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Abstract:

The large and widening gap between economic performance in Eastern European transition economies and those of the former Soviet Union has been dubbed "the Great Divide" by Berglof and Bolton (2002). This paper provides a rationale for the gap based upon the concept of financial repression. The magnified effects of transition to the market can be attributed to the government manipulation of financial markets in these countries, with the divide defined by the length of time that governments relied upon financial-market manipulation to finance government fiscal policy.

Policies undertaken to assist in financing government expenditures caused financial repression and financial fragmentation, to use the terms introduced by McKinnon (1973). After an introductory section, I introduce a theoretical model of real and financial sectors in transition. The dynamic path to equilibrium from transition is derived. It is shown to have a tendency toward output contraction and hyperinflation when government policies promote financial repression. In the third section this hypothesis is examined with macroeconomic data from Ukraine for the period 1992 - 2001. These data are consistent with the hypothesis, although other factors (e.g., recession in trading partners) are also shown to be important.

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I. Introduction.

The formerly planned economies of Eastern Europe and the Soviet Union have presented in the last fifteen years a historic experiment in transition from planned to market economies. While a transition period was expected before the sum of the parts once again equaled -- and then surpassed -- the previous whole, this period was expected to be short. In fact, the transition has been costly, painful and prolonged for the citizens of these countries. The downturn in the formerly Soviet states reached 55 percent on average of its initial production in 1990, and a decade after the transition began remains 60 percent below the initial level.[1] In the German hyperinflation observed after World War I there were only two years (1922 and 1923) in which consumer price inflation exceeded 1000 percent.[2] In the formerly Soviet economies inflation was in excess of 1000 percent per annum in the three consecutive years of 1992-1994. Clearly, this has been contraction and inflation with a vengeance.

In a recent survey article, Berglof and Bolton (2002, hereafter BB) identify a "great divide" among transition economies. On one side of the divide are the Czech Republic, Hungary, Poland, Slovenia and the Baltic nations. In these countries, "economic development has taken off". On the other side are found Bulgaria, Romania, and the non-Baltic countries of the former Soviet Union. These countries are characterized by "a vicious cycle of institutional backwardness and macroeconomic instability".[3] While the authors note a convergence in "financial architecture" in the countries on the right side of the Divide, they argue that financial-sector policies themselves do not distinguish the two groups. Rather,

> "the ability of governments of transition economies to enforce contracts and to achieve fiscal and monetary responsibility, together with a commitment to refrain from excessively bailing out failing banks or loss-making enterprises, determined whether economic *and* financial development took off." Berglof and Bolton (2002, p. 78), italics in original

The logic of this statement is compelling, but I will argue in this paper that financial-sector policies are in fact at the heart of this logic. The missing link in the analysis is summarized in the McKinnon (1973) concept of financial repression adapted to the structure of the transition economy. Fiscal and monetary irresponsibility interacts with excessive control over the interest rates offered by deposit-taking financial intermediaries to discourage saving. Low rates of saving perpetuate the slow-growth equilibria observed on the wrong side of the "Great Divide".

Section II defines financial repression and financial fragmentation.. A simple theoretical model exhibiting these features is presented in section III. Ukraine is singled out by BB as being positioned on the wrong side of the "Great Divide". The observed record of output, inflation and

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[1] This is an unweighted average of data from World Economic Outlook, IMF (various issues). Russia is by far the largest state among the fifteen, and these characteristics hold for Russia as well.

[2] Sargent (1986, p. 81).

[3] These quotes are taken from Berglof and Bolton (2002), p. 77.

financial-asset holding in Ukraine is examined in section IV and is shown to be consistent with the financial-repression hypothesis. Finally, section V concludes.

II. Illustrating the Great Divide in the Economic Transition.

There have been three phases in the economic transition.[4] The timing differs by group of countries. For the former Soviet economies the first phase lasted from 1991 to 1994, and during that period measured output collapsed to only 50 percent on average of its 1990 level.[5] Inflation surged, leading to three consecutive years of inflation rates greater than 1000 percent per annum on average. The second phase, from 1995 to 1997, was one of stagnation in output, as average gross domestic product remained nearly constant. However, inflation rates were brought down to near-single digits on average. The third phase from 1997 to the present has been one of volatility, with rapid growth in some years punctuated by crises in others: this is exemplified by the Russian financial crisis of 1998.

The Great Divide is illustrated in Figure 1 by creating an unweighted average of production in the groups of countries, and then creating a production index with 1990=100 consistent with that unweighted average. BB identify two groups of countries on the right side of the Divide. The first group is drawn from Eastern Europe: Czech Republic, Hungary, Poland and Slovenia (CHPS) experienced a substantial downturn in the early years of the 1990s, but recovered steadily in the following years.[6] By 2001, these countries were on average at higher levels of production than were recorded in 1990. The Baltic countries of Estonia, Latvia and Lithuania are also characterized by BB as being on the right side on the Divide. As Figure 1 illustrates, these countries experienced much larger declines in output during the 1990s. However, by 1994 positive growth had reasserted itself on average. Except for a minor downturn in 1999, the trend has been uniformly upward since 1994. BB characterize the non-Baltic countries of the former Soviet Union as being on the wrong side.[7] The decline in output lasted longer in these countries, on average, with output declining until 1996. The rebound since then has been less pronounced, leaving output over 30 percent below its 1990 level on average in 2001.

The Great Divide of BB -- CHPS and Baltics on one side, non-Baltic FSU on the other -- is even more evident in the record on inflation in these countries. Figure 2 illustrates the percentage change in consumer prices in the period 1996-2001. The inflation rates in the countries on the right

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[4] Conway (2001) documents these trends in great detail.

[5] The averages cited are unweighted averages over the 15 countries. The data are drawn mainly from the World Economic Outlook of the IMF, with complementary sources used when necessary.

[6] In the early years of the decade, neither the Czech Republic nor Slovenia were separate countries. I created the averages reported here by (1) using the growth rate for Czechoslovakia for the Czech Republic in 1991 and (2) excluding Slovenia in 1991 and 1992. Alternative representations do not change the basic pattern found in the data. The dip in output indicated for CHPS understates the real cost of transition for these countries because output reduction predated 1990. Even including this, however, the fall in output in the FSU countries, Baltic or non-Baltic, was more extreme.

[7] The authors focus upon Ukraine and Russia, also include Romania and Bulgaria among these countries. When that set of countries is considered, the message of Figure 1 remains substantially the same.

side of the Divide – CHPS and the Baltics – were already low in 1996 and fell still lower thereafter. The countries on the wrong side of the Divide – the non-Baltic FSU countries – were still on average battling inflation in 1996, and only by 2001 had the average inflation rate fallen to less than 20 percent per annum.[8]

BB provides measures as well of the financial development on both sides of the Great Divide, and Table 1 summarizes those measures. Russia and Ukraine are taken in this table to be indicative of the non-Baltic FSU countries, although they have more sophisticated financial markets in practice than those of the other non-Baltic FSU. In some areas, there are only minor differences in behavior on the two sides of the Divide: concentration ratios, importance of state-owned banks, and the bad-loan ratios are all roughly the same across the three groups. There are two strong indicators of the Divide, however. Credit to households and enterprises as a share of GDP is much higher in CHPS than in the Baltics, and higher in the Baltics than in Russia and Ukraine. The loan-deposit rate spread is also much different on the two sides of the Divide, with much lower spreads in CHPS and in the Baltics than in Russia and Ukraine.

The hypothesis of this paper is that the policy manipulation of financial institutions during the past decade has has been critical in causing and extending the poor economic performance of the transition economies. The argument is an application of the concepts of financial deepening and repression as formulated by McKinnon (1973). His argument, put simply, is that intermediation of the financial sector between savers and investors is crucial to sustained economic growth of an economy at or near its potential. In the absence of this intermediation, or in the absence of savers' confidence in the intermediaries, saving will be discouraged or ineffectively allocated. Both outcomes will reduce the economic activity of the economy.

III. A Theory of Financial Development, and Repression, during Transition.

The Great Divide has opened up, at least in part, because of the severe drop in production in the non-Baltic FSU countries. Explanations that rely upon fiscal and monetary profligacy, or upon excess subsidies to loss-making enterprises, are incapable in general of explaining this feature of the economies. In this section I provide a theoretical integration of the explanations of BB with the missing link -- repressive financial-market policies undertaken by transition governments. The hypothesis of this paper is that the budget-deficit explanations of the Divide must be combined with the effect of governmental interventions in the financial markets to lessen the budgetary cost of financing the deficits. The model of this section introduces explicitly the role of the financial repression so that the government's efforts to finance its deficit can be assessed. It abstracts from the investment decision of the enterprise; as will be seen below, it then provides a focused view of the importance of working capital to the production process.

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[8] The years prior to 1996 also illustrate the difference in experience, but cannot unfortunately be illustrated due to the extremes in scale. The CHPS countries by 1993 had an average inflation rate less than 30 percent, and this average fell to single digits by 1999. The Baltic countries had average inflation rate of 1000 percent in 1993, but were able to reduce this to single-digit inflation by 1997, as illustrated in Figure 2. The non-Baltic FSU countries, by contrast, had average inflation rates that peaked at 2500 percent in 1994. While the average rate declined thereafter, as Figure 2 illustrates the process had not by 2001 led to single-digit inflation.

Financial repression.
McKinnon (1973) defines his concept of financial repression as follows.

> Bank credit remains a financial appendage of certain enclaves: exclusively licensed import activities, specialized large-scale mineral exports, highly protected manufacturing, large international corporations, and various government agencies ...Even ordinary government deficits on current account frequently preempt the limited lending resources of the deposit banks. Financing the rest of the economy must be met from the meager resources of moneylenders, pawnbrokers and cooperatives. It is this phenomenon that I call financial repression. McKinnon (1973, p. 69)

He attributes this repression to regulated interest rate ceilings and collateral requirements. Financial fragmentation describes the economy in which the same transaction in loanable funds will take place at very different real interest rates for different groups within the economy due to the barriers to transactions between the groups. The equilibrium and adjustment path illustrated in this paper is simply an application of that concept to the transition economies.

Production.
The real side of the economy can be summarized quite simply.[9] There is productive capacity in the transition economy. Productive use of this capacity is dependent upon the availability of working capital as an input to the enterprise. For given supplies of the other inputs, the quantity produced y_t is increasing as ρ_t, the real cost of working capital, falls. The appendix provides a detailed exposition of such a model based upon the endogenous-degree-of-specialization model of Becker and Murphy (1992). Other specifications are possible to yield the same result: Roubini and Sala-i-Martin (1992) include the cost of credit in the (concentrated) production function, while Christiano and Eichenbaum (1992, 1995) follow Buffie (1984) and van Wijnbergen (1983) in including a cash-in-advance constraint in the production process. The concentrated production technology can be summarized as:

$$y_t = y(K_t, \rho_t) \qquad -y_\rho(\rho_t/y_t) = \theta > 0 \qquad (1)$$

with K_t representing the non-credit determinants of output and θ the elasticity of output supply with respect to the real interest rate. This production relation is represented by the curve PE in Figure 3.

Demand and supply of saving.
The enterprise has a demand for saving L_t in period t derived from (1) that is increasing more than proportionally with output.

$$L_t = \kappa(y_t)y_t \qquad \kappa_y > 0 \qquad (2)$$

[9] An earlier version of this model is presented and analyzed in Conway (2001).

