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# **LICOS**

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#### **Price Liberalization and Output Decline in Transition**

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# Price Liberalization and Output Decline in Transition

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## Abstract

In this paper, we attempt to fill the gap in theoretical explanations of a large output decline that took place in the early years of transition process. The prevalent explanations, commonly found under the title of disorganisation, are successful in explaining output decline in countries of former Soviet Union, but less so for Central and Eastern European countries. The model we develop shares the cause of output decline with disorganisation - price liberalisation, however, the decline takes place only under a set of plausible assumptions: adjustment costs to labor mobility across economic sectors and large benefits to inactivity in a form of either government transfers or reservation wage earned in informal economy. Liberalisation of prices in a form of removal of distortionary taxes creates incentives for labor mobility from a declining sector to inactivity. The decline takes place only in a part of the economy, while the rest of the economy stagnates or slowly grows. Since the model does not have a closed-form solution, we analyze the equilibrium allocation using simulation methods. We also discuss the political economy of reforms and identify the conditions under which rational voters under majoritarian voting rule would support the price liberalisation.

*KeyWords:* liberalization, transition, recession, adjustment cost, government transfers, reservation wage, heterogeneity

*JEL Classification Numbers:* F11, J21, J60, O11, O17

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# 1 Introduction

The debate on the causes of the large output fall in the early years of the transition process in Central and Eastern Europe (CEE) and countries of former Soviet Union (FSU) has not yet reached a consensus. One obvious reason for this is the low quality or even missing relevant data for these countries for the periods of output decline. The other, potentially more important reason, is that output decline cannot be attributed to only one factor or explained by one underlying mechanism as many structural and policy changes took place simultaneously.

The existing literature on output decline can be usefully divided into two strands depending on the policies and related mechanisms through which output decline takes place.<sup>1</sup> The first strand emphasizes the stabilization policies aimed at reducing the inherently high inflation rates in these countries (Berg and Blanchard (1994) and Rosati (1994)). According to this view, output decline took place due to an excessive inward shift of aggregate demand. While this explanation may account for part of the output decline, several reasons have been put forward against it: (1) historically stabilization programs were not followed by large output declines, which is also true for earlier stabilization programs in Latin America (Kiguel and Liviatan, 1989); (2) the relationship between stabilization and growth is not necessarily negative; and (3) output decline across transition countries took place irrespective of the type of stabilization program (Coricelli and Campos, 2003).

The second strand of the literature, recently receiving more attention, focuses on the factors underlying the inward shifts of aggregate supply. Calvo and Coricelli (1993) related output decline to a lack of credit for financing production. The collapse of the planning system left a void in the financing of firms. Indeed, in the year of the largest output decline, a surge in real interest rates was observed. Although this explanation is plausible, Roland (2000) doubts that we could ascribe entire output decline to it, as inter-firm arrears and continued barter trade may have provided alternatives to costly banking credit and eased the financial constraints faced by firms.

The most popular idea underlying the explanations of output decline provided by Blanchard and Kremer (1997) and Roland and Verdier (1999), is that liberalization of prices and trading relations after the collapse of the planning allocation mechanism leads to disorganization. In addition, their results are driven by the same assumption - specificity of relations between firms. Blanchard and Kremer (1997) argue that price liberalization provided firms in long production chains the scope for bargaining. Under the assumption of either incomplete contracts or asymmetric information, the outcome of bargaining may be inefficient. In both

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<sup>1</sup>The extensive literature review is beyond the scope of this paper. The interested reader is referred to the book *Transition and markets* by Gerard Roland (2000) and a survey article by Coricelli and Campos (2003). An interesting critical review of the existing literature can be also found in Boeri (2000a).

cases buyers of inputs are unable to provide sellers an offer that would beat their outside option and thus output declines. Blanchard and Kremer (1997) draw two important implications from their model: (1) output decline is larger in industries producing more complex goods and (2) output decline is larger in countries which are initially less liberal. Using the data for a sample of Ukrainian firms, Konings and Walsh (1999) provide robust evidence that firms with more complex production structures grew more slowly in terms of employment. However, Blanchard and Kremer (1997) themselves recognized that bargaining inefficiencies are likely to be less important in the countries of CEE than in the countries of the FSU. Firms in CEE were more liberal in their choices in the period prior to the collapse of socialism and institutions governing the contracts between firms were not absent to such extent as in FSU.

In the Roland and Verdier model (1999), the process of liberalization is interpreted as freedom to contract, prices, however, play no role in explaining output decline. They assume that firms engage in relation-specific investment after they find the partners of sufficiently high quality. The fall of output takes place because firms are willing to postpone their relational investment in a situation where the option of further search is more valuable than immediate investment. At the aggregate level, depreciation may be larger than investments and cause a decrease in investment demand and thus aggregate output. An instant appeal of this model is its consistency with an important stylized fact: the simultaneous decline of investment demand and output. However, we cannot exclude the possibility that the causal relationship runs in the opposite direction, from lower expected output growth to lower investments. Again, this explanation relies on information imperfections that may be more relevant for FSU than for CEE.

In this paper, we propose a theoretical model of price liberalization, which relates output decline to a change in relative prices. The idea is not new in transition literature. Gomulka (1992) and Kornai (1994) were the first to emphasize this mechanism. Their idea is that aggregate output declines because a decline in production in a part of the economy is not compensated by a rising output in the rest of the economy. Rosati (1994) and Roland (2000) dismissed this explanation because it can explain at most output decline in a part of the economy. However, this explanation of output decline is the only one that provides explanation for diverging growth rates in different sectors of economy. While Blanchard and Kremer (1997) model predicts that sectors with different complexities should experience different decline rates, this explanation is valid mainly for countries of FSU. Thus, price liberalization operating through relative price adjustment may be considered as complementary explanation of output decline aside to hypotheses of credit crunch, disorganization and decline due to stabilization policies.

