IMF WORKING PAPER

WP/92/6

INTERNATIONAL MONETARY FUND

Research Department

"Household Demand for Money in Poland: Theory and Evidence"

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January 1992

Abstract

This paper examines the household demand for narrow money in Poland during the 1980s. At that time, there were shortages, but informal trade in both goods and foreign exchange was common, and holdings of foreign currency were substantial. Household money demand in this environment is first examined at the theoretical level: a representative household's holding of domestic and foreign money is analyzed in a cash-in-advance model in which domestic currency is needed to purchase goods in the official shops while either domestic or foreign currency can be used in the black market. This model gives rise to a formulation of money demand which is then estimated using household-level data from 1979 to 1988.

JEL Classification Number:
E41, P34

1/ The author wishes to thank Pierre-Richard Agenor, Jim Boughton, Simon Commander, Fabrizio Coricelli, Jo Anna Gray, Peter Isard, Marek Oles, Kent Osband, Rolando Ossowski, Jacek Rostowski, Mariusz Sumlinski, and participants in seminars at the University of Florida and the World Bank for helpful comments and suggestions. He also thanks Marek Oles for kindly sharing his data. The views expressed are those of the author and do not necessarily represent those of the Fund.

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Summary

This paper examines the household demand for money in Poland during the 1980s. At that time, although Polish households were faced with shortages in the official shops, their holdings of foreign currency were substantial, and informal trade was widespread in goods and foreign exchange.

The paper first presents a theoretical model of a representative household's holdings of domestic and foreign money in a socialist economy, using a variant of the cash-in-advance framework. The household needs domestic currency to buy goods in the official shops--where supplies are limited and uncertain--but can use either domestic or foreign money in the black market--where prices are expected to be higher. Changes in the black market exchange rate affect both the return on foreign money relative to domestic money and households' wealth; expectations of, and uncertainty about, exchange rate movements, as well as inflation, therefore influence households' portfolio choice between the two moneys.

The paper presents estimates for household data from December 1979 to October 1988, using the two-stage error-correction framework. It estimates first a static money demand equation and then a dynamic equation for the change in money balances. As implied by the theoretical model, expectations of inflation and the appreciation of the black market exchange rate, as well as their expected variances and covariance, are included as explanatory variables. Under the assumption of rational expectations, the realized values of these variables are included, and an instrumental variables procedure is used to deal with the resulting errors-in-variables and endogeneity problems. The results show that an error-correction equation can be specified in which changes in household income, the price level, and the black market exchange rate play significant roles; they do not show any significant effects of the expected changes in inflation or in the rate of exchange rate appreciation (possibly because these are difficult to predict from their past values). Changes in the variance of the rate of exchange rate appreciation and in its covariance with inflation do, however, have a significant effect on money demand.

The stability of the estimated money demand equation is narrowly rejected at two points: when martial law was imposed in December 1981 and when reforms--including large price increases--were intensified during the Second Stage of Reform in late 1987. This finding is consistent with the theoretical model, though, since such regime changes may be associated with changes in the relationship between official and black market prices and with other changes in the type of shock impinging on households.

These results are evidence against the traditional view of money in socialist economies, according to which money holdings are largely passive. They suggest, rather, that it is fruitful to use a choice-theoretic framework in analyzing the demand for money in a socialist economy.

I. Introduction

Money is often accorded quite an unimportant place in a socialist economy. According to the traditional view, monetary circulation is segmented into household and enterprise circuits (Birman and Clarke, 1985, Hartwig, 1985, Székely, 1990, Abel and Székely, 1988). In each circuit, flows of money play only a passive, record-keeping role, adapting themselves to the real allocations prescribed by the central plan; enterprise revenues and expenditures are constrained by planned input allocations and output targets, while household expenditures are constrained by the availability of consumer goods. Money flows between the two sectors are associated with wage payments and consumers' payments for goods and services, but these are also specified in the plan. This traditional view implies that in a socialist economy, demand for money, whether by the household or the enterprise sector, has little empirical relevance: money holdings are not themselves an object of choice, but a by-product of the planning process. As a result, it is not surprising that there have been relatively few studies of money demand in socialist economies (Hartwig, 1987).

A corrolary of this traditional view is that household money holdings are in some part involuntary. This is associated with the notion of a liquidity overhang: if households' incomes exceed the amount they are able to spend on goods, there is forced saving, which, in the absence of an extensive array of alternative financial assets, takes the form of an unwanted accumulation of money (Birman, 1980, Cottarelli and Blejer, 1991). If such an accumulation takes place, it would mean that if prices were freed, there would need to be a substantial increase in the general price level to bring about market equilibrium--implying that before price liberalization takes place there is "repressed inflation" (Nuti, 1986, 1990; Pindák, 1983).

This traditional view has been qualified or challenged by a number of observers, especially as it pertains to money holding of the household sector. The main criticism is that in practice, households in socialist economies have many more alternatives than the overhang view would imply (Oles et al, 1987). In particular, even if goods are in short supply in the official shops, there are often large unofficial markets: these include free agricultural markets in several countries, as well as black markets, flea markets, and other manifestations of the "shadow economy", where a variety of commodities can be purchased (Cassel et al. (ed.), 1989). Moreover, shortages may lead not only to forced savings, but also to "forced spending" on other goods (Kornai, 1980, Chapter 18; Podkaminer, 1988, 1989); goods may also play a role as a store of value (Weitzman, 1991).

A further point is that the range of financial assets is broader than the traditional view assumes, since in many socialist countries there are large household holdings of foreign currency. In some countries, these holdings consist largely of "mattress money" and deposits in banks abroad, while in some countries--notably Poland and Yugoslavia--there have also been

large legal holdings of foreign currency deposits; in Poland in 1988, these foreign currency deposits, when evaluated at the black market exchange rate, accounted for about 40 percent of household money and quasi-money, while unofficial holdings were of course unknown, but believed to be quite large. Not only have households held foreign currency, but they have been able to buy and sell it relatively easily: in Poland, in particular, the black market in foreign exchange was very active, even before it was legalized in March 1989.

These considerations suggest the usefulness of examining the household demand for money in a socialist economy, taking account of the different constraints to which households in this environment are subject. In particular, it is important to take into account the shortages of goods in the official shops, the availability of goods in the black market, and the possibility of holding foreign currency as an alternative to domestic money. Households should be viewed as choosing optimal money holdings subject to these constraints--in contrast to the traditional view, according to which households are largely passive in adapting their spending to the availability of goods.

This paper proceeds to develop this approach to money demand in a socialist economy, first on the theoretical and then on the empirical level with reference to Poland in the 1980s. The theoretical model is a variant of the cash-in-advance model associated with Clower (1965) and Lucas (1980, 1984). 1/ This approach synthesizes the various motives for holding domestic and foreign money in this environment (Hartwig, 1987). Under the transactions motive, it is assumed that domestic money is needed for purchases in the official shops, while either domestic or foreign money can be used in the black market. The model also incorporates the precautionary motive, or what Kornai (1980, pp. 457-58) characterized as "purchaser alertness": under conditions of shortages, consumers can never tell when, and in what quantitites, desired goods may be available in the shops, and must have money ready to pay for them. Domestic and foreign money are also stores of value, and holdings of the two moneys will be shown to depend on their rates of return in relation to goods, as well as on the variances and covariances of these returns. 2/

1/ The cash-in-advance approach has been used in many papers, few of which, however, pertain to socialist economies. Some exceptions are Mihaljek (1989), who uses cash-in-advance as a framework for money demand in Yugoslavia, and Boycko (1991), who uses a similar approach to formalize the notion of a liquidity overhang.

2/ Another motive for holding money that, for simplicity, will not be addressed here is target savings: in centrally planned economies, there is little consumer credit, so households have to accumulate the purchase price of consumer durables before purchase. For durable goods that are in short supply, such as automobiles, households are often also required to deposit funds into special accounts in order to be given a place on the waiting list. See e.g. Kalicki in Cassel et al. (Ed.), 1989, pp. 195-212.

This theoretical framework is then used as the basis of empirical work using Polish data on household incomes and money holdings. The empirical method used is the two-stage error-correction model proposed by Hendry (1985, 1986). 1/ In previous literature, various indicators have been used to represent the influence of shortages on demand for money, but some of these seem rather circular: for instance Hartwig (1987) used k, the recirpocal of velocity, and Payne (1990) used real consumer credit, as explanatory variables in money demand equations; Feltenstein et al. (1990) constructed "virtual prices" as a combination of official prices and real money, and used these to explain savings--which in China consist mainly of changes in real money. 2/ In this paper, we take a different approach: we assume that the black market exchange rate adjusts to establish equilibrium in the money market, given the controlled official prices; official prices are hypothesized to adjust toward money market equilibrium--a hypothesis which is scrutinized by testing for cointegration of money, real income and official prices. This approach implies that the black market exchange rate must be treated as an endogenous variable (as in Charemza and Ghatak, 1990); for this reason, and because expectational variables are hypothesized to affect money demand, an instrumental variables approach is used in estimation.

The paper proceeds as follows. Section II presents the theoretical model, and derives its implications for money demand. Section III discusses the data, and the underlying economic conditions in Poland over the period of study, December 1979 to October 1988. Section IV presents the empirical results. Section V concludes the paper.

II. The Model

The model is a variant of the cash-in-advance model. A representative household maximizes expected utility, which is a function of consumption, over an infinite horizon. The household holds two kinds of money, domestic (zloty) and foreign (dollar). Purchases of goods must be backed with money; zloty money must be used in the official shops, while either zlotys or dollars can be used in the parallel (black or free) market. For simplicity, it is assumed that there is only one consumption good; the price is lower in the official shops, but the quantity available there is limited and uncertain, while in the parallel market, a consumer can buy as much as desired, but at a higher price. Therefore, zloties are held in preparation for purchasing goods at a favorable price in the official shops. Whether all these zlotys are used up in the official shops, or some are spent in the black market, or some are held over until the next period, depends on what

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1/ The error correction approach has been applied to other socialist economies: in particular, to Yugoslavia by Lahiri (1991), and to China by Burton and Ha (1990).

2/ Similarly, Tyson (1979) used the percentage growth of base money as an indicator of credit conditions in examining entrprise demand for money.

quantity of goods turns out to be available in the official stores, and at what price, as well as on the realization of the black market price.

The timing of transactions in the model is as follows. In the morning, the consumer purchases goods in two markets, constrained by money held over from the previous day. In the afternoon, income is received, and the (parallel) foreign exchange market opens, enabling one currency to be exchanged for another. There are no other financial assets. The price and available quantity in the official shops, as well as the black market price and exchange rate, are treated as random variables, whose realization is not known until the beginning of the day.

