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SPAIN 1856-1874**

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## **Abstract**

This paper analyzes the Spanish monetary system from 1856, when the Bank of Spain was created, to 1874, when it was awarded the monopoly of emission. This period was characterized by the emergence of an unregulated banking system, with multiple banks of issue entitled to emit bank notes. We focus on two main issues: i) the large fluctuations in the money supply during this period; and ii) the lack of a lender of last resort in the banking panic of 1866. To analyze this, we construct a new dataset on money supply aggregates. The paper also estimates the economic impact of monetary fluctuations with the help of a calibrated new Keynesian model. Our results suggest that money supply shocks had a milder effect on inflation and output than the one predicted by the theory.

**Keywords:** unregulated banking, Gresham's law, lender of last resort, Overend and Gurney crisis.

**JEL classification:** N13, N23, E31, E5.

## **Resumen**

Este trabajo analiza el sistema monetario español desde 1856, fecha de la creación del Banco de España, hasta 1874, cuando este recibe el monopolio de emisión de billetes. El trabajo analiza dos aspectos fundamentales: i) el funcionamiento de un sistema monetario con múltiples bancos de emisión y sin un «prestamista de última instancia»; y ii) el papel jugado por las grandes fluctuaciones en la oferta monetaria sobre la crisis española de 1864-1866. Tras haber descrito la situación histórica en ese periodo, se presenta una nueva base de datos con información acerca de la oferta monetaria y sus componentes para este periodo. Dicha base de datos se emplea para comparar la evolución de las principales series económicas con las predicciones de un modelo Keynesiano de equilibrio general capaz de replicar la evolución de la cantidad de dinero. Los resultados indican que las fluctuaciones en la oferta monetaria tuvieron un menor efecto sobre la inflación y el producto agregado de lo predicho por el modelo.

**Palabras clave:** Overend y Gurney, oferta monetaria, crisis financiera, Banco de España, Bimetalismo.

**Códigos JEL:** N13, N23, E31, E5.

# 1 Introduction

We analyze the Spanish monetary system from 1856, when the Bank of Spain was ‘created’, to 1874, when it was awarded the monopoly of emission. This period was characterized by the coexistence of the Bank of Spain and other local banks of issue in a system of fractional-reserve banking. In this paper we describe the origins and operation of such a system. In particular, we focus on two issues: i) the lack of a lender of last resort due to the atomization of the system, which had dramatic consequences during the banking panic of 1866; ii) the role of the large fluctuations in the money supply in the Spanish crisis of the years 1864-1866.

The ‘creation’ of the Bank of Spain in 1856 was not the first attempt to introduce a bank of issue in Spain. The first bank of issue had been the Bank of *San Carlos*, renamed in 1829 as Banco de *San Fernando*. In the early 1850s, Spain experienced a shortage in the money supply and the Bank of *San Fernando* was constantly at its maximum legal emission volume of banknotes. At this time, a debate emerged on the way to increase the money supply. The response of the Government was to introduce, together with other liberal laws, the Law of Banks of Issue, which broke the monopoly of emission of the Bank of *San Fernando*, renamed as the Bank of Spain, by creating a system of multiple banks of issue. New banks had the monopoly of emission in their cities, while the Bank of Spain had the monopoly of emission in Madrid and in any place where no bank of issue was to be created. Thus, the Bank of Spain was created not as the sole bank of issue in the country, but as *primus inter pares*.

This arrangement had many similarities with free banking systems, such as those of Scotland or the United States in the 19<sup>th</sup> century. Any entrepreneur was free to open a new bank of issue in any Spanish city where there were no existing issuer or a branch of the Bank of Spain. These local banks were free to issue their own banknotes, to accept deposits, and to reject banknotes from other issuers. However, the system was not completely unregulated as the maximum volume of emission was limited to three times the capital and the amount of metallic reserves.

Together with the Law of Banks of Issue, the Government introduced other liberal laws in the period 1854-1856. In particular, the Railroads Law provided state aid for the construction of new railways lines, and the Joint Stock Banks Law defined the conditions for the establishment of investment banks similar to the recently created *Crédit Mobilier* in France. The new laws encouraged the increase of credit, money supply and economic activity, especially in the railways sector. Due to these laws, the Spanish economy experienced a sustained period of growth and development from 1856 to 1864. The international environment also supported the economic expansion of these years due to

the large expansion in the world money supply following discoveries of new gold deposits in California, Australia and Russia.

The limitations of the particular banking system in Spain became apparent during the international crisis of 1864-1866. The absence of a lender of last resort and the local structure of the system of banks of issue reduced the capabilities of any single bank to cope with the credit crunch, especially after the banking panic of May 1866 that followed the bankruptcy of the English stock-bank Overend, Gurney and Co.<sup>1</sup> The fiscal position of the Government severely constrained the conduct of monetary policy by the Bank of Spain. At the same time, the small size of the local banks of issue forced them to reduce the amount of banknotes in a more conservative way than the Bank of Spain, in order to limit the risks of a bank-run on banknotes. The consequence of the crisis was a collapse in the Spanish banking system that took several years to repair. This period of deleveraging and reconstruction came to an end in 1874, when the Government decided to award the Bank of Spain the monopoly of emission in the whole country, giving the rest of banks of issue the possibility of either to merge with the Bank or to operate solely as commercial banks.

To analyze the evolution of monetary aggregates during the period, we construct a database with information about the volume of metallic coins, banknotes and current accounts. The database is constructed by collecting dispersed information about net inflows and outflows of money from a variety of sources.<sup>2</sup> Our results indicate that most of the Spanish monetary base was composed of metal coins: on average, the volume of coins was 15 times larger than the volume of banknotes. This is evidence of the underdevelopment of the Spanish financial system at the time. In addition, we document the severe contraction in the money supply during the period 1856-1866 and its progressive recovery from 1868 to 1873. This contraction was the consequence of both the international crisis and the 'Gresham's Law'. The monetary imbalances due to the American Civil War induced a flow of silver towards Eastern countries. Spain had at the time a bimetallic system where the mint ratio between gold and silver was higher than the market ratio. In these conditions, large amounts of silver were drained from Spain, implying a decline in the money supply.

In addition to describing the historical context, this paper attempts to quantify the impact of the fluctuations in the money supply in the observed evolution of output and

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<sup>1</sup>The lack of a lender of last resort was common in European economies at the time, with the exception of England. See below for details.

<sup>2</sup>In contrast to previous studies, such as Martin-Aceña and Pons (2005), which compute the amount of gold and silver taken data from the mint, we analyze inflows and outflows of specie. The reason is that, due to the large capital and trade flows during the period, only employing coinage information may misrepresent the real amount of specie within the country.



prices. To this end, we calibrate a standard new Keynesian model as in Gali (2009) and Woodford (2003). This microfounded general equilibrium model extends the traditional Keynesian IS-LM analysis with a forward-looking Phillips curve, and thus allows to analyze the effects of changes in the money supply on nominal and real variables. We assume that the money supply is characterized by an exogenous stochastic process that replicates the values in the data. Then, we compare the counterfactual evolution of output, inflation and interest rates with that in the data. We find that, in the model, the drop in the money supply from 1860 to 1866 implies large deflationary effects, which produce a fall of around 30 percent in output and around 10 percent in inflation. This prediction is in contrast with the historical data, in which output and inflation were roughly constant during the same period. Also, the effect of the recovery of money growth after 1867 on output and inflation is delayed in the data with respect to the model. These results indicate that the severe contraction in the money supply had a milder effect on the economy than the one predicted in the new Keynesian framework.

This paper is related to two different strands of the literature. In the first place, it relates to previous studies of the Spanish economy in the 1856-1874 period, such as Fernández-Pulgar and Anes-Álvarez (1970), Martín-Aceña (2000), Sánchez-Albornoz (1966), Sánchez-Ballesta and Bernal (2010), Sardà (1998), Sudrià (1994), Tedde (1999, 2004, 2006) and Tortella (1969, 1973). We complement this literature by focusing on the monetary aspects and international linkages of the boom and the bust. In the second place, this paper relates to the growing literature that employs dynamic stochastic general equilibrium (DSGE) models to analyze economic events before Bretton Woods. Most of these works, including Bordo et al. (1995, 2000), Christiano et al. (2003), Cole and Ohanian (1999) and Kehoe and Prescott (2002), focus on the Great Depression.

The structure of the paper is as follows. In section 2, we describe the Spanish financial system in 1856. In section 3, we analyze the boom and bust cycle of the Spanish economy in the period 1856-1874, with a focus on the international crisis of 1864-1866 and its effects on the Spanish economy. In section 4, we introduce the dataset and discuss the evolution of money supply and its impact on output and prices in the context of the new Keynesian model. Finally, in section 5, we conclude.

## **2 The Spanish Financial System in 1856**

### **2.1 The Ancestors of the Bank of Spain**

The Bank of Spain was ‘created’ on 28<sup>th</sup> January 1856. It was not, however, the first attempt to establish a central bank in Spain. In fact, the first bank of issue was the Bank

of *San Carlos*, which was introduced in the country during the kingdom of Carlos III. It was inspired by the ideas of the Enlightenment and followed the example of the Bank of England and the Sveriges Riksbank. The aim of the Bank was to help the Treasury to raise funds. Unfortunately, the increase in public deficit and the fall in revenues from the American colonies due to the continuous wars with the Revolutionary France (1793-1795), Great Britain (1796-1802 and 1804-1808) and Napoleonic France (1808-1814), depressed the value of public debt and the solvency of the Bank. Finally, in 1829, it was closed and renamed as Bank of *San Fernando*.

