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Interest Rate Liberalization and Demand for Money in Turkey

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Summary

As part of a far-reaching stabilization program, in mid-1980 Turkey liberalized the determination of interest rates on time deposits. As a result, time deposit rates have remained positive in real terms since early 1981, with the exception of a temporary reappearance of negative real rates in the second half of 1983, which were, however, eliminated by the end of the year.

This paper presents an application to Turkey of a simple model of money demand that allows explicitly for interest rate liberalization. Disaggregated estimates for the major components of broad money on 1977-82 quarterly data indicate that the positive effect of the increase in time deposit rates on quasi-money holdings outweighed the negative effect on narrow money holdings, resulting in a sizable positive interest elasticity of demand for broad money--ranging from 0.1 in the short run to 0.4 in the long run--after deregulation. The magnitudes over the long run, of the real income elasticity (1.3) and inflation elasticity (-0.3) obtained from estimates for broad money components are comparable to those found in other developing countries. In contrast to the disaggregated estimates, direct estimation of the demand for broad money glosses over the effect of the interest rate and exaggerates the size of the short-run income elasticity and the speed of adjustment of actual to desired money balances.

Dynamic quarterly forecasts of the model for 1983, that is, beyond the estimation period, were generally successful. Although forecasts of the demand for narrow money (less commercial sight deposits) exceed significantly the corresponding actual levels in the first half of the year, forecasts of quasi-money track very well the negative impact of substantial cuts in time deposits. Furthermore, the forecasts confirm

1/ The author is grateful to Peter Hole, Mohsin Khan, Rüsdü Saracoglu, and other Fund colleagues for helpful comments. Orhan Arkan and Peter Woo provided computational assistance.

the accumulation of excess liquidity (equivalent at most to about 4 percent of money supply) toward the end of the year, which was reflected also in an acceleration in the rate of inflation. Forecasts based on direct estimates for broad money are inferior to those based on estimates for its individual components and fail to reflect the buildup of excess liquidity.

The Turkish experience supports the view that interest rates, in conjunction with inflationary expectations, play an important role in determining the size and composition of the demand for money even in the absence of well-developed financial markets. A major implication is that a flexible interest rate policy can make a useful contribution to stabilization, as well as resource mobilization.

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I. Introduction

In recent years there has been a growing consensus among analysts and policymakers toward recognition of interest rate policy as a major instrument for mobilizing financial resources in developing countries. Proponents of this view argue that market determined interest rates, in combination with appropriate external and domestic macro policies, are a necessary condition for channeling--initially through the banking system--financial resources from savers to investors, which in turn should lead to increased economic growth. 1/ Developments in Turkey following the introduction of the 1980 stabilization program lend support to the hypothesized complementarity between the growth of real money balances and fixed capital formation, as well as its contribution to output growth, in response to, inter alia, interest rate liberalization. 2/

While full examination of such linkages lies beyond the scope of this paper, the present analysis focuses on the determinants of money demand in Turkey since the late 1970s, with particular emphasis on the role of the rate of interest. The usefulness of studying the Turkish experience is underscored by the difficulties that are usually encountered in empirically documenting the influence of interest rate policy on financial savings in general or on money demand in particular, in developing economies. 3/ Moreover, a quantitative explanation of the demand for money is an essential ingredient for the formulation of monetary policy.

The first section of the paper reviews the process of interest rate liberalization and associated measures adopted in Turkey in recent years. The second section describes a model of money demand, while the third deals with measurement aspects of the model's application to Turkey. In the final sections, the presentation of estimation results over the period 1977-82 is followed by a discussion of forecasts for 1983.

1/ For an early statement of this view, see McKinnon (1973). Yet resistance to decontrolling interest rates is still strong in most developing countries as well as many developed ones; for a discussion of reasons underlying such resistance, see Lanyi and Saracoglu (1983).

2/ Between the middle of 1980 and the end of 1982, broad money holdings nearly doubled in real terms, while the annual growth of private fixed investment and GNP swung from negative rates of 17 percent and 1 percent, respectively, in 1980, to positive rates of over 5 percent and 4 percent in 1982. For an overview of developments during the period, see Kopits (1983).

3/ The main obstacle for estimating this relationship is the prevalence of rigid interest rate ceilings in many of these countries. See, for example, the estimates of money demand by Khan (1980) and of savings behavior by Kopits and Gotur (1980). An exception is the recent attempt by Mathieson (1982) at measuring the effects of interest rates during financial reform in Argentina.

II. Interest Rate Policy in Turkey

At the end of the last decade, largely as a consequence of mounting public sector deficits accommodated by monetary expansion, Turkey experienced a sharp deterioration in its external accounts and an upsurge of inflationary pressures. These disequilibria were aggravated by rigidities in the price mechanism, including fixed exchange and interest rates. While the year-on-year rate of inflation (measured by fluctuations in wholesale prices) climbed from 18 percent in the first quarter of 1977 to 119 percent in the first quarter of 1980, the ceiling on before-tax nominal annual interest rate on 6- to 12-month time deposits was raised from 6 percent to 12 percent, and on personal sight deposits it was kept unchanged at 3 percent. Highly negative real yields on bank deposits encouraged the flight from domestic money assets into real and foreign assets--to some extent through the unorganized financial market. The accumulation of real assets was financed by excessive borrowing at very low nominal interest rates, also subject to control, circumvented in part by the obligation imposed on borrowers to hold interest-free commercial sight deposits with lending banks.