The household maximizes expected utility, which is a function of consumption c_t over an infinite horizon:

$$(1) \quad \max EU = E_0 \sum_{t=0}^{\infty} \beta^t u(c_t)$$

where E_t denotes the expectations operator conditional on information available at time t. Consumption consists of amounts purchased in official and black markets: 1/

$$(2) \quad c_t = x_t^o + x_t^b$$

The household's budget constraint, expressed in zloties, for each period requires that purchases of goods during the period plus end-of-period money holdings are financed by money carried over from the previous period and by income:

$$(3) \quad p_t^o x_t^o + p_t^b x_t^b + m_t^d + e_t m_t^f = m_{t-1}^d + e_t m_{t-1}^f + y_t$$

where p_t^o and p_t^b are prices of the good in the two markets, expressed in zlotys, m_t^d and m_t^f are holdings of domestic and foreign money e_t is the exchange rate (the price of dollars in terms of zlotys), and y_t nominal income (expressed in zloties).

In addition to the budget constraint, the household's purchases are subject to two cash-in-advance constraints, one for each market: purchases

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1/ This ignores hoarding of commodity inventories, which are typically quite important in planned economies.

in the official market are limited by holdings of zlotys carried over from the previous period,

$$(4) \quad p_t^o \, x_t^o \leq m_{t-1}^d$$

while total purchases on the two markets are constrained by holdings of the two moneys,

$$(5) \quad p_t^o \, x_t^o + p_t^b \, x_t^b \leq m_{t-1}^d + e_t \, m_{t-1}^f$$

The amount that the household can buy in the official market may be limited by the availability of supply:

$$(6) \quad x_t^o \leq \bar{x}_t^s$$

where the quantity available is $\bar{x}_t$. If $p_t^o < p_t^b$, and if anything is bought in the black market, either the constraint on the household's purchases in the controlled market implied by the availability of supply (6) or the cash-in-advance constraint (4) is binding.

There are also nonnegativity conditions on holdings of the two monies, and on purchases of the goods in the two markets:

$$(7) \quad m_t^d, \, m_t^f \geq 0$$

$$(8) \quad x_t^o, \, x_t^b \geq 0$$

The household therefore maximizes the expected discounted value of utility (1) with respect to x_t^o, x_t^b, m_t^d, and m_t^f in each period, subject to constraints (3), (4), (5), (6), (7), and (8). The solution can be characterized using standard recursive methods: defining a value function $J(m_t^d, m_t^f)$ as the expected maximized present value of utility from period t+1 onward, as a function of money carried over from period t, the Lagrangean for each period t can be written as follows:

$$(9) \quad \mathcal{L}_t = u(x_t^o + x_t^b) + \beta J(m_t^d, m_t^f)$$

$$- \lambda_{1,t}[p_t^o \, x_t^o + p_t^b \, x_t^b + m_t^d + e_t m_t^f - m_{t-1}^d - e_t m_{t-1}^f - y_t]$$

$$- \lambda_{2,t}[p^o_t x^o_t - m^d_{t-1}] - \lambda_{3,t}[p^o_t x^o_t + p^b_t x^b_t - m^d_{t-1} + e_t m^f_{t-1}]$$

$$- \lambda_{4,t}[x^o_t - \bar{x}_t] - \lambda_{5,t} m^d_t - \lambda_{6,t} m^f_t - \lambda_{7,t} x^o_t - \lambda_{8,t} x^b_t$$

Using this device, we obtain the following first-order conditions for purchases in the two markets:

$$(10a)\quad u'_t = p^b_t (\lambda_{1t} + \lambda_{3t}) - \lambda_{8,t}$$

$$(10b)\quad u'_t = p^o_t (\lambda_{1t} + \lambda_{2t} + \lambda_{3t}) + \lambda_{4t} - \lambda_{7,t}$$

where $u'_t \equiv \partial u/\partial c_t$. The usual Kuhn-Tucker conditions apply to the inequality constraints (7) and (8). Assuming for simplicity that something is bought in each of the two markets in each period (so that $\lambda_{7,t} = \lambda_{8,t} = 0$), conditions (10a) and (10b) can be solved to yield

$$(11)\quad u'_t[\theta_t/(1+\theta_t)] = p^c_t(\lambda_{2,t} + \lambda_{4,t})$$

where θ_t is the price premium on the free market relative to the official market, that is, $\theta_t \equiv p^b/p^o - 1$. Equation (11) has the interpretation that the wedge between the prices in the official and the black market is associated either with supply shortages in the official market as reflected in $\lambda_{4,t}$, or in a lack of money to pay for goods there, as reflected in $\lambda_{2,t}$. Another way of putting this is that, given the low prices but limited quantities in the official shops, the consumer either buys all that is available at the low prices, or runs out of zloty money in the attempt.

Next, consider the conditions for optimal holdings of domestic and foreign money:

$$(12a)\quad \beta J_{d,t} = \lambda_{1,t} - \lambda_{5,t}$$

$$(12b)\quad \beta J_{f,t} = e_t \lambda_{1,t} - \lambda_{6,t}$$

where $J_{i,t} = \partial J(m_t^d, m_t^f)/\partial m^{i,t}$, i=d,f. Using the definition of the value function,

$$(13a) \qquad J_{d,t} = E_t[\lambda_{1,t+1} + \lambda_{2,t+1} + \lambda_{3,t+1}]$$

$$(13b) \qquad J_{f,t} = E_t[e_{t+1}(\lambda_{1,t+1} + \lambda_{3,t+1})]$$

That is, zloty money is expected to contribute to future utility by providing more wealth and thus easing the budget constraint (reflected in $\lambda_{1,t}$) as well as to the extent that it may ease the two cash-in-advance constraints (reflected in $\lambda_{2,t}$ and $\lambda_{3,t}$). Holding dollar money is expected to ease the budget constraint and the free-market cash-in-advance constraint.

For simplicity, let us focus on solutions in which foreign currency is used as a long-term store of value and thus the household does not exhaust its dollar money this period. In this case, neither the overall cash-in-advance constraint (5) nor the nonnegativity constraint on dollar balances is binding in period t, so $\lambda_{3,t} = \lambda_{6,t} = 0$. Using conditions (12) and (13) and substituting from (10), overall savings are determined by condition

$$(14) \quad u_t' = \beta E_t[u_{t+1}' \ (1+a_t)/(1+\pi_t^b)]$$

where a_t = e the rate of appreciation of the dollar against the zloty from period t to t+1 and π_t^b s the percentage increase in prices on the free market from t to t+1. Next, the condition for optimal holdings of zlotys can be written as

$$(15) \quad \beta E_t \left[\frac{a_t - \theta_{t+1}}{1+\pi_t^b} u_{t+1}' \right] = p_t^b[\lambda_{5,t} + \beta E_t \lambda_{4,t+1}]$$

The left-hand side of equation (15) can be interpreted as the expected utility-weighted excess return to holding dollar rather than zloty money. When this expression is positive, the right-hand side is positive, implying that $\lambda_{5,t+1} > 0$ and that $E_t\lambda_{4,t+1}$ is small, i.e., no zlotys are held and as a result the quantity constraints in the controlled market are not binding unless the quantity available $\bar{x}_t$ is zero. When the expected utility-weighted excess return to foreign currency is negative, the right-hand side is also negative, implying $\lambda_{5,t} = 0$ and $E_t\lambda_{6,t+1} > 0$, i.e., some zlotys are held so there are some eventualities that would lead the consumer to have zlotys ready to spend in the controlled market but be unable to buy the desired quantity. If the left-hand side of equation (14) is just zero, this

implies that $m_t^z = \inf\{p_{t+1} \circ x_{t+1}\}$, i.e., just enough zlotys are held that there is no possibility that shortages are a binding constraint on purchases so that no zlotys are ever left over after purchasing the allowed amount on the controlled market. A lower expected utility-weighted excess return leads the household to hold larger zloty balances, incurring a higher probability of hitting the quantity constraint before the zlotys-in-advance constraint is reached, as well as implying that the former constraint binds more tightly; this is reflected in a higher $E\lambda_{4,t+1}$.

In order further to examine the implications for the demand for zloty money, let us take a second-order Taylor approximation of (15):

$$(16)\quad p^b[\lambda_{5,t} + \beta E_t \lambda_{4,t+1}] \simeq \frac{Ea_t - E\theta_{t+1}}{1+E\pi_t^b} u'(Ec_{t+1})$$

$$+ 1/2 \frac{Ea_t - E\theta_{t+1}}{1+E\pi_t^b} \left\{ u'''(Ec_{t+1}) \mathrm{Var}\, c_{t+1} + \frac{u'(Ec_{t+1})}{(1+E\pi_t^b)^2} \mathrm{Var}\, \pi_t^b \right\}$$

$$+ \frac{1}{1+E\pi_t^b} u''(Ec_{t+1}) \mathrm{Cov}(c_{t+1}, a_t - \theta_{t+1})$$

$$- \frac{Ea_t - E\theta_{t+1}}{(1+E\pi_t^b)^2} u''(Ec_{t+1}) \mathrm{Cov}(c_{t+1}, \pi_t^b)$$

$$- \frac{1}{(1+E\pi_t^b)^2} u'(Ec_{t+1}) \mathrm{Cov}(a_t - \theta_{t+1}, \pi_t^b)$$

Equation (16) can be used to provide portfolio-theoretic rationale for the behavior of the demand for domestic-currency money. First, the demand for zloty money depends negatively on the expected excess return of dollars over zlotys as a transactions medium, which is the expected rate of appreciation of the dollar vis-à-vis the zloty, net of the expected premium of prices in the free market over prices in the controlled market. This difference is divided by the expected (black-market) inflation factor $(1+E\pi_t^b)$, which, for a given dollar appreciation and given intermarket price premium deflates the returns to both dollars and zlotys. Money demand also depends on the variances and covariances of consumption and inflation and the return differential $Ea_t - E\theta_{t+1}$, where the signs of the relationships depend on the return differential.

Let us first consider the case in which $E\theta_{t+1} > Ea_t$, so the benefit of buying at controlled prices rather than in the free market is expected to exceed the appreciation of the dollar in terms of the zloty. In this case, a higher variance of inflation is associated with a larger demand for zloty money. The implication of the variance of consumption is ambiguous, and depends on the third derivative of the utility function, u'''. 1/ The expected utility excess return on foreign currency is positively related to the covariance between consumption and the return differential; the intuition is that if, for example, appreciations of the dollar tended to be associated with states of the world in which consumption is low, and conversely for depreciations, this would increase the attractiveness of dollars as a store of value. The attractiveness of foreign money is also negatively associated with the covariance between inflation and consumption, since if for instance higher inflation were more likely to occur in states with lower consumption, the erosion of the return differential due to inflation would matter more. Finally, the attractiveness of dollars is positively related to the covariance between consumption and the return differential: if a high return on dollars is associated with periods of low consumption, this would increase the attractiveness of holding dollars.