The Bank of *San Fernando*, as its predecessor, had the monopoly of issue in the city of Madrid, which at the time was the only place where banknotes were accepted. It also discounted trade bills and provided short-term loans to the Treasury. The Bank was a key factor of the victory of the liberal faction that supported future Queen Isabel II during the Spanish Civil War (*Primera Guerra Carlista*, 1833-1840).<sup>3</sup> The end of the war was followed by an intense economic boom. The Bank of *San Fernando* was then accused of abusing of its monopoly of issue to obtain large profits by rationing credit and hence two new banks of issue were created in 1844: the Bank of Barcelona, in Barcelona, and the Bank of Isabel II, also in Madrid. In 1846, a fourth bank was created in the Southern city of Cadiz.

The Bank of Isabel II was controlled by a new generation of liberal entrepreneurs, such as José Salamanca, with strong links to the Government. In contrast with the Bank of *San Fernando*, which directed most of its credit to the Government, the Bank of Isabel II financed some private projects, such as the railway line Madrid-Aranjuez, and provided funds to speculate in stock markets. These loans were typically guaranteed by stocks and the borrowers were often members of the Governing Council of the Bank, especially José Salamanca. When the European economic crisis began in 1847, it was clear that most of the credits of the Bank of Isabel II would not be recovered. To avoid bankruptcy, José Salamanca himself became Finance Minister and led the merge of the Bank of Isabel II with the more conservative (and healthier) Bank of *San Fernando* in a new institution, which retained the name of Bank of *San Fernando*.

During the period 1849-1854, the working of the Bank was reorganized by a couple of laws, one in 1849 and the other 1851. The capital of the Bank was set to 30 million pesetas, and the maximum volume of banknotes was limited to the same amount as the capital. The maximum ratio of banknotes over metallic reserves was set to three and no lending was permitted if the collateral were stocks of the Bank. During this period the new Governor of the Bank, Ramón Santillán, redirected most of the profits to mitigate

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<sup>3</sup>Tedde (2006) estimates that the Bank provided 8 percent of the war costs.

the consequences of bad loans in the Bank balance-sheet.<sup>4</sup> The other two banks of issue, those of Barcelona and Cadiz, had a paid-up capital of 1.2 and 2 million pesetas and circulating banknotes with a total value of 2.4 and 2.7 millions, respectively.

## 2.2 The 1854-1856 Liberal Laws

The Bank of Spain was ‘created’ in the period 1854-1856, when a new liberal Government, headed by Baldomero Espartero, began the discussion in the Parliament of a series of new laws aimed at modernizing the Spanish economy. These laws had a profound impact on the evolution of the Spanish economy in the next two decades. Spain had at the time a predominant agrarian economy that kept more than 63 per cent of labor force predominantly occupied in subsistence production of wheat and other grain crops. The only exceptions were Catalonia, where there was a modern textile industry, and some cities in the Southeast, Andalusia and the North, where there was an increasing mining activity under the incentive of the foreign demand. Industrial working population accounted for 17 per cent of the labor force and the Gross Domestic Product (GDP) was equivalent to 73 per cent of the mean of that of the 15 European countries that later would form the European Economic Community.<sup>56</sup>

The first of the laws, known as ‘Expropriation of Madoz’ (*Desamortización General o de Madoz*), expropriated and auctioned the lands of the Catholic Church, the State and the local governments. Some of the previous owners of these lands, like the Church and the local councils, were compensated with public debt.<sup>7</sup> The whole sale of public properties represented nearly 1960 millions of pesetas, equivalent to one third of the Spanish Gross Product of 1860. The original aim of the law was to obtain new funds to reduce the debt burden of the country. Notwithstanding, after a new Government led by O’Donnell took office in 1858, most of the funds were redirected to expand the expenditures in defense and infrastructures.

The second law was the ‘Railroads Law’ (*Ley de Ferrocarriles*). It provided state aid and reduced the administrative burden for building railways lines in Spain, including

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<sup>4</sup>Tedde (1999).

<sup>5</sup>Spanish total population increased, since 1820 to 1850, from 11.7 to 15.3 millions of inhabitants, which implies a rate of growth of 0.9 per cent, higher than in the rest of Southern Europe. See Perez-Moreda (1985, pp. 25-61).

<sup>6</sup>See Carreras and Tafunell (2010). The countries were France, Germany, Italy, Belgium, Nederland, Luxembourg, Greece, Portugal, Finland, Sweden, United Kingdom, Ireland, Denmark, Austria, and Spain.

<sup>7</sup>The product of all these disposals was earned by the Treasury as extraordinary revenues during the years that this process lasted. In fact, the complete sale of public and Church properties almost took until the end of the century, due to magnitude of the transaction and because the majority of the buyers paid the properties in installments, the payment of a single property normally lasting fifteen annuities.

the possibility of foreign investment in the stock of the railways companies, the total exemption of custom tariffs in the import of iron, machinery, wagons and other transport equipment, and the public subsidizing of, at most, the third part of the construction budget. This law soon showed its effectiveness. Prior to 1855, only 440 kilometers had been constructed in Spain; from 1856 to 1866, more of 4,300 kilometers were opened to the traffic. Most of these lines, according to a radial scheme, went from Madrid to the French and Portuguese borders, to Sevilla and Cadiz, in the South, to Santander in the North, and to the main Mediterranean towns, like Barcelona or Valencia, in the East. Additionally, other lines were constructed from the Basque Country to Catalonia. The total railway investment in Spain amounted in 1867 to more than 2,760 millions of pesetas, jointly in stock and debenture bonds; of this sum, about 45 per cent, that is, 1,241 millions of pesetas corresponded to French investments.<sup>8</sup>

The third one, 'Joint Stock Banks Law' (*Ley General de Sociedades de Crédito*) defined the conditions for the establishment of *sociedades de crédito*, that is, investment banks similar to the recently created *Crédit Mobilier* in France and the English joint stock banks. A joint stock bank was a new form of financial enterprise to furnish funds for new enterprises upon pledge of its stock. For example, a proposed railway did not have to await the slow process of placing its stock and bonds among investors, in order to obtain funds to begin construction, but would deposit these securities in a joint stock bank, which would agree to accept its debts for a specified sum. These joint stock banks were able to sell their own shares and thus obtain the funds to make advances to the railways companies. In addition, the principle of limited liability reduced the risks for stockholders.

The arising of joint stock banks had happened in France in advance of England or Spain. Under the encouragement of Napoleon III, the Pereire brothers created the *Crédit Mobilier* in December 1852 with a capital of 60 million francs. During the late 1850s and the 1860s, other joint stock banks appeared in France: the *Crédit Industriel et Commercial* in 1859, the *Crédit Lyonnais* in 1863 and the *Société Générale* in 1864.<sup>9</sup> These banks pushed for legal reforms in England or Spain in order to open new branches in these countries. In England, the Joint Stock Companies Act of 1856 introduced limited liability in the United Kingdom and the general right of incorporation without a precedent act of the Parliament. The right was consolidated in the Company Act of 1862, which enlarged the scope of the legislation. In Spain, it was the *Ley General de Sociedades de Crédito*

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<sup>8</sup>Notwithstanding, effective French capital inflows were smaller, about 796 millions of pesetas, due to the fact that the debenture bonds were sold at a loss, thus providing a real profit of 6 per cent to the investors. See Tedde (1978, pp. 29-46).

<sup>9</sup>Kindleberger,(1993, pp. 112-113)..

that introduced this new form of banking.

The craze for the *sociedades de crédito* in Spain was quite similar to that in England for the joint stock banks. The consequence of the *Ley de Sociedades de Crédito* was the emergence of a great number of *sociedades de crédito* during the period 1856-1864 (Table 1). The largest among them were the *Crédito Mobiliario Español*, created by the Pereire brothers, the *Sociedad Española Mercantil e Industrial*, owned by the Rothschild, and the *Compañía General de Crédito en España*, which was property of a group of French entrepreneurs led by Alfred Prost. All these three banks accounted for a capital of 162.5 millions of pesetas; the most prominent one was the *Crédito Mobiliario Español*, with a capital of 114 millions of pesetas.

### **2.3 The 1856 Law of Banks of Issue (*Ley de Bancos de Emisión*)**

The last of the liberal laws approved in 1856 concerned the establishment of new banks of issue and the regulation of existing ones. The 1851 legislation had strongly limited the maximum emission volume to the bank capital, with deflationary consequences for the economy. During the period 1851-1855, the Bank of *San Fernando* always kept a volume of emission equal to the legal maximum, which implies that the Spanish economy was demanding more liquidity than it was supplied.<sup>10</sup> In this context, some of the most prominent private bankers, typically also shareholders in the Bank of *San Fernando*, were making pressure on the Government to pass a new law that allow the Bank to increase its volume of banknotes. At the same time, a coalition of regional businessmen and foreign bankers was asking to break the emission monopoly of the Bank, or at least to replicate it at a smaller scale in other Spanish cities. The response of the Government was to begin the discussion in the Parliament of a new law to improve the banking system.

