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Exchange Rate Regimes and Reserve Policy on the Periphery: The Italian Lira 1883-1911

Filippo Cesarano°, Giulio Cifarelli[+] , and Gianni Toniolo*

Abstract

The three exchange rate regimes adopted by Italy from 1883 up to the eve of World War I — the gold standard (1883-1893), floating rates (1894-1902), and "gold shadowing" (1903-1911) — produced a puzzling result: formal adherence to the gold standard ended in failure while shadowing the gold standard proved very successful. This paper discusses the main policies underlying Italy's performance particularly focusing on the strategy of reserve accumulation. It presents a cointegration analysis identifying a distinct co-movement between exchange rate, reserves, and banknotes that holds over the three sub-periods of the sample. Given this long-run relationship, the different performance in each regime is explained by the diversity of policy measures, reflected in the different variables adjusting the system in the various regimes. Italy's variegated experience during the gold standard provides a valuable lesson about current developments in the international scenario, showing the central role of fundamentals and consistent policies.

Keywords: Exchange rate; gold standard; reserve policy; cointegration.

JEL Classification: F31, F33, N13, N23

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Introduction

In the last decades of the nineteenth century, globalization was driven by several forces: communication technology, advances in transportation, technical progress, and the free movement of goods, capital, and labor. A further important factor was arguably the international monetary system. The rise of the gold standard provided a stable monetary framework that, anchoring the price level and preventing major payment imbalances, helped to realize the potential of the globalization process. This model of monetary organization allowed short-run flexibility but left little room to independent policies in the long run. Indeed, the gold standard was the nearest thing to the ideal of a world money.

In a seminal paper, Bordo and Rockoff (1996) pointed out the benefits accruing to countries adopting the gold standard in terms of easier access to the international capital market. Being on gold enhanced the credibility of economic policies while offering an escape clause in case of emergencies.[1] Subsequent contributions strengthened the Bordo and Rockoff results (Sussman and Yafeh 2000; Obstfeld and Taylor 2003) while also stressing the role of debt burdens and economic growth (Flandreau and Zumer 2004) or political factors (Eichengreen 1996; Ferguson 2003) as determinants of risk premia. The "good housekeeping seal of approval" applied to the core countries, but peripheral countries too strove to comply with the rules of the game, albeit showing uneven performances.

In this regard, Italy represents an interesting case which may lend itself to general considerations. Over a span of thirty years from 1883 to World War I, Italy experienced three different exchange rate regimes. In 1883 Italy reintroduced *de jure* gold convertibility (suspended during the 1866 war),

[1] "If adherence to the rule was evidence of financial rectitude — like the 'good housekeeping seal of approval' — it would signal that a country followed prudent fiscal and monetary policies and would only temporarily run large fiscal deficits in well-understood emergencies. Monetary

which however was again suspended ten years later during a major currency and financial crisis. In the following decade, the lira was kept within the gold points without however formal commitment to convertibility. The case of Italy therefore provides an *in vitro* experiment of a peripheral country under alternative monetary regimes, with a puzzling result: formal adherence to the gold standard ended in failure while shadowing the gold standard was a great success. The solution of the puzzle hinges on the implementation of a policy design consistent with the rules of the game, independently of the formal adherence to the gold standard. Paradoxically, for a country with a poor reputation, the shadowing strategy proved a better course of action since it allowed wider policy leeway, useful to build up credibility and reap the benefits of a stable exchange rate.

Examining the alternating vicissitudes of Italy's participation in the gold standard, this paper identifies a distinct co-movement between exchange rate, reserves and banknote circulation that holds over the three sub-periods of the sample. Given this long-run relationship, however, the different performance in each regime is explained by the diversity of policy measures, reflected in the different variables adjusting the system in the various regimes.

After a brief account of the properties of the gold standard (section 1), the paper outlines the main features of the three exchange rate regimes adopted in Italy (section 2), illustrates the role of reserve management policy in shadowing the gold standard (section 3), and presents a cointegration analysis of the determinants of the three regimes (section 4). The concluding section discusses some implications of Italy's pre-1914 experience for current developments in the international monetary scenario.

authorities then could be depended on to avoid defaulting on externally held debt" (Bordo and Rockoff 1996, 390).

1. Economic policies and the Gold Standard

A perplexing feature of the evolution of the international monetary system is the stability of the classical gold standard in contrast with subsequent fixed exchange rate regimes like the interwar gold exchange standard, the Bretton Woods system, the narrow-band EMS, and other forms of hard currency peg, like currency boards and dollarization. That fixed gold parities were maintained by a number of "core" countries in a world of free capital movements for roughly four decades is indeed impressive in light of current experience. This stylized fact, Bayoumi and Eichengreen remark, "constitutes an analytical mystery and an important policy question" (1996, 165).

The classical gold standard was the final stage of commodity money. Contrary to subsequent monetary arrangements, it was not designed at the drawing board but developed spontaneously, driven by diverse and yet complementary factors — theory, market forces, technology, and the social and political environment — that shaped the rules of the game. The keystone of this construction was convertibility, providing a commitment mechanism to implement monetary and fiscal policies (Bordo and Kydland 1996), consistent with maintaining the gold parity and thus supposed to display a high degree of automaticity (Mundell 2000, 328).

The idea of convertibility stemmed from classical monetary theory, which viewed money as a commodity and the economy as self-adjusting. The exchange rate measured the currency's gold content vis-à-vis other currencies and was therefore assumed to be invariable, not subject to policy choice. In fact, gold parity was not supposed to be altered but only suspended in exceptional circumstances such as a war or a financial crisis. Once the emergency was over, the restoration rule stipulated the reestablishment of parity, making the system credible (McKinnon 1993; Bordo and Kydland 1996). Exchange rate invariance was a distinctive property of commodity standards as opposed to fiat money standards. The arithmetic of relative weights of gold translates into the economics of a

credible contingent rule. Since a change in parity was not even contemplated, the policy design had to conform with this nominal anchor.

Neither the escape clause nor gold "devices" (McKinnon 1993, 4-6) to overcome transitory shocks were expected to undermine credibility since, given the availability of information and the simplicity of rules, they could be easily monitored.[2] In case of an incipient reserve drain, an increase in the discount rate, prescribed by Bagehot's rule, attracted capital, reining in aggregate demand, because the exchange risk was assumed to be virtually nil. The stabilizing character of capital movements, a corollary of credible gold parities, was further enhanced by the assumption that no country, not even Britain was in a position to influence commodity prices, as the international price level was determined by the world demand for and supply of gold. Since gold solved Mundell's "redundancy problem," the system was symmetric and, given the limited discretionary power of monetary authorities, this solved the time inconsistency problem (McKinnon 1993, 10-11). All in all, the properties underlying the successful performance of the gold standard, i.e. credibility, stability, and symmetry, reflected the rules of the game: the restoration rule, Bagehot's rule, and the price level rule.

The success of the gold standard, therefore, had its roots in classical monetary economics. The metallist principle squared with an equilibrium model in which there was no room for policy objectives other than maintaining gold parity.[3] This theoretical framework nonetheless granted significant short-run flexibility precisely because of the system's long-run

[2] Bordo and Kydland argue that the gold standard was successful as a commitment rule "because it had the virtues of being simple and transparent" (1996, 456). Explaining his preference for a convertible currency instead of an inconvertible currency regulated by keeping the price of bullion in accordance with the mint price, Mill emphasizes "the importance of adhering to a simple principle, intelligible to the most untaught capacity. Everybody can understand convertibility; every one sees that what can be at any moment exchanged for five pounds is worth five pounds. Regulation by the price of bullion is a more complex idea, and does not recommend itself through the same familiar associations" (1848, 546).

[3] As Eichengreen and Flandreau remark: "What pressure existed for the pursuit of other policy goals was exceptional and, ultimately, limited. At the gold standard's European and North American core, its political, ideological, and economic underpinnings sufficed to sustain the system. When push came to shove and the authorities in these countries had to choose

credibility.[4] Conspicuous shocks and crises did occur, and yet the lack of major hindrances to market operation, given the social and political environment, ensured rapid adjustment, avoiding lasting repercussions on output and employment (Bayoumi and Eichengreen 1996). Still, the discipline imposed by the rules of the game allowed but a handful of core countries to commit to convertibility. Countries on the periphery, albeit making the adoption of the gold standard one of their main policy goals, could seldom achieve it. Vulnerability was to a large extent an effect of the weakness of the countries' fundamentals — consistent fiscal and monetary policies, open and deep financial markets, a sound banking system — a set of conditions that Bordo and Flandreau (2003) have graphically synthesized as "financial maturity." Peripheral countries would then be exposed to capital flight and financial crisis.