Next, let us consider the case in which dollars are expected to be a more attractive temporary abode of purchasing power, i.e., where $Ea_t > E\theta_{t+1}$. In this case, under what circumstances will any zlotys be held? In (16), if $Ea_t > E\theta_{t+1}$, the first three terms are positive; it is thus the three covariance terms that can make EUER < 0. 2/ Thus, for any zlotys to be held, the covariance of consumption and the expected return differential on dollars must be sufficiently positive, the covariance of consumption and inflation sufficiently negative, and/or the covariance of inflation and the return differential sufficiently positive to make the RHS of (16) negative. For instance, in an economy in which supply shocks are prevalent, and where adverse supply shocks result in low consumption, high inflation and rapid depreciation of the zloty, the second and third conditions would be met; if demand shocks result in an association between high consumption, high inflation and depreciation of th zloty, this could satisfy to the first and third conditions. thus, some combination of supply and demand shocks might lead expected utility maximizing households to hold some zlotys even if their expected return-- allowing for the fact that zlotys can be exchanged for goods at controlled prices in the official stores--is lower than that on dollars.

1/ For example, in the case of an isoelastic utility function $u = c^{\gamma}/\gamma$, where $0 \leq \gamma \leq 1$, $u''' = (\gamma-2)(\gamma-1)c^{\gamma-3} > 0$, so the demand for zloty money depends positively on the variance of consumption.

2/ This assumes that $u''' > 0$ as in the iso-elastic case.

After some manipulation of equation (16), using equation (3), the demand for domestic money can be derived, and expressed as follows: 1/

$$m_t^d = m(y_t, p_t, e_t, Ea_t, E\pi_t, \text{Var } \pi_t, \text{Var } a_t, \text{Cov}(\pi_t, a_t),$$

$$+ \quad + \quad + \quad - \quad - \quad ? \quad + \quad ?$$

$$E\theta_{t+1}, \text{Var } \theta, \text{Cov}(\theta, \pi)) \qquad (17)$$

$$+ \quad - \quad ?$$

This demand for money, derived from a stylized optimizing framework, combines the considerations underlying the transactions and precautionary demand for money--the fact that domestic currency is needed for purchases in the official shops, but that the quantity of goods available for purchase on any given day are uncertain--with the portfolio approach, as reflected in the role of the variances and covariances of relative returns on the two moneys and on goods.

In the remainder of the paper, the demand for money will be analyzed empirically. In order to lay the groundwork for this analysis, it is als necessary to discuss another issue: whether and how the money market clears. The traditional view, discussed in the introduction, would imply that, although desired money balances may be determined as in this model, actual money balances may differ from desired levels since there are shortages and not enough variables can adjust to equate actual and desired balances. The present model, to the contrary, suggests several variables that can adjust to clear the money market. First, individual households can adjust their money balances by varying their expenditures on goods in the official shops, to the extent that such goods are available--i.e. if constraint (6) is not binding; such expenditures would affect the total stock of money, in nominal terms, held by the household sector. The authorities may, to some extent, adjust the official prices of goods, but these adjustments may be expected to take place gradually. Individual households can also vary their expenditures on goods in the black market; however, in this model, black market prices adjust to clear that market, so that, in the aggregate, adjustment takes place primarily through prices rather than gradually through quantities. Households may also attempt to adjust between holdings of domestic currency and foreign exchange; although in the short run the unofficially-held stock of foreign exchange may be relatively inflexible from the standpoint of the economy as a whole, the black market exchange rate, e_t, adjusts to clear the market, thus affecting the demand for money via the intertemporal budget constraint (3). The framework also implies some persistence in desired real balances, as past

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1/ The details of this derivation are presented in an earlier version of this paper, which is available from the author on request. A similar derivation is presented in Lane, 1990.

money balances also enter the intertemporal budget constraint; however, this will not delay the adjustment of aggregate money balances to the extent that other variables can adjust relatively quickly (Lane, 1990). In summary, the framework presented here suggests that equilibrium in household money holdings may be achieved despite shortages: in the short run, through adjustment of household expenditures as well as black market prices and exchange rates; and in the long run, through adjustment of official prices and of the quantities of goods in the black market and the stock of unofficially-held foreign exchange. These considerations suggest that, if the present model is relevant, one would not necessarily expect to see particularly slow adjustment of money balances in a socialist economy.

III. The Data: Poland in the 1980s

In the remainder of the paper, the model described in the previous section will be explored empirically, using data for the Polish household sector over the period December 1979 to October 1988. This was a turbulent period in the Polish economy. The period began with a phase of political, economic, and social unrest, associated with the Solidarity movement. These developments were broken by the imposition of Martial Law on December 13, 1981. Both the Solidarity years and Martial Law were accompanied by economic reforms, which attempted not only to bring about needed price adjustments to rectify macro- and microeconomic imbalances, but also to modify the system of central planning with a view to ending the economic stagnation (Balcerowicz, 1989). By and large, these reforms were unsuccessful, so a "Second Stage of Reform" was launched with a referendum, held in November 1987, to approve the government's program. Although the government lost the referendum, it nonetheless introduced substantial price adjustments, in the so-called "price-wage maneuver" of February 1988--a price increase accompanied by a smaller increase in wages. The failure of this maneuver began the deterioration economic conditions leading up to the economic crisis of 1989, with the slide into hyperinflation and the accompanying political revolution.

The data set that will be used for this period is at the level of the household sector. This data set was assembled at the National Bank of Poland, and has already been used for some empirical analysis of the demand for money (Oles et al., 1987). 1/ Household sector figures were derived from those for the non-socialized sector by adjusting for the money balances of non-socialized enterprises.

In the empirical work, we will be concerned with narrow zloty money, whose behavior over the sample period is depicted in Chart 1. Why narrow? Because a substantial part of zloty time and savings deposits held by households consisted of specially earmarked deposits which must be set aside for specific large purchases, such as automobiles; such holdings of money

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1/ Special thanks are due to Marek Oles for sharing these data.

are not amenable to explanation in terms of the usual analysis of the demand for a medium of exchange. Why zloty? Because foreign-currency money includes not only officially registered foreign currency deposits, but also "mattress money" and deposits made informally (and illegally) in foreign banks; no reliable data exist on the latter quantities. Moreover, the regulations for foreign currency deposits were liberalized, drawing money out of the mattresses into the banks. In particular, foreign currency deposits by Polish residents originally required a declaration of the source of the funds (e.g. royalties, copyright, gifts from non-residents); then, beginning in April 1985, a new form of account was introduced which could be freely credited with convertible currency without a declaration of source, but funds in these accounts could not be transferred or used to finance travel abroad. In July 1988, the two types of accounts were consolidated, and the restrictions on the use of funds abolished. Meanwhile, the state savings bank issued deposit certificates in US dollars, which beginning in November 1987 it undertook to convert into zloties at close to the parallel exchange rate, and effective June 16, 1988 agreed to buy or sell these certificates in exchange for zloties. These changes in regulations--which may well have affected the relative attractiveness of different ways (legal or illegal) of holding foreign currency, without much affecting the total amount of foreign currency held--would make it unlikely that registered foreign currency deposits were a stable proportion of total foreign currency holdings of Polish households.

Widespread unofficial holdings of foreign currency (especially dollars) by the household sector was associated with a very active parallel or black market for foreign exchange. Although this market was not strictly legal until March 1989, black market exchange rates were widely known and quoted (even by government officials), and there are good data on these rates. Exchange rates are shown in Chart 2; black market rates are of the greatest relevance to the decisions of households, but the official rate is also shown as a reference point. The black market rate shows a rapid depreciation of the zloty in the second half of 1981, associated with the political crisis; the rate dropped again in connection with Martial Law (as well as the devaluation of the official zloty). During the 1982 to 1987 period, there was a gradual official depreciation of the zloty in terms of the dollar, with small adjustments on a weekly basis to maintain the exchange rate in terms of a basket, interspersed with larger adjustments whose target was to guarantee the continuing profitability of 75 to 85 percent of convertible currency exports; beginning in April 1987, a new system was established, with smaller and more frequent adjustments. Throughout this period, the black market rate was at a substantial premium (generally 100 to 300 percent) vis à vis the official rate; this premium shot up dramatically in late 1987 and continued to rise rapidly, reaching over 500 percent in late 1988.

These exchange-rate developments were taking place against the backdrop of variations in inflation. The Retail Price Index, shown in Charts 3 and 4, is a notoriously incomplete measure of inflation, because of the

CHART 1

HOUSEHOLD NARROW MONEY

(Billions of zloties)