During the last months of 1855, there was an intense debate at the Parliament between proponents of a system with a single bank of issue, led by the Governor of the Bank of *San Fernando*, Ramón Santillán, and those that argued for a pseudo-free-banking system of multiple local monopolies. At the time, most European countries were moving toward centralized systems. Nevertheless, the law finally broke the emission monopoly of the Bank of *San Fernando* by creating a system with multiple banks of issue.

The first point of the law renamed the Bank of *San Fernando* as the Bank of Spain, for a initial period of 25 years. It allowed the establishment of local banks of issue in each Spanish city where there were no existing branches of the Bank of Spain. These new banks had the monopoly of emission in their cities. The law also awarded the Bank of Spain the emission monopoly in Madrid and in any place where no bank of issue was to

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<sup>10</sup>Tortella (1970, p. 26).

be created. With respect to the emission volume, the law entitled new and old banks of issue to emit banknotes in a volume of less than three times the amount of their metallic reserves, as in the 1851 law. The novelty was that the volume of banknotes was now limited by three times the amount of the initial capital, that is, a threefold expansion from the existing situation. Finally, the Government was responsible for the appointment of the Governor of the Bank of Spain and of the rest of the banks of issue.

As a consequence of this law, the Bank of Spain was created not as the sole bank of issue in the country, but as *primus inter pares*. This particular institutional design had important implications in the next decade, as discussed in section 3.

## 3 The Evolution of the Financial System 1856-1874

### 3.1 The Boom Years 1856-1863

In the period 1856 the Spanish economy experienced a sustained period of growth and development. The new laws encouraged the increase of credit, money supply and economic activity. Joint stock banks channeled funds from investors to industrial projects, mainly railroads and, to a minor extent, mining. Through them, foreign capital entered Spain in an unprecedented volume since the times of the American colonies. As in the case of England, the emergence of the *sociedades de crédito* increased the volume of credit in the Spanish economy. It is estimated that more than 600 million *reales* of foreign capital were invested in *sociedades de crédito*, roughly 60 per cent of their total capital. The effect was to direct huge volumes of capital towards the railroad sector. As shown in Table 2, most of the capital invested in stock companies during the period 1859-1866 went to railroad companies. It was followed by investment in *sociedades de crédito*, which was typically reinvested in railroads. The manufacturing sector received only a tiny part of the funds. In 1864, for example, only 98 million pesetas out of 1000 were invested in manufacturing (textile, mining, steel, etc.).

From 1856 to 1864 eleven banks of issue were opened in some of the more market-oriented towns, like the earlier Barcelona and Cadiz banks: Bilbao, Sevilla, Santander, Malaga, Jerez, Zaragoza, among others. Their aggregate paid-up capital in 1864 was 36.5 millions of pesetas, compared to 40.6 millions of pesetas of the Bank of Spain. Before 1874, the Bank of Spain only realized the opportunity of opening local branches in two places, Valencia and Alicante, both on the Mediterranean coast.<sup>11</sup> The law of banks of issue was successful in its attempt to increase the circulation of banknotes in Spain, which grew steadily from 1856 to 1863. The aggregate emission volume never reached its limit:

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<sup>11</sup>Tedde, (2006, pp. 88-89).

the ratio of banknotes over metallic reserves was always below the legal maximum of three, a distinct feature with respect to the period pre-1856.

During this period, the Bank of Spain became more involved in the financing of the Government. The various sovereign defaults of the previous decades had closed the access to the international financial markets to the Spanish public debt. The consequence was that the Spanish Government was in need of economic resources in order to finance its program of public works such as road constructions and subsidies to the railways companies. For this reason, the Finance Minister, Pedro Salaverría, decided to issue a special kind of public bonds, the Treasury bills (*billetes del tesoro*), for an amount of 400 millions of pesetas, guaranteed by the properties expropriated in the desamortización; almost all these bonds were purchased by the Bank of Spain. In 1864, Salaverría took the decision of directly involving the Bank of Spain in the policy of sale of public properties. The sales receipts of the public properties were delivered to the Bank, who had to accomplish their collect. For its part, the Bank of Spain created a new asset, the Mortgage Bill (*billete hipotecario*), with an interest of 6 per cent, which was backed by those receipts. The whole amount obtained in the placement of the Mortgage Bills had to be transferred by the Bank to the Treasury. By involving the Bank of Spain, the Government expected to sold these bills at higher prices due to the solvency of the Bank. On the side of the Bank, the deal seemed sound and profitable due to the strong guarantee of the assets.

The international environment also supported the economic expansion of these years. In the decade of the 1850s and early 1860s there was a large increase in the world money supply caused by the increase in the gold production after 1848, when new deposits were discovered in California, Australia and Russia. The gold flow came in Europe from overseas to compensate European exports. The inflow of gold in Europe surged when, in 1861, the United States Government suspended specie payments, seeking to raise revenue for the civil war effort without exhausting its reserves of gold and silver. This decision had the effect of redirecting gold flows from California to Europe during the American Civil War (1861-1865). Net gold exports from the United States were, in million dollars, 21 in 1862, 56 in 1863, 89 in 1864 and 51 in 1865.<sup>12</sup>

### 3.2 The Crisis 1864-1866

In the year 1864-1866 an international crisis affected most European countries. The roots of the crisis are diverse.<sup>13</sup> In many countries the emergence of joint stock banks had

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<sup>12</sup> Conant (1896, p. 500).

<sup>13</sup> Although there is little doubt that both the panics of January 1864 in France and May 1866 in London were but two scenes of the same plot, some authors have often classified them as two distinct crises. Notwithstanding, Hawtrey makes the point that the English crisis was not isolated but a sequel

generated a tremendous expansion in money and credit in the late 1850s and early 1860s.<sup>14</sup> When the American Civil War (1861-1865) produced the blockade of the Southern ports and reduced the supply of cotton for European mills, the price of cotton rocketed. Cotton prices increased fourfold from 1860 to 1864. Speculation in cotton, and to a minor extent in railways, was fuelled by the increase in leverage possible thanks to the emergence of joint stock banks.

The silver drain and trade deficits of European countries and the troubles in European politics caused by the Prussian hegemonic policy inspired by Bismarck, provoked continuous fluctuations of the discount rates of the main European central banks. In the United Kingdom, in late 1863, the discount rate of the Bank of England was raised from 4% in November to 8% in December.<sup>15</sup> Other European banks followed the same line to avoid running out of reserves. The Bank of France raised the discount rate to 8% and purchased bullion, from January to November, to the amount of 221 million francs.

The cotton bubble could not be indefinitely sustained. The abrupt tightening of monetary policy amid a climate of pessimistic expectations generated a financial crisis that affected many banks and businesses and brought the speculative climate of the previous years to a halt.

The scarcity of specie was a key question for many European countries that had at that time large deficits in their balances of payments. In the case of Spain, the international crisis produced a tremendous impact on its monetary and financial system. The reasons why the collapse in money and credit was so massive in Spain should be traced back to the institutional design of the Spanish monetary system. In the first place, the fiscal position of the Government severely constrained the conduct of monetary policy by the Bank of Spain. During the crisis, Government pressures prevented the Bank from selling part of its portfolio in order to obtain additional liquidity. Therefore, the Bank of Spain was forced both to drastically reduce the volume of banknotes and to raise interest rates from 6 to 9 percent.<sup>16</sup> The Bank of Spain was in dire straits when the public required, in a tumultuous way, the payment in specie of their bills, under the suspect that there was an excessive engagement of the Bank with the Treasury, perceived to be at the edge of insolvency.

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to the continental crisis of 1864. See Hawtrey (1979, p. 177). See also Kindleberger and Aliber (2005, p. 117) and Flandreau (1995). Secondary causes are mentioned in Foucaud (2006, p. 56) and in Cottrell (1980).

<sup>14</sup>For example, deposits in London joint stock banks, increased from £43 millions in 1860 to £91 millions in 1864, when the nominal capital of the new limited companies surpassed the £500 millions. See Juglar (1967, p. 385).

<sup>15</sup>See Homer and Sylla, (1963 pp.208-209) and Clapham (1944, vol. II pp. 259-260)..

<sup>16</sup>Tortella (1973, pp. 254-262).



In the second place, the local structure of the system of banks of issue reduced the capabilities of any single bank to cope with the credit crunch. Whereas the Bank of Spain represented half of the Spanish monetary system, the other half was a system of 20 local banks of issue. When the crisis began, the small size of these banks forced them to reduce the amount of banknotes in a more conservative way than the Bank of Spain, in order to reduce the risks of a bank-run on banknotes. The decision in 1865 of the Spanish Government to instruct the trade courts to delay as much as possible all the cases involving convertibility of banknotes into metallic only made matters worse. This decision created a legal vacuum where convertibility was decided case by case by each of the local banks of issue and the Bank of Spain.<sup>17</sup> The consequence was the mistrust by the public in the banknotes of many of the local banks.

