Ganugi, P., Grossi, L. and Ianulardo, G., 2009. Scale Economies and Heterogeneity in Business Money Demand: The Italian Experience. Working Paper. Bath, UK: Department of Economics, University of Bath, (17/09).

Link to official URL (if available):
http://www.bath.ac.uk/economics/research/workingpapers.html

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No. 17/09

BATH ECONOMICS RESEARCH PAPERS

Department of Economics and International Development

SCALE ECONOMIES AND HETHEROGENEITY IN BUSINESS MONEY DEMAND: THE ITALIAN EXPERIENCE

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Abstract.

This paper investigates the demand for money by firms and the existence of economies of scales in order to evaluate the efficiency in the cash management of the Italian manufacturing industry. We estimate a money demand for cash elaborated by Fujiki and Mulligan (1996). Estimates differ from the previous literature firstly, because we use a choice dynamic model to overcome endogeneity problems in cash holdings; secondly, because we use an iterative procedure based on backward exclusion of firms from model estimation with which we point out the high heterogeneity of Italian companies in money demand. Our estimates show that the Italian Manufacturing industry, considered as whole, does not enjoy scale economies in money demand. Our iterative procedure points out that the cause of this result is to be ascribed to small firms which are characterized by thin cash money holdings and a consequently very modest opportunity cost. Once small size firms are removed from our data set our estimates reveal that money demand of medium and large size firms is different for high scale economies. This result, together with the fact that small firms' cash balances are thin, implies the efficiency of Italian manufacturing industry.

1. Introduction

The scope of the present paper is to investigate the demand for money by companies and the existence of economies of scale in the payment technology in the Italian manufacturing industry.

The macroeconomic relevance of this analysis arises from the possibility of shedding light on the velocity of money and through this on the impact of money supply on inflation and rate of interest. At microeconomic level the same analysis is important to evaluate the

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efficiency in cash management of the Italian manufacturing industry which is a significant example of an industrial sector characterized by a modest degree of vertical integration and by the prevalence of small firms.

Since the seminal contributions by Keynes (1931 and 1936), Baumol (1952) and Tobin (1956), both the theoretical and empirical literature has been enriched by important though not abundant contributions. From a theoretical point of view the main contributions have been the stochastic model of money demand introduced by Miller and Orr (1966) and the framework for modeling money demand by households and firms proposed by Fujiki and Mulligan (1996). From an empirical point of view, the model elaborated by Fujiki and Mulligan has served as a benchmark for many applications: Adão and Mata (1999) have studied the demand for money by firms in Portugal; Bover and Watson (2005) in Spain; Lotti and Marcucci (2007) in US. Mulligan (1997) using COMPUSTAT, analyzed economies of scale for a wide range of firms listed on the New York Stock Exchange and American Stock Exchange.

Our main contribution to the literature consists in an empirical analysis based on a new panel data set that contains more than 26,000 Italian manufacturing companies of various sizes and industrial categories along the period 1999-2005. Panel data models for individual and time effects is applied with fixed and random effects like in Lotti and Marcucci (2007). Bover and Watson (2005) estimated sales and interest elasticities at firm level using measurement error static panel models. The main differences with respect to the previous empirical papers based on panel data concern two different aspects.

The first is the choice of dynamic models which overcome problems related to possible endogenity of cash holdings. Elasticities obtained through different models (static and dynamic panel modes) and estimate methods (OLS and GMM) reveal the robustness of estimates.

The second aspect with which we differentiate our work from the previous literature on panel data is an iterative procedure based on backward exclusion of firms from model estimation in which we point out the high heterogeneity of Italian companies in money demand. Through the same procedure we are in fact able to show that small companies feature high elasticities and absence of scale economies whereas medium and large companies are characterized by values of elasticities near to 0.5, as predicted by the models of Baumol and Tobin and relevant scale economies. At the same time, because small companies are generally characterized by thin Cash Balances and with this by the irrelevance of the problem of Cash Management, it becomes hard to qualify the low elasticities of this kind of company as inefficiency.

It is well known that heterogeneity is relevant not only at time and size level but also at industry level. Starting from this fact we partition our data set using also a Sector criterion obtaining estimates for each of them.

The paper is organized as follows. Section 2 presents the most important theoretical models and the most recent and relevant empirical studies. Section 3 and 4 focus on the model and empirical specifications to be tested. Section 5 describes the data used in the analysis. Section 6 presents the empirical results. Section 7 compares and contrasts the results obtained in the Italian case with those obtained in other countries by other researchers who used the same demand for money function. We summarize the key results in the conclusion.

2. Critical analysis of previous theoretical and empirical studies

In the Keynesian approach transaction velocity is considered a variable and it changes in the opposite direction to the change in the quantity of money (Ghatak,1994, p.123). An increase in money supply (M) involves a fall in interest rates which determines an increase of the speculative demand for money and this means a fall in the average velocity of circulation. The traditional multiplier effect implied that a rise in money supply, via the investment schedule, leads to an increase in income which in turn affected the transactions demand for money. This mechanism was challenged by Baumol (1952) and Tobin (1956) as to the transaction demand for money and by Whalen (1968) as to the precautionary demand for money. Baumol (1952) introduced an inventory theoretic approach to show that the transaction demand for money depends inversely on the rate of interest and is proportional to the value of transactions. The square root rule ($M=(2bT/i)^{1/2}$) derives the optimal withdrawal size according to which the demand for cash balances (M) depends directly on a known stream of expenditures (T) which have to be paid for in cash, b is the fixed cost per withdrawal and i is the constant known interest rate on assets. The optimal value of cash holding is obtained by minimising a cost function that takes into account both interest and non interest costs. Interest costs are represented by the opportunity cost of holding cash foregoing interest on assets and non-interest costs by broker's fees, assumed to be linearly related to the value of transaction.

It seems clear that whereas the assumptions of this model might have some significance at the level of the household sector, for the business sector assuming a known pattern of expenditures, a known pattern of receipts and a known asset price is quite unrealistic because as Goodhart (1989) has pointed out "it abstracts from all those facets of uncertainty which give money its essential role as a means of payment". Thus given its nature the model can be of little empirical significance, unless those assumptions are relaxed and a stochastic environment is introduced. This is the path followed by Miller and Orr (1966 and 1968) who reformulated the inventory theoretic approach in a stochastic context. Since a model involving certainty about the timing of receipts and disbursements in the business sector it is quite unrealistic, Miller and Orr (1966) proposed an inventory theoretic model in which the optimal amount of cash held by firms was determined in a stochastic context. Miller and Orr make four main assumptions. First, Baumol preferred assumptions, i.e. use of two assets, absence of lead time and constant marginal cost per transfer. Second, the minimum balance hypothesis, a lower bound below which the cash is not allowed to fall. Third, they introduce a stochastic process, in particular the random behaviour of the cash flow is characterised by a sequence of independent, symmetric Bernoulli trials. Fourth, firms minimise the long-run average cost of managing cash. The transaction technology is given by T=BmI , where B is the time cost of cash management and it is constant over time and across firms, I is the cost of getting cash and is assumed to be independent of the amount of money demanded, m are real cash balances. In this model the cash manager will not make continuous transfers but will wait until cash balance reaches its lower limit, whereas if the upper limit is reached then cash is exchanged for bonds. The result is that the optimal amount of cash demanded depends directly on relative transfers and inversely on interest rates as in Baumol but now the demand for money is related not to the level of transactions but to the variance of transactions. In Miller and Orr the income elasticity of the demand for money depends on the effect caused by income on the frequency of transactions, as compared with average size. The elasticity is 1/3 if the size remains constant as the income rises but the frequency increases. The elasticity is 2/3 if the frequency remains constant but the size increases with income. The interest elasticity of the demand for money is (-1/3).