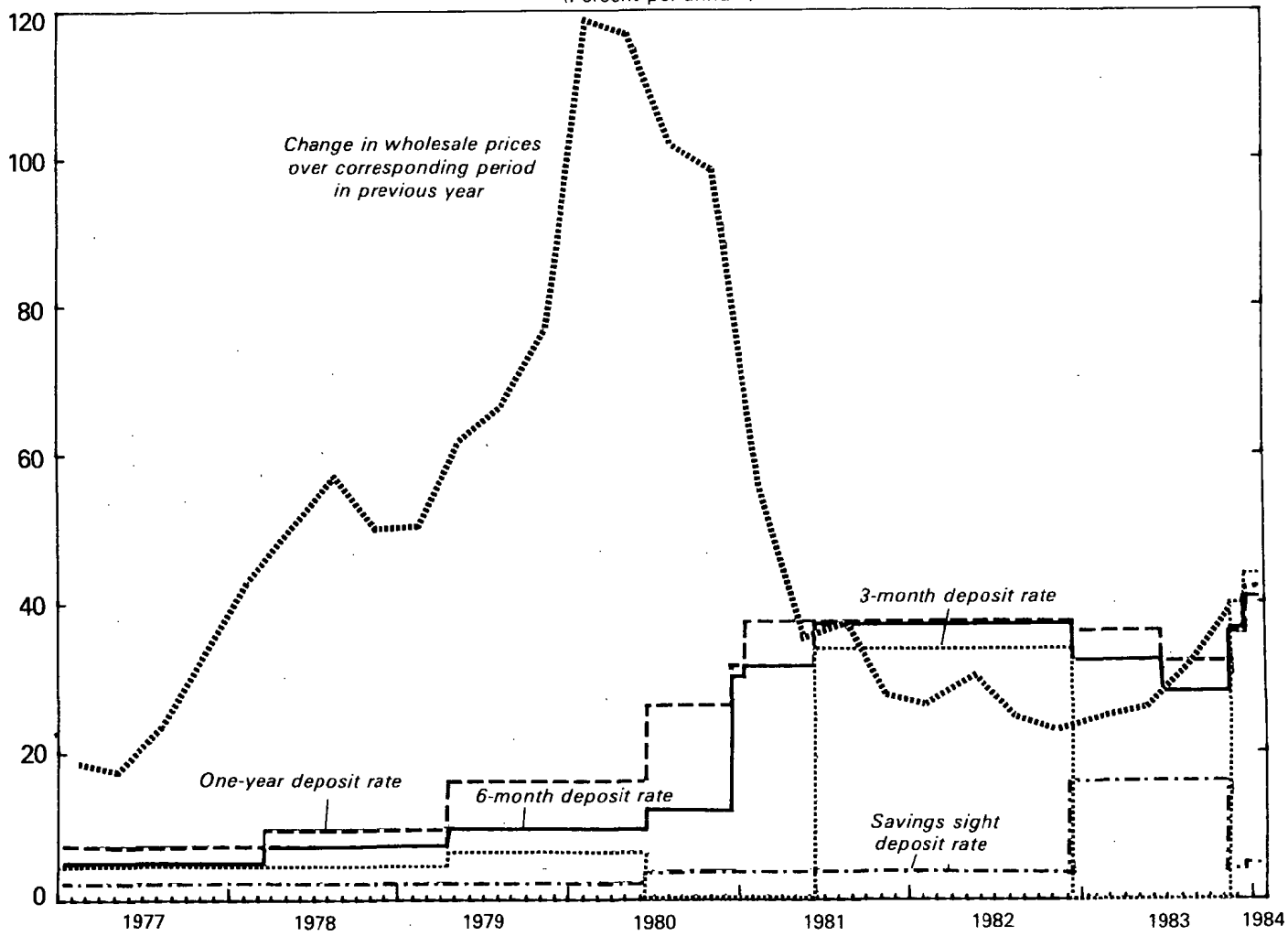
As part of a far-reaching stabilization program, which included tight demand management and a flexible exchange rate policy, interest rates on time deposits were deregulated in July 1980. Following decontrol, time deposit rates were determined through a "gentlemen's agreement" among commercial banks, which--under the pressure of relatively attractive terms offered on government securities--provided for a gradual rise in nominal rates up to 50 percent in gross nominal terms for all maturities of six months or more, equivalent to a 37.5 percent after-tax yield, by the middle of 1981 (Chart 1). In addition, certificates of deposit were introduced bearing the same interest rate as time deposits of comparable maturity. However, because of intense competition among banks and other financial intermediaries, rates offered on time deposits and certificates of deposit often exceeded the rates sanctioned under the agreement. Although nonpreferential lending rates were also raised significantly (surpassing 70 percent in nominal effective cost for many borrowers), the proliferation of preferential credit facilities, the relatively high cost of intermediation, and a confidence crisis triggered by the collapse of a large brokerage house in mid-1982, strained the liquidity position of many commercial banks.

