How the Gold Standard Functioned in Portugal: An Analysis of Some Macroeconomic Aspects

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1. Introduction

At the beginning of the 19th century, the monetary laws of many countries allowed coins made from various precious metals to be minted and circulated. Such commodity-money systems are known as bimetallist standards. Gold was used for high-value transactions, while silver, bronze or copper coins were used for the rest. Great Britain was the exception, establishing a *de facto* monometallic system in 1821. The German states, the Austro-Hungarian Empire, Scandinavia, Russia and the Far East operated under the aegis of silver standards. Countries with bimetallist standards, like France, had links with the gold and silver blocs[2].

The industrial revolution led to the emergence of Great Britain as the leading trading and industrial power in the 19th century, and as the main source of external finance. This fact encouraged other countries to try and tighten trading relations with Great Britain and to go to London for capital loans.

Portugal, which enjoyed strong commercial ties with the British economy, was the first European country to join Great Britain in the Gold Standard, in 1854, adhering to it for a considerable period, only abandoning it in 1891[3]. Portugal's adherence to the monometallic gold system lasted 37 years, longer than what is regarded as the classical Gold Standard period, from 1880 to 1914. Besides a desire to share the same monetary system as its chief trading partner, the low price of gold and the circulation of British gold coinage at home may also have contributed to the adoption of the Gold Standard in Portugal[4].

It provided a nominal stable anchor during the period it was in operation, between July 1854 and June 1891, and it was also a mechanism of credible commitment, even though the Portuguese monetary authorities often violated the "rules of the game". The functioning of the Gold Standard in Portugal was characterized by an

[2] See Michael Bordo and Anna Schwartz (1997) and Barry Eichengreen (1996).
[3] See Jaime Reis (1995), António Mendonça (1996) and Jaime Reis (2002).

overall picture of nominal stability, in terms of both exchange rates and prices, with product behaviour showing quite a favourable evolution in the light of the stagnation observed up to 1854[5].

Then followed a period of monetary instability and flexible exchange rates, as a result of the suspension of the free convertibility of currency into gold at a fixed price, a decision which was taken by all countries after 1913, when the international monetary system known as the Classical Gold Standard began to collapse, owing to the massive shocks of the First World War.

But if Portugal was one of the first countries, along with Great Britain, to adhere to the international Gold Standard, it was the last European country to try restoring the full convertibility of its currency, in 1931, at a time when financial crisis was looming in Europe[6].

This paper aims to elucidate the historical choice of the Gold Standard by the Portuguese authorities, and to analyse its macroeconomic behaviour. Certain performance indicators of this system are compared with the systems that followed it. With respect to comparison criteria, will draw attention of using different indicators for different systems, something that is largely ignored. We came to the conclusion in an earlier study[7] that, from the point of view of money and nominal income, the period 1854-1913 was very similar to the strict period of the Gold Standard. This is why we have focused a certain amount of attention on comparing these two periods. The macroeconomic study considers the characteristics of the series used, and is based on a VAR model. We have used this model to analyse the mutual influence of the variables studied, emphasizing shock analysis.

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[4] See Eugénia Mata and Nuno Valério (1993) and Jaime Reis (2000).
[5] See Jaime Reis (1995).
[6] See Jorge Macedo, Eichengreen and Jaime Reis (1995), Fernando Santos (1995) and Jaime Reis (1995).
[7] See João Andrade (2003).

The data used have been taken from Ana Nunes; Mata and Valério (1989) and Dina Batista; Carlos Martins; Maximiano Pinheiro and Pinheiro Reis (1997). The econometric software employed to process the series was RATS, version 5.1.

The paper is composed of seven points. Point 2 gives a retrospective history of how Portugal came to adhere to the Gold Standard and analyses some of the factors that contributed to that decision. The unique participation of the Portuguese economy in this monetary system is highlighted, bearing in mind the reasons for the emergence of the gold standard as an international monetary system. Point 3 describes the functioning of the Gold Standard in Portugal and examines the reasons for its collapse in June 1891. It further looks at the circumstances under which it was restored and again discarded, in the context of the international financial crisis of the 1930s. Point 4 raises the issue of the presumable evolution of prices and inflation under the Gold Standard, based on a very simple model by which conclusions are drawn with respect to those variables. Point 5 compares different monetary systems in Portugal and looks at the stationary behaviour of macroeconomic series. Point 6 concentrates on a description of the VAR model. It begins with the selection of the order for the two periods mentioned above, 1854-1891 and 1854-1913, to show the importance of each variable in the explanation of the others. Next, the responses of the different variables to shocks in each of them are studied. Finally, we concentrate on the Gold Standard period and after resolving some identification problems of the model, short-term shocks that are identified with demand, supply and money supply are studied. The last point, Point 7, concludes this work, while indicating some openings for future research.

2. The Process of Portugal's Adherence to the Gold Standard

The anarchy of the monetary circulation prevailing in the first half of the 19th century[8] led to a realisation that the only way to solve the problem appeared to be a change to a monometallic system[9]. This would also be the only way to prevent the flight of silver abroad, either as a result of speculative hoarding, or through its export to countries where both official and market value were in closer alignment.

On May 1st 1854, after two years of gold depreciating against silver, the 're-generative' government of Fontes Pereira de Melo laid a proposal for the reform of the Portuguese monetary system before the Chamber of Deputies. The proposal envisaged the resolution of Portugal's monetary problems through the establishment of a monometallic gold system, exactly like the one operating in Great Britain since 1821.

The debate went on until the second half of May, with the arguments raised being essentially technical[10]. Those opposed queried which would be the most opportune time to join the Gold Standard, considering that most countries, notably France, were still operating a bimetallic system. They also expressed concern that a state monopoly of silver coinage, arising from the monetary reform, could be over-used, since the purpose of gaining revenue from seigniorage and minting silver coins could lead to an increase in prices. The government's answer was to immediately exclude this possibility, backing its argument by limiting the acceptance of silver in commercial transactions.

The increase in gold production was to be absorbed by the growth in economic activity at international level, and so there should be no cause for worry. Furthermore, defenders of the proposed reform of Portugal's monetary system, particularly its rapporteur, Casal Ribeiro, the minister Fontes Pereira de Melo, and Lobo de Ávila,

[8] Bimetallism with the circulation of several foreign currencies in parallel with the coinage issued by the *Casa da Moeda*. (Portuguese mint).
[9] See Jaime Reis (1995).
[10] See Rui Esteves and Fabiano Ferramosca (2000).

stressed the fact that a bimetallic system could lead to marked instability, associated with the operation of Gresham's Law, which could only be overcome by adopting a single precious metal as the basis of the monetary system. But the choice could not fall on silver. First, because of the upheavals caused by its sudden depletion owing to differences in its relative price; and second, because monetary circulation in Portugal was then in the mainly form of gold coinage, and so if this precious metal were not chosen as the basis of the system, a new monetary stock would have to be acquired.

After a succession of technical changes, the proposed reform of the Portuguese monetary system was finally approved on May 15th and became law on July 29th 1854, making Portugal the first country in Europe, to join Great Britain in adhering to the Gold Standard. The *real* was defined solely in terms of gold, as 1.626 mg of fine gold, which represented a drop in its value of 1.03%, relative to the parity fixed in 1847. All the classical rules of the Gold Standard monetary system were enshrined in the drawing up of the Law's various articles, to reproduce the essential characteristics of the British Gold Standard[11].

Portugal's 1854 decision to adhere to the Gold Standard is hardly surprising, given the peripheral nature of the country. It displays a number of singular features that underline the importance of the choice of the moment for the changeover to the new monetary system, which can only be understood in terms of the monetary, political and economic circumstances described above. Portugal was by no means a rich industrialized country that could opt for gold for the benefits that it afforded in carrying out high-value transactions. On the contrary, it was a poor country, lacking the capacity to mint its own currency on any grand scale, and this was why its economy was largely non-monetarized[12]. Furthermore, the need to make small, frequent payments at the level of its chief productive sector, agriculture, meant that the "entrepre-

[11] See Jaime Reis (1995), Mendonça (1996), Esteves and Ferramosca (2000) and Jaime Reis (2002).

neurial farming class" preferred silver to gold, since it enabled it to reduce transaction costs[13].

By adopting the Gold Standard early on, the country was clearly distancing itself from the prevailing tendency to demonetise gold that existed in Spain, Naples and Holland, and other states, while simultaneously excluding the option of following France's bimetallic system. The choice of the moment to institute the gold monometallic system in Portugal is also interesting in that the decision was taken almost twenty years before the leading European countries shifted to the Gold Standard. It was left to Germany, the second largest economic power in Europe to start this change at international level, when, in 1872, it abandoned silver in favour of gold, also as the result of monetary reform[14].

