



## A Methodological approach to estimating the Money Demand in Pre-Industrial Economies: Probate Inventories and Spain in the 18th century\*

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### Abstract

The study of monetary phenomena and the understanding of price determination in Modern Europe are too often limited by the scarcity of good-quality data sets on the evolution across time of variables like money holdings, income, or wealth. In this paper we show that the information contained in probate inventories can be extremely useful to circumvent that problem. In particular, combining a data set of 114 inventories from Palencia (North of Spain) between 1750 and 1770 with census information (Catastro de Ensenada) we make a cross-section estimation of a money demand which is the first one ever produced for any period before the 19<sup>th</sup> century. The results provide meaningful insights about the relation between money demand and wealth, urbanization and structural change in a pre-industrial economy and highlight the potential of probate inventories to improve our knowledge of the monetary history of Modern Europe.

**Key words:** money demand, probate inventories, price level, pre-industrial Europe

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## 1. Introduction

Information on the characteristics of the demand for money is crucial to understand the evolution of price levels. However, good quality time-series of the variables needed to estimate a money demand (price levels, interest rates, income, wealth) are very scarce for any economy prior to the nineteenth century. For this reason, the vast majority of economic historians tried to explain the evolution of prices in pre-industrial Europe using the Fisher identity ( $MV=PT$ ) and suggesting hypothesis about what part of the changes in price levels ( $P$ ) can be assigned to changes in the stock of money ( $M$ ), the amount of transactions ( $T$ ) or the velocity of circulation ( $V$ ).

One important problem of Fisher identity in the context of the economic history of Modern Europe is that, although there is plenty of quite reliable information about prices, there is scarce information about  $T$ , very incomplete and unreliable series of  $M$  and basically nothing about  $V$  which in general is calculated as a residual once the series of the other three variables are constructed. This implies that for the whole period between the 15<sup>th</sup> and the first half of the 19<sup>th</sup> century, Fisher identity can only be applied just for few benchmark years with wide margin of errors leaving the analysis of price determination at the level of controlled conjectures.<sup>1</sup>

Another problem of relying only on Fisher's equation to understand the determination of price levels is that, even if we have reliable time series of the four variables in the equation, it is very difficult to pin down the ultimate determinants of the changes in  $V$ . If  $V$  is set independently of the other variables of the equation (for instance, institutional reasons<sup>2</sup>) the equation  $M/P = (1/V)*T$  can be considered a

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<sup>1</sup> See Lindert, "English population"; and Mayhew, "Population".

<sup>2</sup> See Bordo and Jonung, *The Long Run Behaviour*; and Lindert, "English population".

demand for money.<sup>3</sup> Then, changes in the demand for money in Modern Europe have been usually linked to changes in total *marketed* output (T) and to changes in the velocity of circulation (V).<sup>4</sup> On the one hand, total marketed output would have been affected by relatively well known processes (population level, specialization, market structure, etc.) and the higher the marketed output the higher the demand for money. In this case, a relatively more complex economy with a larger tertiary sector would have a higher demand for money because specialization would be higher. On the other hand, the higher the velocity, the lower the demand for money holdings because a smaller amount of money can be used for the same level of transactions; however, the reasons of the changes in V are still far from being clear. For instance, there is a debate about the impact of urbanization on the velocity of circulation: while some authors believe that larger cities would have induced more frequent transactions and therefore smaller money holdings<sup>5</sup>, others suggest that urbanization would have increased the opportunities to use money and the incentives to hold cash.<sup>6</sup>

In this paper we suggest a novel methodological alternative to improve our understanding of the monetary phenomena in pre-industrial Europe. It is based on probate inventories, a very well known source widely available for different periods and regions in pre-industrial Europe.<sup>7</sup> Probate inventories have been used to analyze a variety of issues: wealth distribution, consumption patterns, agricultural practices,

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<sup>3</sup> This setting is quite close to what is known as a Cambridge approach in which  $1/V = k$  and  $M/P = k \cdot T$ . Goldfeld and Sichel, "The Demand for Money".

<sup>4</sup> Goldstone, "Urbanization and inflation" and "Monetary versus velocity interpretation".

<sup>5</sup> Goldstone, "Urbanization and inflation"

<sup>6</sup> Mayhew, "Population".

<sup>7</sup> In fact, probate inventories are available not only for pre-industrial Europe but also for both North and South America for colonial times and even for the 19<sup>th</sup> century.

characteristics of informal credit markets, etc.<sup>8</sup> Focusing on a set of probate inventories from Palencia, Spain in the 18<sup>th</sup> century, we show that it is possible to estimate a money demand (the first ever estimated for a pre-industrial economy) relying on several types of information about the deceased person: the money held in cash, financial assets, wealth, age, place of residence (urban or rural), the economic sector in which she/he worked. Following Mulligan and Sala-i-Martin<sup>9</sup>, we make a cross section estimation of the money demand which sheds new light on (i) the relationship between wealth and money demand which can provide important insights into the impact of economic growth on price levels through the change in the desired money holdings; (ii) the validity of some hypotheses about the relation between price levels, money holdings and non-monetary processes like urbanization and structural change.

