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The Demand for Financial Assets in Pakistan

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In recent years Pakistan has moved to liberalise its financial and capital markets. Consequently the reforms will place heavy demand on the instruments of monetary policy to regulate the working of financial markets. Interest rate policy as a component of monetary policy not only determines the allocation of resources between assets but also within each class of assets. Given the scant research on intra-asset response to intertemporal interest rate movements, the present paper fills the gap by studying the determinants of financial assets and quantifies intra-asset substitutability within a system-wide portfolio framework. Using a simplified version of Brainard and Tobin (1968) model, we explain the asset holdings in terms of wealth and interest rates. We test the model on quarterly holdings of five assets, i.e., saving and fixed deposits, *khas* deposits, national deposit certificates and defence saving certificates. Asset substitutability is ascertained by single equation OLS, FIML (Iterative 3SLS) and restricted FIML estimation techniques. The system-wide restricted model performs according to *a priori* expectations. Own interest rate effect is positive and significant in three of the four equations. Five of the six off-diagonals are negative, and three are statistically significant. Saving and fixed deposits exhibit weak complementarity. *Khas* deposit and national deposit certificates are strong substitutes. The model is also used to decompose the change in portfolio share due to wealth, interest rate and residual components.

I. INTRODUCTION

As the workings of capital markets in Pakistan are gradually exposed to the market forces, the impact of various instruments of monetary policy will assume greater significance. In the emerging scenario the effectiveness of monetary policy will largely depend on the growth of non-bank financial intermediaries, the determination of interest rates, and the substitutability between money and other assets [Gurley and Shaw (1955, 1956)]. The money demand function has been frequently estimated for Pakistan [Mangla (1979); Khan (1982); Hasan (1987)]. The substitutability of monetary assets under alternate aggregation procedures is investigated by Hasan *et al.* (1988). We supplement the above research by studying the determinants of financial assets and quantify intra-assets substitutability within a system-wide portfolio framework.

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The multivariate stock adjustment model of Brainard and Tobin (1968) has been a popular framework to model holdings of financial assets. The balance sheet constraints are built in so that the asset demands sum to total wealth. Empirical estimates of the model by Parkin *et al.* (1975); Purvis (1975) and Taylor and Clements (1983) are characterised by statistical imprecision and suggest that the model is overparameterised. We use in this paper a simplified version of Brainard-Tobin model, as developed by Taylor and Clements (1983) (T-C hereafter), to explain the asset holdings in terms of wealth and interest rates. T-C employ consumer demand theory to impose homogeneity and Slutsky symmetry restrictions to reduce the number of free parameters in the Brainard-Tobin model.

In Section II, we sketch the T-C model and highlight the various restrictions imposed on the model. Section III describes the data base and presents the results of estimation techniques applied to the model. Concluding comments are given in Section IV.

II. THE MODEL

Since the objective of the paper is to estimate the T-C model on the data for Pakistan, we just sketch the model.[1] Financial assets are assumed to be held by the investor for the purpose of (i) generating income and (ii) satisfying transaction requirements. The investor maximises real interest earnings:

$$\Sigma r_i a_i \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where, r_i is the interest rate on asset i, $a_i = A_i / P$, A_i is the nominal value of financial asset i, P is the Consumer Price Index. The constraint is the level of transaction (liquidity) services determined by the total real wealth, $W = \sum_{i=1}^{n} a_i$. The transaction technology is described by the transformation function

$$f(a_1,.....a_n) = g(W) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

with $\partial f/\partial a_i > 0$, $\partial^2 f/\partial a_i \partial a_j$ is a $n \times n$ positive definite matrix and $g(W) > 0$. Maximising (1) subject to (2) generates a demand equation for asset i of the form:

$$a_i = a_i(W,r_1,....r_n) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Combining the Working (1943)-Leser (1963) Engel curve model from consumption theory and Cagan (1956) form of the demand for money equation, T-C postulate the

[1]For details, the reader is referred to Taylor and Clements (1983).

following form of the demand equation for asset *i*,

$$s_i = \alpha_i + \beta_i log\ W + \sum_{j=1}^{n} \pi_{ij} r_j \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

where $s_i = a_i/W$ for the *i*th portfolio share. The coefficient β_i represents 100 times the effect on s_i of a one-percent increase in wealth, holding interest rate being constant. π_{ij} gives the effect on s_i of a one percentage point increase in r_j (other things being equal). This model is flexible and robust in consumer demand applications and there is a presumption that it would probably also be satisfactory for asset demand.[2]

