Institut für Höhere Studien (IHS), Wien
Institute for Advanced Studies, Vienna

Dynamic Model of Privatization
The Case of Ukrainian Economic Transition

Alexander Blinov

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Alexander Blinov
Danilevskogo Str. 17, Apt. 59
310058 Kharkov
UKRAINE
Phone: +380 572 478386
e-mail: blinov@office.kharkov.ua
   or: akimova@polyt.kharkov.ua

Abstract

The paper develops a simple theoretical framework in which the efficiency of industrial restructuring due to privatization process can be analysed. The dynamic model is based on the approach recently proposed by B. Gibson and A.Dutt (1993). This model is extended through inclusion the assumption of increasing efficiency of workers in state enterprises because of competition with the growing number of private firms. This paper attempts to analyse the optimality of time path of privatization in Ukraine as a country with mixed economy.

Keywords

JEL-Classifications

Comments

Contents

1. INTRODUCTION

By now privatization policy in Ukraine was not properly outlined and implemented. This calls for the necessity of more theoretically grounded approach to guiding privatization developments. This paper is devoted to development of dynamic model of privatization that captures the peculariaties of Ukrainian economic transition.

The paper is organized as follows. At the beginning a short overview of privatization process in Ukraine is presented. Chapter 2 focuses in general on the institutional aspects of transition in Ukraine and on current implementation of Privatization Program. Chapter 3 deals with description of dynamic models of transition. The main attention has been concentrated on Aghion-Blanchard approach and its modifications that capture the lack of an efficient tax system, the absence of financial intermediaries, and the exploitation of seigniorage in transitional economies like Ukraine. Chapter 4 presents the complete dynamic model of privatization that includes the assumption about growing productivity of the state sector due to developing competition between private and state sectors of the economy. In the conclusions two main findings of the model are made.

2. OVERVIEW OF THE PRIVATIZATION PROCESS IN UKRAINE

2.1 Privatization as the most important aspect of institutional change

One of the principal ways in which governments of the countries in transition hope to achieve the restructuring of their industrial sectors and economies is through the privatization of state property. This calls for the transformation of the *institutional framework* (legal, economic, technical and social conditions) within which enterprises are going to have to operate.

A change in ownership structure does not automatically mean that the enterprises will be profitable. Efficiency can not be gained as a result of a simple transfer of ownership rights, and privatization itself can not be considered as a panacea for attracting capital and automatically eliminating all of the drawbacks of the state enterprises. The success of privatization depends on the existence of an appropriate *economic* and *social institutions* which enables privatized enterprises to operate effectively. Privatization is viewed by some governments as a crucial element in promoting efficiency and private-sector economic development. The main goals of privatization can be summarised in the Table 2.1.

To reach these goals, specific institutional organizations have to be created that could be able to cover the issues. In this connection it should be pointed out that creating the legislative base for market economy is one of the major points.

Soon after independence, the Ukraine started developing this legislative base. The following laws are very important for property rights, for foundation of new forms of business organisations and for privatization:

– Law on Property (1991) (also known as Law of ownership);
– Law of Business Enterprise (1991);
– Law of Ukraine on Economic Partnerships ("Economic Association Law") (1991)
– Law on Enterprises in the Ukrainian SSR ("Enterprise Law") (1991);
– Civil Code;
– Land Code;
– Law of Ukraine on Bankruptcy (1992);
– Law on Collective Agricultural Enterprise (1992);
– Law on Enterprises, Institutions, and Organisations under Union
  Subordination located within the Territory of Ukraine (1992);
– Law on Consumer Cooperatives (1992);
– Law of Ukraine on Foreign Investments (1992, superseding prior law of (1991);
– Law of Ukraine on Leasing (1992);
– Law of Privatization Certificates (1992);
– Law on Privatization of the property of small State Enterprises (1992)　　("Small Privatization Law");

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– State Program for Privatization (1992);

Table 2.1: The main goals of privatization

Efficient management control	Governance structures that give managers the correct incentives to run and restructure their companies efficiently must be established
Restructuring of the economy	The large industrial firms are more vertically integrated than comparable western firms
	Many of these firms still hoard too much labor and will have to lay off a significant fraction of their work force
	Some firms are expected to be nonvitable and will have to be closed down, either because the markets for their products have disappeared or because their production technologies are hopelessly outdated
Limit the social costs of adjustment	It may be socially inefficient to shut down a large company immediately even if it is not expected to be profitable in the future
	It may be taken into consideration that high unemployment rates and the economic desolation of entire regions may have considerable external effects
	Social and political unrest may put into question the transition process as a whole
Attract foreign capital and expertise	Given the lack of domestic savings, foreign investments will play an important role in economic growth
	Foreign direct investments are expected to lead to transfer of technological knowledge and managerial techniques that are crucial to modernising the economy
Create competitive market structures	Some conglomerates must be split up to reduce their market power, and the government must regulate natural monopolies
Fair initial distribution of wealth	Since existing capital stock belongs to the state, each citizen has the same right on it and it is necessary to start with equal distribution of wealth
Protect government revenues	In all socialist countries, government revenues were raised mainly through the transfer of profits to the state budget, while the tax system comparable for that in western industrialized countries did not exist. If all state-owned companies were privatized before a functioning tax system had been established, the state would lose its main source of revenues

State Program establishes recommended forms of privatization for different categories of state property; it also provides for the issuing of privatization papers (vouchers), their distribution among eligible recipients, and the extent to which property in different categories shall be reserved for voucher sales; it determines measures concerning the involvement of foreign investors; and it sets the requirements for local privatization

programs. As far as institutional aspects of privatization in Ukraine are concerned, an important step was taken in the fall of 1991 with the creation of Ministry of Destatization and Demonopolization, the State Property Fund, and the Committee for Entrepreneurship. The key state organ in privatization is the State Property Fund (including its regional departments). The State Property Fund is headed by a president who is appointed by the President of the Republic. The fund is devided into three boards and includes administrative department and a financial accounts department. Local privatization agencies, enterprize privatization commissions, and intermediary institutions (commercial trust associations, investment funds, holding companies, etc.) are intended to play an important role in the privatization process.

Despite several attempts at enterprise privatization, progress to present date has been very slow. The obstacles to privatization can be variously devided. They could be summarized under five headings: salient, technical, economic, managerial, and attitudinal problems (See Table 2.2).

Table 2.2

Salient	Technical	Economic	Managerial	Attitudinal
Speed (how fast)	Market structures	Savings	Principal-Agent Problem	Time preference and risk-taking
Priorities (why?)	Absence of capital markets	Distributive aspects	Information	Role foreign capital
Foster competition	Information and regulation	Organization of auctions	Efficiency of new management	Entrepreneurship
Enhance stabilization	Valuation	Protecting assets	Corporate governance (implicit, vested, denied)	Claimed property rights
Restructuring	Starting conditions	Macroeconomic environment	Sequencing	Conflicts of interest
Selection of mechanisms				
New owners				

The *speed* of privatization is one of the central problems that bedevilled the debate on the economic transition, and even wider issues, because it may affect - and will be influenced by- how other paramount aspects of socio-political stability can be anchored. It also is a function of the chosen sequence of the transition and its management. It should be stressed that there is an optimal time path of privatization process. It is never optimal to

privatize instantaneously. However, it may be optimal for privatization to begin rapidly and then to taper off over the period or for privatization to start slowly, accelerate, and then diminish.