Since they were commercially dependent on Germany and were in close geographical proximity to it, Sweden, Denmark and Norway quickly followed suit, joining the Gold Standard in 1873 as part of the Scandinavian Monetary Union[15]. In a proper chain reaction, Holland and the countries in the Latin Monetary Union were also drawn towards gold monometallism. France, which in 1873 restricted the free minting of silver, definitively adhered to the Gold Standard in 1878, along with Belgium and Switzerland[16]. At the end of the 19th century Spain was the only country in Europe to retain non-convertible paper money, although it had given up bimetallism in 1883.

The Gold Standard originally developed more or less spontaneously, for historical reasons or due to political-ideological, commercial or financial influences, at a

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[12] See Bordo and Schwartz (1995), Jaime Reis (1995), Mendonça (1996) and Esteves and Ferramosca (2000).

[13] We are thinking particularly of the Port wine producers in the Douro valley, with close ties to the market, who were constantly dealing with the problems of paying workers in gold coinage. For each pound sterling that was converted into silver they were forced to pay one hundred and sixty *réis* discount, a manifestly high amount, given the sums involved. See Jaime Reis (1995).

[14] See Giulio Gallarotti (1995) and Eichengreen and Marc Flandreau (1995).

[15] See Ingrid Henriksen and Niels Koergard (1995).

national level on the basis of countries individual choices. Nevertheless, as the legal tender of silver lost its importance and became increasingly discarded as a monetary standard, the Gold Standard eventually emerged in the 1890s as the world standard, and is referred to in the literature as the classical Gold Standard. It ended up by operating as an authentic international monetary system between 1880 and 1914, at which time it entered into decline as a result of the shocks of the First World War[17].

But none of the factors responsible for the emergence of the Gold Standard as the international monetary system quite fits the events that led to Portugal's decision in 1854[18]. If we list the chief elements that played some part in the generalized shift to the Gold Standard during the 1870s and '80s, we find it hard to see that any of them were decisive in the process of Portugal's adherence to the new monetary system.

In the first place, Portugal's adherence to the Gold Standard was not favoured by technical issues[19]. When Portugal joined the gold monometallic system, the authorities were striving to supply a currency of acceptable quality and in sufficient quantity to facilitate low-value transactions, largely because of the Casa da Moeda's (national mint) technical limitations, since its economy was far less monetised in relation to those of most European countries. In these circumstances, questions of a technical nature were not determinants in the process of Portugal's adherence to the Gold Standard.

Second, there is nothing to lead one to conclude that Portugal's adoption of the Gold Standard was related to a "gold ideology" prevailing in the country or, more specifically, that it was associated with the role played by an "urban-industrial class",

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[16] The decision by France to discontinue the free minting of silver was known as "the crime of 1873". See Flandreau (1996).
[17] See Bordo (1993) and Jean Bourget; Arcangelo Figliuzzi and Yves Zenou (2002).
[18] See Jaime Reis (1990) and Jaime Reis (1995).
[19] Most countries would later benefit from the introduction of steam technology in the minting of coinage. See Angela Redish (1990).

or any other social group[20]. It was only later, after the Paris Conference of 1867 that this ideology was to influence other countries to adhere to the Gold Standard[21].

Third, it is hard to see that, in the Portuguese case, the adoption of gold as a monetary standard could have been the result of being "dragged along" in the wake of certain other countries' adhesion, with others following suit. When Portugal decided to adhere to gold monometallism, only Great Britain was using this system. The fact that this country was a dominant economic power was not enough to trigger the chain reaction observed twenty years later, when most countries ended up by joining the Gold Standard, drawn into it by German policy or the French decision[22].

Finally, Portugal's joining was not determined by financial reasons, which are sometimes held to be one of the main factors determining the change to gold mono-metallism at international level. The adoption of the Gold Standard could also be related to reducing the costs of loans on the international capital markets, where it would operate as a sign of financial credibility[23]. The change to a gold monometallic system would make it possible to obtain funds more cheaply on the capital markets, especially on the London market, but it would also help to overcome any problems in attracting external financing. However, there is no good reason to suppose that one of the factors responsible for Portugal's adhesion to the Gold Standard would have been easier access to the international capital markets; but this does not mean that it was not useful at a later stage[24].

The problem observed in the 1850s in attracting outside finance, particularly for building railway lines, was mostly related to the lack of credit guarantees, and not really to the kind of monetary system; Spain, for instance, with its bimetallist, non-convertible system, managed to attract more capital.

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[20] See Jaime Reis (1995).
[21] See Gallarotti (1995) and Christopher Meissner (2002).
[22] See Jaime Reis (1995), Bordo and Eichengreen (2001) and Meissner (2002).
[23] As a "*good housekeeping seal of approval*". See Bordo and Hugh Rockoff (1996).

As we cannot attribute a determining role to any of the factors responsible for the emergence of the international Gold Standard in Portugal's decision, taken in 1854, we have to conclude that, besides the monetary, political and economic circumstances analysed earlier, the country's adherence to the model followed by Great Britain, was encouraged by a set of specific circumstances, certain facets of which once again have considerable singularity.

First of all, the change to the new system was facilitated by (a) its low implementation cost, relative to the charges that would have resulted from the adoption of a silver monometallism, (b) the fall of the international price of gold, (c) the widespread circulation of gold coinage within Portugal, as mentioned above, and (d) the fact that there was a significant inflow of British gold coins, coming from Brazil, due to the repatriation of capital[25].

Jaime Reis (1995), sees the 1854 decision as a consequence "of accidents of History", and a purely natural response to the monetary chaos obtaining in the Portuguese economy at the end of the 1840s. But when Portugal decided to implement the Gold Standard, it was already virtually governed by it, and so it was not a matter of choosing an ideal monetary system model, but, rather, a system that would be workable and with lower transaction costs. Portugal chose to follow the British model because it worked well, it could guarantee gold coinage and silver small change for carrying out large and small transactions. The relatively extensive outflow of silver in the Portuguese economy may also explain the early adherence of Portugal to the Gold Standard and, at the same time, the somewhat delayed adoption of it by other countries.

[24] See Jaime Reis (1995).
[25] See Bordo and Schwartz (1995), Jaime Reis (1995) and Mata and Valério (1993).

3. Some Features of the Functioning of the Gold Standard in Portugal

The functioning of the Gold Standard monetary system in Portugal basically reproduces the characteristics of the British model of gold monometallism, even though, in practice, there was a certain withdrawal from what had been envisaged. The divergences were not enough, however, to prevent the Gold Standard from working well in Portugal for nearly 37 years, a longer spell than the so-called classical Gold Standard period (1880 to 1914).

The articles in the law of July 29th 1854 contained all the classical rules for the operating of the Gold Standard monetary system. The Portuguese accounting unit became established solely in terms of gold, at a parity of 1.626 mg of fine gold per *real*, the equivalent of 1.7735 mg of gold alloy of 916 2/3 per *real.* This definition illustrates the close proximity to the British model in that the alloy used by Great Britain was chosen, and not that used in France's bimetallist system, which was 900 per thousand. It was also established that bank notes would be freely convertible into gold.

Private individuals could take any gold they had to the Casa da Moeda (national mint) to be freely coined, after which operation it could be exchanged, at no extra cost, for legal currency, unless it weighed over one kilogram, in which case it would be liable to a tax of one thousand *réis*. Copper and silver coins became a means for subsidiary payment, and were minted exclusively by the State, with a face value greater than the market one, and with a legal tender restricted to five thousand *réis* per transaction[26].

During the period in which the Gold Standard was in force in Portugal, the money supply was made up of imported British sovereigns and half-sovereigns which, contrary to other foreign gold coins, remained legal tender, but they were accepted at

[26] See Jaime Reis (1995), Mendonça (1996) and Esteves and Ferramosca (2000).

par and not overvalued, as had happened up to the introduction of the new monetary system. They increased considerably in number as a result of the positive balance of payments situation, due largely to loans obtained on the international market and the capital flows from emigrants' remittances[27].

The position of Portugal in terms of external payments meant that its economy became highly dependent on the evolution of the political, social and economic situation in Brazil, and on its main financial partner, Great Britain.