It is worth mentioning, as Goodhart (1989) has pointed out, that even though the inventory theoretic approach has been much improved by the use of mathematical techniques, it has nonetheless overlooked some key features of the banking system. Sprenkle (1969) has sharply questioned the validity and usefulness of the model[1]. A more complete and richer version, which includes but is not limited to the inventory theoretic model, has been offered by Saving (1972), Ben-Zion (1974), Ben-Zion and Karni (1976), Feenstra (1986) and Fujiki and Mulligan (1996). An important contribution of Ben-Zion (1974), is the criticism to the empirical studies devoted to the analysis of the demand for money by firms. Indeed he finds two main difficulties in the preceding literature. First, the lack of a cost of capital variable and the implicit assumption that all firms in a given cross section have the same cost of capital, which is inconsistent with theory of finance, which predicts that the cost of capital depends on its appropriate risk class (according to the classical Modigliani and Miller results). Second, previous studies have used aggregate data of firms in different industries rather than data of individual firms. In his empirical analysis he considers as a proxy for the firm cost of capital a function of the earnings per share (E), the price of corporate share (P) and the long-run growth of the earning per share (λ) and the cost of capital which takes into account the risk of the firm (ρ). Thus from the valuation of a stock price $P = \left(\frac{E}{\rho - \lambda} \right)$, he derives ρ=(E/P)+λ. Even though λ, the expected increase in earning per share is not directly observed, he assumes that investors use data on the past rate of growth to predict its future rate of growth. The results obtained for 1964-1965 in U.S. show money demand elasticities between 0.866 and 0.889, implying economies of scale in holding money. This criticism has been quite relevant in shaping the following empirical research (see Adão and Mata (1999) and Lotti and Marcucci (2007)). Ben-Zion and Karni (1976) have presented a reconciliation of the inventory theoretic and utility-of-money

[1] A more general criticism is offered by Goodhart (1989) who claims that the dichotomy between the two motives for demanding money, i.e. transactions and speculative is invalid. It is inappropriate to treat the overall demand for money as the simple arithmetical sum of these two separated components. Nevertheless, soon after, he adds that the distinction between these two motives has been so widely followed in the literature, “and presumably fruitful that it would be very difficult to comprehend analytical developments in this area without following the same dichotomy”.

approaches at the individual level. They assume that the individual maximises a utility function with consumption (C) and real balances (m) in it, U(C, m). The individual is constrained $\mathrm{Y} = \mathrm{C} + \mathrm{rm} + \left(\frac{aC}{2m}\right)$, where Y and r are income and interest rates, respectively. They show that the model contains the inventory theoretic model and Patinkin theory as special cases. The former occurs when m does not enter into the utility function and the latter when a=0. The optimal money holding they derive provides a larger money holding than the two special cases. These studies have open the way to further attempts to integrate the two approaches. We mention in this section Feenstra[2] and leave to the next section the model presented by Fujiki and Mulligan (1997) which has been as benchmark model and we will use in the present research.

A further generalisation is presented in the next section[3].

Recently, Alvarez and Lippi (2009) have analysed the transactions demand for cash for households taking into account precautionary motives which are absent in the deterministic inventory model. Specifically, they allow for the possibility of withdrawing cash at low cost up to a certain number of withdrawals. In the deterministic model, the interest elasticity is 0 over the range covered by free withdrawals, while it is again ½ when the number of withdrawals exceeds the range. The model is also extended to deal with random free withdrawals. The randomness of free opportunities to withdraw cash gives rise to a precautionary motive, so that withdrawals may occur when the agent still has a positive cash balance. In this case the elasticity is between 0 and ½ and is smaller at lower interest rates.

3. The development of the model

[2] Feenstra (1986) shows the functional equivalence between liquidity costs and the utility of money approach. He demonstrates that the use of money in the utility function can be explicitly derived from an optimising model with transactions costs. Liquidity costs enter into the maximisation procedure via the budget constraint and are justified using a Baumol-Tobin approach. Finally, Feenstra shows the equivalence between this result obtained by introducing liquidity costs in the budget constraint and that obtained by entering money into the utility function. Again, in this model it is shown that a Baumol-Tobin solution is obtained as a special case of a more general solution.

[3] It is worth mentioning that Romer (1987) has analysed the Baumol-Tobin in a general equilibrium framework, using overlapping generations. His main conclusions are that economy's response to a nominal interest rate shock exhibits large cycles and the economy's response differs dramatically when the time of trips is fixed.

The model we will test has been derived by Fujiki and Mulligan (1996) and will be used because it allows to test a number of relevant hypothesis concerning the economies of scale in the business sector and because it allows also a direct comparison among the different empirical estimates of the economies of scale in different countries, as estimated by other authors.

The production process of firm i at date t, $y_{i,t}$, is described as a function of a vector of inputs, $X_{i,t}$, transaction services, $T_{i,t}$, and a technology parameter, λ_f , supposed to be constant over time and identical across agents, thus $y_{i,t}=f(X_{i,t}, T_{i,t}, \lambda_f)$. Then the authors introduce a production function for the transaction services, which are supposed to depend on real money balances held by the firm i, m_{it}, units of labour used to produce transaction services, l_{it}, a technology parameter used in the production function assumed constant across firms, λ_Φ , and a productivity parameter, $A_{i,t}$, as an indicator of firm's degree of financial sophistication, that is $T_{i,t} =g(m_{it}, l_{it}, A_{i,t}, \lambda_\Phi)$. The firm minimises a cost function, which is the sum of rental expenditures. The cost function is $c_{i,t} = p_{i,t}X_{i,t} + w_{i,t}\, l_{i,t} + R_{i,t}m_{i,t}$, where p is the price of the composite input $X_{i,t}$, w is the wage of the workers, and $R_{i,t}$ is the nominal opportunity cost of money. R_t is assumed to be the same across firms and this is highly questionable from the theory of finance as has been pointed out by Ben-Zion. On the contrary, Adão and Mata (1999) overcome this difficulty by using different interest rates across firms, thus allowing for different risks among firms and different costs of capital.

The optimal solution in Fujiki and Mulligan (1996) is obtained by minimising the total cost function subject to the two production functions.

Thus the minimization problem to be solved is:

$$\text{Min}_{x,\, m}\ (c_{i,t} = p_{i,t}\, X_{i,t} + w_{i,t}\, l_{i,t} + R_{i,t}\, m_{i,t}) \text{ s.t. } y_{i,t}=f(X_{i,t}, T_{i,t}, \lambda_f) \text{ and } T_{i,t} =g(m_{it}, l_{it}, A_{i,t}, \lambda_\Phi) \qquad (3.1)$$

Fujiki and Mulligan assume that the production function is continuous, non-decreasing in all arguments and increasing in T. The production of transactions services is continuous, non-decreasing in each of its arguments and is strictly increasing A and m. Thus the cost function is homogenous of degree one in prices, increasing in $y_{i,t}$, non-decreasing in rental rates and continuous in p, R and w. Two further assumptions on the two production functions are added: the elasticity of the production function with respect to transactions services approaches 0 as λ_f approaches 0, and returns to scale of the transactions services production function is bounded above for any positive level of the two inputs, X and m.

Adão and Mata (1999) assume that a firm faces a random flow of transactions c, with mean $\hat{c}$ and variance $\sigma_c^2 < \infty$. In each period a firm's employee obtains money at intervals of length t, bringing back from the bank an amount of money equal to $\hat{c}$. Money reserves are thus defined as a function MR=f($\hat{c}$, σ_c^2), and it is assumed that the employee goes to the bank when the amount reaches zero. So, in the relevant period average money holdings will be m= (($\hat{c}$)/2)+MR. The functional form used by Adão and Mata is a Cobb-Douglas:

$$f(\hat{c}, \sigma_c) = \left[\frac{\left(\hat{c}t\right)^{g(\sigma_c)} - \hat{c}t}{2} \right] \tag{3.4}$$

with g(σ) increasing in σ and such that g(0)=1 and g(·)≥1. The greater the volatility of the firm's cash outflow the greater should be the firm's money reserves, thus f($\hat{c}$, σ_c) is increasing in its second argument. The model allows for scale economies in the time spent on trips to the bank. The cost of getting cash, l, is not constant but is proportional to the inverse of the intervals at which cash is withdrawn, $l=(1/t)^{1/n}$ which implies $m = \left(\hat{c}t^{-1/n}\right)^{g(\sigma_c)}$.

The transaction technology differs from the Miller and Orr (1966) one because Adão and Mata allow for different degrees of financial sophistication among firms. Thus the transaction technology is $T_{i,t} = B_{i,t} m_{i,t}^a l_{i,t}^b$, where a=1/h and b=1/n. Since each firm's level of transaction is increasing in the level of production, then in order to produce $y_{i,t}$ in period t, $T_{i,t}$ has to be such that $G(y_{i,t}) \leq T_{i,t}$. Firms incur transactions costs because outflows and inflows of cash are stochastic.