Finally, the initial monetary shock was amplified through the value of the collateral of the financial system. In this case, the collateral was mainly stocks in railroad companies. Due to scarcity of specie, the *sociedades de crédito* and local banks of issue were forced to sell their assets in order to get some liquidity. The problem was that the massive selling of assets only depressed stock prices even further, thus reducing even more the value of the banks' assets and their solvency. Hence, the Spanish economy experienced the consequences of a *financial accelerator* during the period 1864-1866.<sup>18</sup>

### 3.3 The 1866 Panic and the Road to a Single Bank of Issue

The international situation seemed to be back in control in 1865 and the Bank of England was able to reduce the rate below 4% during the summer. But in 1866, another huge shock disturbed the financial economy in Europe, especially in Great Britain, when the prestigious bank Overend, Gurney & Co. suspended payments in May 1866 and went into liquidation in June. This occurred amid a climate of pessimism due to the political situation in Central Europe, where the Austro-Pussian War was about to begin.

Overend, Gurney & Co. was the resultant of the transformation of the one of City oldest and more prestigious firms. It had become a joint stock bank in 1865, switching from traditional bill-broking business to facilitating long term credit and being involved in railways, iron production, shipbuilding and others industries.<sup>19</sup> During the spring of 1866, an action by Overend was pending in the courts to recover £60, 000. On May 9<sup>th</sup> the court decided that Overend would not receive any compensation. The decision caused a run upon Overend, and on the afternoon of May 10<sup>th</sup> the firm suspended payments with

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<sup>17</sup>Tortella (1970, ch. 7).

<sup>18</sup>See Bernanke, Gertler and Gilchrist (1999).

<sup>19</sup>Bagehot (1873).

more than £18 millions of liabilities. The next day, May 11<sup>th</sup>, known as ‘Black Friday’, Lombard Street witnessed a stock market collapse and a banking panic with crowds at the gates of the most reputed banks.<sup>20</sup>

As occurred in 1847 and 1857, the Chancellor of the Exchequer authorized the suspension of the Bank Charter Act of 1844 that prevented a strict support of gold, at cent per cent, for the quantity of money at circulation. The temporary suspension of the Bank Charter Act allowed the Bank to facilitate paper money without restriction, even with more severe conditions for credit advances. On Saturday 12<sup>th</sup>, the Bank of England was authorized to supply additional £4 millions not covered by gold reserves at a rate of discount of 10 per cent. English policy-makers, at least some of them, were conscious of the nature of the crisis and of how only by providing extra liquidity it could be averted by the Bank of England.<sup>21</sup>

The rate of ten per cent at the Bank of England was maintained from May 11<sup>th</sup> to August 6<sup>th</sup>. Although distrust in the English banking system lasted for a period of time, there were no doubts about the solvency of the Bank of England, whose bullion rose from £12 millions to £19 in December 1866.<sup>22</sup> Many more banks and companies went bankrupt during this crisis. The result was a second wave of monetary tightening in 1866 that severely affected the already weak health of banks and firms, not only in England, but also in continental Europe. In Italy, for example, the Government was forced to introduce the *corso forzoso* on May 11<sup>th</sup>, which represented a suspension of the convertibility of the lira into gold and an additional supply of 250 million lire by the Bank of Italy.<sup>23</sup>

The impact of the financial crisis of May 1866 was amplified in Spain due to some policy mistakes. In the Spring of 1866, the Government had proposed an heterodox approach to solve its financing problems. The idea was to receive a loan of 100 million pesetas from an English bank syndicate leaded by Overend, Gurney and Co. in exchange for the rights of banknote emission in the whole country, that is, the suppression of the Bank of Spain and the rest of banks of issue and the creation of a new national bank of issue in the hands of the English bankers. The directors of the Bank of Spain strongly opposed the operation, which was aborted due to the failure of Overend. On May 11<sup>th</sup>, when the news about the failure of Overend arrived, the panic extended to many Spanish cities, especially Barcelona. On May 12<sup>th</sup>, the *Catalana General de Crédito* and the *Crédito Mobiliario Barcelonés*, two *sociedades de credito*, suspended payments. After that, a

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<sup>20</sup> “Panic, true panic came with unexpected speed and violence that day”, says Clapham (1944, pp. 261-266).

<sup>21</sup> See Patterson (1870) or Flandreau and Ugolini (2011).

<sup>22</sup> Conant (1896, p. 505).

<sup>23</sup> Kindleberger and Aliber (2005, p. 117).

chain of bankruptcies extended through the country.

The passivity of the Spanish authorities contrasts with the English case, where the Government and the Bank of England cooperated to minimize the crisis and provide extra liquidity during the panic. The practice of providing extra liquidity at penalty rates was not in accordance with the actual orthodox financial theory. In fact, the Central Bank's role of lender of last resort was not respectable among theorists until Bagehot's *Lombard Street*, appeared in 1873. Notwithstanding, in England, the Bank Charter Act had been already suspended during the 1847 and 1857 crisis. In these cases the Bank of England acted as a lender of last resort even if it had no explicit mandate about it.<sup>24</sup> In Spain, however, the Bank of Spain and the local banks of issue considered each other as competitors, so they felt no motivation to help. Besides, without any determination by the Government to suspend convertibility at a national level, any attempt to provide liquidity would have been useless. The consequence was a severe collapse of the financial system in 1866 that amplified the monetary shock by reducing the volume of banknotes and deposits.

The consequence of the crisis was a collapse in the Spanish banking system that took several years to repair. When the crisis was over, more than 40 per cent of the Spanish financial system had been officially liquidated. The Bank of Spain bought during that period 238 million reales of gold and silver bullion, whereas the volume of banknotes did not grow significantly.

This period of deleveraging and reconstruction came to an end in 1874, when the Government decided to award the Bank of Spain the monopoly of emission in the whole country in exchange for a loan of 125 million pesetas. The rest of banks of issue were given the possibility of either to merge with the Bank or to operate solely as commercial banks. On March 19<sup>th</sup> 1874, the Bank of Spain became the only bank of issue in Spain.

## 4 Monetary dynamics

The aim of this section is to analyze the evolution of monetary dynamics during the period 1856-1873. To this end, we have constructed a historical database with information about aggregate monetary variables. The description of the database can be found in Appendix B. Here, we first describe the data about money supply and its components. Then, we use a standard New Keynesian model to quantify the impact of monetary policy on output

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<sup>24</sup>Collins (1992) analyzes the role of the Bank of England as a lender of last resort in the 1866 crisis compared to the ones of 1857 and 1878. He concludes that the Bank of England acted as a *de facto* lender of last resort. Not was until 1890 that this responsibility was entirely displayed, during the Baring crisis, although it ever remained doubtful about possible contradictions between the maintenance of gold standard and the function of lender of last resort. See also Bignon, Flandreau and Ugolini (2011), McKinnon (1993) and Eichengreen (1996).

and prices during the period.

## 4.1 Money Supply and Components

Table 3 and Figure 1 present the data about the evolution of money supply and its components. We define money supply as the sum of the currency (banknotes and coins) plus current accounts in the banks of issue minus the metallic reserves of the system of banks of issue. Two features should be noticed. Firstly, metal coins were by far the bulk of the monetary base. On average the volume of coins was 15 times larger than the volume of banknotes. This is the most explicit evidence of the underdevelopment of the Spanish financial system during the first half of the 19<sup>th</sup> century. Secondly, the evolution of the money supply displays a contraction during the period 1856-1866 and a progressive recovery from 1868 to 1873.

The outflow of currency in the period 1856-1866 was mainly due to the effects of ‘Gresham’s Law’. Market and mint ratios between gold and silver were different in Spain, making silver coins cheaper and thus creating an incentive to export silver. The fall in the market price of gold to silver was due to the gold discoveries in California in 1848 and Australia in 1851. These discoveries increased tenfold world gold production.

In 1851, the Government had suspended gold coinage in an attempt to stop silver outflows. The law did not succeed at stopping silver exports, but it aggravated the reduction in the monetary base. The prohibition was ruled out in 1854 and silver prices were corrected to more sensible levels. However, the continuous rise of silver prices in the world markets made it necessary to reform again the Spanish currency system in 1861 and 1864. These reforms realigned silver and gold prices and rationalized a complex system of coinage.<sup>25</sup> The 1864 currency reform temporarily solved these problems by modifying the metallic content of silver coins and hence devaluing their metallic value in relation to their face value. The new mint ratio was set to 15.48, higher than the London market one, 15.37.

In 1865 the Latin Monetary Union was established. This was similar to a currency area between European bimetallic countries. The initial members were France, Belgium, Swiss and Italy, with Greece joining later in 1868. It established a mint ratio of 15.5 with free circulation of gold coins and restricted circulation of silver coins. The desire to align the Spanish coinage with the Latin Monetary Union explains why in 1868 a new currency reform was published, introducing a new monetary unit, the peseta, and realigning the mint ratio to 15.5.<sup>26</sup> According to the data, during the period 1856-1866, more than 900

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<sup>25</sup>See Sardà (1948, pp. 139-140).

<sup>26</sup>One peseta, at this time, had a value very close to that of the French franc. Although existing

million pesetas left the country.