Monetary dependence on the outside world was nothing new, but in the new monetary context obtaining in Portugal it began to take on greater importance[28]. Portugal was not merely before a Gold Standard, it was confronted by a sterling Gold Standard, given the key role played by the sovereign and half-sovereign in monetary circulation[29]. Among the various negative aspects that were to arise from that situation, "wounded national pride" is conspicuous, due to the possibility of the Portuguese economy becoming even more dependent on that of Britain. In addition to this, the fact that the English Mint was guided by more rigorous standards of weight and alloy in currency coinage, and that it immediately got rid of all non-standardized coins, increased fears of a possible tendency for the more worn and lighter coins to be introduced into Portugal, causing its currency reserves often to be composed of "weak" coinage[30].

One of the most important features of the Gold Standard in Portugal, besides its tight relationship of monetary dependence vis-à-vis British gold coinage, was the fact that it embraced a monetary rule or mechanism of credible commitment, on the basis of which attempts were made over the years to restrict, or even sanction, the actions of the monetary authorities. The rule of maintaining a fixed price for gold in

[27] See Mata and Valério (1995).
[28] In 1854 British gold coins accounted for 56% of the money supply, and in 1890, one year before the gold standard was abandoned, it comprised 74%. See Rita Sousa (1991) and Mata and Valério (1993).
[29] See Jaime Reis (1995).

terms of national currency may be seen as a mechanism of credible commitment whose aim would be to prevent the authorities from embarking on inconsistent monetary and budgetary policies[31].

The rule of the Gold Standard could also be regarded as a type of contingency rule, or a rule with escape clauses, which could be evoked in exceptional circumstances due to outside causes, beyond the responsibility of the monetary authorities. They were pledged to keep the prices of their currency fixed in terms of gold, except in the wake of clearly understood upsets, such as a major war, a severe financial crisis or a shock in terms of trade[32].

At international level, the underlying principle consists of maintaining the free convertibility into gold at the established par value. In this context, the commitment by the various countries to maintain a fixed price for gold should have ensured fixed exchange rates. As a result, the use of monetary and budgetary policy to achieve domestic goals was subordinated to the maintenance of gold convertibility. Monetary policy could be used to pursue domestic aims only within the gold points which represented a system of exchange rates similar to that of target zones[33].

In the period 1880 to 1914, exchange rate fluctuations were very small, especially in the central countries, thus revealing the high level of stability of exchange rates in the period when the Classical Gold Standard was in operation[34]. Even though the exchange rates strayed quite often from the par value, infringements of the gold points and devaluations were nonetheless rare. With the credible adoption of gold convertibility, countries undertook to keep exchange rates stable, not to follow a pol-

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[30] *Idem*.
[31] The same could be inferred for the case of Portugal making the provisions of the 1854 law its basis. Despite the persistence of successive budget deficits. See Bordo (1993), Bordo and Finn Kydland (1996) and Bordo and Schwartz (1997).
[32] See Herschel Grossman and John Van Huyck (1988), Eichengreen (1994), Bordo and Schwartz (1995) and Bordo and Kydland (1996).
[33] *Target zone*. See Bordo and Kydland (1996) and Bordo and Ronald MacDonald (1997).

icy of gradual inflation and to return to the par value for the exchange rate after any shock that temporarily forced to suspend convertibility[35].

In the case of Portugal, the Gold Standard functioned well until 1891, apart from during the financial crisis of 1876, a period when the government ordered a moratorium of three months, which included a two-month suspension of gold convertibility for bank notes. The government further sought to avert the banking crisis of 1891, supporting the Bank of Portugal by supplying a million sovereigns, but to no avail. Apart from this occasion, everything seems to indicate that the principle of free gold convertibility for the Portuguese currency at a fixed price functioned without problems until 1891, when it was abandoned, even though the Classical Gold Standard was to last until the outbreak of the First World War[36].

For 37 years Portugal experienced a situation of fixed exchange rates, with the currency pegged to gold. The *sovereign/real* parity remained unchanged from 1854 to 1891[37]. This was the basis on which the Gold Standard monetary system in Portugal provided a stable nominal anchor and a credible commitment mechanism, even though the monetary authorities violated the gold points.

Exchange stability within the gold points was respected, by and large, while Portugal remained within the international Gold Standard, although there was some foreign exchange volatility in the *sovereign/real* relation. This was sometimes expressed in the breach of the import and export point of gold[38]. The Gold Standard in Portugal thus represented an appreciable level of exchange rate stability, and one that

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[34] Similar results were also found for the growth of the monetary base and currency stock and for long-term interest rates, which were low and stable for the same period. See Arthur Bloomfield (1959) and Bordo and Lars Jonung (2001).
[35] See Bordo and Kydland (1996).
[36] For suggestive evidence see Bordo and Schwartz (1995) and Pablo Aceña and Jaime Reis (2000).
[37] See Bordo and Schwartz (1995).
[38] See Esteves and Ferramosca (2000). The violation of the export gold point is largely explained by the succession of high deficits observed in the balance of trade that had to be paid abroad. The violation of the import point seems to have been justified by the existence of a significant correspondence between the number of periods when this occurred and the movements of gold with Great Britain. The study by these authors further suggests that the width of the fluctuation band between the two points was fixed,

grew with the passage of time, as can be seen from the lower number of violations of the gold points.

However, the context of exchange rate stability afforded by the Gold Standard from 1860 until the end of convertibility, in June 1891, notwithstanding, the Bank of Portugal pursued an active monetary policy, with frequent violations of the "rules of the game" by only using its discount rate sporadically to maintain foreign exchange reserves[39]. This situation, aggravated by a steady exit of gold, was expressed in problems of maintaining the proportion between the fiat money and the metal reserves that were regularly reduced at a worrying rate.

In these circumstances it was only possible to maintain the commitment mechanism to the international Gold Standard rule in a credible manner by continually resorting to borrowing from London, which enabled gold and gold coins to be imported in sufficient amounts to re-establish the proportion between the bank notes in circulation and the reserves guaranteeing them[40]. The use of instruments was to some extent inverted. Only in the last resource was the discount rate increased, the preferred option being foreign borrowing. In the case of the Bank of Portugal, upholding the credibility of the commitment to the Portuguese currency's gold convertibility crucially relied on cooperation between the central banks, although the monetary authorities often broke the "rules of the game".

But if the strict monetary discipline of the Gold Standard provided an overall picture of nominal stability, the period when Portugal adopted it was characterized by unrelenting deficits in the trade balance and persistent negative balances in the public accounts. This was not unrelated to the adoption of a number of "modernization" policies, associated with the creation of economic and social infrastructures.

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on average, at around 2.1% of parity. The export gold point, however, was wider compared with the import gold point.

[39] See Jaime Reis (2002).

[40] *Idem*.

Despite all this, until 1890, Portugal managed to obtain long-term loans, both at home and abroad, to cope with the trade deficit[41]. In addition, the country succeeded in compensating for its negative trade balance by means of revenue from the remittances of emigrants in Brazil and earnings from Portuguese investments abroad, which were significant enough to achieve a series of balance of payments surpluses. In spite of Portugal being a debtor country in terms of current transactions, it remained a regular importer of gold, unlike other peripheral countries, and this situation allowed it to sustain the credibility of its commitment to convertibility. Public accounts deficits could be financed by borrowing from the markets, with an inflow of gold sufficient to maintain convertibility also being allowed[42].

In the long-run, meanwhile, the accumulation of these balances in the public accounts, along with those in the trade balance, made the abandoning of the Gold Standard inevitable when the 1890-1892 crisis struck. The early 90s were marked by a number of problems that led to a widespread lack of confidence, provoking the collapse of the Portuguese Gold Standard.

Brazil was undergoing a period of serious social and political instability following the abolition of slavery in 1888, and the end of the monarchy, a year later. The Brazilian crisis had the effect of severely reducing emigrants' remittances which made it hard to prop up the Gold Standard system[43]. One of the factors that fed the stock of Portuguese gold thus disappeared[44]. In 1890 and 1891 alone remittances fell 20% and 40%, respectively. Portugal also got itself embroiled in a diplomatic conflict with Great Britain, which led to the British ultimatum of January 1890, while, at the same time, the Baring Brothers crisis, the Portuguese government's chief London Bank, further worsened an already delicate economic situation. The beginning of

[41] See Bordo and Schwartz (1995).
[42] See Mata and Valério (1995).
[43] *Idem*.
[44] See Jaime Reis (2000).

1891 saw the recurrence of political and social instability, in the wake of a failed attempt to establish a Republic. Between January and April of that year, currency reserves fell by a half.