$\kappa(y_t)$ can be interpreted as the demand for working capital as a ratio to final product.[10] The government will have its own demand for saving related to the consumers' social safety net. It is assumed to equal a fraction γ_t of output.[11]

The private supply of saving decision depends in theory not only upon current income, but also upon the real interest rate on saving and the value of accumulated wealth.[12] Define real private saving in period t as a share σ_t of real income. The private saving share is increasing, ceteris paribus, in the real interest rate and is decreasing in the ratio of real accumulated wealth (A_{t-1}/P_t) to income.[13]

$$\sigma_t = \sigma(\rho_t, (A_{t-1}/P_t)/y_t) \qquad \sigma_1 > 0, \sigma_2 < 0 \qquad (3)$$

It will be useful to denote the ratio of accumulated wealth to current income as $r_t = (A_{t-1}/P_t)/y_t$ and the real value of accumulated wealth as $a_t = (A_t/P_t)$. The evolution of this wealth can be written

$$a_t = A_{t-1}/P_t + \sigma(\rho_t, r_t)y_t$$

or

$$a_t = a_{t-1}/(1+\pi_t) + \sigma(\rho_t, r_t)y_t \qquad (4)$$

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[10] The enterprise will in general also have a demand for loanable funds to finance investment expenditure as well. This use of funds could be introduced without altering the results, but is excluded to retain the focus upon output contraction and the financial markets.

[11] This corresponds to a fiscal current deficit: expenditure not matched by tax revenues. Government expenditure to support state enterprises will enter identically to the present formulation of the enterprises themselves approaching the loanable-funds market.

[12] This is illustrated most simply in a life-cycle model of income, consumption and storage. Consider an individual who will live for N years, and will work for M of those. The individual has an initial nominal wealth of A_o denominated in domestic currency, and can invest at real interest rate ρ annually. The social rate of time preference is equal to the real interest rate ρ. The annual nominal after-tax income is Y, and P is the price of goods. Under these assumptions, utility is maximized by equal real consumption C in each period. Real saving is rising with real income. It is also rising with the real interest rate on saving instruments. It is declining in the real value of accumulated wealth A_o. It is, in fact, possible to have negative real saving

Real income per period:	(Y/P)
Discounted real value of income:	$V = (Y/P)(1/\rho)(1+\rho-(1/(1+\rho))^M)$
Real consumption per period:	$(1/NP)[A_o + V]$
Real saving per period:	$(Y/P)\,[1 - (1/(\rho N))((1+\rho-(1/(1+\rho))^M)] - A_o/NP$

per period if the stock of accumulated wealth is large relative to the real income per period.

[13] There is a solid theoretical basis for the interest-rate elasticity of saving, but controversy over whether that effect is observed in practice. Giovannini (1985) rejected the conclusion of significant positive elasticity in an empirical sample of developing countries. Ostry and Reinhart (1992), in a dynamic analysis for a broader sample of developing countries, find significant positive interest-rate effects on saving.

with π_t denoting the rate of inflation in commodity price in period t relative to period t-1. This ratio is rising with past accumulated wealth, declining with a rise in current inflation, and rising with current real saving.

Equilibrium in the supply and demand for saving is ensured by

$$\gamma_t + \kappa(y_t) = \sigma(\rho_t, r_t) \tag{5}$$

This condition is an upward-sloping relationship in ρ_t and y_t, and is illustrated as FE in Figure 3. Increased output increases the demand for saving more than proportionally, and this must be met ceteris paribus by an increase in the real interest rate to entice greater saving.[14]

The BB causes for the Great Divide can be illustrated nicely in this model. The "crowding out" effect of fiscal profligacy can be represented by an increase in the current deficit γ_t, (shifting the FE curve up) and will reduce output while driving up ρ_t. The reduced enforceability of business contracts is an increase in coordination cost in production (shifting the PE curve down) and will reduce both output and the equilibrium real interest rate.

While these equilibrium shifts in output are consistent with the empirical record, they miss an important feature of the transition – that financial markets were not in equilibrium. The financial repression, and fragmentation, of the period are critical to understanding the dynamic of transition.

The Dynamic of Transition: Earmarking and Financial Repression.

Three features of transition financial markets caused the historical record to deviate sharply from this theoretical equilibrium. First, the citizens of these economies entered the transition period with a large accumulation of wealth held in nominal financial instruments. This was characterized at the time as the "ruble overhang", and could be represented in equation (3) as a large wealth/income ratio.[15] Second, the borrowers of the transition economy initially were largely limited in the financial instruments they could offer to attract financing. Specifically, the government relied upon money creation or credits at non-market rates to finance its budget deficit, while the enterprise borrowers relied upon the lending of the commercial banking system. I will describe this bifurcation of the financial markets as "earmarking". Third, savers had access to a limited number of saving instruments. These three features led to a competition for saving during the transition that induced high inflation and caused large output reductions due to shortage of working capital.

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[14] Note that this relation is not unambiguously true. The increase in output will lower the wealth/income ratio r_t , and thus will increase saving through that channel as well. I assume in what follows that this wealth effect on saving is smaller than the product effect on the demand for credit, and so the real interest rate must rise to equilibrate.

[15] The ruble overhang was a preoccupation of economists working on the initial stages of transition. See Desai (1989), Nordhaus (1990) and World Bank (1992) for early discussions, and Conway (1997) for an analytical examination of the phenomenon.

The savers' portfolio allocation decision.

Savers could allocate private nominal wealth (A_t) to the holdings of currency (H_t), domestic-currency deposits (D_t) and foreign exchange (F_t). The behavioral equations that characterize this allocation can be written

$$D_t = \alpha(\rho_t, y_t)\, A_t \qquad \alpha_1>0,\ \alpha_2<0 \qquad (6)$$
$$e_t F_t = \beta(\rho_t, y_t)\, A_t \qquad \beta_1<0,\ \beta_2>0 \qquad (7)$$
$$H_t = (1-\alpha(\rho_t, y_t)-\beta(\rho_t, y_t))\, A_t \qquad (8)$$
$$A_t = D_t + H_t + e_t F_t \qquad (9)$$

The shares α and β define the percent of private wealth allocated to deposits and foreign exchange, respectively. The real interest rate on domestic deposits ρ_t is equal to the nominal interest rate on those deposits (i_t) minus the domestic inflation rate (π_t). The real interest rate on foreign currency is equal to zero.[16] The partial derivatives of the α and β functions are indicated by subscripts corresponding to the position of the arguments and are governed by the adding-up constraints outlined in Tobin (1969). For given y_t, and for F_t and H_t determined at any point in time, equations (6) through (9) can be solved for endogenous variables D_t, e_t, ρ_t, and A_t.

The private saving ratio σ_t plays an important role in this portfolio allocation. Private saving is the source of the flow demand for financial assets as a whole, while stock-shifts from one asset to another can also occur in response to relative-price changes. These effects can be derived by differencing equations (6) through (8). They are deflated by the current price level to indicate comparable real values.

$$(H_t - H_{t-1})/P_t = -[\alpha(\rho_t, y_t)-\alpha(\rho_{t-1}, y_{t-1}) + \beta(\rho_t, y_t)-\beta(\rho_{t-1}, y_{t-1})]\, r_t\, y_t + (1-\alpha(\rho_t, y_t)-\beta(\rho_t, y_t))\, \sigma(\rho_t, r_t)\, y_t \qquad (10)$$
$$(D_t - D_{t-1})/P_t = [\alpha(\rho_t, y_t)-\alpha(\rho_{t-1}, y_{t-1})]\, r_t y_t + \alpha(\rho_t, y_t)\, \sigma(\rho_t, r_t)\, y_t \qquad (11)$$
$$(e_t F_t - e_{t-1} F_{t-1})/P_t = [\beta(\rho_t, y_t)-\beta(\rho_{t-1}, y_{t-1})] r_t y_t + \beta(\rho_t, y_t)\, \sigma(\rho_t, r_t)\, y_t \qquad (12)$$

The first term on the right-hand side of these equations is the portfolio reallocation effect; it sums to zero across the three equations. The second term represents the allocation out of current saving, and sums to private saving across the three equations.

Earmarking equilibria.

If borrowers of loanable funds can transact in the markets of all three financial instruments, then the equilibrium outcome depicted in Figure 3 will be observed. However, governments in transition economies have in many cases been precluded from borrowing from the commercial financial system for current budget deficits and precluded from borrowing in foreign currency. In that case, seigneurage from money holdings becomes the sole source of finance for the government

[16] This instrument could equally well be thought of as land or some other asset in limited supply. The e_t will in that case be the market price of that asset. The phenomenon of foreign-currency denominated deposits will be addressed in the next section.

current budget deficit.[17] Another common financial feature of transition economies is that enterprises have no access to seigneurage finance, but are able to approach the commercial banking system. The demand for saving is then financed through domestic deposits. These two restrictions can be stated

$$\gamma_t = (g_t - \tau_t) = -[\alpha(\rho_t, y_t) - \alpha(\rho_{t-1}, y_{t-1}) + \beta(\rho_t, y_t) - \beta(\rho_{t-1}, y_{t-1})]r_t + (1 - \alpha(\rho_t, y_t) - \beta(\rho_t, y_t))\sigma(\rho_t, r_t) \quad (13)$$

$$\kappa(y_t) = [\alpha(\rho_t, y_t) - \alpha(\rho_{t-1}, y_{t-1})]\, r_t + \alpha(\rho_t, y_t)\, \sigma(\rho_t, r_t) \quad (14)$$

The quantity of foreign currency available for savers' portfolios is fixed by the past record of the balance of payments, and its interest rate is held to be zero.[18] The observed equilibrium values of ρ_t and r_t will define the portfolio demand for foreign currency holdings $e_t F_t$. Excess demand for foreign currency, for example, will lead to a depreciation of the nominal exchange rate to return the savers' portfolios to desired balance.[19]

Financial Repression and the Great Divide.

The simplest illustration of financial repression, and the genesis of the Great Divide, follows from the "ruble overhang" episode of the early 1990s. With the liberalization of commodity markets, the governments of the FSU countries encountered a shortage of real saving. This shock (illustrated by a comparative-static shift upward in the FE curve in Figure 2) will lead in an integrated financial market to an increase in real interest rate to induce more saving. In the FSU countries, however, the government maintained ceilings on nominal interest rates offered on saving deposits. This led to financial repression as illustrated in Figure 4. The curve HH represents the money-market equilibrium (13), while the curve DD represents deposit market equilibrium (14). The size of the ruble overhang (a_{t-1}) illustrated by point B ensured that equilibrium could not be observed in both markets. The government, through money creation, met its budgetary needs. Inflation surged to ensure equality in (13). The real interest rate to savers was in many cases negative during this period. This reduction in real interest rates also discouraged saving. While enterprises were quite willing to borrow at the observed negative real interest rate, there were no funds available. The enterprises rather had to reduce operations – and thus output – to a level consistent with the remaining availability of credit. The real interest rate on lending consistent with this degree of financial repression will be called the virtual interest rate $\tilde{\rho}_t$. It is in excess of the real

[17] One can argue that seigneurage is itself borrowing from the financial system, since the government floats bonds which are purchased by the central bank. It is most illuminating in this discussion to consider the central bank as part of the government, so that financing must occur "downstream" from the central bank.

[18] An increase in the supply of foreign currency will come about through a reserve settlement surplus due either to positive net exports of goods and services, to borrowing from foreign sources, or to central bank intervention in the foreign exchange market. These are exogenous to the portfolio allocation choice.

