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Bank Insolvency and Stabilization in Eastern Europe

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The structural reforms under way in Eastern Europe have revealed the weakness of the banking sector there; macroeconomic stability and other reforms are thereby threatened. A model is developed that clarifies the role of banking in an emerging market economy and the danger that the disturbances inherent to it may be magnified and prolonged by a banking collapse. [JEL E44, G21, P34]

THE FORMERLY socialist countries of Eastern Europe face the double challenge of implementing profound structural change and achieving macroeconomic stabilization. These goals may conflict, and in particular, reforms may endanger the financial sector, which in turn could threaten the stability of the whole economy. The aim of this paper is to analyze the relationship between the state of the financial sector and macroeconomic stability in the countries of Eastern Europe.

In the immediate aftermath of the breakdown of the socialist system in Eastern Europe, output declined sharply, and the initial price surge following decontrol has led in most countries to sustained inflation (see International Monetary Fund (1992)). During the transformation process, changes in relative prices and the business environment rendered many of the established enterprises more or less bankrupt. As a result, a large part of the inherited loan portfolio of banks is now of very doubtful quality.

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Although the efficiency of the economies of Eastern Europe should be enhanced in the long run, Calvo and Frenkel (1991), among others, have expressed concern that the financial systems of these economies may be unable to cope with the transition without assistance, and that the adjustment costs may be greatly increased by the fragility of their banks. Here, a model is developed that clarifies the role of banking in centrally planned and emerging market economies and the nature of the problem associated with bank insolvency in these economies. After a brief survey of banking activities in centrally planned and emerging market economies, Section II provides a stylized presentation of a generalized banking system and the particular system prevailing in Eastern Europe in the prereform period, where suppressed inflation, distorted relative prices, and sustained subsidization are modeled.

In Section III we show how, in an overlapping-generations model with long-term investments, the sudden withdrawal of subsidies and liberalization of prices leads to a brief consumption surge, bank runs, and the premature liquidation of investment. Similarly, we show how a large decline in returns on existing capital, despite an increase in the expected return on new projects, leads to bank runs, constrained investment, and erosion of the capital stock. In both cases, the decapitalization of the economy leads to a low and possibly fluctuating level of output and investment for a prolonged period. Individually, banks act rationally in restricting lending, calling in loans, and increasing the spread between deposit and lending rates. However, the aggregate outcome is negative net investment, which perpetuates the disruption. The problem is compounded when each household tries to be the first to withdraw its deposits from the loss-making banks.

Thus, we provide an analysis of how disruption of the banking sector may magnify the negative effects of the types of disturbances suffered by Eastern Europe. The real costs of the reform effort will be increased and perpetuated by failure to mobilize resources to restructure the banking sector. It goes beyond the scope of this paper to discuss how this need should be balanced against the competing demands to provide a social safety net and restore the infrastructure, and how resources can be raised most efficiently while avoiding a loose monetary stance and high inflation.

I. The Banking System in Eastern Europe

Under the socialist banking system that prevailed in Eastern Europe, the centralized "monobank" combined the functions of a central bank

and commercial bank activities.[1] The system was locally stable, in that government manipulation of administered prices, fixed interest rates, and the provision of credit and subsidies ensured the continued liquidity of all institutions. The method of credit allocation was direct, with the banking system acting as an administrative arm of the planning organ.[2] The administered rates of interest had little relation to the return on capital. With almost all production activities run and, hence, guaranteed by the state, banks were not mandated or motivated to pay much attention to the quality of assets; the role of asymmetric information and delegated monitoring services in explaining the existence of banks in socialist economies seems to have been limited.[3] Even prior to the launch of reforms, many banks in Eastern Europe had dubious portfolios. The losses on account of quasi-fiscal operations, such as subsidized selective credit operations or valuation losses chalked up to exchange rate movements, were rolled over for years and listed in the books as assets under "other items, net."[4]

As part of the transformation process that began at the end of the 1980s, the monobank was broken up into a two-tier banking system, with the creation of a traditional central bank and the hiving off of the nongovernmental loan portfolio of the monobank to several commercial banks.[5] The assets transferred to the new commercial banks were not cleansed of nonperforming loans, and many of the banks had solvency problems from the outset.

The reforms have only revealed and compounded a long-standing

[1] Loans to enterprises were often channeled through specialized investment institutions, which were funded through refinance credits from the national banks. The surplus of household deposits at the savings banks was recycled by the national bank.

[2] Enterprises had very little freedom in cash management. The need for the enterprise to have a plan authorization to operate its bank accounts has led to the monetary system in a planned economy being described as having two semi-independent circuits—one for households and one for enterprises. The two circuits have obvious overlaps and linkages, and analytically we find it useful to think of the system as an integral one, with banks imposing some additional withdrawal restrictions on enterprise accounts in accordance with the central plan.

[3] One major focus of the literature on financial intermediation has been on alternative forms of financial contracts. We do not have to consider the possibility of a variety of contracts here, because most of these—for example equity contracts—were irrelevant in socialist economies.

[4] With banks and enterprises both belonging to the public sector, the distinction between fiscal and credit financing of enterprises may be hard to draw in a socialist economy. However, at the time of the breakup of the monobank into a two-tier banking system, the nongovernmental loan portfolio was treated as credit and assigned to the new commercial banks.

[5] Sheng (1991) and Hardy and Lahiri (1992) provide overviews of the banking system in these economies. Sundararajan (1991) discusses the institutional issues involved.

problem, as notionally profitable enterprises were turned almost overnight into loss makers by the new economic environment.[6] Consequently, banks' balance sheets suffered an equally dramatic deterioration. Banks in many of these countries have also been seriously affected by devaluations because of their foreign exchange exposure. Although many of the countries in Eastern Europe have already embarked on loan classification of bank portfolios, as yet no definite estimates of the impaired assets of banks exist. In the meantime, the financial distress in the banking sector has already resulted in the extension of support from the fiscal and monetary sectors.