Added to all this, an unsuccessful attempt to issue an external loan to obtain international liquidity resulted in a run on the banks to exchange notes for gold coins; when the monetary authorities were unable to meet this the abandoning of the Gold Standard was inevitable. There followed a period of monetary instability and flexible exchange rates, due to the suspension of the free gold convertibility of the currency on May 9th 1891. Exactly the same decision was taken by all the other countries after 1913, when the massive shocks of the Great War caused the international Gold Standard to enter into a state of collapse.

Gold coins were either hoarded or exported, and the money supply largely took the form of bank notes. During and immediately after the War, Portugal suffered a period of high inflation and economic difficulties. The money supply was increased several times, following borrowing by the State from the Bank of Portugal to finance (monetise) the gaping budget deficits. The devaluation of Portugal's currency, the *escudo*, introduced to replace the *real* in 1911, was relatively moderate during the War, but it accelerated sharply between 1919 and 1924. The Bank of Portugal's gold reserves were far too low to cope with any run on the bank, should the Portuguese currency see its gold convertibility re-established[45].

It seems that the possibility of restoring the Gold Standard was never formally given up by the Portuguese monetary authorities[46]. For this, the importance of relations between Portugal and Great Britain, which went back to gold in April 1925, and the international prestige of the Gold Standard for fostering price and exchange rate stability had considerable weight. But the project was never seriously considered, and

[45] See Mata and Valério (1995) and Santos (1995).
[46] *Idem.*

so a definitive stabilization of the exchange rate was only achieved in July 1931. This situation led to the adoption of a gold-exchange standard, following the recommendations of the 1922 Geneva Conference, under which full convertibility of the Portuguese currency could be restored relative to the British currency, convertible into gold, albeit at a devalued parity.

The gold *escudo* was defined as weighing 0.0739 gm of gold with a purity of 900/1000, the equivalent of a parity of 110 escudos to the pound sterling. For this, the Bank of Portugal was obliged to keep reserves of gold, foreign currency or other foreign assets convertible into gold, corresponding to at least 30% of its monetary liabilities. As the inflationary effects of the monetisation of the public deficits were still being felt, strict limits were imposed on the issue of notes intended to cover the government's financing requirements[47].

But if Portugal was the first country to join Great Britain in adhering to the international Gold Standard system, it was the last to restore the full convertibility of its currency, which is once again surprising, since it was returning to gold at a time when the beginning of an exceptionally turbulent period for the functioning of the international monetary system was imminent[48]. This return raises some questions. Why did the authorities re-establish the Gold Standard when the instability of the international financial situation was already clear? Why did the decision to go back to a monetary system based on gold take so long, when the escudo had been practically stable since 1924?

The full re-establishment of the convertibility of the Portuguese currency in 1931 was part of a global policy, the first step of which was to stabilize the budget. With a political system of dictatorship and the control of the public finances firmly established, the conclusion of Salazar's reforms with a return to the Gold Standard

[47] See M. Kock (1982) and Santos (1995).
[48] See Macedo; Eichengreen and Jaime Reis (1995), Santos (1995) and Jaime Reis (1995).

was also designed to attract foreign capital, so that Portugal could face the problems of international payments[49]. Portugal was going back to gold when other countries were leaving it.

The suspension of the pound sterling's gold convertibility on September 21st 1931, as a consequence of the effects of the failure of the *Kreditanstalt* and the German banking crisis, brought about the collapse of the monetary system between the wars[50]. The countries that maintained important trading relations with Great Britain were forced to abandon the Gold Standard. This occurred in Portugal, which suspended the gold convertibility of its currency following the British decision, just 82 days after its introduction.

The Portuguese monetary authorities then decided to peg the escudo to sterling, and a fixed exchange rate regime operated in Portugal from 1931 to 1938[51]. The importance of the trading relations with Great Britain and the fact that most of Portugal's external assets were denominated in pounds, explain the decision to anchor the escudo to the pound sterling. Pegging the escudo to the British currency was a way of ensuring the stability of the Portuguese monetary unit that would function as a close substitute for the Gold Standard.

After the Second World War, in 1949, the escudo was pegged to the dollar. Even though it was only in 1962 that Portugal joined the IMF, it can still be said that it saw the same period of fixed exchange as the Bretton Woods system until the early 1970s.

[49] See Mata (1987), Santos (1995) and Mata and Valério (1995).
[50] See Leland Crabbe (1989), Bourget; Figliuzzi and Zenou (2002) and Robert Hetzel (2002).
[51] See Banco de Portugal (1932), Bordo and Santos (1995) and Santos (1995).

4. Inflation and Prices under the Gold Standard

In order to find out about the characteristic of price and inflation stationarity under different monetary systems, let us suppose a very simple macroeconomic model.

Let us take a product equation, (1.1), where current values are determined in accordance with a Phillips curve. A simple supply of this type is also often called a Lucas supply curve, where p_{t-1} represents the anticipation of prices. Price behaviour is given by equation (1.2). In this equation, the constant is a useful variable enabling us to take into account the technological evolution registered in the economy and, further, the type of markets that characterize it. The presence of lagged prices expresses a partial adjustment relation. The last part of the equation incorporates the effects of global excess demand. Finally, equation (1.3) shows the behaviour of the amount of money in circulation. Besides the constant, it contains one component of partial adaptation and another that expresses what may be termed the "endogeneity" of its behaviour. The variables are expressed in logs.

$$y_t = \bar{y} + \gamma \cdot (p_t - p_{t-1}) \tag{1.1}$$

$$p_t = \beta_C + \beta_0 \cdot p_{t-1} + \beta_1 \cdot (y_t - \bar{y}) \tag{1.2}$$

$$m_t = \alpha_C + \alpha_0 \cdot m_{t-1} + \alpha_1 \cdot p_{t-1} \tag{1.3}$$

Substituting (1.2) in (1.1) we get, after simplifying,

$$p_t = \frac{\beta_C}{1 - \beta_1 \cdot \gamma} + \frac{\beta_0 - \beta_1 \cdot \gamma}{1 - \beta_1 \cdot \gamma} \cdot p_{t-1} \tag{1.4}$$

Reorganizing (1.3) in terms of prices and substituting in (1.4), we get the following expression for prices

$$p_t = \frac{\beta_C}{1 - \beta_1 \cdot \gamma} + \frac{\beta_0 - \beta_1 \cdot \gamma}{1 - \beta_1 \cdot \gamma} \cdot \left(\frac{1}{\alpha_1} \cdot m_t - \frac{\alpha_0}{\alpha_1} \cdot m_{t-1} - \frac{\alpha_C}{\alpha_1}\right) \tag{1.5}$$

While equation (1.4) interprets the behaviour of prices, only considering the real part of the economy, equation (1.5) shows price behaviour in terms of the real and monetary part of the economy.

We move on to compare the two states of the economy that we are interested in, an economy with a convertible currency and an economy with a non-convertible currency, and analyse the consequences of the descriptions of these two states.

In the convertible currency situation, it is reasonable to assume that prices react to demand and will be flexible in the manner $\beta_0 = 0$[52]. At the same time, we feel it is also reasonable to consider that productivity evolution in a competitive market will lead to $\beta_0 < 0$. Deflationary pressure is obvious, unless we see equation (1.6), which we get from (1.4),

$$p_t = \frac{\beta_C}{1 - \beta_1 \cdot \gamma} - \delta \cdot p_{t-1} \tag{1.6}$$

where $\delta = \frac{\beta_1 \cdot \gamma}{1 - \beta_1 \cdot \gamma}$.

The two components that constitute the prices behaviour have negative values. If prices show high flexibility, then $\beta_1 \to 1$, and so $\delta \to 0$. But regardless of the situation, prices are far from displaying a unit root in their behaviour. We also see that (1.6) expresses the absence of a "buffer effect" of prices that is normally given by the inertia ($0 < \beta_0 < 1$) of its behaviour.

The situation in an economy with non-convertible currency is different. The parameters β_C and β_0 have quite different values. We may imagine $\beta_C > 0$ as a result of behaviours more remote from competitive ones. The presence of inertia in the evolution of prices that characterizes these systems can also lead to the situation of $\beta_0 = 1$. As a result, in this extreme case, instead of (1.6), we now have

[52] The "clearing markets" hypothesis.

$$p_t = \frac{\beta_C}{1 - \beta_1 \cdot \gamma} + p_{t-1} \qquad (1.7)$$

The rate of inflation ($p_t - p_{t-1}$) now takes a positive constant value because of the new characteristics of the economy. The presence of a unit root in prices evolution is obvious.