[19] The exchange rate will depreciate with inflation, as savers bid up the value of this inflation-resistant asset. It will also depreciate with growth in income , both through the use of foreign currency as a medium of exchange and through the impact of income growth in encouraging saving. A rising real interest rate will have two offsetting effects on the exchange rate. There is an appreciating effect of the shift in asset demand toward deposits and away from foreign-currency holding, while there is a depreciating effect of the rise in saving and thus demand for all assets. A rise in the real value of accumulated wealth will cause an appreciation as it reduces the propensity to save.

deposit rate because of the excess demand among enterprises for financing. Financial fragmentation resulted, and the gap between lending and deposit interest rates widened.

The behavior of the inflation rate can be characterized by total differentiation of equation (13). This operation is reported in the appendix and summarized in equation (15). The coefficient η is positive, while η_2 is negative. Inflation stems from three sources here: the increased demand for financing for the budget deficit, the saving-reducing effect of a large accumulated wealth, and the ambiguous effect of increased nominal interest rate. Accumulated wealth is itself a function of the inflationary record as well as of the propensity to save, falling in the former and rising in the latter. The "virtual" interest rate that would have generated that level of output at that level of accumulated wealth is illustrated in Figure 4. As is evident in equation (17), presented in detail in the appendix, this virtual interest rate is rising with inflation – even as the observed real interest rate on deposits is declining.[20]

$$d\pi_t/(1+\pi_t) = (1/\eta)[d\gamma_t - \eta_2\,(da_{t-1}/a_{t-1}) + (\eta + \eta_2)(di_t/(1+i_t))] \quad (15)$$

$$da_{t-1}/a_{t-1} = (-\pi_t + \sigma(\rho_t, r_t)/r_t)/(1+\pi_t) \quad (16)$$

$$d\tilde{\rho}_t/\tilde{\rho}_t = (1/\varphi)\,[\varphi_o(d\pi_t/(1+\pi_t)) - \varphi_1\,(di/(1+i)) + \varphi_2\,(da_{t-1}/a_{t-1})] \quad (17)$$

Inflation serves to increase saving, other things equal, by reducing the purchasing power of accumulated wealth. It also serves to increase the attractiveness of money relative to deposits by reducing the real interest rate.[21] The first-period adjustment ends at B_i.

At B_i the government's primary deficit γ_t has been financed, but the supply of deposits falls short of firms' demands for working capital.[22] The real interest rate in this example is negative, at ρ^i, and induces saving consistent with that rate and accumulated wealth. The "virtual" value of the real interest rate that would just equate demand from the firms with that supply is denoted $\tilde{\rho}^i$ on locus DR.[23] Specialization and output thus fall as a consequence of the financial fragmentation. The next period a similar adjustment occurs, to B_{ii}. As the wealth overhang is eliminated, for

[20] The coefficients φ, φ_o, φ_1 and φ_2 are all defined to be positive. See the appendix for details.

[21] For example, point B_i could be the combination consistent with 60 percent inflation. If the nominal interest rate is 3 percent, then the real interest rate is -57 percent and the $(a_{t-1}/(1+\pi_t))$ ratio is 62 percent of its original value.

[22] Many transition governments used direct deposit of wages and restrictions on deposit withdrawal to meet partially this excess demand for deposits. The cash shortage phenomenon discussed by Conway (1997) is precisely this, with the government refusing to meet the demand for real balances and thus forcing the portfolio holders to retain more deposits than desired.

[23] The DR locus represents for each value of $a_{t-1}/(1+\pi_t)$ that virtual real rate of interest at which the enterprises will choose to borrow the quantity of loanable funds deposited with the banking system by savers facing the observed real interest rate ρ. For example, ρ^i is the real interest rate observed due to the inflationary pressures of money creation. It reduces saving below the quantity underlying the DD locus (since the value of accumulated wealth is the same, but the real interest rate is lower), and thus the virtual real interest rate must be above that indicated by DD to reduce enterprise demand for funds to equal the quantity made available by savers

constant nominal interest rate, the virtual real interest rate on deposits declines and specialization rises once again. However, the fragmentation of financial markets is not eliminated by this dynamic so long as nominal interest rates are fixed. The zero-inflation equilibrium after this dynamic is B_v in Figure 4, with virtual real interest rate on lending $\tilde{\rho}^v$ still in excess of ρ_o.

As Table 1 indicates, there are substantial differences across the Great Divide in two categories: in credit not issued to the government as a percent of GDP, and in the lending-deposit rate spread. In the model of this section, economies with financial fragmentation will be characterized by just these differences when compared with integrated economies. The repression leads to inadequate saving and thus rationing of enterprises in search of credits. It also leads to large gaps between the interest rates offered on deposits and on loans, with the deposit rate artificially low and the lending rate biased upward.[24]

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[24]In a financially repressed economy, the holdings of foreign currency provide the potential for development of an interest-bearing saving instrument to serve as an alternative to the domestic deposit. Firms seeking working-capital funding can offer positive returns on foreign-currency loans, either to banks as intermediaries or directly to savers. If the foreign-currency deposit differs from the domestic deposit only in its currency of denomination, a result similar to that of the "curb market" literature of Buffie (1984) and van Wijnbergen (1983) follow: the government's efforts at financial repression will lead to savers' shift from domestic deposit holdings toward foreign-currency holdings. The real interest rate on foreign deposits, denoted q_t, becomes the cost of capital for the marginal enterprise. The real interest rates on the two instruments can diverge sharply.

This opportunity can be modeled as follows. Redefine the portfolio choice shares in equations (6) through (8) as:

$$D_t = \alpha(\rho_t, y_t, q_t)\, A_t \qquad (6')$$
$$e_t F_t = \beta(\rho_t, y_t, q_t)\, A_t \qquad (7')$$
$$H_t = (1-\alpha(\rho_t, y_t, q_t)-\beta(\rho_t, y_t, q_t))\, A_t \qquad (8')$$

with the impact of ρ_t and y_t on the portfolio shares as above, and with $\alpha_3 < 0$, $\beta_3 > 0$, $1-\alpha_3-\beta_3 < 0$.
The preceding equilibria were those characterized by $q_t = 0$. Firms continue to demand $\kappa(y_t)$ units of loanable funds per unit of total product. However, the enterprises discover in the financial-repression equilibrium that at the margin available loanable funds will be found in the foreign-currency market. Similarly, savers will discover that the preferred marginal return on saving is in foreign exchange. Thus, in contrast to (1) and (3), the level of enterprise output and household saving will depend as in (1') and (3') upon the real rate of interest q_t in the foreign-currency funds market.

$$y_t = y(K_t, q_t) \qquad -y_q(q_t/y_t) = \theta_q > 0 \qquad (1')$$
$$\sigma_t = \sigma(q_t, (A_{t-1}/P_t)/y_t) \qquad \sigma_q > 0,\ \sigma_A < 0 \qquad (3')$$

The equilibrium conditions in the financial market will be amended versions of (5) and (13), with the specifications of $\alpha(.)$ and $\beta(.)$ taken from (6') through (8') and with $y(.)$ and $\sigma(.)$ defined in (1') and (3').

There are two policies available to the government to eliminate financial fragmentation. The first is to remove controls in the domestic credit market, allowing ρ_t to rise to market-clearing rates. The second is to increase the quantity of foreign saving made available to the economy, thus pushing down the real interest rate on foreign-currency deposits to a rate equal to that of domestic-currency deposits. The first encourages domestic saving, while the second encourages an accumulation of foreign debt.

The "ruble overhang" period illustrates most graphically the implications of financial repression for extreme inflation and output reduction, but there are output costs as well to financial repression even after the inflationary pressure has dissipated. The real interest rate observed in the domestic financial market is less than in the non-repressive equilibrium, and the virtual interest rate offered by enterprise borrowers is greater than that in the non-repressive equilibrium. The virtual interest rate on lending determines the level of output, which will then be strictly below that observed in non-repressive equilibrium.

IV. Financial Fragmentation: Ukraine on the Wrong Side of the Divide.

I examine the record of economic growth and inflation in Ukraine for evidence of the financial-repression hypothesis. Ukraine is a logical candidate for such an investigation. First, Ukraine was not subject to the ethnic conflict and separatist movements that have made economic activity in countries like Georgia and Tajikistan more perilous – these countries faced a true "supply shock" more fundamental than misguided financial policy. Second, it is a relatively large, developed economy with good statistical agencies. Third, Ukraine as an economy has exhibited the tendencies of contraction and inflation in more intense fashion than the average of former Soviet economies. As Figure 5 illustrates, the output contraction has been more pronounced and more prolonged for Ukraine than for the former Soviet economies on average. In Figure 6 it is evident that the inflationary episodes in Ukraine were quite pronounced, and certainly in line with the other non-Baltic FSU countries.

The theoretical discussion of the previous sections suggests that these macroeconomic factors can be explained through reference to the repression and fragmentation of the financial sector in Ukraine. The shortage of credit led to the output contraction, while the repressive financial-sector policies caused a shortfall in deposit-holding that led to the credit contraction and to the inflationary pressure. In this section I examine the evidence for these hypotheses in turn.

Data.

The data used in this section are drawn from two sources. The major source for macroeconomic information is the Ukrainian-European Policy and Legal Advice Center (UEPLAC). These data are of various length and frequency: at best they cover the period from the beginning of 1992 to the fourth quarter of 2001, and are available on a quarterly or monthly basis. The International Financial Statistics of the IMF are used for data on Russia and Germany.

Credit shortage as a cause of output contraction.

As noted previously, there are a number of alternative hypotheses advanced for the output contraction observed in the formerly planned economies: demand contraction, energy price increases and the breakdown of the resource allocation system are three advanced in the literature, while this paper suggests the credit-market channel as a cause.

Table 2 reports a hypothesis test on output determination using quarterly data from 1993/1 to 2001/4. Base real output growth is modeled as a first-order autoregressive process in

logarithms.[25] To this minimal specification are added three variables to represent various hypotheses for output collapse. The logarithm of the real wage lagged one quarter ($\ln(W_t/P_t)$) is added to proxy for worker productivity in the transition. The logarithm of the index of real gross domestic product in Russia ($\ln(Ry_t)$) represents the contraction in demand from the economies formerly members of the Soviet Union. The logarithm of total credits to households, enterprises and government as a share of gross domestic product ($\ln(CR_t)$) models the credit channel effects on output. The credit variable is treated as simultaneously determined with $\ln(y_t)$; the two-stage least squares technique is used to derive the coefficients and standard errors reported.[26]

The evidence of the first column of figures indicates an economy with rather low persistence of real output growth, with significant but small autoregressive coefficient of 0.23. The passthrough coefficient of shocks from the Russian economy to the Ukrainian economy is both large and significantly different from zero, with a 10 percent decline in Russian output correlated with a 5.6 percent decline in Ukraine.[27] The impact of productivity on output is positive with elasticity of 0.38. There is also support for the hypothesis of this paper, as the elasticity of increased credit share in output is positive and significant at 0.28. A 10-percent decline in CR_t will lead to a 2.8 percent fall in y_t.

The second column reports the reduced-form model of $\ln(CR_t)$ implied by the data. There is a larger autoregressive coefficient of 0.67. The budget surplus as a share of GDP (b_t) makes an insignificant but positive direct contribution to credit share with semi-elasticity of .46. The real interest rate on deposits at commercial banks lagged one period (ρ_{t-1}) is included to proxy for the financial intermediation channel at the heart of this paper, and its semi-elasticity is both positive and significantly different from zero at 0.06. This provides additional support to the financial repression interpretation of output collapse.[28]

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[25] Phillips-Perron t-tests for unit roots reject the presence of a unit root. The statistics are calculated for non-zero mean and are:

	Without time trend		With time trend	
	τ	$Pr < \tau$	τ	$Pr < \tau$
$\ln(y_t)$	-2.85	0.06	-1.74	0.71
$\ln(CR_t)$	-3.28	0.02	-3.22	0.10
$\ln(Ry_t)$	-2.96	0.05	-3.19	0.10
$\ln(W_t/P_t)$	-3.28	0.02	-2.85	0.19

The results without time trend are more consistent with the hypothesis test undertaken here, and suggest that differencing the data is not necessary to ensure stationarity. I will also report the results with differencing (and a time trend) however, for comparison.