As for the *priorities* it is very important to find out which privatization should be implemented first - "small" privatization or large scale privatization. The implications for and the best choices of what type privatization can be pursued at each stage of the transition is bound to be ordered differently for housing, land, small businesses, large public industrial firms, financial institutions, and public utilities.

Restructuring is especially important for medium-sized and large industrial enterprises and financial institutions. The restructuring of state-owned enterprises and, in particular, the large enterprises is a complex process. It involves, among other things:

* *The legal transformation of state owned property,* or in other words, the transformation of the ownership of the enterprises - public, joint public/private, private or other forms of ownership. Essentially this calls for the introduction of legislation and redefinition of the ownership of the enterprises;

* *The transformation of the economic environment* within which enterprises are going to have to operate. This calls for the liberalization of markets, prices, etc., the introduction of business and fiscal legislation and regulations governing the banking system as well as internal enterprises accounting and reporting regulations which, on the one hand, force enterprises to be accountable for their operations and actions, and, on the other, allow for the transfer of profits;

* *Technical transformation* - the change from production-driven facilities to product-service and market-driven organizations. This requires technology exchange, process re-engineering, organization-restructuring and attracting funding and investments;

Social transformation - a change in the thinking/philosophy of managers and employees. This calls for retraining of managers, the transfer of know-how, social legislation and the introduction of social safety nets to ease the pain of unemployment and of displacement during the transition period.

2.2 Privatization Program and its implementation

To speed up the privatization process in Ukraine, new government program has been adopted recently that focuses on:

• transforming all state enterprises into open joint-stock companies, except those, still unannounced, that will by decree remain wholly in state hands;

• selling assets belonging to bankrupt liquidated loss-making enterprises;

• beginning mass privatization in all sectors;

• given foreign citizens the right to participate in privatization on equal terms with Ukrainian citizens;

• using privatization proceeds to establish a state investment-credit company;

- developing the insurance in financial markets;
- assisting the development of small and medium-sized businesses.

Unfortunately, the plan is full of contradictory proposals. Declarations in the program's "privatization" section and those in the section on the "state sector of the economy" do not match up. The government blames the catastrophic state of the Ukrainian economy on "the crisis in the state sector, which is loosing its integrity, mobility, and effectiveness chiefly as a result in government regulation/control." Thus, the government prescribes "the formation of the government relations" - not a change in ownership of production facilities as described in the privatization section. The government indicates it will keep its monopoly in some key sectors, including transport, ports, postal services, communications, energy, spirits manufacturing, salt mining, and forestry.

The system of property is so cumbersome in Ukraine that it is difficult to assess the real situation: it is sometimes assumed that what is not "state ownership" is *de facto* privatized, even if it bears the name "collective ownership". In this conception, for the last 3.5 years, 28,000 enterprises have been privatized (See Fig.2.1).
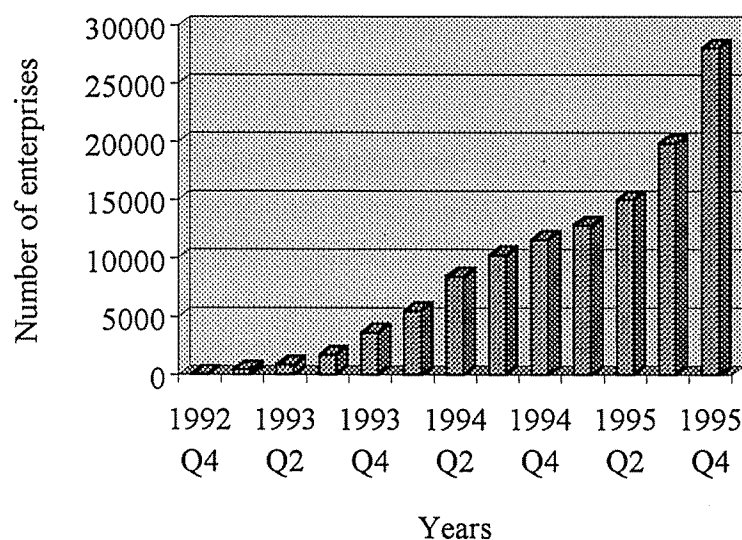
Privatization in Industry

Fig. 2.1

The share of the government in the total equity value has decreased from 96% to 62%. The non-state sector at the end of 1995 represented 56.6% of total number of large and medium-size enterprises. The most intensive process of privatization was observed for small-scale enterprises. There are 80,000 such enterprises (employing less than 200 employees), 25,000 remained state-owned at the beginning of 1995 (others being mainly co-operatives). About 8,000 enterprises had been privatized by the end of 1994, and 22,500 more should have been privatized before end - 1995. In fact, only 13,093 were privatized (that is 58% of the

target) and most of them were privatized during the last quarter (more than 3,000 in December).

The process of privatization mainly can be devided on three parts: the small scale privatization; the large privatization; the mass character of privatization. The main methods of small privatization are buy-outs (50%) and leasing arrangements with buy-out rights (30%). This may partly explain why the prices were often so low and why the local budgets did not receive much of the expected revenues. Starting from September 1995, the number of small enterprises sold through auctions has increased. The Government expects to accomplish the privatization of 10,000 of the remaining small enterprises during the first half of current year. It should be pointed out that a competition must dominate in this process. However, fixed capital indexation problem can slow down process of privatization. Privatization in agriculture has been still less successful. The land owned by 34,700 farmers id just 1.9% of the total area of agricultural land. The main problems are legal land ownership and price of land. The process of the large privatization concerns the so-called medium and large-size enterprises, the number of which was 8,850 in industry alone at the beginning of 1995 (See Fig.2.2).

Development of New Forms of Ownership in Industry
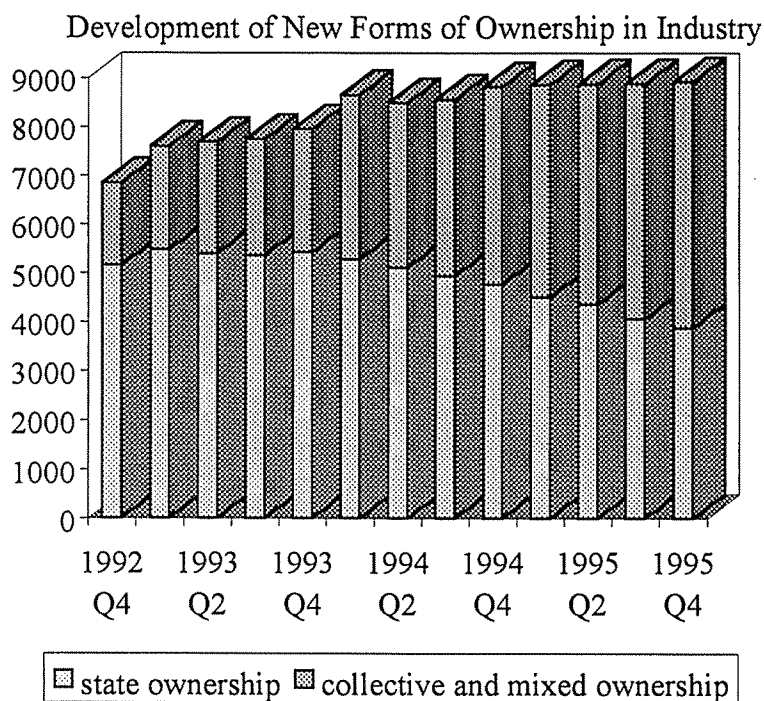
Fig.2.2

Over all branches, there are 18,000 large and medium-size enterprises in Ukraine (including 6,146 of agrarian-industrial complex).