So far we have confined our analysis to the real part of the economy. We want to introduce the monetary part. But before doing so, it is useful to clarify the signification of α_c in (1.3). In fact, its value can be decomposed into

$$\alpha_C = \bar{y} + \alpha_v \qquad (1.8)$$

thereby interpreting the effect of long-term growth of the economy on monetary circulation $(\bar{y})$ and the correction to the behaviour of the velocity of money circulation (α_v). But, in actual fact, this behaviour should only be taken in "managed currency" systems. There is no point in considering (1.8) in convertible currency systems.

In accordance with (1.5) we can admit that in convertible currency systems prices need not necessarily fall. For that, it is enough that α_C is sufficiently high. But this value in such systems may be taken as random[53]. If it depends on the production of a precious metal and the relative price structure in large economies, then in small economies we must add the international circulation of precious metals that is established in these economies. This behaviour will dictate an increased likelihood of the absence of a unit root in the behaviour of prices in small economies that are relatively open to large economies.

We may look at the case of economies whose currency is non-convertible. In this case we have the hypothesis of "managed currency" behaviour. The concept of exogenous money supply $\bar{m}_t$ is now introduced, and the equality of equilibrium be-

[53] This does not mean that some authors have not tried to endogenize the behaviour of the monetary supply of precious metals. See the studies by Robert Barro (1979), Rockoff (1984) and Bennett McCallum (1989).

tween money demand and supply, $m_t = \overline{m}_t$. Equations (1.5) and (1.7) thus undergo a slight change

$$p_t = \frac{\beta_C}{1-\beta_1 \cdot \gamma} + \left(\frac{1}{\alpha_1} \cdot \overline{m}_t - \frac{\alpha_0}{\alpha_1} \cdot m_{t-1} - \frac{\alpha_C}{\alpha_1}\right) \tag{1.9}$$

This behaviour highlights the positive tendency in the growth of prices as a result of decisions on the money supply that over-value full employment product growth or that over-correct foreseeable reductions in the velocity of money circulation (or by default increases in this velocity). An economy with policies geared to maintaining full employment and which penalizes restrictions on liquidity, could lead to a continuous rise in prices, as mentioned above.

We find from (1.6), (1.7) and (1.9) that the behaviour of prices is substantially different in the two systems discussed here[54]. It is interesting to note that in the case of non-convertible currency we move straightaway from prices to a regular behaviour of the rate of inflation.

As mentioned above, we conclude that there is no point in taking inflation rate characteristics, in terms of mean values and standard deviation, to compare the performances of the two systems[55]. On the contrary, we should compare periods (or economies) within a convertible currency system using the statistical characteristics of prices and, for a non-convertible currency system; we should use the inflation rate characteristics.

We have used simulated values to illustrate the consequences of not respecting this principle. We simulated a series of 150 observations, using only the last 101 values (from 50 to 100). The series of random values, u_t, was created as the probabilistic value in accordance with the Normal (0,1), for the values that are generated by a uni-

[54] Despite the result found by Robert Barsky (1987).
[55] Lee Craig; Douglas Fisher and Theresa Spencer (1995) draw attention to the phenomenon of international integration of prices under the gold standard, linking it to a lower rate of inflation. This integration does not take the same form with national non-convertible currency.

form distribution[56]. The price series in the convertible currency system is given by $P_t^C = u_t$, and in a non-convertible currency system by $P_t^{NC} = P_{t-1}^{NC} + u_t + 0{,}4 \cdot T_t$, where $P_1^{NC} = 1$. The price series show mean values equal to 100. We repeated the simulation 500 times, so that the mean price or inflation rate is the mean of these means, and the standard deviation the mean of the standard deviations. The coefficient of variation is given by the division of this last by the value obtained for the mean. The values are found in Table 1.

[Table 1 here]

As we can see, the variable chosen for comparison determines which system is considered as the most stable. If we consider the inflation rate though with a lower mean of inflation rates, the convertible currency system shows the highest value for the coefficient of variation. The relative uncertainty is thus much greater in convertible systems. Precisely the opposite is found if we consider prices. The most stable system now is that of currency convertibility. It does not make sense to compare the Gold Standard with the later systems on the basis of the same variable, that is, the inflation rate, as Bordo and Kydland (1996) and Bordo and Kydland (1997) did for some countries, following the earlier results obtained by Basrky (1987). In the same way as the test by George Alogoskoufis and Smith (1991) and Ron Alogoskoufis (1992) on the growth of the persistence of the Gold Standard inflation for the following systems is deprived of meaning.

[56] In terms of the RATS econometric software, *u = %invnormal* (*%uniform*(0,1)).

5. The Gold Standard in Portugal: some indicators

5.1. General Indicators

The characterization of the Gold Standard period in Portugal is displayed in a comparative form in Tables 2 and 3. We have included in these tables the Bretton Woods period from 1949 to 1972, and the subsequent period up to the EMU, from 1973 to 1998. The values included are the mean (μ) of the variable indicated there and the standard deviation (σ) of that variable.

[Table 2 here]

[Table 3 here]

The results are not very different from those found in Richard Cooper (1982), Bordo (1993), Bordo and Santos (1995) and Bordo and Jonung (2001). Although the inflation rate was lower during the first period (0.2%), the standard deviation for inflation reached a higher value during the Gold Standard than during Bretton Woods.

However, as we have said, the comparison in terms of nominal stability[57], where the Gold Standard is concerned, should be made using prices, and not the inflation rate. Bearing this in mind, we can see how the Gold Standard period was one of great price stability. Its standard deviation was 1/3 of that occurring during B-W. As we expected, product growth was substantially higher during B-W, at almost 5% as against nearly 2%, during the Gold Standard. There was also less product stability during this period[58]. With respect to the money supply, we should note lower growth under the Gold Standard and instability of such growth in the period following Bretton Woods. In short, we may conclude that the nominal stability during the Gold Standard contrasts with the real stability of the Bretton Woods period.

[57] Accepting prices are stationary.
[58] Jaime Reis (2000) mention the phenomenon of real instability in periphery countries during the gold standard as reflecting the asymmetry of this system.

5.2. Analysis of the Stationarity of the Series

Before moving on to the study of the modelling of the Gold Standard period, we should examine the characteristic of stationarity of the series involved. Besides the most current augmented Dickey-Fuller tests for unit root[59], in which we follow the methodology proposed by Hamilton (1994), we performed other calculations, namely: the KPSS stationarity test[60]; finding the limit values for ρ from the t_{ADF} test, at the level of 90%, in accordance with Stock (1991); Bhargava's R_1 e R_2 ratios (1986), with the random walk null hypothesis against the alternative of stationarity, with and without a constant, respectively; and, finally, the corrected ADF test, *DFGLS*, in accordance with Graham Elliot, Thomas Rothenberg and James Stock (1996) and *DFGLU*, in accordance with Elliot (1999). In the KPSS test we used the lags obtained in the first ADF test that eliminate the auto-correlation problem by means of the LM test. The asterisks have the usual meaning of rejection of H0, *** at 1%, ** at 5% and * at 10%, except for the KPSS test, where *** means non-rejection of stationarity at 10%.

The results are given in Tables 4 and 5, below.

[Table 4 here]

[Table 5 here]

Regarding Product and Prices in the 1854-91 period, all the tests indicate that we should accept the stationarity of the respective series. The results are not quite so clear with respect to Money: one test excludes the presence of a unit root and another does not exclude stationarity. All the others correspond to a rejection of stationarity. One reason for these results may lie in the limit value to the right of ρ, a value very close to the unit.

As we said at the outset, we have a second Gold Standard period that lasted from 1891 to 1913. In this period of "extended Gold Standard", only Prices can be

taken as stationary. Product and Money are clearly not stationary. During this period, Prices still have the characteristic appropriate for the convertible currency system.

In the light of these results, in terms of the construction of VAR models, we may opt for a model with variables on levels, for the first period. For the second, we may choose a VAR model with variables on levels or with variables on first differences[61] including, where necessary, an ECM term[62]. Since we are also interested in comparing the results, we have chosen a VAR model on levels for the second period. As we shall see, special care is taken with the stationarity of the models obtained.

6. A VAR model for 1854-91 and 1854-1913

Moving on to the study of a VAR model with Product (Q), Prices (P) and Money (M)[63], the model considered is of the type

$$\mathbf{A}(L) \cdot \mathbf{x}_t = \mathbf{A}_0 + \mathbf{e}_t \tag{2.1}$$

where

$$\mathbf{x}_t = \begin{bmatrix} Q \\ P \\ M \end{bmatrix} \tag{2.2}$$

is the vector of the endogenous variables, $\mathbf{A}(L)$ the matrix of coefficients of the lags of $\mathbf{x}_t$, $\mathbf{A}_0$ the vector of the model's constants, and $\mathbf{e}_t$ the vector of errors with the normal I.I.D. characteristics.