The model we develop in this paper builds on the model considered by Gomulka and Lane (2001). They admit that price liberalization does not generate output decline if production factors are freely mobile, as considered in Blanchard (1997). Gomulka and Lane (2001) rely on evidence provided by Boeri and Flinn

(1999), who show that labor mobility in Central and Eastern Europe was even smaller than in the most rigid Western European labor markets (e.g. Italy). Therefore, in a short run limited or no labor mobility can provide a constraint on growth of firms. They assume prohibitive adjustment costs so that no worker moves between the sectors. This is not enough to generate output decline, so Gomulka and Lane (2001) assume that nominal wages are predetermined and after price liberalization, wage is not allowed to differ across sectors, so a part of workers in a declining sector are made redundant. However, these workers have a strong incentive to bid the wage down and thus keep their employment. In our opinion, the assumption of predetermined wages is a strong limitation of their model to fully characterize the anatomy of output decline.

The model we develop in this paper upgrades the ideas of Gomulka and Lane (2001) in three directions. First, instead of assuming that workers are perfectly immobile, we assume that workers that move across sectors face adjustment cost. Second, we introduce the outside options to workers in a form of government transfers (retirement pensions, unemployment benefits, reservation wage) which provide, to workers who find a burden of adjustment cost to high, incentives to quit the declining sector and thus allow output decline. Third, we provide additional evidence in support of the hypothesis of importance of price liberalization.

The remainder of this paper is organized as follows. Next section summarizes the main stylized facts relevant for the exposition of theoretical model. In the third section, we present the model setup. In the fourth section we analyze the model using simulation methods and discuss political economy issues and measurement of output. In the last, we summarize the main results and conclude.

## 2 Stylized facts

The model we develop in this paper has a relatively rich structure which can be motivated by a wide set of stylized facts. The first and key stylized fact that excited economists most is the output fall across all transition countries in CEE and FSU. In interest of space we selected a set of countries, mostly from CEE, for which the theoretical model we propose may be more relevant. Countries differed in the extent of output declines, ranging from 13% in Czech Republic to 47% in Russia. On average, output declined much less in CEE than in FSU, the difference associated to initial share of trade with Council for Mutual Economic Assistance (CMEA) and the process of disorganization. While we recognize the importance of disorganization explanation, we are interested here in the decline that is associated to the change of relative prices. This, however, does not imply that relative price change did not contribute to output decline in FSU as well.

Table 1: Cumulative real GDP growth factors (1989=100)

Country \ Year	1989	1990	1991	1992	1993	1994	1995
Albania	100	90	65	60	66	71	81
Bulgaria	100	91	80	74	73	75	77
Czech Rep.	100	99	87	87	87	89	94
Estonia	100	94	81	69	63	62	65
Hungary	100	97	85	82	82	84	85
Poland	100	88	82	84	88	92	99
Romania	100	94	82	75	76	79	85
Russia	100	96	91	74	64	56	53
Slovakia	100	97	83	78	75	79	84
Slovenia	100	95	87	82	84	89	92

Source: *EBRD Transition Reports*.Table 2: Share of prices in CPI under government control [in per cent] and number of prices under government control in EBRD basket<sup>2</sup>

Country \ Year	1989	1990	1991	1992	1993	1994	1995
Albania	-, -	-, -	-, -	-, 10	-, 10	-, 10	-, 10
Bulgaria	100, 15	70, 12	24, 2	16, 3	26, 3	43, 3	46, 3
Czech Rep.	-, 15	-, 15	28, 9	18, 4	18, 4	18, 4	17, 4
Estonia	-, -	-, -	-, -	-, -	-, -	21, 3	18, 3
Hungary	18, 7	16, 7	11, 6	11, 4	11, 2	12, 2	13, 2
Poland	19, 10	11, 4	11, 3	11, 3	11, 3	12, 3	12, 2
Romania	100, 15	85, 14	47, 15	29, 13	20, 7	18, 5	18, 5
Russia	-, 15	-, 15	-, 15	-, 7	-, 7	-, 6	-, 5
Slovakia	-, 15	-, 15	-, 9	-, 5	22, 5	22, 5	22, 5
Slovenia	-, 5	-, 5	-, 5	24, 5	20, 6	18, 5	22, 5

Source: *EBRD Transition Reports*.

The effect of price liberalization on differential sectorial performance would need to be explored at disaggregated level. The distortionary elements that affect the allocation of production factors can be traced in differential tax rates, regulated prices, budgetary subsidies, arrears to public utilities and monetary subsidies. The data on all of these aspects of distortions in allocation of production factors are widely unavailable and we are forced to rely on data that can only indirectly measure the extent of removal of price distortions. In Table 2 above, we show the time series for shares of prices in Consumer Price Index under the government control and number of goods in the EBRD basket under

<sup>2</sup>The EBRD basket contains 15 goods and services: flour/bread, meat, milk, petrol, cotton textiles, shoes, paper, cars, television sets, cement, steel, coal, wood, rents and inter-city bus service.

government control. These measures of price distortions are not ideal as they do not necessarily contain the information how different the relative prices are to free market ones. Nevertheless, we believe that these data are the first approximation of timing of large changes in price liberalization.