By the beginning of 1995, 2,700 such enterprises (15%) had been already privatized and 8,000 should be privatized later. During 1995 only 945 enterprises were totally privatized and 3,121 were transformed into open equity companies; at the end 1995 - 5,800 medium and large enterprises (about 32% of the total amount) were privatized. In fact , 2, 176 new

open equity companies have still the government as a majority share-holder and can not be considered private. For 1996, there is a plan to privatize 11,600 enterprises, with the commitment that 65% of shares at least would be in private hands.

Now, as has been recently noted by B. Sobolev, Chairman of the Ukrainian State Credit and Investment Company, 47% of Ukrainian GDP is generated from the private sector, double share in 1994. Sobolev criticized international financial institutions for "establishing plans like before ... on how many enterprises are privatized each quarter." He said that of the $1.5 Billion credits that Ukraine received from abroad "were used improperly for support of loss-maiking industries by the government of the time." So, these credits "very often are not playing a positive role and even playing a negative role... hampering privatization".

Analysing privatization process in Ukraine, regional aspects of privatization should be pointed out. Table 2.3 presents 26 main regions of Ukraine in which privatization proceeded.

Table 2.3: Privatization of enterprises by region in 1993-1994 (units)

Regions	Total for 1993-1994	1993	1994
Ukraine	11502	3555	7947
Donetsk	1351	430	921
Lviv	1125	322	803
Kyiv City	849	165	684
Kharkiv	695	236	459
Khmelnitsk	675	383	292
Dnipropetrivsk	644	183	461
Kyiv Region	611	178	433
Zaporizhia	596	216	380
Lugansk	570	159	411
Mykolaiv	407	91	316
Odessa	387	113	274
Ivano-Frankivsk	339	45	294
Rivne	336	152	184
Volynsk	322	113	209
Zhitomir	312	91	221
Sumy	275	49	226
Poltava	266	82	184
Kherson	256	71	185
Cherkasy	255	98	157
Chernivtsi	244	48	196
Vinnitsa	239	65	174
Ternopil	238	76	162
Kirovograd	178	57	121
Chernihiv	147	65	82
Zakarpatska	103	34	69
AR Crimea	82	33	49

Source: Statistical Year-Book of Ukraine 1994. The Ministry of Statistics of Ukraine. Kyiv 1995.

Total number of enterprises that have been privatized during 1993-1994 is 11,502. As it has been mentioned before by the end of 1995 the number of privatized enterprises has

grown more than two and the half times. To clearify the picture of regional distribution of privatized enterprises it seems to be convenient to present these data as a pie graph (Fig. 2.3).

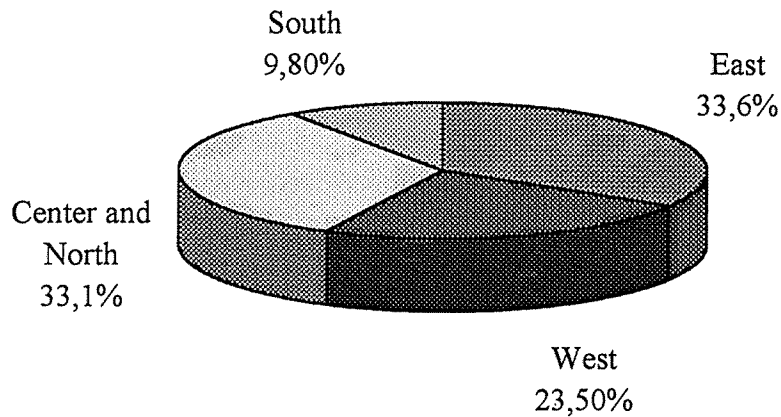## Privatization of enterprises by regions in 1993-1994

South
9,80%

East
33,6%

Center and
North
33,1%

West
23,50%

Fig. 2.3

Regional distribution of industrial production

South
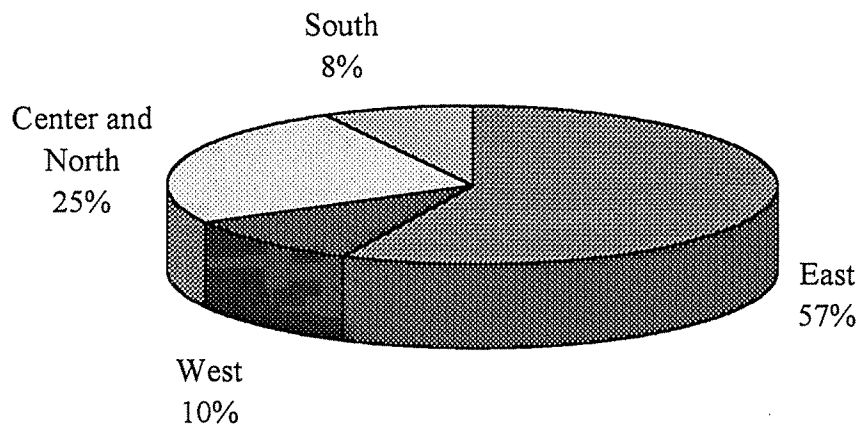8%

Center and
North
25%

East
57%

West
10%

Fig. 2.4

Looking at the break down of privatized enterprises by regions and comparing these data with regional distribution of industrial production (Fig. 2.4), several conlusions can be arrived at:

* Privatization in East much less successful as compared to other regions (the share of this region in industrial output is 57% but it only contributes 33.6% to the whole number of

privatized enterprises). Probably, this can be explained by the fact that mainly, enterprises of heavy industry and machine-building are concentrated here, that are still mostly state-owned.

* West appears to be more advanced, as, with the share of industrial output of 10%, it contributes 23.5% to the number of privatized enterprises. The pace of privatization in this region is the highest one.

* The share of South (9.8%) and Center and North (33%) in the total number of privatized enterprises seems to be more consistent with these region's distributions to industrial output in the country (8% and 25% respectively).

The main method of privatization of medium and large enterprises is the issuance of shares and the placement of them in the public (85%). However, as has been said, only few enterprises succeeded in placing more than 70% of their shares, and the government remains a majority shareholder for many enterprises candidate to privatization.

Attempts at mass privatization in Ukraine have been deceiving up to now. The privatization accounts of 1994 partly failed, and a new system of privatization certificates had been established in 1995. "Voucher" system has been launched, and auctions sales have been developed. In January 1995, the new privatization certificates were distributed in five pilot oblasts and auction centres were set up. Each Ukrainian citizen receives one certificate, with a face value of 50 million Krb, although they are given to the population for free and are nontradable. They may be used to bid directly for an enterprise, or given to an investment fund which will hold a portfolio of shares in different enterprises; the certificates themselves are indivisible, and thus can only be used to buy shares at a single enterprise.