In light of these pressures on the banking system, in 1983 the authorities introduced a number of financial reforms, including modifications in the determination of deposit rates. In order to protect the competitive position of small banks, from January 1983 onward the nine largest banks were bound by the agreed-upon time deposit rates, while the others were allowed to pay a premium of up to 2.5 percent above these rates. Encouraged by the deceleration of the annual rate of inflation to 23 percent in the fourth quarter of 1982, gross nominal interest rates were reduced to 40 and 45 percent (from 50 percent), respectively, on 6- to 12-month deposits and one-year deposits, but raised to 20 percent (from 5 percent) on personal sight deposits. In effective terms, the fall in time deposit rates was dampened by a cut in the withholding tax

CHART 1
TURKEY

INFLATION RATE AND AFTER-TAX DEPOSIT RATES, JAN. 1977-JAN. 1984

(Percent per annum)



Source: See Appendix.

rate from 25 percent to 20 percent. By contrast, the effective yield of certificates of deposit became relatively lower as the applicable withholding tax rate was raised to 30 percent. In July, gross interest rates on time deposits and certificates of deposit were lowered by an additional 5 percentage points, partly in anticipation of a continued decline of inflationary expectations. Concomitantly, many borrowing rates were broadly reduced.

However, the reduction in interest rates coupled with a reacceleration of inflation resulted in negative real interest rates during the second half of 1983. In view of the reluctance of major banks to raise interest rates to positive real levels, in December a more flexible interest rate policy was adopted. Under this approach, the Central Bank of Turkey has been authorized to review and to set deposit rates at least every three months, taking into account fluctuations in the rate of inflation and other relevant economic developments. Immediately, gross interest rates were increased to 47 percent on 6-month deposits and 45 percent on 1-year deposits. Also, a 3-month call deposit was reinstated bearing a 49 percent interest rate, while a 5 percent rate was extended to all sight deposits. These steps were augmented by a 10 percentage point reduction in the withholding tax rate. On the lending side, banks were allowed to set nonpreferential interest rates freely; but as the financial transactions tax was lowered from 15 percent to 3 percent, effective borrowing costs did not increase significantly.

The revision of interest rates in early 1983 was accompanied by the simplification of a highly variegated system of reserve requirements and unification of liquidity ratios, and was followed by the enactment of a banking reform law aimed at strengthening the financial position of commercial banks. The principal features of the new banking law are: higher required equity participation in commercial banks, creation of a deposit insurance scheme, stricter regulation of branch banking, and upgraded professional standards for bank managers. These measures are of singular importance in a country where the banking system is expected to continue to operate as the central vehicle of financial intermediation.

III. A Model of Money Demand

It is customary to postulate the demand for money as a function of the level of income (or some other scale variable), and the opportunity cost of money, which in turn is determined by the market rate of interest and the expected rate of price inflation. Thus, the determination of the equilibrium level of money balances in time t can be expressed in exponential form

$$m_t^* = e^{\alpha_0} y_t^{\alpha_1} e^{\alpha_2 r_t} e^{\alpha_3 \pi_t} \qquad (1)$$

where m* denotes the demand for real money balances, y the level of real income or output, r the rate of interest, and π the expected rate of inflation.

The value of each parameter is contingent mainly on the definition of the dependent variable. The transactions demand for money is reflected in a positive income elasticity, or $\alpha_1 > 0$, which tends to be larger for narrow money than quasi-money. Through the speculative motive for holding money, the rate of interest on time deposits has a positive effect on the demand for quasi-money, that is, $\alpha_2 > 0$, particularly if there are few alternative interest-bearing financial assets. By the same token, the deposit rate acts as a depressant on the demand for narrow money (whose nominal yield is near zero) so that $\alpha_2 < 0$, as portfolios are adjusted toward larger holdings of interest-bearing assets in response to a rise in the interest rate. Hence, the elasticity of demand for broad money with respect to the time deposit rate is theoretically ambiguous. 1/ Meanwhile, the expected rate of inflation exercises a negative influence on all forms of money holdings, whereby $\alpha_3 < 0$ regardless of the definition of money, determining the allocation of wealth between money and real assets, as well as other inflation hedges (such as foreign and indexed domestic financial assets).

Over the long run, actual money balances are adjusted fully to the desired level of money balances. However, in a shorter time horizon, there is usually a lagged response of actual money holdings to changes in the desired stock. This partial adjustment mechanism can be described as

$$m_t/m_{t-1} = (m_t^*/m_{t-1})^{\lambda} \qquad (2)$$

where $0 \leq \lambda \leq 1$ stands for the coefficient of adjustment of real money balances to changes in the equilibrium level of real balances. Clearly, the faster the adjustment, the closer is the value of λ to unity.

Substituting equation (1) into (2), taking natural logarithms, and adding an intercept and a stochastic term u, results in the following linear relationship

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1/ By contrast, the elasticity of broad money holdings in countries with well-developed capital markets, estimated with respect to the interest rate on nonmonetary financial assets, is negative. See the survey by Laidler (1977, Chap. 7).

$$\ln m_t = \lambda\alpha_o + \lambda\alpha_1 \ln y_t + \lambda\alpha_2 r_t + \lambda\alpha_3 \pi_t + (1 - \lambda) \ln m_{t-1} + u_t \quad (3)$$

where real money balances are determined by real income, the rate of interest, the expected rate of inflation, and the past level of money holdings. Equation (3) is sufficiently general to accommodate any definition of money. However, for estimation purposes, it is necessary to incorporate two further modifications.

First, as the expected rate of inflation cannot be measured directly, inflationary expectations must be specified in terms of observed price fluctuations. Broadly stated, the expected rate of inflation in period t is generated by actual price changes over the lagged periods k = 0, 1, 2 ... n,

$$\pi_t = \sum_{o}^{n} \gamma_k \, \Delta \ln p_{t-k} \quad (4)$$

where $0 \leq \gamma \leq 1$ is the distributed lag weight and p is the price level. The actual form of the distributed lag (4) adopted for estimation purposes is discussed in the following section.