After the Introduction, the structure of the paper is as follows: Section 2 briefly reviews the literature on price levels in Pre-Industrial Economies. In section 3, we characterize the economic situation of Palencia -from a comparative perspective- during the 18<sup>th</sup> century. The following section describes the process of selection in the probate inventories. Section 5 then presents the methodology and estimations about the demand for money, while section 6 discusses the results and their contributions. Finally, section 7 concludes with a summary.

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<sup>8</sup> See for instance Shamma, *The Pre-industrial Consumer*; Weatherill, *Consumer Behaviour*; Van der Woude and Schuurman, *Probate Inventories. A new source*; Torras and Yun, *Consumo, Condiciones de vida y Comercialización*; Allen, “Inferring Yields”; and Holderness, “Credit in English Rural Society”.

<sup>9</sup> Mulligan and Sala-i-Martin, “U.S. Money Demand”.

## 2. Previous Approaches

Most of the debate surrounding the mechanisms of the determination of price levels in pre-industrial Europe is focused on the ultimate causes of the Price Revolution. Probably the first milestone in this debate is the work by Hamilton who advanced the hypothesis that the main explanation for the inflation in Spain and the rest of Europe during the 16<sup>th</sup> and 17<sup>th</sup> centuries is the inflow of precious metals from America and their diffusion throughout Europe.<sup>10</sup> This hypothesis is based on the Fisherian quantity theory ( $MV=PT$ ) and it is argued that the increase in  $M$  fostered by the imports of American silver was by far more important than any change in the velocity of circulation and in real output. More recently, Fisher used more complicated econometric techniques to argue that prices changes can largely be explained by changes in the money supply.<sup>11</sup>

Goldstone proposed an explanation focused on  $T$  (the level of transactions) and on  $V$  (or the inverse of the demand for money).<sup>12</sup> His population –and velocity- based explanation states that the growth of population, urbanization and specialization between 1500 and 1650 implied more transactions (which should have reduced prices) but also, and more importantly, a higher velocity of circulation (which should have pushed prices up). In his explanation, the increase in  $M$  is not enough to explain the increase in  $P$  once the increase in  $T$  is taken into account. Consequently an important growth of  $V$  is required to explain the increase in prices. However, the links between population growth and velocity proposed by Goldstone are only a set of elegantly elaborated hypotheses but lacking rigorous empirical foundations.

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<sup>10</sup> Hamilton, *American Treasure*.

<sup>11</sup> Fisher, “The Price Revolution”

<sup>12</sup> Goldstone, “Urbanization and inflation”; and “Monetary versus velocity interpretations”.

Lindert analyzed the possible links between population growth (and its connections with velocity in Fisher's equation) and the changes in prices in England between the 16<sup>th</sup> and the 19<sup>th</sup> century.<sup>13</sup> He explicitly uses Fisher's equation and endorses, at least partially, the Goldstone hypothesis regarding the link between population density, urbanization, velocity, and price levels. However, he also recognizes that it is very difficult to establish a clear-cut link between some historically observed processes (like population growth, urbanization, institutional change) and any of the variables of the equation.<sup>14</sup>

Flynn went a step further stating that the Fisherian approach is not only difficult to handle in a precise way, but also that it is wrong in that it makes an artificial difference between active and passive money and that it confuses stock with flows: while the Fisherian approach is based on a flow approach (what matters is *money in circulation*), modern monetary economics is focused on stocks (what matters is *money holdings at a given moment in time*).<sup>15</sup> In this context, he insists that price determination depends on the interaction of supply and demand of money stocks but, at the same time, notes that the estimation of a demand for money stock, although very desirable, is extremely difficult with the data currently available.

Mayhew suggested that  $V$  declined sharply in England between 1561 and 1643 and, hence, rejects any association of urbanization and commercialization with a rising  $V$ . He explains this fact by discussing the difference between  $V$  and the concept of  $k$  from the Cambridge school: "In truth  $V$  is far more likely to fall with the increasing use of money than to rise. The Cambridge school of economics understood this well when

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<sup>13</sup> Lindert, "English population."

<sup>14</sup> Lindert, "English population," pp.621-22.

<sup>15</sup> See Flynn, "Use and Misuse"; and Doherty and Flynn, "A Microeconomic Quantity Theory."

they preferred to use the concept of  $k$ , the demand for money to hold, instead of  $V$ . An increase in the use of money entails a rise in the demand for money and therefore a fall in  $V$  (since  $k$  is the inverse of  $V$ )".<sup>16</sup>

So, until recently, the use of Fisher's equation and the Cambridge approach has been pervasive in the debate surrounding prices in pre-industrial Europe. In this context the only possible reference to changes in the demand for money is seen through changes in  $k$  or  $V$ .<sup>17</sup> However, the lack of reliable and consistent data on money stocks makes it impossible to obtain reliable estimations of  $V$  and to venture more than educated guesses about its determinants. Although we have important reasons to believe that economic growth, structural change, population growth, and urbanization (among other things) affect the demand for money holdings and hence the price level, it is impossible with the available data to assess their direction and the magnitude of their impact.

In the next sections we will suggest that the analysis of probate inventories can be extremely helpful in understanding the determinants of money holdings. Although our example comes from Palencia, a relatively small area in the North of Spain, we argue that it provides an important methodological innovation towards an understanding of the effects of urbanization, structural change and economic growth on the demand for money and price levels.

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<sup>16</sup> Mayhew, "Population", p. 253.

