

Pasquale Jannaccone: A Neglected Originator of the Monetary Approach to Balance of Payments and Exchanges Rates

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"Events in the world of money move fast: but it does not follow that principles shift as quickly".

(Keynes, 1924)

"[The] new approach is not actually new".

(Johnson, 1975)

1. Summary and conclusions

The purpose of the paper is twofold. First, it is meant to be an exercise in the history of economic thought. The profession has acknowledged that while the spirit of the monetary approach to the balance of payments and exchange rates can be traced back in earlier, classical writings, the formalization of it, namely the expression which makes the balance of payments or the exchange rate depend on money supply and demand, does represent a novel development. A specific contribution of this paper will be to show that in at least one case that expression, too, can distinctly be found in an earlier study which was published in Italian, back in 1918, and which attempted to explain the lira exchange rate over a 40-year period ending with World War I.

Our second goal is to re-estimate the monetary approach, over both the same and a more extended sample period. The exercise is of interest in that it is as if we were endowing an earlier writer with the data, computer facilities and estimation techniques that have become available since the time — 70 years ago, in this case — his work was first published.

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But our tests are of interest also in their own right; for it is the first time that exchange rate data drawn from the experience of the XIXth century are subject to formal econometric testing in order to assess the empirical relevance of the monetary approach. Our interpretation of the results is that, indeed, the monetary approach is a useful ingredient for analyzing the exchange rate determination processes.

2. The New Monetary Approach to the Balance of Payments and Exchange Rates: What is Really New?

In an insightful article on the monetary approach, Fausten (1980)¹ argues that "The propagation and development over the last decade of the new monetary theory of balance of payments analysis has been attended by a somewhat uncommon, yet not altogether unhealthy, phenomenon of self effacement in the sense of a reluctance on the part of its advocates to extol the novelty and originality of [the] approach".

Such reluctance was not entirely unjustified. For it just did not turn out to be easy to settle the issue as to where the element of novelty really lies.² According to Harry Johnson, the novelty had to be found in the hypothesis concerning the nature of the transmission mechanism. So, he wrote that the new approach "... places the emphasis not on relative price changes but on the direct influence of excess demand for and supply of money on the balance between income and expenditure... and therefore on the overall balance of payments" (Johnson (1976)); this, in conjunction with Johnson's insistence on attaching the Humean label to the approach, would seem to suggest that he must have had in mind a particular combination of relative price and direct expenditure effects, a combination which, however, was never fully spelled out. The overall picture was made even less clear by the presence of previous work by other proponents of the monetary approach — (Polak (1957), Prais (1961), and Mundell (1968)) for instance — who, for a variety of historical and philosophical reasons, chose not to specify an equation for domestic prices.³ As for the followers of the approach no consensus has ever been reached on the relative roles of price and quantity adjustments, on whether and how long the money market should be allowed to be out of equilibrium, and on how far to push the law of one price. Because of all this it has always been

¹ For a related paper see FAUSTEN (1979).

² This aspect is interesting in its own right. In fact, in the well known Ely lecture by HARRY JOHNSON (1971), the most visible and influential of the proponents of the monetary approach, we read that it takes a proper, exactly specified combination of tradition and novelty to bring about successful revolutions and counter-revolutions in economics.

³ In Mundell prices are kept fixed, in Polak there is no breakdown between quantity and price changes.

clear that it would be impossible to identify the new monetary approach with a well defined and widely accepted hypothesis concerning the nature of the transmission mechanism.⁴

An alternative element of novelty, which systematically characterizes the analytical and empirical papers on the monetary approach, has usually been found in a balance of payments or exchange rate equation which has money demand and supply among the regressors.⁵ Such an equation has now come to be regarded as the single most important specific feature of the new monetary approach; any disagreement on the transmission mechanism in general or on the relative importance of monetary, non-monetary, stock and flow variables in particular simply translates into a variation on the theme, i.e., into the presence of either further regressors or some constraints on the values of the parameters, or both. As a result, there now seems to be a general tendency to acknowledge that while the spirit of the new monetary approach can be traced back in earlier writings, the profession has succeeded in pushing things a bit further by translating that spirit into a well, agreed, upon equation which has two major explanatory variables: excess money supply at home and abroad.

The first and major purpose of this paper is to show that even such an equation cannot be considered to be a distinct, and hence novel, feature of the new monetary approach because it, too, can be encountered in earlier studies of exchange rates; in particular, we will draw the reader's attention to a 1918 study of the Italian lira by Pasquale Jannaccone where the empirical implementation of the monetary approach turns out to be remarkably similar to what is usually done nowadays.

A brief description of monetary developments in Italy over the pre-World War I period is needed before we actually approach Jannaccone's analysis. This will help one to understand why the problem of explaining the lira exchange rate over the gold standard period arises and to fully appreciate that

⁴ See, for instance, the empirical papers in the very same volume edited by FRENKEL and JOHNSON (1976).

⁵ From a technical point of view, people arrive at such an equation in a variety of ways. In balance of payments theory, most set money demand equal to money supply, replace the latter with the sum of domestic credit and international reserves, and then differentiate both sides; for the early literature, see most of the papers in FRENKEL and JOHNSON (1976), or AGHEVLI and KHAN (1977). In exchange rate theory the tendency has been to set money demand and money supply equal to each other in the two countries, solve for the two price levels, and then impose PPP. The disequilibrium view sets the balance of payments as the difference between income and absorption and lets monetary disequilibrium affect the latter (POLAK (1957), PRAIS (1961), RHOMBERG (1965), MUNDELL (1968)). When both prices and quantities are free to adjust, then monetary disequilibrium enters both the output and the balance of payments (or exchange rate) equations (LAIDLER and O'SHEA (1980)).

analysis. A discussion of Jannaccone's and our own empirical results will then follow.

3. Monetary Developments in Italy Between 1861 and 1913 ⁶

Upon becoming a unified nation state in 1861, Italy inherited the financial structures of its constituent states. Some of these states had central banks, others did not.⁷ Two intellectual and political forces competed to give shape to the country's monetary system. There were those who wanted competition in banking and, in particular, freedom of currency issue; and there were others, instead, who believed that the political and economic integration of Italy, as well as control by the government over the country, could be enhanced by a strong single monetary authority. In Parliament the pro-competition group tended to dominate over the monopoly-of-issue group and, as a result, up to 1926 Italy did not have a unique bank of issue.

In 1862 the new state adopted a currency system that resembled that of France; it was based on a bi-metallic standard where silver could be exchanged for gold at the ratio of 14.38 to 1 which, at the time, was in line with prevailing market conditions. Full convertibility of paper into gold and silver at the nominal price was also ensured.

The state of public finances in the period from 1861 to 1865 was poor: on average, budget deficits represented more than 6 per cent of national income.⁸ The external accounts did not fare any better. At the start of 1866 the government announced a new large budget deficit, while another war⁹ was approaching. The market perceived Italy to be a large risk. Italian bond prices fell dramatically, more so abroad than at home. Foreign capital, i.e., gold, which had flowed in up to this time, was no longer available while domestic gold moved massively abroad¹⁰ to exploit the large profit opportunities from arbitraging the differences in bond prices.¹¹ The outflow of gold was so large that even the dominant bank of issue¹² had to reduce to a minimum its portfolio of earning assets to cope with the liquidity drain. On 1 May, 1866 the

⁶ This section draws on FRATIANNI and SPINELLI (1983), to which the reader may refer for a more extensive discussion.

⁷ By central banks we mean institutions that issue paper currency which is legal tender; the money stock of the states that did not have a central bank consisted of coins and fiduciary currency.

⁸ Of course one must not apply today's standards. At that time nobody was prepared to challenge the view that budgets had to balance.

⁹ Against Austria.

¹⁰ In particular, to Paris, where Italian bonds were mainly traded.

¹¹ Notice that Italy's bonds abroad were gold bonds.

¹² The Banca Nazionale.

authorities decreed what is known as "corso forzoso"¹³ or the inconvertibility (into gold) of paper money.

The lira-French franc exchange rate and the (natural logarithm of) the money stock, shown respectively in Charts 1 and 2, capture the essence of the aforementioned events. The money stock jumped in 1866, as did the exchange rate. The concomitance of these two facts and inconvertibility should not be surprising. Inconvertibility was basically brought about by fiscal imbalances. Thereafter the government was able to monetize the deficit by directly borrowing from the banks of issue which, in their turn, no longer had to worry about gold reserves.¹⁴

No sooner was inconvertibility effected than Parliament considered the possibility of returning to convertibility. A law was passed in 1868 setting the maximum amount of notes issued by the largest of the central banks to a figure which was approximately the current amount in circulation; the growth rate of the money stock came to a halt.¹⁵ Monetary discipline lasted less than two years. Budget deficits were again on the rise and once more the government chose to finance them by printing money. The lira depreciated dramatically, reaching its highest level of the sample period.

Towards the end of the 1870s discussions about a return to metallic convertibility began in earnest. A bill was introduced in Parliament at the end of 1880 and approved in the spring of 1881 which would allow the government to borrow abroad up to 644 million lire¹⁶ to repay its indebtedness to the six banks of issue. The bill also provided that the reserves of these six banks were to be kept only in the form of precious metals, and that convertibility would be restored at *nominal* prices even though paper currency was worth 10 per cent less than gold at the time. Thanks to the combined positive effects of the passage of the Redemption Act on economic agents' expectations and of a deflationary monetary policy, the lira appreciated *immediately*¹⁷ to gold parity

¹³ It would take a whole sentence to translate these two words into English. At that time, throughout Europe, Britain included, the French "cours forcé" was used to describe the situation in a compact way. See, for instance, WILLIS (1901).

¹⁴ Up to 1866 there were two banks of issue. The inconvertibility law extended the right to issue legal tender to another three banks. In 1870 when Rome became part of the Italian state that right was also extended to the Roman Bank.

¹⁵ The minor banks of issue held their reserves in notes issued by the major one; therefore, the circulation of the latter is a major driving force behind the behavior of the total money stock.

¹⁶ Two-thirds of the loans had to be paid in gold, the rest in silver. The figure of 644 million lire represented *more than 6 per cent of nominal income* and the percentage would be even greater if gold prices were used to compute nominal income.

¹⁷ Passages of Redemption Acts by Parliaments have always brought about immediate revaluations of the exchange rate. Further examples can be found in the events that took place in Britain in 1819 and in Austria in 1890. For a theoretical explanation of why this might happen see WILSON (1979).

in spite of the fact that convertibility would not actually be restored until April of 1883.