The net flow of currency can be decomposed in three components, as shown in Table 4 and Figure 2. In the first place, the large trade deficit, which peaked in 1863. Part of this trade deficit was a consequence of the massive import of materials for the construction of the new railways. In the second place, the large amounts of foreign capital that entered the country to be invested in railways. This capital came mainly from France and Belgium, as the English capital market was closed to Spain since the debt restructuring of Bravo Murillo in 1851. In the third place, the payment of interests on public and private debt and dividends on stocks. Before 1866, the outflow was larger as capital inflows were not enough to compensate the trade deficit plus interests and dividends. The situation reversed after 1867, due to the strong adjustment in the trade balance during the crisis and to the large inflows of foreign capital to finance new emissions of public debt.

Figure 3 shows the evolution of banknotes and current accounts. During the boom years, the volume of banknotes grew due to the emission by the new local banks and to the relaxation in the ratio of banknotes over metallic reserves. When the crisis began and due to the scarcity of metallic reserves, banks were forced to reduce the volume of banknotes to minimize the risk of a bank-run on the banknotes. As shown in Figure 4, the ratio of banknotes over metallic for the aggregate of local banks of issue was below 1.5. Some of them, such as the Bank of Barcelona operated with ratios of less than 1, that is, all the banknotes were covered by specie ('narrow banking'). This is a very low level of emission, providing that the 1856 law entitled banks to emit banknotes in a volume of less than three times the amount of their metallic reserves.

The Bank of Spain also contributed to the collapse in money and credit. To avoid running out of reserves, the Bank of Spain began a tightening of its monetary policy and raised interest rates to 9 percent at the end of 1864, keeping it at this level until the end of 1866. It also tried to buy bullion in foreign markets. The result was an increase in its reserves, which reached 27 million pesetas in 1865. Simultaneously, its volume of banknotes fell from 71 million pesetas in 1864 to 61 in 1865 and then again to 44 in 1866. The fall in current accounts was also dramatic, from 56 million pesetas in 1863 to 22 millions in 1866. The consequence was an abrupt decline in the ratio of banknotes over metallic reserves in 1865 and 1866.

Finally, Table 5 and Figure 5 display the evolution of the Spanish exchange rate against the British Pound and the French Franc. Exchange rates are in line with the evidence about metallic flows. From 1856 to 1868, Spain experienced a steady outflow of specie,

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from the beginning of the nineteenth century, the peseta only was the first Spanish monetary sign after 1868. Previously, the real – one quarter of the nominal peseta - was the Spanish monetary basis. See Martín-Aceña (2000, pp. 112-151) and Fernández-Pulgar and Anes-Alvarez (1970).

which generated a depreciation of the Spanish Real against the Pound and the Franc.<sup>27</sup> From 1869 onwards, capital and trade inflows surpassed the outflows, which produced an appreciation of the currency, albeit quite volatile due to the turbulent political and economic situation at the time.

## 4.2 The effects of monetary fluctuations

In this subsection we use the dataset to quantify the impact of the fluctuations in the money supply in the observed evolution of output and prices. To this end, we compare the counterfactual results from a calibrated new Keynesian DSGE model that replicated the evolution in the money supply with the data in the 1856-1873 period.<sup>28</sup> We choose the new Keynesian model as it represents the current benchmark in the analysis of monetary economics. We consider a very stylized framework, as in Galí (2009, Ch. 3) or Woodford (2003, Ch. 3), that includes an IS equation, a forward-looking Phillips curve and a LM equation. It describes a simple monetary economy, which appears appropriate to represent a newborn monetary system as that of Spain in 1856-1973. Appendix A provides a complete description of the model.

Our specification is such that, by log-linearizing the first order conditions of the household and the firm problems around a zero inflation steady state, it is possible to derive the complete system of forward-looking equations. The IS relationship is given by

$$y_t = E_t y_{t+1} - [i_t - E_t \pi_{t+1}] \quad (1)$$

where  $y_t$  represents the percentage deviation of output from its long-run trend,  $i_t$  is the nominal interest rate and  $\pi_t$  is the inflation rate. The Phillips curve is given by

$$\pi_t = \beta E_t \pi_{t+1} + \kappa y_t, \quad (2)$$

where  $\kappa = \frac{(\varphi+1)(1-\theta)(1-\beta\theta)}{\theta}$  is the slope of the Phillips curve,  $\varphi$  is the inverse of the Frisch elasticity of labor supply,  $\beta$  is the subjective discount factor of households and  $\theta$  is the proportion of firms allowed to change price in each period.

The LM equation relates real money balances with nominal interest rates:

$$y_t - \frac{\beta}{1-\beta} i_t = l_t, \quad (3)$$

where  $l_t \equiv m_t - p_t$  are real money balances. Finally, the law of motion of real money balances is

$$l_t = l_{t-1} - \pi_t + \Delta m_t, \quad (4)$$

<sup>27</sup>A Real was equivalent to a 1/4 Pesetas.

<sup>28</sup>Data for GDP and Inflation are from Prados de la Escosura (2003). Data for the nominal interest rate are from Tedde (2011).

where  $\Delta m_t \equiv \log M_t - \log M_{t-1}$  is the money growth rate of the money supply.

A common assumption in the new Keynesian literature is that monetary policy is conducted by adjusting the nominal interest rate. However, this description does not seem to fit with the Spanish experience of the 1850s and 1860s, during which the nominal rate responded endogenously to changes in the metallic reserves of the banks of issue. For this reason, we consider instead that the evolution of the money supply followed an exogenous path given by

$$\Delta m_t = \rho_m \Delta m_{t-1} + \varepsilon_{mt}, \quad (5)$$

where  $\varepsilon_{mt} \stackrel{i.i.d.}{\sim} N(0, \sigma_m^2)$ . This modelling strategy intends to reflect the exogenous changes in the money supply due to the inflows and outflows of specie and to the issuing decisions of a multiplicity of independent banks.

The model composed of (1), (2), (3) and (4) is a rational expectations linear system in  $y_t$ ,  $\pi_t$ ,  $i_t$ ,  $l_t$  and  $\Delta m_t$ , which can be solved using standard techniques.<sup>29</sup> We ignore technology and preference shocks to focus solely on the impact of monetary shocks.

The calibration of the model is as follows. First, as the average inflation rate during the period 1856-1873 is zero, we assume inflation to be zero in the steady-state of the model. Next, we set the subjective discount factor  $\beta$  to 0.96 to match a nominal interest rate of 6% in the steady state, which is the average value during the period 1856-1873. We estimate the money supply process (5) by OLS and obtain  $\rho_m = 0.56$  and  $\sigma_m = 0.07$ . We are not able to directly estimate from the data the inverse of the Frisch elasticity of labor supply  $\varphi$  and the frequency of price adjustment  $\theta$ . Thus, we set  $\varphi = 1$  as in Christiano, Eichenbaum and Evans (2005) and consider a value of  $\theta = 0.75$ , which implies an average frequency of price adjustments of one year, a common assumption in the new Keynesian literature that seems plausible for the period.

Figure 6 compares the model results with the data. In particular, we estimate a sequence of shocks to money supply growth such that the money supply predicted by the model matches exactly the actual money supply observed in the data (see bottom right panel). Figure 6 also displays the performance of output, inflation and the interest rate in the data and in the model. In the data, there is a large drop in money growth between 1860 and 1866. In the model, this drop in the money supply implies large deflationary effects, which produce a fall of around 30% in output and around 10% in inflation. Strikingly, this prediction is in contrast with the data, that show that output and inflation were roughly constant during the 1860-1865 period.<sup>30</sup> Also, the recovery of money growth occurred in

<sup>29</sup>See, for example, Blanchard-Kahn (1980).

<sup>30</sup>We also consider the inflation data from Sardà (1998), based on agricultural commodities and from Maluquer de Motes (2006), based on prices at the *Boqueria* market in Barcelona. These series do not display any significant deflationary pressure between 1861 and 1865. However, it is important to notice

1867 appears to have a delayed effect in the data of output and inflation with respect to the model.<sup>31</sup>

In Table 6 we report volatility statistics in the data and in the model. Given that we cannot estimate the frequency of price adjustment from the data, we consider three scenarios for the parameter  $\theta$ : 0.50, 0.75 and 0.85. In the first case, prices are changed on average every six months. Although the volatility of output in the model is very close to that in the data, 6% versus 7%, inflation volatility is significantly larger in the model, 10.2% versus 4.3%. The large inflation volatility is due to the high frequency of price adjustment assumed. By increasing the value of  $\theta$ , the volatility of output increases while that of inflation declines. With a value  $\theta = 0.75$ , for which the average duration of a price is one year, both inflation and output in the model display a larger volatility in the model with respect to the data, 7.1% and 13.1%, respectively. Finally, for an average duration of roughly one year and a half,  $\theta = 0.85$ , the volatility of inflation is close to that in the data, 5.8% versus 4.3%, but output volatility becomes very large, 17.7%. In this case the small frequency of price adjustment implies that monetary shocks have a large impact on output. In all cases, the volatility of the nominal interest rate is 0.6%.

We conclude that monetary shocks did not affect the economy as predicted by this stylized new Keynesian model. Nevertheless, it does not imply that new Keynesian theory cannot account for the observed evolution of variables in the period. It is possible that the Spanish economy was affected by a productivity shock that partially offset the effects of the money contraction. It is however difficult to identify this technological breakthrough in the Spanish economy of the 1860s. Another explanation is that the credit creation by the *sociedades de credito* could have partially compensated the outflow of specie. Unfortunately, we have not been able of collecting data on credit creation by these financial agents. Finally, it is also possible that more complex models might describe better the evolution of macroeconomic aggregates. In particular, the introduction of distortions à la Christiano, Eichenbaum and Evans (2005) could help to explain the delay in the response to the monetary shock.<sup>32</sup> We leave all these open questions for future research.