The firm solves the optimisation problem as in Fujiki and Mulligan (1996), i.e. minimises its cost function subject to the two production functions, but now with the modified version of the transaction technology. First, at the optimum $y_{i,t}=f(x_{i,t})$, and the minimisation simplifies to $\min_{x_{i,t},m_{i,t}}\left(c_{i,t}=p_{i,t}F_{i,t}^{-1}(y_{i,t})+w_{i,t}l_{i,t}+R_{i,t}m_{i,t}\right)$ subject to $G(y_{i,t})\leq T_{i,t}(m_{i,t}, l_{i,t})$. By assuming $G(y_{i,t})=k_i y_{i,t}$, where k_i is the cash flow structure of firm i, the minimisation can be rewritten as $\min_{x_{i,t},m_{i,t}}\left(c_{i,t}=p_{i,t}F_{i,t}^{-1}(y_{i,t})+B_{i,t}^{-1/b}m_{i,t}^{-a/b}k_{i,t}^{1/b}y_{i,t}^{1/b}w_{i,t}+R_{i,t}m_{i,t}\right)$. First order conditions allow to derive the optimal demand for money

$$m_{i,t}=\left(\frac{R_{i,t}}{w_{i,t}}\frac{b}{a}B_{i,t}^{1/b}k_i^{-1/b}y_{i,t}^{-1/b}\right)^{\frac{-b}{a+b}} \tag{3.5}$$

which can be linearized as:

$$\log m_{i,t}=\log\Phi_{i,t}-\left(\frac{b}{a+b}\right)\log R_{i,t}+\left(\frac{b}{a+b}\right)\log w_{i,t}+\left(\frac{1}{a+b}\right)\log y_{i,t} \tag{3.6}$$

where $\Phi_{i,t}$ is a function of B:

$$\Phi_{i,t}=\left(\frac{b}{a}B_{i,t}^{1/b}k_i^{-1/b}\right)^{\frac{-b}{a+b}}.$$

4. Empirical specification to be tested and econometric procedure description

In this section we briefly discuss the empirical specification and related parameters derived from the Fujiki and Mulligan model discussed in the previous section and used in Adão and Mata (1999).

One main issue to cope with in the econometric analysis of the model, as pointed out by Lotti and Marcucci (2007), is the presence of a possible non-zero correlation between the exogenous variables and the contemporaneous disturbances undermining the assumption of strict exogeneity.

In the empirical specification we need to assume that all differences between companies in the cash-flow structure and in the degree of financial sophistication are persistent over time, so that they can be captured by the individual fixed effects. Furthermore, we allow for possible changes in the degree of financial sophistication over time, imposing that such movements have the same effects on all firms at each point in time. To control for such economy-wide changes in financial sophistication, we include time effects in the empirical specification. However, we leave all the firm-specific changes in the financial technology as residuals. In sum, we mainly model time and firm-specific effects as fixed effects so that

$$\log m_{i,t} = \alpha_i + \beta_t + \gamma \log R_{i,t} + \delta \log w_{i,t} + \theta \log y_{i,t} + \varepsilon_{i,t} \tag{4.1}$$

With $i = 1,...,N; t = 1,...,T$ where $m_{it}, R_{it}, w_{it}, y_{it}$ indicates, respectively, cash balance, ratio of financial costs on total debt, personnel expenditure and sales for i-th firm at time t; $\alpha_i, i = 1,...,N$ are the firm-specific effects and $\beta_t, t = 1,...,T$ are the time effects. In practice, we assume a two way error component regression model where the disturbances are composed of an unobservable individual effect, an unobservable time effect and a purely stochastic disturbance. This particular specification is very useful because it removes the effects of all the persistent differences among firms from the estimates. In practice, the estimated demand elasticity will be immune from any difference in money holding between small and large firms. We have to consider that normally, small and large firms differ not only in terms of size, but also in many other aspects, for example cash-flow structure and degree of financial sophistication. Introducing time effects in the empirical specification, the variable R_{it} reflects the deviations of each firm's cost-of-capital from its average level over time, rather than the evolution of the overall level of interest rates. The effects of the entire evolution of interest rates and changes in financial technology and wages are captured by the time effects.

There are two differences between the theoretical demand for money derived in the previous section and the empirical one. First, γ and δ are not constrained to be symmetrical, but symmetry is a hypothesis to be tested. Furthermore, whereas in theoretical demand for money no restrictions are imposed on the variability of the financial technology, for estimation purposes additional restrictions are needed, and thus the intercept cannot vary for each firm in each period. Thus the degree of financial sophistication and firm’s cash flow structure are supposed to be persistent over time and captured by α_i , which measures firm’s specific effects. The parameter β_t captures the time specific effects caused by changes in financial sophistication at the economy-wide level.

The latter effect at firm level is not explicitly modelled in the equation and left to the residual term $\varepsilon_{i,t}$.

Time and firm specific effects are modeled as fixed effects, which has the advantage of removing the effect of all the persistent differences between firms. This implies that the estimated parameter of the elasticity of money with respect to production, θ, will not be affected by differences in money holdings between small and large firms, indeed small and large firms differ not only in money holdings but also in many other aspects such as cash flow structure or the degree of financial sophistication. Thus, as Adão and Mata (1999) point out, the parameter θ will not be estimated based on the fact that small and large firms hold different amounts of money but on the basis of the hypothesis that when a firm grows larger it uses a greater amount of money.

The same can be said about the cost of capital, which is not based on differences across firms, but on changes of these costs over time.

As money holdings could be considered, to some extent, endogenous, we considered the dynamic version of model (1) as follows:

$$\log m_{i,t} = \alpha_i + \beta_t + \delta \log m_{i,t-1} + \gamma \log R_{i,t} + \delta \log w_{i,t} + \theta \log y_{i,t} + \varepsilon_{i,t} \qquad (4.2)$$

where δ is the coefficient of the lagged dependent variable. In order to identify model (2), we need to assume some restrictions on the serial correlation properties of the error term and on the properties of the explanatory variables. The error terms ε_{it} are assumed to be serially uncorrelated and independently distributed across units with zero mean. To solve the problem of potential endogeneity of m_{it} we apply transformations that allow to use lagged endogenous variables as instruments in a transformed equation. The most common transformation is the first difference which wipes out the individual effects which are correlated with endogenous variables. After this transformation it is therefore possible to use suitably lagged endogenous variables and the GMM estimator in order to instrument the non-exogenous variables (see, for example, Arellano and Bover, 1995).

5. The data

The firm-level data in this study are drawn from the AIDA data bank which is collected by the Bureau Van Dijk. The data bank includes company accounts, ratios and activities for all Italian companies with sales greater than 100000 Euros. From this immense mine of datasets we get a complete panel data set consisting of 26389 companies for the period 1999-2005. Selected items from corporate end-of-year balance sheets and income statements are reported for the manufacturing sector. The firms in our study are classified in 23 industries by Standard Industrial Classification (SIC). We use as a proxy for money holdings by business firms m_{it}, which is cash balances at the end of the year, including bank deposits and the total amount of short-term investments. The other variables used in the empirical analysis are y_{it}: total "net sales" of firm *i* during year *t*; w_{it}: total personnel expenditure for firm i during year t; R_{it}: cost-of-capital for firm i during year t, computed as the total financial expenditures during the year (given by "interest expense"), divided by the total debt (given by "total liabilities") at the end of the year as in Adão and Mata (1999). Actually, this measure represents the cost of credit and has the advantage of being firm-specific. In addition, it is a weighted average of interest rates paid on short- and long-term loans. All the variables are in euros and have been converted using the year 2000 euro rate using the GDP implicit price deflator. Some synthetic descriptive statistics are reported In the following tables to give an idea about level and scale of the panel. Comparing means and medians, the extreme positive skewness of the distributions of balance items (cash holdings, sales and wages) is evident. This feature is due to the large frequencies of high positive values. Heterogeneity of firms is pointed out by high values of coefficient of variation. Finally, it is worth noticing that level and range of balance items are quite constant along time.

Table 1. ***Cash holdings. Descriptive statistics (thousands of Euros).***

Year	mean	median	sd.dev	mad	cv	rcv
1999	512	88	4592	127	897.4	144.5
2000	507	85	3697	123	729.0	144.7
2001	533	90	4959	131	930.7	144.8
2002	543	88	4031	128	741.9	145.3
2003	525	84	3218	122	612.7	145.5
2004	578	90	3388	131	586.5	145.4
2005	590	98	2995	143	508.1	145.3

* sd.dev = standard deviation, mad = median absolute deviation, cv = coefficient of variation (mean/sd.dev*100), rcv = robust coefficient of variation (mad/median*100)

Table 2.***Sales. Descriptive statistics (thousands of Euros).***

Year	mean	median	sd.dev	mad	cv	rcv
1999	10842	3507	72717	2900	670.7	82.7
2000	11724	3789	74572	3179	636.1	83.9
2001	12011	3880	77280	3308	643.4	85.2
2002	11958	3847	77121	3323	644.9	86.4
2003	11528	3691	73068	3247	633.8	88.0
2004	11975	3742	79034	3369	660.0	90.0
2005	12108	3681	83217	3382	687.3	91.9

* sd.dev = standard deviation, mad = median absolute deviation, cv = coefficient of variation (mean/sd.dev*100), rcv = robust coefficient of variation (mad/median*100)

Table 3.*Personnel expenditure. Descriptive statistics (thousands of Euros).*

Year	mean	median	sd.dev	mad	cv	rcv
1999	1584	590	7600	512	479.8	86.8
2000	1624	607	7526	524	463.3	86.3
2001	1719	622	12905	538	750.9	86.5
2002	1755	637	13256	552	755.2	86.7
2003	1692	638	7296	557	431.1	87.3
2004	1714	647	7349	571	428.8	88.2
2005	1711	638	7308	574	427.1	89.9