II. A Theoretical Framework

In this section a model of banking in socialist economies is developed to capture the principal function that banks fulfilled in these economies, namely, converting illiquid into liquid assets. The basic model belongs to the genre developed by Bryant (1980), Bryant and Wallace (1980), Bernanke (1983), Diamond and Dybvig (1983), Williamson (1987), and Jacklin and Bhattacharya (1988). Banks transform short-term liabilities into long-term assets to satisfy the demands of both consumers and enterprises. Banks therefore depend on their ability to attract a continuous inflow of deposits and to recover loans from borrowers. Hence, the stability of a banking system depends on expectations about the continued solvency of the constituent parts of the system. A temporary decline in confidence can lead to a bank run, making intermediation difficult or impossible and investment financing hard to obtain; output suffers because of a suboptimal capital stock and limited opportunities for intertemporal substitution. Here simplifications and an emphasis on the long-run features of the model are accepted in order to concentrate on the special features characteristic of socialist economies in transition that are introduced into the model.[7]

The Basic Model

Time is discrete and indexed by t; time subscripts are dropped whenever ambiguity is not thereby created, and there is an infinity of

[6] See Hughes and Hare (1991) for a detailed analysis of how profitability was changed by the removal of distortions.

[7] In light of the persistent disturbance observed in Eastern Europe in recent years, the attention devoted here to "equilibrium" may appear odd. However, an understanding of the equilibrium is essential as a reference point for the disrupted system discussed later.

periods. All agents are sufficiently small so that each takes prices and the behavior of others as unaffected by his or her own decisions. A cohort, of constant size, is born each period and lives for two periods. The young receive an endowment, $E_t = aE_{t-1}$, $a > 1$, of the investment good, and may inherit any financial assets of past generations that have not been disposed of. Only the old consume.[8]

Each unit of the endowment can be converted into K units of the consumption good or sold to firms. Thus, the investment good is an input that may even be interpreted as labor.[9] Neither the investment nor the consumption good can be stored as inventory. The consumption good has a price, p, and the investment good costs q per unit. An investment of I yields sI units of the consumption good after one period, and SI units after two periods, but has no immediate liquidation value. It is interesting to concentrate on the case where $S > K > s$, $S > 1$. The capital stock depreciates entirely after two periods. A government absorbs G_t of the consumption good, where G_t is a fixed proportion, $\gamma < 1$, of the final consumption in the economy in any period.[10] Government consumption is financed by seigniorage, which adds ΔM_t to M_t, the stock of outside money at the start of the period.

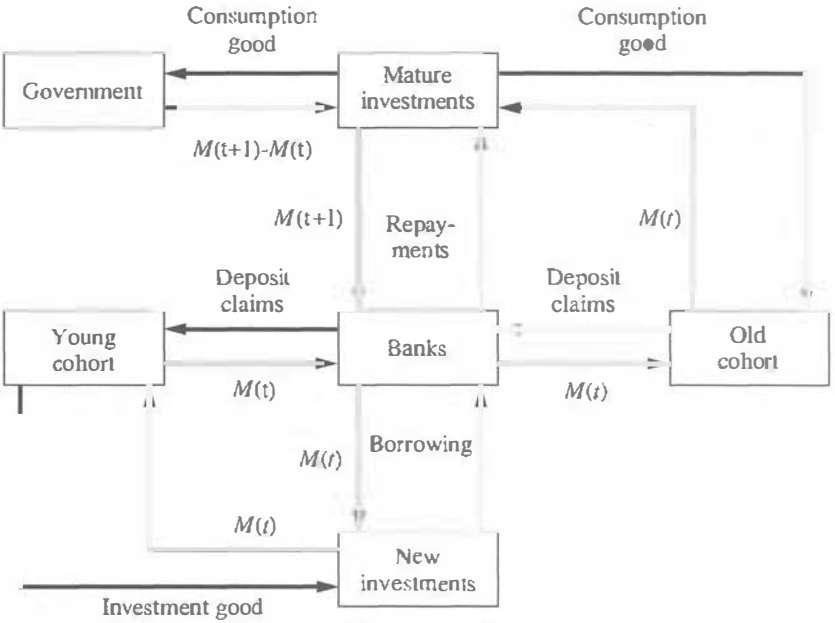
Banks provide an intermediation service that transforms short-term savings into long-term investments. They hold cash and loans to firms as their assets, and their liabilities consist of nontradable demand deposits. Note that by the time the investment matures, an individual who was alive when it was undertaken is dead. Individuals can only hold cash or deposits as stores of value, and no individual can "go short" in any asset. In notation, banks in period t lend an amount, B, to firms, which promise to repay LB at time $t + 2$ if they are able. The loan is "callable," in that the bank can demand its money back after one period; if all banks call in the loans of a firm, they share, at most, the liquidation value of the firm. A deposit made at time t can be redeemed at $t + 1$ with a gross yield, R, if the bank is not in financial difficulties; if a bank cannot honor all

[8] Relaxation of this assumption and allowing for intertemporal substitution in consumption introduces complications that could be addressed in further research.

[9] The means of direct conversion of the investment good into K units of consumption goods can be thought of as an alternative production process taking place in the kitchen garden.

[10] None of the results below depend importantly on this specification of the government's expenditure rule. Note that in purely theoretical terms the introduction of government expenditure is not explicitly related to the need to provide a public good or to the need to correct any market failure, and only provides an easy route for increasing money supply in the model over time. Without an increasing money supply, the expanding economy would experience continuous deflation.

Figure 1. *Flow of Funds*



claims, its creditors divide the available resources in proportion to their claims. All transactions in the goods market are conducted in cash.[11]

In each period the goods and financial markets operate according to the following pattern: banks may lend what cash they initially have on hand to firms, which are then able to buy the endowment from the young for investment; the young may deposit their income with the banks, which are then able to meet withdrawals of deposit plus interest by the old; the old and the government buy the output of firms (and any of the consumption good directly provided by the young), so firms receive the cash with which to repay loans to the banks. If all goes well, banks will have cash on hand at the start of the next period. The pattern of transactions in the economy is depicted in Figure 1.