The periphery of the gold standard offered a variegated picture. After the crisis of the 1890s, in particular, solutions differed considerably, depending on fundamentals and general economic conditions (Bordo 2003, 24-33). Some countries continued to float (Spain and Portugal), others developed *de facto* currency boards (Russia and Greece), some shadowed the gold standard (Austria-Hungary and Italy) or tried to stay (on and off) on gold (Argentina). *De jure* adherence to the gold standard remained the ideal to aim at but, for most peripheral countries, building up credibility required a policy design both stricter and maintained for a longer period of time with respect to core countries. Hence, in the absence of conditions for implementing such a design, joining the gold standard was often ephemeral. In this connection, the difficulty of gaining credibility in international financial markets is shown by the small number of countries that issued debt abroad denominated in their own currency, and were thus immune from the "original

between interest-rate increases to keep the gold standard from collapsing and interest-rate reductions to stimulate production, they never hesitated to opt for the former" (1997, 19).

[4] Obstfeld and Taylor (2003, 262) find that in the inter-war years, in contrast to the gold standard period, countries were punished for running high public debts, which shows the policymakers' greater room for maneuver during the gold standard.

sin," in relation to the members of the gold standard. In fact, bonds issued by peripheral countries normally contained "gold clauses." From the end of the nineteenth century, gold discoveries and sustained growth contributed to narrowing the gap between the core and peripheral countries, witnessed by the decrease in the interest rate differential and its variability (Obstfeld and Taylor 2003). Nevertheless, the performance of the periphery remained highly diversified. While not officially returning to gold, Austria-Hungary and Italy were among the most successful 'semi-peripheral' countries (Morys 2007).

The experience of Italy in the three decades preceding World War I provides an eloquent example that *de jure* commitment to convertibility *per se* does not ensure the maintenance of fixed parity while the steady pursuit of a policy design consistent with gold standard rules does. For peripheral countries with a long history of bad reputation, shadowing the gold standard may well be the best strategy, since it might better shield it from speculative attacks while allowing more room for maneuver in short-run policy implementation.

2. Italy's exchange rate regimes

In 1862 an act of Parliament made the Piedmontese lira the country's single currency. Banknotes were convertible into either gold or silver but, to prevent the effects of Gresham's law and to suit the needs of the largest bank of issue (Banca Nazionale), which held mainly gold reserves, a new law was passed that "introduced a gold-based monometallism in disguise" (Fratianni and Spinelli 1997, 65). Convertibility was suspended during the 1866 war against Austria. Despite the call for immediate resumption by prominent economists, only in April 1883 was the lira again made legally convertible (De Mattia 1959; Toniolo, Conte, and Vecchi 2003). In the following thirty years Italy adopted three monetary regimes: the gold standard (April 1883-June 1893), floating rates (July 1893-December 1902), and a regime of shadowing the gold standard from January 1903 to the end

of 1913.[5] This sequence makes Italy an interesting case study of monetary arrangements in a semi-peripheral, developing open-economy during the "first globalization."

In the early 1880s, the upswing in economic activity throughout Europe was also shared by the Italian economy. The external deficit almost disappeared setting the scene for the return to gold. To make convertibility credible, the government negotiated with three international financial houses to obtain a 644 million lire loan (about 5 percent of Italy's GDP), 70 percent denominated in gold and the rest in silver. On the eve of resumption, the lira rapidly appreciated and remained within the gold points for the following four years (see Figure 1).[6] During this period, the price of Italian consols (Rendita Italiana) rose from an average of 88.32 lire in 1883 to a peak of 101.60 lire in the second half of 1886 (Supino 1921, 30). Easy credit from banks of issue, however, pushed down both the reserve ratio and interest rates, fueling stock exchange and real estate speculation. By 1887, therefore, the lira was again trading above the export gold point. To avoid or limit note conversion, the banks of issue resorted to administrative measures or "manipulation of the gold points" (Bloomfield 1959, 52) and the Government bought substantial amounts of consols in Paris to support the price (De Cecco 1990; Di Martino 2001; Tattara 2003).

<INSERT FIGURE 1 HERE>

From the mid-1880s onward, domestic policies proved to be inconsistent with exchange rate stability and eventually gold convertibility. Easy money,

[5] Using cluster analysis, Garofalo (2005, 23-28) identifies a number of sub-periods within this broad tripartite division of the time span. For the two periods after the 1893 suspension of convertibility, he argues that cluster analysis allows us to distinguish between pure floating and managed floating on the one hand and between soft and crawling pegs on the other.

[6] By far the thickest foreign market for the lira and lira-denominated securities was the Paris stock-exchange. The profile of the lira-sterling exchange rate is, however, not significantly different. Exchange rates are those for the last trading day in each month. Following Fratianni and Spinelli (1997), the gold points have been set at +/- 0.5% of the official parity. On the role of the Paris Bourse in setting the price of Italian consols and its influence on the lira exchange rate, see De Cecco (1990), Di Martino (2001), and Tattara (2003).

increasing public deficits, lack of government supervision of the banks of issue, and overtrading by commercial banks, compounded by the international financial crisis, prepared the ground for a major banking crisis, which eventually pushed the country out of gold. Some of the most distinguished economists at the time were critical about a policy of resorting to a foreign loan while failing to carry out measures consistent with the gold standard. Vilfredo Pareto stressed the basic principle that to ensure gold convertibility, currency circulation must be reduced in order to restore the equilibrium price level.[7] Marco Fanno pointed out the drawbacks of the loan and suggested instead a decrease in fiduciary money through budget surpluses as an alternative strategy for resumption (Fanno 1908, 98-105).[8] Barone advanced similar arguments.[9]

The main flaws of the resumption strategy were also perceived by some policymakers. In 1890, Luigi Luzzatti contended that consolidation of the public budget was a necessary measure to sustain resumption (De Cecco, 1990, 712-15). An anonymous memorandum in 1892, attributed to Giacomo Grillo, director general of Banca Nazionale, highlighted the dire consequences of irresponsible policies following the return to gold.[10] Indeed, by the early

[7] "To return from paper currency to metallic currency it is therefore worth withdrawing as much paper money as necessary to reduce prices precisely to the level there would have been with metallic currency. And only afterwards can metallic money be substituted for paper money … . It is deduced that a foreign loan in gold to eliminate inconvertible paper currency is vain and harmful. … The loan can be useful only after equilibrium has been attained by reducing the quantity of currency or, which comes to the same thing, by increasing trade and industry. What happened in Italy, what is now happening in Austria, and the theory of economic crises, all confirm these theoretical deductions" (Pareto 1894, 157; 169-170).

[8] Distinguishing between a foreign loan and a domestic loan, Fanno (1908, 90-97) points out that while the former increases reserves but does not restrict circulation, the latter does the opposite. By destroying the banknotes paid by subscribers to a domestic loan, the monetary authority can make the agio disappear, although it cannot resume convertibility for which a sizeable reserve is needed. To achieve this objective, the decrease in the stock of paper money must continue until the balance of payments is in surplus. Yet, this policy of sudden deflation may well bring about disruptive shocks to the economy.

[9] Building upon Fanno's analysis, Enrico Barone, in a chapter eloquently titled "Countries with Rotten Circulation," also emphasized the central role of fiscal discipline and sound bank portfolios in ending convertibility suspension (1918, 113-25).

[10] "That was the period [1883-97] … that, by abusing credit, excessive trust in our own forces, mistakes and aberrations which would be shocking today, prepared for the sad days to follow inasmuch as easy credit brought about the establishment of new industries and all sorts of speculations heavily fueled and vigorously encouraged by cheap capital. Grandiose designs

1890s, inconsistent policy design led to abandoning the gold standard. The Baring Crisis did not seem to affect Italy's bond yields and spreads until after mid-1891 (Mitchener and Weidenmier 2007, 36), but it may have triggered the flight to quality (De Cecco 1990, 49). The confidence crisis hitting semi-peripheral borrowers compounded on domestic problems and pushed the exchange rate above the export gold point.

Both contemporary observers and some later-time historians saw the way the gold standard was introduced and managed as the root of the real estate bubble and bust that led to the suspension of convertibility in 1894. According to this view, the international loan of 1883 and the ensuing capital inflows produced an "atmosphere hyper-oxygenated by gold" in which banks could expand credit at interest rates that did not reflect the increasing risk of lending based on real estate security. This was made possible by an overly accommodating monetary stance and lax bank regulation (Fratianni and Spinelli 1997, 89-90). When housing prices crumbled leading borrowers to bankruptcy, most banks – including banks of issue – found themselves excessively burdened with illiquid assets. Small bank failures took place in the late 1880s followed by the liquidation, in the early 1890s, of the two largest commercial banks. In 1892-93 one of the banks of issue was brought to its knees amidst a fraud scandal that also had major political repercussions.