Unfortunately, three powerful mechanisms were soon set in motion which would eventually determine a new and definite ¹⁸ departure from gold. One had to do with the working of Gresham's law, the others with the return to budget deficits and with overissue of paper money by banks. With the return to convertibility the official exchange rate between gold and silver was kept fixed at the previous ratio of 14.38 to 1; since its present market rate was above 18.5 to 1, profits could be made by exporting gold, i.e. the proceeds of foreign loans which were essential to the defence of convertibility, and importing silver. The process was worsened by deterioration, since the middle of the decade, in the balance of public finances; it led again to a significant gap between the yields at home and abroad of Italian bonds, and hence added to the incentive to export gold. As a result of all this, the annual outflow of gold rose from 9.2 million lire in 1883 to 101.3 million lire in 1885. Finally, the banks of issue began to overissue notes in relation to what was permitted by law, while at the same time raising the cost of convertibility to the public. From 1883 onward, the lira depreciated marginally but continuously. By the end of the decade it was clear that the monetary authorities had lost control over the situation.

In 1891 Parliament gave a bad signal: in order to cope with the unlawful practices of the banks (overissue) ceilings were raised. One year later it was found that overissue by the Roman Bank was much larger than expected and the bank failed. Three of the remaining banks of issue merged and acquired the name of Bank of Italy. In the wake of these events, Parliament passed a law in 1893 which made it technically impossible for the remaining banks to print notes without direct supervision of the state, but also raised the ceilings further in order to incorporate the entire, previously underestimated overissue by the former Roman Bank; excessive circulation would have to be reduced over several years into the future. Inexplicably, the law also called for a resumption of convertibility;¹⁹ but only a few months later (February 1894) that decision was reversed and Italy went formally off gold for the second time.

The combined effects of the widespread distrust of the public in the central banking system and of the essence of the 1893 law — monetary discipline was postponed to sometime in the future — were reflected in the sharp depreciation of the lira during the first half of the 1890s.

The period that followed was the most stable and prosperous of the entire

¹⁸ Definite as far as our sample period is concerned. Italy will formally return to gold in the 1920s.

¹⁹ Formally this was still in place; practically, however, it would just impossible to turn paper money into gold, which explains why the law called for a resumption of convertibility.

sample period. Budget deficits were first reduced and later converted into surpluses; thanks to that and to rapid economic growth,²⁰ monetary policy never turned out to be inflationary. The lira started appreciating in the mid-1890s; by 1903 the exchange rate fell within the gold points and remained there until 1911.

The immediate, important conclusion that emerges from the above capsule description of monetary developments in Italy over the pre-World War I period is that the country had been almost systematically on a flexible exchange rate. That alone already explains why, back in the early part of the century, somebody might have been interested in looking into the behaviour of the lira over what is usually called the gold standard period. The historical validity and contemporary relevance of the problem analyzed by Jannaccone is thus apparent. Reestimating it is important also because it is not easy to find another country besides Italy which at that time was on a flexible exchange rate and which had an acceptable set of readily available data.²¹ This can be done by first taking a close look at the way in which the problem of explaining the behaviour of the lira exchange rate over the pre-World War I period was first tackled (in a systematic fashion) some 65 years ago.

4. The Monetary Approach in Pasquale Jannaccone

In 1918 Pasquale Jannaccone, an Italian economist and statistician, published a paper on "The relationship between international trade, exchange rates and the money supply in Italy from 1871 to 1913". The year of publication and title indicate very clearly what the purpose of the study was, namely to test two competing hypotheses: the (at that time) emerging balance of payments view of the exchange rates and the traditional, much discredited monetary approach.²² What is of interest here is not Jannaccone's overall conclu-

²⁰ GNP at constant prices rises from 84.1 in 1861 to 124.9 in 1896 and to 188.9 in 1913.

²¹ Notice that not one single formal empirical study of any exchange rate in the XIXth century has been published so far. In YAEGER (1969) the reader finds an analysis of the Austrian and Russian exchange rates over a much shorter time period, 1879-1891; furthermore, the emphasis is not on systematic impulses, but on wars and confidence crises. NUGENT's (1973) paper deals with the exchange rates in the XIXth century (1873-1894) but these are treated as independent variables. In MYRMAN (1976) we have a discussion of the exchange rate in Sweden from 1746 to 1768 and in England from 1796 to 1822 but, once again, no formal econometric analysis. The same was true of Marshall who wrote extensively on the Indian rupee.

²² These two hypotheses have systematically characterized the debate on the exchange rate determination process since the times of the bullionists-antibullionists controversy. According to the antibullionists, the exchange rate is governed solely by the state of the balance of payments so that its level does not indicate at all whether or not the money supply is excessive. As a matter of fact, it is typical of them to insist on

sion, which is that the monetary approach wins by a wide margin,²³ but his analytical description and empirical implementation of that approach.

Central to both is the hypothesis that the exchange rate is driven *by the excess demand for money and not just by money supply*.

In his words (all emphasis in the original, translation by the author):

In order to study the relationship between paper money and the exchange rate it is of no help to contrast the level of and changes in the latter to changes in the *actual total stock of money in circulation*. The money stock would turn out to grow both when the exchange rate is high or rising and when it is low or falling and therefore one would be unable to explain why the premium [deviations in the exchange rate from gold parity] appears and disappears and rises and falls without any apparent relationship to the stock of money. The fact is that the devaluation of a currency is not determined by just its growth, but by its growth beyond a certain limit; and such limit varies over time.

So he who pretends to test the quantity theory by comparing the behaviour of prices or exchange rates with that of the *actual total paper money in circulation* would make the same mistake as those who look for a confirmation of the law of demand in time series of prices and quantities sold of a commodity.

The ground is now ready for the introduction of the distinction between money demand and money supply. We read:

Over time the amount of paper money in circulation is determined by at least three variables:

- a. population;
- b. per-capita traffic ²⁴ [real income];
- c. world prices.

Under normal circumstances, i.e., under convertibility — the analysis continues — the outstanding stock of money would be demand determined

the effects of military spending and bad weather on exchange rates via a deteriorating balance of payments. Interestingly enough, those who succeed in making the balance of payments view popular, not to say axiomatic, during World War I, do the same. On all this see VINER (1937) and MYRMAN (1976).

²³ Later on we will see the extent to which Jannaccone's own empirical results lend support to the monetary approach. What we should do here is describe the way he soon disposes of, not to say ridicules, the balance of payments view. Basically he makes three remarks, which are (a) throughout Europe there seems to be no systematic relationship between the signs of the balances of payments and those of the deviations in the exchange rates from gold parities, (b) if a trade deficit were to lead to depreciation, the problem would take care of itself, thanks to changes in real exchange rates, and (c) Italian figures show that over the 1871-1913 period there is a *negative* correlation between trade deficits and exchange rates and that changes in the exchange rate *lead* to changes in the trade balance.

²⁴ Ricardo also uses the word traffic, but he doesn't fully spell out the determinants of money demand. See FRENKEL and JOHNSON (1976s, p. 35).

and hence money demand would be systematically equal to money supply; if, however, paper currency is not convertible, as has been the case with the lira over most of the sample period under consideration, then the outstanding money stock

"generally includes an arbitrary component which is not determined by the above mentioned variables"

and therefore cannot be taken to be systematically equal to money demand.

At this stage Jannaccone turns to the data to stress that, as a matter of fact, over time there appears to be a *negative* correlation between the total money supply and the exchange rate²⁵ — which of course cannot be taken to support the monetary approach — and then adds the following three key sentences:

To overcome these problems one has to divide the total stock of paper money in circulation into two parts which I shall call for short *sufficient and excess circulation*.

Sufficient circulation is the amount that would have been brought about... by the variables indicated above [by money demand]; even when rising this variable would not lead to depreciation.

Excess circulation is the difference between actual and sufficient stocks; this is what causes depreciation.

To underscore the merits or indeed the modern flavour of the study under examination, two considerations ought to be added. First, the year of publication happens to coincide with that of "The Value of Money", by Pigou;²⁶ that article is celebrated for several good reasons, among which we find the emphasis, stressed by its very same structure, on the distinction between money demand and money supply.²⁷ If that is the case, then one should also praise Jannaccone's paper for defining what we nowadays call disequilibrium money and for putting it to work.

The second consideration eventually takes us back to the discussion of the relationship between old and new monetary approaches to exchange rates. From what we have just seen it seems as if in at least one case not just the spirit, but the formalization as well, of the modern monetary approach can be traced back in earlier writings; in fact, what Jannaccone says is that (i) only when the money market clears can the exchange rate be at its equilibrium

²⁵ Throughout this paper the exchange rate is defined as the price of one unit of foreign currency.

²⁶ See *Quarterly Journal of Economics*, 32, 1917-18, pp. 38-65.

²⁷ For the first time ever we have a study with three major sections dealing with money demand, money supply and the interaction between money demand and supply. I owe this insight to Don Patinkin's lectures on the history of monetary thought which he gave at the University of Western Ontario in the fall of 1978.

level and (ii) in order to be explained the exchange rate has to be "regressed"²⁸ on money supply and money demand.

Although impressed with the above quotations, one might object that one key building block is still missing from the analysis, namely the foreign money market. The answer to such objection would be that in this case there is a valid reason for not bringing any specific foreign money market into the picture. The exchange rate under consideration is between a country, Italy, on a paper standard, and another, France, on a gold standard; since arbitrage ensures that the purchasing power of gold in terms of goods is the same all over the gold standard world, monetary disequilibrium in a particular country, France, for instance, would not be easy to define and, more important, would not have much to say about the lira-gold exchange rate.²⁹

What we just said does not represent a mere *ex post* defence of the article. As a matter of fact, Jannaccone himself considers,³⁰ the case of an exchange rate between two inconvertible currencies, which is the case we face nowadays, and writes:

In order to take into consideration the possible depreciation of either currency, changes in the exchange rate should more correctly be made to depend upon excess money in the two countries...

At this stage there should not be any doubts that, had it not been for the lack of computer facilities, Jannaccone would have estimated exactly the same equation that we do nowadays. The only remaining questions are: how did he actually test the monetary approach, and how reliable are his results? The next section bears on that.

5. Pasquale Jannaccone's Test of the Monetary Approach: Description and Critique

In order to turn a problem of multiple regression analysis into one of bivariate regression analysis, which could then be tackled with the help of a

²⁸ The word regressed is in quotes because, for obvious reasons, that was extremely difficult at the time. Economists began to use regression analysis in a systematic fashion in the 1930s.