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the divergences in the data for this period.

<sup>31</sup>Note that, as discussed in Galí (2008), the new Keynesian model with exogenous money supply does not display the standard *liquidity effect* usually observed in the data after a monetary shock. Thus, a decline in the money supply in the model implies a slight decline in the nominal interest rate.

<sup>32</sup>In addition, a small open-economy monetary model à la Galí and Monacelli (2005) might help to explain the large trade flows at that time and their impact on the economy.



## 5 Conclusion

In this paper we described the main characteristics of the historical context in which the Bank of Spain was created. In particular, we focus on the multiplicity of banks that were entitled to emit banknotes during the period 1856-1874. In this context, the Bank of Spain was only the largest issuer of banknotes in the country. This system was successful in expanding the volume of paper money during the expansion period, 1856-1864, but it also amplified the contraction during the 1864-1868 crisis. In particular, the lack of a lender of last resort might explain why the banking panic was so severe in Spain, in contrast to England, where the Bank of England acted as a *de facto* lender of last resort and convertibility was temporarily suspended. This paper also quantifies the economic effects of the monetary fluctuations. We find the puzzle that, despite the fact that the contraction of the money supply began in the early 1860s, the recession and deflation were delayed until 1868, in contrast to what is predicted by new Keynesian theory.

In addition, this paper contributes to the literature analyzing free banking systems. The Spanish monetary system during the period 1856-1874 shares many similarities with other historical episodes where a multiplicity of private banks had the right to emit banknotes. The year 1874 marks the transition from this type of system to a more standard one, with a single issuer of banknotes. This natural experiment can be analyzed in future research to understand the effects of a such a transition on the aggregate economy.

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## 6 Appendix A: The New Keynesian Model

In this appendix we described the model that we use for the empirical analysis of section 4.3.

### 6.1 The household problem

The intertemporal maximization problem of the household is

$$\max_{C_t, B_t, M_t, N_t} E_0 \sum_{t=0}^{\infty} \beta^t \left\{ \log(C_t) + \gamma \log\left(\frac{M_t}{P_t}\right) - \chi \frac{N_t^{1+\varphi}}{1+\varphi} \right\} \quad (6)$$

subject to

$$P_t C_t + M_t + Q_t B_t = W_t N_t + M_{t-1} + B_{t-1} + P_t \Pi_t,$$

where  $\eta$ ,  $\varphi$ ,  $\gamma$ ,  $\chi$  are all positive parameters,  $C_t$  is consumption,  $M_t/P_t$  real money balances,  $N_t$  labor,  $B_t$  bond holdings,  $P_t$  the price of the consumption good,  $W_t$  the real wage and  $Q_t$  is the nominal price of bonds. Finally,  $P_t \Pi_t$  are nominal profits from the ownership of firms.

The first order conditions for this problem are summarized by the following three conditions

$$1 = E_t \left[ \frac{\beta C_t P_t}{C_{t+1} P_{t+1}} \frac{1}{Q_t} \right], \quad (7)$$

$$\gamma \left( \frac{M_t}{P_t} \right)^{-1} = C_t (1 - Q_t), \quad (8)$$

$$\frac{\chi N_t^\varphi}{C_t} = \frac{W_t}{P_t}. \quad (9)$$

The consumption index of the household is given by

$$C_t = \left[ \int_0^1 C_{jt}^{\frac{\epsilon-1}{\epsilon}} dj \right]^{\frac{\epsilon}{\epsilon-1}}, \quad (10)$$

where  $\epsilon > 1$  represents the elasticity of substitution among differentiated goods, and the corresponding price index is  $P_t = \left[ \int_0^1 P_{jt}^{1-\epsilon} dj \right]^{\frac{1}{1-\epsilon}}$ . It follows that the demand function for good  $j$  is

$$C_{jt} = \left( \frac{P_{jt}}{P_t} \right)^{-\epsilon} C_t.$$

### The firm problem

All firms  $j \in [0, 1]$  produce a differentiated good using the same constant returns to scale technology with labor as the only input

$$Y_{jt} = A N_{jt}. \quad (11)$$

Each period a fraction  $\theta$  of randomly chosen firms in the economy is not allowed to change the price while the remaining  $1 - \theta$  will set prices optimally. The problem of a firm allowed to change prices at time  $t$  is

$$\max_{p_{jt}} E_t \sum_{k=0}^{\infty} \theta^k \Delta_{t,t+k} \left[ \frac{p_{jt}}{P_{t+k}} - MC_{t+k} \right] Y_{jt+k}, \quad (12)$$

where  $\Delta_{t,t+k} = \beta^k \left( \frac{C_{t+k}}{C_t} \right)^{-1}$  is the stochastic discount factor from  $t+k$  to  $t$  and  $MC_{t+k} = \frac{W_{t+k}}{P_{t+k}A}$  is the marginal cost.

## Equilibrium and Money Supply

Market clearing in the goods market requires

$$Y_{jt} = C_{jt}, \quad (13)$$

and market clearing in the labor market requires

$$N_t = \int_0^1 N_{jt} dj. \quad (14)$$

We consider an exogenous path for the growth rate of the money supply  $\Delta m_t \equiv \log M_t - \log M_{t-1}$ .<sup>33</sup> The process for the money growth rate is given by

$$\Delta m_t = \rho_m \Delta m_{t-1} + \varepsilon_{mt}, \quad (15)$$

where  $\varepsilon_{mt} \stackrel{i.i.d.}{\sim} N(0, \sigma_m^2)$ . The evolution of nominal interest rates  $i_t \equiv -\log(Q_t)$  is given by equation (8).

## Appendix B: Sources and Methodology

### Table 3

Data on the Net Flow of Money is described below (Table 4). Data on Banknotes, Current Accounts and Metallic Reserves by Banks of Issue is taken from Tortella (1970). Finally, the data on Money Supply is constructed by combining the information on banknotes and current accounts with the amount of metallic coins. Metallic coins are constructed backwards by taking as given the volume of coins in 1874 and using the Net Flow of Money. Data about the metallic composition of the money supply is offered by Anes-Alvarez (1974).

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<sup>33</sup>Gali (2008) carefully describes this approach and analyzes the stability properties of new Keynesian models with exogenous money supply.

#### **Table 4**

Data on the Balance of Trade of Spain, 1856-1874, are directly taken from Prados de la Escosura (2003).

Data on Net Entries of Foreign Capital are taken from several sources. For data about railway investments, we have consulted: Broder (1976,1981) and Tedde (1978, pp. 9-354). For banking investments, data have been collected from Sánchez-Albornoz (1977), Tortella (1973), Broder (1976) and Tedde (1974). The information about mining and metallurgy foreign investments come, for the British sources, from Stone (1999) and Harvey and Taylor (1987). The French and Belgian data are drawn from Broder (1976,1981) and from Chastagnaret (2000). We also have consulted Tortella (2008). The foreign investment data of public utilities, like light and water urban services, come from Stone (1999) and Costa-Campí (1982). For new issues of Public Debt along the period 1868-1874 data are taken from Martín-Niño (1973).

Finally, data on Foreign Capital Interests and Benefits, Repayments and Interests of Public Bonds and Transfers also come from several sources and we have applied for its completion some conjectures. So, we have supposed that the recurrent repayment of Public Debt was made by the buying of bonds by the Spanish Treasury, in the Stock Market, at current prices. This hypothesis is backed by some specialists in Spain's Financial History, as Artola (1986) and Comín (1988). Also, we have supposed that the profitability of all the three private Banks in the form of *Credit Mobilier* that were created by French initiative at the middle of the 19<sup>th</sup> Century was the same of the *Sociedad de Crédito Mobiliario Español*, of which we have some data from Sánchez-Albornoz (1977). Similarly, we have speculated with equal dividends of railways companies, along this period, in term of percentage on capital share, to those paid off by the two major of them, the *Compañía de Caminos de Hierro del Norte de España* and *Madrid-Zaragoza-Alicante*; this last information is contained in Tedde (1978). For mining and metallurgy profitability, we have taken the relative information from Harvey and Taylor (1987), which contains averages of dividend and interest payments for British investments. We have assumed that it can be acceptable to apply this rate of return to the French and Belgian investments in the same industry. For the public utilities investments we have applied the same real rate of return resulting from public bonds. Transfers data are directly taken from Prados de la Escosura (2010).

## Appendix C: Tables and Figures

Table 1. Number of Banks and *Sociedades de Credito*

	Banks of issue	<i>Sociedades de Credito</i>	Total
1856	4	6	13
1857	10	6	19
1858	10	7	20
1859	10	7	20
1860	11	8	22
1861	11	12	26
1862	12	17	32
1863	14	20	37
1864	21	34	57
1865	21	35	58
1866	21	32	54
1867	21	26	47
1868	20	21	41
1869	19	14	33
1870	16	14	30
1871	16	14	30
1872	16	14	30
1873	16	14	30

Source: Tortella, (1973, p. 9).