Second, equation (3) ignores structural shifts that take place in an economy undergoing financial reform. Specifically, liberalization of interest rates constitutes a structural shift that may affect the stability of the demand for money function. In order to capture the impact of this shift, the interest rate variable is truncated into separate variables r_1 and r_2 which stand for the time deposit rates prevailing before and after decontrol, respectively. Accordingly, equation (3) is expanded as follows

$$\ln m_t = \lambda\alpha_o + \lambda\alpha_1 \ln y_t + \lambda\alpha_{21} r_{1t} + \lambda\alpha_{22} r_{2t} + \lambda\alpha_3 \sum_{o} \gamma_k \, \Delta \ln p_{t-k} + (1 - \lambda) \ln m_{t-1} + u_t \quad (5)$$

where α_{21} and α_{22} represent interest semielasticities of money demand prior to and following decontrol.

IV. Data and Estimation

Besides broad money, three components of broad money have been selected as alternative measures of the dependent variable in equation (5) because of certain distinguishing characteristics. The first component, adjusted narrow money, consists of currency in circulation plus personal sight deposits (excluding commercial sight deposits) which are highly liquid and have yielded traditionally a very low nominal interest rate. The second, comprised of commercial sight deposits, differs from other forms of narrow money in that borrowers are required to hold a large part of them as compensatory balances against credits outstanding. The third and remaining component of broad money is quasi-money, made up of interest-bearing fixed-maturity time deposits and certificates of deposits. 1/

The nationwide wholesale price index was used for deflating the dependent variable and for measuring the rate inflation. The choice of this index is justified on grounds that it is probably Turkey's most reliable price index covering the period of estimation. 2/ Moreover, in comparison with consumer price changes, movements in wholesale prices can be regarded as a better measure of the opportunity cost of money inasmuch as they reflect the capital gains that accrue on inventories of basic commodities and inputs (excluding services), which are the principal alternatives to holding money balances in developing countries. 3/

The effect of the rate of inflation in equation (5) was estimated through a polynomial distributed lag of the second degree without end-point restrictions. Clearly, this approach does not permit estimation of parameter α_3 separately from lag weights γ_k. Instead, it yields estimates of the product $\beta_k = \alpha_3\gamma_k$ which stands for the semi-elasticity of the demand for money in time t with respect to the actual rate of inflation in t - k rather than the expected rate of inflation in t.

The interest rate was measured by the nominal yield on 6- to 12-month time deposits--considered a typical interest rate on quasi-money balances--net of withholding tax. The interest rate variable was split in the middle of 1980 when interest rates on quasi-money were decontrolled. Thus, r_1 is measured by the after-tax time deposit rate through the second quarter of 1980 and r_2 by the deposit rate from the third quarter onwards. 4/ Data on each partitioned variable outside the relevant period were replaced by zero.

As only annual time series of real GNP were available for quantifying the income variable, it was necessary to search for an appropriate quarterly indicator of economic activity. In the absence of a suitable

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1/ Further data description and sources are given in the Appendix.
2/ See Organization for European Cooperation and Development (1983, p. 16).
3/ McKinnon (1973, pp. 96 ff.)
4/ This approach is equivalent to applying slope dummies to the rate of interest.

production index on a broad sectoral basis, quarterly data on electricity output were grafted onto the annual GNP at constant prices. The high correlation between annual GNP and annual electricity output 1/ suggests that the quarterly series of electricity output is an adequate proxy of quarterly variations in overall activity.

V. Estimation Results

Ordinary least squares estimates of the money demand function on quarterly data over the period 1977-82 are shown in Table 1. The table contains a pair of estimates for each definition of money: with a single interest rate variable and with partitioned interest rate variables. 2/ The fits are excellent, as reflected by the closeness of the predicted and actual values of the dependent variable over the estimation period (Chart 2). The relevant tests for autocorrelation reveal serial independence of residuals--after appropriate correction of the estimates for narrow money. On the whole, the model has a greater explanatory power for narrow money and quasi-money than for broad money, capturing more fundamental demand behavior separately for active and idle balances. Not surprisingly, the fit for commercial sight deposits is weaker in view of the somewhat compulsory nature of such deposits.

The evidence confirms that in the late 1970s Turkey experienced a severe crisis of financial disintermediation. Real money holdings declined in response to rising inflationary pressures and lack of adequate return--negative in real terms--on idle balances. This development was reversed since 1980, as the reorientation of financial policies and falling rates of inflation led to a marked rise in the demand for money. Whereas fluctuations in real income--which reached a trough in 1980--dominated the demand for narrow money, as reflected in the size and significance of the income elasticity estimate, the introduction of more realistic interest rates on quasi-money encouraged a substantial shift from currency and sight deposits (including commercial sight deposits), as well as nonfinancial assets and assets held abroad, into interest-bearing deposits.

On balance, therefore, the negative effect of deposit rates on the demand for narrow money seems to have been more than offset by the positive effect on quasi-money, implying a positive overall effect on the demand for broad money, even though the coefficient of the interest rate variable turned out to be insignificant in direct estimates of the demand for broad money. The results for broad money components indicate that on average the negative impact of the inflation rate was transmitted in less

1/ The coefficient of correlation between annual electricity output and GNP at constant prices is 0.99 over the 1973-82 period.