²⁹ From a theoretical point of view, what would be needed to close the model is the analysis of world demand and supply of gold, which could then explain the changes in world prices and hence in the purchasing power of gold in terms of goods. However, as we will see in the next section, the only variable that is eventually used to measure money demand over time is the sum of imports and exports, and that must be sensitive to the behaviour of world prices. This, we believe, explains why right from the outset Jannaccone includes world rather than domestic prices among the determinants of money demand. The consequences of changing domestic prices of the exchange rate are captured anyway through the variations in the domestic money stock, so that what would be left out is just world prices.

³⁰ As a theoretical possibility, of course.

graph and of a simple correlation coefficient, Jannaccone searches for *one* variable, the movements of which might depend on population, real income and world prices and finds it in the sum of imports and exports.³¹ He then divides his entire sample period into three subsamples, 1871-80, 1881-97, and 1898-1913, which correspond to periods of growth and inflation (the first and the third ones) or stagnation and deflation (the second one), and then *defines* equilibrium velocity for each of the three subsamples.³² That is taken to be the ratio of the scale variable to the money stock in the three years³³ 1869, 1884, and 1908, when the exchange rate is exactly equal (1884 and 1908) or close to (1869)³⁴ gold parity. Desired money for each year is then computed and subtracted from money supply to arrive at excess or disequilibrium money. As a final step excess money is plotted alongside the exchange rate; the two variables are found to be systematically correlated with each other — see Chart 3. Jannaccone considers that to be a decisive piece of evidence in favour of the monetary approach.

Even when supplemented with the computation of a simple correlation coefficient between excess money and the exchange rate³⁵ the above test would leave today's reader still wondering about the statistical significance of coefficients and the explanatory power of the model. To meet such curiosity, we ran a few OLSQ³⁶ regressions the result of which are given in Table 1.³⁷ The first equation has the exchange rate depend on a constant and on excess

³¹ He discards Cassel's method for computing money demand over time, which is based only on the use of population. The reason for this is that it does not generate large enough movements in money demand around a time trend. Data on income were not available at the time, but we doubt whether he would have used them. More on this below.

³² When prices are on the rise, "The demand for money rises in absolute value because of higher prices, but falls in relative value because of the rise in the velocity of circulation...". Velocity is therefore seen as varying over time in a procyclical fashion and Jannaccone wants to allow for different ratios of the scale variable to desired money.

³³ One for each subsample.

³⁴ Over the first subsample the minimum value for the exchange rate was that for 1871, which nevertheless is more than five percentage points above gold parity — see Chart 1 — which is why Jannaccone felt that he should turn to 1869, where the problem was less severe *but still existed*. We will come back to this.

³⁵ Which is all one could possibly do at the time of writing.

³⁶ Later on we will present our own tests based on 2SLS.

³⁷ Thanks to Jannaccone's extremely detailed data appendix, which gives both the raw data and their transformations, today we can look into his results without any fear that the discussion might be biased because of the use of a different data set. What is true, however, is that the regressions that follow do not fully reflect what Jannaccone would have done had he had the possibility of using modern day computers; in fact, money demand would certainly have been estimated directly, as we will do later, rather than being computed separately.

Table 1
 JANNACCONI'S MODEL: A REGRESSION ANALYSIS
 OF THE LIRA - FRENCH FRANC EXCHANGE RATE, 1871-1913
 (OLS and Cochrane-Orcutt correction for first order autocorrelation;
 t-statistics in parentheses)

Equation Number	Constant	Money Supply (1)	Money Demand (2)	Excess Supply of Money (1)-(2)	a/	S.E.	R ²	D.W.
(1)	102.682 (110.642)	—	—	0.010 (4.163)	0.658 (5.546)	1.985	0.748b/	1.682
(2)	[99.15] c/	—	—	0.013 (4.424)	0.833 (9.634)	1.943	0.307d/	1.812
(3)e/	4.585 (16.414)	0.152 (2.748)	-0.146 (-4.349)	—	0.644 (5.394)	0.019	0.753b/	1.687

a/ First-order autocorrelation coefficient.

b/ Error based values. The corresponding regression based values are 0.728 and 0.713.

c/ Constrained parameter.

d/ Relative to zero. Once the constant is taken to the right-hand side, the R² rises to 0.75.

e/ This equation is estimated in natural logarithms.

money. In the second equation, the dependent variable is given by the difference between the exchange rate and the minimum exchange rate ever to be reached over the sample period and all negative values for excess money have been replaced by zeros; these transformations are meant to cope with the potential asymmetry which — according to Jannaccone himself — might characterize the exchange rate determination process in a situation where gold is prevented from leaving, but not from entering the country on inconvertible paper.³⁸ Finally, in the third equation money supply and money demand are entered separately.

The estimated constants indicate that in the absence of monetary disequilibrium the exchange rate converges on a value that is fairly close to gold parity. Excess money is strongly significant and has the correct sign; the elasticity of the exchange rate with respect to the money supply is about 0.13;³⁹ the coefficients on money supply and demand are both significant, with the correct sign and the same order of magnitude. As for the explanatory power of the equations, the R²'s and Chart 4 seem to suggest that the model tracks fairly well over the entire sample period.

³⁸ In commenting on the graph of the exchange rate and excess money, Jannaccone notices that the exchange rate does not fall significantly below gold parity when excess money supply turns negative, and he then adds that that is simply natural. If money expands at home the exchange rate could rise to any level above gold parity; if, however, monetary deflation occurs, then the exchange rate will not drop below the gold import point. In our case 99.15 is the minimum value for the exchange rate.

³⁹ Whether we consider equation (3) or equation (1) the result is the same.

Notwithstanding the extra empirical evidence that we have gathered, the overall picture remains unconvincing. Setting aside the severe first-order autocorrelation of the estimated equations,⁴⁰ there exists the problem of the arbitrary manner of computing excess money and its implications on the robustness of the conclusion.⁴¹ Indeed, we shall argue that a new test is needed.

We begin by noting that the Jannaccone procedure need not be labelled an *ad hoc*ery; most certainly, it does not lack a reputable history. In fact its usage goes back to the time of the bullionist controversy when the presence of a devalued currency was taken by some as evidence that currency was in excess supply.⁴² The problem lies merely in the empirical implementation of the theory. In particular we focus on the choices of both the base years and of 1881 as the beginning of the second sub-period.

The choice of two out of three base years, 1869 and 1884, is questionable.⁴³ It is easy to see what's wrong with the former. Over the first

⁴⁰ We will come back to this later.

⁴¹ There are two potential weaknesses the reader might worry about. First, the definition of money, which excludes bank deposits and coins. In defence of Jannaccone data on these two variables were never easy to collect; as a matter of fact, it was not until the late 1960s that they became available, thanks to the work of DE MATTIA (1969). In addition, early in the century not many people were prepared to consider bank deposits as part of the money supply (COOPER (1982)). For example, Irving Fisher in his 1911 volume treated demand deposits as money but with different attributes.

The second problem has to do with simultaneity. Since it is only with the development of regression analysis that people become aware of such a problem, it would be unfair to charge Jannaccone with ignoring it. Most importantly, the analysis of the money supply process in Italy over the pre-World War I period suggests that by and large the hypothesis of an exogenous money supply is reasonable (FRATIANNI and SPINELLI (1983, 1984)). What is still left, however, is the potential feedback from the exchange rate to the *sum* of imports and exports (which drives money demand).

⁴² In his description of that controversy VINER (1937) wrote: "During the inflation phase the main issue in controversy was as to the proper method of determining the existence of excess issue. The chief test of excess issue used by the bullionists was the existence of a premium on bullion over paper currency, although since they held that the level of prices was determined by the amount of currency and that the amount of premium of bullion over paper and the amount of discount of sterling exchange from the metallic parities were closely related, they also held that a relative rise of prices in England as compared to abroad and a fall in the sterling exchanges below parity were evidence of depreciation".

⁴³ One further and more general problem also exists which, however, does not turn out to be very relevant from an empirical point of view and therefore is not stressed in the text. As mentioned in the previous section, the exchange rate determination process is seen as being characterized by a basic asymmetry: the exchange rate rises with excess money supply but it does not fall below gold parity as the latter turns

subsample, 1871-80, nowhere does the exchange rate turn out to be sufficiently close to gold parity for Jannaccone to be able to compute equilibrium velocity; because of that, he feels compelled to go further back and select the year 1869, when the exchange rate is at a relative minimum *without, however, falling within the gold points* — see Chart 1.⁴⁴

Turning to the choice of 1884, the problem here is more general and more controversial in that it has to do with the interpretation of the behaviour of the exchange rate over part of the 1880s. As pointed out in Section III, the fluctuation of the exchange rate in the 1880s within the gold points has to be attributed to three factors: monetary deflation, the positive expectational effects of the Redemption Act of 1881,⁴⁵ and massive inflow of gold resulting from the sale of bonds abroad which enabled the monetary authorities to “intervene” and keep for a few years the price of gold in terms of paper currency (the exchange rate) in line with its gold parity value.⁴⁶ On this interpretation, any monetary model which ignored the role of news⁴⁷ and of intervention would overpredict the actual exchange rate over most of the 1880s, while missing its sharp drop in 1881. In the case of Jannaccone’s test — see Chart 4 — that does not happen because of the *assumption* that the period is basically characterized by monetary equilibrium⁴⁸ and because the second subsample is made to begin with 1881. As a result of this latter choice, money demand for 1880 and 1881 turns out to be 1,126.2 and 1,519.0 million lire, excess money drops sharply, and the sudden big change in the exchange rate then

negative. The implication is that the presence of an exchange rate that falls into the gold points zone does not necessarily mean that the money market is in equilibrium which, in turn, would suggest that rather than selecting those years where the exchange rate is exactly equal to gold parity — this is why 1884 and 1908 were chosen — one should select those when the exchange rate *first* enters the gold points zone from above. If this procedure were adopted, then 1881 and 1904 would replace 1884 and 1908. However, the overall conclusion would not be affected, for the ratio of foreign trade to the money stock, i.e., equilibrium velocity, does not vary dramatically between 1881 and 1884 or between 1904 and 1908.