More than 28 million Ukrainian citizens have received property certificates (other should receive them before July, 1st 1996), and 15 mln persons became shareholders. Trust companies have acquired 3.7 mln privatization certificates and have invested 2.2 mln of them; investment funds and companies have acquired 2.5 mln and invested 606,000 certificates. Around 6.8 mln privatization certificates were offered at the auction, 6.3 mln of which have been satisfied.

Privatized enterprises shown at the Fig.2.1 refer to enterprises of all sizes or sectors, and do not include the private enterprises created as such. As it can be observed the pace of privatization in 1992-1993 was very slow, with speed-up starting in 1994 - 1995. The optimality of privatization time path in the transitional economy such Ukrainian one needs to be considered more explicitly.

Development of new forms of Ownership in Industry can be seen from Fig.2.2. The growing share of new forms of ownership in industry provides grounds for considering Ukrainian economy at the current stage as a mixed one.

3. OUTLOOK OF DYNAMIC MODELS OF TRANSITION

3.1 Aghion - Blanchard Model of Transition in Central Europe

The model of transition developped by Phillip Aghion and Olivier Blanchard (NBER Macroeconomic Annual, 1994) is one of the most prominent dynamic models.

It is devoted to transition in Central Europe and based on Polish patterns. Two main assumptions enter the scene: the first is that, after a rapid initial adjustment, private job creation will take time and that it is affected by unemployment (at low levels of unemployment, higher unemployment helps job creation; at higher levels, higher unemployment hinders and may even destroy job creation); the second is that restructuring in the state sector requires the support of the insiders, so that the speed of restructuring depends on labor market conditions as well (in particular, high unemployment hinders restructuring)

This model yields an equilibrium rate of unemployment and speed of restructuring, which are such that the flow into unemployment from restructuring is just absorbed by the rate of private job creation. It implies that the initial adjustment can lead to an initial unemployment rate that exceeds the equilibrium rate. Also, restructuring does not take place until job creation has reduced unemployment to low levels. If unemployment is high, and private creation slow, this adjustment will take time. This configuration fits well the experience of most Central European countries.

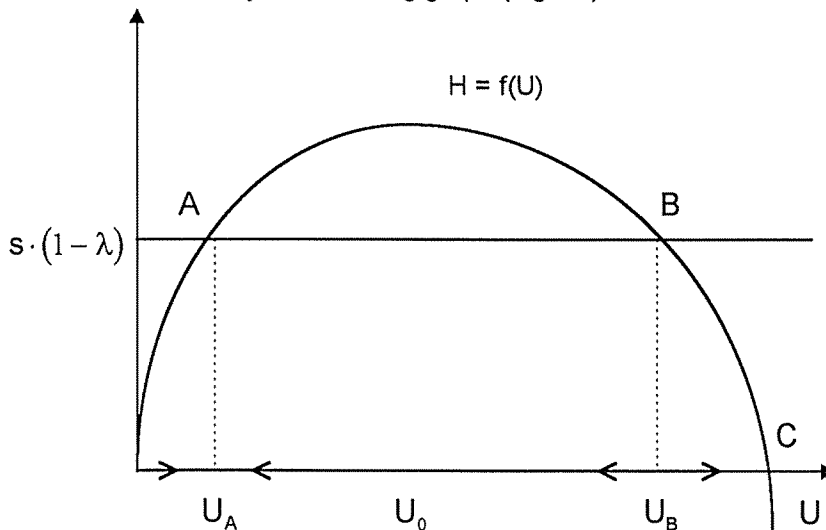This can be confirmed by the following graph (Fig.3.1)

Figure 3.1 Dynamics of unemployment under exogenous restructuring

This figure plots job creation H = f (U) as a function of unemployment U. Horisontal line is flow into unemployment. This yields two conclusions.

(1) There is maximum speed of restructuring. If s (speed of restructuring) is such that

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s(1-λ) exceeds the maximum rate of private job creation, then transition eventually fails. Starting from low unemployment, private job creation is initially positive and increasing. But it remains smaller than the flow into unemployment coming from restructuring, and unemployment becomes so large that the adverse fiscal effects become dominant. Private job creation declines, leading to a faster increase in unemployment. Eventually - at point C in the figure - the fiscal burden becomes so large that both the new and the privatized sector become unprofitable and close down.

(2) If the speed is less than the maximum, there are two equilibria, U_A and U_B. The lower equilibrium is stable, the higher one is unstable. If the initial net decrease in employment is so large that U_0 is to the right of U_B, then private job creation is insufficient to avoid a further increase in unemployment and, again, the eventual collapse of the private sector. But, as long as the initial level of unemployment, U_0, is less than U_B, the economy converges to the lower level of unemployment U_A.

This model has a number of policy implications. Among them is that, in the initial phase of adjustment, priority should be given to private job creation. trying to increase speed of reconstructing of state firms may not be feasible - running into opposition from workers in the state firms - an not be desirable anyway: even if restructuring increases output, its indirect effects through unemployment on private job creation may make it undesirable if unemployment is already high.

In this model it was assumed that state firms faced a hard budget constraint that might be suitable to Central European countries, but it is not true for East European countries like Former Soviet Union republics such as Ukraine.

In the Aghion-Blanchard model the relation bettween restructuring and privatization can be followed up. As it was shown the assumption that restructuring and privatization happen simultaneously is not correct: privatization does not necessarily lead to restructuring, and whether it does depends in part on the form of privatization. A more explicit treatment of the relation between privatization and restructuring may help estimate if, e.g., increasing the speed of privatization by making it easier for insiders to acquire their firms is likely to help or hinder the process of transition.

There are two things that have been neglected in Aghion-Blanchard model: the first one has been mentioned before - soft budget constraint the state firms faced in Eastern European countries; and the second - monetary and financial aspects of transition.

3.2 Transition Model with Inflationary Finance Dynamics

The monetary aspects that have been neglected in Aghion-Blanchard model, were successfully implemented in the model proposed by L. Ruggerone (The Economic Journal, March 1996). The theoretical statements have been modified to capture the lack of an

efficient tax system, the absence of financial intermediaries, and the exploitation the seigniorage.