Matching the data from Tables 1 and 2 confirms the relationship between price liberalization and output decline. For example, in 1990 Bulgaria reduced the share of prices under government control from 100 to 70 per cent, while output declined by 9 per cent. In the following year, the process of liberalization was even more intense and output lost further 12 per cent. Poland, which initially had smaller share of prices under the government control, similarly experienced the largest output decline in the year of the largest change in share of government controlled prices. Czech and Slovak Republics made the largest efforts in price liberalization in 1991, when also the largest output declines in these countries took place. For countries like Albania, the data does not allow to establish in which year liberalization took place. However, EBRD Transition Reports note a significant change in the direction of price liberalization, which took place in 1992. Although those are available for all years, we decided to use share of CPI as they are more informative about the speed of price liberalization. For Slovenia, major change in price liberalization was in 1990 when output declined for 5 per cent. In the subsequent year, trade embargo by Serbia caused additional output decline.<sup>3</sup>

Table 3: Employment growth factors

Country \ Year	1989	1990	1991	1992	1993	1994	1995
Albania	-	100	100	71	69	75	80
Bulgaria	100	94	82	75	74	74	75
Czech Rep.	-	100	93	90	91	90	91
Estonia	100	99	96	91	83	81	76
Hungary	100	97	87	83	73	72	70
Poland	100	95	91	88	87	88	88
Romania	100	99	98	95	92	91	87
Russia	-	-	100	98	96	93	87
Slovakia	100	97	91	86	90	89	91
Slovenia	100	96	85	81	89	90	90

Source: *ILO Employment Statistics*

The data clearly indicate the relation between price liberalization and output falls across the region. Countries that had initially more liberal prices, experienced smaller output declines. Also, the data do not convey the extent of other forms of distortions that do not necessarily show in the used proxies for price

<sup>3</sup>In that year total exports declined by 20 per cent.



liberalization. Such an example are budget subsidies which in Czech Republic, Hungary and Romania even in year 2000, presented a significant share of GDP.

The third stylized fact is related to the mechanism of output decline. In the model we develop in this paper we argue that incentives for workers to become economically inactive were crucial in generating the output decline. In Table 3, we first show employment growth factors. Comparison of Tables 1 and 3 confirms that the largest output declines took place simultaneously with the lowest employment growth rates.

Simultaneous output and employment declines are, however, not enough to justify the mechanism we propose. We need evidence that dynamics of labor markets features voluntary quits as opposed to lay offs. Table 4, reproduced from Boeri (2000a), demonstrates the importance of voluntary quits in total labor outflows. The upper part of the table shows the data from Labor Force Surveys and compares them with their western counterparts. Two important facts are relevant for the model we propose below: (1) ratios of job losers to employees are relatively low, in Czech Republic and Poland even lower than ratios observed in Italy, which has a very rigid labor market; and (2) ratios of job leavers to employees are significantly higher than in their western counterparts. In the second part of the table, the data shown are from unemployment registers which cover the periods of output declines and are thus of particular interest. Shares of job leavers in total separations are in all three countries, for which the data are available, higher than 60 per cent.

Table 4: Job leavers and losers in the early stages of transition

Country	Dates	Job leavers	Job losers
Labor Force Survey <sup>1</sup>			
Czech Republic	Q2 1993	2.1	1.5
Hungary	Q2 1992	0.8	4.5
Poland	Q2 1992	1.4	2.0
Slovakia	Q1 1994	2.6	4.3
Italy	1993-94	0.4	2.3
USA	1991-92	0.9	3.1
EU average	1991-95	1.2	3.2
Unemployment registers <sup>2</sup>			
Czech Republic	1991-92	72.1	27.4
Poland	1991-92	65.7	34.3
Slovakia	1991-92	79.2	20.9

Notes: <sup>1</sup> As a percentage of employment.

<sup>2</sup> As a percentage of total separations.

Source: *Tito Boeri (2000a), Table 1.*

Boeri (2000a) emphasizes another feature of labor market dynamics. The restructuring of firms takes place with relatively small flows of workers between sectors, occupations and labor market states. The survey of foreign firms, reported in EBRD Transition Report (1997), identified large adjustment costs in the form of retraining of workers, which is consistent with observed low labor mobility between sectors and occupations. This is important, as the results of the model, we present below, heavily rely on the assumption of presence of adjustment costs to labor mobility.

Boeri (2000b) and Boeri and Terrell (2002) also provide evidence why relatively large outflows to inactivity or unemployment may be voluntary in some of the advanced transition countries, e.g. Czech Republic, Slovak Republic and Poland. They emphasized the generosity of government transfers to either unemployed or inactive workers in a form of early retirement and redundancy payments. The rationale for introduction of these was to buy the support for reforms. However, government transfers were likely to be insufficient incentive for inactivity. Additional benefit to "inactivity" is participation in informal economy or simply utility to inactivity. Although the estimates on informal economy are subject to large measurement errors, all available estimates of informal economy show a large surge in its output simultaneous to large output decline. The estimates of informal economy provided by Lacko (2000) are presented in Table 5. According to Lacko (2000), these estimates, based on electricity consumption, are conservative when compared to other estimates prevalent in the literature (e.g. Johnson, Kaufmann and Schleifer, 1998). Note that the largest surges in informal activity take place simultaneously with output decline.

Table 5: Informal economy initial share and growth factors (1989=100)

Country \ Year	$(\frac{Y_I}{Y_R})_{1989}$	1989	1990	1991	1992	1993
Bulgaria	0.23	100	113	116	109	107
Czech Republic	0.22	100	110	128	127	109
Estonia	0.17	100	122	152	153	143
Hungary	0.25	100	100	107	111	112
Poland	0.23	100	121	117	117	119

Source: *Own calculations using the estimates by Lacko (2000).*

The last relevant stylized fact is related to differential growth rates of the main economic sectors shown in Tables 6 and 7. Although the data at the aggregate level do not convey information of differential growth rates at more disaggregated level. Nevertheless, we can deduce that declines of output and employment in agriculture (with exception of Czech Republic) services were much lower than declines in industry. Although critics would argue that this is due to overindustrialization, this would not take place without a distortionary allocation of labor, which is in our model, the main heritage of planned system.