Two Equilibria

One Nash equilibrium of this economy, termed the "good" equilibrium, is characterized by successful, sustained intermediation. Prices

[11] The quantity of cash outstanding is demand determined.

are flexible. Each period the banks begin with a stock of money, M_t, which they lend to firms to buy the endowment; the entire money stock is spent purchasing the quantity of the investment good, E_t, which must, by an accounting identity, achieve a per unit price of $q_t = M_t/E_t$. The young deposit M_t with banks, confident that their deposits are safe. The banks can then pay out M_t on deposits to the old, who, along with the government, buy the output of mature investments made two periods ago. Output is $C_t = SE_{t-2}$, of which the government buys a share, γ. Since consumers spend M_t on the purchase of $(1 - \gamma)C_t$ of the consumption good, its price must be

$$p_t = \frac{M_t}{(1 - \gamma)SE_{t-2}}.$$

The young have no incentive to convert their endowment directly into the consumption good, provided that $p_tK < q_t$. Given p_t, government consumption, $G_t = \gamma SE_{t-2}$, and the government's budget constraint, $\Delta M_t = p_tG_t$, it is easy to establish that $M_{t+1} = M_t + \Delta M_t = M_t/(1 - \gamma)$, and $p_{t+1} = p_t/a(1 - \gamma)$.[12] Without government consumption supported by seigniorage, and with positive growth, the economy would experience continuous deflation. The government generates positive inflation in the economy whenever $a < (1 - \gamma)^{-1}$. Firms repay the banks with their earnings, $M_t + p_tG_t = M_{t+1}$, so banks will be liquid at the start of the next period. The banks can pay depositors and charge borrowers a nominal, one-period gross return of $R = 1/(1 - \gamma)$, while $L = M_{t+1}/M_{t-2} = 1/(1 - \gamma)^3$, and the real gross return per period equals the growth factor, a.

Cash—that is, "outside" money—may seem to play a minor role in the model, because all equilibrium transactions could as well be conducted by check and only banks are motivated to hold cash from period to period. However, the availability of cash as a store of value will be important in other possible equilibria or when the economy is in transition between equilibria.

Another Nash equilibrium exists, termed the "bad" equilibrium, characterized by autarky and the absence of intermediation and, therefore, of investment. Each period, the young all convert their endowment into the consumption good, which is bought by the older cohort using their cash holdings. The available supply of the consumption good each period is KE_t, of which the government consumes γKE_t. Since the old spend

[12] Note that the government determines its desired consumption and is then a price taker.

their entire wealth on the consumption good, their budget constraint implies that

$$p_t = \frac{M_t}{(1-\gamma)KE_t}.$$

None of the endowment is left over for investment. The young use only cash as a store of value, and there is no intermediation.

In a Nash equilibrium, no individual wishes to deviate, given the behavior of others. Suppose that an individual decides at time t to deposit his or her earnings with a bank, which then would be able to lend to firms to purchase some of the investment good. Taking the price level as given, if everyone else holds cash and, at $t + 1$, the endowment will again be converted into the consumption good, the individual who placed his or her money on deposit will receive a gross return of, at most, $p_{t+1}s$ next period. The reason is that to honor the individual's claim, the bank will have had to call in its loans early, and real investments will have to be liquidated prematurely. But bank deposits will be dominated by cash when $p_tK > p_{t+1}s$. If inflation is not too high, no individual will be motivated to break the autarkic equilibrium, and banks never have any liquidity to lend to firms; the "bad" outcome is a Nash equilibrium. Because investments are long term, confidence in banks depends on the soundness of their portfolio of existing loans and assets, not on the long-term potential profitability of new investments.

Notice that, as long as $(1-\gamma)S > Ka^2$, direct conversion of the investment good into the consumption good is sufficiently inferior to its conversion through the technology in the firms, and, therefore, just two possible Nash equilibria are possible: the intermediated economy and the autarkic economy. Suppose that there were a third equilibrium that stands between the other two. Every period the young hold back a fraction, Φ, $0 < \Phi < 1$, of their endowment to convert directly into the consumption good and to sell to the old generation. Output from mature investments is $(1-\Phi)SE_{t-2}$, and the young provide a further ΦKE_t of the investment good. Setting expenditure by the old cohort divided by the quantity they consume equal to price yields

$$p_t = \frac{M_t}{(1-\gamma)[(1-\Phi)SE_{t-2} + \Phi KE_t]}.$$

Firms, having borrowed M_t, buy up the residual supply of the investment good, implying a unit price of $q_t = M_t/[(1-\Phi)E_t]$.

An individual young person must have no incentive to change his or her behavior, taking prices and the behavior of others as given, for this to be an equilibrium. Individuals choose the share, $1-\phi$ of their endow-

ment to sell to firms and the share, ϕ, to convert directly into the consumption good so as to maximize their income, $(1 - \phi)q_t + \phi K p_t$. If an equilibrium obtains, $\phi = \Phi$. Because the problem is linear, an interior solution with $0 < \phi < 1$ requires $q_t = Kp_t$.[13] Substituting the expressions for q and p and rearranging, we obtain

$$\phi = \frac{(1 - \gamma)S - Ka^2}{(1 - \gamma)S - Ka^2 - (1 - \gamma)Ka^2}.$$

But by assumption, $(1 - \gamma)S > Ka^2$, so $\phi > 1$, which is impossible. Hence, there is no third equilibrium. With the available technology favoring long-term investment, the young have an incentive to supply as much of the investment good as possible if the banking system is operational.

Subsidies, Monetary Overhang, and Suppressed Inflation

It is widely accepted that the socialist economy of Eastern Europe had evolved into a system of rationing, controlled prices, and subsidization through the financial system. In this subsection a representation of such a system, which is fully intermediated by a banking sector, will be developed.

Banks start some period, t, with M_t, which they lend to firms at a two-period rate of interest, L. Firms receive in addition a "quasi-fiscal" subsidy, $\pi_1 M_t$, from the monetary authority, and use their combined liquidity to bid for the investment good, the price of which is flexible; in equilibrium, price equals expenditure divided by quantity, so

$$q_t = M_t(1 + \pi_1)/E_t.^{14,15}$$

With a positive interest rate on deposits, $R > 1$, the young prefer to place their cash income with the banks, which are therefore able to meet withdrawals by the older generation. To determine the rate of interest on deposits, it is assumed that the banks must have just enough cash on hand to meet all potential withdrawals. The current old generation deposited

[13]This concept of an interior solution will be useful later.

[14]Subsidies are not fully motivated within the model, but they may be the product of a political process that favors seemingly generous rewards to factors of production. One may think of q_t as the wage rate that is continually raised despite the absence of productivity gains or an elastic supply of consumption goods.