Assuming the simplest type of inflationary dynamics (unemployment contributions are financed by printing money rather than by taxing labor), the author found the following relationship between inflation rate π and unemployment U (See Figure 3.2). Here straight line is a locus $\pi = \dfrac{b}{h} \cdot U$, and functional lines are steady state locuses for unemployment. Three situations can be observed: two steady states (one stable, one unstable); one steady state associated with the maximum speed of transition; and no equilibrium. If the steady state locus lies above the straight line, unemployment and inflation will be decreasing. On the other hand, if steady state locus $\dot{U} = 0$ is below the straight line: the system collapses.
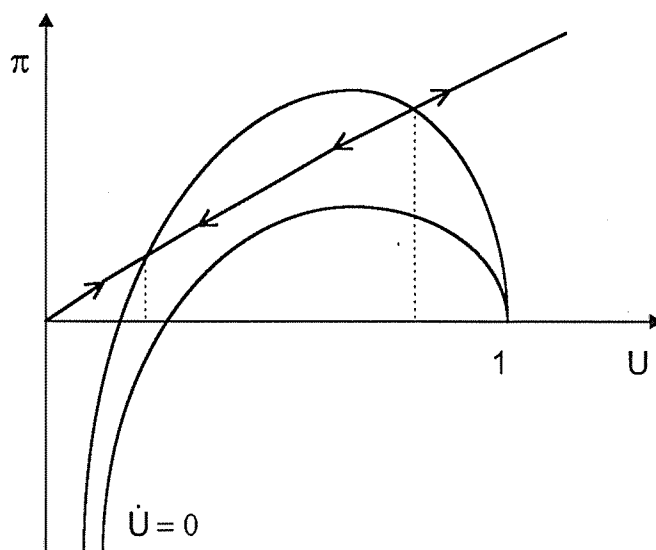

Figure 3.2 Dynamics of unemployment with introduced inflation

Having introduced inflationary finance L.Ruggerone came up with the results similiar to the ones obtained by Ph. Aghion and O.Blanchard. But in this paper the more complicated dynamics is analysed too. Assuming inflation dynamics to be

$$\dot{\pi} = \beta\left(m - e^{-\alpha\pi}\right),$$

considering dynamics of real money as following

$$\dot{m} = Ub - \pi m$$

and the dynamics of unemployment to be

$$\dot{U} = s - \left(\frac{aU}{U + ac}\right)\left(y - cr - b - \frac{\pi m}{1 - U}\right),$$

the author arrived at the following results. Steady state $\pi = k/\alpha$ is a stable focus, i.e. trajectories around the low inflation equilibrium are localy convergent. While the high inflation equilibrium is unstable.

Situation when the system collapses is presented on Fig.3.4. Along the path that tends to the steady state locus for real money asymptotically, inflation is rising and in this case transition economy collapses.

Fig.3.3

Fig.3.4
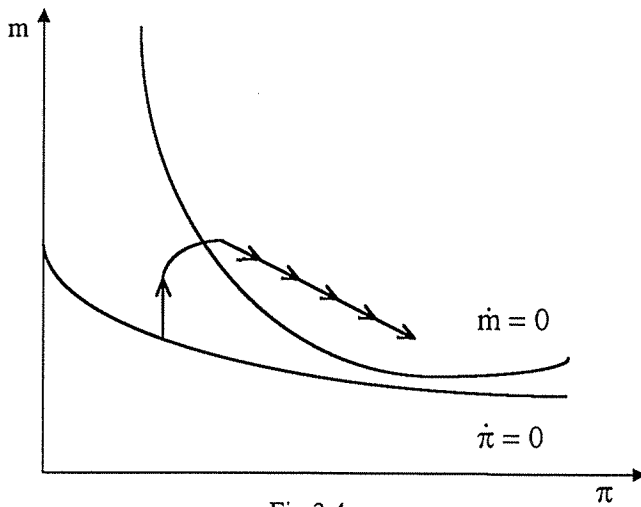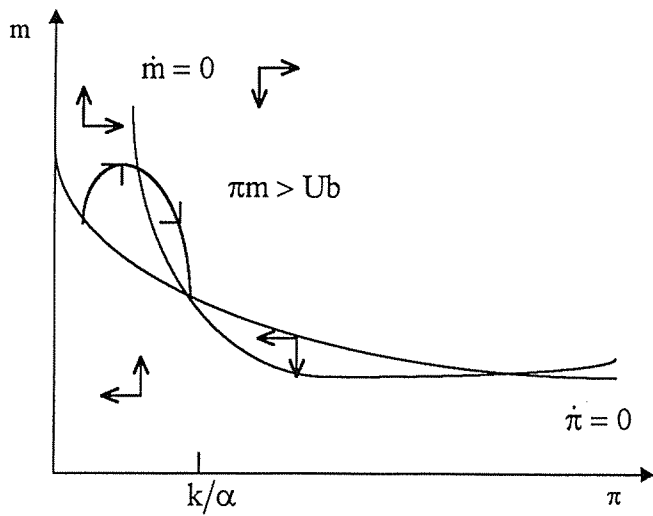
This model has interesting interpretation that is connected with Ukrainian economic transition. Till the year 1993 Ukraine had been moving towards hyperinflation that was accompained by aggravation of public finance, the monetarization of deficit, and the explosion of prices. Existing macroeconomic instability in Ukraine is well explained by the dynamics described in the model.

Thus, the model introduces the possibility that failure of the transition can be due to both too fast transition, and the behaviour of the monetary and financial sectors when the deficit can not be sustained by inflationary finance, and credit market are absent.

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4. DYNAMIC MODEL OF PRIVATIZATION ADJUSTED TO UKRAINIAN REALITIES

4.1 Basic Framework

The proposed model is based on the approach of B. Gibson and A. Dutt (JCE, 17, 1993) in which the feasibility of the mixed economy is discussed. Since, in previous chapter it was shown that Ukraine is may be one of the best example of mixed economy, it is reasonable to apply this model to Ukrainian case. The main difference between Gibson and Dutt model and the one considered here is additional assumption about growing labor productivity in state sector due to competition between state and private sector in the economy. It is quite reasonable because, as privatization and restructuring proceed, the government spending will be shifting from support to loss-making enterprises towards more support given to social sphere development. This creates additional incentives for increased labor productivity, as the part of enterprises profit reallocated via budget is now more efficiently used. There are also another reasons for workers in the firms remaining nationalized firms to become more efficient. As noted in Lipton and Sachs (1990, p.121), "The labor situation has traditionaly been further aggravated by widespread absenteeism and sick leave. Now, however, with workers afraid of job losses, sick leave has dropped sharply according to unpublished government surveys". Bobinski and Robertson making overview the state of Poland's coalition government in the *Financial Times* (January 28, 1992, p.2) have reported, "The biggest surprise is that rapid growth in the private sector has been accompanied by improved efficiency among the remaining 8,000 state-owned enterprises" Thus, this additional assumption calls for more complicated dynamics in the model.

This chapter develops a dynamic macroeconomic model in which there are two sectors, one state and one private. Several assumptions should be marked out. Closed economy is considered. Both private and state sectors produce the same good that could be either consumed or invested and is sold at uniform price. Besides, it is assumed that there is unlimited supply of labor such that capital stock is binding constraint on the output of each sector. The private sector accumulates capital according to its investment function and produces for profit. The state sector profits are used to finance current state expenditure, in order to keep current budget in balance. Saving in state sector can emerge only because of extra profit related to increase in labor productivity in state sector caused by growing competition between state and private firms in the process of privatization. Privatization is attractive to the government as it provides additional sources to reduce public sector deficit. There are no taxes in the model. Money supply is growing at the rate that is equal to the capital account deficit (the rate of new state sector investment less privatization). Real wages fall as privatization slows down and *vice versa*. Sales of state sector capital stock to the private sector causes reduction in money supply that, in turn, influences price level and real wages. When real wages grow, private sector has less incentives to purchase assets from the state, whereas state sector has less incentives to sell its assets too. Let us suppose that

capital coefficients are equal in state and private sectors. But as far as labor coefficients are concerned, they differ across the sectors (initially it is assumed that state sector employs more labor per unit of output). The main point here is: whether the privatization process will cause complete dissolution of the state sector or equilibrium outcome within the mixed economy will be reached.