⁴⁴ A rough estimate of the gold points would be ± 0.5 per cent from gold parity. See MORGENSTERN (1959) for instance. A more sensible procedure would have been to take 1865 as the first base year, but then things would have changed quite a lot. In fact, the ratio of foreign trade to end-of-year M_1 is 1.31 for 1865 and 0.63 for 1869. We underscore M_1 because starting with 1866, when Italy went off the gold standard, the ratio of coins to notes dropped dramatically; it would be less meaningful to compare the ratios of foreign trade to notes alone.

⁴⁵ One must not overlook the fact that the Act of 1881 establishes that with resumption of payments in gold, paper will be exchanged for gold at its nominal higher value.

⁴⁶ See BENINI (1894) on this.

⁴⁷ The news, of course, is given by the change in the monetary regime (Redemption Act).

⁴⁸ Therefore overprediction is ruled out by *construction*.

becomes easy to explain. Unfortunately, inspection of the data on the domestic and world business cycles lends little support to the idea that 1881 should be selected to mark the beginning of that long period of stagnation that will come to an end in 1897.

The conclusion to be drawn at the end of this section is the following: since there are problems with Jannaccone's computation of excess money over much of the sample period, his results cannot be taken to be a decisive piece of evidence in favour of the monetary approach. New tests are needed.

6. The Monetary Approach to the Exchange Rate of an Inconvertible Currency in a Gold Standard World: Two Alternative Scenarios

In trying to explain the behaviour of the exchange rate of an inconvertible paper currency in a gold standard world we have to distinguish between the case where the domestic relative price of notes to gold (coins) is also allowed to fluctuate with the exchange rate and the case where it does not.⁴⁹

Let us take the first case.⁵⁰ If bank deposits are ignored, the money supply (of the country on inconvertible paper) expressed in terms of domestic currency units will be

$$(1) \quad M^s = E \cdot GM + NT$$

where E is the country's exchange rate⁵¹ and GM and NT the outstanding

⁴⁹ Law and moral suasion could be used by the authorities to bring about this result.

⁵⁰ An example of such a regime can be found in the Greenback Period in the United States. For instance, FRIEDMAN and SCHWARTZ (1963) write that in the aftermath of the suspension of payments in specie... "In the rest of the country, prices were quoted in greenbacks, and gold offered in payment was valued at its current market premium in greenbacks. On the West Coast, by contrast, prices were quoted in gold, and greenbacks offered in payment were valued at their current market discount in gold... The two kinds of money were not interchangeable at a fixed rate. That is why they could coexist side by side without ever driving the other out" (p. 26).

⁵¹ The exchange rate is the price of gold in terms of domestic currency units. Let $P_{g,c}$ be the price of one unit of gold in terms of domestic currency units and $P_{G,g}$ the price of goods in terms of gold. Choose the unit of gold in such a way that its *fixed* price in terms of foreign currency units is equal to 1. Finally, $P_{G,g}^*$ indicates the price of goods abroad in terms of gold. By definition, the exchange rate, E , is the ratio of the price of goods in terms of paper currency in two different countries. In this case it turns out to be

$$E = P_{G,c}/P_{G,g}^* = P_{g,c} \cdot P_{G,g}/P_{G,g}^*$$

By arbitrage, $P_{G,g} = P_{G,g}^*$ and hence $E = P_{g,c}$.

For an interesting analysis of the determination of the price level under the gold standard see BARRO (1979).

stocks of gold money and notes. The log linear approximation to equation (1) is:

$$(2) \quad ms = \mu e + \mu gm + (1-\mu)nt$$

where μ is the mean ratio of the gold component of the money stock to the stock itself and small letters indicate the natural logarithms of the variables in equation (1). Money demand is the standard one, i.e.,

$$(3) \quad md = a + by - cr + p$$

where y , r , and p are the logarithms of real income, interest rates and the general price level of goods in terms of domestic currency, which can be seen as the sum of the price of goods in terms of gold ($p_{G,g}$) and of gold in terms of domestic currency ($p_{g,c}$). If we set money demand and money supply equal to each other, then we can write

$$(4) \quad \mu e + \mu gm + (1-\mu)n \sim a - by + cr - p_{G,g} - p_{g,c} = 0$$

Since $e = p_{g,c}$ we have

$$(5) \quad e = \frac{\mu}{1-\mu} gm + nt \frac{a}{1-\mu} - \frac{b}{1-\mu} y + \frac{c}{1-\mu} r - \frac{1}{1-\mu} p_{G,g}$$

Because of arbitrage $p_{G,g}$ can be seen as being determined in the money market of the rest of the world. Such market is then brought into the picture by setting⁵²

$$(6) \quad p_{G,g} = gm^* - a^* - b^*y^* + cr^*$$

where gm^* , y^* , and r^* are the world supply of gold money, income, and interest rates. On substituting we obtain the expression for the exchange rate:

$$(7) \quad e = \frac{a^*-a}{1-\mu} + \frac{\mu}{1-\mu} gm + nt - \frac{b}{1-\mu} y + \frac{c}{1-\mu} r - \frac{1}{1-\mu} gm^* + \frac{b^*}{1-\mu} y^* - \frac{c^*}{1-\mu} r^*$$

The first major⁵³ consideration relates to the uncommon homogeneity properties of (7). To see where they come from, consider that a gold discov-

⁵² We ignore paper currency issued by the rest of the world; it is assumed that the supply of notes is ultimately determined by the behavior of gold.

⁵³ From equation (4) as μ approaches 1.0 $gm - a - by + cr = p_{G,g}$. If equation (6) is subtracted from this expression the result is the following: $p_{G,g} - p_{G,g} = 0$,

ery takes place in the rest of the world. The price of goods in terms of gold will go up throughout the world and the exchange rate will tend to appreciate — see equation (5). Because of the drop in the domestic money stock shrinks, which adds to the revaluation process; this is why the coefficient on the rest of the world gold money is greater than 1. There is a mixture of fixed and flexible exchange rates: any change in the value of gold on world markets transmits itself to the gold component of the domestic money stock and, as a consequence, the flexible exchange rate, which only applies to the non-gold component, will have to adjust by more.⁵⁴ Hence overshooting which increases with μ .⁵⁵

A second key consideration relates to the behavior over time of the gold component of the money stock of the country on inconvertible paper. As long as the value of domestic gold in terms of domestic paper currency is allowed to fluctuate freely, domestic inflation or deflation shouldn't bring about any change in the incentive to hoard gold and/or use it in the settlement of international payments.⁵⁶ This, in its turn, implies that the country is not expected to go through successive periods of scarcity and abundance of gold and to be faced with either shifts or non-linearities in the relationship between domestic monetary policy and the exchange rate.

The above important consideration can be understood best by focusing on the alternative, Italian scenario where with the suspension of convertibility the domestic exchange rate between paper currency and gold is set equal to one by law and moral suasion. If the domestic values of gold and paper currency in terms of goods cannot deviate from each other then, whenever the domestic monetary policy turns inflationary — which typically accompanies the suspension of convertibility — and domestic prices in terms of paper go up, gold becomes undervalued and is then forced into hoarding and into

which means that the exchange rate is equal to 1.0. This makes sense; in fact a μ value of 1.0 simply implies that the money supply is made up of just gold, the exchange rate of which is then *fixed* and by construction equal to 1.0. If instead μ goes to zero, then equation (7) reduces to the standard expression one encounters in studies of the exchange rate under the present circumstances; the only difference is that * should then be interpreted as referring to one particular country rather than to the rest of the world.

⁵⁴ To put things even more clearly, consider the case where domestic and foreign monies are both inconvertible and where as foreign money rises part of domestic money is destroyed.

⁵⁵ In spite of all this there should not be major and systematic deviations from P.P.P. Arbitrage and melting ensure that prices of goods in terms of gold are the same all over the world. As for prices in terms of currency, we will simply notice that the nominal exchange rate adjusts by more than the world supply of gold simply because at home the price of goods in terms of currency has also gone down by more.

⁵⁶ Since we are talking about non-interest bearing assets (gold and foreign notes) we do not even have to assume that interest parity holds systematically.

the settlement of international payments. As monetary policy turns deflationary, that process might partially reverse itself.⁵⁷ The consequences on the exchange rate of such sudden shifts in the propensity to hoard gold and/or to use it in international transactions could be significant and systematic; therefore, what we might call "gold availability" becomes a key variable to look at, particularly if one wants to avoid modelling non-linearities.⁵⁸ In effect, a situation is conceivable where, in spite of persistence in monetary disorder at home, a large enough, exogenous or induced reduction in the stock of hoarded gold results in a downward shift in the demand for foreign currency and in an appreciation of the exchange rate. Similarly, any sale of gold by the domestic monetary authorities (which can only take place at its lower official domestic price) enhances gold availability and turns out to be a powerful form of "intervention"; its consequences on the exchange rate are more dramatic the larger the initial gap between the foreign and the domestic value of gold⁵⁹ and the larger the initial stock of gold hoarded by private economic agents.⁶⁰

Our estimating equation is obtained by changing equation (2) above to

$$(2') \quad ms = \mu gm + (1-\mu)nt$$

and then combining it with equations (3) and (6). Once changes in the availability of gold (ga) are included, we have the following expression:

$$(7') \quad e = (a^* - a) + ms - gm^* - by + b^*y^* + cr - c^*r^* - dga$$

7. Empirical Results

The first problem that is encountered in the estimation of equation (7') is the lack of meaningful data on world money and income; because of it we had to resort to the direct use of world prices of goods expressed in terms of gold. Two such prices were tried out, the wholesale price index for Britain and the Sauerbeck price index of internationally traded commodities; they

⁵⁷ We say partially, because part of the gold has been exported.

⁵⁸ Non-linearity arises from the fact that as domestic prices rise so does the demand for gold and the exchange rate rises by more than expected; the opposite happens when monetary policy turns deflationary.

⁵⁹ I.e., the larger the gap between the exchange rate itself and its gold parity.

⁶⁰ The reason being that there does not seem to be any point in hoarding gold when this is readily available at a fixed known price from the monetary authorities and there are reasons to believe that the situation will not change in the future. This also suggests that it may be difficult to pinpoint the exact cause of the deviation in the exchange rate from its expected pattern. See BENINI (1894) for a discussion of intervention in Italy over the post-1883 period.

both turned out to be not significant — one example will be given below — and were dropped. As a result of that, fluctuations in the Italian lira exchange rate will be seen as mainly due to domestic developments.