[15]Taxes have not been introduced in the model to preserve its simplicity. Without taxes there is no possibility of modeling more conventional types of subsidies—for example, payments directly from the budget. Introduction of such subsidies, however, only strengthens the results reported in this paper.

$M_{t-1}(1 + \pi_1)$ in period $t - 1$, which has since grown by a factor, R; the bank now holds $M_t(1 + \pi_1)$ in liquid form; hence, with a constant rate of subsidization the interest rate just equals the rate of growth of money supply from period to period:

$$R = M_t(1 + \pi_1)/M_{t-1}(1 + \pi_1) = M_t/M_{t-1}.$$

The price of the consumption good is fixed artificially low at $\hat{p}_t$, which is always below the market-clearing price. The government still buys a fraction, γ, of the available supply, SE_{t-2}, of consumer goods at the low price. Hence, the money supply must be increased by an additional amount, $\hat{p}_t\gamma SE_{t-2} = \pi_{0t}M_t$, to finance public consumption. The supply of the consumption good in the market for the old is rationed, and therefore they cannot spend all their wealth; they need actually withdraw only $\hat{p}_t(1 - \gamma)SE_{t-2}$ from the banks to make what purchases they can. Their remaining deposits are bequeathed to the young of period t. Firms earn $\hat{p}_tSE_{t-2}$ in revenues with which to repay banks their debt-service obligations, LM_{t-2}. The banks end the period with cash holdings of $M_t(1 + \pi_{0t} + \pi_1) = M_{t+1}$.[16]

A few features of this economy with subsidies to firms and suppressed inflation are noteworthy. First, the input market is not rationed and $q_t/q_{t-1} = (1 + \pi_{0t-1} + \pi_1)/a$, so the price of the investment good inflates as long as the money supply grows faster than the endowment.

Second, were there no rationing in the goods market, the market-clearing price would be given by

$$p_t^* = \frac{(1 + \pi_1)M_t}{(1 - \gamma)SE_{t-2}}.$$

Thus, the market-clearing price also grows at the same rate as the input price. A natural definition of suppressed inflation is

$$\frac{p_t^*}{\hat{p}_t} = \frac{\gamma(1 + \pi_1)}{(1 - \gamma)\pi_{0t}}.$$

Thus, if $\hat{p}_t$ is not adjusted by an average factor of $[1 + \pi_{0t-1} + \pi_1]/a$ per period, seigniorage as a share of the outstanding money stock approaches zero, and the degree of suppressed inflation becomes infinitely large. A very large degree of suppressed inflation encourages black markets and

[16]Note that here seigniorage supports two different policies, namely subsidies to firms and government consumption. The part of seigniorage that supports government consumption, $\hat{p}_tG_t$, is given to firms in exchange for goods when the goods market meets at the end of the period and accounts for the growth in money supply during the second half of the period from $M_t(1 + \pi_t)$ to M_{t+1}.

threatens a sudden collapse into the autarkic mode, with endowments being converted directly into the consumption good. If the system is to survive, controlled prices must be inflated. Henceforth, it will be assumed that $\hat{p}_t$ is indeed suitably adjusted and that π_{0t} is constant.

Third, the "forced" bequests by the older generation, which equal the excess of savings over expenditure

$$RM_{t-1}(1 + \pi_t) - \hat{p}_t(1 - \gamma)SE_{t-2} = M_t(1 + \pi_t) - (1 - \gamma)\pi_0 M_t/\gamma,$$

are a measure of the "monetary overhang," the excess liquidity that will put pressure on the goods market when prices are liberalized.

III. Immediate Response to Liberalization

Although the almost universal consensus is that liberalization will eventually lead to a sustained upsurge in economic activity in Eastern Europe, shifting economies from a socialist hierarchy to a market-based system will incur large costs. This section is concerned with one particular source of this nonmonotonicity of the dynamic response, namely the financial sector.

The banking system is assumed to have been decentralized and broken up into separate, relatively small banks at the beginning of the reform process. For clarity of exposition, we concentrate in turn on two important developments associated with the reform process: (1) the removal of price controls and subsidies, and (2) a decline in the rate of return on existing projects and a simultaneous introduction of superior technology that can be embodied in new projects.

Withdrawal of Price Control and Subsidies

Suppose that at the start of some period, t, the government decides to stop all subsidies and to liberalize prices. Then, as will be shown, a Nash equilibrium outcome is for the banks not to lend for new investments, the young to convert their endowment into the consumption good, all loans to be called in during period t, and output to fall drastically and recover slowly.[17]

Start with the old in period t. In an effort to purchase as much as possible of the consumption good, they will wish to withdraw the whole of their deposits, which amounts to a claim of $M_t(1 + \pi_1)$ on the banks.[18]

[17] The uniqueness of this equilibrium has not yet been established.

[18] A bequest motive could be introduced into the model; it is sufficient that the old wish to withdraw somewhat more than under the controlled-price regime for the model to generate a financial crisis.

But the banks certainly cannot have enough cash on hand, because the government has stopped the subsidy to firms and the entire supply of "outside" money is fixed at only M_t. In this sense, there is a rational bank "run." Each individual bank will try to generate liquidity to honor its obligations, first by eliminating lending at the start of the period to preserve its initial cash holdings, and then by calling in loans made in period $t - 1$.[19] The investments liquidated after one period yield an output of sE_{t-1}.

For every bank acting alone, it is wise to restrict lending and call in loans, but for the system as a whole the price level falls as the supply of the consumption good increases, so banks can never acquire enough liquidity. Indeed, from a global point of view the banks could lend to the firms at the start of the period and get back liquidity in the form of deposits from the younger generation, but each single bank is afraid that what it lends will end up as deposits with other banks.[20] Investment financing is unavailable at any price.

With no lending for investment, the young of period t see no demand for their endowment unless they convert it into the consumption good. Total supply of the consumption good in period t is

$$C_t = [SE_{t-2} + sE_{t-1} + KE_t],$$

made up of the output of mature investments, liquidated early investments, and the transformed endowment. The old have benefited from the transformation of capital into consumables, but there is no capital left to produce the consumption good in periods $t + 1$ and $t + 2$.[21] The budget constraint of the old determines the price of the consumption good as

$$p_t = \frac{M_t}{(1-\gamma)C_t} = \frac{M_t}{(1-\gamma)[SE_{t-2} + sE_{t-1} + KE_t]}.$$

Note that the consumption good is certainly priced below what it would be, given the money supply, in the baseline equilibrium with successful intermediation, because its supply has temporarily increased. It is quite possible, however, for p_t to be substantially above $\hat{p}_{t-1}$, the previous administered price.