The lira exchange rate duly reflected the uncertainty of the economic and political situation and rapidly depreciated from 1891 to almost 16 per cent below parity in 1893, marking the start of the floating rate regime. It is not entirely clear, however, when the gold standard was legally suspended. The Bank Act of 1893 was unclear about the statutory obligation for the newly created Bank of Italy to convert notes into specie, indicating that conversion

and grandiose public works, railways, and other projects undertaken by the government, were the sorry example that dragged provincial and city councils and private citizens to push individual and collective activities to the limit while, on the other hand, the ever growing defense needs created by an insecure political situation in Europe obliged the government to reach levels of expenditures far exceeding the nation's tax potential" (De Cecco, 1990, 782).

rules would be issued at a later date. Ambiguity about lira convertibility was probably intentional. The Parliamentary Committee Report on the political responsibility of bank failures read: "[I]n present circumstances, if conversion would be fully effective, metal reserves could run the risk of disappearing. Conversely, by not imposing such an obligation, it could be interpreted as a tacit acceptance of inconvertibility" (quoted in Fratianni and Spinelli 1997, 94). In the following years, this dilemma continued to haunt the minds of policymakers, long after the crisis had been overcome and a new climate of trust begun to surround Italy's economy and politics.

If by 1895 the banking crisis had been overcome, it took longer for the country to redress the deeper economic, social, and political predicaments of the early 1890s, reflected in the exchange rate. The political turning point came in 1896 (Toniolo 1990, 100) with the defeat of the Italian army at Adowa, Ethiopia, which, putting an end to the expensive policy of expansion in the Horn of Africa as well as to the semi-authoritarian regime of Francesco Crispi, paved the way to a new liberal political order and reliable institutions.[11] The economic turning point came a year or two later: budget surpluses, accelerating growth, and balance of payment surpluses led to a steady appreciation of the lira (Fanno 1908, 107-108; Supino 1921, 39-40). From 1903 to 1911, the exchange rate remained stable, fluctuating almost always within the gold points.

The change in policy design hinged upon the political will to renounce ephemeral expedients and adopt, instead, a coherent economic strategy.[12] Aggressive fiscal consolidation, tight monetary discipline, and the restoration

[11] A new Bank Act was passed after which the Bank of Italy was reorganized, giving the government a prominent role in appointing the bank's management and supervising its operation. Two new large commercial banks were created to fill the void left by those that had failed in 1893.

[12] Praising the shrewd conduct of Bonaldo Stringher, at the helm of the Bank of Italy from 1900 to 1930, Corbino noted that, in carrying out his successful monetary stabilization, Stringher had "the help and political support of men like Giolitti, Sonnino, and Luzzatti all of whom had the profound conviction that it was necessary to consider the period of weaknesses and banking adventures as definitively closed and look at the monetary system as a means to foster the country's economic growth, provided that it was used without artifice and political interference" (1938, 389).

of a sound banking sector soon produced a substantial improvement in fundamentals.[13] As a result of these policies, the exchange rate remained firmly within the gold points. The authorities however decided to shadow rather than formally reintroduce the gold standard. The important novelty was the time consistency with which macroeconomic policies were carried out. Policymakers refrained from impromptu measures that tampered with the rules of the game until the outbreak of World War I. Such unyielding rigor was instrumental in building up the credibility of gold parity in a country with a history of dubious reputation. The theory underlying this objective was quite clear to contemporary economists and policymakers. According to Supino (1921, 62-68), exchange rate fluctuations depend on the quantity of fiduciary money and the balance of payments, but primarily on the "trust in the state," as regards the country's public finances, growth, wealth, and political stability. In the same vein, Stringher, reporting to the shareholders meeting in March 1903, stressed the reversal of expectations and its impact on the exchange rate, brought about by the improvement in the public finances, growth in savings and output, repayment of domestic and foreign debt, and increasing emigrant remittances.[14] The link between fundamentals and credibility in a gold standard regime was well understood by contemporaries. From the end of the 19th century onward, credibility was consistently pursued also by accumulating huge reserves.

[13] In the 1897-1913 period, the ratio of debt to GDP fell from 128.0 to 77.2 per cent and the share of foreign debt from 22.2 to 9.5 per cent (Francese and Pace 2008). As early as 1903 a foreign observer, the French economist Arthur Raffalovich, remarked: "Italy … , with precise measures and secure methods that could be taken as a model, brought the exchange rate to its definitive level. The Italian government has spoken little, knowing that in monetary policy the less discussion the better. It has persevered with tenacity to improve the public finances. For his part, the skillful Director General of the Bank of Italy was able to mend past faults, sacrificing the popularity that he would have won from the Bank's shareholders by increasing the dividend for a more substantial result. Success has crowned this resolute and truly patriotic conduct and it is not without legitimate pride that we can see that today the lira is equal to the franc, i.e. it is worth gold" (quoted in Corbino 1938, 391).

[14] "All this was fortunately reflected in the price of foreign exchange. Financial and economic factors together with the steady improvement of banks' circulation, soon determined the disappearance of the agio. The *psychological* element contributed powerfully and rapidly to

3. Reserve management and the exchange rate, 1903-1911

If the legal obligation to convert paper into gold remained vague and, in any event, was never enforced, a 40 per cent reserve requirement was however mandated on the Bank of Italy and the other two junior banks of issue.

<INSERT FIGURE 2 HERE>

Convinced that large reserves were crucial to the stability of the exchange rate, from the turn of the century onward, the Bank of Italy stuck to a policy stance that, sacrificing both shareholders' interests and macroeconomic expansion, continuously raised the stock of metallic reserves. The reserve to banknote ratio rose from 34 per cent in 1899 to 60 per cent in 1913, well above the mandatory coverage requirement (see Figure 2).[15] The improvement in Italy's international financial position is also reflected in the u-shaped curve of the financial mismatch index (Bordo and Meissner 2005), equal to the ratio between international reserves net of total hard currency debt outstanding – defined as the fraction of total public debt which is serviced in gold – and the value of exports (see Figure 3). After 1903, the "mismatch" converges falling almost to zero.

<INSERT FIGURE 3 HERE>

If the lira exchange rate remained within the gold points almost uninterruptedly, the reintroduction of a legal commitment to convertibility was never publicly debated. This ambiguous and cautious attitude was partly

this result while at other times, it contributed instead to keeping the exchange rate too high. " (Banca d'Italia 1903, 7-8).

[15] The series in the graph are in thousands of lire. The reserve requirement rose from 33 to 40 per cent in August 1893. The banks were allowed, however, to use up to seven percent of their issue of notes to discount foreign bills labelled in a convertible foreign currency. In 1895 their deposits in foreign banks and their holdings of foreign sovereign bonds payable in gold were considered akin to specie reserves. Figure 2 shows a conservative 40 per cent gold coverage requirement from 1893 onwards.

motivated by feelings of insecurity: the successful turn in policy strategy (see note 13) could not suddenly erase the memory of the 1893 currency crisis. The steady accumulation of reserves aimed at preventing the repetition of the event, buttressing convertibility while providing for growth of fiduciary money.[16] Thus, recalling the dramatic crisis of 1892-93, Bank of Italy Bonaldo Stringher warned about the need of "timely preventing painful relapses," adding: "The Bank of Italy intends to persevere in the measured and prudent conduct followed in the past years, when … she increased her gold reserves by more than 300 million" (Banca d'Italia 1906, 55-56). The quest for patience and prudence was reiterated *ad nauseam*. Even after monetary stabilization had long been completed, Stringher still vowed not to resort to "artifices" in monitoring the foreign exchange market (Banca d'Italia 1909, 54; 1911, 49; 1913, 11).

But insecurity was by no means the prevailing motivation for shadowing rather than legally committing to the gold standard. For a semi-peripheral country still characterized by financial weakness, shadowing the gold standard may well have been the best course of action to strengthen its position and withstand potentially disruptive shocks. Contemporary policymakers understood this point very well. By avoiding an official commitment to convertibility, a not yet entirely credible country, endowed with large reserves, would be in a more comfortable position to avoid speculative attacks. Italy's performance during the most severe crisis of that period, the worldwide liquidity crunch of 1907, vindicated the strategic choice of the previous years.

The 1907 crisis was potentially disruptive to the Italian economy owing to the strong ties between German-type universal banks and most of the country's large utility and manufacturing companies. The reckless lending and risky

[16] These objectives were clearly stated from the very beginning. The growth in reserves had the "double aim of increasing the ratio between the metallic guarantee and the value of bills in circulation, and making a greater amount of exchange media available to the market, widening the paper circulation entirely covered by specie and thus independent of the normal limit of circulation. In short, in increasing measure, a part of our bills has been given the

stock market operations which led to the liquidation of the third largest bank (Società Bancaria Italiana) posed a serious threat both for the financial and the real side of the economy. A serious risk existed that the insolvency of Società Bancaria Italiana would be transmitted to its industrial customers and, by contagion, to the two other large credit institutions and their client companies. Prompt action by the Bank of Italy, as lender of last resort, and a loan from the Treasury defused the threat. These were made possible by the fact that "the Bank of Italy was in such a strong position that it could increase circulation without negative effects on the size of its reserves or the exchange rate" (Bonelli 1971, 52). No economy-wide credit crunch resulted from providing all the liquidity needed by the ailing banks. Throughout the crisis the lira remained within the gold points. Stringher, noticing that in 1907 the discount rate had been raised to 5.5 per cent, its highest level since 1894, proudly added: "But what a difference between this rate, applied by us for a few months only, and the rates other countries had to apply in order to protect their metal reserves: the Bank of England set its rate to 7% and the Imperial Bank of Germany to 7.5%" (Banca d'Italia 1908, 27).