* sd.dev = standard deviation, mad = median absolute deviation, cv = coefficient of variation (mean/sd.dev*100), rcv = robust coefficient of variation (mad/median*100)

Table 4.*Interest rates. Descriptive statistics.*

Year	mean	median	sd.dev	mad	cv	rcv
1999	0.035	0.028	0.042	0.019	120.2	69.0
2000	0.041	0.030	0.082	0.020	200.9	68.2
2001	0.042	0.032	0.149	0.021	352.8	66.0
2002	0.034	0.029	0.032	0.020	94.7	69.3
2003	0.034	0.027	0.041	0.019	122.8	70.5
2004	0.025	0.023	0.029	0.017	114.8	74.7
2005	0.025	0.022	0.029	0.016	119.5	75.3

* sd.dev = standard deviation, mad = median absolute deviation, cv = coefficient of variation (mean/sd.dev*100), rcv = robust coefficient of variation (mad/median*100)

6. The results

6.1 Scale economies and firm heterogeneity

The econometric model specified in equation (1) (section 4) has been estimated on different industries and on the whole manufacturing industry through different methods: pooling regression, fixed effects models (between and within estimators), random effects models (Baltagi, 2005, chapter 2). The random effects model has been obtained using different estimators of the innovations variance: Wallace and Hussain, Amemiya, Swamy and Arora, Nerlove. In order to not make the exposition of results too heavy, we report only elasticities based on the Swamy and Arora estimator, but other methods yield very similar results and are available from the authors upon request. The estimates of the dynamic version of the model reported in equation (2) has been obtained by GMM estimator (Arellano, 2003, p.127-174) with instruments given by lagged dependent variable. Sales elasticities, which are the main focus of this paper, are reported in Table 5. The statistical significance of elasticities is very high (p-value < 0.01), nevertheless italic indicates 0.01< p-value <0.05, bold is for 0.05 <p-value <0.1 and italic+bold is used for estimates with p-value >0.1.

The consistency of the GMM estimators which instrument the lagged dependent variable with further lags of the same variable, relies on the hypothesis that the disturbances $\varepsilon_{i,t}$ are not correlated. If the disturbances are not serially correlated these two conditions should be observed:

1. negative first order serial correlation in differenced residuals, that is $E(\Delta\hat{\varepsilon}_{i,t}\Delta\hat{\varepsilon}_{i,t-1}) < 0$
2. no evidence of second order serial correlation in the differenced residuals, that is $E(\Delta\hat{\varepsilon}_{i,t}\Delta\hat{\varepsilon}_{i,t-2}) = 0$.

Residual diagnostic for our GMM estimates shows significant first order serial correlation while the hypothesis of no second order serial correlation has been never rejected.

The null hypothesis of the validity of the instruments has been never rejected by the Sargan's test of overidentifying restrictions (applied as reported in Baltagi (2005), p. 141, asymptotically distributed as a Chi-square with as many degrees of freedom as overidentifying restrictions).

Considering the whole manufacturing industry, the coefficient of sales elasticity is around 0.94 when estimated by static panel models and about 0.9 when GMM estimator has been applied (see Table 5 last row). Anyway it is significantly less than 1 but by a small amount. The same coefficient has been found to be 1 for the United Kingdom and 0.93 for US by Bover and Watson (2005), between 0.50 and 0.70 for US by Lotti and Marcucci (2007), between 0.5 and 0.7 (when firm-specific effects are not included in the regression) for Portugal by Adão and Mata (1999), 0.8 for US by Mulligan (1997) and 0.9 for US. by Ben-Zion (1974).

Because sales are a proxy of size, the value of the elasticity we have obtained reveals the absence of substantial scale economies in Italian manufacturing industry.

According to the model of Baumol (1952), Miller and Orr (1966) and Ben-Zion (1974) the absence of scale economies showed by our estimates for the Italian manufacturing overall can be interpreted as a substantial inefficiency of its Industrial Organization in Cash management. Following the deterministic model of Baumol an efficient Cash Management involves an elasticity of 0,5. In their stochastic model Miller and Orr do not give a punctual value of the same elasticity but a range between 0,50 and 0,70. In his model Ben-Zion obtains an elasticity above 0,5 but sufficiently below 1 to assure scale economies.

Table 5. ***Sales elasticities obtained by different models and estimates procedure. Between and within are for fixed effects models; Random effect model has been estimated by the Swamy-Arora procedure; the dynamic version of the model includes one-period lagged cash holdings.***

	Pooling	Between	Within	Random	Dynamic	N.obs.
Total (manufacturing)	0.939	0.939	0.920	0.940	0.886	26389

The dominium of validity of our conclusion- i.e inefficiency of Italian Manufacturing in Cash management- has to be heavily restricted if we run our model on subsets of our data obtained according to level of cash holdings and size of companies and Sector. Consequently we have produced a skimming of our data set using three different profiles:

a) Cash holdings;

b) Sales;

c) Industrial Sector

6.2 Exploring the impact of liquidity and size on sales elasticity.

Relevance of Cash Holdings arises from the fact that thin Cash Balances make irrelevant the problem of cash management. Table 6 puts in fact in evidence that the median of cash holdings is between 80.000 and 100.000 euros in the analyzed period. It is manifest as well that firms below these values do not face a problem of Cash Management. The distribution of money holdings is strongly asymmetric on the right, the third quartile is in fact four times the median and between 330.000 and 400.000 euros: after this value bad Money Management involves relevant losses of income. For the same reason cash management is not relevant for small size companies.

As can be easily presumed, the skimming of companies according to their size or cash holdings level involves new distributions of the same variables. (As an example, the first line of the table reports mean, minimum and median of sales and cash holdings for all companies exceeding the 10-th quantile of the average sales computed across the period 1999-2005. Thus, 12.794.222 indicates the average sales of all companies exceeding the 10-th quantile of the average sales distribution in the period considered. The same findings are reported in Table 7, this time using the distribution of yearly average cash holdings).

Table 6.*Descriptive statistics based on quantile thresholds obtained from sales distribution. All variables have been averaged across time. (Whole manufacturing industry)*

	Sales (Euro)		Cash holdings (Euro)	
Alpha	mean	Median	Mean	Median
10	12794222	4293355	587631	149496
20	14185390	4932861	648638	175072
30	15903014	5713385	722002	201500
40	18092238	6707048	815461	237857
50	20994658	8003632	936503	283094
60	25079268	9805458	1100312	341158
70	31342738	12453821	1353054	426055
80	42496161	17252214	1778033	592774

Table 7.*Descriptive statistics based on quantile thresholds obtained from cash holdings distribution. All variables have been averaged across time. (Whole manufacturing industry)*

	Sales (Euro)		Cash holdings (Euro)	
alpha	mean	Median	Mean	Median
10	12576730	4097188	594171	157113
20	13696150	4483292	665415	194283
30	15011368	4959136	753964	239152
40	16698204	5498645	867121	298215
50	18919909	6224973	1017214	375899
60	21636185	7152991	1227418	490208
70	26191310	8535400	1546991	658352
80	34065114	11200630	2106444	969684

Table 8.Quantiles of Money Holdings (euro).

year	25% quantile	50% quantile	75% quantile
1998	11327,5525	87838,33	340435,8875
1999	11379	84785	338050,25
2000	12001,9175	90392,81	350756,745
2001	11016,025	88124,395	360926,5
2002	10373,8075	83554,9	345959,025
2003	11277,1525	90209,17	373370,54
2004	12351,1675	98273,045	391704,075

Our procedure has now to be summarized.