[26] The logarithm of real GDP in Germany was included as a proxy for European demand pressures, but its coefficient was found to be insignificantly different from zero.

[27] Significance is measured in this study by 95-percent confidence intervals.

[28] Note that an alternative model of the real interest rate on deposits and the volume of credits offered in the economy will consider them as simultaneously determined variables. The current model is based upon a sequential financial-intermediation model, where deposits attracted in period t-1 are lent out as credits in

The system of equations was estimated as well in error-correction form. This transformation should preserve the coefficients of the model if the series are stationary, and should correct for non-stationarity and measure cointegration if it exists. The results are reported in Table A1. In both equations, the intercepts (measuring the time trend) are both positive and significant. In the output equation, the coefficients on worker productivity and Russian passthrough are quite similar. The coefficient on the credit share, however, becomes smaller and insignificantly different from zero. In the credit share equation, the real interest rate on deposits retains its positive and significant contribution to the availability of credit. The autoregressive coefficients are insignificantly different from zero in each case, while the error-correction term in the output equation takes the expected negative sign.

Inflation as a product of accumulated purchasing power.

The theory of the preceding sections suggests that budget deficits will be inflationary, and especially those deficits financed through credits extended by the National Bank of Ukraine (NBU) to the government. However, the new contribution of this theory is the independent effect of private purchasing power a_t on inflation. In Table 3 I examine these competing theories in two separate regressions using quarterly observations for the periods 1993/2 through 2001/4.[29] The first column represents inflation as an autoregressive process dependent upon its own persistence, the budget surplus as a share of GDP (b_t) and a_t (defined as the stock of M_2 to GDP including only assets denominated in local currency). Inflation is modeled as jointly determined with the holdings of M_2 as a share of GDP: that equation is specified as an autoregressive process with a Cagan effect of inflation π_t, b_t and a measure of the financial fragmentation of the economy defined as the lagged ratio of credit to the economy over payables due (CR_{t-1}/PB_{t-1}): a rise in this should indicate a reduction in fragmentation.

The inflation equation has a strong autoregressive component. An increase in the size of the budget surplus as a share of GDP has the expected effect of reducing inflation, but its coefficient is insignificantly different from zero. By contrast, the impact of private real asset holdings a_t is positive, as predicted, and significantly different from zero. This supports the dissaving-based theory of inflation.

It is useful to consider as well the implied behavior of local-currency-denominated financial

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period t. I plan to address the simultaneous model in the future (i.e., once more data points are available).

[29] Tests of stationarity send mixed signals for these variables as well. The Phillips-Perron t statistics for non-zero-mean processes are:

	No Time Trend		Time Trend	
	τ	$Pr < \tau$	τ	$Pr<\tau$
π_t	-2.65	0.09	-3.21	0.10
a_t	-2.39	0.15	-2.08	0.54
CR_t/PB_t	-10.60	0.001	-8.96	0.001
b_t	-2.88	0.06	-5.76	0.001

The unit root is clearly rejected for the fragmentation ratio and the budget surplus/GDP ratio. For π_t and a_t there are indications of a unit root. However, this would be a unit root with time trend toward zero. I report results for stationary processes in the text.

holdings ratio a_t. As the second column of Table 3 indicates, the estimation results return a quite sensible demand-for-assets function. There is strong and significant persistence in the ratio. There is also a significant negative effect of current inflation on domestic-asset holding. There is a positive and significant association between budget surpluses and the M_2/GDP ratio, indicating a reduction in "crowding out" of private asset holding, while the lagged fragmentation ratio has a significant coefficient. Its positive sign is also consistent with the financial-repression theory of inflation.[30]

Financial repression in private portfolio allocation.

The portfolio allocation decision is a key component of the process of financial deepening. As demonstrated in the previous section, the shift from other assets to bank deposits in the investor's portfolio is hypothesized to be in response to increases in the real interest rate, other things equal.

Data on the volume of money in circulation (H_t) , credit offered by commercial banks (CR_t), real GDP (y_t), total hryvnia-denominated deposits (D_t), and the weighted real interest rate on deposits at Ukrainian commercial banks (ρ_t) are available on a monthly basis. It is also possible, using household survey information from the same source, to decompose aggregate money and deposit holdings into shares held by households and by other actors (whom I here refer to as enterprises). Two (H_t/D_t) ratios can then be calculated. $(H_t/D_t)^h$ is the ratio of currency holdings to deposit holdings by households in period t, while $(H_t/D_t)^e$ is the same ratio for enterprises. These data are available for the period October 1995 to December 2001.

The theory of the preceding section predicts that the (H_t/D_t) ratio will be a negative function of the current ρ_t and a positive function of y_t when currency is more liquid for transactions purposes than are deposits. An increase in the interest rate on foreign-exchange-denominated assets is also predicted to have an effect, but the direction of the effect is contingent upon the relative substitutability of currency and deposits, respectively, for foreign exchange. While there is no consistent interest rate on foreign-exchange-denominated assets available, the nominal depreciation rate of the USD/Hryvnia exchange rate (δ_t) is used as a proxy.[31]

I test these hypotheses with a version of equations (10)-(12) amended to include the impact of δ_t and random uncorrelated errors ε_{it}, i=h,d,f.

$$\Delta h_t = (H_t - H_{t-1})/(P_t y_t) = - [\alpha(\rho_t,y_t,\delta_t)-\alpha(\rho_{t-1},y_{t-1},\delta_{t-1}) + \beta(\rho_t,y_t,\delta_t)-\beta(\rho_{t-1},y_{t-1},\delta_{t-1})]\, r_t + (1-\alpha(\rho_t,y_t,\delta_t)-\beta(\rho_t,y_t,\delta_t))\, \sigma(\rho_t, r_t) + \varepsilon_{ht} \quad (18)$$

$$\Delta d_t = (D_t - D_{t-1})/(P_t y_t) = [\alpha(\rho_t,y_t,\delta_t)-\alpha(\rho_{t-1},y_{t-1},\delta_{t-1})]\, r_t + \alpha(\rho_t,y_t,\delta_t)\, \sigma(\rho_t, r_t) + \varepsilon_{dt} \quad (19)$$

$$\Delta f_t = (e_t F_t - e_{t-1} F_{t-1})/(P_t y_t) = [\beta(\rho_t,y_t,\delta_t)-\beta(\rho_{t-1},y_{t-1},\delta_{t-1})] r_t + \beta(\rho_t,y_t,\delta_t)\, \sigma(\rho_t,r_t) + \varepsilon_{ft} \quad (20)$$

[30] This estimation was redone using foreign-currency denominated component of M_2 as a ratio of GDP as the dependent variable. The resulting coefficients (not reported, but available on demand) were insignificant for all regressors except the lagged dependent variables, suggesting that the dichotomy between local-currency-denominated assets and foreign-currency-denominated assets is a meaningful one in explaining inflation – as the theory of this paper implies.

[31] For example, if currency is more substitutable for foreign exchange than are deposits in portfolio holdings then the depreciation of the nominal exchange rate will cause the ratio to fall.

The endogenous variables in this system of equations include δ_t, ρ_t and Δd_t. The variables exhibit stationarity in the Phillips-Perron sense.[32] The behavioral relations $\alpha(.)$, $\beta(.)$ and $\sigma(.)$ establish a set of cross-equation restrictions that are imposed in what follows, with the functions modeled in linear form.

$$\alpha(\rho_t,y_t,\delta_t) = \alpha_o + \alpha_1 \rho_t + \alpha_2 y_t + \alpha_3 \delta_t \quad (21a)$$
$$\beta(\rho_t,y_t,\delta_t) = \beta_o + \beta_1 \rho_t + \beta_2 y_t + \beta_3 \delta_t \quad (21b)$$
$$\sigma(\rho_t,r_t) = \sigma_o + \sigma_1 \rho_t + \sigma_2 r_t + \sigma_3 \delta_t \quad (21c)$$

Estimation is complicated by the fact that the real interest rate and the depreciation rate are endogenous variables. The theory suggests an econometric solution: model the system of equations (18) - (21c) as jointly determining δ_t, ρ_t , σ_t and Δd_t. The result of this estimation strategy using iterative two-stage least squares is reported in the first column of Table 4.

The impact of relative prices on portfolio shares take the expected signs for the most part: α_1, as the effect of the real interest rate on deposits on the share of wealth allocated to deposits, has a positive and significant coefficient; β_3, the effect of exchange-rate depreciation on the holdings of foreign currency, is also positive as expected, although insignificantly different from zero. The real-income effects on portfolio shares indicate that both deposits (α_2) and foreign-currency (β_2) holdings fall as real income rises; the implied transactions demand for money ($-\beta_2-\alpha_2$) is positive as expected.

The hypotheses of this paper are tested most directly by considering the sign and significance of the determinants of σ_t. The impact of the real interest rate on saving, other things equal, is both positive (2.15) and significantly different from zero. The impact of accumulated wealth on saving is negative (-0.04) and significantly different from zero. The impact of exchange-rate depreciation on saving is positive (37.13) and significantly different from zero. The preconditions of the financial-repression explanation for inflation and saving stagnation are thus confirmed in the data: a positive effect of real interest rates on the saving ratio, and a negative effect of accumulated wealth on saving.

Specifications (2) and (3) in Table 4 report two restrictions on the original system. In (2) I impose the restriction that δ_t does not enter the portfolio-share equations (21a) and (21b), but maintains its role in (21c). This implies that δ_t is determined exogenously. The results maintain the qualitative features of (1): signs expected in the portfolio-share coefficients are observed, and the

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[32] The results for the Phillips-Perron test (for non-zero mean) on the monthly observations are:

	No trend		Time trend	
	τ	$Pr < \tau$	τ	$Pr < \tau$
Δd_t	-5.49	0.001	-5.59	0.001
Δf_t	-8.56	0.001	-8.53	0.001
Δm_t	-8.66	0.001	-9.41	0.001
ρ_t	-4.60	0.001	-4.64	0.002
δ_t	-8.44	0.001	-8.38	0.001
y_t	-4.24	0.002	-4.50	0.003
σ_t	-7.65	0.001	-8.18	0.001

The hypothesis of non-stationarity is rejected in all instances at the 95 percent level of confidence.

crucial features of the saving coefficients remain significant as well. In (3) the specification is further simplified by exclusion of δ_t from the saving equation. This leads to infinitesimal changes in the portfolio-share coefficients and maintains the main results of the saving equation – although the real-interest-rate effect σ_1 is no longer significantly different from zero.