Besides the important episode of the 1907 crisis, the huge and continuous drop in the interest rate differential between the Rendita and British consols, which fell from a mean of 251 basis points in 1894 to 19 basis points in 1913, also testifies to Italy's success in shadowing the gold standard.

4. Exchange rate, reserves, and circulation: stylized findings

The relationship between the lira exchange rate and key gold standard variables — banknotes in circulation and metallic reserves — is investigated in this section. That monetary authorities deemed these variables as closely interrelated and essential to successfully shadow the gold standard is vividly depicted in a graphical appendix to the 1914 Annual Report of the Bank of

function of deposit certificates of gold purchased abroad in order to better satisfy the new needs of the national economy" (Banca d'Italia 1903, 13).

Italy. In particular, Figure 4 shows the inverse relationship between the lira-franc exchange rate and the reserve to banknote ratio over twenty years (1894-1913), reflecting the fundamental principles underlying the workings of the gold standard.

<INSERT FIGURE 4 HERE>

The aim of the statistical analysis is straightforward. Having identified a coherent behavioral pattern for the *de jure* members of the gold standard, an analogous pattern should hold if, as maintained in the previous section, the authorities were successful in their shadowing policy and achieved *de facto* lira convertibility in the first decade of the twentieth century. For reasons already explained (see note 6 above) we take the lira-franc exchange rate to be the most appropriate measure. The analysis is carried out at monthly intervals (data are for the last business day of each month). The sample spans from January 1883 to December 1911. It is divided into three sub-periods: (i) the gold standard (from January 1883 to December 1893), (ii) floating rates (from January 1894 to December 1902) and (iii) the shadowing policy (from January 1903 to December 1911).

4.1. A VECM investigation

As Italy's adoption of an exchange rate regime was neither clear-cut nor persistent, we do not know a priori whether the three time series mentioned above — exchange rate, reserves, and banknotes — are exogenous or endogenous. Of course, in a textbook model of the gold standard, reserves are endogenous and so are banknotes. However, as discussed above, both note issue and reserve levels turned out to be policy instruments. The exchange rate, in turn, becomes endogenous whenever the gold standard is abandoned in favor of free floating. The difficulty of introducing a priori hypotheses is compounded by the peculiar financial positioning of the country *vis-à-vis* the gold standard. Italy was on the periphery of the system and the

monetary authorities did not hesitate to manipulate the variables mentioned above directly.

Thus, at this stage of the analysis, we treat all three variables as potentially endogenous and investigate their behavior over time with the help of a vector autoregressive parameterization. A preliminary assessment of stationarity of the time series over the full sample and the three sub-samples mentioned above is called for, along with an analysis of cointegration if two or more of them are found to be I(1). The currency and banking crisis preceding the abandonment of the gold standard in 1893 brought about sudden changes in the level of the time series, which did not depend on the dynamics of their correlation structure, so that the corresponding outliers may well be considered additive. The unit root tests (Table A.1) are thus performed using the robust statistic by Ng and Perron (2001).[17] The tests suggest that the logarithm of the monthly exchange rate, reserves, and banknotes are I(1) in the time periods under investigation. We implemented the test procedure of Perron and Rodríguez (2003) and identified several additive outliers. The value of the test statistics that are significant at the 5 per cent level and the corresponding dates are set out in the Appendix (Table A.2). Cointegration analysis is then implemented using Johansen's multivariate approach (1991).[18]

The (small sample adjusted) trace statistics, set out in Table 1, identify in each time period a single cointegration relationship among the three I(1) variables $\log e_t$, $\log \mathrm{Re}\, s_t$ and $\log Not_t$, where e_t is the lira-franc exchange rate

[17] Additive outliers introduce a moving average component with a negative coefficient into the residuals of standard unit root test estimates which, in turn, inflates the size of the test and brings about over-rejection of the null of non-stationarity.

[18] Additive outliers may also distort inference on cointegration rank in finite samples. Following the interpolation strategy suggested by Nielsen (2004), the outlying observations are eliminated and replaced by an average of the respective adjoining data. The smoothed time series will then be used in the cointegration analysis below.

(number of liras per franc), $\mathrm{Re}s_t$ is the stock of total reserves[19] and Not_t is the stock of banknotes in circulation.

<INSERT TABLE 1 HERE>

The following Vector Error Correction Models (VECMs) are then estimated in the relevant time periods

$$\Delta X_t = \Phi + \beta\alpha' X_{t-1} + \sum_{j=1}^{k} \Gamma_j \Delta X_{t-j} + \nu_t \qquad (1)$$

where Φ is a n x 1 vector of constant terms, and Γ_j is a matrix of distributed lag coefficients. β and α are n x m matrices of adjustment coefficients and cointegration equation coefficients respectively, n = 3 being the number of I(1) time series in X_t, viz. $\log e_t$, $\log \mathrm{Re}s_t$, and $\log Not_t$, and m = 1 the number of cointegrating relationships. We have thus n - m = 2 nonstationary common trends that drive the system of jointly endogenous variables.

4.2. Error correction dynamics on and off the gold standard

Each VECM describes the behavior over time of the monthly rate of change of the exchange rate, the stock of reserves, and the stock of banknotes in circulation. The VECM diagnostics of Table 2 are satisfactory and suggest that the appropriate number of lags — also used in the Johansen cointegration tests above — has been selected, an important finding since, as shown by Hall (1991), the latter are highly sensitive to lag length.[20]

[19] Non-metallic reserves, equal to zero in the first sub-period, went up to 20 per cent of total reserves in 1900 and then progressively decreased to 7 per cent in 1913.
[20] We follow Urbain (1995) and base the choice of the VECM order on the absence of serial correlation of the residuals.

<INSERT TABLE 2 HERE>

A preliminary question is whether the choice of the three sub-periods mentioned above is justified by the model behavior. The answer is definitely positive. Figure 5 shows a plot of the full sample "known cointegration vector" recursive test for cointegration parameter constancy proposed by Hansen and Johansen (1993).[21] Two results stand out: (i) the long run cointegration vector estimates are unstable if the VECM is re-estimated at each iteration, with shifts that correspond with accuracy to the dating chosen for the three sub-samples of the paper (continuous line); (ii) the cointegration relationship estimates become marginally stable if the long run coefficient vectors α and β only are reestimated at each iteration, while the short run VECM coefficients are maintained at their full sample estimated values (dotted line). We conclude that the two regime shifts are due more to the short run than to the long run components of the VECM. A homogeneous economic interpretation of the latter over the three sub-samples may thus be justified. (Full sample estimates of the VECM used in the parameter constancy analysis are available from the authors upon request.)

<INSERT FIGURE 5 HERE>
<INSERT TABLE 3 HERE>

A second question deals with the structure of the error correction process in the three sub-periods. Preliminary information on long run dynamics is provided by the Likelihood Ratio (LR) tests for weak exogeneity set out in

[21] The test is meant to assess if the full sample estimate is contained in the space spanned by the recursive α_i estimates. Formally the hypotheses tested are $H_{0\alpha_i}: \hat{\alpha} \in sp(\alpha_i), i = T_0,...,T$, where $\hat{\alpha}$ is the full sample cointegration vector estimate and T_0 is the January 1883-December 1885 base period. The last recursive estimation is equal to the full sample one. The null is thus that the cointegration vector α estimate at each recursive iteration is not statistically different from the full sample one, which has the lowest sample variance. It is asymptotically distributed here as a χ^2 with m(n-m) degrees of freedom.

Table 3.[22] In the January 1883-December 1893 and January 1903-December 1911 sub-periods, the exchange rate and the stock of banknotes are weakly exogenous for the long-term cointegration coefficients in α, while in the January 1894-December 1902 sub-period, reserves and banknotes turn out to be weakly exogenous.[23] These findings are central to the paper's message and merit further discussion.

These results are corroborated by the estimates of the error correction coefficients of Table 2, which correspond to a normalization of the cointegrating vector with the exchange rate coefficient.[24] The entries of the error correction vector β identify the variables that shift in order to restore equilibrium. Indeed, a variable plays a role in the adjustment required to return to the long-run equilibrium after a shock if the error correction coefficient is significantly different from zero (and, obviously, of the appropriate sign) in the corresponding dynamic equation of the VECM.

In the first sub-period the error correction coefficient is significantly different from zero in the dynamic relationship which parameterizes the rate of change of reserves. The latter bring the long-run relationship between the level of reserves, the exchange rate, and banknotes back to equilibrium, as should be the case in a gold standard regime with free international capital movements. The Italian case is more complex since, from 1886 onwards, the adjustment pattern reflects various attempts to support the price of Rendita in Paris as mentioned in section 2 above.

In the second, free floating, regime (January 1894-December 1902), adjustment is brought about, as expected, by the exchange rate. The error

[22] Neither the "known cointegration vector" stability test nor the LR tests for weak exogeneity are affected by the normalization of the cointegrating vector.