Table 6: Sectorial real output growth rates (per cent)

Country \ Growth rate	GDP	Industry	Services	Agriculture	Manuf.
Bulgaria (1991)	-11.7	-21.0	-7	4	-
Czech Rep. (1991)	-11.6	-12.9	-9.0	-21.2	-26.4
Estonia (1992)	-14.2	-35.6	-	-	-38
Hungary (1991)	-11.9	-18.4	-11.0	-6.2	-21.1
Poland (1990)	-11.6	-24.2	-4.3	-2.2	-24.1
Russia (1992)	-14.5	-18.0	-15.0	-9.0	-19.0
Slovenia (1991)	-8.9	-12.4	-12.9	-2.5	-10.9

Source: *EBRD Internal Database*.

Note. In parentheses are the relevant years.

Table 7: Sectorial growth rates of employment (per cent)

Country \ Growth rate	Economy	Industry	Services	Agriculture
Bulgaria (1991)	-13.0	-19.0	-8	0
Czech Rep. (1991)	-11.6	-3.0	-10.0	-17.2
Estonia (1992)	-5.3	-8.0	0.0	-12.0
Hungary (1991)	-5.0	-7.0	0.0	-16.
Poland (1990)	-4.3	-5.7	-3.0 ()	-4.7
Russia (1992)	-2.3	-5.0	-3.0	5.0
Slovenia (1991)	-8.0	-10.5	-5.0	-2.5

Source: *ILO Employment Statistics*.

Note. In parentheses are the relevant years.

### 3 The model setup

The effects of price liberalization and related change of relative prices can be analyzed in a variety of different general equilibrium setups. The aim of this paper is to demonstrate under what conditions relative price change can generate output decline. In a similar exercise, Mussa (1978) shows that, in a short run, a relative price change due to opening of the economy to international trade, may cause output decline if there is convex adjustment cost to factor mobility.

When compared to Mussa (1978), the setup in this paper is somewhat different. We introduce additional sector, informal economy, and allow for heterogeneity of workers in terms of adjustment cost and government transfers. Since these additional complexities in Mussa's framework would be computationally intractable, we work in a partially dynamic framework and assume Ricardian production functions and Cobb-Douglas utility functions. In spite of this simplification, it can be shown that key results do not hinge on the specific choice of framework.

The model features two partially related periods: the first is pre-transition or socialist period and the second is transition period. The first period of the model is used to determine initial conditions, which form a benchmark labor allocation in the second period. In this sense the model is dynamic, but with an unexpected shift in economic policy - the removal of distortions to price mechanism which affected labor allocations.

In the remainder of this section we describe the setup of the model and characterize the pre-transition equilibrium.

### 3.1 Firms

The production side of the economy consists of two parts: official (formal) and unofficial (informal) economy. Since informal economy is modeled as a backyard production, we postpone its discussion to the section describing the behavior of households. The formal economy produces two types of goods:  $x$  and  $y$ , with Ricardian technologies with labor as a sole production factor:  $x = Al_x$  and  $y = Bl_y$ , where  $A$ ,  $B$  and  $l_x$ ,  $l_y$  denote respective average (and marginal) labor productivities and amounts of employed labor. Firms are allowed to freely enter either of the two sectors, which combined with linear production functions does not determine the market structure. This is not, however, relevant for our results, as we are interested in labor allocation between and not within sectors. In particular, we are interested in a response of labor allocation between sectors to a change in the relative price between the two types of goods.

The firms are assumed to maximize profits and thus choose the optimal amounts of labor, while taking the prices and wages as given. The profit for a representative firm in the sector producing good  $x$  is  $\pi_x = p_x(1 - \tau_x)Al_x - w_xl_x$ , where  $\tau_x$  denotes tax rate (or subsidy rate if negative) and  $p_x$  and  $w_x$  are price and wage rates in the sector. The first order conditions of the profit maximization problems (or zero profit conditions) for firms in both formal sectors  $x$  and  $y$ , are standard:

$$\begin{aligned} p_x(1 - \tau_x)A &= w_x, \\ p_y(1 - \tau_y)B &= w_y. \end{aligned} \tag{1}$$

The zero profit conditions differ in the pre-transition and transition periods. In the pre-transition period, we assume, without loss of generality, that sector  $x$  is subsidized and sector  $y$  is taxed, so that  $\tau_x < 0$  and  $\tau_y > 0$  and wages equalize. In the transition period, we will assume that  $\tau_x = \tau_y = \tau > 0$  and wages do not equalize due to presence of adjustment cost.

### 3.2 Households

The economy is in both periods populated by a continuum of one worker households, where index of workers is running from 0 to 1. The distribution of labor

is uniform and its total mass is normalized to 1. Since workers face no disutility to work, they always supply their total labor endowment to either formal or informal sectors. The choice of households is thus two-fold: (1) choice of the sector of employment and (2) choice of consumption bundle. The general utility maximization problem for household  $i$  can be thus written as:

$$\max_{x,y,s} u(x,y,s) = \alpha \ln[x + (1-s)u_R] + (1-\alpha) \ln[y + (1-s)u_R], \quad (2)$$

subject to a budget constraint:

$$p_x x + p_y y \leq s \max\{w_0, w_a(1-\kappa i)\} + (1-s)\beta i, \quad (3)$$

where  $x, y$  denote the quantities of goods consumed,  $u_R$  denotes the real reservation wage of participation in informal economy,  $0 < \alpha < 1$  denotes the weight of good  $x$  in the Cobb-Douglas utility function and  $s$  is the dichotomous variable assuming values 0 if worker is employed in an official sector and 1 if she participates in informal economy.  $w_0$  and  $w_a$  denote wages in initial and alternative sectors of employment, respectively, while  $\kappa$  denotes a parameter of adjustment cost and  $\beta$  denotes a parameter for government transfers. Since the specification of this problem differs between periods and contains several implicit assumptions, we discuss them in turn.

