Roover 1953, Santarosa 2015).

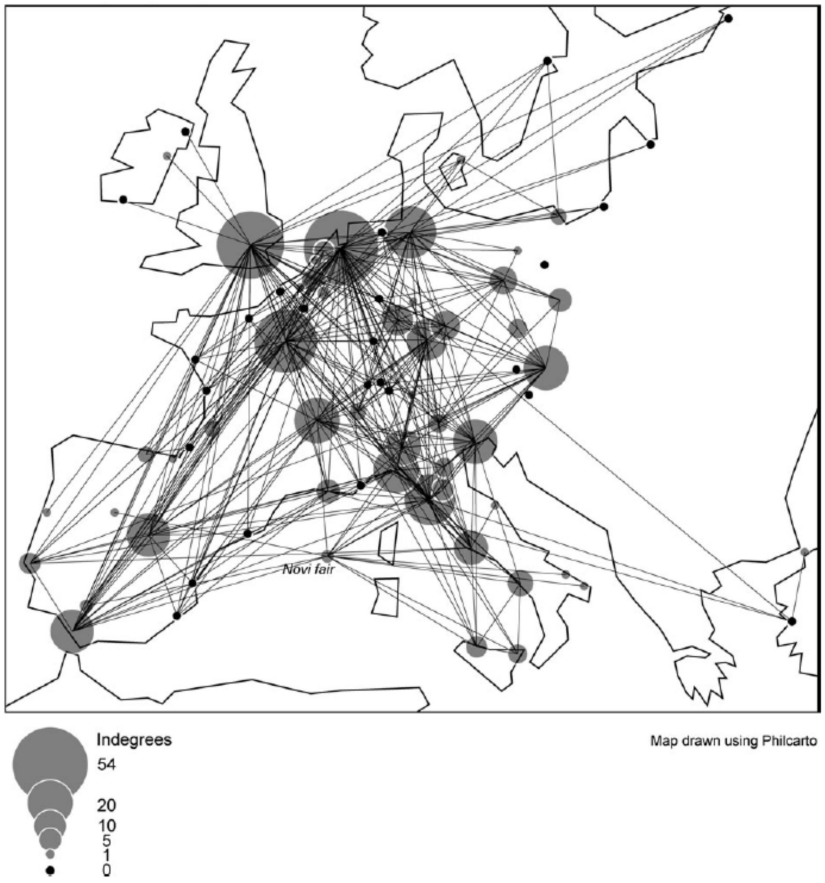
The market for bills-of-exchange was restricted to Europe until the late 18th century. Flandreau *et al.* (2009b) mapped the bills-of-exchange connections between nearly eighty cities in the mid-18th century. A high proportion of the cities (close to one half) were ports. There were typically several markets per country, except for the case of England that stands out as the one large political entity with only one exchange center in London. Locations were evenly scattered all over Europe with outreaches on the fringes of the Orient. There were no American, Asian or African cities, while only two cities in the Ottoman Empire, Constantinople and Smyrna. This European bias is the result of a structural characteristic of the foreign exchange network: European sources did not direct to non-European centers while non-European sources directed back to Europe. The global financial system of that period had a distinct European focus.[7]

Amsterdam, London and Paris were the core of the system in the mid-18th century. They were quoted in the vast majority of the cities (more than 60% of the cities quoted London and Paris while 84% quoted Amsterdam) implying that multilateral settlement using these centers as clearing centers was feasible by the mid-18th century. Amsterdam, London and Paris were already tightly integrated with one another by the mid-18th century and enjoyed a high degree of liquidity (Neal 1990, Flandreau *et.al*. 2009a).