2/ Independent variables displaying coefficients that are statistically insignificant at the 10 percent level have been dropped from the second set of estimates. For the same reason, the lagged dependent variable was omitted altogether from the regressions for commercial sight deposits.

Table 1. Turkey: Estimates of the Demand for Money, 1/ First Quarter 1977-Fourth Quarter 1982

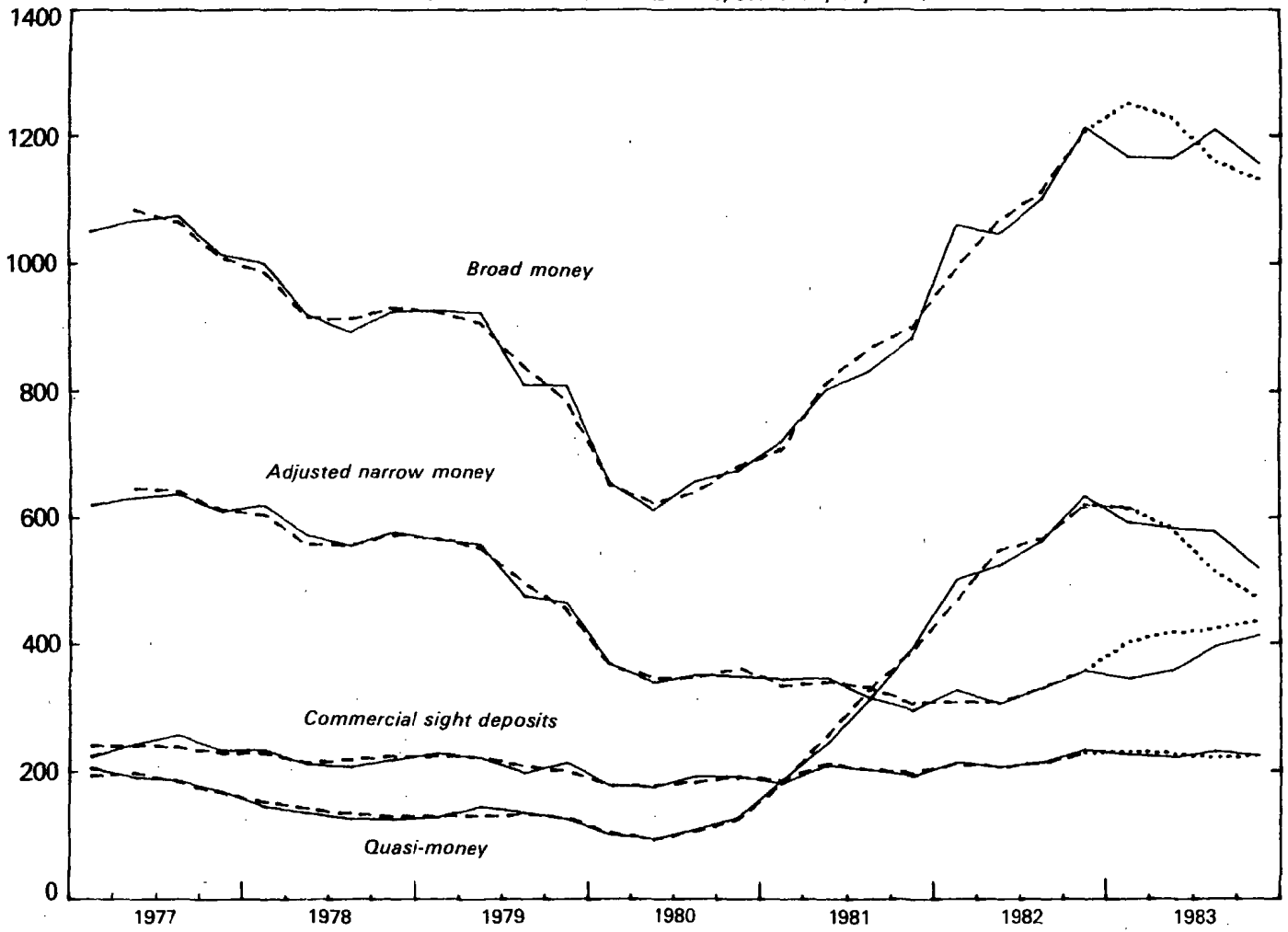
Equation	Dependent Variable	Regression Coefficients							Summary Statistics				
		$\lambda\alpha_0$	$\lambda\alpha_1$	$\lambda\alpha_2$	$\lambda\alpha_{21}$	$\lambda\alpha_{22}$	$\lambda\sum_0^n\beta_k$	$1-\lambda$	$\bar{k}$	ρ	H	DW	$\bar{R}^2$
1.	Broad money	-5.472	1.207	-0.090			-2.817	0.352	2.66		-0.24		0.975
		(1.98)	(3.19)	(0.72)			(5.43)	(2.45)	(3.27)				
2.		-3.895	0.990				-2.743	0.386	2.76		-0.11		0.975
		(2.36)	(4.44)				(5.47)	(2.89)	(3.34)				
3.	Adjusted narrow money	-8.518	1.253	-0.891			-1.381	0.711	1.08	-0.64	-1.48		0.985
		(4.37)	(5.04)	(4.95)			(7.30)	(9.31)	(2.38)	(3.86)			
4.		-8.071	1.224		-0.687	-0.915	-1.509	0.679	1.03	-0.62	-1.32		0.985
		(3.80)	(4.71)		(1.82)	(4.82)	(5.32)	(7.26)	(2.29)	(3.66)			
5.	Commercial sight deposits	-3.809	1.121	-0.608			-1.689		1.69			2.13	0.845
		(1.29)	(3.20)	(6.22)			(8.57)		(3.87)				
6.		-2.985	1.020			-0.499	-1.793		1.50			1.90	0.830
		(0.99)	(2.84)			(5.80)	(8.69)		(3.49)				
7.	Quasi-money	-0.422	0.137	1.294			-1.781	0.700	0.72		0.57		0.993
		(0.11)	(0.29)	(9.54)			(6.64)	(18.19)	(2.49)				
8.		1.554			1.266	1.307	-1.769	0.703	0.71		0.49		0.993
		(7.76)			(1.82)	(8.02)	(5.42)	(18.33)	(2.37)				