[23] We test to see if any of the variables in X_t is weakly exogenous with respect to α, i.e. if it does not adjust to the long run disequilibrium error. Formally, we test the null $H_0: \beta_{ij} = 0, j = 1,...,m \quad and \quad i = 1,...,n$, where m = 1 is the number of cointegration relationships and n = 3 is the number of variables in X_t. The test is asymptotically χ^2 distributed with m degrees of freedom.

[24] A tentative economic interpretation of the cointegration relationships is set forth in the Appendix.

correction coefficient is significantly different from zero in the exchange rate equation of the VECM.

The third sub-period, the gold shadowing regime (January 1903-December 1911), provides some interesting results. The error correction terms of both the exchange rate and reserve change relationships are different from zero. The former, however, has the wrong sign and has a very small absolute value. Moreover, the joint hypothesis that the error correction terms of both the exchange rate and banknote rate of change relationships are nil cannot be rejected at the standard level of significance (the corresponding LR test, distributed as χ^2 with two degrees of freedom, is 3.776 with a probability value of 0.15). Reserves play a dominant role, as in the official gold standard regime of 1883-1893, in restoring the long-run equilibrium after a shock. The monetary and fiscal policies mentioned in the previous section, along with emigrant remittances, restored the country's international financial balance and the lira-franc exchange rate fluctuated within the gold points (see Figure 1). The reserve change equation error correction coefficient is larger in absolute value than in the first sub-period, and the speed of adjustment of reserves after a shock to the cointegration equilibrium relationship has increased. This finding may be associated with the policy of large reserve accumulation implemented by the Bank of Italy and the ensuing integration of the country in the international financial system.

There is a final point to be made about the role of the stock of banknotes. It is always weakly exogenous, which suggests that the banking authorities were able to control the monetary base irrespectively of the exchange rate regime. If this finding is not unduly surprising as regards the second (inconvertibility) regime, this is not the case for the first. Indeed, in a gold standard framework the availability of reserves should constrain the supply of banknotes. Their exogeneity suggests that banks were somehow able to hinder convertibility, from 1887 onwards, with the help of moral suasion and/or alternative administrative measures. In the third sub-period, exogeneity is due to the rapid growth of the stock of reserves. As shown in

Figure 2, they amply exceed the mandatory level associated with the supply of banknotes.

5. Conclusions

Italy's case prior to the First World War may be seen as an *in vitro* experiment of the relations between three key policy variables across different exchange rate regimes in a semi-peripheral country.

Our empirical findings corroborate the hypothesis of the existence of three distinct exchange rate regimes from 1883 to 1911. In the gold standard period (1883-1893) the exchange rate was weakly exogenous, and so was, less obviously, money circulation, indicating that banks of issue were able to manipulate convertibility. Reserves were endogenous. Under the floating rate regime (1894-1902) circulation and reserves were weakly exogenous while the exchange rate was naturally endogenous. Finally during the gold shadowing years (1903-1911) the causality structure replicated the one found under the gold standard: reserves were endogenous while the two other variables were weakly exogenous.

The contrast between the failure of *de jure* return to gold in the first sub-period and the success of shadowing gold in the third one points to the crucial role of policies and fundamentals in maintaining an exchange rate regime. The mere commitment to convertibility, *per se*, did not ensure exchange rate stability, while the implementation of a consistent policy framework did, even in the absence of *de jure* convertibility. In 1883 Italy took out a huge foreign loan before resumption but did not carry out policies consistent with convertibility. The return to gold was therefore doomed to fail. At the turn of the century, on the contrary, a time consistent policy design was pursued until the eve of World War I, which allowed policy makers to effectively mimic the gold standard.

Nowadays the issues are essentially the same, although they appear in a different shape. In the absence of the clear-cut rules of commodity standards, credibility becomes all the more crucial to the viability of fixed

exchange rates.[25] Like Italy a century ago, today some peripheral countries informally peg to a reserve currency, a policy analogous to gold shadowing, trying to build up credibility through macroeconomic policies and the accumulation of international reserves to withstand liquidity crises and overcome the "fear of floating."[26]

For peripheral countries, therefore, the choice of exchange regime may well be a "mirage" (Calvo and Mishkin 2003) inasmuch as the achievement of macroeconomic goals does not relate to the choice itself but to sound fundamentals, adequate financial institutions, and consistent policies. Building up reserves is part of this strategy in that it provides an effective shield against crises originating from domestic credit markets and exchange markets, i.e. from both internal and external drain.[27] In this regard, Italy's variegated vicissitudes during the gold standard teach a valuable lesson. Only after the abandonment of ad hoc measures having ephemeral effects, was Italy able, by implementing a long-run strategy based on rigorous

[25] Drawing attention to the influence of political factors, Obstfeld and Taylor stress the same point: "[I]f we seek lessons from the past, our results have some implications for today's attempts to gain capital market credibility through the use of pegged exchange rates. It is clear that the post-World War One political developments that rendered interwar exchange-rate commitments less credible have not receded in the meantime. Thus, policymakers should not expect to gain market credibility even through seemingly irrevocable exchange rate commitments. In the absence of robust fundamentals and complementary economic and institutional reforms, efforts to forswear discretionary exchange rate changes are of questionable value" (2003, 266). The central role of credibility is definitely reflected in the effectiveness of capital mobility. During the gold standard, capital movements were a major stabilizing factor because the exchange rate risk was virtually nil. From the inter-war years onward, the waiving of key rules weakened credibility and capital flows became a major source of instability. Hence, the "analytical mystery" stressed by Bayoumi and Eichengreen, contrasting the stability of the gold standard with subsequent fixed exchange rate regimes (see the beginning of section 1 above), is accounted for by the changed nature of the monetary system.

[26] Bordo and Flandreau emphasize the similarity of the problems affecting peripheral countries. "If going on gold was so costly for the periphery, one may wonder why a number of countries nonetheless sought to stick to gold. We argue that this choice rested on something quite similar to the current fear-of-floating dilemma. If fixing was quite painful under the gold standard for many of the peripheral countries, floating could be just as deadly as today. This was due to pervasive problems of currency mismatch arising from the inability, for underdeveloped borrowing countries, to issue foreign debts in their own currency" (2003, 436).

[27] This twofold objective of reserve policy was clearly stated by Stringher (see footnote 16). In a recent paper, Obstfeld, Shambaugh, and Taylor (2008) trace back this hypothesis to Thornton and Keynes, corroborating it with panel data analysis covering the 1980-2004 years and 134 countries.

policies and reserve accumulation, to successfully shadow the gold standard and join the group of advanced countries.

References

Banca d'Italia, 1903-1914, Adunanza Generale Ordinaria degli Azionisti, Roma: Banca d'Italia.

Barone, E., 1918, Il mercato internazionale della moneta e del risparmio, Rocca S. Casciano: Tipografia Licinio Cappelli.

Bayoumi, T. and B. Eichengreen, 1996, The Stability of the Gold Standard and the Evolution of the International Monetary Fund System, in T. Bayoumi, B. Eichengreen, and M. P. Taylor (eds), Modern Perspectives on the Gold Standard, Cambridge: Cambridge University Press, 165-88.

Bloomfield, A. I., 1959, Monetary Policy Under the International Gold Standard, 1880-1914, New York: Federal Reserve Bank of New York.

Bonelli, F., 1971, La crisi del 1907. Una tappa dello sviluppo economico italiano, Torino: Fondazione Einaudi.

Bordo, M. D., 2003, Exchange Rate Regime Choice in Historical Perspective, National Bureau of Economic Research, Working Paper No. 9654.

Bordo, M. D. and M. Flandreau, 2003, Core, Periphery, Exchange Rate Regimes, and Globalization, in M. D. Bordo, A. M. Taylor, and J. G. Williamson (eds), Globalization in Historical Perspective, Chicago: The University of Chicago Press, 417-68.

Bordo, M. D. and F. E. Kydland, 1996, The Gold Standard As a Rule: An Essay in Exploration, Explorations in Economic History 32: 423-64.

Bordo, M. D. and C. M. Meissner, 2005, Financial Crises, 1880-1913: The Role of Foreign Currency Debt, National Bureau of Economic Research, Working Paper No. 11173.

Bordo, M. D. and H. Rockoff, 1996, The Gold Standard as a 'Good Housekeeping Seal of Approval', Journal of Economic History 56: 389-428.

Calvo, G. A. and F. S. Mishkin, 2003, The Mirage of Exchange Rate Regimes for Emerging Market Countries, Journal of Economic Perspectives 17: 99-118.

Corbino, E., 1938, Annali dell'economia italiana. Volume Quinto 1901-1914, Tipografia "Leonardo da Vinci": Città di Castello.

De Cecco, M., 1990, L'Italia e il sistema finanziario internazionale, Roma-Bari: Laterza.

De Mattia, R., 1959, L'unificazione monetaria italiana, Archivio Economico dell'Unificazione Italiana, serie III, vol. II, Torino: Ilte.