<sup>17</sup> The debate surrounding the causes of the changes in price levels and the applicability of Fisher's identity are not confined to the European context. For instance, the case of New England has recently been discussed by Officer, "The quantity theory."

### 3. Spain in the Eighteenth Century: *Palencia* in the Castilian Economy.

Towards 1600 the Crown of Castile was among the most highly urbanized areas of Europe, surpassed only by the Netherlands and Italy. From that time on, the urban network of Old Castile began to weaken gradually, and its population growth rate was far slower between the seventeenth and eighteenth centuries than Europe as a whole. In 1800, Europe had 364 cities of at least 10,000 inhabitants; England and Wales 44, Germany 53, France 78, Northern Italy 33 and Spain 34.<sup>18</sup>

In the second half of the eighteenth century Palencia (located in the North of Castile) had a population of around 120.000 with a relatively high population density: it was in the tenth place among the Spanish provinces.<sup>19</sup> Within Palencia there were three municipalities –Palencia (10,345 inhabitants in 1787), Paredes de Nava (3,926 inhabitants) and Villarramiel (2003 inhabitants) – with over two thousand inhabitants.<sup>20</sup>

[Graph 1]

During the eighteenth century Palencia was an eminently agricultural province, although with a certain degree of economic diversity. In general terms, the market

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<sup>18</sup> See de Vries, *European Urbanisation*. At the end of the eighteenth century nearly 25% of the Spanish population lived in urban settings, and the regions with greatest urban density were Andalusia, the Balearics and Valencia-Murcia. Catalonia was slightly above the national average – although its urban growth was the most important in the whole peninsula – while Asturias, Castile-León and Galicia had the lowest ratios of urban development. Reher, *Town and Country*.

<sup>19</sup> The geographical boundaries of Palencia in the Catastro de Ensenada were not too different from the actual province of Palencia (see graph 1).

<sup>20</sup> García Colmenares points out how, during the second half of the eighteenth century and the first third of the nineteenth, the city of Palencia was characterized by a relative stagnation in urban population growth which would continue until the 1840s. For its part, in the province of Palencia demographic growth was above the Spanish average and similar to the average for Castile-Leon until the late eighteenth century. After the first third of the nineteenth century, the province of Palencia and Castile-Leon itself veered further and further away from the demographic patterns of the rest of the peninsula. García Colmenares, *Economía y Población*, pp. 65-80.



region of *Tierra de Campos* and, to a lesser extent, the *Cerrato Palentino*, had quite important secondary and tertiary sectors. In contrast, in the market regions of the northern half of the province, with the exception of the valleys of Boedo and La Ojeda – of great importance in the local cheap textile industry-, agricultural and livestock activities were practically the only source of wealth. Chronicles of the time even classified Palencia as “the most industrious province of Castile”.<sup>21</sup> Available data for the working population show that between 60 and 75 % of the inhabitants of the city of Palencia were working in the secondary and tertiary sector (according to the Ensenada Land Register around 3,000 people based around the *La Puebla* district of the city –out of a population of more than 9,000 inhabitants– worked in one of the various stages of the textile manufacturing process). In contrast, in the rural areas this percentage barely rose above 30% given the lack of connections between the productive processes of the “unionized” urban industry and of the scattered rural industry.<sup>22</sup>

[Table 1]

By 1799 textile production in Castile-Leon represented 28 % of the national total but the crisis of the first decade of the nineteenth century –because of the Napoleonic wars among other things- and the later emergence of new and more competitive forms of organization which mechanized carding and spinning in the productive processes in Catalonia or Alicante, would dismantle the commercial circuits of the textile industry.<sup>23</sup>

Standards of living in Palencia in the second half of the 18th century were probably neither obviously higher nor lower than in other places in Modern Europe.

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<sup>21</sup> Larruga, *Memorias políticas y económicas*, p. 286.

<sup>22</sup> Yun, *Sobre la transición al capitalismo en Castilla*, p. 566.

<sup>23</sup> García Colmenares, *Evolución y crisis de la industrial textil palentina*, pp. 136-150.

Between 1750 and 1800 nominal wages of bricklayers in the city of Palencia were very similar to wages those of “peones” in Madrid.<sup>24</sup> A precise comparison of real wages is impossible because there are not comparable price indexes but, assuming that price levels were not very different between the two cities, real wages should be relatively close.<sup>25</sup> According to Allen, workers' welfare in Madrid in the second half of the 18th century was lower than in other important pre-industrial European cities but it was not unusually low: the welfare ratio of building craftsmen in Madrid in 1750-1799 were 63 % of the average of that measure in London between 1500 and 1800 (the second highest in Europe after Antwerp) but 95 % and 90 % of the average in Paris and Milan-Florence respectively.<sup>26</sup> Although the comparison is quite crude, it suggests that in the pre-industrial European context, the region of Palencia was not an outlier in terms of standards of living.

Real wages for unskilled workers (building workers and day labourers) in Palencia decreased from 1750 until 1800, increased between 1815 and 1830, and finally declined in the next decade of nineteenth century.<sup>27</sup> This trend in real wages coincided with a period of economic and demographic growth in Castile, and also with an expansion in household consumption.<sup>28</sup>

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<sup>24</sup> Moreno, “¿Fomentó el capitalismo agrario la desigualdad?”; and Hamilton, *War and Prices in Spain*, Appendix V.

