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ROLE OF REAL MONEY BALANCE IN PAKISTANI MANUFACTURING FIRMS

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The paper examines the role of real cash balance in the production process in the Pakistani Manufacturing Industries. The issue has been empirically examined for four firms, belonging to tobacco, rayon, sugar and cement industries. Results do provide a justification for treating real cash holdings as a factor input. One of the key findings is the complimentary relationship between money and labor. This result has an important macro-policy implication. The result suggests that any contractionary monetary policy, aiming to control inflation, may not be successful. It may actually increase unemployment of labor force.

The issue of including real cash balances into the production function has received a great deal of importance in the literature. Authors in this area justify the inclusion of real balances as a factor input on the following grounds. Money is not held for its own sake but as an intermediate good for the services it provides. Friedman [1969] argued that money should be treated as any other factor input to explain the behaviour of the firm. Therefore, one may explore the differences in the money demand functions of the consumers in general and business firms in particular. The motives for holding cash balances could be quite different across these two groups of economic agents. It has been argued that real balances in the production function also provide a possible link between real output and nominal interest rate on the supply-side of the aggregate economy (Harkness [1984] and Jansen [1985]).

The only study in this area related to Pakistan is by Khan [1985]. He has employed Cobb-Douglas production function. Furthermore, the derived factor demand equations in his paper are not based on optimization problem of firms.

The purpose of this paper is to report new empirical evidence on the role of real money balances as a productive factor. Instead of estimating an aggregate production function in which data on money generally pertains to the total economy rather than the manufacturing sector, we have estimated

micro-level production function for individual firms. We have used flexible functional form for the production function. i.e. Translog. Zellner's iterative estimation technique has been employed to estimate the factor cost share equations (labor, capital and real money balances).

Section 2 deals with the model. in Section 3 we report our results. And finally in Section 4 we provide summary and concluding remarks.

2. THEORETICAL BACKGROUND

2.1 A Translog Cost Model

In examining the underlying factor demand functions one can either evaluate the nature of the production function directly or can derive the cost function based on a particular specification of the production function using the duality properties. Invoking duality theory, it has been established that under rather weak regularity conditions, there is unique correspondence between the production function and the cost function. It has also been argued that the information about the underlying technology is contained in each function (Shephard [1970]).

We have chosen the translog specification of the cost function. A translog cost function imposes no a priori restriction on the substitution possibilities among factors of production. This is especially desirable in our study where we would like to allow the elasticities of substitution between money and other inputs to take any value. The translog cost function corresponding to the three factor inputs, namely, capital (k), labor (n) and money (m) can be written as:

$$[1]\quad \ln C = \alpha_o + \alpha_q (\ln Q) + 0.5\,\beta_{qq} (\ln Q)^2 + \sum_i \alpha_i \ln P_1 +$$

$$0.5 \sum_i \sum_j \beta_{ij} (1n\ P_i)\ (L_n P_j) + \sum_i \beta_{q1} (1nq)\ (\ln P_i)$$

where i, j = k, n.m and C is total nominal cost

Partially differentiating (1) with respect to factor prices, invoking Shephard's lemma and imposing homogeneity and symmetry conditions yields the following share equations:

$$[2]\quad S_i = \alpha_1 + \beta qi \ln Q + \Sigma \beta i1j \ln Pi$$

2.2 Factor Demand Elasticities

For the translog cost function specified in equation [1], Allen-uzawa's substitution elasticities are given by:

[3] $\sigma_{rk} = (\beta_{rk} + S_r S_k)/S_r S_k$,

[4] $\sigma_{rr} = \{\beta_{rr} + S_r (S_k - 1)\}/(S_r)^2$.

The own price elasticities of factor demands can be obtained from:

[5] $\varepsilon_{rr} = \sigma_{rr} S_r$,

and the cross price elasticities of factor demands are given by:

[6] $\varepsilon_{rk} = \sigma_{rk} S_r$,

3. ESTIMATION OF THE MODEL

3.1 Data and Econometric Estimation of the Model

The primary source of data are the balance sheets of the selected firms for the period 1971-1986. In the selection of these manufacturing firms, two main aspects have been considered. First, the firms should be producing a homogeneous product. Second, time-series data for a sufficient length be available to carry out the analysis. Four large firms, one from each of the following industries have been selected:

i) Tobacco,
ii) Sugar,
iii) Rayon,
iv) Cement,

Perpetual inventory method has been used to estimate capital stock. The short-term and long-term interest rate, used in the calculation of the opportunity cost of money and user cost of capital respectively, have been taken from the State Bank Bulletin. The user cost of capital is calculated by adding the rate of depreciation and the long-term interest rate. The data on the firm-specific wage rates was not directly available. We have, therefore, derived wage rate using the data on the annual earnings of the workers and the total workers in the manufacturing sector, taken from various issues of the Statistical year book of Pakistan.

3.2 Estimation Procedure

The cost share equations in [2] must add up to unity by definition. Hence,

the errors in the share equations must add to zero for each observation. This implies that one of the share equations must be dropped, as their covariance structure is not of full rank.