Di Martino, P., 2001, Corso della Rendita e andamenti del tasso di cambio della Lira negli anni del gold standard (1883-1893), Rivista di Storia Economica 17: 3-31.

Eichengreen, B., 1996, Globalizing Capital: A History of the International Monetary System, Princeton: Princeton University Press.

Eichengreen, B. and M. Flandreau (eds), 1997, The Gold Standard in Theory and History, 2nd ed., London: Routledge.

Fanno, M., 1908, La moneta, le correnti monetarie e il riordinamento della circolazione nei paesi a finanze dissestate, Torino: Fratelli Bocca Editori.

Ferguson, N., 2003, The City of London and British Imperialism: New Light on an Old Question, Manuscript, University of Oxford.

Flandreau, M. and F. Zumer, 2004, The Making of Global Finance, 1880-1913. Paris: OECD.

Francese, M. and A. Pace, 2008, Il debito pubblico italiano dall'unità ad oggi. Una ricostruzione della serie storica, Banca d'Italia, Questioni di Economia e Finanza (Occasional papers) n. 31.

Fratianni, M. and F. Spinelli, 1997, A Monetary History of Italy, Cambridge: Cambridge University Press.

Garofalo P., 2005, Exchange Rate Regimes and Economic Performance: The Italian Experience, Banca d'Italia, Quaderni dell'Ufficio Ricerche Storiche n. 10.

Hall, S. G., 1991, The Effect of Varying Length VAR Models on the Maximum Likelihood Estimates of Cointegrating Vectors, Scottish Journal of Political Economy 38: 317-23.

Hansen, H. and S. Johansen, 1993, Recursive Estimation in Cointegrated VAR-Models, Mimeo, Institute of Mathematical Statistics, University of Copenhagen.

Johansen, S., 1991, Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models, Econometrica 59: 1551-80.

Johansen, S., 1995, Likelihood Based Inference in Cointegrated Vector Autoregressive Models, Oxford: Oxford University Press.

Lettau, M. and S. C. Ludvigson, 2004, Understanding Trend and Cycle in Asset Values: Reevaluating the Wealth Effect on Consumption, American Economic Review 94: 276-99.

McKinnon, R. I., 1993, The Rules of the Game: International Money in Historical Perspective, Journal of Economic Literature 31: 1-44.

Mill, J. S., 1848, Principles of Political Economy, W. Ashley (ed.), New York: Augustus M. Kelly, 1987.

Mitchener, K. J. and M. D. Weidenmier, 2007, The Baring Crisis and the Great Latin American Meltdown of the 1890s, National Bureau of Economic Research, Working Paper No. 13403.

Morys, M., 2007, Adjustment under the Classical Gold Standard (1870s-1914): How Costly did the External Constraint Come to the European Periphery?, University of Oxford, Department of Economics.

Mundell, R. A., 2000, A Reconsideration of the Twentieth Century, American Economic Review 90: 327-40.

Ng, S. and P. Perron, 2001, Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power, Econometrica 69: 1519-54.

Nielsen, H. B., 2004, Cointegration Analysis in the Presence of Outliers, Econometrics Journal 7: 249-71.

Obstfeld, M., Shambaugh, J. C., and A. M. Taylor, 2008, Financial Stability, the Trilemma, and International Reserves, National Bureau of Economic Research, Working Paper No. 14217.

Obstfeld, M. and A. M. Taylor, 2003, Sovereign Risk, Credibility and the Gold Standard: 1870-1913 versus 1925-31, Economic Journal 113: 241-75.

Pareto, V., 1894, Teoria matematica dei cambi forestieri, Giornale degli Economisti 8: 142-73.

Perron, P. and G. Rodríguez, 2003, Searching for Additive Outliers in Nonstationary Time Series, Journal of Time Series Analysis 24: 193-220.

Reinsel, G. C. and S. K. Ahn, 1988, Asymptotic Properties of the Likelihood Ratio Test for Cointegration in the Nonstationary Vector AR Model, Technical Report, Department of Statistics, Madison, University of Wisconsin.

Supino C., 1921, La carta moneta in Italia, Bologna: Zanichelli.

Sussman, N. and Y. Yafeh, 2000, Institutions, Reforms, and Country Risk: Lessons from Japanese Government Debt in the Meiji Era, Journal of Economic History 60: 442-67.

Tattara, G., 2003, Paper Money but a Gold Debt: Italy on the Gold Standard, Explorations in Economic History 40: 122-42.

Toniolo, G., 1990, An Economic History of Liberal Italy, 1850-1918, London Routledge.

Toniolo, G., Conte, L., and G. Vecchi, 2003, Monetary Union, Institutions and Financial Market Integration: Italy 1862-1905, Explorations in Economic History 40: 443-61.

Urbain, J.-P., 1995, Partial Versus Full System Modelling of Cointegrated Systems. An Empirical Illustration, Journal of Econometrics 69: 177-210.

Figure 1

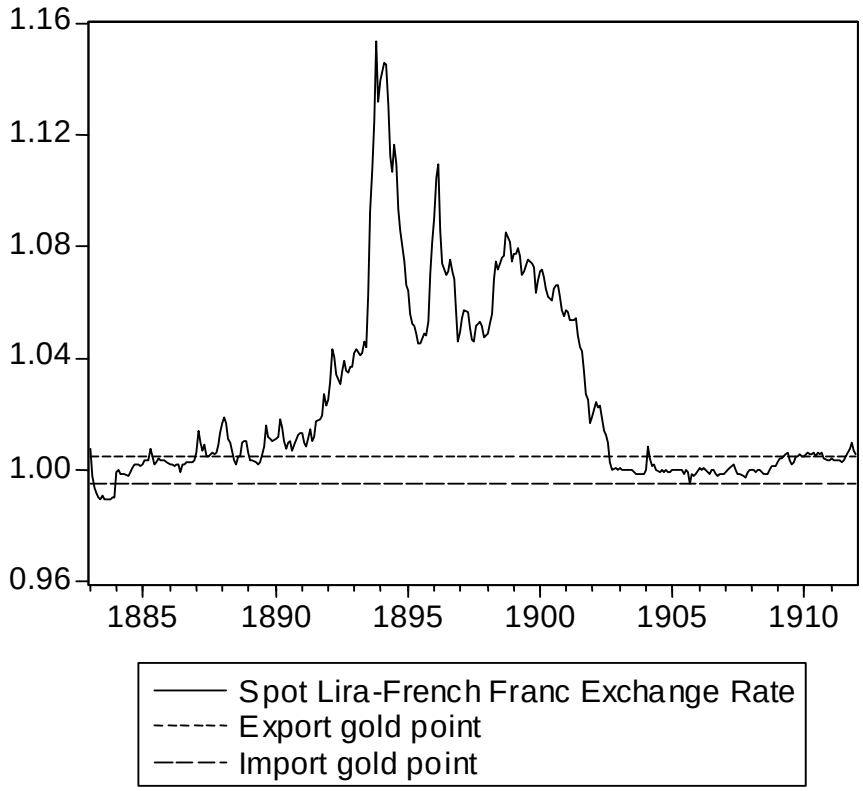

1.16
1.12
1.08
1.04
1.00
0.96
1885
1890
1895
1900
1905
1910
Spot Lira-French Franc Exchange Rate
Export gold point
Import gold point