To select the order for the VAR model we used Akaike, ($AIC = N \cdot log|\Omega| + 2 \cdot (k_{UR} \cdot K)$)[64] and Schwarz ($SBC = N \cdot log|\Omega| + k_{UR} \cdot K \cdot log(N)$) indicators, as well as

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[59] Statistics $t_{\rho = 1}$ and $N \cdot (\rho - 1)$, where N is the number of observations. See David Dickey and Wayne Fuller (1979), Peter Phillips (1987) and Phillips and Pierre Perron (1988).
[60] See Denis Kwiatkowski; Phillips; Peter Schmidt and Yomgcheol Shin (1992).
[61] Since the first difference for Product and Money are stationary variables.
[62] This means that we are estimating a VECM model.
[63] Q represents the per capita GDP at 1990 prices; P the implicit deflator of GDP 100 in 1990; and M represents the per capita M1 monetary stock. All the variables have been converted into logs.
[64] Where N, k_{UR} and K represent the number of observations, the number of parameters for each equation of the unconstrained model and the VAR order, respectively.

a likelihood ratio test (LR) in accordance with the correction proposed by Sims (1980). The values obtained are given in Table 6. The value in brackets in the "LR" column is the significance level of the value of χ^2 of order 9.

[Table 6 here]

As we can see, those two indicators and the LR test point in the same direction: reject K = 4 against K = 3, K = 3 against K = 2 and finally K = 2 against K = 1. The model that we are going to retain is thus of order 1. As Table 7 shows, the root modules are below the unit, and so the model is stationary.

[Table 7 here]

Employing the Choleski decomposition, we estimated the error variance decomposition of each variable in terms of their individual contribution. The results for the fiftieth observation are given in Table 8.

[Table 8 here]

We have to stress the influence of Product and Prices on Product and Prices. Money plays little part in explaining the errors of these variables. Note too the importance of Money and Product on Money itself. This behaviour may be explained by the fact that, in fact, the money is based on the production of metal and on fiduciary behaviour, which latter is dictated by the evolution of production.

6.1. The Study of Shocks on the Model Variables

Continuing with the Choleski decomposition, we show in Figures 1 and 2 below the effects of shocks (standard deviation of each estimation) on each variable[65].

As the models estimated are stationary (Table 7), the impulses resulting from shocks tend to become null with the passage of time. Analysis of these models should

[65] We used the RATS monteva2.prg program, which applies the methodology indicated in Sims and Tao Zha (1999). Below another RATS program is used montezha.prg, applying the same methodology to the case of an above-identified model.

therefore lead us to choose a maximum period for which we can carry out a study on the effects of such shocks. For this we have chosen a period of ten years.

Graphic analysis of the effects of shocks shows some similarities, but also differences, in the two models.

A shock to Product:

— has immediate deflationary effects, but after 3 or 4 years the effect is virtually null;

— has long-lasting effects on Product and Money. After 10 years Product and Money still register 1/3 and 36% of the percentage value of the shock on the Product, in the first model, and 27% and 30% in the second model[66].

[Figure 1 here]

We can see what is happening when there is a shock to Prices:

— its effects on Product and Money are important. After 10 years these variables still registered 39% and 42% of the percentage value of the shock on Prices, in the first model, and 44% and 20%, in the second model;

— its effects on Prices themselves are very different in the two models. In the first model, at the end of the 10 year period, the effect is 0.16% of the initial shock, and in the second it is 22%. We may say, then, that in one case the effects were nullified quickly, while in the other these take longer.

[Figure 2 here]

Finally, we can look at the reactions to a monetary shock:

— in both models, the effects on Prices vanish quite quickly, while on Product and Money they are more persistent. After 10 years, the effects on these last two

[66] This result differs from that obtained by Bordo (1993) using a VAR model with an inflation rate and product variation rate, where supply shocks also affect inflation. For an explanation of this "strange result", see John Keating and John Nye (1998) and Tamim Bayoumi and Eichengreen (1994). Bayoumi and Bordo (1998), too, failed to get the results expected for the case of the USA, contrary to what happened for the United Kingdom.

variables are 4.1% and 4.5% of the initial percentage shock on Money, in the first model, and 2% and 5%, in the case of the second model, respectively;

— the deflationary effect of a growth of money, in the second model, is odd, to say the least, especially in the years close to the shock.

The results found for shocks to products can also be regarded as increases in the demand for coined metal, and the results obtained here are in agreement with the analysis by Barro (1979) and McCallum (1989), for the short-term, and also with Rockoff (1984), from the long-term perspective.

Two differences in the behaviour of the two models should be stressed: the effects of Price shock on Prices themselves, and the effects of a Money shock on Prices. In the model restricted to the Gold Standard: the effects on Prices of a shock to Prices themselves are quickly annulled – which does not happen in the other model; and a shock to Money has positive effects on Prices, which, however, tend to disappear quickly – while in the other model, we find deflationary effects[67]. Another feature of shocks, in either model, relates to the fact that, in the first model, Product variations are always accompanied by slightly higher Money variations, which does not happen in the second model. This behaviour ought to mean that in a small economy, like that of Portugal, the positive evolution of a Product is accompanied by a Money evolution motivated by a requirement related to circulation or even reserves (or net wealth held).

Having analysed the impulses on variables, in the two models, it seem to us that they indicate a confirmation of Gold Standard behaviours in the case of the first model, that is, in the case of the model restricted to the exclusive Gold Standard period. This is why our analysis now on focuses solely on this period, and thus on the first model.

[67] Bordo and Redish (1993) draw attention to deflationary policies in periods of non-convertibility as a way of resolving credibility problems.

The results obtained above enable us to give some general characteristics for the Gold Standard period in Portugal. In this period, Product, Prices and Money are stationary variables. This means that no matter what the shock to each of them, it would end up being annulled, and thus it would leave no permanent effects. In terms of macroeconomic behaviour, we found that the shocks to Product have very persistent effects on Product itself and on Money. Prices, too, have positive effects on Product and Money, although less important than shocks to Product. Finally, the effects of shocks in Money supply are not felt on Prices, and are felt in product and itself, but extremely weakly. The endogeneity of money and the behaviour of prices in a reality that is international are thus emphasized in this model of the Portuguese economy for the period 1854-1891.

6.2. Analysis of Supply, Demand and Monetary Shocks

These results may be regarded as confirming the classical hypothesis of supply shocks ($\varepsilon_{S,t}$) which overwhelmingly affect the product and demand shocks ($\varepsilon_{D,t}$), or monetary shocks ($\varepsilon_{M,t}$), which are exerted on prices and not on production. The errors of equation (2.1), instead of presenting the usual structure in a Choleski decomposition,

$$\begin{bmatrix} e_{Q,t} \\ e_{P,t} \\ e_{M,t} \end{bmatrix} = \begin{bmatrix} g_{11} & 0 & 0 \\ g_{21} & g_{22} & 0 \\ g_{31} & g_{32} & g_{33} \end{bmatrix} \cdot \begin{bmatrix} \varepsilon_{Q,t} \\ \varepsilon_{P,t} \\ \varepsilon_{M,t} \end{bmatrix} \qquad (2.3)$$

may take another form[68], where we define supply shocks as being exerted solely on production, demand shocks on prices, and nominal shocks that are exerted via a monetary equilibrium equation. The Equation (2.4) expresses this behaviour,

[68] Sims-Bernanke decomposition. See Ben Bernanke (1986).

$$\begin{bmatrix} e_{Q,t} \\ e_{P,t} \\ e_{M,t} \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ g_{31} & g_{32} & 1 \end{bmatrix} \cdot \begin{bmatrix} \varepsilon_{S,t} \\ \varepsilon_{D,t} \\ \varepsilon_{M,t} \end{bmatrix} \tag{2.4}$$

This definition of shocks has become generally accepted. But although the idea is promising, it cannot be sustained. Equation (2.4) implies an over-identification of order 1 of the matrix **G** which is clearly rejected by a probability ratio test: $\chi^2 = 63.465$.

Within the possible definitions of shocks, and bearing in mind the results obtained earlier, we eventually chose a model where the matrix **G** = **G*** took the following form

$$\begin{bmatrix} e_{Q,t} \\ e_{P,t} \\ e_{M,t} \end{bmatrix} = \begin{bmatrix} 1 & g_{12} & g_{13} \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} \varepsilon_{S,t} \\ \varepsilon_{D,t} \\ \varepsilon_{M,t} \end{bmatrix} \tag{2.5}$$

The likelihood ratio test leads to the non-rejection of the null hypothesis for a constraint implied in Equation (2.5), its value was $\chi^2 = 0.598$ (0.439), where the respective significance level is in brackets.