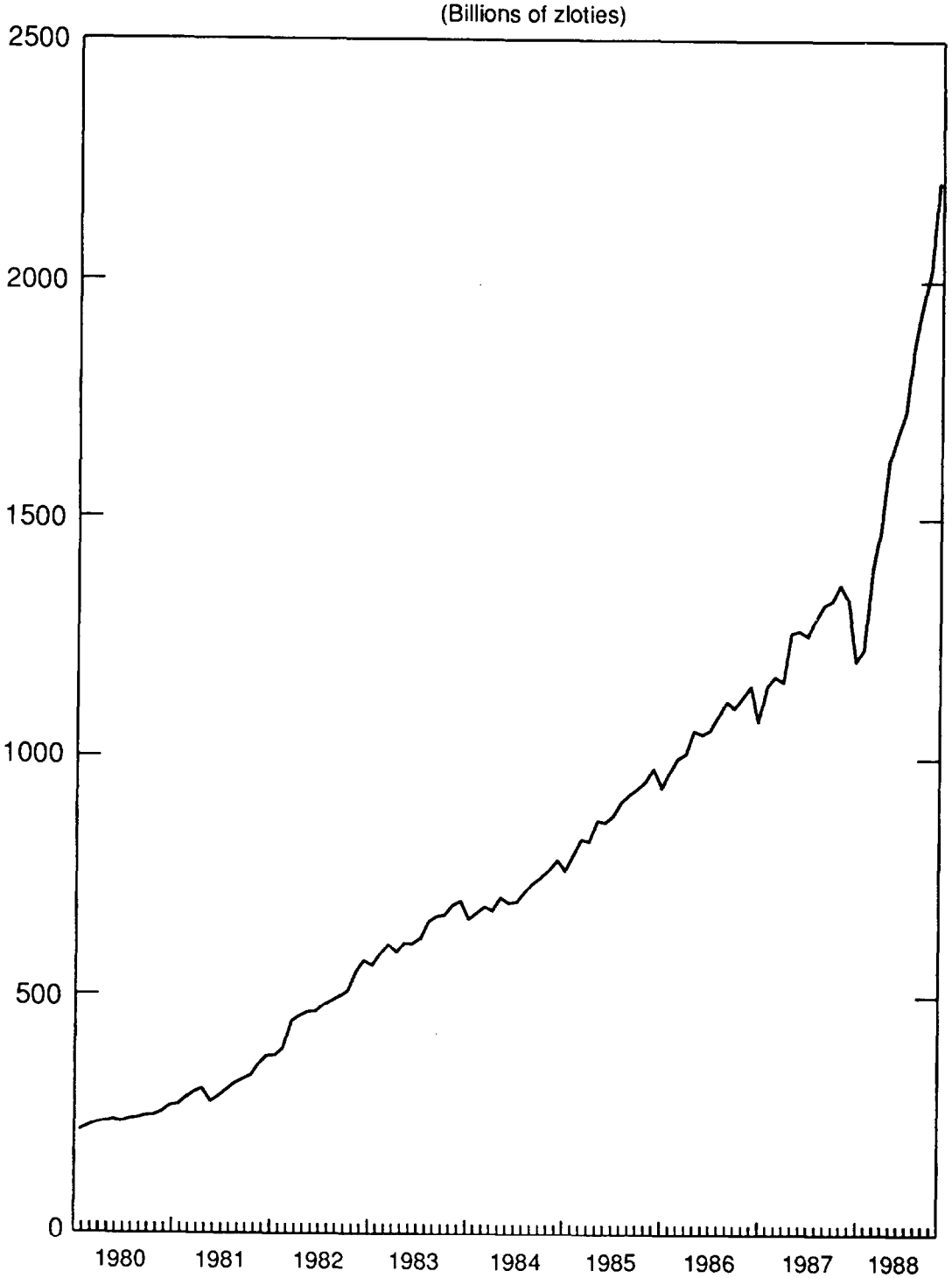


CHART 2

EXCHANGE RATES

(Zloties per dollar)

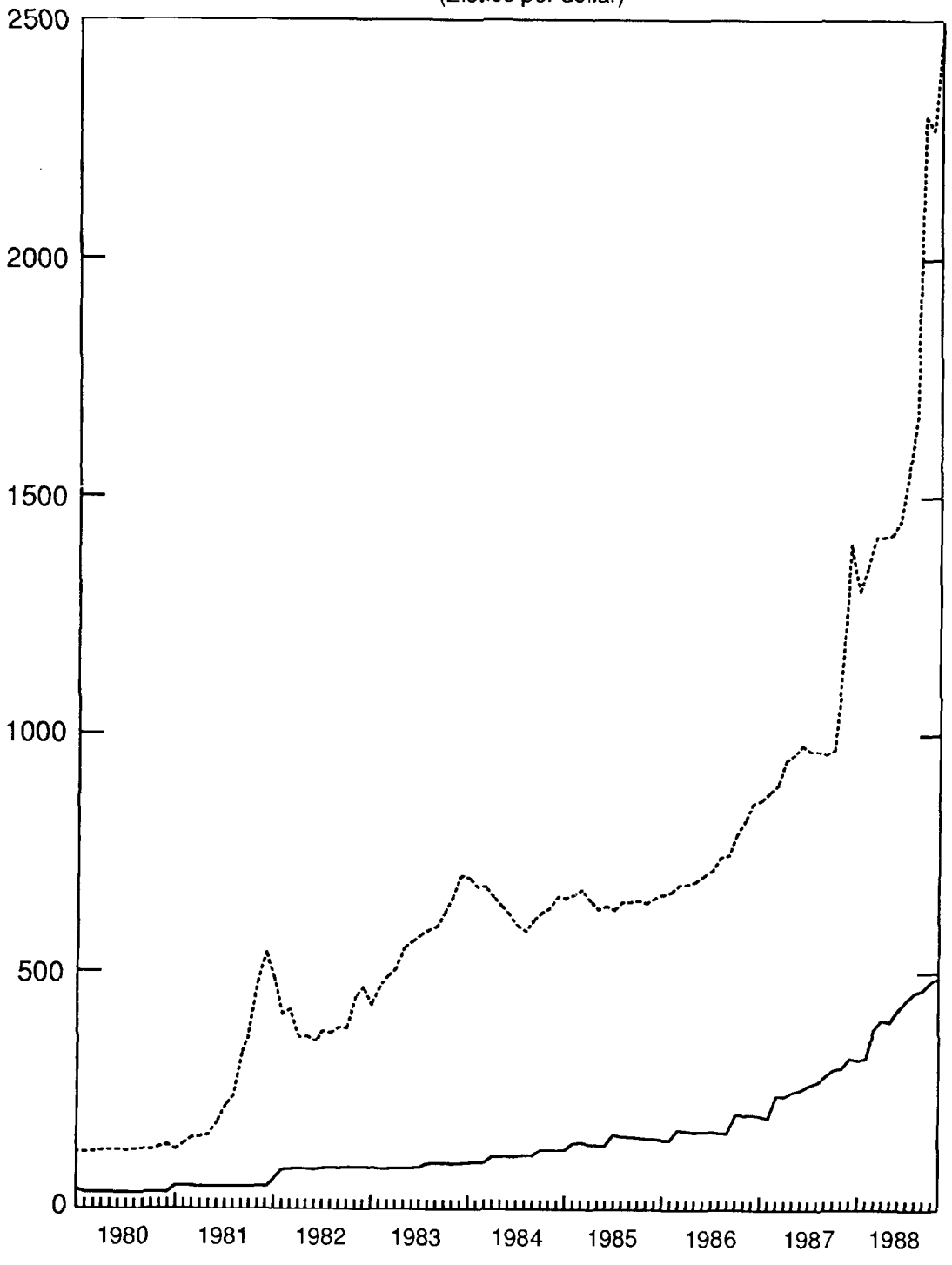


CHART 3

CONSUMER PRICE INDEX

(1980=100)

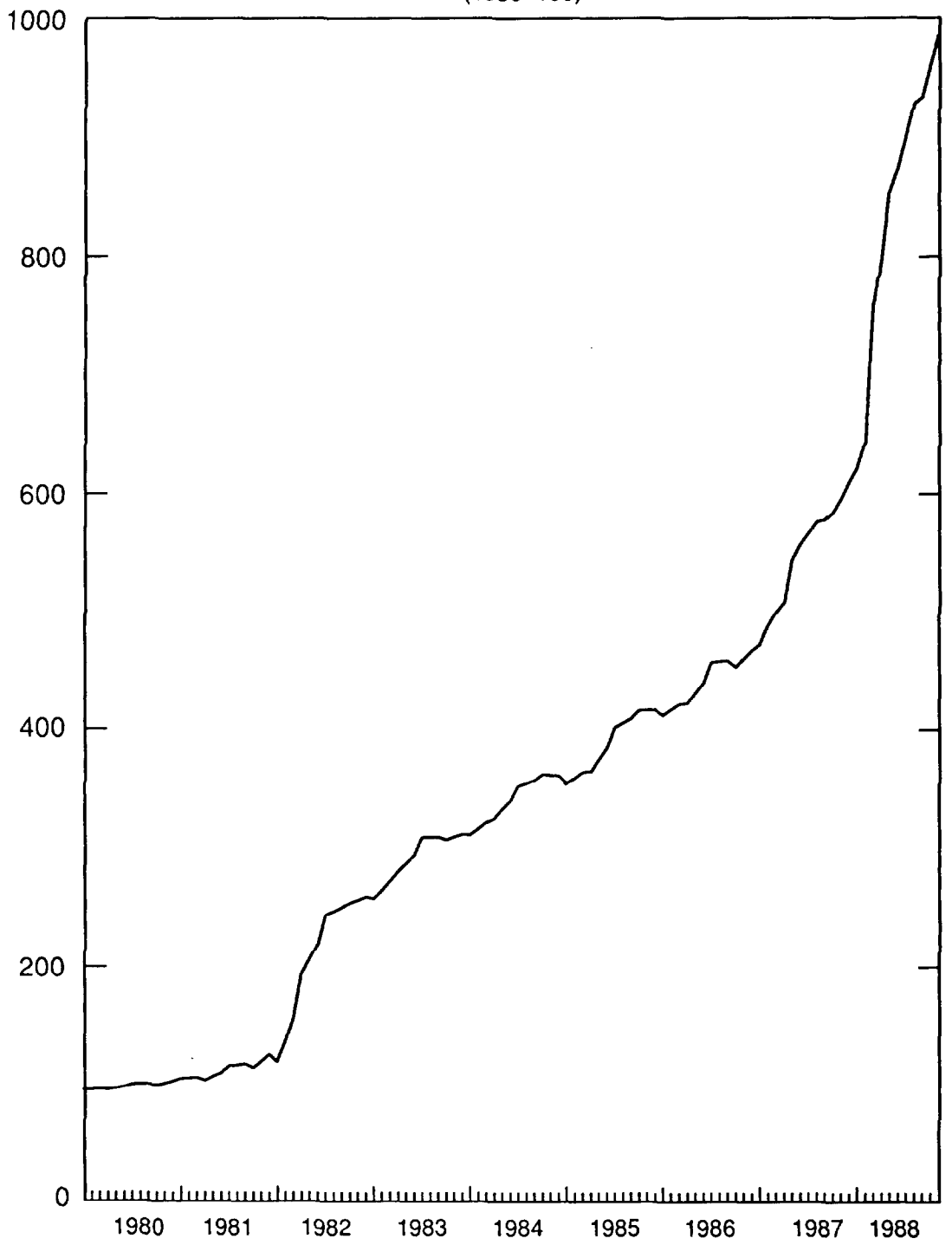
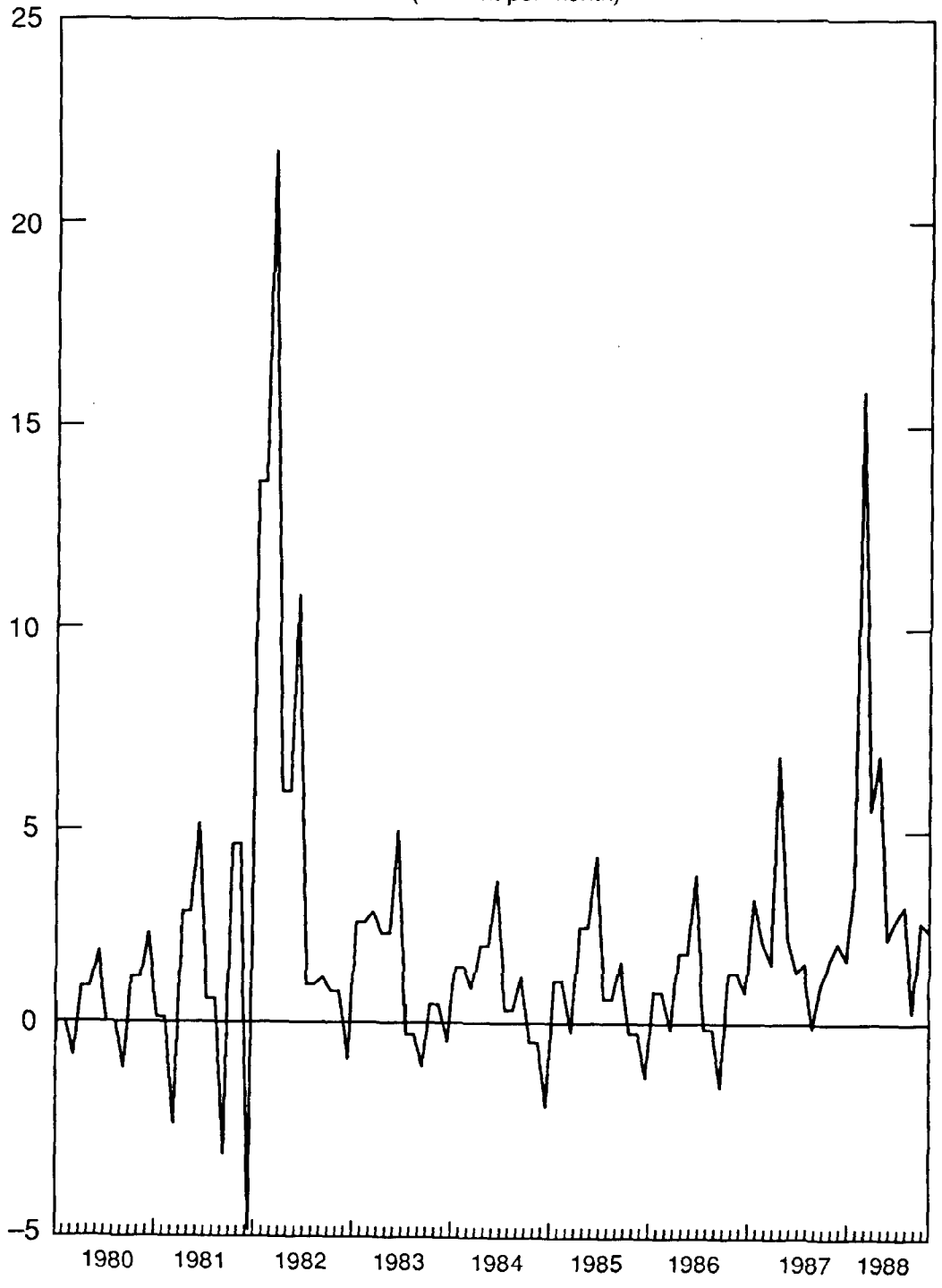