[7] Exchange contacts from London to North America and the British West Indies had already existed during the colonial era, in particular Boston from 1630 and Philadelphia probably from the 1730s to the American independence in 1776, but bills drawn in London on the colonies were negotiated only occasionally, mostly during wartime. The exchange transactions of London on North America or the West Indian colonies were insignificant for the London merchants to be mentioned in the exchange rate quotations (Denzel 2010: 12-13, 406). The use of bills was limited because there seems to have been a difficulty locating anyone in London with sufficient credit in the colonies to draw against. Instead, London merchants preferred to bring such credit home and ship specie (McCusker 1978: 122, 131-150).

The agglomeration of monetary links is shown in Figure 5, which plots the number of links that a particular market received by the mid-18th century. About 20% of links between cities were direct, 75% had to pass through an intermediary center, while only 7-8% had two intermediaries. This reinforces the notion of an encompassing multilateral settlement system with Amsterdam, London, Paris, and also Hamburg and Genoa as the main connecting hubs. Therefore, the European system was a dense web with an area of intense financial linkages that stretched from an Amsterdam-London-Paris-Hamburg core and thinned out as it headed towards Italy.

Figure 5. Monetary Agglomeration in the mid-18th century



Source: Flandreau *et al*. (2009b: 161)

The European network of bills of exchange expanded worldwide at the end of the 18th century and the early 19th century. London started to quote Rio de Janeiro from the early 19th century, after the Brazilian ports had been opened to non-Portuguese trade. Quotations in London on New York and Philadelphia as well as on Buenos Aires and Mexico City existed by the 1840s (Denzel 2010: 9, 12).

Philadelphia was the first center in North America that quoted Europe after the American independence in 1776. Philadelphia quoted on London from 1783 and quoted regularly on Paris, Amsterdam and Hamburg from 1794. New York superseded Philadelphia not only as the financial but also the general economic center of the Atlantic coast in the USA, and started quoting London in 1794, as well as Amsterdam, Hamburg and Paris from the early 19th century (Denzel 2010: 408, 117).

Slave trade expanded the use of bills of exchange in North America in the second half of the 18th century. Colonial planters bought and sold slaves through local factors and met their bills through crop sales. Agents transferred bills to ship captains, who handed them to British slave merchants, who then redeemed them, via other merchants, businessmen, and brokers, to secure their funds. The interconnections of merchants, factors, planters, and guarantors in the eighteenth-century British slave trade helped to foster greater financial integration in the transatlantic trading world (Morgan 2005).

Trade integrated Asian centers into the European bills-of-exchange network. To be sure, before this integration, domestic systems of bills of exchange already operated in both India and China. In India, *hundi* was the financial instrument developed to transfer money in the Early Modern period. However, even if the *hundi* was a transferable instrument, it did not include a JLR, which limited the expansion of the financial instrument beyond personal networks. This meant that in case of non-payment, the payee had to demand payment from the last person from whom he had bought the *hundi*; and so on, up the chain of endorsements until the original drawer (Habib 1971, Chaudhury 2017). Similarly, *fu-tie* (also called *dui-tie*) was a commercial-finance instrument developed in North China in the 18th century to facilitate business transactions. Analogous to European bills of exchange, the receiver of a *fu-tie* was required to pay the bearer the designated amount of cash on behalf of the issuer. But this instrument was not personally registered and it was thus payable to whomever possessed it, which also limited its expansion to personal networks (Qiao 2017). By the end of the 18th century, Asia became integrated in the European network of bills of exchange. The East India Company started issuing Company's bills on the Court of Directors payable in London for trade with India and China, and Company's bills payable on the Government of Bengal (and, rarely, Bombay) for trade with China (Canton) (Greenberg 1951, Dermigny 1964, Marshall 1976).

The openness of trade to private merchants at the end of the mercantilist period facilitated the expansion of bills of exchange as transfer instrument between Asia and Europe during the first half of the 19th century. Contemporary merchant manuals listed quotations in London on Calcutta, Bombay and Madras by the early 19th century and on Canton by the mid-19th century. By mid-19th century, *The Economist* listed rates on Indian, South and East Asian as well as Australian centers. Regular quotations in Canton on Bombay started in 1827/31. Quotations in Shanghai on London started in 1848, on Canton in 1849/52, on Hong Kong in 1856, on Calcutta in 1850 and on Bombay in 1855 (Denzel 2010: 13, 511-512).