<sup>25</sup> If anything, it is probable that price levels were higher in Madrid, a considerably larger city than Palencia. This would imply a higher real income for workers in Palencia reinforcing the argument we present in the following lines.

<sup>26</sup> Allen, “The Great Divergence,” Table 5, p. 428.

<sup>27</sup> Moreno, “¿Fomentó el capitalismo agrario la desigualdad?”, pp. 75-112.

<sup>28</sup> Nevertheless in the Spanish context, Castile has been considered an obstacle to the economic development of Spain, due to the low purchasing power of the Castilian population. For instance, Nadal, “El fracaso”, p. 307, pointed out the Spanish economic backwardness in the nineteenth century due to agricultural stagnation and to the weakness of the domestic market. On the other hand, Prados de la Escosura, *De imperio a nación.*, pp. 37-65, pp. 95-138 and p. 175, argues that the responsibility for the backwardness lies with industrial underdevelopment, which led to a surfeit of available

Since the 16<sup>th</sup> century, Spanish economy was strongly influenced by the inflow of silver from Mexico and Potosi and by the outflow of that metal because of a persistent deficit in the balance of payments. One of the main preoccupations of Spanish monetary policy in the eighteenth century was to maintain stable monetary circulation and to keep hold of precious metals in order to lay the foundations for an economic development.<sup>29</sup> Charles III (1759-1788) tried to meet these goals with the devaluations of 1772 and 1786 and the Royal Warrant of October 12<sup>th</sup> 1778 which authorized the majority of Spanish ports to conduct commerce with America. The expansion in trade with the American colonies and the resulting increase in the inflow of American silver made an increase in imports of foreign merchandise (as much for the domestic market as for re-export to America) and a greater circulation of cash in the Spanish economy possible.

#### **4. Data from Probate Inventories and Catastro de Ensenada**

The probate inventories and the deeds of valuations and divisions of goods carried out for the allocation of inheritances report a complete and detailed lists of all the assets of the deceased. In Castile, legislation on inheritance was based on the “*economic power of the head of the family*”. In fact, the breaking up of a family only acquired personal and economic significance when the husband died. With the male dead, the

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labour for agriculture which reduced productivity levels, motivated by poor demand for work in urban areas.

<sup>29</sup> Sardá considers that exchange devaluation would have been a possible solution to avoid the continual outflow of these metals but, for fiscal reasons, it was not undertaken. For centuries the Spanish economy relied on American shipments of gold and silver from America whose principle recipient was the Crown. That meant that the more legal the metal content of the coin, the more the State would receive. In this context it is easy to understand that those responsible for currency were not in the least bit interested in the increase of taxes and a monetary devaluation. Sardá, *La política monetaria*, pp. 18-19.

wife and mother could only be tutor and guardian of her children if this was expressly stated in one of the clauses in the will written by the husband.<sup>30</sup>

A probate inventory is a comprehensive list of all the goods owned by the deceased at the moment of his death and it was usually elaborated by a notary or judicial authority few days after the head of the household passed away. Given that the main purpose of the inventory is to divide the heritage among the heirs, each good is valued by the notary to calculate the total worth of the patrimony and to assign the proper shares to each heir. Obviously biased valuations would be resisted by the heirs because it would probably end in an unfair assignation of shares.

On the basis of the information contained in the list of probate inventory goods, we have defined total wealth as the sum of real assets, financial assets, capital assets (or goods) and durable and semi-durable consumption goods. By real assets, we take into account the total of urban and rural properties. With regard to financial assets, given the wide range of these, we have chosen to group within this category the following items: cash, net credit in account (claims)<sup>31</sup>, land rents, expenditure on account on the funeral service, shares of the estate received by the inheritors in advance, and so on. Regarding capital assets, we have included implements and tools (made up of farming implements, winemaking equipment and measuring equipment, implements for livestock and implements for producing textiles), raw textiles, livestock, etc. Finally we have carried

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<sup>30</sup> See an exhaustive study of the legal system regulating inheritances in Castile in García, *Herencia y Patrimonio Familiar*, pp. 24-27.

<sup>31</sup> Probate inventories provide a list of the claims in favour of the deceased (assets) and claims against the deceased (liabilities). A detailed description of each debt is not that common. With fragmentary information available in some inventories it is possible to see that its composition is quite diverse since it covers repairs to the family house, expenditure on the purchase of textile manufactured goods (trousers, shirts, shoes, etc.), expenditure on laundry, expenditure on food (purchase of wheat, bread, chocolate, wine, straw etc.), expenditure on medical care, expenses related to the education of one of the children, unsettled debts for commissions, tithes and entry fees (customs), etc.

out a classification of the different durable and semi-durable consumption goods, understanding such goods as being all types of clothes, bed linen, table linen, personal items, articles related to household equipment (kitchen and furniture), pictures, items of a religious nature, books and items of jewelry.

To carry out this study we analyzed all the inventories available in the province of Palencia in the period: 1752-1770.<sup>32</sup> In order not to accumulate inventories incoherently, those where the estate had already been shared out and which would have meant a break up of the family structure have been ignored. Secondly, those inventories where there was reasonable doubt regarding the concealment of assets, generally urban or rural property, have also been rejected.