CHART 4

CONSUMER PRICE INFLATION

(Percent per month)



exclusion of goods purchased in the informal market, as well as in some cases the deliberate concealment of price changes behind changes in product classification--which together are known as "hidden inflation" (Nuti, 1986; Kalicki in Cassel et al. (ed.), 1989, pp. 73-91). The Retail Price Index does, however, show some general trends on a monthly basis. Official prices were held relatively steady until the Martial Law period, which was followed by rapid price increases, peaking with a monthly rate of 21.8 percent--equivalent to an annual rate of 963 percent--in March 1982. Measured inflation followed a more regular pattern during 1983 to 1986, and then took off sharply with the reforms of late 1987 and early 1988, with monthly inflation reaching a temporary peak of over 15 percent--an annual rate of nearly 500 percent--in February 1988.

Net household income also showed substantial variation over the sample period, as shown in Chart 5. 1/ Measured incomes rose as a result of large wage settlements, during the period 1979 to 1981; the imposition of Martial Law was followed by a drop in household incomes of about 35 percent from peak to trough. Incomes fluctuated, but on average edged up slightly during the rest of the 1980s, although never regaining their 1981 peak.

There is an important omission from the data set: data are not generally available on the premium of black-market commodity prices above official prices, θ_t, a premium which affects the relative attractiveness of zloty as opposed to foreign money, as shown in the model of section II. To the extent that this premium was relatively stable and uncorrelated with other variables in the model, this omitted variables problem would not be serious. However, the discussion in section III suggests that there were potentially (at least) two regime changes over the sample period: one associated with the imposition of Martial Law in December 1981, and the other with the inception of the Second Stage of reform in 1987. It will be important to consider whether these events were associated with structural breaks in the household demand-for-money relationship, which might arise from a change in the relationship between commodity prices on official and black markets.

The next section describes the method used to estimate the money-demand relationship, and reports the results.

IV. Empirical Analysis

The household demand for money relationship given in equation (17) was estimated using Polish data from the period December 1979 to October 1988, as described in the previous section.

An important feature of the analysis is that, in the model of Section II, the expected values, variances and covariances of the inflation rate π_t

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1/ Figures are deflated by the Retail Price Index.

and the rate of appreciation of the black market exchange rate a_t are important. A common approach to incorporating expectations in an empirical model is based on rational expectations: the realized values of the variables whose expectations appear in the model are taken as unbiased estimates of their expected values. This introduces an errors-in-variables problem, which is addressed using an instrumental variables procedure; variables whose realization was known when expectations were being formed are used as instruments. The realized values of the inflation rate π_t and the appreciation of the black market exchange rate a_t are thus included as explanatory variables. In order to allow for the possibility that the variances and covariance of π_t and a_t varied over the sample period, and played a role in household demand for money as the model in section II suggests, the realizations of their squares and cross products are also included.

In estimating demand for money, dynamic structure is also particularly important, as it may shed light on the mechanism by which the money market is brought into equilibrium. In order to address this issue, we use the two-stage error-correction model as suggested by Hendry (1986) and by Engle and Granger (1987). The first step in this approach is to test the order of integration of the variables in the model. Dickey-Fuller tests were conducted, indicating that the log of household holdings of zloty currency and sight deposits, ln m_t, the log of the retail price index, ln p_t, the log of the black-market exchange rate, ln e_t, and the log of real net household income, ln y_t, were all I(1). Given these results, an error-correction approach can be sought: first a "static equation", a relationship among the levels of the variables, is estimated; 1/ for this approach to be valid one must be albe to reject non-stationarity of the residual, which means by definition that the non-stationary variables included in the equation are cointegrated. In the second stage, a "dynamic equation" for the first difference of the dependent variable is estimated; all the explanatory variables in this equation must be stationary. The dynamic equation includes the lagged disturbance term from the first-stage static equation as an "error correction" term.

A static equation was first estimated. A cointegrating relationship was found between ln m_t, ln p_t and ln y_t, provided that dummies were included to divide the three regimes discussed in section III: dummies were included period of unrest prior to the imposition of martial law on December 13, 1981 (UNREST), and for the reform program begun following the November 1987 referendum (REFORM); in this context, such dummies indicate permanent shifts in money demand associated with a regime change. Initial estimates showed a coefficient on the log of the price level, ln p_t, that was very close to unity, as implied by economic theory; accordingly, this condition,

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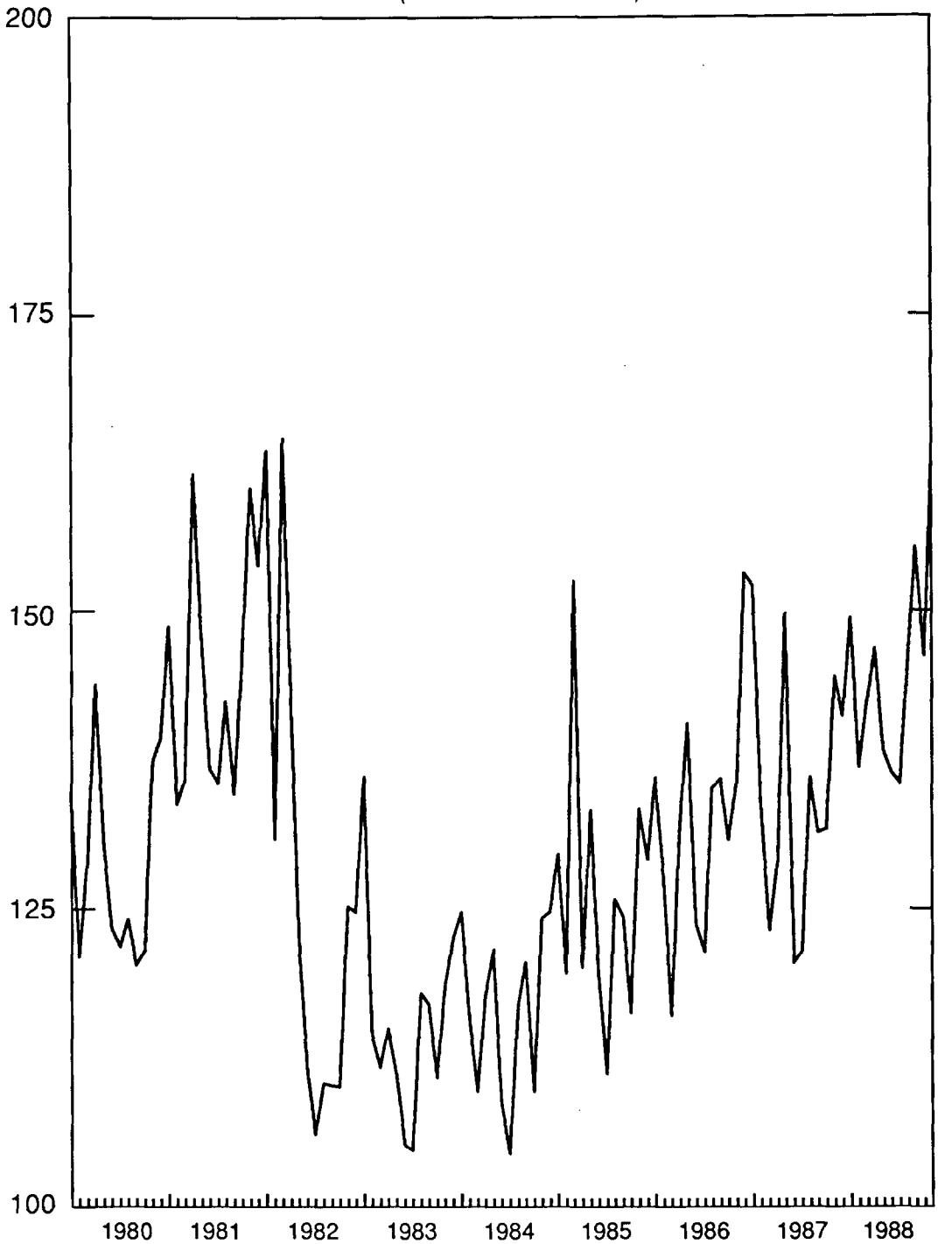
1/ Ordinary least squares estimates of this equation are consistent even if the disturbance term is not well behaved--e.g. even if it is serially correlated, or is not orthogonal to the regressors.