Income from the sale of the consumption good is split between the young generation and the firms, which use their share to repay banks as much as they are able. Due to government consumption of γC_t, continued

[19] Firms are assumed to have de facto limited liability.

[20] In this context, the assumptions that the system faces a unique shock and that banks and enterprises are each relatively small suggest that the coordination failure cannot readily be overcome by renegotiation.

[21] The consumption binge would be less if intertemporal substitution were possible.

seigniorage raises the money stock to $M_{t+1} = M_t/(1 - \gamma)$. The young of period t deposit their cash income

$$p_t KE_t = \frac{M_{t+1} KE_t}{C_t},$$

with the banks at the end of period t in exchange for a promise of M_{t+1} next period; the offer of a positive nominal return ($R_t = C_t/KE_t$) makes depositing with the banks superior to storing wealth as cash.

The banks start period $t + 1$ with a total of M_{t+1} in cash, no loans outstanding, and liabilities to the period t cohort. A Nash equilibrium is for the banks to lend their cash to new firms, which purchase part of the $t + 1$ cohort's endowment. The young redeposit this cash with the banks, allowing withdrawals to be met in full.

Equilibrium in the goods markets is achieved at an interior solution; the young are indifferent between selling their endowment to firms and converting it into the consumption good and selling it to the old. If, say, $q_{t+1} > p_{t+1}K$, the young would wish to sell all their endowment to the firms, but then the old would bid up the price of the consumption good, for otherwise they would obtain nothing. If $q_{t+1} < p_{t+1}K$, the young would convert all their endowment into the consumption good, but then firms would bid for them not to do so. Hence, the condition for equilibrium is the interior solution, $q_{t+1} = p_{t+1}K$. The new price of the input relative to the output price is lower than at market-clearing levels in the socialist economy or in the successfully intermediated economy, and even lower than the input price relative to the old administered output price.

Consider, first, the behavior of households. Let the $t + 1$ cohort reserve a proportion, Φ_{t+1}, of their endowment to convert into the consumption good and sell to the old cohort and government. There is no capital stock inherited from previous periods, so the supply of the consumption good is just $C_{t+1} = \Phi_{t+1} KE_{t+1}$. With the government purchasing a fraction, γ, of the supply of the consumption good, equilibrium prices are

$$p_{t+1} = \frac{M_{t+1}}{(1 - \gamma)\Phi_{t+1} KE_{t+1}},$$

and

$$q_{t+1} = \frac{M_{t+1}}{(1 - \Phi_{t+1})E_{t+1}}.$$

Using the condition for an interior solution yields $\Phi_{t+1} = 1/(2 - \gamma)$. Note that $p_{t+1} > p_t$, because the supply of consumption goods has shrunk, owing to the lack of productive investment and the conversion of only

some of the endowment into the consumption good. Period $t + 2$ is similar because as yet there is no mature investment and the banks have no incentive to call in loans made at $t + 1$.

The young of period $t + 1$ receive the full money stock, $M_{t+1} + \Delta M_{t+1} = M_{t+2}$. Banks will be able to offer only a zero nominal rate of interest because withdrawals during $t + 2$ will be made before the government injects new money; the young obtain a real rate of return on deposits of $1 - 1/(1 - \gamma)a$, which could well be negative. If the young hold their wealth as cash the economy will fall into the bad equilibrium without intermediation. Here it will be assumed that bank deposits offer some small nonmonetary advantage over holding cash.

In contrast, firms borrow M_{t+1} at the start of period $t + 1$, which they repay with their earnings, $p_{t+3}S(1 - \Phi_{t+1})E_{t+1}$, two periods later. Inverting the expression for p_{t+1} to solve for M_{t+1}, and using the expression for Φ_{t+1} given above allows one to show that the real return on the investment is S/K, where the consumption good is the numeraire. Hence, by the zero-profit condition firms face a positive real borrowing rate and, in normal circumstances, positive nominal rates. The term structure steepens and lending and deposit rates diverge.

In subsequent periods, $t + 2 + i$ ($i = 1, 2, \ldots$), there is some production, $(1 - \Phi_{t+i})SE_{t+i}$, from investment in period $t + i$. The $t + 2 + i$ cohort reserves a fraction