At the end of the 19th century, the bills-of-exchange market had achieved a worldwide scope. The core of the system was composed by three senior centers: London, Paris, and Berlin/Germany in descending order. The periphery, that is, countries quoted almost nowhere, comprises Latin American and Pacific Asian nations but also Canada and parts of Europe. Finally, there was a large group of centers between the two extremes. This group was formed by the United States, the North-Western European centers (Netherlands, Belgium, and Switzerland), Austria-Hungary, Italy, Spain, and, to an extent, Russia (Flandreau and Jobst 2005: 989).

4. The specie-flow mechanism and international trade adjustment (1820s-1870s)

The Scottish philosopher David Hume articulated the first model of balance of payments adjustment in a letter to Montesquieu in 1749:

> "If half the money in England were suddenly destroyed, labour and goods would suddenly become so cheap that there would suddenly follow a great quantity of exports which would attract to us the money of all our neighbours. If half the money which is in England were suddenly doubled, goods would suddenly become more expensive, imports would rise to the

> disadvantage of exports and our money would be spread among all our neighbours." (Hume 1955: 188-89)

The model came to be known as the price-specie flow mechanism and predicts that external adjustment will happen mostly through expenditure switching rather than expenditure reduction or increase: a country facing a current account deficit would adjust by losing gold, leading to a fall in relative prices that would reestablish its competitiveness with respect to its trade partners. The mechanism rests on two assumptions: an open capital account and flexible prices. While Hume repeatedly stated his belief on the flexibility of the prices of "all labour and commodities", he conceded that barriers to trade in precious metals could prevent the adjustment of external imbalances: [8]

> "in money, if the communication be cut off, by any material or physical impediment (for all laws alone are ineffectual), there may, in such a case, be a very great inequality of money." (Hume 1955: 64)

Despite Hume's dismissal of the effectiveness of capital controls (legal barriers to trade in specie), practically all nations retained laws preventing the free export of monetary metals until the mid-19th century, a policy consistent with the mercantilist doctrine of retaining precious metals at home that lived on in many countries until the dismemberment of mercantilism. Whether these were effective is an empirical question and we should be able to test it by decomposing the sources of real exchange rate variations. Real exchange rates (*q*) measure the ratio of domestic and foreign prices (*p* and *p**), adjusted by the nominal exchange rates (*e*), i.e. $q = (p^* e)/p$. They are a measure of competitiveness. But since no country trades with just one partner, the relevant measure of competitiveness should take into account the actual trade networks of each nation. This is referred to as *effective* exchange rate. For a given country *i*, we can define its nominal effective exchange rate (NEER) as the average of bilateral exchange rates (e_{ij}) weighted by the share of each of its *j* trade partner's in its exports (x_{ij}) and imports (m_{ij}):

$$NEER_i = \sum_j e_{ij} x_{ij} + \sum_j e_{ij} m_{ij}$$

Similarly, we can define a concept of real effective competitiveness as:

$$REER_i = \frac{1}{p_i} \sum_j e_{ij} p_j x_{ij} + \frac{1}{p_i} \sum_j e_{ij} p_j m_{ij}$$

where p_i and p_j are the domestic and foreign price levels, respectively. Computing the effective exchange rates offers several insights about the adjustment of international trade. First, it reveals which countries gained and lost competitiveness over time and whether those deviations were related to external disequilibria. Second it allows distinguishing between adjustment through relative prices (p_j/p_i), as envisaged by Hume, and through changes in nominal exchange rates. In a world where all countries pegged their currencies to a commodity (gold or silver), nominal exchange rates should have been largely constant, at least so long as the market prices of gold and silver were successfully anchored, as previously mentioned. However, countries had frequently to abandon their pegs and adopt inconvertible currencies with floating exchange rates. As shown by Catão and Solomou (2005), even in the heyday of the classical gold standard (1870-1913), nominal exchange rate flexibility was instrumental in facilitating current account adjustment. Especially in the case of peripheral nations, external imbalances were corrected more through exchange rate fluctuations (e_{ij}) than price changes. This runs contrary to the predictions of Hume's model in that the flexibility