Figure 2

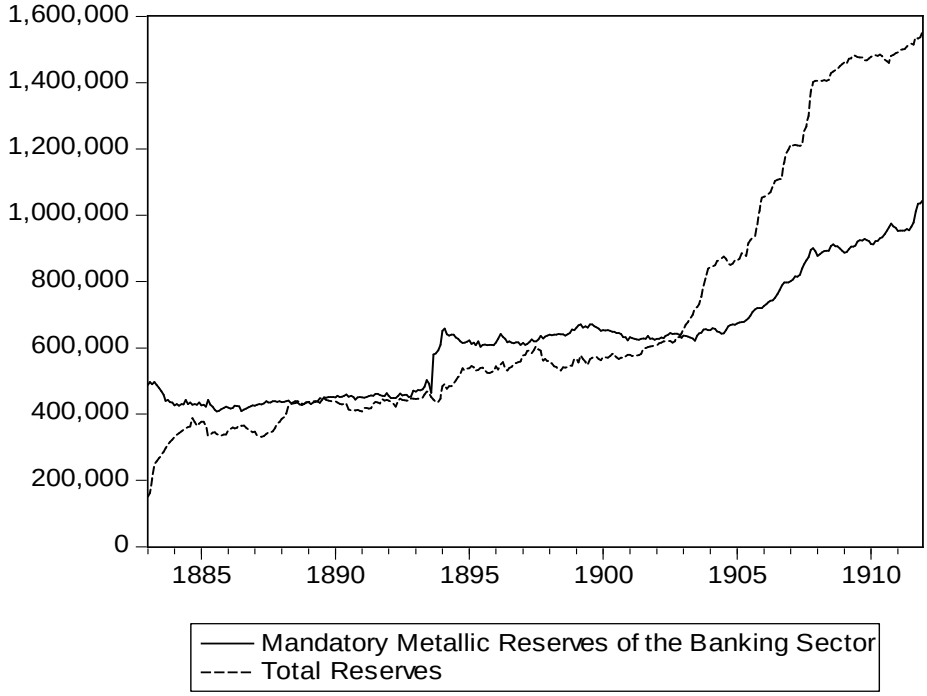


Figure 3

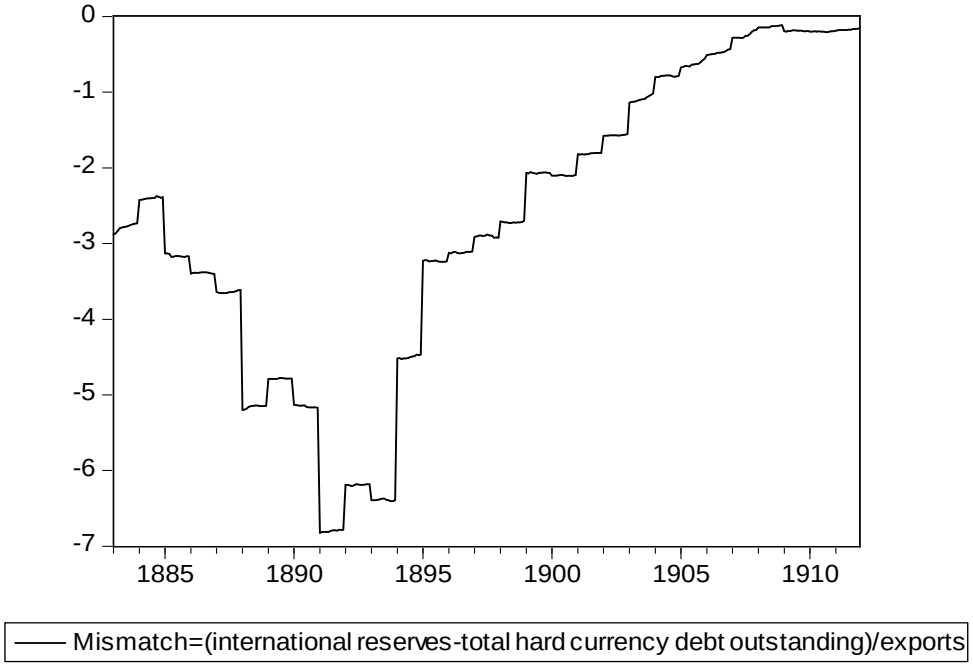
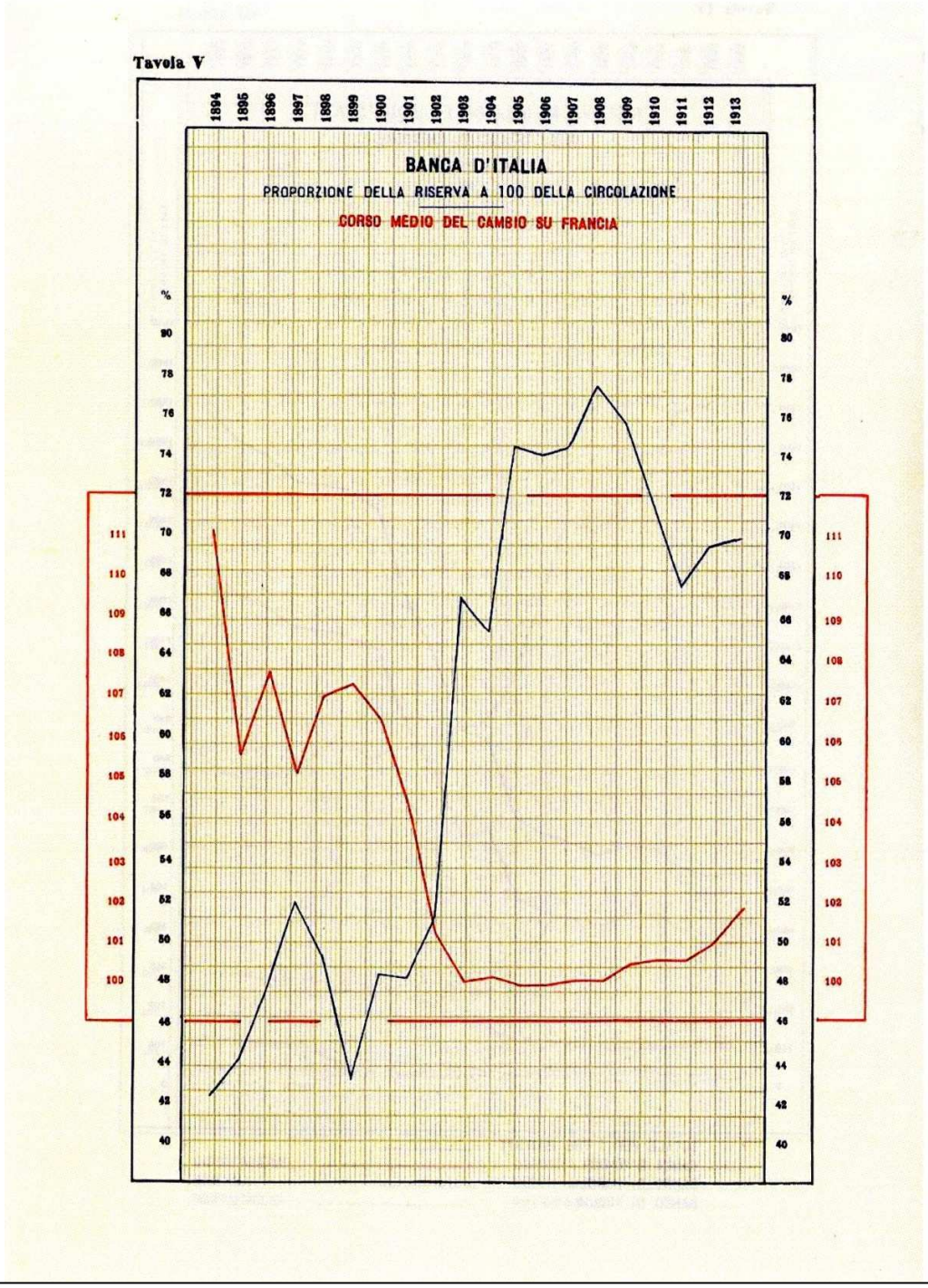
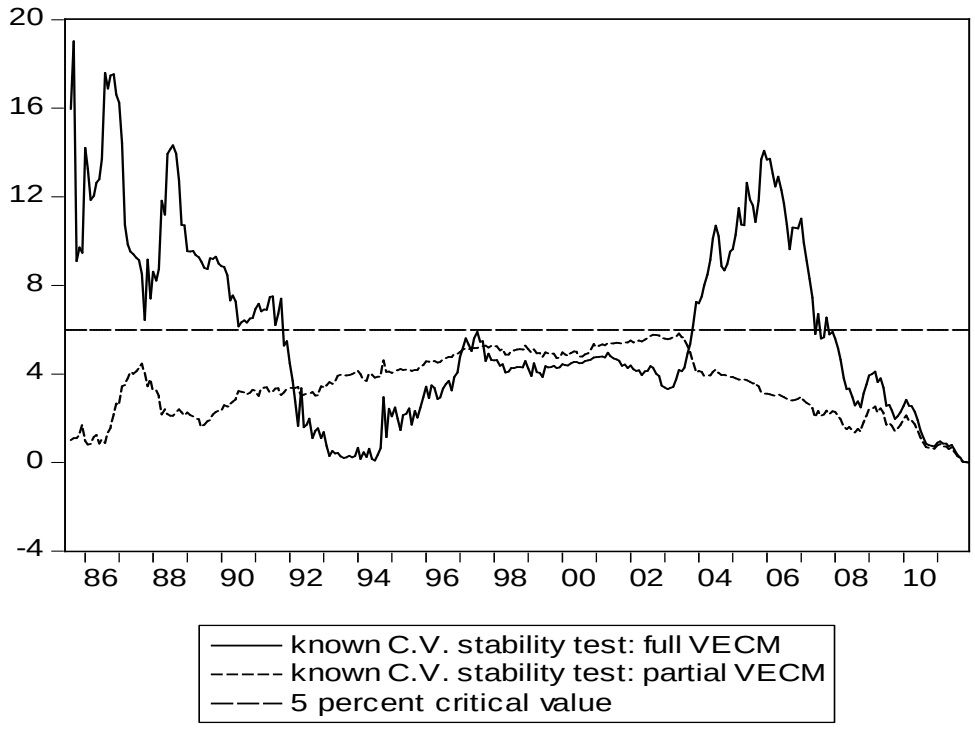


Figure 4



Red line: Spot Lira-French Franc Exchange Rate; Blue line: Percentage Reserve to Banknote Ratio

Figure 5



Note. The plot above the critical value suggests that the null, that the cointegration vector estimate from the corresponding recursive estimation interval is not statistically different from the full sample cointegration vector estimate, has to be rejected. The null hypothesis is accepted in the 1892 - 1904 sub-sample and rejected in the remaining sub-periods if each VECM is reestimated at each iteration. It is marginally accepted if the long run coefficients only are recursively estimated, since the short term dynamics are concentrated out prior to performing the estimation.