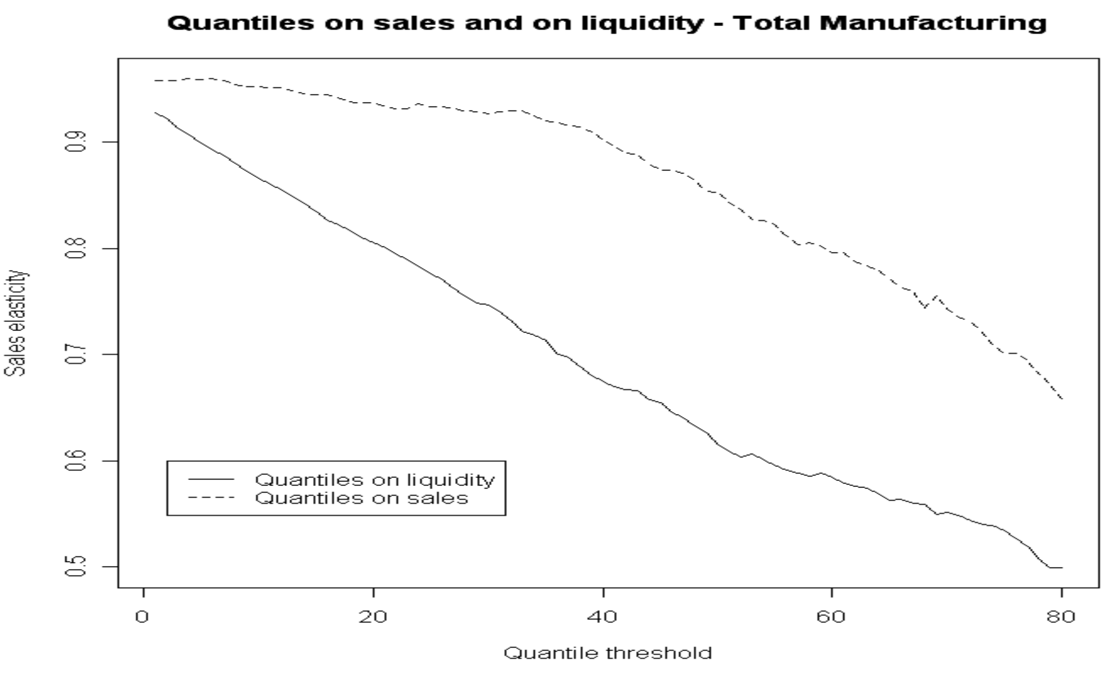
Equation (1) can be written as:

$$M_{it}^{[\alpha]} = \Gamma^{[\alpha]} X_{it}^{[\alpha]} + \eta_{it} \qquad i \in \Im \;\; if \;\; \bar{z}_i > \bar{z}_\alpha, \; t = 1,\ldots,T \qquad (6.2)$$

where $M_{it}^{[\alpha]} = \log m_{it}^{[\alpha]}$, $X_{it}^{[\alpha]} = (1,1,\log R_{it}^{[\alpha]}, \log w_{it}^{[\alpha]}, \log y_{it}^{[\alpha]})'$, $\bar{z}_i = \sum_{t=1}^{T} z_{it}$ and $\bar{z}_\alpha$ is the *α*-th percentiles of the distribution of a dimension variable *Z* averaged along time; $\Gamma = (\omega_i^{[\alpha]}, \beta_t^{[\alpha]}, \gamma_1^{[\alpha]}, \gamma_2^{[\alpha]}, \gamma_3^{[\alpha]})$ is the parameters vector corresponding to observations included in $\Im$. Note that, when *α*=0 equation (1) and (2) are equivalent. As an example, if Z_t are sales at time *t*, $\bar{Z} = \sum_{t=1}^{T} Z_t$ is the average sales in a given time interval and $\bar{z}_\alpha$ is the corresponding percentile. Finally, in equation (2), dependent and explanatory variables encompass only $N^* = |\Im| < N$ units whose average value of the auxiliary variable is larger than the given α-th percentile. Note that the symbol |.| indicates the cardinality of a set. In this section, we let $Z_{it} = m_{it}$, estimate a sequence of $\Gamma^{[\alpha]}$ for α=1,2,...,s<100 and monitor the trajectories of sales elasticities during the iterative procedure.

In Figure 1 we report the estimates with a progressively greater skimming of companies according to their cash holdings level. The results (continuous line in) are quite interesting: scales elasticities are below 0,6 after the median and become 0,5 after the 80th percentile. The first conclusion we can draw form this exercise is that Italian companies' cash management is efficient after the median value of 100.000 euro and assumes the value of 0,5-the same of Baumol's- after the 80th percentile i.e. for the 20% of our data set.

Figure 1.*Sales elasticities with gradual exclusion of smallest firms. Firm size is measured by cash holdings. Exclusion is carried out according to methodology described in section… X-axis report the quantile threshold. When threshold is 1, only the 99% biggest firms (according to cash holdings are included) and so on. Generalizing we can say that given threshold quantile ζ, a fraction 1-ζ of the largest is used in elasticity estimation.*



The second profile by whom we have portioned our data is size: considering Sales as ordering variable again we iteratively run our model on a progressively reduced data set. The results (dashed line in Figure 1) are quite surprising: scale economies become very relevant after the 75° percentile, with the elasticity close to 0.5. Because the same percentile corresponds to sales for €8million - a reliable upper threshold for Italian Small Firms in 2005 - we can deduce that efficiency in Cash management is peculiar of Medium and Large firms while it excludes Small Firms. Respect to the profile of Cash management the same results can be considered quite encouraging for the kind of Industrial Organization of Italian Manufacturing characterized by modest ratios of Vertical Integration and with this by a shift of the firm size distribution to the left respect to the previous decades.

Table 9.Quantile of Sales in different years (Euro)

year	25%	50%	75%
1999	1922658	3506999	7496134
2000	2055058	3789242	8131396
2001	2070565	3880351	8277419
2002	2029356	3847329	8247697
2003	1929165	3691461	8004482
2004	1908204	3742466	8214459
2005	1837229	3680843	8211548

Sector heterogeneity

Following Selden (1962) we abandon the aggregate Manufacturing running the model on single Sectors (See Table 5).

Food Processing and Beverage, Wood and Wood Products, Paper, Office Machinery, Refined Petroleum and Recycling have relevant scale economies with elasticities between 0,50 and 0,70. Textile, Apparel, Rubber and Plastic, Non metallic Mineral Products have elasticities near to 1 while sectors Machinery, Publishing, Leather, Furniture are characterized by elasticities equal and higher than 1,10.

The export leader sector of Italy -Mechanics- reveals heavy inefficiencies in Money Management. The same can be said for typical "made-in-Italy" sectors: Textile, Apparel, Leather. Another typical "made in Italy" sector-Food Processing-reveals high scale economies.

Following the Eurostat partition of Sectors according to their technological level our estimates do not seem to suggest a definite relation between the degree of technology and the values of the elasticities. As in fact it is depicted in the table low tech Sectors -Food, Textile and Apparel - are characterized both by high and low elasticities. The same occurs for medium/low tech level (Oil refinement, Rubber and non Metalliferous Minerals). Medium high and high tech Sectors-Mechanics and Information technology in our data set- are respectively featured by high and low elasticities.

Table 10.*Sales elasticities obtained by different models and estimates procedure. Between and within are for fixed effects models; Random effect model has been estimated by the Swamy-Arora procedure; the dynamic version of the model includes one-period lagged cash holdings.*

Industry	Pooling	Between	Within	Random	Dynamic	N.obs.
Food products and beverages	0.578	0.551	0.789	0.676	0.851	2200
Textiles	1.243	1.291	0.929	1.079	1.013	2041
Wearing apparel; dressing and dyeing of fur	1.030	1.031	1.009	1.012	1.009	956
Leather and leather products	1.128	1.130	1.192	1.143	1.064	1043
Wood and wood products	0.621	0.609	0.810	0.711	0.620	677
Pulp, paper and paper products	0.838	0.823	0.832	0.844	*0.607*	630
Publishing, printing and reproduction of recorded media	1.028	0.963	1.289	1.183	1.320	1012

Chemicals and chemical products	0.910	0.900	0.831	0.884	0.913	1187
Rubber and plastic products	0.968	0.960	0.893	0.950	0.892	1455
Other non-metallic mineral products	0.973	0.960	1.003	1.001	1.002	1536
Basic metals	0.888	0.882	1.136	0.978	1.377	660
fabricated metal products, except machinery and equipment	1.041	1.055	0.860	0.960	0.785	4155
Machinery and equipment	1.118	1.109	1.063	1.106	0.888	3829
Office machinery and computers	0.987	1.038	0.745	0.850	1.050	150
electrical machinery and apparatus	0.824	0.795	0.862	0.859	0.812	1137
radio, television and communication equipment and apparatus	1.019	1.060	0.778	0.875	0.510	348
medical, precision and optical instruments, watches and clocks	1.097	1.116	0.869	0.981	0.948	609
motor vehicles, trailers and semi-trailers	0.938	0.926	0.977	0.963	0.809	386
other transport equipment	0.895	1.004	0.471	0.648	***0.153***	269
Forniture	1.140	1.148	1.025	1.093	1.019	1967
Recycling	0.558	0.529	0.853	0.712	**0.499**	142
Total (manufacturing)	0.939	0.939	0.920	0.940	0.886	26389

* Estimates reported in italic: 0.01< p-value <0.05; bold: 0.05 <p-value <0.1; italic+bold: p-value >0.1

We have then tested the independence of scale elasticities and tech level constructing a contingency table according to the same two variables. Through Chi squared test we can not reject the independence of the two variables.