The balance sheet restrictions can be derived by summing Equation (4) over $i = 1,.....n$. Since the asset shares sum to unity, this gives

$$1 = \sum_i \alpha_i + \sum_i \beta_i log W + \sum_i \sum_j \pi_{ij} r_i.$$

For this equality to hold for all values of the variables on the right, the coefficients must satisfy the following constraints:

$$\sum_i \alpha_i = 1 \quad \sum_i \beta_i = 0 \quad \sum_i \pi_{ij} = 0.$$

With these restrictions, Equation (4) satisfies the balance sheet constraint

$$\sum_i a_i = W \text{ or } \sum_i s_i = 1.$$

Homogeneity and Slutsky symmetry restrictions are imposed on the interest rate coefficients of Equation (4). Homogeneity implies

$$\sum_j \pi_{ij} = 0 \quad i = 1,.....n.$$

Slutsky symmetry means that interest rate substitution effects are symmetric,

$$\pi_{ij} = \pi_{ji} \quad i, j = 1,.....n.$$

These restrictions are linear in the coefficients and can thus be easily tested and then imposed.

[2]This conclusion emerges clearly from a survey by Evans (1979).

III. DATA AND RESULTS

Quarterly data on holdings of five types of financial assets, (i) saving deposits, (ii) fixed deposits, (iii) *khas* deposit certificates (KDCs), (iv) national deposit certificates (NDCs), and (v) defence saving certificates (DSCs), were extracted from the various issues of *Bulletin–State Bank of Pakistan.*[3] The data series extend from July 1982 to March 1992. The KDCs and the NDCs were discontinued in the first quarter of 1990 and were replaced by two types of saving instruments, namely, special saving certificates (SSCs), i.e., registered and bearer. As these are qualitatively not very different from the KDCs, the holdings of SSCs are considered as a continuation of KDCs.[4] For saving deposits, a weighted average rate of return series is published on a quarterly basis in the *Bulletin–State Bank of Pakistan.* The rates of return on fixed deposits differ by the maturity period, ranging from less than 6 months to over 5 years. Consequently, a single weighted rate of return is computed for this asset. Across quarters, there is almost no variation in the rate of return of the remaining three saving instruments. Nominal rate of return on the NDCs has been revised once, i.e., in 1988, during the last ten years. The rate of return on the KDCs and the DSCs has remained *unchanged* during the reference period. However, rates of return differ marginally by the length of the holding period or encashment.[5] In the absence of any information on outstanding balance by the length of holding period, a simple average rate of return is used for the KDCs and the NDCs. For the KDCs, the rate of return after 1990 reflects the rate of return on special saving certificates. During the period under study, subscription to the above-mentioned five government saving instruments was open *only* to individuals.[6] The share of individual accounts in saving deposits has varied from 76 percent in March 1987 to 71 percent in March 1992. The share of personal accounts in fixed deposits

[3]The KDCs, NDCs, and DSCs do not exhaust the list of government saving instruments available in the economy. Savings are also channelled into prize bonds, monthly income accounts (i.e., *mahana amdani* accounts), premium saving certificates, and special saving accounts. The selection of these three financial assets is guided by their distinguishing characteristics, data availability on outstanding balances, rates of return and their weightage in overall holdings. In quarter-2 1987, these three instruments constituted 76 percent of the total holdings of government saving instruments. In quarter-2 1992, their share dropped to 72 percent. Corresponding share of investment in prize bonds of various denominations was 22 and 18 percent respectively. We also exclude from analysis the saving bonds issued by WAPDA (a public sector corporation) and the DFIs. WAPDA began to issue the bonds, which are qualitatively similar to the KDCs, in 1989. Certificates and bonds of the DFIs are an insignificant portion of total holdings.

[4]Both the KDCs and the SSCs mature in 3 years, with interest accrual every six months. The rate of return on special saving certificates is approximately two percentage points below the return on *khas* deposit certificates.

[5]For example, the KDC yields a rate of return of 15 percent for 5 periods of complete six months. For the last period of complete six months, it yields 17.1 percent. For three years, the compound yearly rate of return is 13.44 percent.