CHART 5

NET HOUSEHOLD INCOME

(Billions of 1980 zloties)



implying a demand for real money balances, was imposed. 1/ The resulting static equation in the levels of the variables, estimated over the period December 1979 to October 1988, is

$$\ln (m_t/p_t) = \underset{(52.61)}{.68} + \underset{(10.72)}{.57} \ln y_t + \underset{(8.17)}{.11} \text{UNREST} - \underset{(-11.27)}{.20} \text{REFORM} \qquad (18)$$

Sum of squared residuals = 0.2715
Standard deviation of dependent variable = .1129
Standard error of regression = 0.051
R^2 = .7989
Adj. R^2 = .7930
F(3,103) = 136.40
Durbin-Watson = 1.22
Number of observations = 103

where figures in parentheses under the estimated coefficients are t statisics. 2/ This equation implies a long-run income elasticity of money demand of about .6, which is toward the low end of the range of estimates typically found for developed countries; this is consistent with the theoretical model presented in section II, as well as with simpler models of the transactions demand for money. One interpretation of the positive coefficient on the dummy UNREST is that, during the period leading up to Martial Law, the public's demand for zloty money may have been augmented by fear that an impending regime change would include measures, such as a clampdown on the black markets, that would make dollar holdings less desirable. The negative coefficient on the dummy variable REFORM may indicate that the increases in administered prices introduced in connection with the reform program may have been expected to reduce the premium of black-market prices over official prices (the unobserved variable θ_t), thus reducing the incentive to hold zloty money as reflected in equation (16). The static equation's predictions of demand for money, in relation to the actual outturns, are shown in Chart 6. Deviations between actual and predicted values appear to be serially correlated, and this is confirmed by the Durbin-Watson statistic; this does not affect the consistency of a cointegrating equation, however. The residuals from this static equation (19) were examined for stationarity, and a Dickey-Fuller test rejected the

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1/ The estimated coefficient on ln p_t is 0.9692, and the reported standard error is 0.0198, which implies that one cannot reject the null hypothesis of a unitary coefficient at a significance level of .05. Strictly speaking, though, hypothesis testing using this estimated standard error is not valid, due to the non-stationarity of the variables.

2/ These t statistics are reported purely as a matter of convention, while recognizing that the associated standard errors are invalidated by the non-stationarity of the data.

hypothesis of a unit root (with a test statistic of -7.34). This indicates (as shown by Engle and Granger (1987)) that the dynamic behavior of the money stock can be represented in terms of an error-correction model. 1/

A dynamic equation for $\Delta \ln m_t$ was accordingly estimated, including the lagged residual from the static equation, EC_{t-1}, as one of the explanatory variables. The log first differences of real income, $\Delta \ln y_t$, the retail price index, $\Delta \ln p_t$, and the black market exchange rate, $\Delta \ln e_t$, were also included. However, the discussion at the end of section II suggests that $\Delta \ln e_t$ is a variable that adjusts to clear the money market in the short run, and thus should be treated as endogenous. Moreover, as discussed in section III, $\Delta \ln p_t$ measures the change in the relevant price level with considerable error, since it omits prices in the unofficial sector. In addition, first differences of the expected change in the black-market exchange rate, ΔEa_t, where $a_t = (\ln e_{t+1} - \ln e_t)$, and of expected inflation, $\Delta E\pi_t$ were included, as implied by the theoretical model; these were represented, using the assumption of rational expectations, by their respective realized values. Furthermore, as suggested by equation (16), the conditional variances of inflation and the black market exchange rate, and their conditional covariance, were also included as explanatory variables; using the same rational expectations assumption, they were represented by their realized values $\Delta(a_t^2)$, $\Delta(\pi_t^2)$, and $\Delta(a_t\pi_t)$. Lagged values of all of the variables, including 12 monthly dummies, were used as instruments. 2/

Initial explorations confirmed the appropriateness of the error correction model, as the error correction term turned out to be statistically significant and negative. Moreover, coefficients on the first differences of prices, income, and the black market exchange rate were all significant and of the expected sign. No statistically significant effect of changes in expected inflation, $\Delta E\pi_t$, and expected exchange rate appreciation, ΔEa_t, could be found, however; this is perhaps not surprising, given the difficulty of forecasting prices. The variance of inflation also turned out to have no statistically significant effect--also perhaps unsurprising, given the theoretical ambiguity of the sign of this variable's influence.

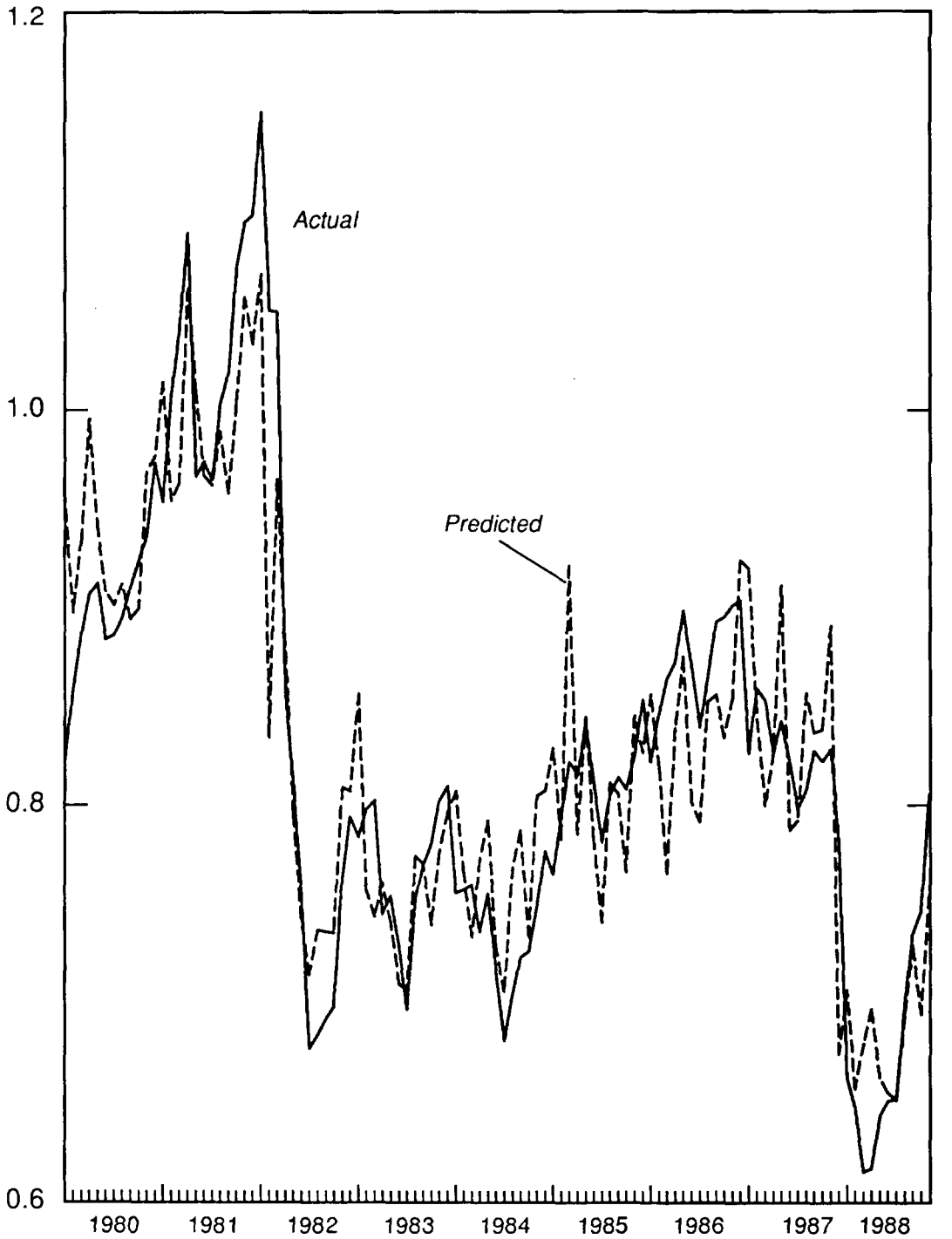
1/ In estimating the dynamic equation we entertain the possibility of ARCH in the exchange rate and inflation rate, so it is important to test that this does not also affect the residuals of the static equation. No evidence was found of ARCH(1) in the residuals of (18); the test statistic, distributed as F(1,100), was 2.32.

2/ In an earlier version of the paper, time-series predictions were used to represent $E\pi_t$ and Ea_t. The conditional variances and covariances were proxied by the precdictions of ARCH models using the squares and product of residuals from these time-series representations. Results were similar to those reported here.

CHART 6

REAL HOUSEHOLD NARROW MONEY

(In logs)



Monthly dummies were initially used in the equation. It was discovered that the only important seasonal effects were a December minus January effect and a March effect; one could not reject the hypothesis that the other monthly dummies and constant term could be excluded from the equation ($F(10,84) = 0.49$).