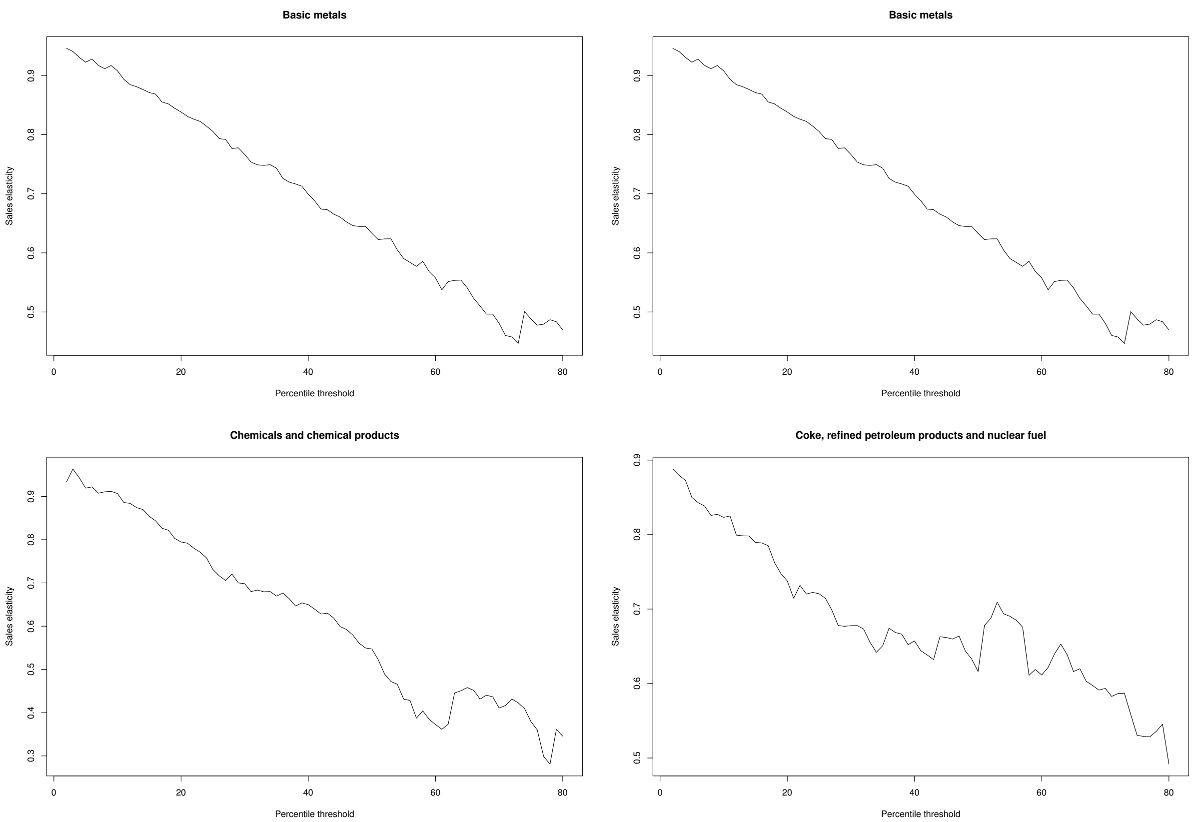
Contingency 2x2 table for sales elasticities and level of technology

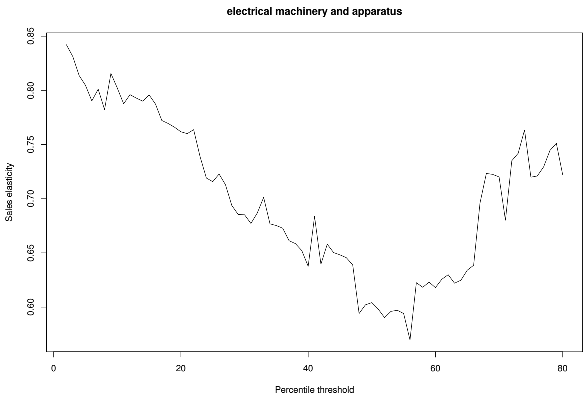
	Technology		
Elasticities	**t_low**	**t_high**	**Total**
e_high	9	4	13
e_low	4	3	7
Total	**13**	**7**	**20**

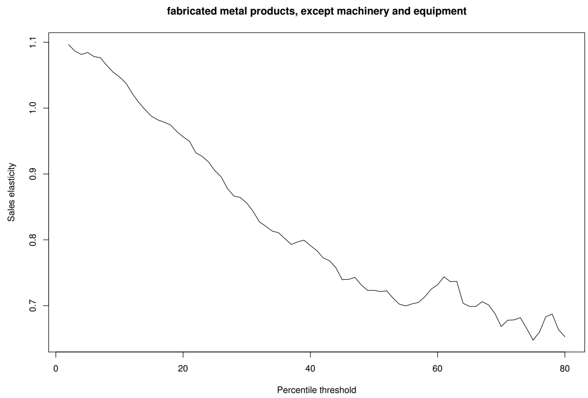
Chi_square-test = 0.0024, df = 1, p-value = 0.9608 → the null hypothesis of independence cannot be rejected

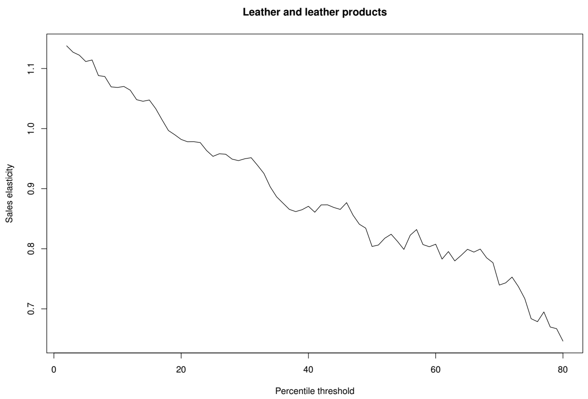
We have also applied our recursive procedure for each sector. Inspections of the graphs reveals that progressive skimming of companies according to their size involves the curbing of the elasticities for each Sector with the exception of Electrical Machinery, Machinery and Equipment and in a far less pronounced way, Publishing and Printing. It is very interesting to notice that for some industries (Chemicals, Cokes, Metal Products, Office Machinery, Other non-Metallic Products) sales elasticity become more or less stable after a given quantile threshold. In some, few industry sales elasticities increases after reaching a minimum value (Electrical Machinery, Publishing). This seems to indicate that the maximum efficiency in cash management is reached by medium firms.

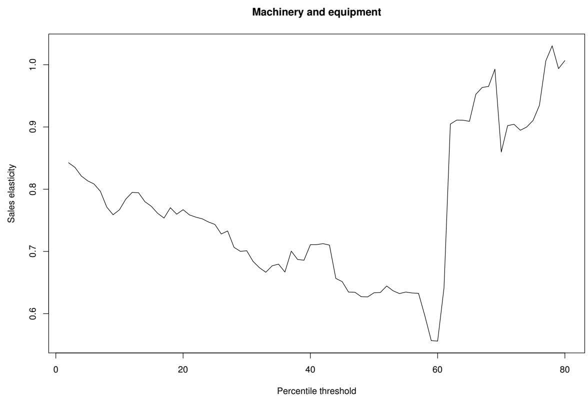
Figure 2. Skimming iterative procedure applied to single industries. Partitioning criteria is sales.

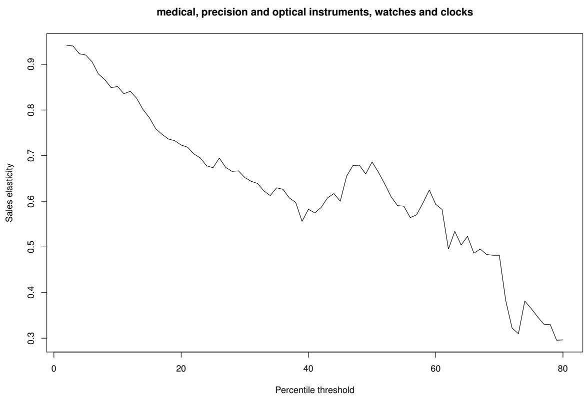


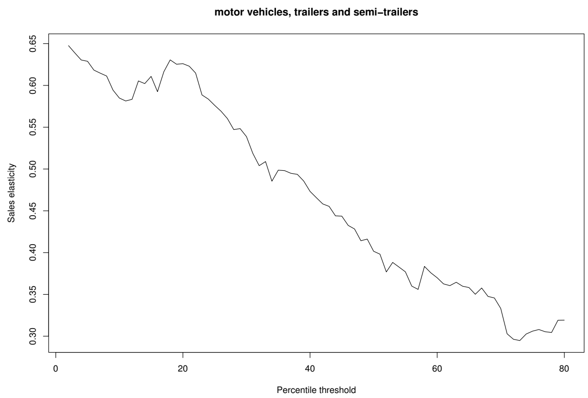

electrical machinery and apparatus
Sales elasticity
Percentile threshold

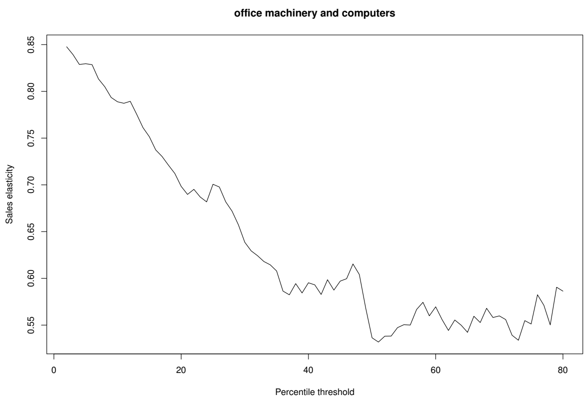

fabricated metal products, except machinery and equipment
Sales elasticity
Percentile threshold