The results of Table 4 are derived with maintained hypothesis of portfolio-share equations (21a) and (21b), and with the cross-equation restrictions that these portfolio shares imply. A less restrictive test of the theory can be derived through creating ratios of asset holdings from (6') - (8'), and results of this estimation are provided in Table 5.[33] The theory predicts that savers will substitute from other assets into deposits as ρ_t rises. This is evident in the first column, where the (H_t/D_t) ratio is reported for households; the coefficient is both negative (-35.33) and significantly different from zero. For enterprises, the (H_t/D_t) ratio also responds negatively, but with effect insignificantly different from zero. The impact on the (H_t/e_tF_t) ratio is insignificantly different from zero, in line with the ambiguous prediction of theory. Theory also predicts that substitution will occur from domestic assets to F_t as the real exchange rate $(\hat{re}_t)$ rises. This is evident in the final column, although the effect is not significant. The transactions demand for H_t is evident in the significant positive coefficient (34.00) in the final column, but the results of the first column indicate that substitution from currency to deposits also occurs as y_t rises.

Enterprises, as represented in the results of the second column, have a much lower currency/deposit ratio on average, as the relative size of the intercepts indicates. The regression explains a smaller percentage of the variability of the ratio.[34] Exchange-rate depreciation does not affect the ratio significantly. Since enterprises conduct business largely through sight deposit accounts, the response to an increase in y_t is to reduce their currency-deposit ratio.

V. Conclusions.

This paper contributes two building blocks to the effort to construct a theory of the output contraction and hyperinflation observed in the former Soviet economies during the 1990s. First, a theory is advanced that finds the root of both these events in repressive financial policies in the transition economies. Second, data for the Ukrainian economy are found to be consistent with this theory.

Berglof and Bolton (2002) provides an intriguing characterization of the bifurcation in financial-sector experience in transition economies, and identifies a number of critical differences between high-performing and low-performing economies. This paper builds upon its characterization while providing a crucial addition to the logic. Financial-sector policy is not peripheral to performance, but rather can be placed at the heart of any explanation of diverging performance. I argue, and provide empirical support, for the proposition that financial repression á la McKinnon (1973) is fundamental to the understanding of the prolonged and painful transition.

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[33] These equations are each estimated as one of a three-equation simultaneous system using two-stage least squares, with the real interest rate ρ_t and the real exchange rate $\hat{re}_t$ as other endogenous variables. Details are given in the note to Table 4.

[34] If the time trend is excluded, the remaining regressors have a jointly insignificant explanatory power as measured by the F statistic.

There are a number of remaining steps to be taken to support the conclusions of this paper. First, the theoretical model is a simple one, and excludes the potentially important physical investment decision of the enterprise. While I conjecture that this will introduce an additional demand for loanable funds that will intensify the pressures discussed here, it is important to do this explicitly. Second, the data analysis remains sketchy. The production theory advanced here is most directly examined through analysis of firm-level decision-making; I will be looking into the availability of data for analyzing the degree of coordination directly. The portfolio choice analysis could also be productively expanded through consideration of additional stores of wealth.

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Table 1: **Indicators of Financial Development**

	Non-government Domestic Credit/GDP 1999	Concentration Ratio, 1997	Asset share of state-owned banks, 1999	Bad loans/total loans, 1999	Loan-deposit rate spread, 1999
CHPS	34.0	64.1	24.8	14.7	4.6
Baltics	18.1	69.1	19.4	7.1	7.3
Russia/Ukraine	8.9	59.1	27.2	8.2	30.2

Source: Berglof and Bolton (2002), Tables 1 and 4.
Non-government domestic credit/GDP refers to credit to households and enterprises as a share of GDP.
Concentration ratio is defined as the ratio of three largest banks' assets to total banking sector assets. The loan rate is defined as the average rate charged by commercial banks on outstanding short-term credits to enterprises and individuals, weighted by loan amounts. Deposit rate is defined as the average rate offered by commercial banks on short-term deposits, weighted by deposit amounts.

Table 2
GDP Function Regression Results
(Quarterly data, 1993/1 to 2001/4)

Dependent variable:	$\ln(y_t)$	$\ln(CR_t)$
Intercept	-2.57 *	1.36 *
	(0.93)	(0.48)
$\ln(W_{t-1}/P_{t-1})$	0.38	
	(0.23)	
$\ln(Ry_t)$	0.56 *	
	(0.10)	
$\ln(CR_t)$ s	0.28 *	
	(0.07)	
$\ln(y_{t-1})$	0.23	
	(0.11)	
ρ_{t-1}		0.06 *
		(0.03)
$\ln(CR_{t-1})$		0.67 *
		(0.11)
b_t		0.46
		(0.70)
R^2	0.80	0.60
F(.)	27.83	14.52
N	32	32

s – Treated as simultaneously determined variable. Instruments include lagged endogenous variables, budget deficit, and exogenous regressors in these equations. Standard errors reported in parentheses.
* indicates significance at the 95 percent level of confidence.

Table 3
Consumer Inflation Rate: Ukraine

Dependent variables:	π_t	a_t
Intercept	-101.9 *	18.32 *
	(34.54)	(7.53)
π_t^s		-0.33 *
		(0.09)
a_t^s	2.22 *	
	(0.68)	
π_{t-1}	0.61 *	
	(0.12)	
a_{t-1}		0.54 *
		(0.16)
b_t	-1.54	0.88 *
	(1.75)	(0.40)
(CR_{t-1}/PB_{t-1})		1.42 *
		(0.36)
R^2	0.61	0.64
F(.)	15.28 *	12.28 *
N	32	32

Jointly endogenous variables marked with s; two-stage least squares used in estimation. Instruments include lagged dependent variables and other independent variables in equation. Standard errors are reported in parentheses. * indicates significance at the 95 percent level of confidence.

Table 4
Portfolio Asset Demand Estimation

	(1)	(2)	(3)
α_o	0.07 *	0.06 *	0.06 *
	(0.01)	(0.01)	(0.01)
α_1	0.14 *	0.15 *	0.15 *
	(0.07)	(0.06)	(0.06)
α_2	-0.07	-0.05	-0.05
	(0.08)	(0.08)	(0.08)
α_3	-0.64		
	(0.90)		
β_o	0.28 *	0.83 *	0.83 *
	(0.03)	(0.04)	(0.04)
β_1	0.23	-0.04	-0.04
	(0.20)	(0.23)	(0.23)
β_2	-0.65 *	-1.51*	-1.51 *
	(0.24)	(0.32)	(0.32)
β_3	2.23		
	(2.57)		
σ_o	0.15 *	0.16 *	0.18 *
	(0.03)	(0.02)	(0.02)
σ_1	2.15 *	1.63 *	0.82
	(0.81)	(0.70)	(0.53)
σ_2	-0.04 *	-0.04*	-0.05 *
	(0.01)	(0.01)	(0.01)
σ_3	37.13 *	18.39	
	(14.83)	(9.94)	
N	68	68	68

Statistical method used: iterative two-stage least squares. In (1) a four-equation system was estimated with endogenous ρ_t, δ_t Δd_t and r_t. In (2) and (3), a three-equation system was estimated in ρ_t, Δd_t and r_t. In each case, cross-equation restrictions on parameters are imposed. In (2), δ_t is treated as an exogenous variable. For all equations, contemporaneous exogenous and lagged endogenous and exogenous variables are used as instruments. * indicates significance at the 95 percent level of confidence, and standard errors are in parentheses.

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Table 5

Asset Ratio Response to Real Interest Rate Stimulus

	Dependent variable		
	$(H_t/D_t)^h$	$(H_t/D_t)^e$	(H_t/e_tF_t)
Intercept	5.74 *	0.12 *	-0.68 *
	(0.85)	(0.03)	(0.28)
ρ_t^s	-35.33 *	-20.21	0.81
	(8.13)	(28.61)	(3.42)
$\hat{re}_t^s$	- 6.73	2.56	-0.95
	(157.40)	(5.57)	(0.53)
y_t	- 35.47 *	-1.04	34.00 *
	(15.38)	(0.54)	(5.22)
t	-1.32 *	0.04 *	0.02
	(0.42)	(0.02)	(0.16)
N	71	71	69
R^2	0.37	0.14	0.46
F(x,71-x)	10.04 *	2.63 *	13.87 *

Each of these equations was estimated in a three-equation system by two-stage least squares. The three simultaneously determined variables were the asset ratio, ρ_t and $\hat{re}_t$, and these are marked with s above. The variable t represents a time trend. The variables used as instruments in the first stage included y_t, lagged values of the endogenous variables, CR_{t-1}, μ_{t-1}, and the growth rates of these two variables. For the F statistic, x=3 for the first equation, and x=4 in the second and third equations. Statistics in parentheses are standard errors, and significance at the 95 percent confidence level is marked by *.