1/ The figures in parentheses are absolute values of t-statistics. The summary statistics include: $\bar{k}$, the mean lag of the distributed lag coefficients β; the first-order autoregressive term ρ; Durbin's H statistic; the Durbin-Watson statistic; and $\bar{R}^2$, the coefficient of determination adjusted for degrees of freedom.

TURKEY

MONETARY AGGREGATES[1], 1977-83

(In billions of 1980 Turkish liras, seasonally adjusted)



Source: Equations (4), (6), and (8), Table 1

[1] *Actual value* ——, *predicted value* — —, and *dynamic forecast* ····· . Broad money is calculated from sum of components.

than two quarters on narrow money holdings, while for broad money the mean lag is closer to three quarters. However, the adjustment of actual money balances to their equilibrium level is much slower for adjusted narrow money and quasi-money than for commercial sight deposits; for the latter, apparently the adjustment is realized within one quarter.

For more meaningful quantitative evidence on the determination of the demand for money it is necessary to turn to Table 2, which displays the elasticities of the demand for broad money with respect to each exogenous variable. It shows the percentage change in money holdings, within one quarter, one year, and over the long run, given a 1 percent rise in real income, in the rate of interest, or in the rate of inflation. 1/ Two separate sets of elasticities are presented: one is based on direct regression estimates for broad money, while the other set is derived from the sum of estimates for the components of broad money--weighted by their relative shares therein.

Both approaches result in similar long-run income and inflation elasticities, of about 1.4 to 1.6 and of -0.3, respectively. These values are comparable to long-run elasticities of demand for broad money obtained for other developing countries. 2/ However, in other respects, the two approaches reveal considerable differences. The one-year income elasticity based on direct estimates is almost as high as the long-run elasticity, as against the one-year elasticity of 1.1 based on the sum of estimates for components. This difference is in part attributable to the unusually rapid adjustment to the equilibrium stock of broad money reflected in the direct estimates (completed virtually in one year), as against the separate estimates for narrow money and quasi-money (with about three-fourths of the adjustment taking place within the year). Much more critical, however, is the contrast between the two sets of estimates as regards the response of broad money holdings to a marginal change in the time deposit rate. Whereas direct estimates of the effect of the interest rate are statistically insignificant, the sum of estimates for components provides interest elasticities ranging from about 0.1 for one quarter to nearly 0.4 over the long run following decontrol--considerably higher than those calculated for the preceding period. 3/ The principal explanation for the divergence of the elasticities calculated with direct estimates as opposed to estimates for components lies in the

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1/ Since for both the interest rate and the inflation rate the regression coefficients are semielasticities, the latter were multiplied by mean values of the rates of interest and inflation, in order to obtain the corresponding elasticity estimates.

2/ See, for example, Khan (1980).

3/ Notwithstanding the similarity of the interest rate coefficients in each equation before and after decontrol, shown in Table 1, the implied interest elasticities are very different because of the sharp increase in interest rates following decontrol. In contrast to the interest elasticities in Table 2, calculated for the period beginning in the third quarter of 1980, the sum of estimates for components through the second quarter of 1980 are: 0.031 for one quarter, 0.080 for one year, and 0.107 over the long run.

Table 2. Turkey: Elasticities of Demand for Broad Money 1/

Independent Variable	Short-Run Elasticity		Long-Run Elasticity
	One quarter	One year	
Direct estimates 2/			
Real income	0.990	1.577	1.612
Interest rate	--	--	--
Inflation rate	-0.035	-0.162	-0.295
Sum of estimates for components 3/			
Real income	0.571	1.104	1.348
Interest rate	0.087	0.278	0.388
Inflation rate	-0.043	-0.214	-0.313

1/ The one-quarter elasticity with respect to the ith independent variable is $\lambda\alpha_i$; the one-year elasticity is $\lambda\alpha_i\sum_0^3(1 - \lambda)^t$; and the long-run elasticity is α_i. The interest elasticity is based on parameter estimates for the period 1980 III through 1982 IV. Elasticities with respect to the interest rate and inflation rate are calculated at their mean values during that period.

2/ Based on parameter estimates from equation (2) in Table 1.

3/ Based on the sum of parameter estimates from equations (4), (6), and (8) in Table 1, weighted by the 1982 relative share of each component of broad money.

probable aggregation bias present in direct estimates. In all, the elasticities based on the sum of estimates for broad money components, weighted by their relative shares, are far more credible.