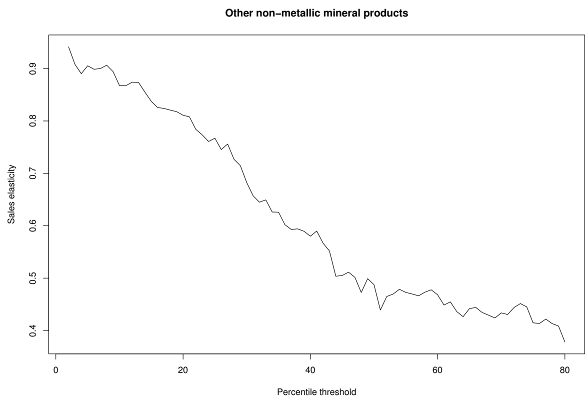

Leather and leather products
Sales elasticity
Percentile threshold


Machinery and equipment
Sales elasticity
Percentile threshold

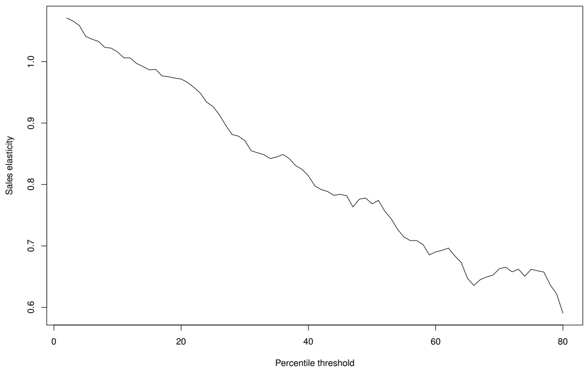

medical, precision and optical instruments, watches and clocks
Sales elasticity
Percentile threshold


motor vehicles, trailers and semi−trailers
Sales elasticity
Percentile threshold

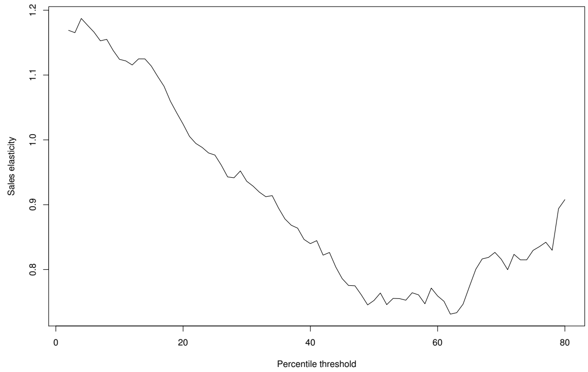

office machinery and computers
Sales elasticity
Percentile threshold


Other non−metallic mineral products
Sales elasticity
Percentile threshold

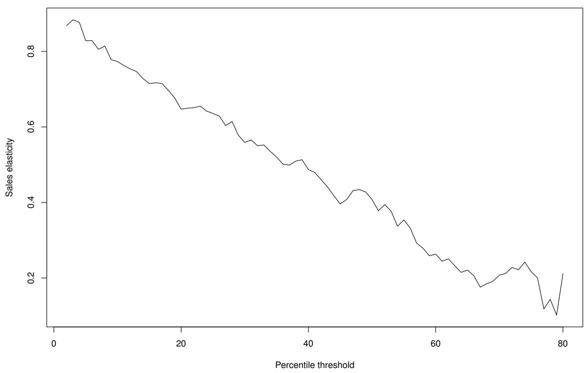
other transport equipment



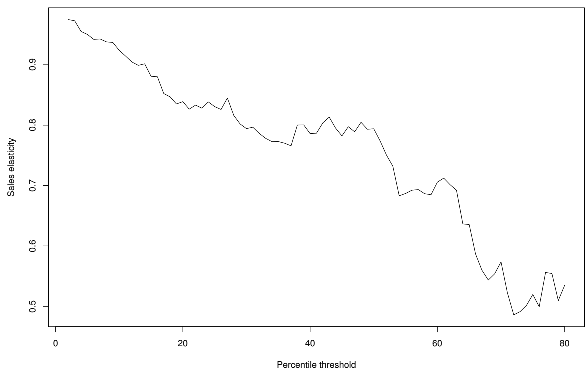
Publishing, printing and reproduction of recorded media



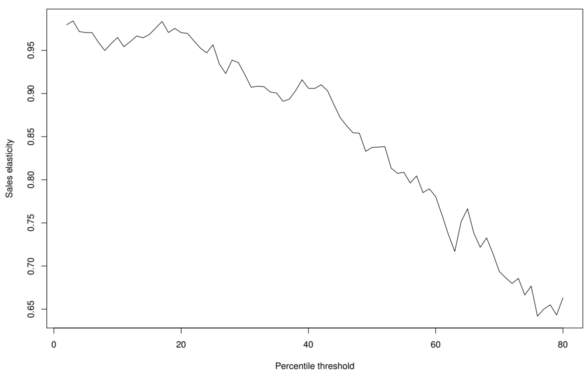
Pulp, paper and paper products



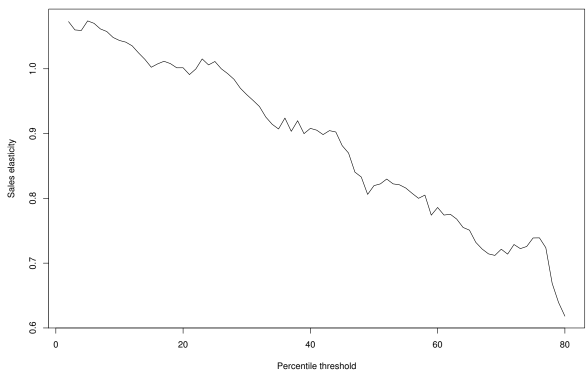
radio, television and communication equipment and apparatus



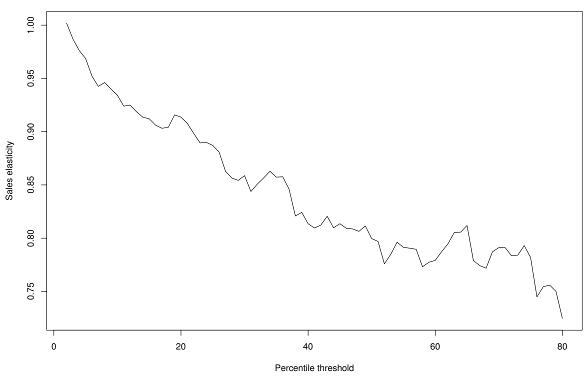
Rubber and plastic products



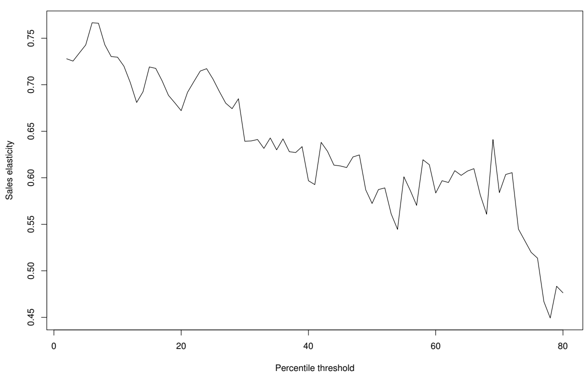
Textiles



Wearing apparel; dressing and dyeing of fur



Wood and wood products



6.3 Interest Rate and Wages

In the econometric specification of models of money demand in the previous literature (Mulligan (1997), Adao and Mata (1999), Bover and Watson (2005) and Lotti and Marcucci (2007) the variable Wage is modeled as medium wage calculated dividing the total payroll expenditure by the number of the employees. Because the number of the employees reported in Italian Balance Sheets can not be considered reliable, we have chosen to include the overall amount of payroll expenditure in the econometric specification of our model.