Table 2. Capital invested in joint stock companies by sector (million pesetas)

	Manufacturing	<i>Sociedades de Credito</i>	Railways
1859	99.8	93.3	943.9
1861	96.0	105.1	517.4
1864	98.4	242.7	654.8
1866	66.5	229.2	698.9

Source: Tortella (1973, p. 170).



Table 3. Money creation and money supply

	Net flow of money	Banknotes			Current accounts			(-) Reserves			Money supply
		BoS	Rest	Total	BoS	Rest	Total	BoS	Rest	Total	
1856	20.5	39.7	17.3	57.0	41.1	15.4	56.5	36.3	12.0	48.3	2,129
1857	-23.8	45.7	25.8	71.6	33.8	17.0	50.7	27.1	18.2	45.3	2,117
1858	-165.5	52.0	34.0	86.0	45.1	18.3	63.5	29.2	21.4	50.6	1,973
1859	-10.7	66.9	45.4	112.3	57.3	25.1	82.5	30.8	34.0	64.8	1,993
1860	-7.4	63.5	54.7	118.2	43.3	25.9	69.2	23.1	29.9	53.0	1,991
1861	-34.5	44.9	55.1	100.0	35.7	17.8	53.6	23.6	24.1	47.6	1,928
1862	-94.2	52.1	47.9	100.0	54.6	17.8	72.4	29.0	22.8	51.8	1,848
1863	-159.2	68.3	49.3	117.6	56.8	19.4	76.3	31.0	24.4	55.5	1,707
1864	-141.8	71.8	53.0	124.8	22.1	16.0	38.1	19.7	25.3	45.0	1,544
1865	-199.6	61.9	52.8	114.7	22.2	21.2	43.4	27.4	27.2	54.5	1,330
1866	-129.4	44.6	45.2	89.8	18.0	29.3	47.3	21.6	42.5	64.0	1,170
1867	14.4	49.4	46.0	95.4	47.4	33.3	80.7	29.5	40.6	70.1	1,218
1868	-41.7	55.1	47.8	102.9	28.8	29.5	58.2	20.6	38.1	58.7	1,173
1869	224.4	53.1	42.9	96.0	40.6	36.1	76.7	26.1	53.1	79.1	1,388
1870	157.4	61.1	38.0	99.1	78.3	41.7	120.0	73.1	65.7	138.8	1,532
1871	81.6	79.6	42.6	122.2	75.7	51.8	127.5	101.9	60.0	161.9	1,621
1872	147.2	68.1	46.6	114.8	62.5	50.5	113.0	54.0	73.2	127.2	1,781
1873	85.0	55.0	42.3	97.3	43.7	34.9	78.6	31.8	42.0	73.8	1,868

'BoS' refers to the Bank of Spain, 'Rest' is the rest of the banking system. All units are in million pesetas.

Table 4. Net flow of money 1856-1873

	Balance of trade			Net entries of foreign capital						Net interests, dividends and transfers				Total
	Exports	(-) Imports	Total	Railways	Mining	Banking	Public Debt	Other	Total	Public	Private	Transfers	Total	
1856	343.7	348.9	-5.2	15.8	0.5	54.7	0	0	71.0	-51.4	-1.0	7.1	-45.3	20.5
1857	358.8	413.5	-54.7	78.3	0.5	1.8	0	0	80.6	-55.2	-2.5	8.0	-49.7	-23.8
1858	222.8	415.2	-192.4	81.6	0.4	1.0	0	0	83.0	-48.5	-15.6	8.0	-56.1	-165.5
1859	262.5	346.5	-84.0	127.4	0.6	8.2	0	0	136.2	-49.3	-22.0	8.4	-62.9	-10.7
1860	333.0	360.7	-27.7	91.6	0.4	1.8	0	0	93.8	-45.8	-36.3	8.6	-73.5	-7.4
1861	339.4	377.5	-38.1	59.9	3.7	17.1	0	0	80.7	-49.9	-35.8	8.6	-77.1	-34.5
1862	265.9	420.1	-154.2	121.4	6.5	5.7	0	0	133.6	-37.6	-45.9	9.9	-73.6	-94.2
1863	316.6	514.3	-197.7	86.3	6.4	45.6	0	0	138.3	-55.8	-53.5	9.5	-99.8	-159.2
1864	352.6	503.3	-150.7	65.6	6.6	22.8	0	0	95.0	-33.3	-62.6	9.8	-86.1	-141.8
1865	282.9	442.0	-159.1	25.5	6.5	0	0	0	32.0	-34.7	-48.3	10.5	-72.5	-199.6
1866	315.7	439.9	-124.2	41.8	6.4	0	0	0	48.2	-32.3	-33.8	12.7	-53.4	-129.4
1867	398.0	348.4	49.6	10.3	6.6	0	0	0	16.9	-31.1	-34.4	13.4	-52.1	14.4
1868	411.8	408.7	3.1	10.0	6.5	0	0	0	16.5	-40.9	-35.0	14.6	-61.3	-41.7
1869	454.8	357.3	97.5	45.9	6.4	0	171.4	0	223.7	-74.2	-39.5	16.9	-96.8	224.4
1870	357.5	375.7	-18.2	23.1	6.6	0	250.0	0	279.7	-74.2	-47.2	17.3	-104.1	157.4
1871	470.8	440.7	30.1	5.7	6.5	0	152.3	8.4	164.5	-74.2	-55.7	16.9	-113.0	81.6
1872	525.3	547.6	-22.3	3.0	23.8	0	236.3	7.4	271.5	-59.5	-64.6	22.1	-102.0	147.2
1873	618.1	462.4	155.7	2.7	23.7	8.7	0	4.3	42.5	-76.9	-64.3	28.0	-113.2	85.0

'Mining' includes investments in mining and metallurgy. All units are in million pesetas.

Table 5. Rates of Exchange of the Spanish Real, 1856-1874  
(Spanish Reales by British Sterling Pound and French Franc)

	Sterling Pound	French Franc
1856	93.93	3.77
1857	96.11	3.88
1858	94.77	3.79
1859	96.15	3.8
1860	95.26	3.8
1861	96.77	3.84
1862	95.63	3.83
1863	96.78	3.89
1864	96.8	3.85
1865	98.005	3.935
1866	98.93	3.935
1867	97.86	3.9
1868	98.82	3.94
1869	96.48	3.87
1870	96.03	3.54
1871	97.96	3.81
1872	99.23	3.86
1873	94.6	3.79

Source: Years 1850-1855: Tedde (1999); Years 1856-1874: Banco de España, Memoria(s) and Archivo del Banco de España, Books 1426 to 1451.

Table 6. Volatility statistics

%	Data	Model		
		$\theta = 0.50$	$\theta = 0.75$	$\theta = 0.83$
$y_t$	7.0	6.0	13.1	17.7
$\pi_t$	4.3	10.2	7.1	5.8
$i_t$	1.3	0.6	0.6	0.6
$\Delta m_t$	8.5	8.5	8.5	8.5