VI. Forecasts for 1983

Projections of money demand are necessary to provide the basis for setting quantitative ceilings on net domestic central bank credit--the principal instrument of monetary control in Turkey. Hence, it is appropriate to investigate the forecasting properties of the model and to ascertain its usefulness for policy purposes. To this end, quarterly dynamic forecasts were computed for 1983 by applying parameter estimates to data on exogenous variables and forecast values of lagged endogenous variables. Forecasts and actual values of broad money and of each major component, along with goodness-of-forecast statistics, are shown in Table 3 and Chart 2. 1/

Forecasts of broad money based on direct estimates are fairly close to actual values, except for the first two quarters of 1983 when they exceed the actual levels by more than twice the standard error of the regression estimate. Accordingly, the forecast F-statistic is significant at the 1 percent level, whereby the hypothesis that broad money was determined by a different structure in 1983 than postulated by the model cannot be rejected entirely. Forecasts based on estimates for broad money components are superior (with the exception of the third quarter), as reflected in a lower root-mean-square error. 2/ Forecast errors for the broad aggregate seem to mask, however, larger forecast errors for individual components, by averaging such errors with opposite signs. Indeed, in the third and fourth quarters positive deviations of adjusted narrow money forecasts partly offset much larger negative deviations of quasi-money forecasts from observed levels.

In general, the model performs fairly well for individual components of broad money beyond the estimation period: forecasts fluctuate broadly in the same direction as actual values. In 1983, real quasi-money balances fell in response to declining interest rates, while real adjusted narrow money increased owing to the positive influence of both increased activity and interest rate cuts. Yet upon closer examination, the forecasting power of the model is mixed. Unlike for the other components, the F-value for adjusted narrow money is statistically significant; the forecasts overshoot the actual values throughout the year albeit

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1/ Forecast errors shown for 1983 are not altogether comparable to the estimation errors over the period 1977-82 insofar as the latter involves a static simulation based on the actual values of the lagged endogenous variable, whereas the simulated values of this variable are employed to generate forecasts.

2/ Nevertheless, both sets of estimates yield better forecasts than the naive approach based on an assumed constant income velocity of money. Extrapolation of the 1982 average velocity results in an RMS error of 0.070 for 1983.

Table 3. Turkey: Forecasts of Money Demand, 1/ 1983

(In billions of 1980 Turkish lira, seasonally adjusted)

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Forecast Statistics RMS	Forecast Statistics F
Broad money						
Forecast (direct)	1,262	1,239	1,185	1,187	0.053	3.24*
Actual	1,165	1,164	1,208	1,157		(4, 18)
Deviation	97#	75#	-23	30		
Broad money						
Forecast (sum of components)	1,251	1,227	1,159	1,131	0.049	
Actual	1,165	1,164	1,208	1,157		
Deviation	86	63	-49	-26		
Adjusted narrow money						
Forecast	403	417	423	436	0.116	13.48**
Actual	346	358	397	413		(4, 15)
Deviation	57#	59#	26	23		
Commercial sight deposits						
Forecast	233	228	222	225	0.029	0.53
Actual	228	223	233	224		(4, 18)
Deviation	5	5	-11	1		
Quasi-money						
Forecast	615	582	514	470	0.076	2.61
Actual	592	583	578	520		(4, 17)
Deviation	23	-1	-64#	-50#		

1/ Forecasts based on equations (2), (4), (6), and (8) in Table 1. The symbol # indicates that the deviation of forecast from actual value (forecast error) is more than twice as large as the corresponding standard error of the estimate. RMS is the root-mean-square forecast error, and the F-statistic is given by the ratio of the sum of squared errors of forecast to the sum of squared errors of estimate, adjusted for degrees of freedom. The single asterisk (*) denotes statistical significance at 1 percent level, and the double asterisk (**) denotes significance at 5 percent level.

converging from deviations in excess of four times of the standard error of the estimate in the first and second quarters, to about one standard error by the end of 1983. It is hard to ascribe these positive deviations to behavioral or institutional changes not accounted for by the model. On the contrary, one such change, namely, the relatively large increase in the interest rate on personal sight deposits at the beginning of the year could have led to a jump in active balances--above the levels forecast by the model. Instead of such an unforeseen increase, there was merely a shift from currency to sight deposits within narrow money holdings. 1/ Hence, the forecast errors for adjusted narrow money may stem from possibly biased parameter estimates. Also, forecasts of narrow money are contingent (more than forecasts of other components) on preliminary 1983 estimates of real income. 2/ No comparable problems are apparent in the forecasts of commercial sight deposits which are virtually identical to the observed values.

For quasi-money, the forecasts are satisfactory even though they fall short of actual levels during the second half of 1983. This outcome, indicative of a buildup of excess liquidity, is consistent with the rebound in inflation, which by the fourth quarter had reached a 39 percent year-on-year rate. In fact, assuming that the positive forecast errors for adjusted narrow money are due to measurement difficulties, it can be argued that the shortfall in the quasi-money forecasts of LT 50 billion in 1980 prices (LT 130 billion in current prices), equivalent to about 4 percent of total money supply, represents the liquidity overhang toward the end of the year. 3/ According to a less plausible view, the forecast errors for all components of broad money should be added up--implicitly attributing the narrow money forecast errors to some unidentified structural shift--so that estimated excess liquidity would have stood at LT 26 billion (less than LT 70 billion in current prices) in the fourth quarter of 1983. In either case, the magnitude of the overhang tends to be overstated to the extent that a fraction of it may have been absorbed through the rise in the price level and net external outflows. As against separate forecasts of broad money components, broad money forecasts based on direct parameter estimates fail to reflect the accumulation of excess liquidity--except for a small amount in the third quarter. This limitation, resulting largely from the absence of the interest rate as an explanatory variable, is, of course, not captured adequately by the reported forecast statistics.