A second, more delicate problem lies in the choice of a proxy for gold availability. Although data on gold hoarding by private economic agents do not exist, I eventually found information on the sales of gold (at its official price and in exchange for notes) by the Italian monetary authorities over the period 1883-1893, and assumed that some sort of relationship must have existed between gold hoarding by private economic agents and commitment to convertibility by the monetary authorities.⁶¹ Thus a sensible solution to the problem could be afforded by use of the information on gold sales.⁶²

As for the other variables in equation (7') no problems are encountered. Money is narrowly defined; following Spinelli (1980) and Fratianni and Spinelli (1984) a weighted average of actual real income is used as a proxy for expected income⁶³ in money demand; finally, a long-term interest rate is employed. All variables are in natural logarithms.⁶⁴

The estimation period is 1864-1913⁶⁵ which is undoubtedly superior to Jannaccone's 1871-1913 in that it basically starts and ends with an exchange rate close to gold parity. To cope with the simultaneity problem, 2SLS (with correction for first order autocorrelation in the residuals) are employed. Results are given in Table 2.

Equation (1) is the simple monetary model à la Jannaccone. Money and income have the expected sign, the former is significant, the latter only marginally so;⁶⁶ the interest rate variable is not significant⁶⁷ and the autocorrelation parameter fairly high. In equation (2) gold availability (intervention) turns out to be significant and with the correct sign; money and income are

⁶¹ See the footnote at the end of the previous section.

⁶² This variable is set equal to zero over the years of nonconvertibility.

⁶³ A four-year weighted average of the logarithm of real income is used. Weights are 0.35 (t), 0.26 (t-1), 0.21 (t-2), and 0.18 (t-3); they have been chosen in an *a priori* fashion with two constraints in mind, namely that they decline geometrically and that the lag be no longer than four years so that expected income could be computed for 1864 which is the first year of the estimation period.

⁶⁴ All variables are centred on mid-period. Sources and definitions may be found in FRATIANNI and SPINELLI (1984).

⁶⁵ It actually becomes 1865-1913 because of the first differencing.

⁶⁶ It is significant at the 87 per cent probability level.

⁶⁷ This result was somewhat expected. In fact, the two studies of money demand over this period by SPINELLI (1980) and FRATIANNI and SPINELLI (1984) have been unable to detect a statistically significant relationship between money demand and interest rates. Furthermore, it is becoming increasingly clear that from a theoretical point of view the role of the interest rate is not well defined. Indeed, we no longer know whether its coefficient should be expected to be positive or negative. See DORN-BUSCH (1978) and FRANKEL (1979) for interesting discussions bearing on this.

now both strongly significant; the autocorrelation coefficient drops significantly.

A step further with respect to what was said in the previous section is taken by bringing "news" (Frenkel (1981)) into the picture. The variable news is here meant to capture the independent effect of any dramatic change in legislation — suspensions and resumptions of payments in specie — on the exchange rate. The reader will recall from our discussion in Section III that over the sample period three such changes were introduced, in 1866 and 1894, when convertibility was formally suspended, and in 1881, when the Resumption Act was passed. To test the hypothesis that news matters, three dummy variables are defined, one for each change in legislation, and then included in the equation. By looking at equation (3) we notice that these newly defined variables are all significant and signed as one would expect. For it makes sense to assume that changes in legislation might affect the exchange rate positively or negatively (the exchange rate falls or rises) depending on whether the country is going back to or off gold. Interestingly enough, suspension of convertibility turns out to have the same effect in 1866 and 1894.⁶⁸ The inclusion of news also results in an increase in the level of statistical significance of money supply, income and gold availability. As for the estimated auto-correlation coefficient (the same applies to equation (2)) it certainly looks better than in similar studies of later periods.⁶⁹ The only major problem with the equations so far is in the low coefficients on money and income; since we have nothing to say about it, it will have to be left for further research.⁷⁰

Equation (3') has been included just to show that the presence of world prices, w_p , does not make any difference.⁷¹

In Charts 5 and 6 we have the exchange rate and its fitted values computed on the basis of equations (1) and (3). What has to be highlighted is that

⁶⁸ The value of the coefficient on news 81 is, in a sense, constrained by the situation that prevails when the new legislation is introduced; the exchange rate will have to fall by whatever is necessary to bring it to gold parity.

⁶⁹ See, for instance, FRENKEL (1976, 1980), DORNBUSCH (1978, 1980), FRANKEL (1979, 1981), CLEMENTS and FRENKEL (1980).

⁷⁰ An obvious starting point would be to look into both the role of world money and the dramatic changes in tariffs and transportation costs which characterize our sample period. For a compact way of dealing with tariffs see CLEMENTS/FRENKEL (1980). In any case one cannot constrain the coefficient on money to be one unless he first shows that at that time people believed in the neutrality of money. See COOPER (1982).

⁷¹ At this stage we should also report that neither the current account nor the domestic relative price of traded and non-traded goods were found to be significant. On the role of those two variables see DORNBUSCH (1976), CLEMENTS and FRENKEL (1980), and DOOLEY and ISARD (1983). We also experimented with slow adjustment, but without getting any sensible result.

Table 2
EXCHANGE RATE, ITALIAN LIRA - FRENCH FRANC: 1864-1913
(2SLS 1/ + Cochrane-Orcutt correction for first order
autocorrelation; t-statistics in parentheses 2/)

Equation Number:	(1)	(2)	(3)	(3')
constant	3.589 (4.973)	4.397 (7.872)	4.275 (9.379)	4.256 (9.156)
m ^s	0.239 (2.851)	0.205 (3.431)	0.254 (5.023)	0.251 (4.483)
y	-0.189 (1.527)	-0.278 (3.298)	-0.328 (4.517)	-0.325 (4.440)
r	0.076 (1.067)	0.010 (0.204)	-0.001 (0.012)	-0.003 (0.049)
ag	—	-0.0004 (2.834)	-0.0004 (3.459)	-0.0004 (3.431)
news66	—	—	0.036 (2.102)	0.036 (2.111)
news81	—	—	-0.083 (4.968)	-0.083 (4.916)
news94	—	—	0.035 (2.043)	0.036 (2.062)
wp 3/	—	—	—	0.007 (0.143)
p 4/	0.666 (6.286)	0.445 (3.426)	0.476 (3.718)	0.479 (3.758)

(1) Instruments: m^s, m^s(-1), e(-1), Time, constant, y(-1), r(-1), government spending (-1), ag, news, wp. The money supply is therefore considered to be exogenous; on reasons for this see FRATIANNI and SPINELLI (1983).

(2) In this table and in the discussion of the results, the term t-statistic simply denotes the absolute value of the ratio of a parameter estimate to an estimate of its asymptotic standard error. Such ratio has an asymptotic normal distribution.

(3) Natural logarithm of the Sauerbeck commodity price index.

4/ Autocorrelation coefficient.

equation (1) misses the 1881 drop in the exchange rate entirely and overpredicts and underpredicts systematically thereafter. That lends support to both our criticism of Jannaccone's results and our analysis of the determination of the exchange rate of an inconvertible paper currency in a world on gold. It is also evident that much of the explanatory power of the equation is to be attributed to auto-correlation. On the contrary, equation (3) seems to track fairly well over the entire sample period *except for 1882* when intervention has not started yet but the positive psychological effects of the Redemption Act linger. Instead of trying to eliminate the 1882 outlier (through a redefini-

tion of news 81) we rather keep it as a reminder that there are times when the basic monetary model needs to be supplemented.⁷²

An alternative way of assessing the role of news and intervention in the determination of the exchange rate of the period starting with 1881 and ending in the mid-1890s would be to study the behaviour of the nominal and real exchange rates over those years. If it is the case that variables other than those which appear in the standard monetary equation play a major and systematic role, then the nominal and real exchange rates should move together with the direction of causation going, of course, from the former to the latter.

To look into that we computed the real exchange rate by using domestic wholesale prices and the Sauerbeck prices of internationally traded commodities. We then divided the whole sample period into three sub-periods, 1865-1880, 1880-1895, and 1895-1913, and for each of them we obtained a plot of real and nominal exchange rates.⁷³ Chart 7 speaks for itself. It is only over the second sub-sample that the two variables are clearly correlated with each other.

The final words are on intervention. It is true that the empirical evidence that we have gathered here seems to indicate that the monetary authorities can effectively intervene and keep on doing so, even for a few years in a row, but it is also true that:

(i) Over the gold standard period, and indeed, up to the ill-fated returns to gold of the 1920s, there existed a widespread and strongly rooted conviction that under normal circumstance, i.e., under formal convertibility, both prices — see Klein (1975) for instance — and exchange rates converge on their natural, fixed values; in the case of the exchange rate that value is given by gold parity, and the objective of intervention can only be gold parity.

(ii) The stock of gold, i.e., of foreign currency at the disposal of Italian monetary authorities when intervention started in 1883, was incredibly large, well above 6 per cent of nominal income.⁷⁴

(iii) In spite of (i) and (ii) above, in a matter of a very few years convertibility, i.e., intervention, had to be restricted because the authorities were running out of reserves.⁷⁵

⁷² Interestingly enough, equation (3) mildly overestimates from 1903 on. That might be due to the role of the missing world money stock, which is known to have accelerated over that period, but it might also be due to intervention once again. In fact, that very same year the Bank of Italy was granted formal permission to raise the stock of foreign reserves and to intervene. See CIOCCA (1978).

⁷³ We made sure that for each subsample the mean of the two rates was the same.

⁷⁴ That gold was borrowed abroad. In PENATI (1983) the reader finds an interesting discussion of the conditions under which a foreign loan leads to a short-run depreciation of the currency.

⁷⁵ Basically, from 1885 onwards, it became increasingly difficult to convert paper into gold, in spite of the fact that the banks of issue were required to make payments in specie. On this see FRATIANNI and SPINELLI (1983).

8. Conclusions

The first part of the paper was meant to be an exercise in the history of economic thought; in particular, the aim was to draw the profession's attention to a study which, back in 1918, worked out and applied what was later to be known as the "modern" monetary approach to the exchange rate determination process.

The paper has also confronted the monetary approach with data drawn from the pre-World War I experience and hence adds significantly to the already available set of empirical results on the topic, which so far only consisted of a lot of studies of the 1970s and of a very few of the 1920s.⁷⁶ What we believe we have shown is that the monetary approach is a valid starting point around which to organize thoughts concerning the determination of the exchange rate of an inconvertible currency in a world on gold.

⁷⁶ On the 1920s see FRENKEL (1976, 1980) and CLEMENTS and FRENKEL (1980).