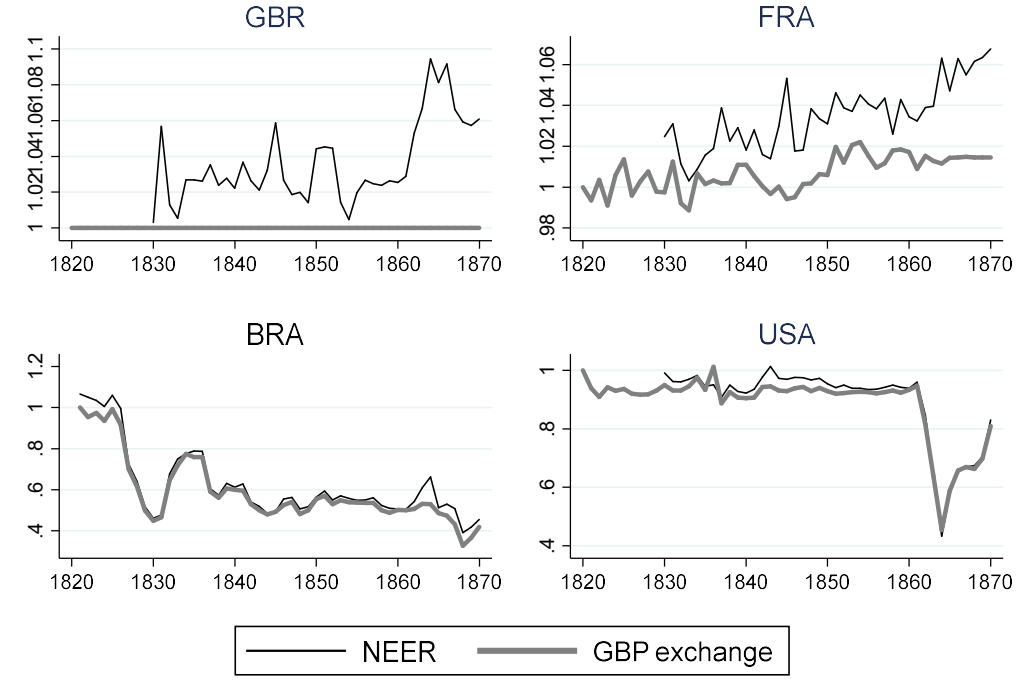
[8] In fact, Hume was aware that price adjustments might take a while to take effect, and acknowledged that changes in real income could occur in the short-run as a consequence of external disequilibria (Murphy 2009).

of peripheral currencies also diminished the need for specie flows and price adjustment in the core European countries (Bloomfield 1959).

In this section we extend Catão and Solomou's (2005) analysis to the first seven decades of the 19th century to confirm how well did Hume's price-specie flow apply in that earlier period. In so doing we draw on large new datasets of bilateral trade (Fouquin and Hugot 2016, Dedinger and Girard 2017), exchange rates (Denzel 2010) and prices (de Zwart 2015). The data covers a maximum of 54 countries and territories.

Figures 6-8 represent the evolution of nominal exchange rates after the Napoleonic wars, separating between core and periphery nations, as well as between monetary regimes. To measure nominal exchange rates we use the pound sterling (GBP) as the *numéraire*. In all cases, there are substantial deviations between the nominal and the effective exchange rates, suggesting that competitiveness was very much a bilateral phenomenon: individual countries' effective exchange rates were influenced at least as much, if not more, by their trade partners' exchanges, as by their own.[9] In general, nominal and effective exchange rates are closer for emerging or peripheral nations than for the core European nations (Figure 8), which accords with what we know about the stability of their monetary regimes in this period, namely, the greater prevalence of inconvertible currencies among peripheral countries. Core nations, on the other hand, witnessed moderate effective nominal appreciation as a counterpart.