Using the above decomposition, we again considered shocks of the magnitude of the standard deviations associated with the estimation of the model. The results are given in Figure 3.

[Figure 3 here]

We given a brief description of the results obtained. Supply shocks do not affect Prices[69] and have lasting positive effects on Product and Money. After 10 years, the effects on production and Money are still 60% and 64% of the initial percentage supply shock. Demand shocks have deflationary effects on the Product and Money which are disappear relatively quickly. The effects of a demand shock on Prices meant that by the 3rd year less than 1/10 of the initial shock was registered, and

the effects disappeared swiftly[70]. Monetary shocks have positive effects on all the variables in the model, although these effects disappeared quickly with time[71]. The maximum effect on production occurred after 3 years and represents 9.5% of the initial monetary shock. It is interesting to see that a joint supply and demand shock is neutral. If the results are deflationary on the Product, in the first 3 years, and on Prices, in the first 4 years, these quickly converge to symmetrical values, nullifying any effect of these shocks in the medium term.

A better confirmation of the appropriate application of the principles of classical economics to the Gold Standard would be impossible to find. But this does not mean that we would uphold the old notion of the equilibrium and smoothness of such a system[72]. In our ideas and, why not say so, too, in our culture, demand policies and monetary policies hold an important position. Indeed, they either had harmful effects under the Gold Standard, or they had no significant impact at all. It seems to us that Robert Mundell (1995) and Bordo and Eichengreen (1998) are equally correct when they attribute the disasters of inappropriate policies to the policies themselves, or to the actual system. The Gold Standard did not allow the use of the policies we have seen above. It was able to exist because it corresponded to the political consensus of those represented in the governments that really held power[73].

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[69] It might be better to say that their effect is small and fleeting. Falling into what we could call an example of beneficial deflation.

[70] Selahattin Dibooglu (1998), using a model of a similar type to that used here, supports the temporary growth of the effectiveness of demand shocks, which eventually accompanied the evolution of monetary systems.

[71] This seems to support those who defend convertible systems as a way of achieving price stability. See Kevin Dowd (1993).

[72] The classical position of Bloomfield (1959) on these aspects is well known.

[73] See Jeffry Frieden (1992).

7. Conclusion

Thirty-seven years of convertibility, apart from the three-month moratorium in 1876, demonstrated, for a peripheral country like Portugal, that the adoption of the Gold Standard in 1854, alone in following the example of Great Britain, was the right decision, and a practical one, given the chaos of the country's monetary situation. Even though the factors that motivated it were obviously different from those which, two decades later, led most other countries to adhere to the disciplinary rigour of that monetary system.

Remittances from emigrants and the ability to borrow on the markets enabled Portugal to become a net importer of gold, which was a crucial factor for maintaining the gold convertibility of the Portuguese currency. All this came to an end in 1891, when the country was unable to secure loans abroad and its monetary reserves were extremely depleted, largely thanks to the crisis in Brazil, the source of most of the emigrants' earnings, and the monetary authorities had no choice but to adopt a system of a flexible exchange rate for non-convertible paper money.

Portugal returned to gold in 1931, but at a devalued parity. In any case, this return lasted a brief 82 days. As had happened in 1891, suspension of convertibility again resulted from an international financial crisis. This act demonstrated the willingness of the authorities to peg the monetary unit to international benchmark currencies in an effort to achieve a situation of macroeconomic stability. But times had changed and so had the requirements of economic policy. Our work has shown that it would have been impossible for that system to continue.

The Gold Standard period for Portugal was, therefore, from 1854 to 1891, although certain of its macroeconomic characteristics remained in place until 1913. The performance of the system in Portugal, compared with subsequent systems, was not much different, on the whole, form that experienced by other countries.

Prices between 1854 and 1891 were stationary, that is to say, they exhibited the characteristics that were expected from the Gold Standard from the outset. In an international market like the Gold Standard, a small economy, such as that of Portugal, has absolutely no chance of controlling the money supply, and international competition would drive towards single prices. We can thus see the absence of inertia in the actual behaviour of prices, which was not observed for the large important economies in the international context. Similarly, we can find in the modelling of supply, demand and monetary shocks, an illustration of the classical position of economics. But his last outcome also represents the reason why the Gold Standard could not exist after 1945. A world that began to demand State intervention through demand policies and monetary policy initiatives with the aim of achieving full employment is not compatible with the Gold Standard.

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Table 1: Simulated Results

—	Mean	Standard Deviation	Coefficient of Variation
P^C	100	1.00	0.010
$\dot{P}^C$	≈ 0	0.014	123.38
P^{NC}	100	34.00	0.34
$\dot{P}^{NC}$	0.013	0.004	0.301

Table 2: Values for Prices and Inflation

Period	$\mu_{\dot{P}}$	$\sigma_{\dot{P}}$	σ_P
1855-1891	0.0019	0.0604	0.0600
1855-1913	0.0039	0.0508	0.0850
1949-1972	0.0233	0.0228	0.1622
1973-1998	0.1299	0.0612	1.0840

Table 3: Values for Product and Money

Period	$\mu_{\dot{Q}}$	$\sigma_{\dot{Q}}$	$\mu_{\dot{M}}$	$\sigma_{\dot{M}}$
1855-1891	0.0195	0.0663	0.0327	0.0467
1855-1913	0.0142	0.0566	0.0287	0.0433
1949-1972	0.0492	0.0317	0.0694	0.0464
1973-1998	0.0275	0.0342	0.1439	0.0703

Table 4: Unit Root and Stationarity Tests, 1854-91

Test	**Product**	**Prices**	**Money**
$t_{\rho = 1}$	– 4.107** *(T)*	– 4.317***	– 2.323 *(T)*
$N \cdot (\rho - 1)$	– 23.67** *(T)*	– 21.79***	– 23.22***(T)*
KPSS	0.083*** *(T)*	0.113***	0.053***(T)*
Stock ($\rho_{m,M}$)	[–, 0.876]	[–, 0.839]	[0.853, 1.035]
R_1	-	0.9898**	0.2319
R_2	1.000**	-	-
DFGLS	– 2.790*	– 3.204***	– 1.742
DFGLSU	– 3.022*	– 3.404***	– 1.842

Table 5: Unit Root and Stationarity Tests,, 1854-1913

Test	**Product**	**Prices**	**Money**
$t_{\rho = 1}$	– 2.385 *(T)*	– 3.92** *(T)*	– 2.331 *(T)*
$N \cdot (\rho - 1)$	– 11.56 *(T)*	– 23.77** *(T)*	– 7.99*(T)*
KPSS	1.015 *(T)*	0.282 *(T)*	0.621*(T)*
Stock (ρ_{m},*M*)	[0.846, 1.035]	[–, 0.904]	[0.832, 1.018]
R_1	-	0.353	0.2079
R_2	0.3321	-	-
DFGLS	– 1.625	– 3.170**	– 0.151
DFGLSU	– 2.103	– 3.265**	– 2.166

Table 6: Selection of the VAR order 1854-1891 and 1854-1913

Lags	AIC	SBC	LR	AIC	SBC	LR
4	-569.6	-510.3		-1001.0	-922.1	
3	-571.7	-526.0	9.936 (0.356)	-1005.9	-945.1	10.111 (0.341)
3	-585.7	-539.1		-1013.8	-952.5	
2	-595.2	-562.5	6.085 (0.731)	-1020.1	-977.2	9.658 (0.379)
2	-599.4	-566.1		-1019.5	-976.2	
1	-610.5	-591.5	6.855 (0.652)	-1034.5	-1009.7	2.206 (0.988)

Table 7: Roots of the Characteristic Polynomial, 1854-1891 and 1854-1913

Root	Module	Root	Module
0.95544	0.95544	0.97275	0.97275
0.33190 – 0.023i	0.3327	0.80776	0.80776
0.33190 + 0.023i	0.3327	0.39223	0.39223

Table 8: Variance Decomposition – 50th Observation

Influence of:	Q	P	M	Q	P	M
Product	88.2	9.3	2.5	79.8	18.3	1.9
Prices	81.2	17.8	1.0	62.8	31.3	5.9
Money	55.8	6.0	38.2	43.2	3.2	53.6