[6]Since November 1993, private firms, commercial banks, and development finance institutions (DFIs) can also subscribe to the DSCs, the SSCs, and the NDCs.

has ranged from 44 percent to 36 percent in the corresponding period.[7]

Single-equation Estimation

Before we move to the system-wide estimation of the demand equations, it will be useful to look at the single-equation estimates. The following stock adjustment model is estimated for each of the five financial assets:

$$log\ a_{it} = \alpha_i + \beta_i log\ W_t + \sum_{j=1}^{4} \pi_{ij} r_{jt} + \gamma_i log(a_{it-1}) + \mu_{it}$$

Note that although we estimate five demand equations, we use rate of return series only for four financial assets. To avoid perfect collinearity with the intercept term, constant rate of return series on the DSCs has been dropped. The estimation results presented in Table 1 can be summarised as follows:

(a) The effect of own interest rates on saving and fixed deposits are of the wrong sign but statistically not significant. (Equations 1.1 and 1.2.)
(b) Of the sixteen cross-effects, eleven are negative. Only four among these are statistically significant at the 95 percent level.
(c) The lagged terms are statistically significant in all the equations, implying adjustment towards the desired level of real value holdings.
(d) The relationship between the NDCs and the KDCs is vague. Equation 1.4 indicates a complementarity between the two assets, while the impact of the NDCs interest rate on the demand for the KDCs is negative but not significant (Equation 1.3). It may be more of a statistical anamoly as holdings in both these assets have declined since quarter-1, 1990.
(e) Defence saving certificates and the KDCs are strong substitutes (Equation 1.5). A one percentage point fall in the rate of return of the KDCs increase the demand for the DSCs by 0.54 percent.

System-wide Unrestricted Estimates

As stated above, the rate of return on defence saving certificates has remained constant during the last ten years. Consequently, system-wide estimates (including intercept) can only be possible without including the demand equation for the DSCs. Consequently, financial wealth was redefined as the sum of four financial assets, i.e.,

[7]Within the theoretical framework outlined in Section II above, the relatively small proportion of fixed deposits held by the individuals implies caution in interpreting the empirical results for the demand of this asset. We relied on aggregate information as data on a detailed breakdown of personal savings in fixed deposits by maturity periods is not available.

Table 1

Single-equation Results

$$Log\ a_{it} = \alpha_i + \beta_i\ log\ W_t + \sum_{j=1}^{4} \pi_{ij}\ r_{jt} + \gamma_i log(a_{it-1})$$

$i = 1,2,3,4,5 \qquad j = 1,2,3,4$

	1	2	3	4	5
	Saving Deposits	Fixed Deposits	*Khas* Deposits	National Deposits Certificate	Defence Saving Certificate
α_i	1.6224	4.1140	–2.3684	–1.5248	–1.2622
	(3.54)	(4.03)	(1.86)	(4.95)	(2.45)
β_i	0.2838	0.2402	0.3266	0.0258	0.4113
	(3.17)	(1.68)	(2.03)	(1.10)	(3.81)
π_{i1}	–0.0024	–0.0444	0.0103	0.0056	0.0147
	(0.21)	(1.61)	(0.43)	(0.65)	(1.47)
π_{i2}	–0.0026	–0.0222	–0.0024	–0.0066	–0.0118
	(0.32)	(1.04)	(0.15)	(1.10)	(1.69)
π_{i3}	–0.0332	–0.1298	0.0858	0.0767	–0.0368
	(2.38)	(3.70)	(2.63)	(7.56)	(2.21)
π_{i4}	–0.0193	–0.0885	–0.0105	0.0075	0.0218
	(1.12)	(2.05)	(0.29)	(0.507)	(1.14)
γ_i	0.5302	0.6342	0.8118	1.0565	0.7105
	(4.09)	(5.13)	(12.30)	(33.14)	(9.36)
R^2	0.9841	0.9373	0.9912	0.9929	0.9982
D.W.	1.41	1.66	1.86	2.35	1.75
F	329.64	79.81	603.87	741.81	2918.93

Note: t-values are given in parentheses.