First, we consider the assumptions relevant for pre-transition period. We assume that adjustment cost and government transfers were not present, that is,  $\kappa = \beta = 0$ . The assumption of no adjustment cost is a convenient description of a long run equilibrium, where workers have to decide for a field, or in this context sector, of specialization. In the process of entering of young and exiting of old workers, the wages in two sectors may have equalized as if there were no adjustment cost. The second assumption sets government transfers to 0. This assumption conveys one of the main socialist goals, that of full employment, which was achieved by allocating workers to work as soon as they concluded education. This goal was readily achieved and government transfers to unemployed workers did not exist in many of these countries. We also assume that in the pre-transition period, utility derived from the participation in informal economy did not exceed the utility of work in the official sectors. Since the presence of informal economy in the pre-transition period is undeniable (as shown in Table 5), this assumption should be interpreted as a convenient normalization. Given these assumptions, the solution of the optimization problem in the pre-transition period is standard.

We turn now to discussion of assumptions relevant to transition period. In calculation of equilibrium, we consider it as a short-run equilibrium, where inflows and outflows of workers from different cohorts are only a small share of total flows. As a consequence, in calculation of equilibrium, adjustment cost to mobility of workers in different sectors plays an important role. In the specification of the budget constraint (3), we made an implicit assumption on the form of adjustment cost. These are in the form of lost working time,  $\kappa i$ . Although in

reality, adjustment costs can be monetary, psychic or time costs, we believe that an important part of these costs is time cost. In particular, the adjustment costs in a form of re-training, search or even physical mobility (e.g. permanent or daily commuting) may be crucial to observed limited ability. The results, however, do not depend on the assumed form of adjustment cost, as their role in the model is a barrier to mobility and thus a diversion of workers to informal economy. This is in line with Boeri (2000a) who reports limited low inter-sectoral mobility of workers in for a sample of countries in CEE.

Another important implicit assumption in the above problem is dependence of adjustment cost on index,  $i$ . This index is a way of introducing heterogeneity of workers and should be considered as a proxy for age. The index counter starts at 0 for the youngest worker in the sector of pre-transition employment to  $i_{\max}$  for the oldest worker in this sector. Since we solve the model under the assumption that sector  $x$  is subsidized in the pre-transition period, workers in these sector have an incentive to move and effectively index is a counter of workers initially employed in sector  $x$ . The assumption of heterogeneity of workers in terms of adjustment cost captures two features of reality. First, older workers have lost more of their general knowledge, which may be crucial for re-training, are less familiar with various search channels and are more likely to be tied to a fixed location through ownership of assets, an element of monetary adjustment costs. Second, older workers have shorter remaining life, which makes them less likely to invest in adjustment. Proper treatment of age would require a fully blown overlapping generations model. This, however, does not affect the qualitative results of the model as age would play the same role as adjustment cost - a deterrent to sectorial mobility. For obvious reasons, we assume no adjustment cost to mobility from official sectors to informal economy. For the sake of computational simplicity, we assume a uniform distribution of adjustment costs.

Government transfers, which in transition period assumed many different forms like unemployment benefits, early retirement and redundancy payments, are also assumed to vary with index or age. Again, this is an attempt to capture a feature of reality. Older workers are entitled to unemployment benefits for longer periods, larger redundancy payments and are more likely to be entitled to retirement. For similar reason as for adjustment cost, we assume a uniform distribution of transfers.

The last comment is related to reservation wage,  $u_R$ . We assume it is the same for all workers and it can produce similar set of goods as official economy. This last assumption is a convenient way of assuming away the structure of goods produced in informal economy. In addition, we also implicitly assume that production of these goods is a backyard production and that goods are not traded on markets (or traded on local markets). This prevents supply of goods produced in informal economy affecting relative price of officially produced goods.

Given these assumptions, in the transition period, workers choose between three options: (1) staying in the sector of pre-transition employment and earning

wage rate  $w_0$ , (2) moving to alternative official sector and earn a wage rate  $w_a$  and bear adjustment cost in terms of a lost work time, and (3) moving to informal sector and receive a transfer from government in a form of unemployment benefit or pension and enjoy the reservation utility due to participation in informal economy,  $u_R$ . Given the choice of the sector of employment, the choice of consumption bundle is standard.

### 3.3 Government

From the specification of firms' and households' optimization problem, it is clear that government plays a crucial role in determination of equilibria. Its role in pre-transition and transition periods is different. In the pre-transition period, government only taxes and subsidizes firms, while in the transition period it taxes all firms and distributes transfers to workers. The government is always assumed to have a balanced budget.<sup>4</sup> The budget constraint in the pre-transition period is:

$$\tau_x p_x X + \tau_y p_y Y = 0, \quad (4)$$

where  $X$  and  $Y$  are aggregate amounts of goods  $x$  and  $y$  produced.

In the transition period, government uniformly taxes firms at rate  $\tau$  and gives transfers to workers. The budget constraint in this case is:

$$\tau(p_x X + p_y Y) = \int_{L_x^* - L_{xu}}^{L_x^*} \beta i di, \quad (5)$$

where  $L_x^*$  denotes the amount of workers initially employed in sector  $x$  and  $L_{xu}$  denotes share of workers moving to informal economy. We postpone discussion of the specified bounds of an integral on the right-hand side to the section where we explain the calculation of the transition equilibrium.

### 3.4 The pre-transition equilibrium

The assumptions of no adjustment cost and the indirect utility of participation in informal economy falling short to indirect utility of participation in formal sectors, majorly simplify the calculation of equilibrium. The determination of equilibrium is standard and therefore omitted. The following set of allocations

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<sup>4</sup>Socialist governments accumulated large external debts (e.g. Hungary's external debt to GDP exceeded 100%). Since we work in a static framework, we cannot avoid this assumption.

and prices fully characterize the equilibrium:

$$\begin{aligned}
(X^*, Y^*) &= (\alpha A(1 - \tau_x), (1 - \alpha)B(1 - \tau_y)), \\
L_x^* &= \alpha(1 - \tau_x), \quad L_y^* = (1 - \alpha)(1 - \tau_y), \\
p_y^* &= (1 - \tau_x)A / ((1 - \tau_y)B), \quad p_x = 1, \\
w^* &= (1 - \tau_x)A, \\
\{(\tau_x, \tau_y) &: \tau_y = \frac{\alpha}{\alpha - 1}\tau_x, 0 \leq \tau_x, \tau_y \leq 1\}.
\end{aligned} \tag{6}$$

This equilibrium has standard features of economy with Ricardian production functions: relative prices do not depend on preference parameter ( $\alpha$ ), while labor allocation does not depend on relative productivities  $A/B$ . It usefully simplifies the expressions, while still delivering the main message.