Figure 1
EXCHANGE RATE ITALIAN LIRA-FRENCH FRANC:
1864-1913
(Annual averages; gold parity = 100 lire per franc)

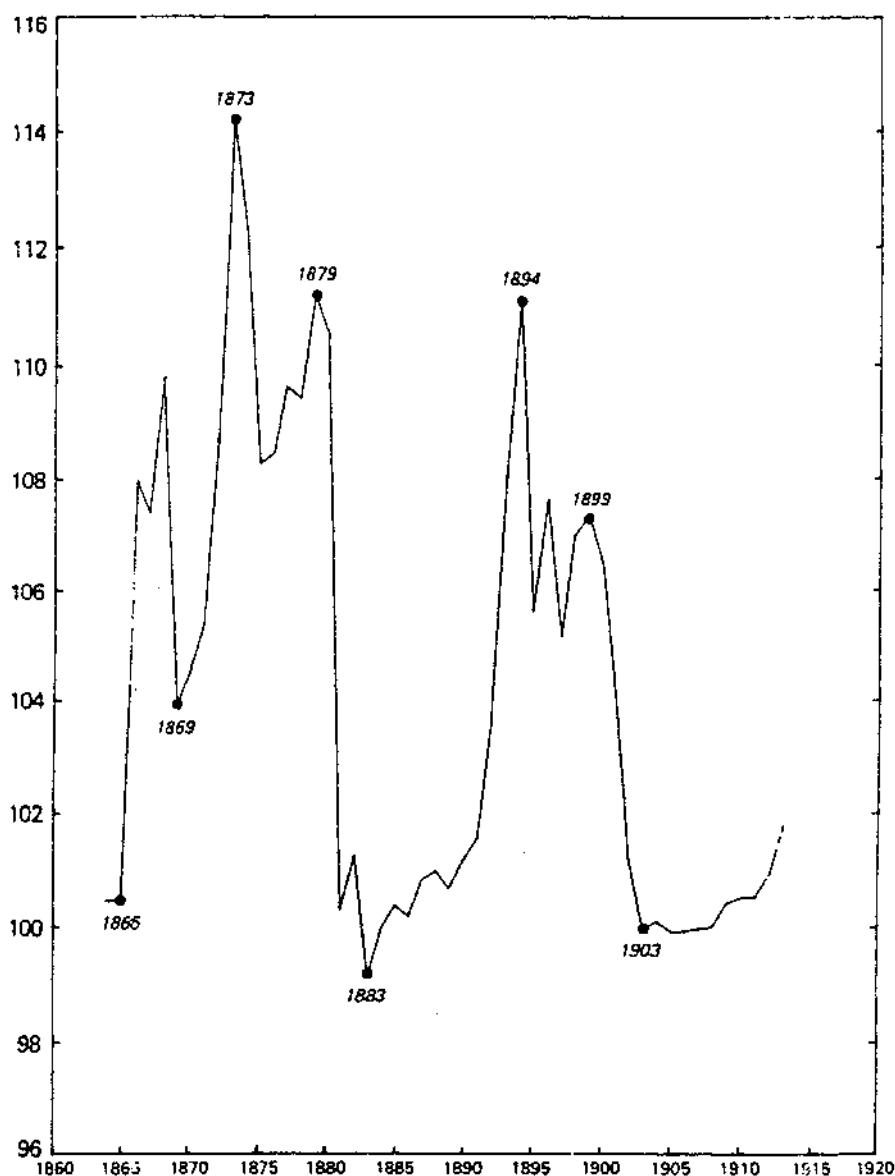


Figure 2
CURRENCY IN THE HANDS OF THE PUBLIC: 1864-1913
(Natural logarithms of millions of lire; mid-year figures)

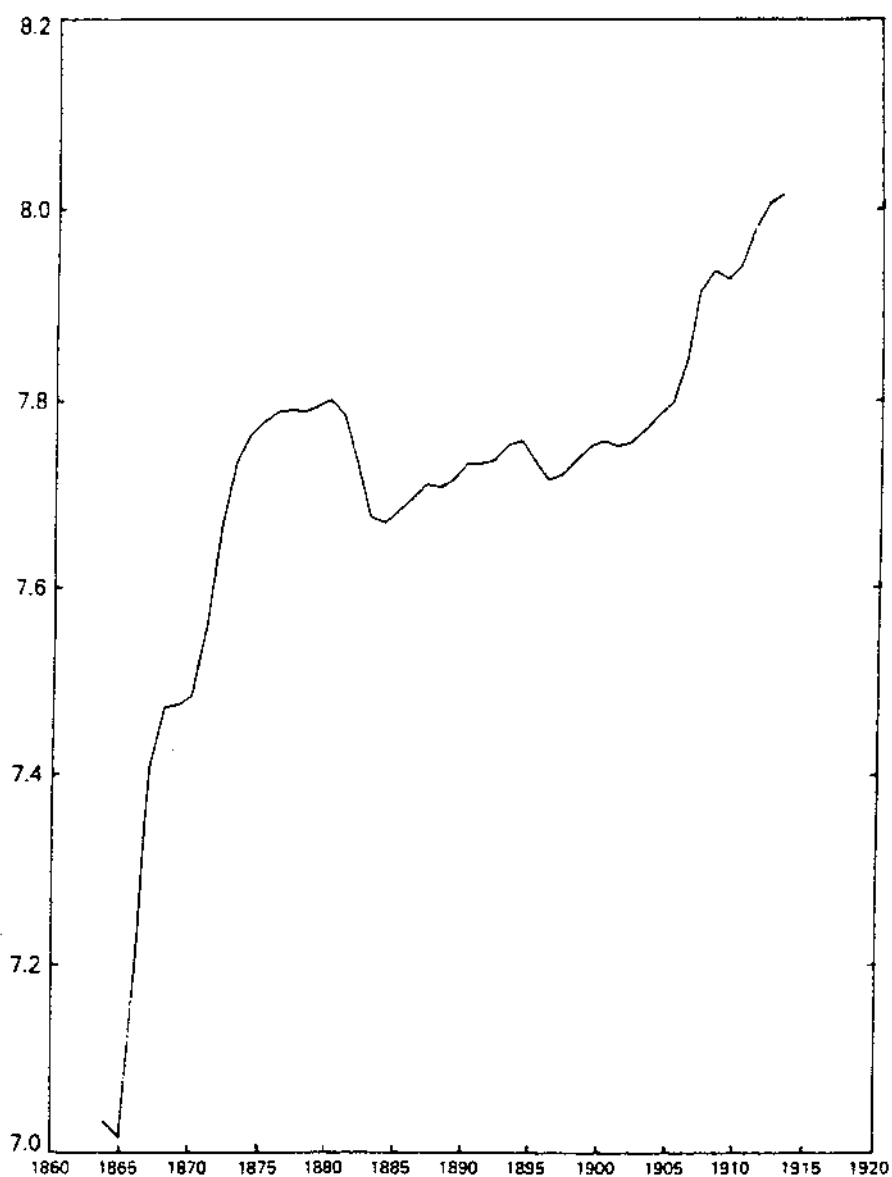


Figure 3
THE EXCHANGE RATE (—) AND EXCESS MONEY (-----; millions of lire)
AS COMPUTED BY JANNACCONE: 1871-1913