Following Zellner [1962], the system can be estimated using the seemingly unrelated regression technique, and the estimates so obtained are invariant to the choice of the equation dropped. It has been shown that a maximum likelihood estimateof the share equation guarantee such invariance. Dhrymes [1970] has shown that a continuing iteration of Zellner's method, until the covariance matrix converges, yields the maximum likelihood and ensures invariance of parameter estimates to the choice of the share equation dropped.

The invariance of the estimates has been ensured by estimating the model three times, dropping one cost share equation at a time.

3.3 Discussion of Results

The results of the estimated parameters are reported in Table 1. There are several parameter estimates that are statistically insignificant. However, we may safely conclude that money does play a significant role in the production process and should be considered as a factor input. The Allen's elasticities of substitution and price elasticities are presented in Table 2 and Table 3 respectively. The signs of these elasticities show a definite pattern. Ten out of twelve own price elasticities are negative, as expected. All the four price elasticities between money and labor are negative, indicating that these two inputs are complements to each other in the production process. There are no earlier studies related to Pakistan in which money is treated as factor input. However, studies for other countries indicate similar pattern. For instance Dennis and Smith [1978] found production workers and money to be complement to each other (in nine out of eleven U.S. manufacturing industries). The intuitive explanation for this complementarity lies in the fact that salaries/wages of the workers account for a major part of cash holdings. As the opportunity cost of money increases, an effort to economize on cash holding would be translated into economizing the use of the factor inputs which typically require large cash holdings. Incidently, this explanation has important implications for policy as it establishes a link between interest rate and labour demand. This link is referred in the economic literature as the supply-side effect of monetary policy.

The cross price elasticities between money and capital are positive (in three out of four cases) [Table-3]. This again conforms with earlier studies.

The explanation follows logically from the above argument. When a firm attempts to decrease labour input in response to an increase in the price of money, it substitutes capital for labour. This conclusion is further supported by the fact that in all four cases labour and capital are **substitutes.**

It may also be noted that the cross price elasticities between money and capital are very low which is consistent with intution.

4. CONCLUDING REMARKS

The purpose of this paper was to examine the role of real cash balances in the production process in the Pakistani Manufacturing Industries. We have empirically examined this issue for four firms, belonging to tobacco, rayon, sugar and cement industries. The results do provide a justification for treating real cash holdings as a factor input.

The results of the elasticities are interesting and consistent with earlier estimates for other economies. One of the key findings is the complementary relationship between money and labour. This result has an important macro-policy implication. The result suggests that any contractionary monetary policy, aiming to control inflation, may not be successful. It may actually increase unemployment of labour force. We therefore, suggest two possible extensions of this study. First, there is a need to empirically estimate a partial adjustment model, in which capital is a quasi-fixed factor input. This would provide estimates of both the short-run and long-run elasticity estimates. Second, if data permits, a dynamic model for the manufacturing industries should be estimated in which cost of adjusting capital stocks are incorporated into the optimization framework. This would enable us to evaluate the possible supply- side effects in more detail.

Table-1
Parameter Estimates of the Cost Function for the
Pakistani Manufacturing Firms

	Tobbacco	Sugar	Rayon	Cement
αn	0.394	-2.086	-2.853	0.029
	(1.02)	(-2.37)	(-1.64)	(0.024)
αm	0.050	-0.001	0.013	0.921
	(1.40)	(-0.01)	(0.283)	(2.867)
βnn	-0.241	-0.778	-0.748	0.047
	(-3.88)	(-3.20)	(-3.99)	(0.330)
βmm	-0.0001	0.036	0.003	0.063
	(-0.02)	(1.106)	(0.378	(2.089
βnm	-0.014	-0.033	-0.005	-0.014
	(-2.14)	(-0.95)	(-1.19)	(-0.36)
βqn	-0.018	0.063	0.190	0.036
	(-0.456)	(1.830)	(0.946)	(0.357)
βqm	-0.008	-0.003	-0.002	-0.069
	(-2.11)	(-0.60)	(-0.46)	(-2.55)
£	103.127	51.398	86.659	51.905

Note: £ is the value of the log likelihood function for the respective manufacuring firms.

Table-2
Own and Cross Allen's Elasticities of Substitution

	Tobacco	Sugar	Rayon	Cement
σnn	-0.602	-3.95	-4.809.	-1.273
σmm	-115.31	108.66	-103.43	31.534
σkk	-12.73	-4.662	-3.427	-0.474
σnm	-1.059	-3.492	-2.050	-0.1221
σnk	2.74	4.338	4.059	0.851
σmk	10.263	0.477	1.865	-1.643

Table-3
Own and Cross Price Elasticities

	Tobacco	Sugar	Rayon	Cement
εnn	-0.487	-2.015	-2.188	-0.492
εmm	-1.003	1.553	-0.383	1.006
εkk	-2.309	-2.219	-1.854	-0.275
εnm	-0.858	-1.781	-0.933	-0.0471
εnk	2.219	2.213	1.847	0.328
εmk	0.089	0.147	0.038	-0.052

Note: εij represents price elasticity. When $i=j$ it represents the own price elasticity of the ith factor and when $i=j$, it represents the cross price elasticity of the ith factor input with respect to the price of the jth factor.

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