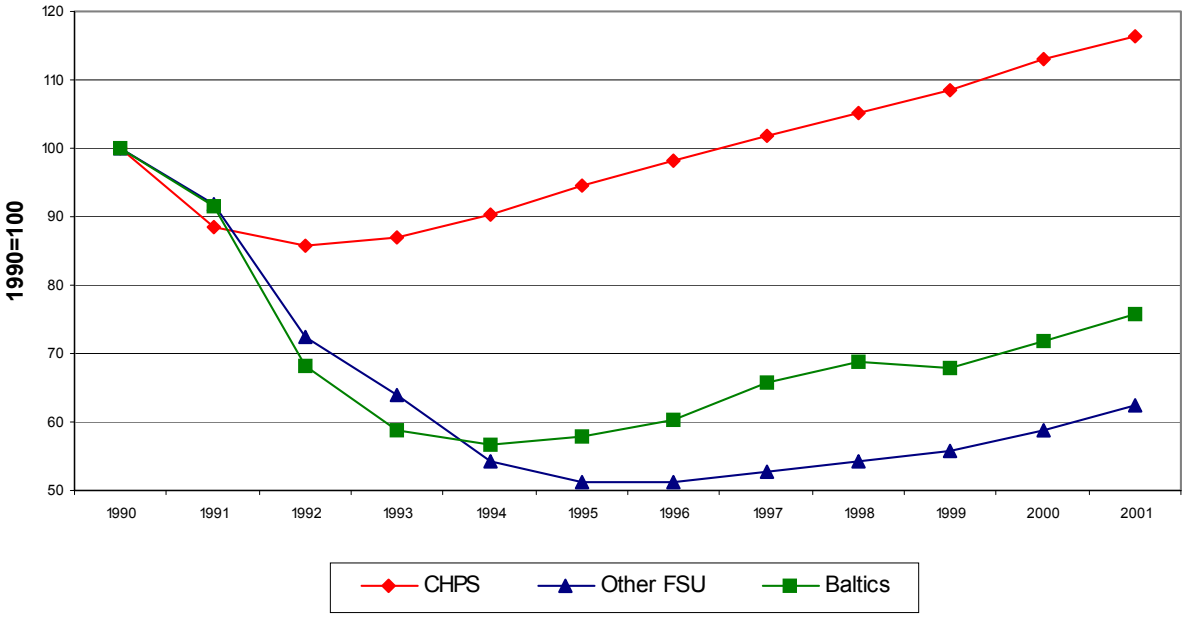


Figure 1: **The Great Divide in Output**

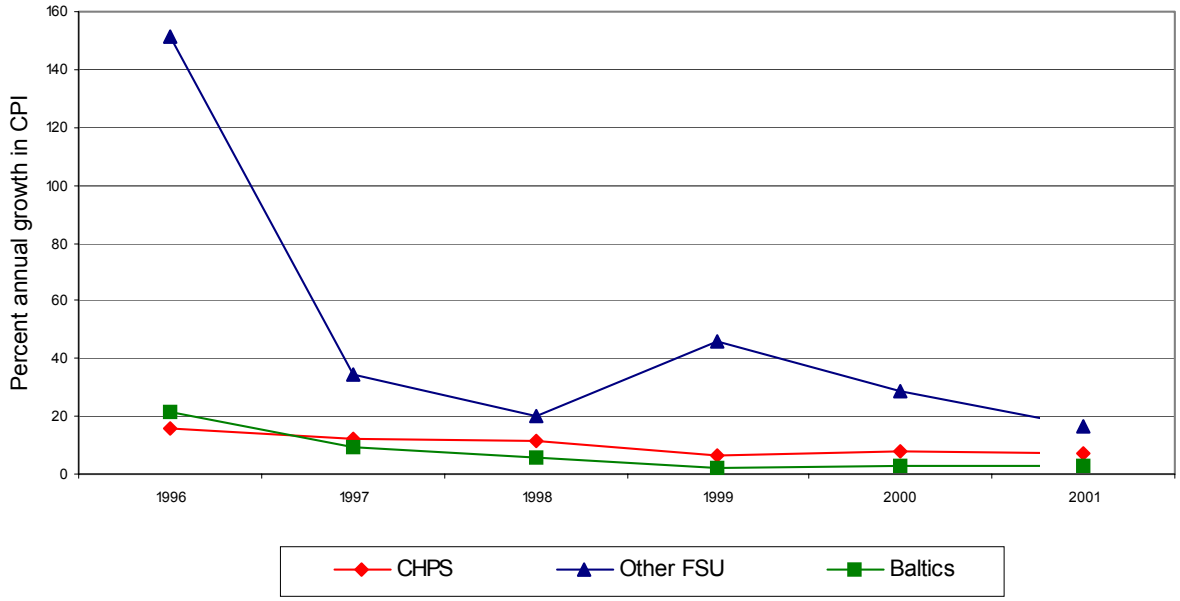
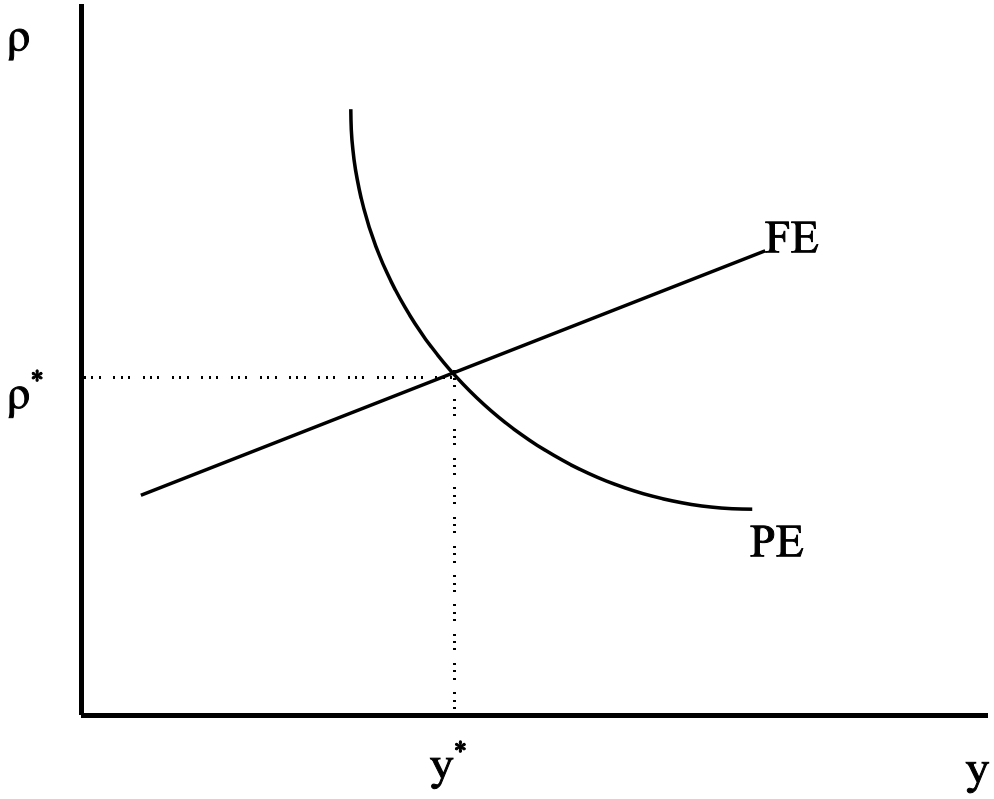


Figure 2: **Annual Inflation along the Great Divide**

Figure 3**: Product and Financial Market Equilibrium**



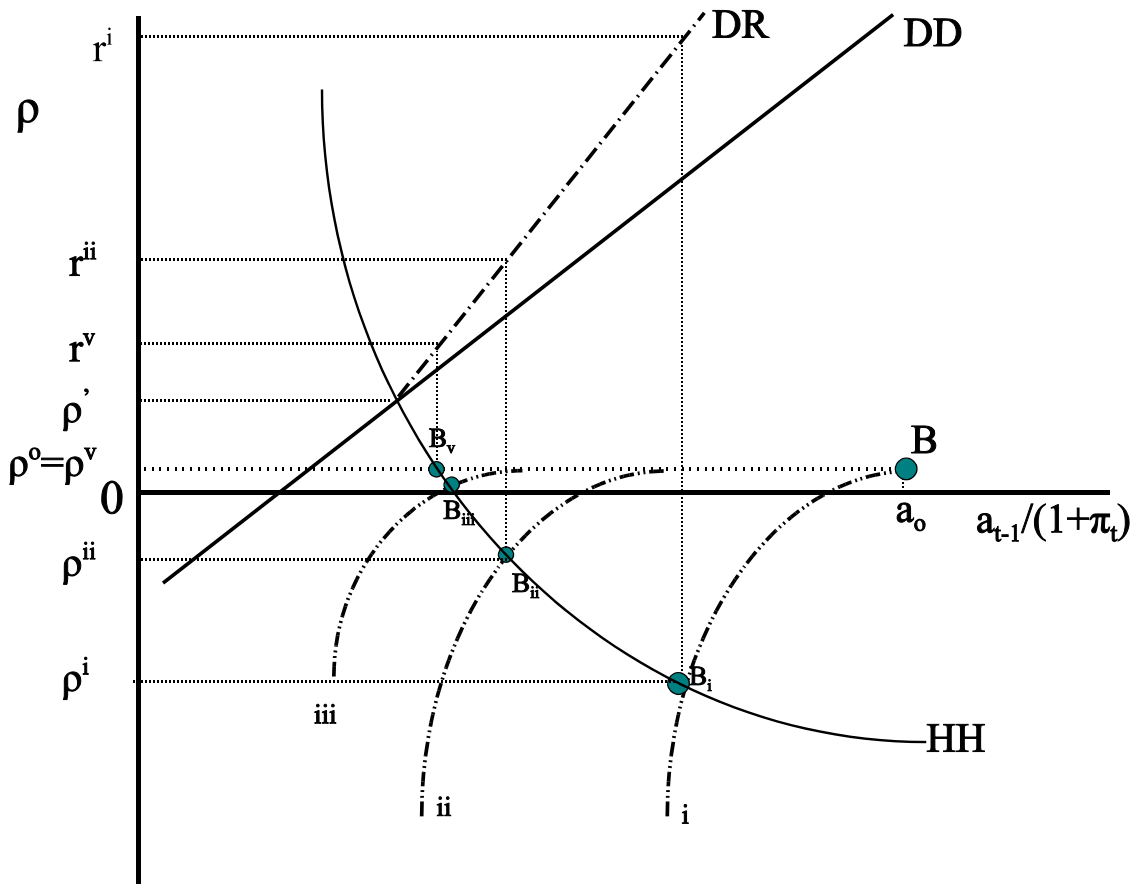


Figure 4: **The Dynamic of Adjustment to Wealth Overhang with Earmarked Financial Instruments**

Figure 5: **Ukraine on the Wrong Side of the Output Divide**

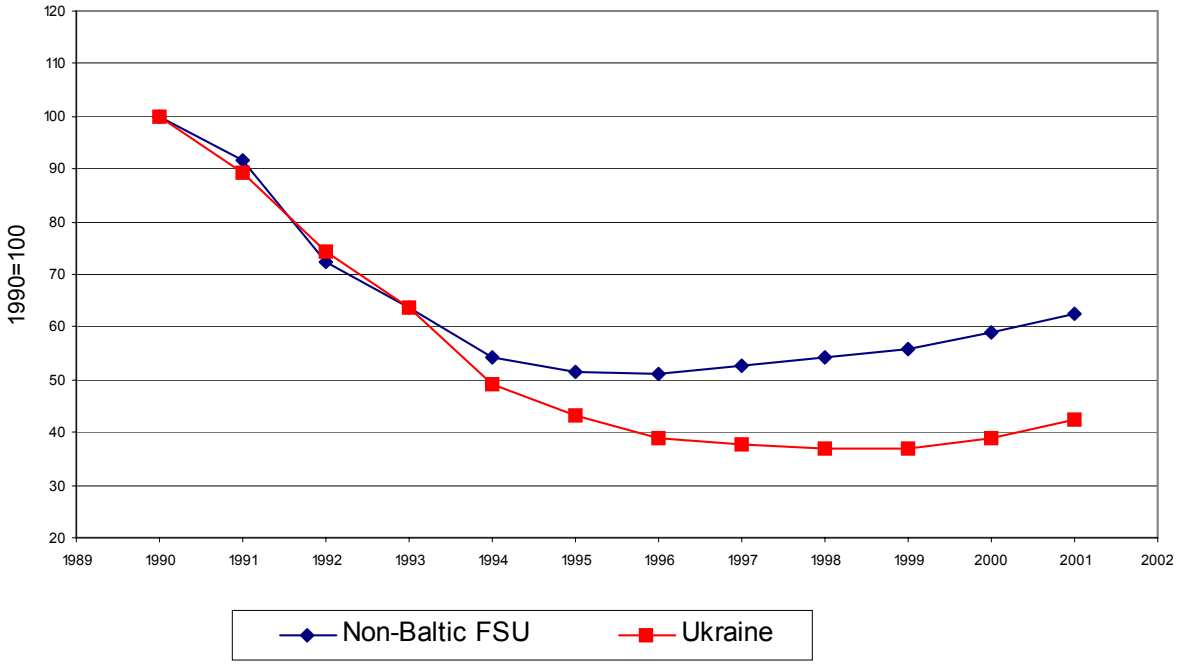
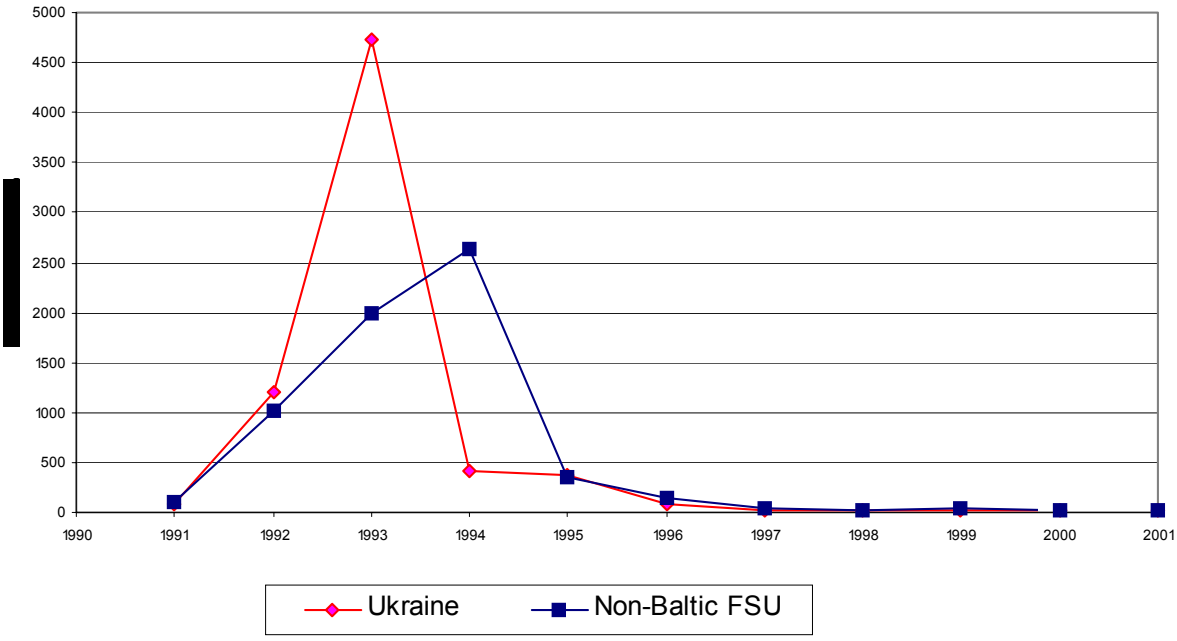