Accordingly, the following, more parsimonious specification of the equation was estimated for the March 1980 to September 1988 period: 1/

$$\Delta \ln m_t = \underset{(7.24)}{.57}\ \Delta \ln p_t + \underset{(5.92)}{.19}\ \Delta \ln y_t + \underset{(2.59)}{.12}\ \Delta \ln e_t \qquad (19)$$

$$- \underset{(-2.59)}{1.28}\ \Delta(a_t \pi_t) + \underset{(2.43)}{.50}\ \Delta(a_t)^2 + \underset{(3.17)}{.25}\ \Delta \ln m_{t-1} + \underset{(-3.49)}{.19}\ EC_{t-1}$$

$$+ \underset{(6.38)}{.049}\ (JAN\text{-}DEC) - \underset{(-2.03)}{.017}\ MARCH$$

Sum of squared residuals = .04569
Standard deviation of dependent variable = .03500
Standard error of regression = .02205
$R^2 = .6414$
Adjusted $R^2 = .6109$
$F(9,99) = 20.06$
E'PZ*E = .611109E-02

Several features of this estimated equation can be noted. The equation seems to track changes in money balances fairly well, as suggested by Chart 7. The error correction term show up strongly, suggesting that household money balances do in fact adjust toward their long-run real level as represented in equation (18); this corroborates the cointegration results from the static model, and contradicts the notion--associated with the liquidity overhang story discussed in the introduction--that housholds' money holdings are largely passive. The error-correction coefficient implies a mean lag of about a month in response to a change in the price

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1/ Instrumental variables include $\Delta \ln p_{t-1}$, $\Delta \ln p_{t-2}$, $\Delta \ln e_{t-1}$, $\Delta \ln e_{t-2}$, $\Delta \ln y_t$, $\Delta \ln y_{t-1}$, $\Delta \ln y_{t-2}$, $\Delta \ln m_{t-1}$, $\Delta \ln m_{t-2}$, π_{t-2}^2, π_{t-3}^2, a_{t-2}^2, a_{t-3}^2, $\pi_{t-2}a_{t-2}$, $\pi_{t-3}a_{t-3}$, EC_{t-1}, and twelve monthly dummies.

level. 1/ This rapid adjustment is striking; it is broadly consistent with results obtained for Polish data by Hartwig (1987) and Oles et al. (1987), but the lag in adjustment is shorter than that obtained in many money demand studies for other economies apparently displaying much less structural rigidity. 2/ This suggests that Polish households were able to adjust their holdings of zloties rather rapidly in response to changes in the determinants of their desired holdings, and/or that black market exchange rates adjusted quickly to clear the money market. 3/

Also of particular importance is the conditional variance of exchange-rate movements and their conditional covariance with inflation, represented by $\Delta(a_t\pi_t)$ and $\Delta(a_t^2)$. The variance of exchange-rate movements had a significantly positive effect, suggesting that (for a given domestic price level) a greater variance of the black-market exchange rate makes dollars a less attractive temporary store of value for domestic residents. 4/ The covariance term, whose sign is theoretically ambiguous, turned out to have a significant negative effect on the change in money holdings: the intuition behind this result is that a higher covariance of the exchange rate and inflation makes dollars a better inflation hedge, and thus reduces the incentive to hold zloties. These results corroborate the dynamic portfolio approach developed in Section II. They also stand in constrast to previous empirical work on market economies, which has not generally accorded an important role to such variance and covariance effects, despite the fact that such effects are an implication of the portfolio approach that was long part of the standard equipment of monetary theory (Laidler, 1976). Why, then, do such effects show up in Poland in the 1980s? Two reasons come to mind: one is that, in Poland, unlike developed market economies, there is little alternative to money with similar risk characteristics, so risk considerations may affect the demand for money. Second, during the sample period there were substantial changes in the Polish economy, which could quite conceivably have brought about substantial enough changes in the

---

1/ In the presence of a lagged dependent variable as well as an error correction term, the mean lag is $(1-\beta_0-\beta_2)/\beta_1$, where β_0 is the coefficient on the price level in the dynamic equation (given a unit coefficient in the static equation), β_1 the error correction coefficient, and β_2 the coefficient on the lagged dependent variable.

2/ Kremers and Lane (1990) find an error correction of -0.95 from quarterly data, implying a mean lag of about one month, for an aggregate of European Monetary System countries. Most country studies, however, report much smaller error correction coefficients: for example, Hendry (1985) and Baba et al. (1987) find error correction coefficients, of 0.1 and 0.14, respectively, for quarterly data, implying much longer mean lags.

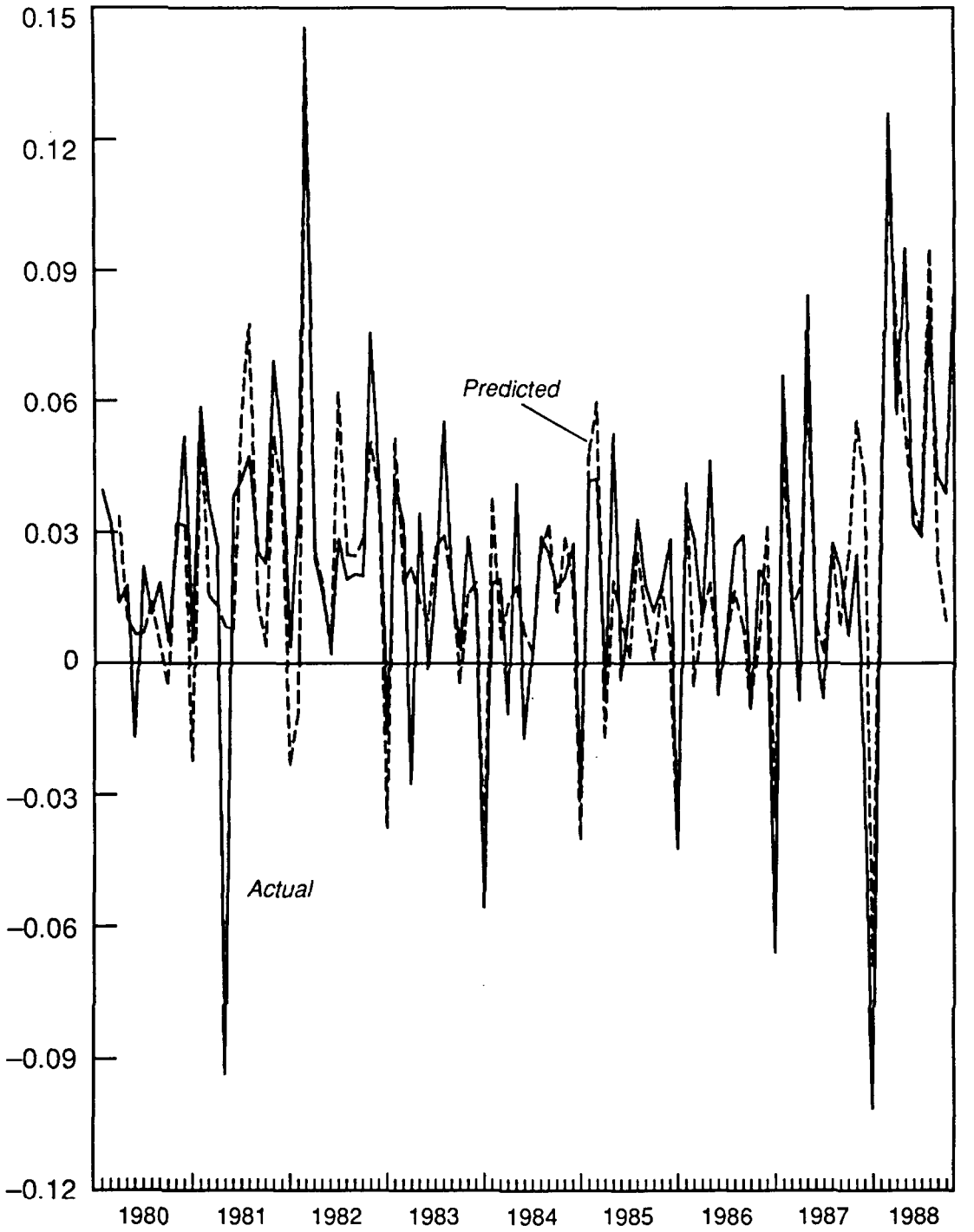
3/ Price flexibility would lead to rapid adjustment of actual to desired money balances in the economy as a whole, even if adjustment at the level of the individual household were costly (Laidler, 1982, Lane, 1990).

4/ Heard in a Warsaw restaurant in November 1989: "No, we couldn't possibly accept dollars: the dollar has been going up and down like a yo-yo!"

CHART 7

CHANGES IN NOMINAL MONEY

(In logs)



variances and covariances of prices and exchange rates to have an influence on the behavior of individual households.

Next, we proceed to test the stability of the estimated equation over the sample period. Here, we have in mind the two possible structural breaks associated with the possible regime changes: one associated with the imposition of Martial Law in December 1982, the other with the inception of the Second Stage of reform, which we date at the referendum of November 1987. Structural breaks at either or both of these points would be unsurprising in terms of the theoretical model presented in section II, since the model implies that changes in θ_t, the spread between prices in the black market and the official stores, would affect the demand for zloty money given the observable explanatory variables. If a regime change alters the process generating prices and exchange rates, it would also be expected to alter the way in which expectations are formed.

First, we test stability of the dynamic equation over the periods before and after the imposition of Martial Law--that is, between the March 1980-December 1981 and the January 1982-September 1988 sub-periods. Here, the test statistic is 2.59, distributed as F(11,83); the critical value is 1.91, so stability is rejected. Next, we test for whether the inception of the Second Stage reforms led to a structural break; that is, we test for stability over the March 1980-October 1987 and November 1987-September 1988 sub-periods. In this case, the test statistic is 2.00, so stability is again (although even more narrowly) rejected. Thus, significant, although not drastic changes in structure appear to have been associated with both of these apparent regime changes. This is unsurprising in light of the extreme nature of the regime changes involved, as described in Section III: the imposition of Martial Law was accompanied by social disruption, massive price adjustments, and sharp drop in houshold incomes, while the Second Stage was associated, among other things, with substantial price increases and with liberalization of the conditions under which foreign currency deposits could be held. It is also unsurprising in terms of the theory developed in section II--which itself predicts that regime changes and the attendant changes in market conditions would likely be associated with structural changes in the demand for money.

This, of course, is not the end of the story. In late 1989 and through 1990, further and much more vigourous reforms were carried out (Lane, 1991). These reforms have entailed freeing many prices, beginning with the freeing of most food prices in August 1989 and continuing through large administered price increases in October 1989 and the "Big Bang" freeing and/or adjustment of remaining prices in January 1990. These changes apparently drastically reduced the gap between official and black-market prices, so that by early 1990, food and other commodities were being sold in the burgeoning street market at prices which anecdotal evidence suggests in at least some cases were <u>below</u> official prices. As the program of reform and stabilization was intended to alter the processes generating inflation and exchange-rate movements in Poland, and alter the way in which expectations are formed, it

is not clear what overall effect on demand for zloty money is likely to emerge, but a further structural shift in money demand would appear likely.

V. Conclusion

This paper has developed a model of household demand for money in a reforming socialist economy such as Poland in the 1980s, in which the prevalence of black markets in commodities and foreign exchange has widened housholds' range of choice. It suggests that, even though the Polish economy has been characterized by shortages in the official markets, household money demand within that economic environonment can nonetheless fruitfully be analyzed in the framework of rational intertemporal choice, taking due account of the alternatives available to consumers.