4.2 Description of the model

More rigorous description of the model follows. Production function is assumed to be as:

$$Y_i = a_i \cdot K_i$$
$$Y_i = \frac{1}{b_i} \cdot L_i \tag{1}$$

where Y_i is output, K_i and L_i are respectively capital and labor stocks of sector i (s- state sector, p - private sector). Labor and capital coefficients b_i and a_i in general case are not constants. For closed economy we can write the fundamental equation

$$\sum_{i=s,p} Y_i = \sum_{i=s,p} [C_i + I_i + G] \tag{2}$$

where

$$C_s = \frac{1}{P}(\omega \cdot L_s)$$ - Consumption in state sector;

$$C_p = \frac{1}{P}(\omega \cdot L_p) + (1-s)\frac{1}{P}(P \cdot Y_p - \omega \cdot L_p)$$ - Consumption in private sector;

ω - nominal wage (the same in state and private sectors);

I_i - investment functions in both sectors;

G - government spending that by assumption is the following

$$G = \frac{1}{P}(P \cdot Y_s - \omega \cdot L_s). \tag{3}$$

Here s is fraction of income that is saved in private sector.

It should be pointed out that extra saving in state sector that emerges due to growing labor productivity when privatization proceeds can be presented as function of speed of privatization in the economy. In this case equation (2) can be rewritten as

$$I_s + I_p = s \cdot \left(1 - \frac{wb_p}{P}\right) a_p K_p + \sigma \tag{4}$$

where $\sigma = \sigma(\pi)$, and π - the rate of growth state capital stock, privatized over time, i.e. this function shows that if privatization proceeds, the state sector will have additional saving due

to increased labor productivity and this saving will be directed to additional investment in the economy. On the other hand, when process of privatization does not proceed, this function is just equal to zero, i.e there is no extra investment involved. Implicitly this function can be presented by linear relationship

$$\sigma(\pi) = \alpha \cdot K_s \cdot \pi$$

where α is positive parameter.

The private investment function will depend:

– in the short run - upon excess holding of money by private sector firms over their money demand;

– in the long run - upon state investments (in the sense of their profitability in future).

This can be expressed in Gibson and Dutt model by following way

$$I_p^d = \tau_0 \cdot K_p + \tau_1 \cdot I_s + \tau_2 \cdot \left(M_p \Big/ P - \beta_p \cdot K_p \right), \tag{5}$$

where τ_0, τ_2, β_p - positive parameters, τ_1 - can be either positive or negative. This reflects the profitability of state sector investment for private sector in future. If private sector considers state investment as profitable one then the sign of this term will be positive (i.e. investment is crowding in) and vice versa . First term on r.h.s. reflects autonomous investment. As far as the value τ_2 is concerned, in the short run it is supposed to be zero because of lag in this operation. However, in the medium run this parameter can be positive.

Desired state investment function can be presented as

$$I_s^d = I_s + \tau_s \cdot \left(M_s \Big/ P - \beta_s \cdot K_s \right) \tag{6}$$

where M_s - money balances held by state enterprises. Besides, it is assumed that money supply is equal the sum of deposits, i.e.

$$\sum_{i=s,p} D_i = M$$

Then let us determine the main variables of the system $k = K_s / K$, the ratio of state capital to the total capital stock, and $m = M / K$, the ratio of money supply to total capital stock. Proportional rate of change of these variables is expressed as

$$\begin{aligned} \hat{k} &= \hat{K}_s - \hat{K} \\ \hat{m} &= \hat{M} - \hat{K}, \end{aligned} \tag{7}$$

Where

$$\hat{K}_s = g - \pi, \tag{8}$$

$g = I_s \Big/ K_s$ in turn is the rate of growth of state stocks due to state sector investment and π,

as it was mentioned before, is the fraction of state capital stock that is privatized over time. Privatization function π is very complicated one that hinges upon expected

profitability of state assets and other parameters reflecting the transfer of assets between state and private sectors in the economy. The rate at which private sector will purchase state sector assets depends on the current real wage in state sector that in turn depends on price level:

$$\pi = \pi \ (P), \tag{9}$$

while $\pi' > 0$. It is also assumed that privatization function is continuous and differentiable one of the price level. Thus, dynamic of this process is the following: as state sector capital is sold, money supply is decreasing, real wages grow that results in less incentives to purchase capital assets from the state.

4.3 Transitional Dynamics

The core of the evolution of dynamics is the following expression that is valid for short time

$$\tau_0 \cdot K_p + I_s \cdot (1 + \tau_1) = s \cdot \left(1 - \frac{\omega \cdot b_p}{P} \right) \cdot a_p \cdot K_p + \sigma(\pi) \tag{10}$$

where l.h.s. is sum of investments in state and private sectors and r.h.s. represents saving in private sector and extra saving in state sector

Price adjustment in medium run depends on excess of desired investment over actual saving. The adjustment mechanism can be written as:

$$dP/dt = \theta \cdot \left[I_s^d + I_p^d - s \cdot (1 - \omega \cdot b_p / P) \cdot a_p \cdot K_p - \sigma(\pi) \right], \tag{11}$$

where θ is the speed of price adjustment. Substituting variables from (10) into (11) and assuming that $\tau_2 = \tau_s = \tau > 0$ and $\beta_s = \beta_p = \beta$ yields

$$dP/dt = \theta \cdot \tau \cdot (M/P - \beta \cdot K) \tag{12}$$

where $K = K_p + K_s$.

While $P = m/\beta$ is stable equilibrium in the medium run. Rate of growth of state sector capital stock g from (10) is presented

$$g = \frac{\left[s \cdot (1 - \omega \cdot b_p / P) \cdot a_p - \tau_0 \right]}{(1 + \tau_1)} \cdot \frac{1 - k}{k} + \frac{\alpha}{1 + \tau_1} \cdot \pi(P) \tag{13}$$

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It can be seen from this equation that surplus of private sector saving over private sector investment and the term of equation reflecting the state of privatization determine the rate of growth in state sector capital stock. Taking into account equilibrium condition in medium-run for equation (12) it can be derived that $g = g(m, k)$ and partial derivatives are the following

$$g_m = \frac{s \cdot \omega \cdot b_p \cdot a_p \cdot \beta \cdot (1-k)}{(1+\tau_1) \cdot k \cdot m^2} + \frac{\alpha}{\beta(1+\tau_1)} \cdot \pi' > 0,$$

$$g_k = -g/k \cdot (1-k) < 0, \qquad\qquad (14)$$

$$P_m = 1/\beta > 0,$$

Analysing these expressions one can conclude that :

− Since $\pi' > 0$, in our model, like in the model by Gibson and Dutt, the rate of growth of the state capital stock will be increasing as money supply grows;

− Absolute value of growth of state sector capital stock is reduced with increasing in the state sector share of capital stock.

− Growth in money supply entails increase in price level.