To discuss the methodological advantages and drawbacks of probate inventories goes beyond the scope of this study.<sup>33</sup> It is true that, even though inventories and valuations were carried out before a notary public and judicial authorities, the recorded amount of money in cash could have been affected by concealment.<sup>34</sup> Sometimes the division of assets is disputed by one of the beneficiaries, so after the “defective” inventory of goods there will be a batch of papers containing the “correct” one.

In order to eliminate the bias of the sample towards the larger estates, the data from probate inventories has been crossed with fiscal sources, the Ensenada Land Registry (“Catastro de Ensenada”), completed approximately between 1749 and 1754 which contains lists of the annual income for each family in Spain in that period. The “Respuestas Particulares del Catastro de Ensenada” are the answers to questions asked

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<sup>32</sup> We don't know exactly the percentage of probate inventories which were entered on record in relation to deaths. In fact, to make a reliable guess for dates prior to the nineteenth century is practically impossible. For the city of Palencia in 1830-40 there are 32 available inventories which represent 0.75 % of the total of deaths in that period (4,208). See Ramos, “Pautas de consume familiar en la Castilla Pre-industrial”.

<sup>33</sup> Torras and Yun, *Consumo*, and De Vries, “Between purchasing power,” pp. 85-132.

<sup>34</sup> See the discussion in the next section.

to heads of family about household wealth in the Ensenada Index. These “Private Replies” (“Respuestas Particulares”) show, family by family and town by town, the incomes for the population of Castile. From this source, different intervals in family income have been considered. In Table 2 we can see that the number of inventories corresponding to families with incomes of less than 500 *reales* per year is rather small. With regard to families with incomes ranging from 500 to 1,000 *reales*, the relative size of the sample is practically analogous to that reflected in the Ensenada Land Registry. At the same time, for those families with annual incomes ranging from 1,000 to 4,000 *reales* the percentage is always higher in the sample collected. With the data from Table 1 we have re-weighted our sample in such a way that each income group has a weight equivalent to its relative size in the total population.

[Table 2]

Finally, it is important to note that these probate inventories were from the Castile Crown where the accounting unit was the real (one “real” was equivalent to thirty four “maravedies”). Consequently, all the probate inventories are in “reales”.<sup>35</sup> Table 3 shows a summary of information about the basic financial variables constructed from the data set of 114 probate inventories: a third of the probate inventories included money in cash.

[Table 3]

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<sup>35</sup> For instance, the accounting unit in Catalonia (“libra catalana”) was different to Castile.

## 5. Methodology

This set of 114 probate inventories is the starting point of our estimation. They contain quite detailed information about cash, assets, liabilities, wealth, profession and place of residence of each deceased head of household. Our estimation regards each inventory as a point in the sample. The variables we use in the econometric analysis are the following:

- a) Money: *lmoney* is the log of the amount of money in the inventory.
- b) Total wealth: *lwealth* is the sum of real assets, net financial assets, capital assets and durable and semi-durable consumption goods (in logs).
- c) Place of residence: we have created a dummy variable *urban* which is equal to 1 if the household is located in a city larger than 3000 inhabitants and 0 otherwise.
- d) Economic sector: we have created two dummy variables: *secondary* which is equal to 1 if the main economic activity of the household head is related with the secondary sector and 0 otherwise; and *tertiary* which is equal to one if the main economic activity of the household head is related with the tertiary sector and 0 otherwise.<sup>36</sup>
- e) Age: is the age of the head of the household
- f) Positdebt: is the total sum of claims in favor of the head of the household (credit in account).

The model used to estimate the money demand is

$$\mathbf{m} = \mathbf{a} + \mathbf{b} \cdot \mathbf{Y} + \mathbf{c} \cdot \mathbf{D} + \mathbf{u}$$

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<sup>36</sup> According to the Catastro de Ensenada many households receive income from activities related with more than one economic sector. In such cases we have included the household in the sector from which the imputed income is higher.

where  $\mathbf{m}$  is the quantity of money,  $\mathbf{Y}$  is a measure of wealth,  $\mathbf{D}$  is a set of dummies providing other information about the characteristics of the household (in our case  $\mathbf{D}$  will include the dummy *urban* and those related with the economic sector) and  $\mathbf{u}$  is the error term.

Probate inventories recorded both personal belongings and goods related with the entrepreneurial activities of the deceased person (stored merchandise, manufacturing and agricultural implements and inputs, etc). Hence, our approach is combining information on the money holdings by households and also by firms. Although it would have been interesting to distinguish between the money demand from firms and the money demand from households, the way the data is presented in probate inventories precludes this possibility.

There are some advantages of using wealth instead of income when estimating a money demand: given that the endogenous variable (money holdings) is a stock variable, the advice of relating stocks with stocks rather than stocks with flows applies; moreover, some approaches emphasize that money holdings depend more on permanent than on current income and wealth is sometimes suggested as a better proxy for permanent income than current income.<sup>37</sup> The main problem is that it is more difficult to compare the result for those obtained using current income.

Using probate inventories for the analysis of the demand for money has two potential shortcomings. First, we can not include the interest rate in the analysis even though it is a crucial variable in most of the empirical approaches to money demand. Given that our data set is a cross-section of individuals, what would have been relevant for our analysis is information on the variation of the interest rates faced by different

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<sup>37</sup> See for instance Meltzer, “The Demand for Money” and Bomberger, “Income, Wealth and Household Demand for Deposits”.



individuals in the data set. If interest rates are correlated with the dependent variables in our model, the estimated parameters would be biased.