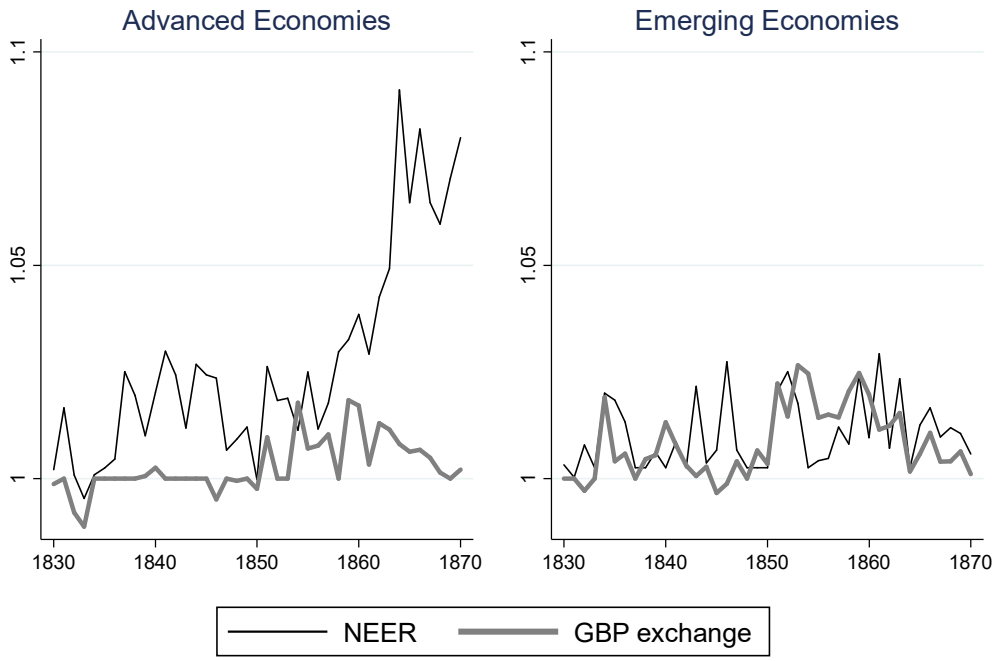
Figure 6: Nominal and effective exchange rates, 1800-1870



Sources: see text. Values in deviation from parity with =1.

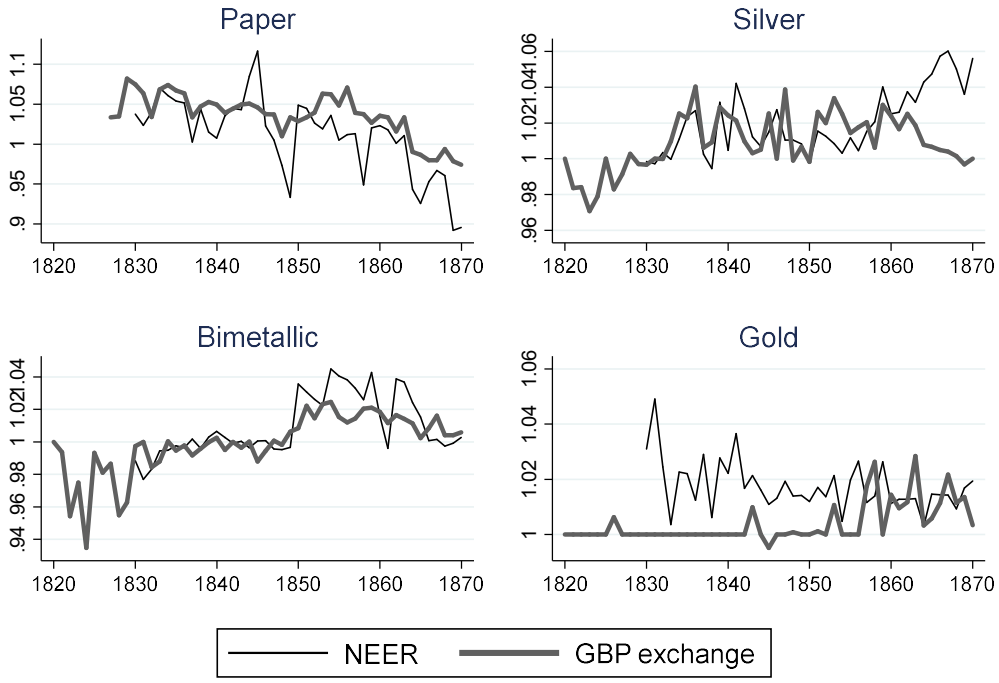
[9] Brazil and the USA are exceptions as most of their NEER variation is driven by their own nominal exchange rates (see Figure 6).