On the contrary, our specification of Interest Rate is consistent with the recent work: it is not the marginal rate but the medium rate calculated as the ratio between the net financial charges and total debt.

In our model we would expect values of elasticities of Wage (Table 12) and Interest Rate (Table 11) which are equal in absolute value but opposite in sign. The obtained elasticities have the expected signs: positive for Wage and negative for Interest Rate. The positive sign of elasticity of Wage and its significance confirms the positive effect of monetary wage level on money holdings.

Also Interest Rate has the expected sign which is negative given the opportunity cost of holding cash.

The two variables do not have equal absolute value as would be suggested by our model: using the Wald test we are not able to accept the equality hypothesis of the absolute value. In contrast to what has been observed for sales, estimates of elasticities of wages and interest rates are not constant across different estimators and not always significant. The last point is particularly evident for interest rates where the corresponding coefficients are most of the time not significant (p-values > 0.1). Money demand from Italian firms is therefore determined mainly by size (sales and wages) while interest rates play a marginal role.

Table 11. ***Interest rate elasticities obtained by different models and estimates procedure. Between and within are for fixed effects models; Random effect model has been estimated by the Swamy-Arora procedure; the dynamic version of the model includes one-period lagged cash holdings.***

Industry	Pooling	Between	Within	Random	Dynamic
Food products and beverages	-0.477	-0.582	-0.204	-0.293	-0.084
Textiles	-0.459	-0.558	-0.259	-0.309	*-0.079*
Wearing apparel; dressing and dyeing of fur	-0.365	-0.424	-0.207	-0.269	-0.108
Leather and leather products	-0.459	-0.555	-0.239	-0.311	***-0.069***
Wood and wood products	-0.478	-0.603	-0.196	-0.269	***-0.040***
Pulp, paper and paper products	-0.456	-0.526	-0.268	-0.327	***-0.045***
Publishing, printing and reproduction of recorded media	-0.456	-0.551	-0.207	-0.286	*-0.107*
Chemicals and chemical products	-0.321	-0.414	-0.130	-0.183	***-0.052***
Rubber and plastic products	-0.493	-0.612	-0.201	-0.291	***-0.032***
Other non-metallic mineral products	-0.517	-0.604	-0.293	-0.367	*-0.073*
Basic metals	-0.446	-0.564	-0.217	-0.281	***-0.056***
fabricated metal products, except machinery and equipment	-0.525	-0.657	-0.253	-0.334	*-0.057*
Machinery and equipment	-0.428	-0.536	-0.204	-0.267	-0.065
office machinery and computers	-0.387	**-0.355**	-0.426	-0.423	***-0.118***
electrical machinery and apparatus	-0.443	-0.551	-0.210	-0.280	*-0.084*
radio, television and communication equipment and apparatus	-0.374	-0.489	-0.116	-0.201	***-0.055***
medical, precision and optical instruments, watches and clocks	-0.450	-0.587	-0.156	-0.252	***-0.007***
motor vehicles, trailers and semi-trailers	-0.457	-0.652	**-0.077**	-0.181	***0.021***
other transport equipment	-0.457	-0.546	-0.177	-0.307	***-0.025***
Furniture	-0.456	-0.544	-0.225	-0.306	-0.106
Recycling	-0.589	-0.727	-0.221	-0.370	0.010
Total (manufacturing)	-0.458	-0.458	-0.225	-0.342	-0.068

* Estimates reported in italic: 0.01< p-value <0.05; bold: 0.05 <p-value <0.1; italic+bold: p-value >0.1

Table 12.*Wage elasticities obtained by different models and estimates procedure. Between and within are for fixed effects models; Random effect model has been estimated by the Swamy-Arora procedure; the dynamic version of the model includes one-period lagged cash holdings.*

Industry	Pooling	Between	Within	Random	Dynamic
Food products and beverages	0.270	0.298	***0.059***	0.171	***0.086***
Textiles	-0.156	-0.168	-0.168	-0.128	**-0.200**
Wearing apparel; dressing and dyeing of fur	***-0.012***	***0.023***	-0.307	-0.137	*-0.204*
Leather and leather products	***-0.032***	***-0.017***	-0.233	*-0.109*	***-0.160***
Wood and wood products	0.384	0.407	***0.101***	0.252	*0.407*
Pulp, paper and paper products	***0.054***	***0.073***	***-0.015***	***0.023***	***-0.017***
Publishing, printing and reproduction of recorded media	***-0.027***	***0.029***	-0.381	-0.188	*-0.430*
Chemicals and chemical products	***0.005***	***0.020***	***0.012***	***0.009***	***-0.041***
Rubber and plastic products	***0.041***	***0.065***	***-0.061***	***-0.014***	**0.290**
Other non-metallic mineral products	***-0.032***	***-0.010***	-0.240	*-0.112*	***-0.080***
Basic metals	0.198	*0.217*	**-0.203**	***0.061***	*-0.446*
fabricated metal products, except machinery and equipment	-0.090	**-0.086**	**-0.091**	*-0.079*	***0.015***
Machinery and equipment	***-0.014***	***0.010***	-0.107	*-0.062*	***-0.018***
office machinery and computers	***0.082***	***0.070***	***0.151***	***0.119***	***-0.124***
electrical machinery and apparatus	0.108	**0.151**	**-0.127**	***0.001***	***-0.006***
radio, television and communication equipment and apparatus	***-0.107***	***-0.137***	***-0.011***	***-0.013***	*0.323*
medical, precision and optical instruments, watches and clocks	-0.187	**-0.205**	***-0.055***	***-0.104***	***0.123***
motor vehicles, trailers and semi-trailers	*-0.147*	**-0.137**	**-0.242**	**-0.186**	***0.016***
other transport equipment	*0.138*	**0.062**	*0.235*	0.269	*0.467*
Forniture	-0.129	*-0.134*	*-0.139*	-0.114	***-0.145***
Recycling	*0.246*	**0.290**	***-0.093***	**0.111**	***-0.190***
Total (manufacturing)	0.034	0.034	-0.097	-0.035	***-0.005***

* Estimates reported in italic: 0.01< p-value <0.05; bold: 0.05 <p-value <0.1; italic+bold: p-value >0.1

7. Conclusions

In spite of some relevant contributions, until recently business money demand has received limited attention from economic practitioners and academics. On the contrary during the last ten years we have recorded a surge of contributions aimed at supplying empirical evidence on the same topic.

More precisely in the last few years conspicuous energies have been spent on corroborating business money demand through econometric procedures on panel data of companies. In this respect Fujiki and Mulligan's model (1996) has been one of the most tested. The econometric procedure applied in this paper is original and differs from the econometric techniques used in the previous works on money demand in at least two ways: 1) different estimators have been applied and compared; low variability of estimates obtained using different estimators is a clue of the high robustness of our results; 2) dynamic panel data models has been used in order to avoid problems coming from possible endogeneity of sales with respect to cash holdings; 3) a completely new iterative procedure has been introduced to analyze the sensitivity of estimates to the size of cash holdings and sales.

In this paper we have studied the case of Italian manufacturing. The data set is represented by a panel of seven years for more than 26.000 companies for which AIDA data-base provides balance sheets figures. The case of Italy is particularly interesting given its industrial organization which is characterized by a very modest degree of vertical integration..

Our estimates on the whole dataset reveal the absence of scale economies in money demand.

The same conclusion should be heavily restricted if we estimate – via a recursive procedure- the same model on a progressively reduced number of companies according to the value of Cash Holdings and successively to the value of Sales.

The results of our exercise reveal that the absence of scale economies is determined by the large subset of small companies with sales below €8million. Once, in fact, companies under this size are progressively skimmed from our data set, economies of scale emerge and become near and coincident to the elasticity of 0,5 indicated by Baumol as a feature of efficient Cash Management.

The high values of the elasticity of money demand to Sales by Small Companies finds its explanation in the thin stock of money they generally need, involving a very modest cost opportunity in relatively large Cash Balances. On the contrary the low elasticities of the remaining Medium and Large companies reveal a high efficiency in Cash Management of the Industrial Organization matured in Italy in the last thirty years and characterized by a low level of Vertical Integration and a general shift of firm size distribution to the left.

We have also conducted the same exercise separately on individual Sectors. The curbing of the elasticities with the progressive skimming of companies according to the values of Cash balances and then of Sales is confirmed with the exception of three important Sectors.

An interesting result which emerges by this further exercise is the independence of scale elasticities from the level of technology which –according to the Eurostat classification partition-characterizes the Sectors.

As is expected from the theoretical model, signs of the coefficients of Interest Rate and Wage are respectively negative and Positive, while they are not equal in absolute value.

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