Table 1: Johansen cointegration tests

Trace test statistics

List of variables in X_t : $\log e_t$ = *log (Spot exchange rate),* $\log \mathrm{Re}\, s_t$ = *log (Reserves),* $\log Not_t$ = *log (notes)*

	Hypothesized No. of Cointegration Relationships	Trace Statistic	5 percent Critical Value	Adjusted 5 percent Critical Value°	N. of lags in VAR	Deterministic Trend Assumption
Lira-Franc						
January 1883 December 1911	None at most 1 at most 2	75.96* 13.43 3.36	29.80 15.49 3.84	32.01 16.64 4.12	8	Linear deterministic trend
January 1883 December 1893	None at most 1 at most 2	55.95* 11.14 3.07	29.80 15.49 3.84	34.50 17.93 4.45	6	Linear deterministic trend
January 1894 December 1902	None at most 1 at most 2	39.58* 14.41 3.79	29.80 15.49 3.84	31.55 16.40 4.07	2	Linear deterministic trend
January 1903 December 1911	None at most 1 at most 2	42.70* 19.56 5.75	35.19 20.26 9.16	40.87 23.53 10.64	5	Restricted constant

Notes. *: denotes rejection of the null hypothesis at the 5 percent level; ° the critical values are adjusted for a finite sample bias using the Reinsel and Ahn (1988) procedure.

Table 2: Error correction coefficients

$$\Delta X_t = \Phi + \beta\alpha' X_{t-1} + \sum_{j=1}^{k} \Gamma_j \Delta X_{t-j} + \nu_t \qquad (1)$$

		VECM equation			VECM Log Likelihood	VECM order
Lira-Franc	**Dependent Variable**	$\Delta \log e_t$	$\Delta \log \mathrm{Re}s_t$	$\Delta \log Not_t$		
January 1883 December 1893	Error correction coefficient	0.006 (1.685)	-0.126* (-7.014)	-0.003 (-0.337)	1872.94	6
	LB Q-test for serial correlation of the residuals	0.01 (lag 1) [0.91] 0.51 (lag 5) [0.99]	3.51 (lag 1) [0.06] 9.45 (lag 5) [0.05]	0.10 (lag 1) [0.75] 2.29 (lag 5) [0.81]		
January 1894 December 1902	Error correction coefficient	-0.183* (-4.867)	-0.227 (-1.668)	-0.031 (-0.330)	1526.90	2
	LB Q-test for serial correlation of the residuals	0.78 (lag 1) [0.38] 7.19 (lag 5) [0.21]	0.19 (lag 1) [0.66] 0.72 (lag 5) [0.98]	1.79 (lag 1) [0.18] 11.06(lag 5) [0.09]		
January 1903 December 1911	Error correction coefficient	0.052* (2.261)	-0.823* (-4.749)	0.033 (0.225)	1754.972	5
	LB Q-test for serial correlation of the residuals	0.09 (lag 1) [0.76] 1.19 (lag 5) [0.95]	0.06 (lag 1) [0.82] 0.62 (lag 5) [0.97]	0.00 (lag 1) [0.98] 0.63 (lag 5) [0.99]		

Notes. *: significantly different from zero at the 5 percent level; t ratios are in parentheses and probability values in square brackets.

Table 3: Likelihood ratio tests for weak exogeneity

	$\log e_t$	$\log \mathrm{Re}s_t$	$\log Not$
January 1883 December 1893	2.759 [0.097]	36.558* [0.000]	0.105 [0.745]
January 1894 December 1902	14.092* [0.000]	1.800 [0.180]	0.073 [0.787]
January 1903 December 1911	3.516 [0.061]	9.323* [0.002]	0.023 [0.881]

Notes. Probability values in square brackets; *: significant at the 5 percent level.

Appendix

Table A.1: Ng Perron (2001) unit root tests*

January 1883 December 1911			January 1883 December 1893		
$\log e_t$	-1.81	I(1)	$\log e_t$	-1.96	I(1)
C, lag 9			C, t, lag 0		
$\log \mathrm{Re}\, s_t$	-0.87	I(1)	$\log \mathrm{Re}\, s_t$	-0.58	I(1)
C, t, lag 11			C, t, lag 11		
$\log Not_t$	-0.32	I(1)	$\log Not_t$	-1.22	I(1)
C, t, lag 15			C, t, lag 6		
January 1894 December 1902			**January 1903 December 1911**		
$\log e_t$	-1.88	I(1)	$\log e_t$	-1.36	I(1)
C, t, lag 1			C, lag 4		
$\log \mathrm{Re}\, s_t$	-1.87	I(1)	$\log \mathrm{Re}\, s_t$	-0.72	I(1)
C, t, lag 0			C, t, lag 12		
$\log Not_t$	-1.28	I(1)	$\log Not_t$	-2.13	I(1)
C, lag 9			C, t, lag 1		

Notes. *: The GLS-detrended autoregressive spectral density estimator of the frequency zero spectrum uses the modified AIC to select the number of lags. Critical values with constant, C, and trend, t: -3.42 (1 percent), -2.91 (5 percent); with constant without trend: -2.58 (1 percent), -1.98 (5 percent).

Table A.2: Perron Rodríguez (2003) additive outliers tests*

	τ_d	Time period		τ_d	Time period		τ_d	Time period
$\log e_t$	6.96	1893m11	$\log \mathrm{Re}\, s_t$	5.44	1883m02	$\log Not_t$	4.42	1885m04
	3.81	1893m12		5.32	1883m03		3.81	1893m05
	5.03	1895m12		4.92	1883m04		5.28	1893m08
	4.09	1896m03		4.30	1884m05			
				4.59	1884m11			
				4.51	1884m12			

Notes. *: Critical values of the τ_d test statistic of Perron and Rodríguez (2003, 203): with no trend, 4.20 (1 percent), 3.75 (5 percent). $\log \mathrm{Re}\, s_t$ and $\log Not_t$ are trending and the corresponding critical values are: 4.19 (1 percent), 3.74 (5 percent).

Table A.3: Cointegration equation estimates

$$\log e_t - \rho_0 - b_1 \log \mathrm{Re}\, s_t - b_2 \log Not_t = \varepsilon_t$$

	Lira-Franc		
	$-\rho_0$	$-b_1$	$-b_2$
January 1883 December 1893	-	0.481 (6.051)	-1.382 (-3.746)
January 1894 December 1902	-	0.392 (11.607)	-0.220 (-2.637)
January 1903 December 1911	0.498 (2.193)	0.075 (3.967)	-0.107 (-3.271)

Note. t ratios are in parentheses.

A tentative economic interpretation of the cointegration relationships

The investigation of the economic interpretation of a cointegration relationship is seldom straightforward. For a given cointegration rank, m, the cointegration vectors are the eigenvectors that correspond to the m largest solutions of the eigenvalue equation in the Johansen estimation procedure (Johansen, 1995, theorem 6.1, equation 6.15, 93) and have to be normalized in order to acquire an economic significance. A standard procedure is to divide each coefficient of the cointegrating vector by the coefficient of an adjusting variable, i.e. of a variable which reacts to the disequilibrium error having a non zero error correction coefficient in the corresponding equation of the VECM. In some cases, however, a strong a priori economic interpretation of the cointegration equation suggests a normalization with the coefficient of a weakly dependent variable, i.e. of a variable which has an error correction coefficient in the VECM that is not significantly different from zero.[28] In our case the exchange rate policies implemented by the monetary

[28] For examples in the literature, see Lettau and Ludvigson (2004) among many others.

authorities might provide an economic justification for this normalization. An emerging market country, Italy was at the margin of the gold standard and the automatisms of the latter did not apply. The authorities carefully monitored the exchange rate, controlling both the process of reserve accumulation and the issue of banknotes. The writings of Pareto (1894), Fanno (1908), and Barone (1918) set forth in section 2 provide a lucid discussion of this proposition.

<INSERT TABLE A.3 HERE>

Table A.3 sets out the estimates of the cointegrating equation of the VECM estimates of section 4.2 above. The cointegrating vector is always normalized with the coefficient of the exchange rate even if the latter is the adjusting variable only in the January 1894 - December 1902 time period. The resulting parameter estimates are always significant and of the appropriate sign: an exchange rate appreciation is associated in the long run with an increase in the stock of reserves and with a decrease in the stock of banknotes and vice versa in the case of depreciation of the exchange rate. There is but little evidence of changes in regime: if the estimated parameters tend to become smaller in absolute value, their sign however does not change. As shown by the stability tests above, the exchange rate regimes seem to have affected the short run more than the long run aspects of the analysis.