There are strong reasons to believe that richer people face lower interest rates when borrowing because of their possibility to present collateral or their reputation. However, the reason why the interest rate is relevant in the determination of the demand for money is because it represents the alternative cost of keeping money in cash. Then, the question is whether wealth or the characteristics of the household (rural/urban and economic sector) are correlated with the interest rate that the individual receive when lending not when borrowing. It is possible that richer people face higher interest rates when lending because there were some kind of fixed costs in accessing the financial markets (formal or informal) but there is not clear evidence at this respect and research on the characteristics of pre-industrial informal credit markets is rather scarce for Europe and for Spain in particular.<sup>38</sup> We present a more detailed discussion about the consequences of excluding interest rates in our model in the appendix.<sup>39</sup>

The second shortcoming is the possibility that sometimes the money in cash is not registered in the inventory (concealment): in our sample, only 31 % of the probate inventories mention cash among the belongings and some inventories of very rich individuals do not mention any cash. This raises the suspicion that some families (or some of the heirs) are hiding the money before the inventory is written down. The simplest strategy for dealing with this problem is to assume that concealment is not systematically related with other variables in the analysis which means that there is no

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<sup>38</sup> For England see Holderness, “Credit in English Rural Society”; for Spain Sabio Alcutén, “Los mercados informales.”

<sup>39</sup> Mulligan and Sala-i-Martin, “U.S. Money Demand”, have also made their analysis excluding interest rates. They suggest that the resulting bias is bounded relying on assumptions about the evolution of the stock of capital in each State of the USA and identifying interest rates as the marginal productivity of capital. For obvious reasons it is not possible to apply this approach to our data set.

need to model the missing data mechanism as part of the estimation process. The simplest suggested procedure in this case is *listwise deletion* which is accomplished by deleting from the sample any observations with missing data and then applying conventional methods of analysis for complete data sets.<sup>40</sup> We follow this procedure in table 4.

[Table 4]

However, if concealment is not randomly distributed (for instance, poorer households or rural households tend to conceal more frequently than richer or urban ones) some bias can arise in our estimation. We first tried to explore this possibility by checking whether the information in our data set is useful to predict potential concealment. We have estimated a Probit model with a dummy variable with value 1 if there is some money included in the inventory and 0 otherwise as a dependent variable and all the variables which could eventually be related with incentives or possibilities to conceal money as independent (see table 5).

[Table 5]

The only significant variables (at 5 %) in this estimation are age (with negative effect) and secondary (with positive effect). This result suggests that although the variables affecting the probability of non declaration of cash are not among the most relevant in the estimation of the money demand, we cannot reject the possibility of some non random sample selection.

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<sup>40</sup> Allison, "Missing Data".

The usual strategy for solving non random sample selection is to apply the Heckman selection model <sup>41</sup> in which we need to define, together with the usual *regression equation* (the money demand  $m = a + bY + cD + u$ ), what is known as the *selection equation* which states that concealment ( $m=0$ ) depends on other variables in the data set. We included in the selected equation the two variables significantly different from zero in our Probit regression<sup>42</sup>. The results of this approach are presented as follows

[Table 6]

The very close similarity between the parameters estimated in regression 1 and 3 and the result of the Wald test of independent equations show that the hypothesis that missing observations are randomly distributed within our data set is reasonable.

## 6. Results

One of the important contributions of this methodology is to produce an estimation of the elasticity of the money holdings with respect to wealth. Our results from regressions 1 and 3 show that the elasticity of money demand with respect to wealth in modern Spain is between 1.4 and 1.5. Given that this is the first time that a money demand has been estimated for a period before the 19<sup>th</sup> century, the only possible comparison is with other empirical approaches focused on the second half of the 19<sup>th</sup> century and the 20<sup>th</sup> century. Although most of these estimations based on time-series data and using income as a control variable suggest that income elasticity is around 1,

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<sup>41</sup> There are two possible ways of estimating the Heckman model: to apply a two-step procedure or to use full maximum likelihood (Wooldridge, *Introductory Econometrics*, pp. 563). In this case we use the second strategy because it is easier to handle when the sample is re-weighted as it is in our case.

<sup>42</sup> Different permutations of the set of variables included in the selection equation produce results very similar to those reported here.

our results are quite close to other estimations using either cross-section data but income as scale variable which obtain an income elasticity between 1.3 and 1.4 or time-series data and wealth as a scale variable –with a wealth elasticity of 1.32.<sup>43</sup> This comparison reinforces the plausibility of the results and suggests that the methodological innovation proposed in this paper provides a useful tool for understanding the demand for money.

The implications of these results can be quite important if they are generalized for the pre-industrial economies. The explanations for the evolution of prices, for instance the Price Revolution of the 16<sup>th</sup> century, should take into consideration that the demand for money holdings increases more rapidly than wealth, and therefore the decline in prices caused by economic growth (*ceteris paribus*) would probably be more pronounced than what Fisher's identity suggests.