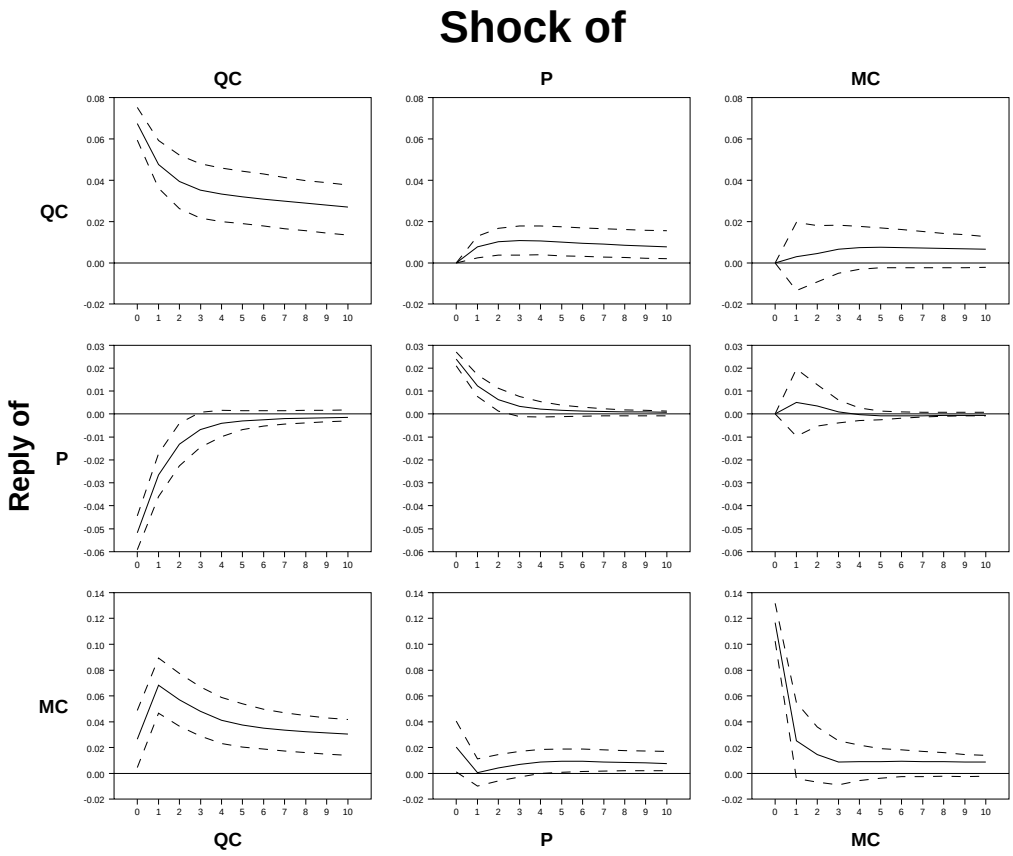

Figure 1: Standard Deviation Shocks (Choleski), 1854-91

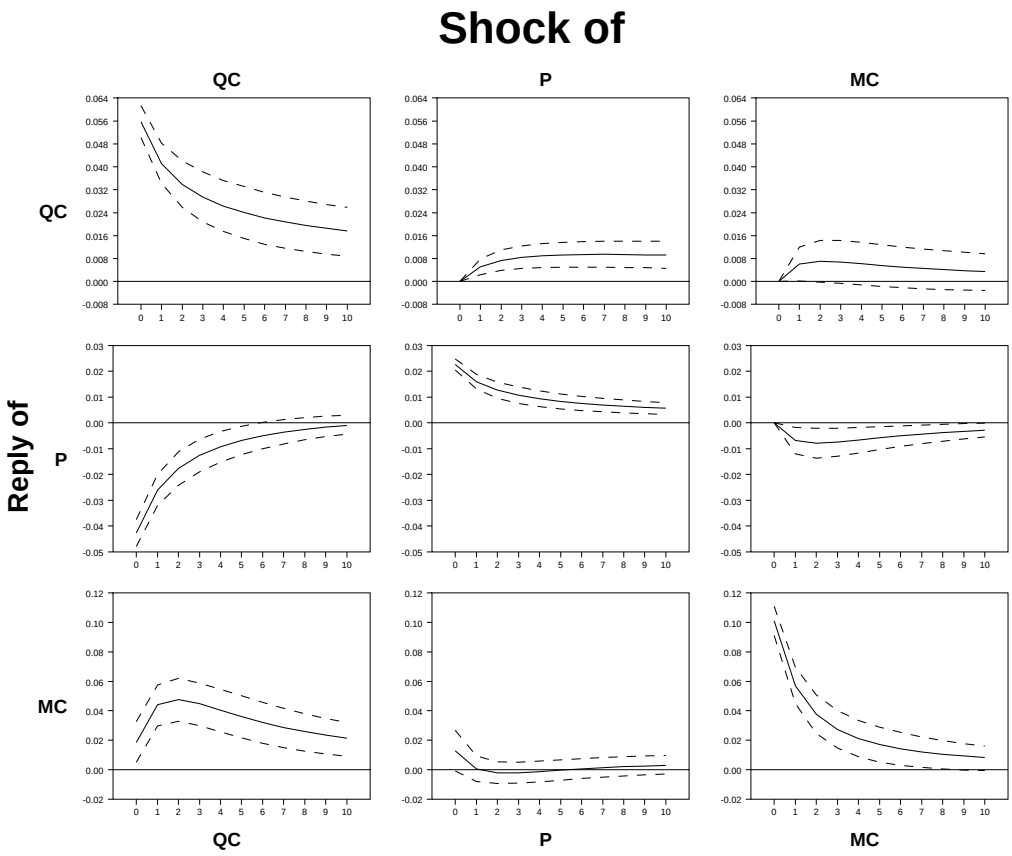

Figure 2: Standard Deviation Shocks (Choleski), 1854-1913

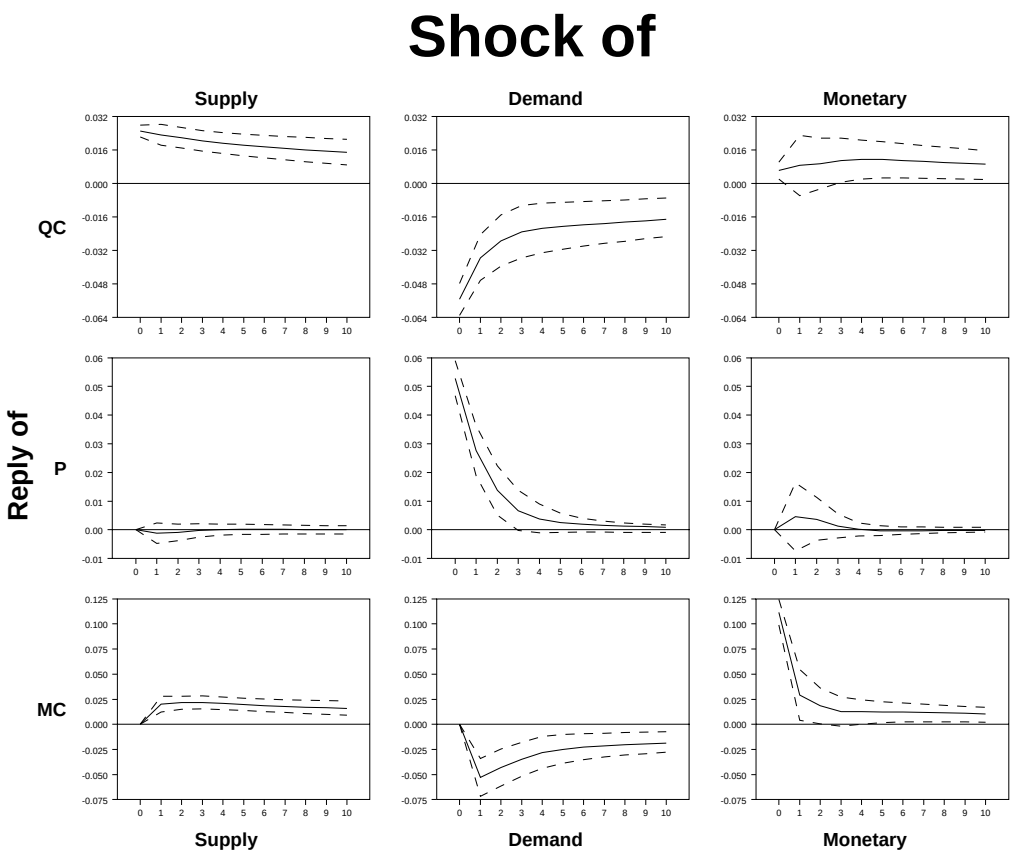

Figure 3: Standard Deviation Shocks (Sims-Bernanke), 1854-91