saving deposits, fixed deposits, *khas* deposits, and national deposit certificates. Table 2 presents the FIML (Iterative 3SLS) estimates for the unrestricted model, based on the form specified in Equation 4. Wealth and interest rate elasticities reported in the same table are calculated as follows: For asset *i*,

$$\partial log\ a_i / \partial log\ W = 1 + \frac{\beta_i}{s_i}$$

$$\partial log\ a_i / \partial log\ r_j = \frac{r_j \pi_{ij}}{s_i}$$

Thus an asset with positive (negative) β_i has a wealth elasticity larger (smaller) than unity. The results show marginal improvement over the single-equation estimates. The own interest rate effect on saving deposits is negative but statistically insignificant. Only the cross effects in the fixed deposit equation are negative and statistically significant. Three off-diagonals are positive and significant, indicating complementarity. A weak complementarity is indicated between saving and fixed deposits (Equation 2.1). The impact of wealth on holdings is not robust across the four equations.

Restricted Estimates

We impose homogeneity and Slutsky symmetry restrictions on the matrix of interest rate coefficients and re-estimate the model.[8] The results are given in Table 3. Applying the Likelihood Ratio Test we obtain the value of $-2log\ \lambda = 5.56$. It is less than the critical value of $\chi^2(6)$ at the 1 percent level of 16.81. The null hypothesis of homogeneity and Slutsky symmetry is therefore accepted. Not only is the imposition of restrictions validated by the ratio test, but the estimates are a marked improvement in an economic sense over the unrestricted results. Wealth coefficients are significant in all the equations. Own interest rate effect is positive and significant in three of the four equations. Five of the six off-diagonals are negative, and three are statistically significant. However, saving and fixed deposits continue to exhibit a weak complementarity. According to Tobin and Brainard (1962), it is possible to find a complementary relationship among financial assets. In our case, the increased demand for saving deposits *to act as reserves* for fixed deposits outweighs the decline in their demand due to an increase in the rate of return of fixed deposits. These estimates indicate that the KDCs and the NDCs are strong substitutes in contrast to vague results of single-equation estimation and weak complementarity

[8]The Iterative 3SLS programme of the TSP version 6.0 was used to estimate the restricted model.

Table 2

Unrestricted Model

Equation	Parameters						Elasticities				
	α_i	β_i	π_{i1}	π_{i2}	π_{i3}	π_{i4}	W	r_1	r_2	r_3	r_4
1. Saving Deposits	1.9203	–0.1584	–0.0051	0.0008	–0.0261	–0.0018	0.64	–0.09	0.19	–0.88	–0.06
	(0.13)	(0.16)	(0.01)	(0.00)	(0.05)	(0.00)					
2. Fixed Deposits	1.4492	–0.0314	–0.0178	0.0064	–0.0256	–0.0342	0.90	–0.42	0.20	–1.18	–1.45
	(4.47)	(1.41)	(1.98)	(0.99)	(2.36)	(2.52)					
3. *Khas* Deposits	–2.4046	0.2030	0.0218	–0.0064	0.0514	0.0312	1.90	0.75	–0.29	3.36	1.89
	(5.97)	(7.36)	(1.96)	(0.81)	(3.82)	(1.86)					
4. National Deposits	0.0351	–0.0134	0.0010	–0.0007	0.0003	0.0048	0.21	0.47	–0.42	0.24	3.86
	(1.34)	(7.47)	(1.43)	(1.39)	(0.31)	(4.36)					

Notes: 1. *t*- values are given in parentheses.

2. Elasticities are evaluated at sample means;
$\bar{S}_1 = 0.4360, \bar{S}_2 = 0.3220, \bar{S}_3 = 0.2250, \bar{S}_4 = 0.0170$
$\bar{r}_1 = 7.63, \bar{r}_2 = 10.30, \bar{r}_3 = 14.80, \bar{r}_4 = 13.75.$

Table 3

Restricted Model

Equation	Parameters						Elasticities				
	α_i	β_i	π_{i1}	π_{i2}	π_{i3}	π_{i4}	W	r_1	r_2	r_3	r_4
1. Saving Deposits	1.4555	–0.1446	0.0088	0.0009	–0.0093	–0.0005	0.67	0.15	0.02	–0.31	–0.01
	(21.2)	(16.1)	(2.31)	(0.32)	(4.09)	(0.97)					
2. Fixed Deposits	0.7087	–0.0554		0.0035	–0.0037	–0.0007	0.83	0.02	0.12	–0.17	–0.03
	(6.7)	(3.71)		(1.00)	(1.10)	(1.9)					
3. *Khas* Deposits	–1.2630	0.2128			0.0147	–0.0017	1.93	–0.32	–0.17	0.99	–0.10
	(9.41)	(11.21)			(3.36)	(4.56)					
4. National Deposits	0.0977	–0.0127				0.0028	0.24	–0.21	–0.41	–0.14	2.29
	(9.81)	(8.49)				(5.30)					

Notes: 1. *t*- values are given in parentheses.