Figure 6: **Ukraine on the Wrong Side of the Inflation Divide**



Appendix A
Derivation of Dynamic Equations for Earmarking Equilibrium

Money market equilibrium:

$$\gamma_t = (g_t-\tau_t) = - [\alpha(\rho_t,y_t)-\alpha(\rho_{t-1},y_{t-1}) + \beta(\rho_t,y_t)-\beta(\rho_{t-1},y_{t-1})]\, r_t + (1-\alpha(\rho_t,y_t)-\beta(\rho_t,y_t))\, \sigma(\rho_t, r_t) \quad (13)$$

$$d\gamma_t = (1-\alpha-\beta)\sigma_A\, r_t\, (da_{t-1}/a_{t-1} - d\pi_t/(1+\pi_t)) - \rho_t((\sigma_t+r_t)(\alpha_\rho+\beta_\rho) - (1-\alpha-\beta)\sigma_\rho)(d\rho_t/\rho_t) - (y_t(\alpha_y+\beta_y)(\sigma_t + r_t) + (1-\alpha-\beta)\sigma_A\, r_t)\, (dy_t/y_t)$$

but $(dy_t/y_t) = - \theta\, (d\rho_t/\rho_t)$

and $(d\rho_t/\rho_t)\ .\ di/(1+i) - d\pi_t/(1+\pi_t)$

then define:

$\eta_o = \rho_t((\sigma+ r_t)(\alpha_\rho+\beta_\rho)) > 0$
$\eta_1 = y_t(\alpha_y+\beta_y)(\sigma+ r_t) < 0$
$\eta_2 = (1-\alpha-\beta)\sigma_A\, r_t < 0$
$\eta_3 = \rho_t(1-\alpha-\beta)\sigma_\rho > 0$
$\eta = \eta_o-\eta_3-\eta_2(1+\theta)-\theta\eta_1$, assumed positive

$$d\gamma_t = \eta_2(da_{t-1}/a_{t-1} - d\pi_t/(1+\pi_t)) - (\eta_o-\eta_3)\,(d\rho_t/\rho_t) - (\eta_1 + \eta_2)\,(dy_t/y_t)$$

$$= \eta_2\, da_{t-1}/a_{t-1} - \eta_2\, d\pi_t/(1+\pi_t) - (\eta_o - \eta_3 - \theta\,(\eta_1 + \eta_2))(di/(1+i) - d\pi_t/(1+\pi_t))$$

$$= \eta_2\, da_{t-1}/a_{t-1} - (\eta_2 - \eta_o + \eta_3 + \theta\,(\eta_1 + \eta_2))\, d\pi_t/(1+\pi_t) - (\eta_o - \theta\,(\eta_1 + \eta_2))di/(1+i)$$

$$d\pi_t/(1+\pi_t) = (1/\eta)[d\gamma_t - \eta_2\,(da_{t-1}/a_{t-1}) + (\eta+\eta_2)(di/(1+i))]$$

Deposit-market equilibrium:

$$\kappa(y_t) = [\alpha(\rho_t,y_t)-\alpha(\rho_{t-1},y_{t-1})](r_t + \alpha(\rho_t,y_t)\sigma(\rho_t, r_t)) \quad (14)$$

$$[y_t\kappa_y + (\alpha/(1-\alpha-\beta))\eta_2 - y_t\alpha_y\,(\sigma_t+r_t)](dy_t/y_t) = [(\sigma_t+r_t)\alpha_\rho+ \alpha\sigma_\rho]d\rho_t + (\alpha/(1-\alpha-\beta))\eta_2(da_{t-1}/a_{t-1} - d\pi_t/(1+\pi_t))$$

Define:

$\varphi = \theta(y_t\kappa_y - y_t\alpha_y\,(\sigma_t+r_t) + (\alpha/(1-\alpha-\beta))\eta_2)$
$\varphi_o = [(\sigma_t+r_t)\alpha_\rho+ \alpha\sigma_\rho] + (\alpha/(1-\alpha-\beta))\eta_2$
$\varphi_1 = [(\sigma_t+r_t)\alpha_\rho+ \alpha\sigma_\rho] > 0$
$\varphi_2 = (\alpha/(1-\alpha-\beta))\eta_2 < 0$

$$d\tilde{\rho}_t/\tilde{\rho}_t = (1/\varphi)[\varphi_o\, d\pi_t/(1+\pi_t) - \varphi_1\,(di/(1+i)) + \varphi_2\,(da_{t-1}/a_{t-1})]$$

Updating equation, accumulated wealth:

$$a_t = a_{t-1}/(1+\pi_t) + \sigma(\rho_t,r_t))y_t \qquad (4)$$

$$da_{t-1}/a_{t-1} = -\pi_t/(1+\pi_t) + \sigma(\rho_t,r_t)y_t/a_{t-1}$$

$$= (-\pi_t + \sigma(\rho_t,r_t)/r_t)/(1+\pi_t)$$

Exchange rate depreciation:

$$(e_tF_t - e_{t-1}F_{t-1})/P_t = [\beta(\rho_t,y_t) - \beta(\rho_{t-1},y_{t-1})]r_t + \beta(\rho_t,y_t)\,\sigma(\rho_t,r_t)\,y_t \qquad (12)$$

$$de_t/e_t = \pi_t - (dF_t/F_t) + (y_t/\beta a_t)\{[(1+\beta)\sigma_t + r_t\,(1-\sigma_A/y_t)](dy_t/y_t) + (\beta_\rho(\sigma_t+r_t)+\beta\sigma_\rho)(d\rho_t/\rho_t)$$

Appendix B
The Endogenous-Specialization Model: an Example

The economy examined here has a final product y_t available at the end of period t. It is assembled from a set of Z intermediate inputs (indexed by z). Each enterprise employs 1 worker in each period and has stocks of capital K(z) specific to production of each of the intermediate goods. The final product is assembled by combining the Z intermediate inputs with a fixed quantity of energy ξ. The enterprise producing this final good is the "assembly enterprise".

Intermediate inputs are produced at the beginning of period t and sold to the assembly enterprise. The assembly operation occurs throughout period t. The final good is complete at the end of period t and is sold to the consumer at that time. The assembly enterprise thus has a need for financing, since its cost expenditures occur at the beginning of the period but its revenues are only available at the end of the period. The working capital necessary for that financing must be obtained in some way.[35]

Transition on the supply side of the economy. The productive capacity in these countries was constructed during the Soviet period. There remains a debate over whether the placement and scale of production embodied in this capacity reflected profit-maximizing principles. [...] A model of the transition process must then admit the possibility of production re-allocation in the face of the changing incentives to producers offered by the transition to freer markets. The following model of production, based on the endogenous-specialization model of Becker and Murphy (1992), does so.

Consider production of a quantity of final product y_t in period t. It is created through the combination of Z intermediate products $Y_t(z)$ with a quantity ξ_t of an energy input. The complementarity of intermediate goods and energy in production is represented as the Leontief production function (1), so that at efficient resource allocation the Z+2 quantities y_t, $Y_t(z)$ and ξ_t are identical. In a market economy a firm contracts with producers of $Y_t(z)$ and ξ_t to obtain these inputs and then assembles the final product y_t. In the command economy of the Soviet Union the central planner directed this assembly.

Each enterprise is endowed with 1 unit of labor and K(z) units of capital specific to each intermediate good. A fraction $\lambda_t(z)$ of the labor is allocated to the production of each intermediate good. With full employment, the sum of $\lambda_t(z)$ for all z is equal to one. Each $\lambda_t(z)$ is divided between production labor $\beta_t(z)$ and labor in training $\tau_t(z)$. The productivity $E_t(z)$ of the production labor is determined by K(z) and by the training time $\tau_t(z)$. The parameter $\theta>0$ determines the marginal productivity of time spent in worker training.[36] Increasing the share $\upsilon>0$ of capital in production also is assumed to raise productivity through mechanization of tasks. The parameter δ is a measure of productivity for unit use of the two factors. Energy does not require labor resources for production.

$$y_t = \min_{z,\xi}\{Y_t(z), \xi_t\} \quad (1)$$

$$E_t(z) = \delta K(z)^{\upsilon}\tau_t^{\theta}(z) \quad (2)$$

---

[35] Note that the intermediate enterprises and the assembly enterprise are treated assymmetrically with respect to time. Enterprises do not have working- capital demands in production of intermediates. The assembly enterprise does have working-capital demands, but only for those intermediates not produced internally.

[36] The construction of productivity as a function of current training alone is that of Becker and Murphy. An alternative specification will measure the impact on productivity not only of current training, but of training in prior periods. The specification used here is analogous to an investment decision that depreciates completely in one period.

$$Y_t(z) = \beta_t(z)E_t(z) = \beta_t(z)\delta K(z)^{\upsilon}\tau_t^{\theta}(z) \quad (3)$$

Two decisions are made at the enterprise level (or by the central planner on behalf of the enterprise): (1) what fraction of work force to allocate to training and to production of each intermediate, and (2) how many intermediate goods to produce.

Worker allocation within industry. For production of each intermediate good the $\lambda_t(z)$ are allocated between $\tau_t(z)$ and $\beta_t(z)$. Optimal allocation of worker time to maximize $Y_t(z)$ yields the condition (4) and the concentrated form (5) of the production function.

$$\tau_t(z) = (\theta/(1+\theta))\lambda_t(z) \quad (4)$$

$$\begin{aligned} Y_t(z) &= \delta K(z)^{\upsilon}(1/(1+\theta))\lambda_t(z)[(\theta/(1+\theta))\lambda_t(z)]^{\theta} \\ &= B(\delta,\theta)\ K(z)^{\upsilon}\lambda_t(z)^{(1+\theta)} \end{aligned} \quad (5)$$

$$\text{With } B(\delta,\theta) = (1/(1+\theta))\delta[(\theta/(1+\theta))]^{\theta} \qquad B_{\delta} > 0,\ B_{\theta} > 0$$

Output is increasing in both factors of production, with economies of scale evident in the use of labor. Output is increasing in the elasticity of productivity with respect to training time θ through two channels – first through the impact of employment, and second through the total factor productivity measure $B(\delta,\theta)$. Output is also increasing in the productivity coefficient δ through the total factor productivity measure.

Varieties of intermediate goods. For simplicity, assume that any of the enterprises could undertake the assembly through costless entry. The intermediates have price normalized to unity, while the final-good price is a mark-up over the cost of inputs.