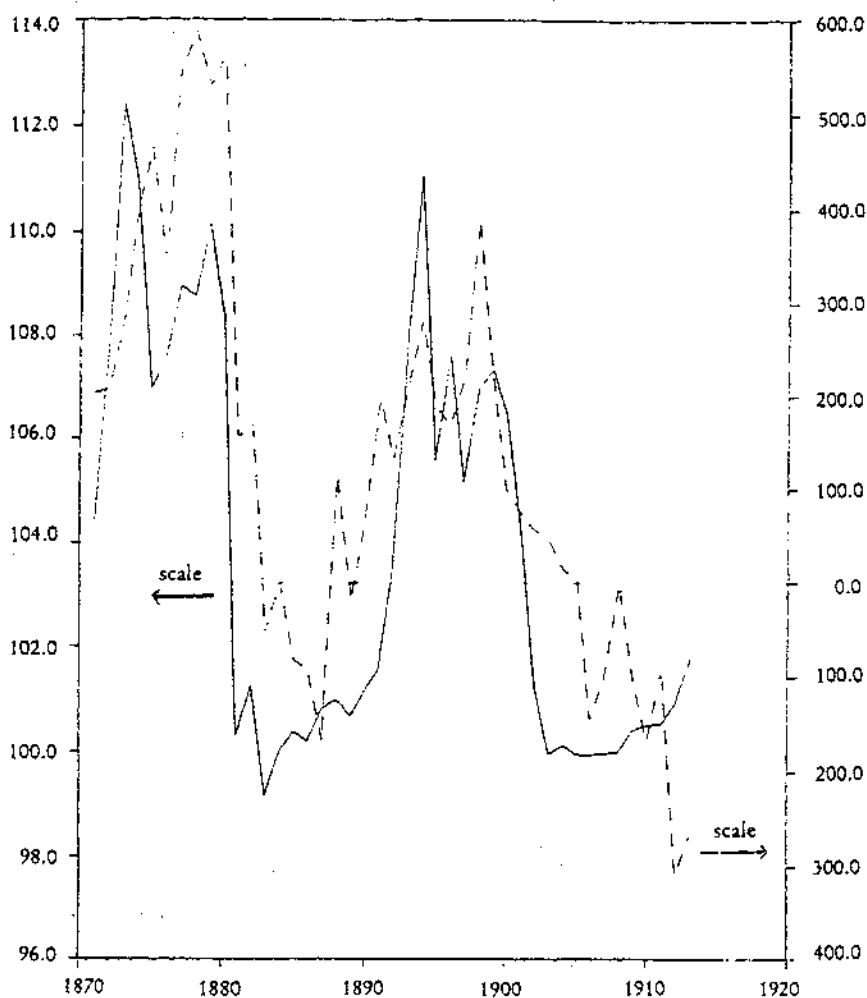


Figure 4
EQUATION 1, TABLE 1: FITTED (-----) AND ACTUAL (—) VALUES

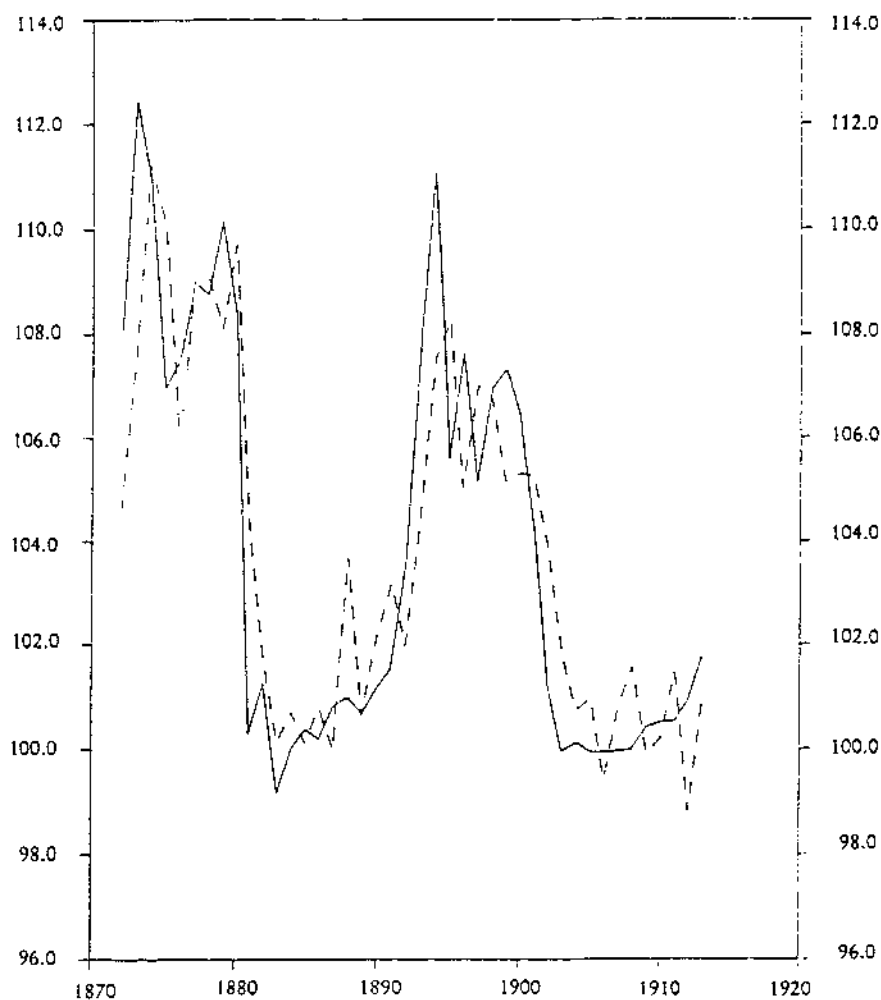


Figure 5
ITALY
ACTUAL (—) AND FITTED (-----; Eq. 1, Table 2)
VALUES FOR THE EXCHANGE RATE

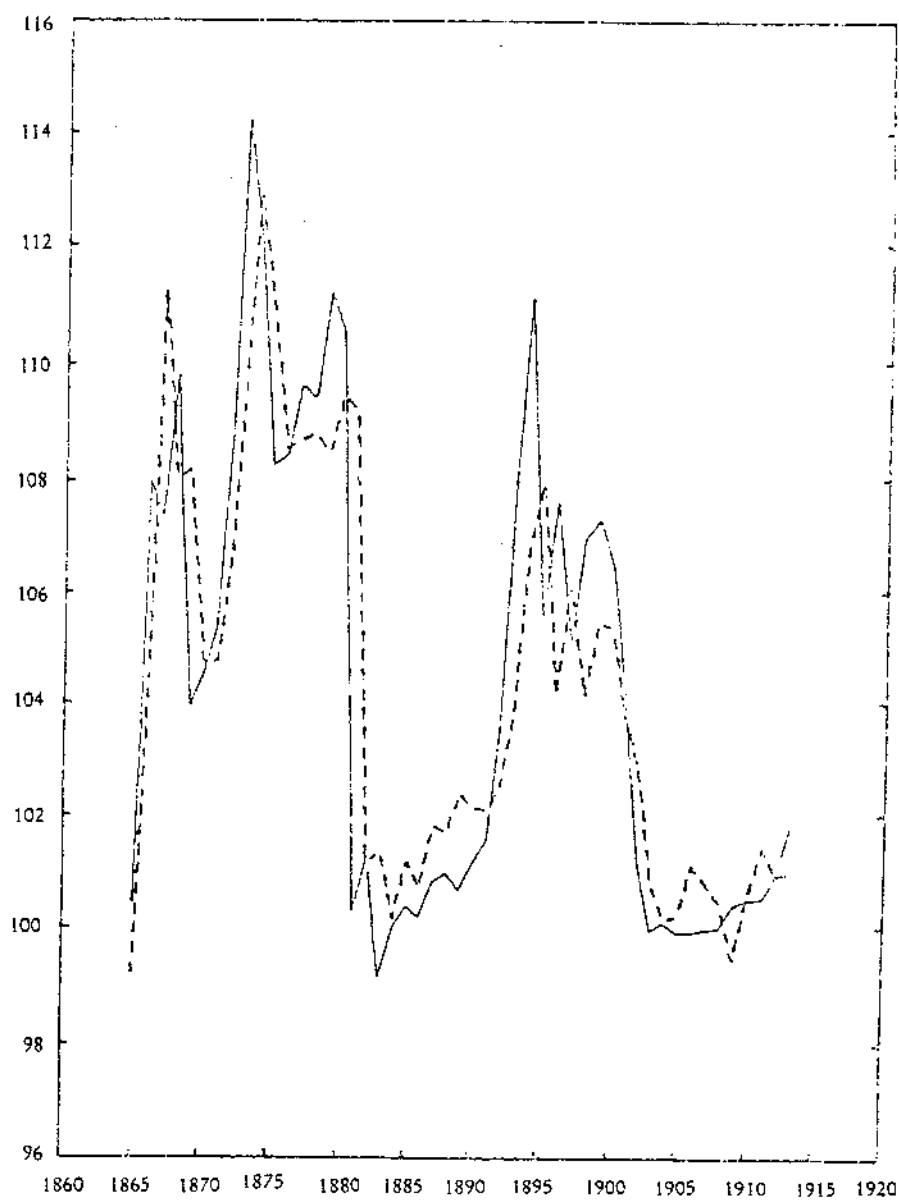


Figure 6
ITALY
ACTUAL (—) AND FITTED (-----; Eq. 3, Table 2)
VALUES FOR THE EXCHANGE RATE

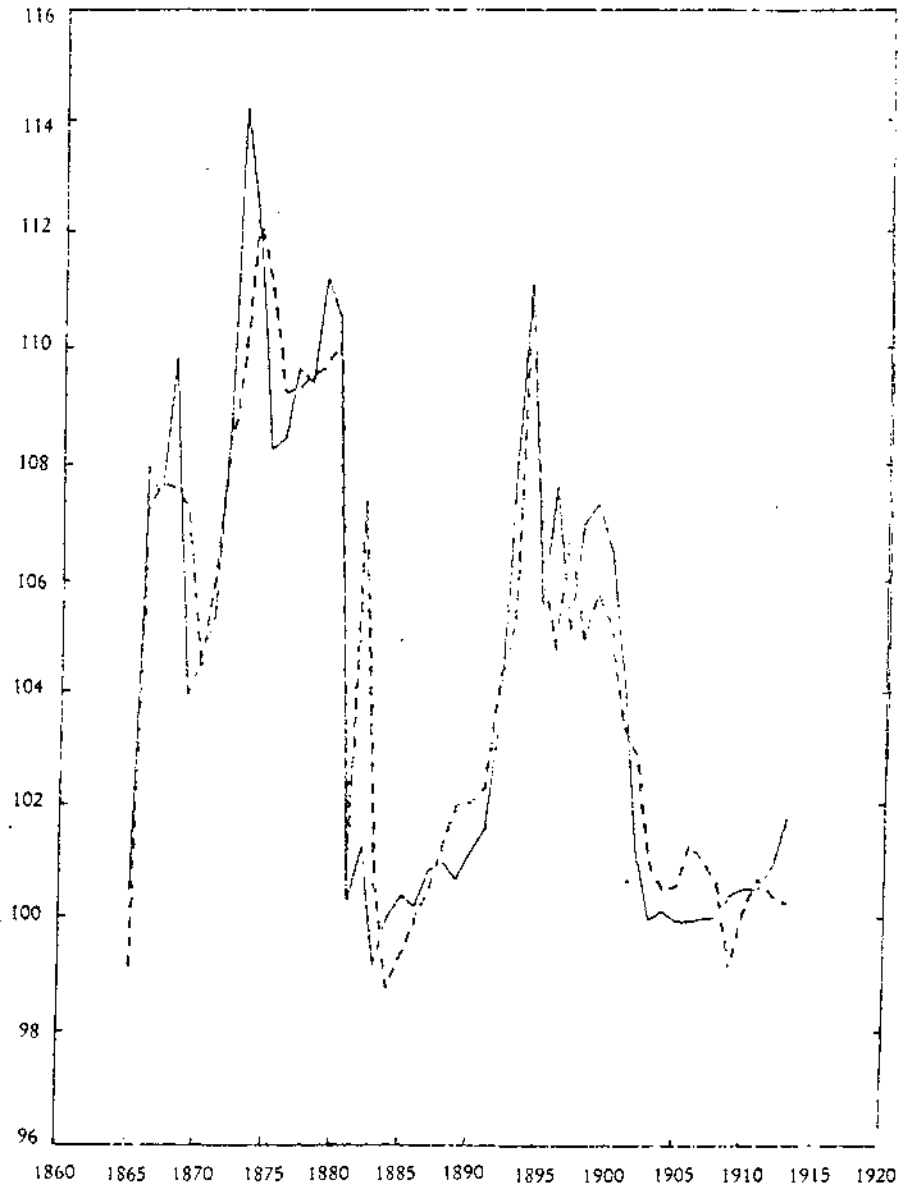
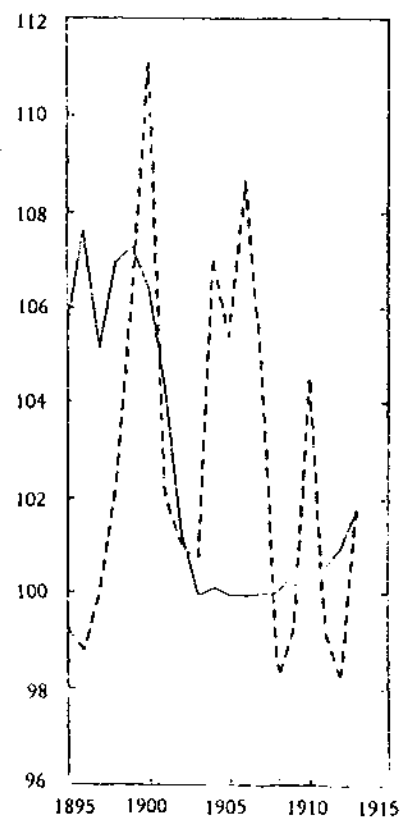
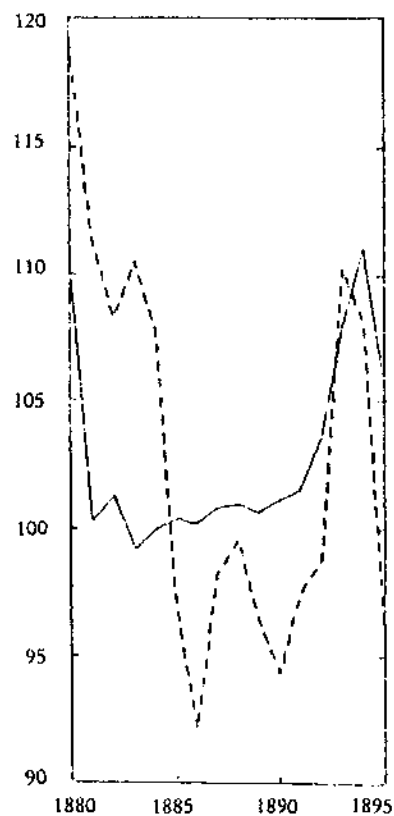
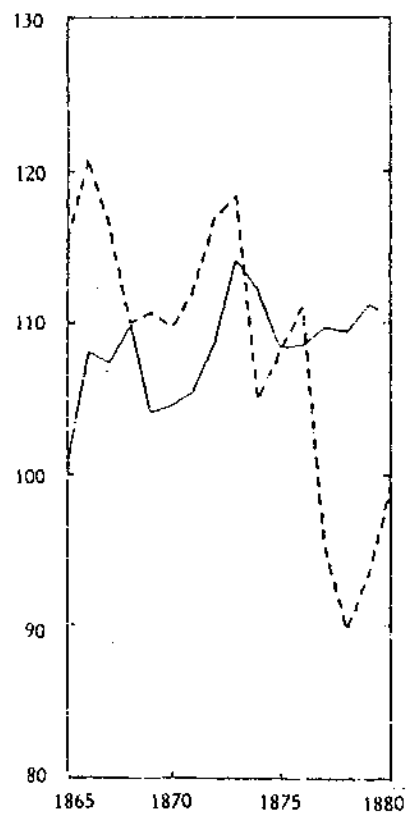