In the long run all state variables can adjust. The rate of growth in total capital stock is expressed from equation (10) as

$$\hat{K} = g \cdot k \cdot (1+\tau_1) + \tau_0 \cdot (1-k) - \alpha \cdot \pi \cdot k \qquad\qquad (15)$$

and the equation of motion for state sector capital as a share of the total one is the following

$$\hat{k} = g \cdot \Gamma - \pi(1 - \alpha \cdot k) - \tau_0 \cdot (1-k) \qquad\qquad (16)$$

where $\Gamma = \left[1 - k \cdot (1+\tau_1)\right]$.

The equation of motion of money supply as a share of total capital is determined as

$$\hat{m} = (k \cdot \mu/\beta) \cdot \left\{ g\left[1 - (1+\tau_1) \cdot \beta / \mu\right] - \pi \cdot \left(1 - \alpha\frac{\beta}{\mu}\right) \right\} - \tau_0 \cdot (1-k). \quad (17)$$

where μ is money multiplier.

These two equations (16) and (17) determine dynamics of this system. For convenience these two differential equations can be presented more generally

$$\hat{k} = F_1(k,m)$$

$$\hat{m} = F_2(k,m)$$

Although some simplifications were made in the model it remains quite complex for analytical solution. Steady state of the system is defined according to a common rules, i.e. r.h.s. of equations are set equal zero simultaneously. Solving for k gives steady state

$$k = \beta/\mu \qquad (18)$$

It is worth using Jacobian method for testing stability of the system. Like in Gibson and Dutt model, Jacobian is the following

$$J = \begin{bmatrix} \dfrac{\partial F_1}{\partial k} & \dfrac{\partial F_1}{\partial m} \\ \dfrac{\partial F_2}{\partial k} & \dfrac{\partial F_2}{\partial m} \end{bmatrix} = \begin{bmatrix} \tau_0 - g \cdot (1 + \tau_1) + \Gamma \cdot g_k + \alpha \cdot \pi & \Gamma \cdot g_m - \pi' \cdot (1 - \alpha k)/\beta \\ \tau_0/k + \Gamma \cdot g_k & \Gamma \cdot g_m - \pi' \cdot (1 - \alpha k)/\beta \end{bmatrix}, (19)$$

except for some additional terms that reflect labor productivity growth in state sector when privatization proceeds in the economy. It is implicitly assumed that in these expressions $\Gamma > 0$ and $g>0$.

It is very helpful for the analysis to know the slopes of isoclines (m, and k) which can be determined by

$$\left. \frac{dm}{dk} \right|_{\hat{k}=0} = -\frac{\partial F_1}{\partial k} \bigg/ \frac{\partial F_1}{\partial m} = -\frac{\tau_0 - g \cdot (1 + \tau_1) + \Gamma \cdot g_k + \alpha \cdot \pi}{\Gamma \cdot g_m - \pi' \cdot (1 - \alpha k)/\beta}$$

$$(20)$$

$$\left. \frac{dm}{dk} \right|_{\hat{m}=0} = -\frac{\partial F_2}{\partial k} \bigg/ \frac{\partial F_2}{\partial m} = -\frac{\tau_0/k + \Gamma \cdot g_k}{\Gamma \cdot g_m - \pi' \cdot (1 - \alpha k)/\beta}$$

As it is known stability of the system depends on signs of trace and determinant of Jacobian matrix. Obviously, the three key parameters that shape phase diagram are τ_0, α and π'. There are several variances of relationships between these signs. Not taking into account unstable patterns of growth, we will only consider options that seem to be plausible in the Ukrainian context.

Option 1: Stable tangent node (trace is negative, and determinant is negative too). This case is presented on the figure 4.1. As it can be observed slopes of these two isoclines are negative. Trajectory starting at the point A(figure 4.1) will be gradually reducing the amount of the state-owned capital along the trace towards long-run equilibrium. The closer the economy is to the steady state along A, the price level will be increasing due to increase in money supply. Real wages fall, saving in the private sector of the economy grows, and

capital accumulation increases. Scenario A corresponds to the strong privatization evolvements that appear to be quite painful with respect to the labour force in the economy. Though, this privatization path is quick one.

If our initial location were at B, the pace of growth of fiscal deficit would be lower as compared to one of the capital stock. If this is the case, one should expect to see decline in the price level and, thus, increase in the level of real wages. Strong privatization is related to declining real wages along A, whereas more slow privatization- with increasing real wages along B. If the assumption about increasing labour productivity in the state sector holds, the slopes of both isoclines are getting steeper (in this picture it is shown by dotted lines). In this case, long-run equilibrium of the mixed economy can be reached much earlier along A trajectory. At the same time, case B is almost identical to the one with constant labour productivity in the state sector.

Option 2: Stable focus (eigenvalues of Jacobian matrix are complex, and trace is negative). In this case, as it is shown at figure 4.2 , long-run equilibrium is stable as well , but it is achieved cyclically that implies the possibility of nationalization of the early privatized enterprises. Although B.Gibson and A.Dutt do not consider this outcome to be realistic, there are many reasons to believe that this could be the case in most of transitional economies. Poland and Russia provide good examples of this. Dotted line presents the situation when the state sector faces increasing labour productivity as privatization proceeds. Like in the first option, the slopes of isoclines will be steeper. In this case, the movement towards long-run equilibrium passes through more phases privatization - nationalization as compared to the case when labour productivity in the state sector is assumed to be constant (solid line). As the state sector is getting stronger, it will have more incentive to nationalize rather than continue selling stocks out.
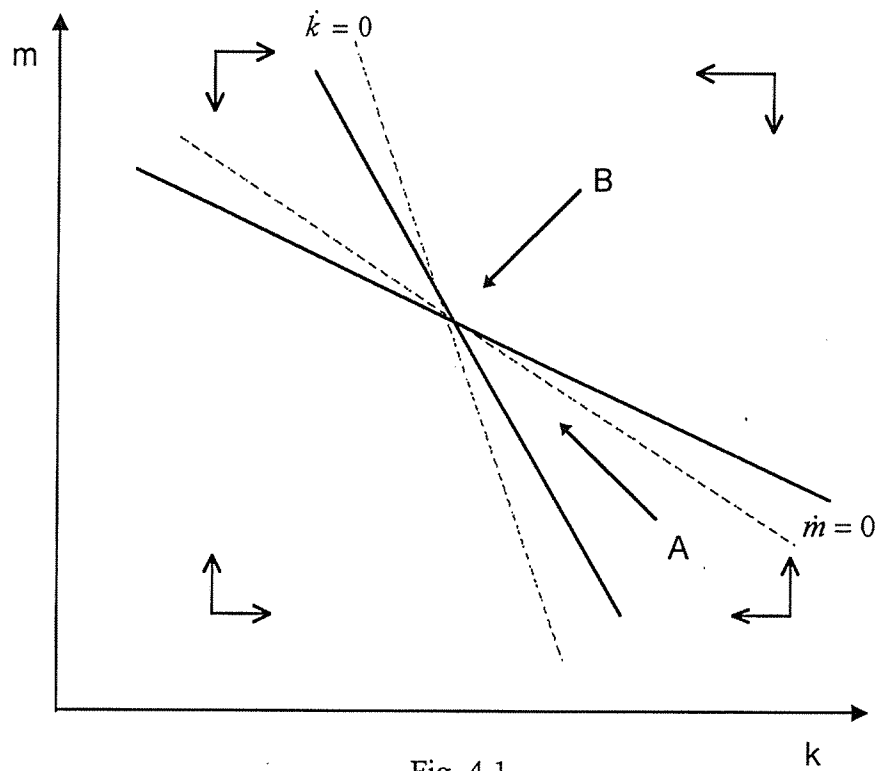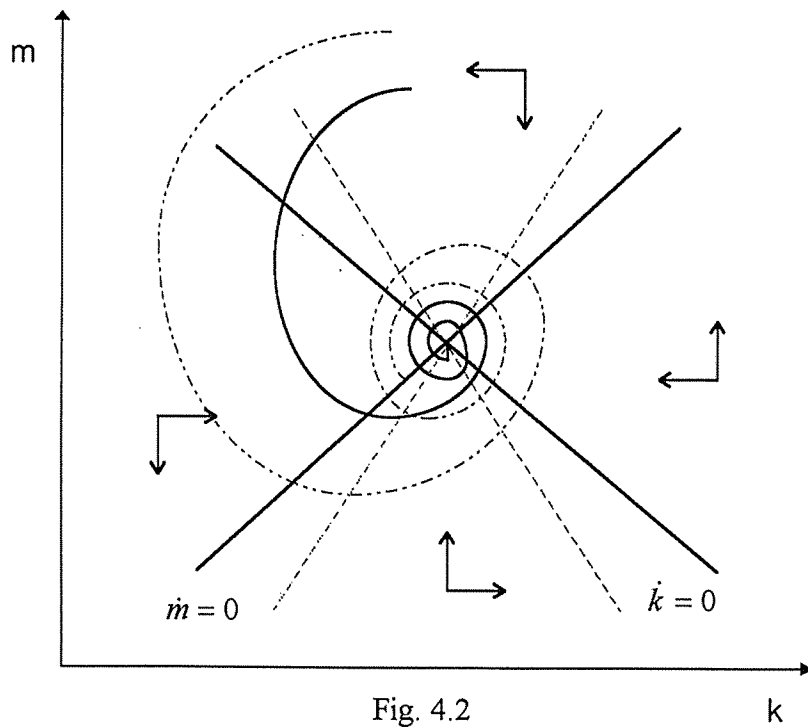
Fig. 4.1