The other estimated parameters in our econometric model allow us to discuss the nature of the determinants of money holdings keeping wealth constant which, in the context of the Fisher identity, would be an indirect way to analyze some determinants of the velocity of circulation. We notice some interesting effects regarding the economic sector: we have included in our model two dummies, *tertiary* and *secondary* reflecting the difference between the money holdings of the households whose head was working in that sector and the households whose head was working in the primary sector (our control group). The estimated parameters of *tertiary* are significant at 6 % in regression 1 and 3 % in regression 3. The implied elasticity of these estimations suggests that people working in the tertiary sector would have 303 % and 332 % respectively more money than people in the primary sector. The estimated parameters of *secondary* are not significant showing that people in the primary and in the secondary sector have broadly

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<sup>43</sup> See Lewis and Mizen, “Monetary economics”, Mulligan and Sala-i-Martin, “U.S. Money Demand”, and Meltzer, “The Demand for Money”.

similar money holdings. Although the effect of tertiary is rather large, it is to be expected given that the tertiary sector is money-intensive.

Our estimation can also shed some light on the effect of urbanization. There has been a lively debate about whether urbanization implied smaller money holdings (because of more efficient and rapid exchanges) or it implied larger money holdings (because more exchange implied more incentives for holding money)<sup>44</sup>. Our estimated parameter attached to urbanization is significant at 11 % in Regression 1 and at 4 % when the Heckman model is used. Both suggest that urbanization implied an increase in the demand for money: people in cities would have 84 % more money (98 % with the Heckman model) than those in the countryside. If our results can be generalized to other areas and periods in pre-industrial Europe, they can be interpreted as a strong case against Goldstone's hypothesis that urbanization pushed price levels up. Rather, our results show that urbanization would have increased the demand for money, making money more valuable (in terms of goods) and goods less valuable in terms of money. This would have implied a decline in prices.<sup>45</sup>

## **7. Conclusions**

The main contribution of this paper is methodological: we have shown that it is possible to estimate a money demand for pre-industrial economies using probate inventories, a source available for many places and periods in Modern Europe. The

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<sup>44</sup> See Goldstone, "Urbanization and Inflation"; Flynn, "Use and Misuse"; and Mayhew, "Population".

<sup>45</sup> If urbanization is defined with thresholds at 2,000 or 10,000 inhabitants (instead of 3,000) the estimated parameters do not change very much but their statistical significance declines. If this difference in the impact of urbanization is not a problem generated by the small size of the sample, it can suggest the extremely interesting hypothesis that size of the urban agglomeration has a non-linear relation with the demand for money.

information provided by probate inventories, although far from perfect, allows to take a big step forward in our understanding of the determinants of the demand for money and the relation between money holdings on the one hand and wealth, urbanization and the structure of the economy on the other hand.

Regarding the wealth effect on the money demand, we have provided evidence that wealth elasticity is around 1.4 and significantly larger than 1. It implies that economic growth and the increase of wealth would have produced (*ceteris paribus*) a larger negative effect on prices than hitherto considered. The estimated effect of urbanization on money holdings is positive which implies an increase in the demand for money and therefore a reduction of price levels. This provides the first quantitative evidence regarding the impact of urbanization on the evolution of prices and suggests that Goldstone's hypothesis -that a higher share of urban population increased velocity and therefore increased prices- is not correct. The results on the effect of structural change show that the tertiary sector is very money-intensive while those engaged in the secondary sector do not hold higher money balances than those with agricultural occupations.

Given that our main purpose is methodological, there is plenty of room for further research. Probably the two most obvious priorities are enlarging the data set and combining data from Spain in the 18<sup>th</sup> century with data from other periods and other countries. If the use of probate inventories to analyze money demand proves to be a sound idea, a new area of research could provide interesting insights into the monetary history of Modern Europe.

## Appendix

### Impact of the exclusion of Interest Rates in the econometric model

The complete equation for a money demand would be

$$M = a + b Y + c D + z I + e \quad (\text{A.1})$$

where  $I$  is the interest rate and the other variables are defined as in section 5.

If people hold money because of the transactions motive (following for instance the approaches of Keynes or Baumol-Tobin), the interest rate should affect the money demand because it is the alternative cost of holding money and not putting financial wealth in a interest-earning asset. In this context, the higher the interest rate the lower the money demand ( $z < 0$ ).

If instead of estimating (A.1) we estimate

$$M = a + b Y + c D + u$$

then  $u = z I + e$  and, as long as the exogenous variables ( $Y$  and  $D$ ) are correlated with the error term, the estimated parameters would be biased.

One of the most sensible assumptions about why different people face different interest rates in equilibrium is that richer people will have better access to the financial markets because of fixed costs, reputation, information advantages, etc. If richer people face higher interest rates when lending, the correlation between  $Y$  and  $u$  would be positive. Let us imagine that we can represent this lack of orthogonality by assuming that  $I = k + h Y$  with  $h > 0$ . Then the true equation would be

$$\begin{aligned} M &= a + b Y + c D + z I + e \\ &= a + b Y + c D + z (k + h Y) + e \\ &= a + z k + (b + z h) Y + c D + e \end{aligned}$$

and our estimation of  $b$  would be biased. Given that  $zh$  is negative, our estimation would be biased downwards. At the same time, if the sensitivity of money demand to

interest rates is low ( $z \rightarrow 0$ ) or the sensitivity of the interest rates to wealth is low ( $h \rightarrow 0$ ), the bias would be small. A similar reasoning can be made about the possible bias in the estimation of the impact of urbanization and economic sector.