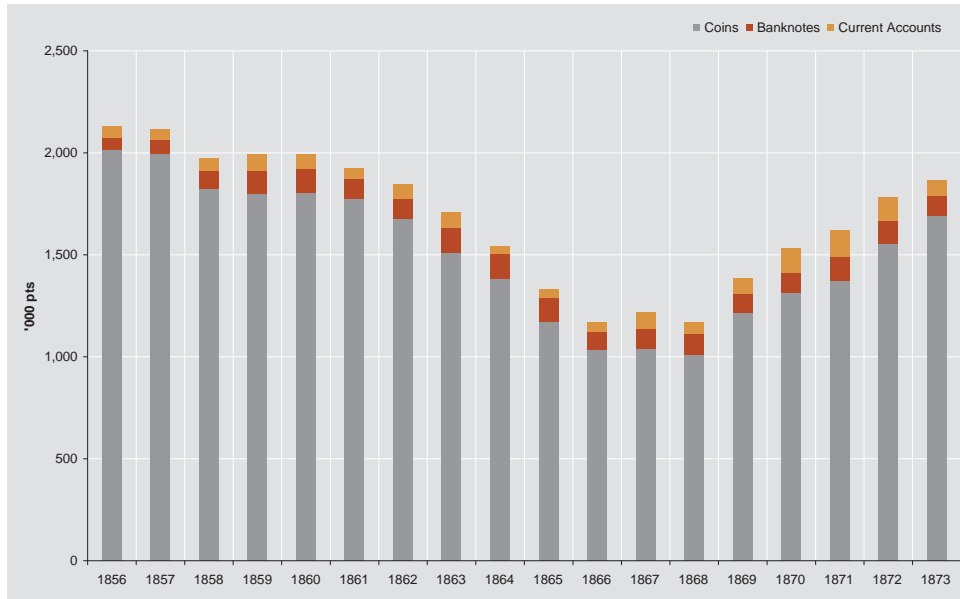


Figure 1: Evolution of Spanish money supply



Figure 2: Net flow of money

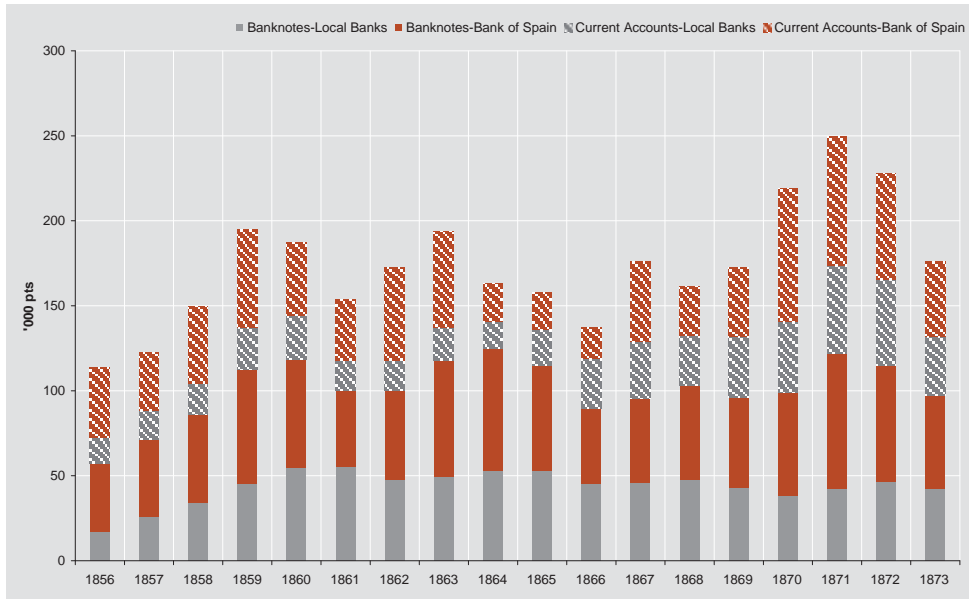


Figure 3: Volume of banknotes and current accounts

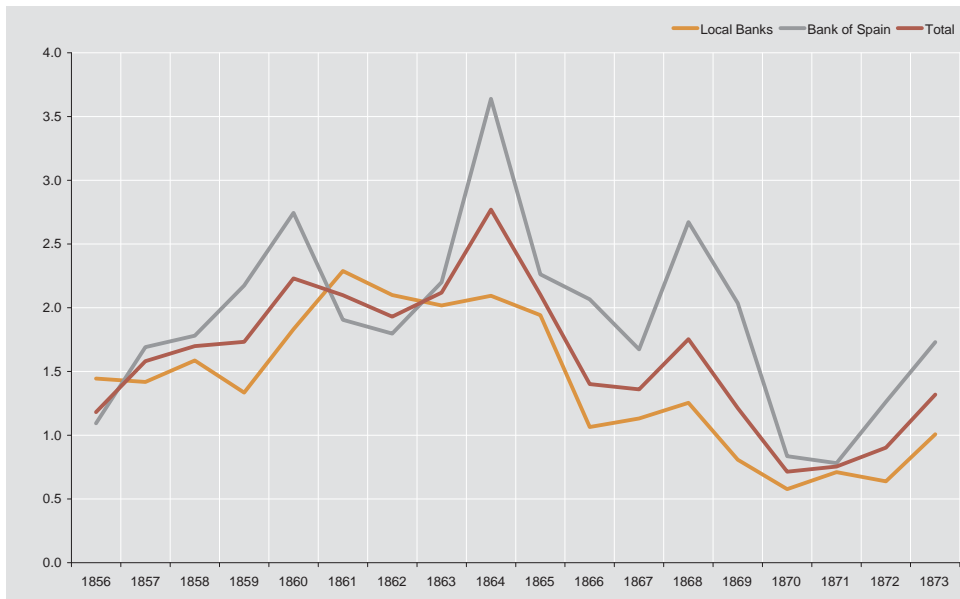


Figure 4: Ratio of banknotes / metallic

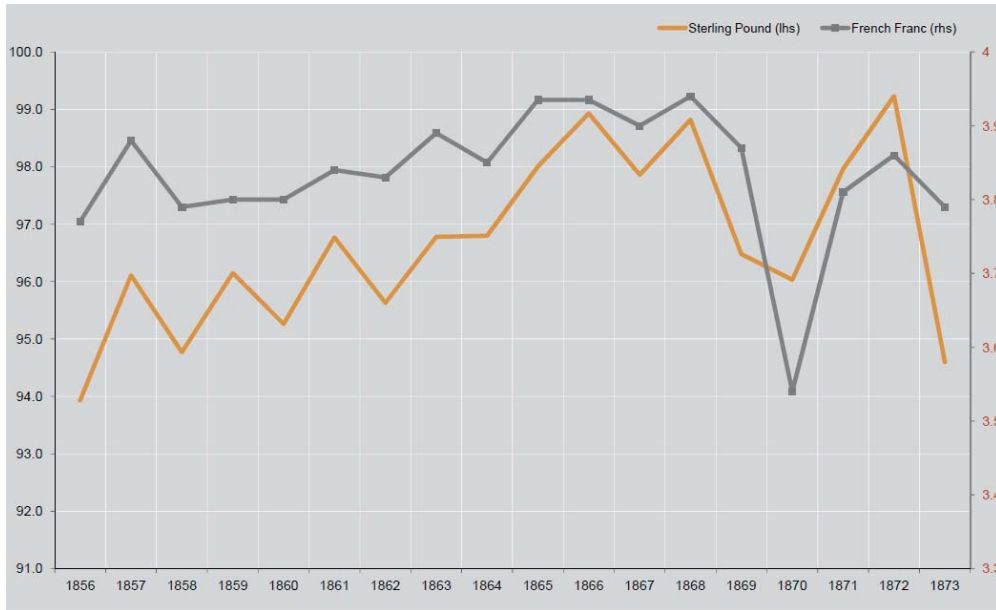


Figure 5: Rates of Exchange of the Spanish Real, 1856-1874 (Spanish Reales per British Sterling Pound and French Franc)

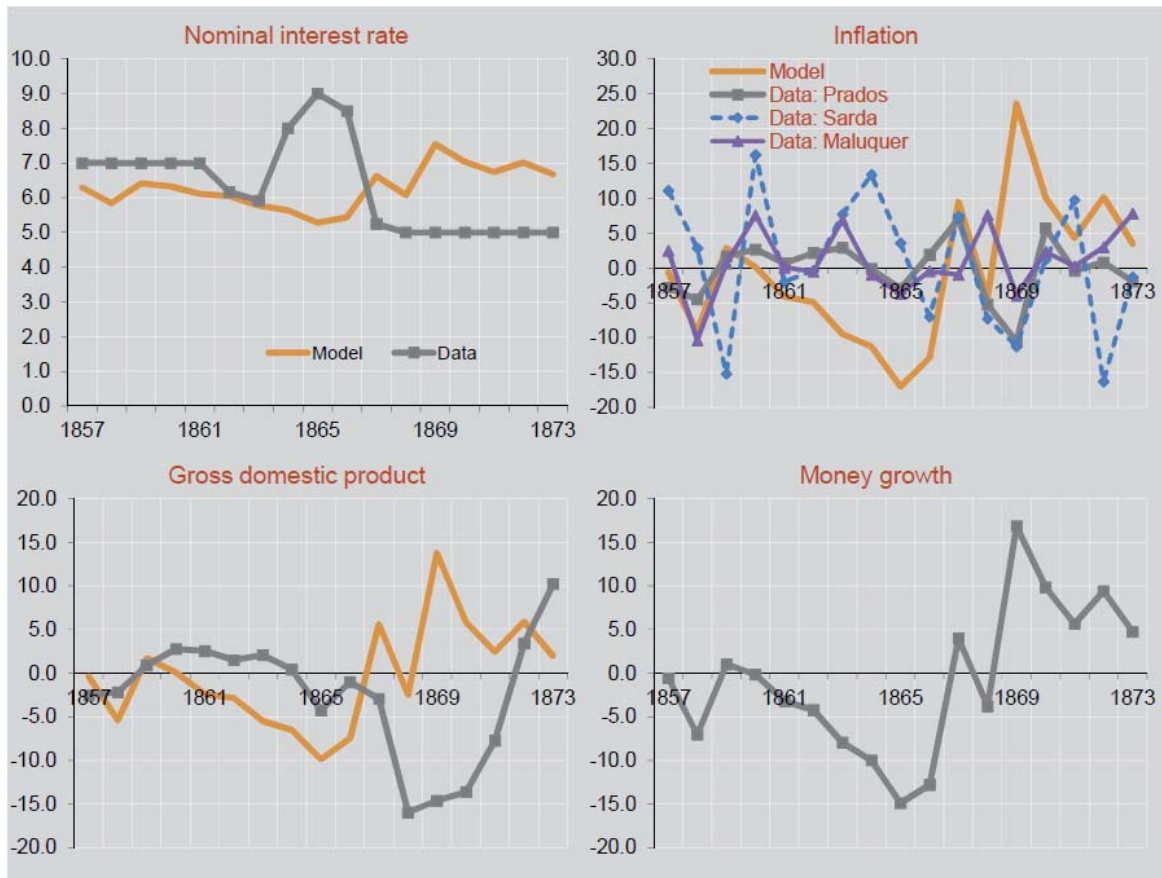


Figure 6: Comparison between model and data.  $\theta = 0.75$ .

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