1/ The ratio of currency in circulation to savings sight deposits fell by 37 percent between November 1982 and February 1983.

2/ The forecast of adjusted narrow money improves considerably if no provision is made for serial correlation of residuals. Without such correction, the RMS drops to 0.099 and the F-value declines by about one half to 6.86 (while $\bar{R}^2$ remains 0.98).

3/ Besides the less reliable nature of the adjusted narrow money forecasts, it is worth noting that excess money balances are normally held in the form of interest-bearing deposits, rather than currency or sight deposits which are held primarily for transactions purposes as they yield much lower or zero interest.

VII. Conclusion

This paper provides an insight into the evolution of the demand for money in a developing country which embarks on a stabilization program that includes interest rate liberalization. Allowing explicitly for this policy-induced structural shift, the above estimates of a simple money demand model support the view that interest rates, along with inflationary expectations, play an important role in determining the size and composition of the demand for money even in the absence of well-developed financial markets.

More specifically, disaggregated estimates for the major components of broad money on 1977-82 quarterly data for Turkey indicate that the positive effect of the increase in time deposit rates on quasi-money holdings outweigh the negative impact on narrow money balances, resulting in a sizable positive interest elasticity of demand for broad money. Further, estimates of the model with the interest rate partitioned in mid-1980, when time deposit rates were decontrolled, reveal a shift in the interest elasticity of money demand as a result of deregulation. The magnitudes of the income and inflation elasticities, as well as of the adjustment parameter, obtained from separate estimates for broad money components are comparable to those found in other developing countries. As opposed to the disaggregated estimates, direct estimation of the demand for broad money covers up completely the role of the interest rate, and exaggerates the speed of adjustment of actual to desired money balances, and thus the size of the short-run income elasticity.

The model's forecasting power was tested rather successfully for 1983, that is, outside the estimation period. Whereas forecasts of quasi-money and commercial sight deposits track very closely the effect of interest rate cuts undertaken that year, the forecasts of adjusted narrow money demand exceed significantly the corresponding actual levels in the first two quarters. In addition to yielding satisfactory forecasts of quasi-money demand, the model confirms an accumulation of excess quasi-money holdings from mid-1983 onwards. On balance, forecasts of broad money based on direct estimates are inferior to those obtained from estimates of the demand for each component thereof and fail to reflect the buildup of excess liquidity.

Appendix

The variables used for estimation and forecasting purposes are:

m = M2/WPI, M1A/WPI, CSD/WPI, or QM/WPI

y = Benchmark (GNP, ELCY)

r = INT(1 - TAX)

$r_1 = D_1INT$

$r_2 = D_2INT$

p = WPI

The underlying data are defined as follows:

M2 = M1A + CSD + QM: broad money, in billions of Turkish liras

M1A: adjusted narrow money, comprised of currency in circulation plus savings sight deposits, in billions of Turkish liras

CSD: commercial sight deposits, in billions of Turkish liras

QM: quasi-money, comprised of time deposits plus certificates of deposits, in billions of Turkish liras

WPI: general wholesale price index (1980 = 100) calculated by the Ministry of Commerce, base 1963

GNP: annual gross national product at market prices, in billions of 1980 Turkish liras

ELCY: electricity output per quarter, in millions of kilowatt-hours

INT: rate of interest on 6- to 12-month deposits, in percent per annum

TAX: rate of withholding tax on interest income from time deposits, in percent

D_1: dummy variable, 1 through second quarter of 1980 and 0 thereafter

D_2: dummy variable, 0 through second quarter of 1980 and 0 thereafter

Quarterly variables m, y, and p are seasonally adjusted. Also, observations on m, p, and r are centered in the middle of the quarter. This refinement is necessary in particular to eliminate the impact of

large year-end "window dressing" accummulation of deposits by commercial banks, on the measurement of monetary aggregates. The data sources are: Central Bank of Turkey, for monetary aggregates and interest rates; and Republic of Turkey, State Planning Organization, for output and price data.

References

han, M.S., "Monetary Shocks and the Dynamics of Inflation," IMF Staff Papers (June 1980), pp. 250-284.

opits, G., "Turkey Seeks to Build on Economic Gains Achieved Under 1980 Stabilization Program," IMF Survey (August 22, 1983), pp. 245-247.

opits G., and P. Gotur, "The Influence of Social Security on Household Savings: A Cross-Country Investigation," IMF Staff Papers (March 1980), pp. 161-190.

aidler, D.E., The Demand for Money: Theories and Evidence (New York: Harper and Row, 1977).

anyi, A., and R. Saracoglu, Interest Rate Policies in Developing Countries, IMF Occasional Paper 22 (Washington, October 1983).

athieson, D.J., "Inflation, Interest Rates, and the Balance of Payments During Financial Reform: The Case of Argentina," World Development (September 1982), pp. 813-821.

cKinnon, R.I., Money and Capital in Development (Washington: Brookings Institution, 1973).

rganization for Economic Cooperation and Development, OECD Economic Surveys 1982-83: Turkey (Paris, April 1983).

epublic of Turkey, Central Bank, Quarterly Bulletin (Ankara, various issues).

epublic of Turkey, State Planning Organization, Turkey: Main Economic Indicators (Ankara, various issues).

epublic of Turkey, State Planning Organization, Production Report (various monthly issues).