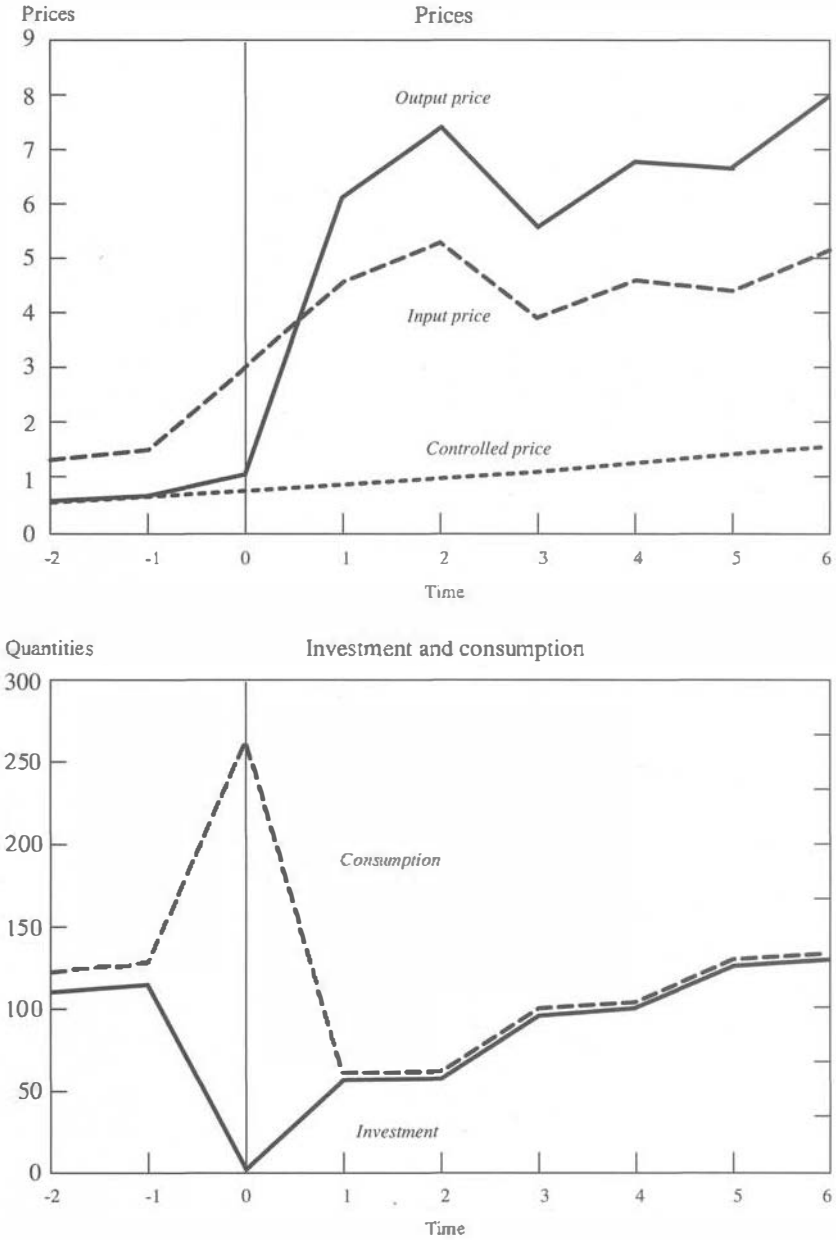
$$\Phi_{t+2+i} = \max\left[0, \frac{1}{2 - \gamma} - \frac{(1 - \gamma)(1 - \Phi_{t+i})S}{(2 - \gamma)Ka^2}\right],$$

of its endowment to be converted into the consumption good. Slowly, output and investment recover as the successful, intermediated equilibrium is approached. Recovery may be protracted, and for certain parameter values oscillations may be induced. The relative price of the input remains at $q/p = K$, below its long-run equilibrium level, so long as Φ_{t+2+i} remains greater than zero.

An example of the behavior of the economy after the withdrawal of price controls and subsidies is shown in Figure 2.[22] Investment collapses and recovers only slowly and with fluctuations following the removal of controls at $t = 0$. After an initial surge, consumption is restricted by the limited supply, which in turn induces the young of each period to convert part of their endowment into the consumption good. Inflation is sharp but variable as the new long-run equilibrium is slowly approached.

[22] Figure 2 is based on the param eterization of the model: $a = 1.04$; $S = 1.20$; $s = 0.15$; $K = 0.85$; $\gamma = 0.18$; $\pi_0 = 0.09$; $\pi_1 = 0.10$; and $\hat{p}/p^* = 0.40$. Figure 3, which follows below, is also based on this parameterization.

Figure 2. *Effects of Removing Price Controls and Subsidies*



Note that it is the combination of liberalizing prices and stopping subsidies after a history of repressed inflation that generates these fluctuations in output and prices. Suppose that the government continued to dictate $\hat{p}_t < p_t^*$ and ration the consumption good, but firms lose their subsidies. Then firms would not be able to service all their debts. But a banking collapse need not be triggered by this one-off capital loss, because the old have no incentive to withdraw more than what they can spend, namely, an amount, $(1 - \gamma)\hat{p}_t SE_{t-2}$. Alternately, if subsidies had continued but the price of the consumption good was freed, firms would still buy the endowment of the young, the banks would have enough cash in hand to meet the demand for withdrawals, and firms could service their debts. The costs of such an inflationary accommodation are not addressed in this model.

However, even if subsidies had been absent, price liberalization leads to a banking collapse when there are index-linked returns on deposits. Deposits denominated in foreign currencies, which were common in many countries of Eastern Europe, become index-linked deposits with the pursuit of devaluation in line with inflation. When prices are liberalized, the price level moves up, and the nominal claims on banks increase equiproportionately, but the available liquidity is limited. Banks' efforts to meet demand for withdrawals will again lead to a collapse of investment and the calling in of existing loans.

If there are strong microeconomic and political grounds for the speedy removal of price controls and subsidies, financial policies may be devised that in effect slow the impact of the transition on the financial sector. Writing off most pre-existing liabilities would free enterprises and banks from obligations that they could not meet, but the old cohort would be left with nothing, and the economy would fall into the bad equilibrium without intermediation. Within the confines of the model presented here, a more promising solution would involve the expropriation of part of the deposits of the old by a partial suspension of convertibility of the deposit claims of the old cohort. Banks would suffer a capital loss, but they would still acquire enough liquidity from new deposits by the young to meet their obligations, and so they would not have to restrict lending or call in loans. However, in a more elaborate model, such a betrayal of people's confidence in the banking system may have long lasting effects on the reputation of financial institutions and the government. A nearly equivalent, but more subtle, policy would provide a transfer of $\pi_1 M_t$ to the banks, so that they could meet their short-term obligations, at the cost of further inflation; again, this solution will not be effective if banks have index-linked liabilities.

A temporary tax on the consumption good may be a useful adjunct to

direct intervention in the financial system. Besides discouraging the direct conversion of the endowment into the consumption good, such a tax would reduce nominal demand and slow inflation, thus limiting banks' index-linked liabilities and generating revenue for government. However, enterprises would then not receive sufficient revenue to make all loan repayments due in periods t and $t + 1$, so further relief for this purpose might be needed to keep the system operating.

Divergent Movements in Returns on Existing and New Capital

In order to concentrate on real rather than monetary disturbances, the peculiar features of socialist economies, such as fixed prices and permanent subsidies, will be ignored here. Consider the "flexprice" economy where intermediation is successful and sustained, with a good equilibrium as described in Section II. At the end of period t the firms are due to repay $M_{t+1} = p_t S E_{t-2}$ to the banks, having borrowed M_{t-2} in period $t - 2$ to finance the now mature investments.