The paper proceeds to estimate the resulting money demand equation, using the error correction framework to capture the dynamics. This empirical analysis yields several important results. First, there is a cointegrating relationship between households' real money balances and real incomes, allowing for intercept shifts associated with the imposition of Martial Law and with the inception of the Second Stage of Reform. This result contradicts the traditional view that, in a socialist economy, money is largely passive. Since "real" here implies deflation by the official Retail Price Index, this result also suggests that official prices adjust, in some degree, toward their equilibrium levels.

Another important aspect of the results pertains to the dynamic equation. This equation identifies an error correction mechanism underlying the long-run relationship between money, prices, and output. The estimated error correction coefficients suggest quite a rapid adjustment of household money balances toward their equilibrium levels. The dynamic equation also shows a significant role for some other variables: the role of the black market exchange rate is important, as suggested by the theoretical model and consistent with the view that the black market exchange rate adjusts to equilibrate the money market, given the sluggishness of official prices. Moreover, the variance of exchange rate changes, and their covariance with inflation, were found to have a significant influence on demand for money over this period; these factors may have been important because of the lack of alternatives to money as a store of value in Poland at this time, and because of the turbulence of the Polish economy which may well have led to significant alterations in the variance-covariance structure of returns on domestic and foreign money in relation to goods.

The stability of the equation is narrowly rejected over both of the regime changes examined. This result, while disappointing, is unsurprising given the drastic nature of these regime changes; it is also consistent with the theoretical model, which suggests a rationale in terms of some omitted variables--notably the ratio of black-market and official prices of goods--

which were clearly altered with these regime changes, and would be expected to have an important influence on demand for money.

Reforms in Poland, which have freed most prices, have greatly changed the transactions environment, and quite probably led to a further shift in demand for money. The framework presented in this paper may therefore now be more readily applicable to economies at an earlier stage in the reform process--and notably to the emerging Soviet sovereign republics.

This paper, in both its theoretical and empirical parts, stands against the view--associated with the notion of a liquidity overhang--that household money holdings in a socialist economy can suitably be regarded as adapting passively to government decisions on wages and on the availability of consumer goods. This suggests that the monetary economics of socialist economies is a subject that has been neglected unfairly.

References

Abel, István, and Istvan Székely, "Money and Causality in CPEs (The Case of Hungary), Karl Marx University of Economics, Budapest, Department of Economic Planning and Modelling Working Paper 88/3, August 1988.

Baba, Yoshihisha, David F. Hendry and Ross M. Starr, "U.S. Money Demand, 1960-1984" (unpublished manuscript, Nuffield College, Oxford, 1987).

Balcerowicz, Leszek, "Polish Economic Reform, 1981-88: An Overview", in Economic Reforms in the European Centrally Planned Economies, United Nations Economic Commission for Europe Economic Studies No. 1, pp. 117-122.

Birman, Igor, "The Financial Crisis in the USSR", Soviet Studies, Vol. 32, No. 1 (January 1980), pp. 84-105.

Birman, Igor, and Roger A. Clarke, "Inflation and the Money Supply in the Soviet Economy", Soviet Studies Vol. 37, No. 4 (October 1985), pp. 494-504.

Boycko, Maxim, "The Velocity of Money in a Shortage Economy", Mimeo, Institute of the World Economy and International Relations, Moscow, September 1991.

Burton, David, and Jiming Ha, "Economic Reform and the Demand for Money in China", International Monetary Fund Working Paper WP/90/42, April 1990.

Cassel, Dieter, Wladislaw Jaworski, Dietmar Kath, Tadeusz Kierczynski, Karol Lutkowski, and Hans-Joachim Paffenholz (Ed.), Inflation und Schattenwirtschaft in Sozialismus. Hamburg: S&W Steuer- und Wirtschaftsverlag, 1989.

Charemza, Wojciech W. and Subrata Ghatak, "Demand for Money in a Dual-Currency, Quantity-Constrained Economy: Hungary and Poland, 1956-1985", Economic Journal Vol. 100, December 1990, pp. 1159-1172.

Clower, Robert W., "A Reconsideration of the Microfoundations of Monetary Theory," Western Economic Journal, Vol. 6 (1987), pp. 1-9.

Cottarelli, Carlo, and Mario Blejer, "Forced Savings and Repressed Inflation in the Soviet Union: Some Empirical Results", IMF Working Paper WP/91/55, June 1991.

Engle, Robert F. and Clive Y.J. Granger, "Cointegration and Error Correction: Representation, Estimation, and Testing," Econometrica Vol. 35 (1987), pp. 143-159.

Feltenstein, Andrew, David Lebow, and Sweder Van Wijnbergen, "Savings, Commodity Market Rationing, and the Real Rate of Interest in China", Journal of Money, Credit and Banking Vol. 22, No. 2 (May 1990), pp. 234-252.

Goodfriend, Marvin, "Reinterpreting Money Demand Regressions," in Karl Brunner and Allan H. Meltzer (eds.), Understanding Monetary Regimes, Carnegie-Rochester Conference Series 22 (Amsterdam: North-Holland, 1985), pp. 207-41.

Granger, Clive Y.J., "Developments in the Theory of Cointegrated Economic Variables," Oxford Bulletin of Economics and Statistics, Vol. 48 (1986), pp. 213-228.

Hartwig, Karl-Hans, "Theoretische und empirische Ansätze zur Bestimmung der Geldnachfrage in sozialistischen Planwirtschaften", in Geldtheorie, edited by H. Jörg Thieme. Baden-Baden: Nomos Verlagsgesellschaft, 1985, pp. 235-253.

Hartwig, Karl-Hans, "Die Geldnachfrage in sozialistischen Planwirtschaften: Polen 1954-1984", Kredit und Kapital 1987, No. 3, pp. 378-401.

Kornai, Janos, Economics of Shortage Vol. B, Amsterdam: North-Holland, 1980.

Heri, Erwin W., "The Short-Run Demand for Money in Germany: Some Caveats for Empirical Work," Weltwirtschaftliches Archiv, Vol. 121 (1985), pp. 524-540.

Hendry, David F., "Monetary Economic Myth and Econometric Reality," Oxford Review of Economic Policy Vol. 1 (1985), pp. 72-84.

_____, "Econometric Modelling with Cointegrated Variables: An Overview," Oxford Bulletin of Economics and Statistics, Vol. 48 (1986), pp. 201-212.

Kremers, Jeroen J.M., and Timothy D. Lane, "Economic and Monetary Integration and the Aggregate Demand for Money in the EMS", IMF Staff Papers Vol. 37, no. 4, December 1990, pp. 777-805.

Lahiri, Ashok, "Yugoslav Inflation and Money", IMF Working Paper WP/91/50, May 1991.

Laidler, David E.W., The Demand for Money: Theories and Evidence, Second edition. New York: Harper & Row, 1977.

Laidler, David E.W., "On the Demand for Money and the Real Balance Effect," in Monetarist Perspectives (London: Philip Allan, 1982), pp. 37-66.

Lane, Timothy D., "Costly Portfolio Adjustment and the Short-Run Demand for Money," Economic Inquiry Vol. 28, No. 3, July 1990, pp. 466-487.

Lane, Timothy D., "Inflation Stabilization and Economic Transformation in Poland: The First Year", IMF Working Paper WP/91/70, July 1991. Forthcoming in Carnegie-Rochester Conference Series on Public Policy.

Lucas, Robert E., Jr., "Equilibrium in a Pure Currency Economy," Economic Inquiry, Vol. 18 (1980), pp. 203-20.

Lucas, Robert E., Jr., "Money in a Theory of Finance," in Karl Brunner and Allan H. Meltzer (eds.), Essays on Macroeconomic Implications of Financial and Labor Markets and Political Processes, Carnegie-Rochester Conference Series on Public Policy 21 (Amsterdam: North-Holland, 1984), pp. 9-45.

Mihaljek, Dubravko, "Wealth Effects of Inflation and Devaluations in Yugoslavia: Who Gains and Who Loses?", Economic Analysis and Workers' Management, Vol. 23, No. 3, 1989, pp. 207-251.

Nuti, Mario, "Hidden and Repressed Inflation in Soviet-Type Economies: Definitions, Measurements and Stabilization", Contributions to Political Economy, Vol. 5, March 1986, pp. 37-82.

Nuti, Mario, "Internal and External Aspects of Monetary Disequilibrium in Poland", in Economic Transformation in Hungary and Poland, European Economy, No. 43, March 1990, pp. 43-60.

Oles, Marek, Jerzy Pawilno-Pacewicz, and Mariusz Sumlinski, "Popyt Gospodarstw Domowych Na Pieniadz", Finanse 1987, No. 10, pp. 21-33. English version entitled "Households Money Demand Function for Poland, 1960-1986", Mimeo, National Bank of Poland, 1987.

Payne, James E., "A Model of Money Demand in Yugoslavia: 1952-1985", Economic Analysis and Workers' Management Vol. 24, No. 1, 1990, pp. 83-94.

Pindák, Frantisek, "Inflation Under Central Planning" Jahrbuch der Wirtschaft Osteuropas/Yearbook of East-European Economies Vol. 10, 1983, pp. 93-131.

Podkaminer, Leon, "Disequilibrium on Poland's Consumer Markets: Further Evidence on Intermarket Spillovers," Journal of Comparative Economics, Vol. 12 (1988), pp. 43-60.

Podkaminer, Leon, "Macroeconomic Disequilibria in Centrally Planned Economies: Identifiability of Econometric Models Based on the Theory of Household Behavior under Quantity Constraints," Journal of Comparative Economics, Vol. 13 (1989), pp. 47-60.

Portes, Richard, "On the Theory and Measurement of Macroeconomic Disequilibrium and Shortage in Centrally Planned Economies", in Models of Disequilibrium and Shortage in Centrally Planned Economies, ed. by C. Davis and W. Charemza, (London: Chapman and Hall Ltd., 1989), pp. 27-47.

Portes, Richard, Richard E. Quandt, David Winter and Stephen Yeo, "Macroeconomic Planning and Disequilibrium: Estimates for Poland, 1955-1980," Econometrica Vol. 55 (1987), pp. 19-41.

Székely, István, "The Role of Money and Monetary Policy in a Modified CPE (The Case of Hungary)", Mimeo, Cambridge University, January 1990.

Tyson, Laura D'Andrea, "Enterprise Demand for Money and Illiquidity Crises in Yugoslavia", European Economic Review, Vol. 12, No. 1, February 1979, pp. 53-71.

Weitzman, Martin, "Price Distortion and Shortage Deformation, or, What Happened to the Soap?", American Economic Review, Vol. 81, No. 3, June 1991, pp. 401-414.