Figure 7: Nominal and effective exchange rates, 1820-1870



Sources: see text. Values in deviation from parity with 1820=1.
Advanced Economies = Britain, France, Germany (Zollverein), Belgium and the Netherlands.

Figure 8: Nominal and effective exchange rates, by monetary regimes 1820-1870



Sources: see text. Values in deviation from parity with =1.

All in all, this evidence coincides with the findings of Catão and Solomou (2005) for the subsequent period. Table 1 summarizes the evidence by comparing the coefficients of variation of the two nominal measures of the exchange rate, divided by group of countries and monetary regime.[10] The majority of nominal exchange rate variations of advanced nations and nations on metallic pegs were driven by its trade partners. For these nations, the volatility of their effective exchange rates is always larger than their exchange against the *numéraire* (sterling). The opposite applied to peripheral nations and countries on inconvertible paper standards, where the ratio between the two was lower than one.

Table 1: Volatility of exchange rates, 1830-1870

	Nations		Regimes			
	Advanced	Emerging	Paper	Silver	Bimetallic	Gold
GBP exchange	0.007	0.008	0.056	0.012	0.010	0.007
NEER	0.019	0.007	0.046	0.018	0.017	0.007
Ratio (NEER/GBP)	2.677	0.909	0.819	1.523	1.656	1.023
REER	0.072	0.037	0.072	0.053	0.041	0.208
PREL	0.066	0.030	0.081	0.040	0.036	0.214
Ratio (NEER/PREL)	0.265	0.197	0.633	0.337	0.422	0.036

Note: values in coefficient of variation = standard deviation/ mean of each variable. PREL is the trade-adjusted relative price index (1830=1).

As a way of testing directly for David Hume's price-specie, we compute the real effective exchange rates and compare the fraction of its variance explained by nominal exchange rate (NEER) fluctuations with that due to relative price movements (PREL).[11] Table 1 summarizes this a ratio between the variances of the two variables. As Catão and Solomou (2005), we find that nations in metallic pegs did not have much margin for nominal exchange rate adjustments. The most extreme case were nations in gold where the variance of their NEER was only 4% of the variance of their relative prices. Contrary to the evidence post-1870, this was true even for nations on unconvertible monetary regimes, where the contribution of nominal exchange rate adjustments was still only 63% as large as that of relative price adjustments.

In conclusion, notwithstanding the pervasiveness of barriers to exporting specie until the mid-19th century, in practically all nations nominal rigidity did not stand in the way of real exchange rate adjustments, consistent with Hume's dismissal of the effectiveness of capital controls and his model of balance of payments adjustment.

[10] The Table covers the period from 1830 only because of sparse price data to compute REERs before that date.
[11] Formally, we do this by decomposing the variance of the log of REER: $ln(REER) = ln(NEER) + ln(PREL)$.

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