The main "sin" of socialism considered here is creation of incentives that distorted labor allocation. For this purpose, distortionary tax system was sufficient. More precisely, since we assumed that sector  $x$  was preferred in pre-transition period and thus subsidized at rate,  $\tau_x < 0$ , employed labor in this sector exceeded the employed labor in distortion free equilibrium. The opposite applies for sector  $y$ . While the evidence on distortionary subsidies and taxes in the pre-transition period is abundant and uncontroversial, the assumption of distortionary prices is not necessary.

We can alternatively assume, in line with a common belief of socialist overindustrialization, that social planner allocated labor according to her distorted preferences. If we assume that the preference parameter in the social planner's Cobb-Douglas utility function is  $\gamma$  (instead of  $\alpha$ ), we can replicate the equilibrium in (6) by replacing  $\alpha(1 - \tau_x)$  and  $(1 - \alpha)(1 - \tau_y)$  with  $\gamma$  and  $1 - \gamma$ . This implies that these two causes of output decline, difference in preferences between decentralized consumers and a dictator and elimination of distortionary taxation, which were often put forward as two distinct causes, are mathematically equivalent within this framework. The main difference is in fact related to prices that support these two equilibria. In the case of distortionary taxes, relative price of  $y$  is higher than in the case of social planner's preferences. In fact, the choice between these two assumptions plays an important role in calculation of aggregate output and its growth. We return to this point below.

## 4 The transition period

In the transition period, we "re-introduce" the heterogeneous adjustment cost and government transfers and replace distortionary taxation with uniform taxation of official sectors to finance the transfers. Since these additional elements make the analysis fairly complicated, we carefully discuss the steps in determination of equilibrium.



## 4.1 Demand for goods

After price liberalization, workers can be divided in four groups: (1) those who stay in sector  $x$ , (2) those who move from sector  $x$  to sector  $y$ , (3) those who move from sector  $x$  to informal economy and (4) those workers that were initially employed in sector  $y$ . The aggregate demand functions of these workers are sums of aggregate demand functions for these four types of workers. Anticipating the equilibrium allocation, we can order these groups of workers according to the index of age. The group with lowest index are those that find adjustment cost a variable investment and thus move from sector  $x$  to sector  $y$ . These workers earn a wage rate  $w_y$  and have the following demand for good  $x$ :

$$x_{xy}^d = \alpha \frac{w_y \int_0^{L_{xy}} (1 - \kappa i) di}{p_x}, \quad (7)$$

where the bounds of the integral are indices of the first worker, with 0 adjustment cost to worker with index  $L_{xy}$  and adjustment cost  $\kappa L_{xy}$ . (Note that we omit discussion of demand for good  $y$  as it is analogous.) Next group of workers, ordered by age, are those that stay in sector  $x$  and have too high adjustment cost to move to sector  $y$  and are entitled to too low government transfers to move to informal economy. Their aggregate demand is:

$$x_x^d = \alpha \frac{w_x \int_{L_{xy}}^{L_x^* - L_{xu}} di}{p_x}, \quad (8)$$

where  $L_x^*$  is a share of workers initially employed in sector  $x$  and  $L_{xu}$  is a share of movers from sector  $x$  to informal economy.

The third group of workers are movers from sector  $x$  to informal economy. Their aggregate demand is different to standard form for Cobb-Douglas utility function as they enjoy reservation wage of participation in informal economy:

$$x_{xu}^d = \alpha \frac{\int_{L_x^* - L_{xu}}^{L_x^*} [\beta i + u_R(\alpha p_y - (1 - \alpha)p_x)] di}{p_x}. \quad (9)$$

Since we assumed that  $u_R$  is a quantity of goods  $x$  and  $y$  that workers "earn" in informal economy, relative scarcity of goods, reflected in prices, and preferences, reflected in  $\alpha$ , affect market consumption of these agents. In general good  $y$  will be more scarce in equilibrium than desired and thus  $\alpha p_y - (1 - \alpha)p_x > 0$  and demand for  $x$  larger.

The last part of aggregate demand is aggregate demand of workers that initially worked (and stay) in sector  $y$ :

$$x_y^d = \alpha \frac{w_y \int_0^{L_y^*} di}{p_x}, \quad (10)$$

where  $L_y^*$  is a share of workers initially employed in sector  $y$ . The aggregate demand for good  $x$  is obtained by summing aggregate demands of these four groups of workers:

$$\begin{aligned} x^d = & \frac{\alpha}{p_x} \{w_y[L_y^* + L_{xy} - \frac{\kappa}{2}L_{xy}^2] + w_x[1 - L_y^* - L_{xy} - L_{xu}] + \\ & + L_{xu}\beta[2 - 2L_y^* - L_{xu}]\} + u_R L_{xu}(\alpha \frac{p_y}{p_x} - (1 - \alpha)) \end{aligned} \quad (11)$$

Similar expression can be obtained for the aggregate demand for good  $y$ .

$$\begin{aligned} y^d = & \frac{1 - \alpha}{p_y} \{w_y[L_y^* + L_{xy} - \frac{\kappa}{2}L_{xy}^2] + w_x[1 - L_y^* - L_{xy} - L_{xu}] + \\ & + L_{xu}\beta[2 - 2L_y^* - L_{xu}]\} + u_R((1 - \alpha)\frac{p_x}{p_y} - \alpha) \end{aligned} \quad (12)$$

## 4.2 Supply of goods

The supply side of the transition period is characterized by first order or zero profit conditions given in (1) and production function. Note that tax rate on firms' revenues are equalized in this period,  $\tau = \tau_x = \tau_y$ . The zero profit conditions relate prices and wages and are used to substitute prices for wages from demand functions.