Suppose now that the economy suffers a temporary negative real shock at t that reduces the productivity of existing capital (that is, capital maturing in periods t and $t + 1$) from S to S'; the productivity of new investment rises permanently to S'', $S'' > S$.[23] For a small disturbance, no capital is liquidated and the entire endowment continues to be invested each period; the price level at t and $t + 1$ would rise to offset the fall in S and firms would have enough revenue to meet their (nominally defined) liabilities; the price level will fall relative to that after period $t + 1$; the ex post real interest rate will fall and then briefly rise; the entire adjustment effort is borne by current generations.

A large decline in productivity is qualitatively different. If S' is sufficiently low, the rise in the price of the consumption good alters the behavior of the young of periods t and $t + 1$. Once the young start converting some of their endowment into the consumption good, less of the investment good will be available to take advantage of the improved productivity of new capital. Furthermore, firms will not receive enough revenue to meet their obligations, and so banks will call in some loans prematurely. Although consumption immediately increases, the capital stock is eroded and consumption is reduced for several periods into the future. The source of these large and persistent effects is the presence of long-term contracts between banks and firms and the durability of capital.

[23]It is easy to construct other scenarios where the productivity of even new investments is low during some transition period.

Specifically, assume that the government continues to purchase a fraction, γ, of the output of the consumption good. In period t the young reserve a proportion, Φ_t, $0 \leq \Phi_t \leq 1$, of their endowment to convert into the consumption good at rate K. Only $(1 - \Phi_t)E_t$ of the endowment is invested. As will become apparent, firms cannot generate enough revenue to repay all debts, even when all investments made in period $t - 1$ are liquidated. Then banks, acting individually, will demand the maximum repayment, even if they have to close down firms. Since firms invested E_{t-1} in period t, the liquidation of these immature investments yields sE_{t-1}. By assumption, the investment of $(1 - \Phi_t)E_t$ made at the start of the period has no resale value or is undertaken by new firms. Hence, the total supply of the consumption good is $C_t = \Phi_t K E_t + S' E_{t-2} + sE_{t-1}$. Deposits by the young allow banks to meet their obligations, M_t, to the old cohort. Prices are determined by equating financing to nominal expenditure:

$$q_t = \frac{M_t}{(1 - \Phi_t)E_t},$$

and

$$p_t = \frac{M_t}{(1 - \gamma)[\Phi_t K E_t + S' E_{t-2} + sE_{t-1}]}.$$

In order for an equilibrium to obtain at an interior solution, the young must be just indifferent between selling their endowment of the investment good and converting it into the consumption good, which occurs when $q_t = Kp_t$. Again, the relative price of the investment good falls. Using the expressions for p_t and q_t and the fact that $E_t = aE_{t-1} = a^2 E_{t-2}$, it can be shown that

$$\Phi_t = \frac{Ka^2 - (1 - \gamma)(S' + sa)}{(2 - \gamma)Ka^2},$$

if an interior equilibrium exists. Certainly, $\Phi_t < 1$, and $\Phi_t > 0$ if

$$Ka^2 > (1 - \gamma)(S' + sa).$$

If this last inequality is not met, the "kitchen garden" technology is so inefficient that the young do not have an incentive to convert any part of their endowment; p_t rises enough that firms obtain enough cash to repay their debts without liquidating any immature investments; the transition through the periods of low productivity and on to the periods of higher productivity is quick.

If, however, the real shock is large, its effects will be long lasting and

complex. When $\Phi > 0$, it can be shown by substitution that production of the consumption good in period t will be

$$C_t = \frac{[Ka^2 + S' + sa]E_{t-2}}{(2 - \gamma)},$$

and, correspondingly, only $(1 - \Phi_t)E_t$ of the endowment is invested in the new technology despite its superior productivity. Since enterprises earn

$$p_t[S'E_{t-2} + sE_{t-1}] = M_{t+1} \cdot \left[\frac{S'E_{t-2} + sE_{t-1}}{\Phi_t K E_t + S'E_{t-2} + sE_{t-1}}\right],$$

but have obligations of M_{t+1}, they are insolvent even after the liquidation of all their investments if $\Phi_t > 0$.[24]

In period $t + 1$ no mature capital is left to produce the consumption good, so its entire supply is generated by converting the endowment; it can be shown that in equilibrium, $\Phi_{t+1} = 1/(2 + \gamma)$.[25] Output increases somewhat in period $t + 2$ because limited investment occurred in period t and because productivity has increased to S'', but it is possible that some of the endowment will still be used for consumption. Subsequently, the economy can take many periods to return to maximum investment and consumption despite the improvement in technology. Because investments are long term whereas the shock results in the liquidation of capital of all vintages, recovery need not be monotonic; rates of investment, output, and relative prices may fluctuate as they converge toward their new equilibrium paths. The real interest rate charged to borrowers jumps at period t, but the rate to depositors falls; convergence occurs as long-term equilibrium is re-established.