Fig. 4.2

CONCLUSIONS

Recent privatization developments in Ukraine and changing proportions of state and non-state owned property provide grounds to treat Ukraine as a country with mixed economy. The model described in this paper shows the outcome where private and state sectors are mixed in comparable proportions in long run.

Two main outcomes of our model, which includes assumption about growing labor productivity in state sector due to competition between state and private sectors that appears as privatization proceeds, are as following:

- the state of long-run mixed economy is achieved more quickly (but brings on more pain for the economy);
- on the way to this equilibrium economy can also pass through several privatization-nationalization phases (this seems to be quite plausible for some transitional economies in spite of the fact that many scholars do not accept this outcome).

However, this model is only the first step in development of more complicated one which includes more factors, such as inflation and unemployment in the economy. To proceed with the more complicated model, quite sofisticated simulation will be needed.

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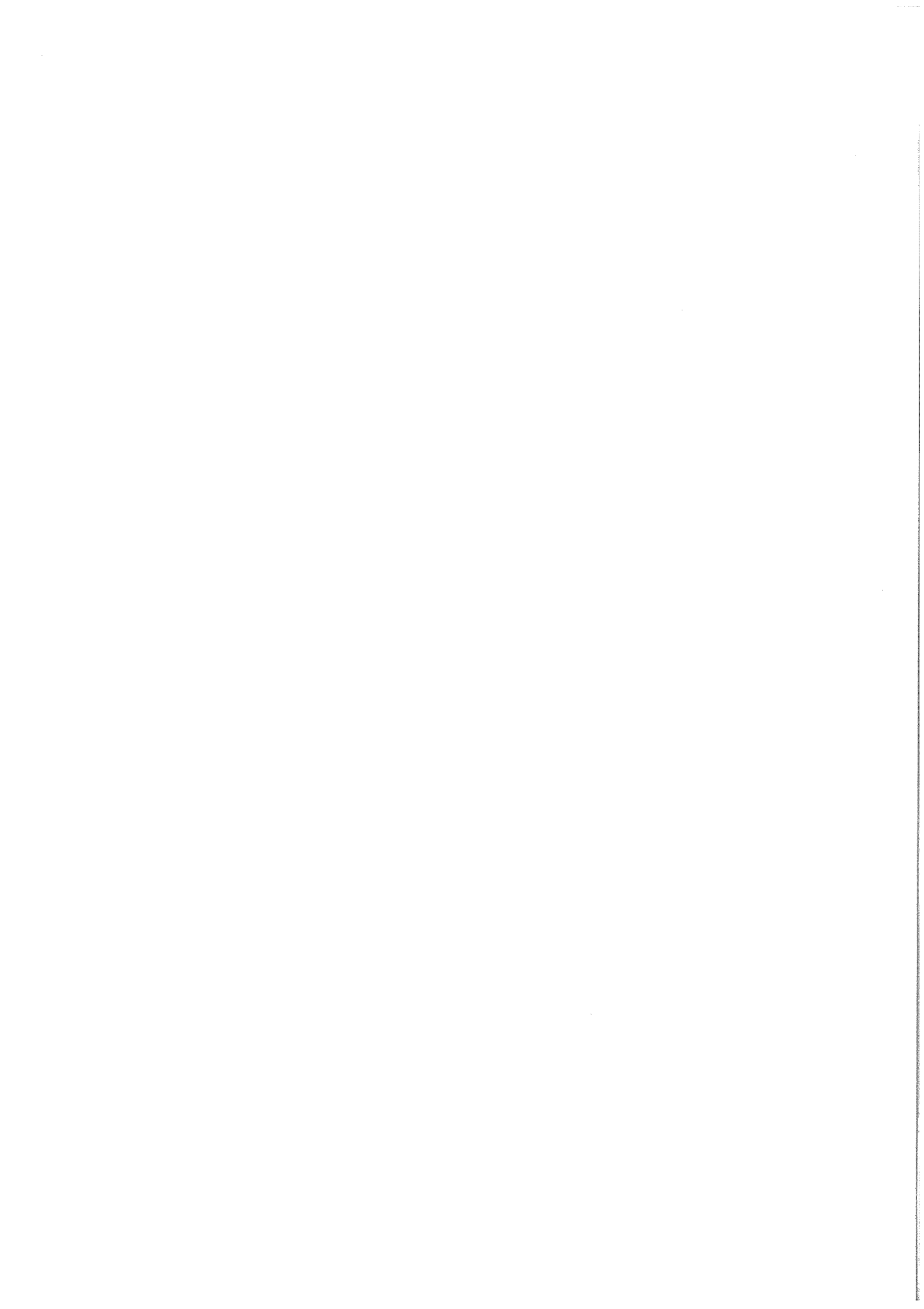
Institut für Höhere Studien
Institute for Advanced Studies
Stumpergasse 56
A-1060 Vienna
Austria

Phone: +43-1-599 91-145
Fax: +43-1-599 91-163