The final good y_t could be created by each enterprise using its available labor to create all Z intermediates. There are, however, economies of scale available through specialization. If n_t identical enterprises cooperate by each producing a subset of the intermediate inputs, then the number of inputs produced per enterprise is $\psi_t = Z/n_t$. The work force at each enterprise will be divided into intermediate-input teams, with $1 = \lambda_t(z)\psi_t$. The quantity produced of the intermediate is then an exponentially increasing function of n_t as in (6):

$$Y_t(z) = B(\delta,\theta)\ K(z)^{\upsilon}\ n_t^{(1+\theta)}\ Z^{-(1+\theta)} \quad (6)$$

Specialization (i.e., rising n_t) thus has its benefits. By this reasoning, and for a given stock of labor and capital, each enterprise has the incentive evident in (6) to increase its specialization indefinitely. However, specialization also has coordination costs. Becker and Murphy (1992) and Davis (1999) provide the logic of the endogenous-specialization decision: the enterprise will choose to specialize up to the point where the marginal returns from specialization are just equal to the marginal coordination cost of doing so.

Working capital and coordination costs. As Figure 1 illustrates, production occurs in stages. Production of intermediate goods must precede the assembly of the final goods. For simplicity, I assume that intermediate goods are produced instantaneously at the beginning of the period, and are sold to the assembly enterprise at that time.[37] Energy must also be purchased at that time. Assembly takes the entire period, with the sale of the final good at the end of the period. The assembly enterprise must then pay for its inputs at the beginning of the period, but receive payment for its product at the end of the period. It thus needs working capital equal to the value of intermediate goods and energy purchased from other

[37] This assumption is made to keep the complete production process to a single period. The logic of the model is maintained if intermediate goods also take a period to produce.

enterprises.

Working capital creates a coordination cost in this model because the assembly firm pays in advance only for energy and the intermediate goods purchased from other enterprises -- the cost of intermediate goods produced internally need not be financed. Thus, if the assembly firm produces all intermediate goods itself, its working-capital requirements are only for energy purchases. If the assembly firm produces a small range of intermediate goods, it will have a larger working-capital requirement for purchase of the remaining intermediate goods as well as of energy. The demand for working capital to purchase intermediate goods is equal to $[1 - (1/n_t)]Y_t(z)Z$. The cost of working capital is determined by the real interest rate ρ_t in the formal financial sector.[38] The costs of working capital (C_{Ft}) will be increasing in the number of intermediate goods purchased from other enterprises as stated in (7). Each enterprise will maximize the net returns from specialization ($\psi_t Y_t(z) - C_{Ft}$). The first-order condition from the enterprise's specialization choice yields the optimal specialization level in (8).

$$C_{Ft} = \rho_t [(v_t/Z) + (1-(1/n_t))]Y_t(z)Z \quad (7)$$
$$n_t^* = (\theta/(1+\theta))((1+\rho_t)/\rho_t)(Z/(v_t+Z)) \quad (8)$$

The optimal degree of specialization is increasing in Z and in θ. It is declining with an increase in the real interest rate ρ_t and the cost of energy v_t.

The first-order condition summarized in (8) provides a locus of combinations of ρ_t and n_t that achieve optimal resource allocation for the productive enterprise. This locus is illustrated in Figure 2 and is denoted PE. Total output is increasing and final-good price decreasing as ρ_t falls along the locus.

Consider as example the costs of adjudicating contract disputes with other enterprises (C_{Jt}). If there is a possibility of breach of contract, then these costs will be increasing in the number of enterprises supplying intermediate goods to the assembler as in (i). It may be useful to think of this cost in expected terms. Each contract with an intermediate supplier will either be honored or breached, and the probability of a given number of breached contracts is rising with the number of suppliers. The Soviet era will be represented by setting the value of c_o equal to .01, and independence with $c_o = 1$. The institution-building necessary to re-establish the judicial system can be represented by the long process of returning c_o to .01, but is not modeled in this discussion.

$$C_{Jt} = c_o n_t Y_t(z)Z \quad (i)$$

The optimal degree of specialization by the enterprise can be derived by maximizing the value of output net of coordination costs in (ii). The first-order condition yields (iii) that holds for optimal choice of n_t. The second-order condition is satisfied for $c_o > 0$ and $0<\theta<1$, with $\partial^2(\psi Y(z) - C_J)/\partial n^2 = [(\theta-1)/n^2 - c_o(2+\theta)]n^\theta < 0$. The optimal degree of specialization is, as expected, increasing in θ and decreasing in the cost of adjudicating contractual disputes (c_o).

$$\text{Max}_n (\psi_t Y_t(z) - C_{Jt}) = Z\, B(\delta,\theta)\, K(z)^\upsilon\, Z^{-(1+\theta)} [n_t^{\ \theta} - c_o\, n_t^{\ (2+\theta)}] \quad (ii)$$
$$n^* = (\theta/((2+\theta)c_o))^{1/2} \qquad n_\theta > 0,\ n_{co} < 0 \quad (iii)$$

The observed degree of specialization in the Soviet era is thus not necessarily optimal, and some

[38] The firm's endogenous choice of the range of transactions to be governed by external borrowing is logically similar to the household's choice of consumption transactions governed by various payment mechanisms (including money) found in Cole and Stockman (1992). Thanks to Lewis Davis for pointing this out.

"optimal" adjustment may be observed with the transition to post-Soviet institutions. Interpreting this coordination cost as the cost of adjudicating breached contracts puts the Soviet period in a positive light, for such adjudication was not typically a concern. However, coordination costs may also be modeled as the costs to Soviet planners of keeping track of and making consistent the entire flow of inter-enterprise transactions. These costs – in terms of time and skilled planners – will be increasing with the degree of specialization, and will yield a calculation similar to that of (ii) for the allocation of the scarce time and skill resources. Transition to the market may then, other things equal, support increased specialization.

The final-good relative price can then be calculated as a mark-up over the input prices:

$$\begin{aligned} P_t y_t - C_{Jt} &= \Sigma_z Y_t(z) + v_t \xi_t \\ P_t &= Z + v_t + (Z c_o n_t^*) \\ &= Z\{1 + (v_t/Z)\} + Z (\theta/(2+\theta))^{1/2} c_o^{1/2} \end{aligned} \qquad \text{(iv)}$$

with the mark-up the final term in the expression. Note that this calculation presumes that the assembler has no monopoly power in the final-good market. This is justified by the threat of entry of other enterprises in the assembly process. If the assembler knew that any increase in cost would be passed on in the final-good price, then its behavior would not be bound by the profit-maximizing calculus described here. The description of behavior in that instance would be more closely defined by the "soft budget constraint" analysis of Kornai (1980). The threat of costless entry by other assembly enterprises is sufficient to keep the final-good price at this level. The relative price P_t is increasing in the price of energy input, the productivity parameter θ and the coordination cost c_o.

This theory predicts that even with full employment there will be output reductions if the degree of specialization falls. Equation (iii) provides an indication of the potential reasons for such output reduction in the degree of specialization. Notably, an increase in the coordination costs of production will lead to reduction in specialization and a fall in production of final goods. As (iv) illustrates, the increase in coordination cost will also cause the price of final goods to rise relative to the price of energy inputs or intermediate goods.

Figure A1
Production Process: Intermediate and Final Goods

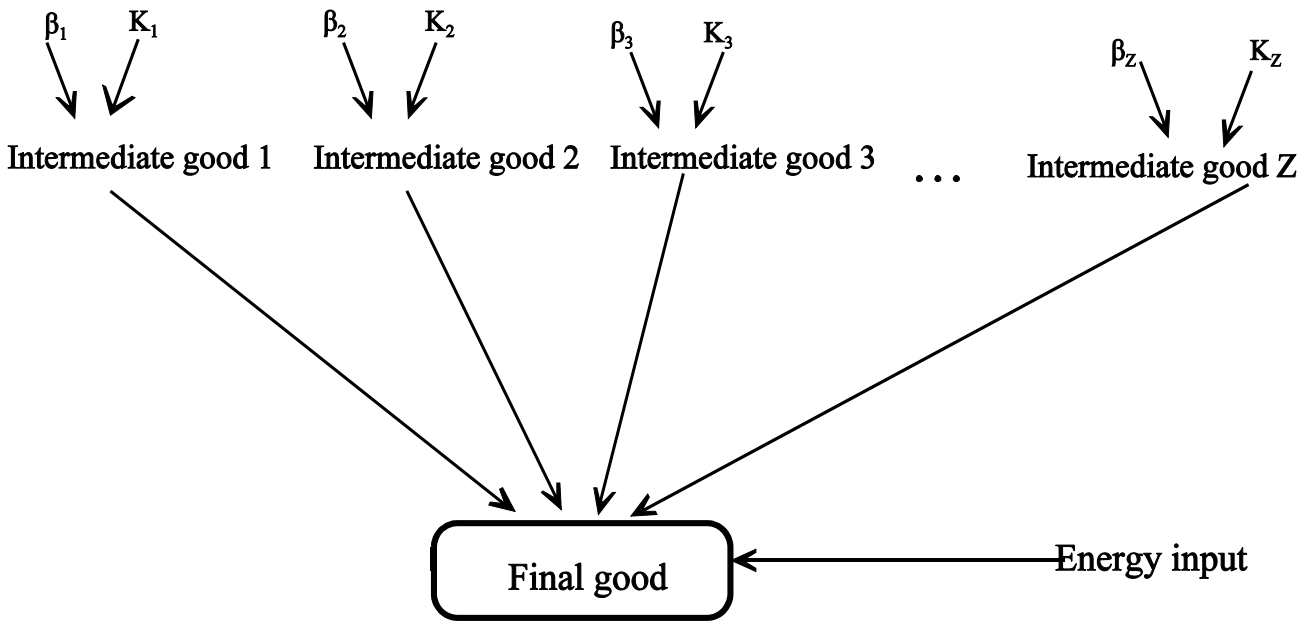


Table A1: **Estimation of Output Equation in Error-Correction Form**

	$\Delta\ln(y_t)$	$\Delta\ln(CR_t)$	$\Delta\ln(y_t)$	$\Delta\ln(CR_t)$
Intercept	0.80 *	2.83 *	0.76 *	2.99 *
	(0.33)	(0.70)	(0.24)	(0.66)
$\Delta\ln(y_t)^s$		-0.94 *		-0.98 *
		(0.38)		(0.36)
$\Delta\ln(CR_t)^s$	-0.03			
	(0.08)			
$\Delta\ln(y_{t-1})$	-0.10	-0.10		
	(0.16)	(0.21)		
$\Delta\ln(CR_{t-1})$	0.05	-0.17	0.06	
	(0.07)	(0.21)	(0.06)	
$\ln(y_{t-1})$	-0.30 *	-0.67 *	-0.26*	-0.69 *
	(0.10)	(0.25)	(0.08)	(0.24)
$\ln(CR_{t-1})$	0.02	-0.22 *		
	(0.05)	(0.10)		
$\Delta\ln(W_{t-1}/P_{t-1})$	0.41 *		0.32 *	
	(0.21)		(0.12)	
$\Delta\ln(Ry_t)$	0.55 *		0.58 *	
	(0.11)		(0.10)	
r_{t-1}		0.11 *		0.08 *
		(0.04)		(0.03)
Δb_t		-2.26 *		-2.37 *
		(0.70)		(0.67)
N	31	31	31	31
F(.)	14.59 *	5.99 *	26.34 *	8.52 *
R^2	0.81	0.64	0.80	0.62

* indicates significance at the 95 percent level of confidence. Standard errors are reported in parentheses..