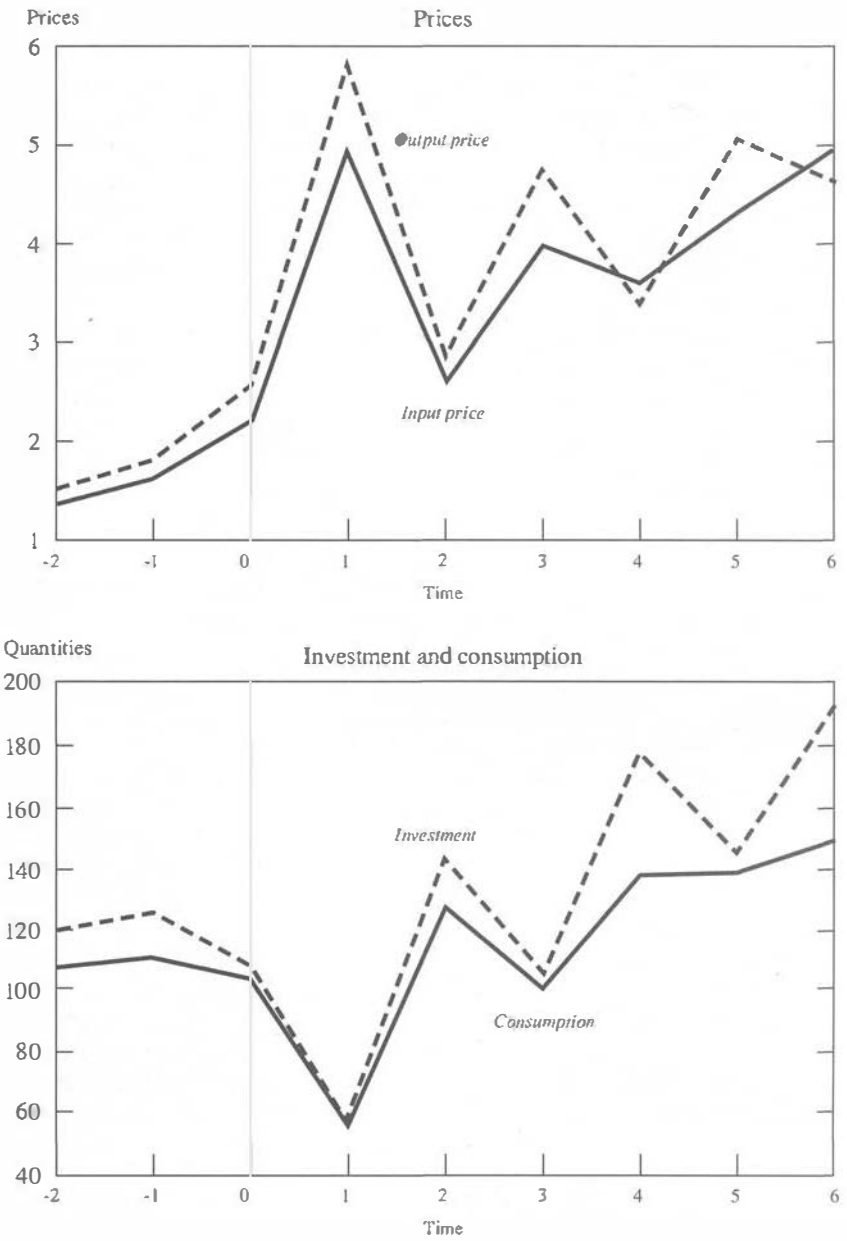
The equilibrium reaction of the economy to a large real shock is illustrated in Figure 3.[26] The decline in the return on existing capital occurs at $t = 0$. The various sectors do not respond by accepting a brief reduction in consumption and maintaining investment; rather, the impact of the shock on consumption is delayed but magnified and perpetuated by the uncoordinated actions of banks, firms, and the sequence of consumers. Disturbances to relative prices induce some of the endowment to be used for immediate consumption, and investment is correspondingly lower.

[24] If banks held callable term deposits, there would be a bank run.

[25] Note that the investments undertaken at t are not liquidated already at $t = 1$; banks have no incentive or grounds to call in loans early, and the behavior of p_{t+1} and p_{t+2} is assumed to be such that the investing firms do not volunteer to produce early.

[26] Figure 3 is based on the additional parameters, $S' = 0.70$, and $S'' = 1.40$.

Figure 3. *Effects of a Large Real Shock*



A transitory real disturbance with persistent effects presents, in some ways, a more complex policy problem than the removal of subsidies and price controls. Policy needs to be directed both toward the rapid attainment of a good long-run equilibrium, and the optimal degree of consumption smoothing. An unavoidable real cost has to be borne, and the intergenerational distribution of this cost is essentially a political issue.

It is always possible to subsidize the purchase of the input so much that $q_t > Kp_t$, and the young have no incentive to convert any of their endowment into the consumption good.[27] Investment is equal to the endowment each period, and no capital is liquidated prematurely; those who consume in periods t and $t + 1$ make the maximum effort on behalf of future generations. A smoother path of consumption can be achieved if some of the endowment is not invested. Such behavior can be induced by setting $q_i = Kp_i$ after net taxes, and ensuring that firms have the revenue to service their debts in $j = t$ and $t + 1$.[28] It can be shown (see Hardy and Lahiri (1992)) how a subsidy on the investment good can be "tuned" to determine the proportion of the endowment converted.

The model has only one final good and one input, and the scope for improving allocation is restricted to the choice of only a few technologies; nor does the model take into account the possibility of intertemporal substitution of consumption by an economic agent. It also abstracts from the issue of allocation of inputs to the production of alternative consumer goods as well as the distinction between efficient and inefficient state firms. We conjecture that the broad outline of the results will survive even if greater substitution possibilities across both time and goods and heterogenous firms are introduced into the model.

IV. Conclusion

The model developed in the last two sections, although abstracting from many institutional and economic complications, clarifies the role of banking in centrally planned and emerging market economies and the nature of the problem associated with bank insolvency in these economies. Bank insolvency in Eastern Europe is not a product of malfeasance on the part of bank officials in the past but the result of a radical change in the economic environment in the countries concerned. In the short run, it is not the outstanding stock of nonperforming loans

[27]Taxing the consumption good in period t is not useful because it removes revenue from enterprises.

[28]If, as assumed here, $K > s$, converting some of the endowment into the consumption good is more efficient than liquidating immature investments.

but the discrepancy between the cash inflows and outflows that jeopardizes the system of financial intermediation and may even lead to a financial collapse.

Policies to sustain the liquidity and solvency of banks would allow investment to continue and prevent the liquidation of firms that generate positive value added; at the same time, incentives and regulations need to be established that stop the self-perpetuation of past misallocations. In this paper we cannot hope to resolve the debate over the best combination of additional taxes and reduced expenditure, and eventually privatization receipts, that will generate the resources needed to mitigate the flow problem associated with the weakness of banks' balance sheets. Part of the cost of adjustment can be shifted forward to future generations by, first, not seeking to maximize investment in the short run, and, second, by borrowing abroad, as part of a comprehensive financial program. The monopolistic structure of the banking industry and the interlocking interests among enterprises and banks in Eastern Europe tend to strengthen the case for a gradual approach.

In this context, experience in other countries shows that immediate and total decontrol of the financial sector far in advance of reform in other sectors may have severe negative consequences.[29] The unintended consequences of financial liberalization in such countries as Argentina, Chile, and Uruguay during the late 1970s and early 1980s should not be allowed to revisit Eastern Europe a decade later.

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[29] See Diaz-Alejandro (1985) and Villanueva and Mirakhor (1990) for a discussion of the theoretical reasons as well as empirical experience with strategies for financial reforms. Cho and Khatkhate (1989) provide a detailed analysis of the lessons of financial liberalization in Asian countries.

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