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**Table 1**  
**Structure of the Working Population, Palencia 1750-1860**

Economic Sector	City of Palencia		Province
	1772	1858	1860
Primary	25.2	12.1	68.6
Secondary	51.4	50.6	18.0
Tertiary	23.4	37.3	13.4

Source: García Colmenares (1998), pp. 178-181.

**Table 2**  
**Distribution of Population and Probate Inventories according**  
to Annual Income as collected in the “Ensenada Land Registry”, Palencia (1749-1753)

<b>Annual Income (in reales)</b>	<b>Population Distribution</b>	<b>Inventory Distribution</b>	<b>Number of Inventories 1750-1770</b>
1-500	42.15	5.13	6
501-1000	31.47	30.77	36
1001-1500	10.88	17.95	21
1501-2000	5.02	15.38	18
2001-2500	3.00	8.55	10
2501-3000	1.27	7.69	9
3001-3500	1.47	6.84	8
3501-4000	0.78	5.13	6
> 4000	3.95	2.56	3

Source Ramos (2001)

**Table 3**  
**Assets in Probate Inventories, Palencia 1750-1770**

	<b>1750-1770</b>
Average Total Assets (current <i>reales</i> )	19170.65
Average Total Assets (constant <i>reales</i> )	21669.31
<b>Money in Cash</b>	
% Inventories with Money in Cash	35.90
Average Amount of Money in Cash (current <i>reales</i> )	2450.50
Average Amount of Money in Cash (constant <i>reales</i> ) *	2565.08
% Money in Cash in relation to Total Assets	7.37
Probate Inventories	116

\* The price index comes from Palencia's Hospital records. Moreno (2002, pp. 108-110).

**Table 4**  
**OLS Estimates of Money Demand**  
Dependent Variable: Imoney

	Coefficient	t-student	P >  t	[95% Conf. Interval]	
Constant	-8.348276 (1.8014880)	-4.63	0.000	-12.001860	-4.694689
Lnetwealth	1.430028 (0.1743046)	8.20	0.000	1.0765220	1.783534
Secondary	0.3360651 (0.4376522)	0.77	0.448	-0.5515347	1.223665
Tertiary	1.3940420 (0.6916851)	2.02	0.051	-0.0087600	2.796845
Urban	0.6097980 (0.3671994)	1.66	0.105	-0.1349169	1.354513
N	41				
F (4, 36)	17,60				
Prob > F	0.0000				
R-squared	0.6070				
Root MSE	1.0834				

Notes: OLS: Ordinary Least Squares. Regression with robust standard errors. Robust Standard errors are in parentheses.

**Table 5**  
**Probit Estimates of Money in cash being non zero**  
Dependent Variable: du\_money

	Coefficient	Z	P >  z	[95% Conf. Interval]	
Constant	-1.267794 (1.9535810)	-0.65	0.516	-5.096742	2.561154
Lnetwealth	.2946369 (0.1963254)	1.50	0.133	-.0901538	.6794275
Urban	-.2987661 (0.3947014)	-0.76	0.449	-1.072367	.4748343
Age	-.0364515 (0.0105143)	-3.47	0.001	-.0570592	-.0158438
Positdeb	-.0001808 (0.0001298)	-1.39	0.163	-.0004352	.0000735
Secondary	1.415074 (0.4236499)	3.34	0.001	.5847359	2.245413
Tertiary	.2898854 (0.4031384)	0.72	0.472	-.5002514	1.080022
N	114				
Wald chi2 (6)	17,60				
Prob > chi2	0.0002				
Pseudo R2	0.2935				
Log pseudo-likelihood	-52.081059				

Notes: Robust Standard errors are in parentheses.



**Table 6**  
**Heckman Selection Model of Money Demand**  
 Dependent Variable: Imoney

	Coefficient	Z	P >  z	[95% Conf. Interval]	
Constant	-9.285765 (1.471236)	-6.31	0.000	-12.16933	-6.402195
Lnetwealth	1.523464 (.1468014)	10.38	0.000	1.235739	1.81119
Secondary	.3211945 (.4972364)	0.65	0.518	-.6533709	1.29576
Tertiary	1.463191 (.6364509)	2.30	0.022	.2157697	2.710611
Urban	.6829925 (.3304634)	2.07	0.039	.0352961	1.330689
Select					
Secondary	1.028839 (.5177093)	1.99	0.047	.0141472	2.04353
Age	-.0326563 (.0128837)	-2.53	0.011	-.057908	-.0074047
Constant	1.097722 (.765036)	1.43	0.151	-.4017205	2.597165
/athrho	.1015882 (.2643128)	0.38	0.701	-.4164553	.6196317
/lnsigma	-.02898 (.2233424)	-0.13	0.897	-.4667231	.408763
Rho	.1012401 (.2616037)			-.39394	.5508715
Sigma	.9714359 (.2169628)			.6270537	1.504955
lambda	.0983483 (.2704542)			-.4317322	.6284288
Wald test of indep. eqns. (rho = 0): chi2(1) = 0.15 Prob > chi2 = 0.7007					
N	114				
Censored Observations	74				
Uncensored Observations	40				
Wald chi2 (4)	118,38				
Prob > chi2	0.0000				
Log pseudo-likelihood	-114.5792				

Notes: Robust Standard errors are in parentheses.

# Graph 1 Palencia, 1700-1800

*Spain*



*Castile & León*



*Palencia in Catastro de Ensenada  
(c. 1750)*



*Palencia from 1833*