The supply functions can be more usefully expressed in terms of initial labor shares and shares of movers. Total labor endowment is equal to 1 and labor can be either employed in sector  $x$ ,  $L_x$ , in sector  $y$ ,  $L_y$ , in informal economy,  $L_{xu}$  or lost due to adjustment costs,  $\kappa/2L_{xy}^2$ . Knowing this, we can express the supply functions in the following way:

$$x^s = A(L_x^* - L_{xy} - L_{xu}), \quad (13)$$

$$y^s = B(L_y^* + L_{xy} - \frac{\kappa}{2}L_{xy}^2). \quad (14)$$

The labor employed in sector  $x$  is thus equal to initial employment in this sector minus movers to sector  $y$  and informal economy. Similarly, the employment in sector  $y$  is initial employment share plus share of movers minus labor lost due to mobility.

## 4.3 Labor market equilibrium conditions

Although we already discussed the labor market clearing conditions, we write it here for the future reference:

$$L_x + L_y + L_{xu} = 1 - \kappa/2L_{xy}^2 \quad (15)$$

The labor market clearing condition. While we already discussed the labor market clearing conditions, the characterization of equilibrium needs also two

additional labor market equilibrium conditions. The first condition equalizes the utility of the last worker (the highest index) who moves to sector  $y$  and utility of workers who stay in sector  $x$ , while the second condition equalizes the utility of the first worker (the lowest index) who moves to informal economy and the utility of workers that decide to stay in sector  $x$ . These two conditions can be compactly expressed with the following equalities:

$$v_x = v_y(i_1 = L_{xy}) = v_u(i_2 = L_x^* - L_{xu}), \quad (16)$$

where  $v_x$  denotes the indirect utility of workers who stay in sector  $x$ ,  $v_y(i_1 = L_{xy})$  denotes indirect utility of the last worker (with index  $L_{xy}$ ) that moves to sector  $y$  and  $v_u(i_2 = L_x^* - L_{xu})$  is the utility of the first worker (with index  $L_x^* - L_{xu}$ ) that moves to informal economy.

These two conditions are not fulfilled for all values of parameters. In general, the model gives a variety of qualitative solutions, depending on adjustment cost parameter,  $\kappa$ , and parameter of government benefits,  $\beta$ . We rule out, however, some of these, as they do not comply with what we observed in the early transition process. For example, for sufficiently low  $\beta$ , we can expect that no worker in sector  $x$  would decide to move to informal economy, which contradicts the stylized facts discussed in section 2. The fulfillment of the conditions in (16) is thus a desired feature of an equilibrium.

These equilibrium conditions can be simplified to obtain linear relations between the wage paid in sector  $x$ , the wage paid in sector  $y$  and the parameters  $\beta$  and  $u_R$  that determine the compensation in informal economy:

$$w_x = w_y(1 - \kappa L_{xy}) = \beta(L_x^* - L_{xu}) + u_R(p_x + p_y). \quad (17)$$

Note that due to adjustment cost to labor mobility across official sectors, there is a wedge between wage rates in the two sectors, which depends on the parameter of adjustment cost. There is, however, a non-standard part in the relation between wage rates due to heterogeneity of adjustment costs. The wage (a product of wage rate and working time) earned in sector  $x$  is equal to wage earned in sector  $y$  only for worker with index  $L_{xy}$ . For all movers between official sectors with index lower than  $L_{xy}$ , wage earned exceeds the wage earned in sector  $x$ . Similarly, the wage earned in sector  $x$  is equal to total compensation only for a worker with the lowest index  $L_x^* - L_{xu}$ . All workers that move to informal economy have total compensation exceeding the wage in sector  $x$ .

#### 4.4 Characterization of equilibrium

The transition equilibrium can be characterized by a non-linear system of three equation with three unknowns. The first equation combines the labor market equilibrium conditions (17) and zero profit conditions (1) and has the following form:

$$w_x = \frac{\beta(L_x^* - L_{xu})AB(1 - \tau)}{(1 - \tau) - u_R(B + A(1 - \kappa L_{xy}))} \quad (18)$$

The second equilibrium equation combines labor market clearing conditions (15), goods market clearing condition combining aggregate demand (11) and supply (13) for good  $x^5$ , zero profit conditions (1) and labor market equilibrium condition (17):

$$\begin{aligned} & \alpha \left\{ \frac{1}{1 - \kappa L_{xy}} [L_y^* + L_{xy} - \frac{\kappa}{2} L_{xy}^2] + \right. \\ & \left. + [L_x^* - L_{xy} - L_{xu}] \right\} + \alpha L_{xu} \frac{\beta}{w_x} [2 - 2L_y^* - L_{xu}] + \\ & + \frac{u_R}{(1 - \tau)} L_{xu} \left( \frac{\alpha}{B(1 - \kappa L_{xy})} - \frac{(1 - \alpha)}{A} \right) = \frac{(L_x^* - L_x - L_{xu})}{1 - \tau}. \end{aligned} \quad (19)$$

The last equation defining equilibrium combines government's balanced budget constraint (5), zero profit conditions (1), labor market clearing conditions (15) and labor market equilibrium conditions (17):

$$\frac{\tau}{1 - \tau} [L_x^* - L_{xy} - L_{xu} + \frac{L_y^* + L_{xy} - \frac{\kappa}{2} L_{xy}^2}{1 - \kappa L_{xy}}] = \frac{\beta}{w_x} L_{xu} (2L_x^* - L_{xu}). \quad (20)$$