2. Elasticities are evaluated at sample means;
$\bar{S}_1 = 0.4360, \bar{S}_2 = 0.3220, \bar{S}_3 = 0.2250, \bar{S}_4 = 0.0170$
$\bar{r}_1 = 7.63, \bar{r}_2 = 10.30, \bar{r}_3 = 14.80, \bar{r}_4 = 13.75.$

observed in the estimates of the unrestricted model. Among the four instruments, the KDCs are highly elastic to wealth changes, followed by fixed deposits.[9] The inelastic demand of the NDCs with respect to wealth may reflect its weak popularity as a financial instrument providing liquidity services equal to other instruments (not included in the analysis) in the economy. The real value holdings (i.e., a_i) of the NDCs and the KDCs are fairly elastic to own interest changes. At the mean, one percentage point increase in the rate of return of the NDCs leads an individual investor to increase (reallocate within its given portfolio) the NDC holdings by 16 percent. The corresponding figure for the KDCs is 6.7 percent.

Decomposition of a Change in Portfolio Share

The model can be used to decompose the change in each portfolio share into wealth, interest rates, and residual component. Table 4 presents results of this exercise. During the decade of Eighties, the holdings in the KDCs have grown at the expense of the other three instruments. Its share in the four assets has gone up from 9.7 percent in 1982 to 20.6 percent in 1992. The reason for growth in KDCs is the increase in wealth. Given the high wealth elasticity, the model predicts an increase

Table 4

Decomposition of Change in Portfolio Shares

Asset	Change in Share of		Wealth	Interest Rates					
i	Wealth in Asset i		$\beta_i \Delta log W$	$\pi_{i1}\Delta r_1$	$\pi_{i2}\Delta r_2$	$\pi_{i3}\Delta r_3$	$\pi_{i4}\Delta r_4$	$\sum_{j=1}^{4}\Delta_i rj$	Residuals
S	Sum	–8.90	–14.7	0.47	0.041	1.30	–0.044	1.77	4.03
	Mean	–0.23	–0.38	0.01	0.00	0.03	0.001	0.05	0.10
F	Sum	–0.45	–5.56	0.05	0.16	0.52	–0.064	0.65	4.45
	Mean	–0.12	–0.14	0.001	0.00	0.01	0.001	0.02	0.11
K	Sum	10.89	21.24	–0.50	–0.16	–2.10	–0.16	–2.93	–7.42
	Mean	0.79	0.54	–0.01	0.00	–0.05	0.00	–0.08	–0.19
N	Sum	–1.54	–1.31	–0.025	–0.03	0.24	0.27	0.457	–0.64
	Mean	–0.04	–0.03	–0.00	0.00	0.01	0.01	0.011	–0.02

Notes: All values are to be divided by 100.
S = Saving Deposits; F = Fixed Deposits; K = *Khas* Deposits; and N = National Deposits.

[9]Real rates of return on the KDCs have been mostly positive, and vice versa, for the saving and fixed deposits. Over time, with increase in financial wealth, this feature of the KDCs has attracted increasing amounts of savings.

in its share to 21 percent. However, the combined effect of all interest rate changes lowered its share by 3 percent and, furthermore, unaccounted factors dampened its share by 7 percent. In contrast, the change in all interest rates marginally increased the share of the remaining instruments in the portfolio but could not offset the wealth effect in favour of allocation towards the KDCs.

IV. CONCLUDING COMMENTS

In this paper our objective was to empirically estimate the simple portfolio model developed by Taylor and Clements (1983) on quarterly data of Pakistan. Single-equation, system-wide unrestricted and restricted estimates were presented in the paper. In spite of little variation in the quarterly rates of return of two saving instruments, i.e., *khas* deposit certificates and national deposit certificates, the allocations within the portfolio were sensitive to own and cross-interest rate effect. Interest rate coefficients were mostly negative and indicated a high degree of substitutability between assets.

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