Figure 7
ITALY
NOMINAL (—) AND REAL (-----) EXCHANGE RATES OVER SELECTED PERIODS



BIBLIOGRAPHY

- AGHEVLI B.B. and M.S. KHAN, 1977, "The Monetary Approach to Balance of Payments Determination: An Empirical Test", in International Monetary Fund (1977), pp. 275-90.
- BARRO R.J., 1979, "Money and the Price Level under the Gold Standard", *Economic Journal*, 89, March, pp. 13-33.
- BENINI R., 1894, "L'azione dello stato sui mercati dei cambi ed i criteri dell'amministrazione italiana, *Giornale degli Economisti*, April, pp. 199-322.
- CIOCCA P., 1978, "Note sulla politica monetaria italiana 1900-1913", in G. Toniolo (ed.) *L'Economia Italiana 1861-1940*, Laterza, Bari, pp. 179-230.
- CLEMENTS K.W. and J.A. FRENKEL, 1980, "Exchange Rates, Money, and Relative Prices: The Dollar-Pound in the 1920s", *Journal of International Economics*, 10, pp. 249-62.
- COOPER R.N., 1982, "The Gold Standard: Historical Facts and Future Prospects", *Brookings Papers on Economic Activity*, 1, pp. 1-56.
- DE MATTIA R., 1969, *I Bilanci degli Istituti di Emissione Italiani 1865-1936*, Bank of Italy, Rome.
- DOOLEY M.P. and P. ISARD, 1983, "The Portfolio-Balance Model of exchange Rates and Some Structural Estimates of the Risk Premium", IMF Departmental Memorandum 83/20.
- DORNBUSCH R., 1976, "The Theory of Flexible Exchange Rate Regimes and Macroeconomic Policy", *Scandinavian Journal of Economics*, 78, 2, pp. 225-75.
- , 1978, "Monetary Policy under Exchange-Rate Flexibility", in Federal Reserve Bank of Boston, *Managed Exchange Rate Flexibility: the Recent Experience*, Conference Series No. 20, Boston, October, pp. 90-126.
- , 1980, "Exchange Rate Economics: Where Do We Stand?" *Brookings Papers on Economic Activity*, I, pp. 143-202.
- FAUSTEN D.K., 1979, "The Humean Origin of the Contemporary Monetary Approach to the Balance of Payments", *The Quarterly Journal of Economics*, XCIII, 4, November, pp. 655-73.
- , 1980, "Beyond the Analytics of the Monetary Approach to the Balance of Payments: Methodology, Innovation and Monetarism", *Kredit und Kapital*, 13, 1, pp. 66-81.
- FRANKEL J.A., 1979, "On the Mark: A Theory of Floating Exchange Rates Based on Real Interest Differential", *American Economic Review*, 69, 4, pp. 610-22.
- , 1981, "On the Mark: Reply", *American Economic Review*, 71, 5, pp. 1075-82.
- FRATIANNI M. and F. SPINELLI, 1983, "Currency Competition, Fiscal Policy and the Money Supply Process in Italy: 1860-1914", IMF, unpublished, June.
- , "1984, Italy in the Gold Standard Period, 1861-1914", in M. Bordo and A.J. Schwartz (eds.) *A Retrospective on the Classical Gold Standard, 1821-1931*, The University of Chicago Press, Chicago (for NBER, forthcoming).

- FRENKEL J.A., 1976, "A Monetary Approach to the Exchange Rate: Doctrinal Aspects and Empirical Evidence", *Scandinavian Journal of Economics*, 78, 2, pp. 200-224.
- , 1978, "Purchasing Power Parity: Doctrinal Perspective and Evidence from the 1920s", *Journal of International Economics*, 8, pp. 169-91.
- , 1980, "Exchange Rates, Prices and Money: Lessons from the 1920s", *American Economic Reviews*, 70, 2, May, pp. 235-42.
- , 1981, "Flexible Exchange Rates, Prices, and the Role of 'News': Lessons from the 1970s", *Journal of Political Economy*, 89, 4, pp. 665-705.
- and H.G. Johnson (eds.), 1976a, *The Monetary Approach to the Balance of Payments*, Allen and Unwin, London.
- , 1976b, *The Monetary Approach to the Balance of Payments. Essential Concepts and Historical Origins*, in J.A. Frenkel and H.G. Johnson (eds.) (1976).
- FRIEDMAN M. and A.J. SCHWARTZ, 1963, *A Monetary History of the United States, 1867-1960*, Princeton University Press, Princeton (for NBER).
- IMF, 1977, *The Monetary Approach to the Balance of Payments*, Washington, D.C.
- JANNACCONE P., 1918, "Relazioni fra commercio internazionale, cambi esteri e circolazione monetaria in Italia nel quarantennio 1871-1913, *Riforma Sociale*, XXV, XXIX, XI-XII, November-December.
- JOHNSON H.G., 1971, "The Keynesian Revolution and the Monetarist Counter-Revolution", *American Economic Review*, 68, May, pp. 1-14.
- , 1975, "The Monetary Approach to Balance of Payments Theory: A Diagrammatic Analysis", *The Manchester School*, XLIII, September, pp. 220-74.
- , 1976, "The Monetary Approach to the Balance of Payments Theories", in J.A. Frenkel and H.G. Johnson (eds.), Chapter 6.
- KEYNES J.M., 1924, *A Tract on Monetary Reform*, Preface to the French Edition, Macmillan, London.
- KLEIN B., 1975, "Our New Monetary Standard: The Measurement and Effects of Price Uncertainty, 1880-1973", *Economic Inquiry*, XIII, December, pp. 461-84.
- LAIDLER D. and P. O'SHEA, 1980, "An Empirical Macromodel of an Open Economy under Fixed Exchange Rates: The United Kingdom 1954-1970, *Economica*, 47, pp. 141-58.
- MORGENSTERN O., 1959, *International Financial Transactions and Business Cycles*, Princeton University Press (for NBER), Princeton.
- MUNDELL R.A., 1968, *International Economics*, Macmillan, New York.
- MYRMAN J., 1976, "Experiences of Flexible Exchange Rates in Earlier Periods: Theories, Evidence and a New View", *Scandinavian Journal of Economics*, pp. 169-96.
- NUGENT J.B., 1973, "Exchange-Rate Movements and Economic Development in the Late Nineteenth Century", *Journal of Political Economy*, 81, 4, pp. 1110-34.
- PENATI A., 1983, "Expansionary Fiscal Policy and the Exchange Rate. A Review," IMF Departmental Memorandum 83/14.
- POLAK J.J., 1957, "Monetary Analysis of Income Formation and Payments Problems", *IMF Staff Papers*, 6, November, reprinted in IMF (1977).

- PRAIS S.J., 1961, "Some Mathematical Notes on the Quantity Theory of Money in an Open Economy", *IMF Staff Papers*, 8, May, reprinted in IMF (1977).
- RHOMBERG R.R., 1965, "Money, Income and the Foreign Balance", in E.F. Jackson (ed.), *Economic Development in Africa*, Basil Blackwell, Oxford, reprinted in IMF (1977), Chapter 6.
- SPINELLI F., 1980, "The Demand for Money in the Italian Economy: 1867-1965", *Journal of Monetary Economics*, 6, 1.
- VINER J., 1937, *Studies in the Theory of International Trade*, Harper and Brothers, New York and London.
- WILSON C.A., 1979, "Anticipated Shocks and Exchange Rate Dynamics", *Journal of Politic Economy*, 87, 3, pp. 639-47.
- WILLIS H., 1901, *A History of the Latin Monetary Union*, Chicago Press, Chicago.
- YAEGER L.B., 1963, "Fluctuating Exchange Rates in the Nineteenth Century: The Experiences of Austria and Russia", in R.A. Mundell and A.K. Swoboda (eds.), *Monetary Problems of the International Economy*, The University of Chicago Press, Chicago, pp. 61-118.