The system of equations (18), (19) and (20) has three endogenous variables:  $L_{xu}$ ,  $L_{xy}$  and  $\tau$ .<sup>6</sup>  $L_x^*$  and  $L_y^*$  are pre-determined,  $\kappa$ ,  $u_R$  and  $\beta$  are exogenous. We assume that the wage rate,  $w_x$ , is a numeraire and set it to 1. Non-linearity of the model prevents us from providing analytical solutions to the model. Insights can be gained either by assuming away one of the two complexities generating non-linearities or resort to simulation exercise. We could either assume that government does not provide transfers,  $\beta = \tau = 0$ , or assume away adjustment costs,  $\kappa = 0$ . However, since we are trying to explain the output decline due to presence of adjustment cost and government transfers, this would defeat the purpose. Therefore, in the remainder to this section, we analyze the model in a simulation exercise.

## 4.5 Analysis of the model

In the short discussion of the model setup, we argued for a simplest model possible that can still convey the main message: output decline was (at least partly)

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<sup>5</sup>Either of the two goods market clearing conditions can be used in determination of equilibrium.

<sup>6</sup>Although we assume that  $\beta$  is given and  $\tau$  is endogenously determined, we could assume the opposite.

caused by price liberalization which changed relative prices. Therefore, it would be naive to expect that this model could replicate any quantitative features of reality. Although we choose the baseline values of the models' parameters to match the shares of labor flows, there is no way we could check if the chosen parameters match the actual ones. Thus, the purpose of simulation exercise is to convey the qualitative features of this model.

The baseline parameter values are summarized in Table 8. Note, first, that 40 per cent tax rate on revenues in sector  $y$  (in the pre-transition period) generates the employment share in this sector from 0.5 to 0.3. Alternatively, if we consider the interpretation of initial distortions as dictator's preferences and hypothesis of "over-industrialization", than,  $\gamma$ , the weight of good  $x$  in Cobb-Douglas utility function should be 0.7. If prices were liberalized (dictator removed) and there were no adjustment costs to labor mobility and utility to inactivity (government transfers and reservation wage), the employment shares would shift to 0.5 in both sectors.

Table 8: Baseline parameter values in simulation exercise

Parameter	Name	Value
$\alpha$	Weight of $x$ in utility function	0.5
$\tau$	Tax rate in transition period	0.05
$u_R$	Reservation wage of inactivity	0.1
$\tau_y$	Pre-transition tax rate on $y$	0.4
$w_x$	Wage rate in sector $x$	1
$A$	Productivity in sector $x$	1
$B$	Productivity in sector $y$	1
$L_y^*$	Pre-transition employment in $x$	0.3
$\kappa$	Adjustment cost parameter	5

In the baseline parameter set, we assume that adjustment costs increase with age index at factor 5, that is  $\kappa = 5$ . Given this value, the youngest worker in sector  $x$  has 0 adjustment cost, while the oldest worker has adjustment cost as high as a factor 3.5 of available working time. This guarantees that some workers move from sector  $x$  to sector  $y$ , that is  $L_{xy} > 0$ . We assume that reservation wage is 0.1, which generates utility that is much below of that enjoyed in the pre-transition period. This value of reservation wage is consistent with assumption of zero informal economy participation. The transition tax rate is assumed to be 0.05, wage in sector  $x$  is a numeraire, while labor productivities are also set to 1, to simplify expressions and equate employment with output. For this set of parameter values, we calculate the equilibrium, summarized in Table 9.

Table 9: The equilibrium allocations and prices for the baseline parameter values and alternative assumptions

Parameter	Baseline	$\tau_y = 0.65$	$\kappa = 2$	$\tau = 0.08$	$u_R = 0.15$
$L_{xy}$	0.070	0.115	0.113	0.063	0.064
$L_{xu}$	0.075	0.093	0.068	0.113	0.106
$L_x = X$	0.555	0.617	0.519	0.523	0.530
$L_y = Y$	0.358	0.257	0.400	0.353	0.354
$L_{Agg}$	0.913	0.874	0.919	0.876	0.884
$w_y$	1.538	2.351	1.291	1.466	1.471
$\kappa/2L_{xy}^2$	0.012	0.033	0.025	0.020	0.020
$\beta$	1.234	0.885	1.201	1.247	0.807

Note: The columns 3-6 differ from the baseline case only in the parameter in the head of the table.

This equilibrium differs substantially from that one without adjustment costs. Total employment, a sum of employment shares in official sector is 0.913, which implies a loss of 8.7% of aggregate working time. If evaluated at producers prices, this is also aggregate output fall. This output loss can be attributed to aggregate adjustment costs, 0.012, born by movers between official sectors, 0.07, and lost working time of workers that move to informal economy, 0.075. The share of workers that work in sector  $y$  is 0.358, which is a 20% employment and output increase. However, a decrease of employment in sector  $x$  is much larger in absolute terms, 0.145, and makes the total employment and output in the economy decline. Wage rate in sector  $y$  is 1.538, which implies 50% wage premium over wage rate in sector  $x$ . The parameter which determines government transfers is 1.234 and implies that worker with the largest transfer receives 86% of the wage paid to workers in sector  $x$ . If workers in informal economy received only government transfers, this could not be an equilibrium as no worker would choose inactivity. However, combined with reservation wage, total utility of inactivity exceeds utility of those who stay in sector  $x$ .

In the remainder of this section analyzes the behavior of the model's outcomes when initial distortions in taxation, adjustment costs parameter, reservation wage and transition tax rate are varied.

#### 4.5.1 Variation of initial distortions ( $\tau_y$ )

At the outset of the transition process there were significant differences between different countries in terms of their institutional setup. With respect to the process of liberalization, allocation of resources in some countries was much less distorted than in others. The most striking example is that of relative prices of raw materials in the FSU, which were much lower than international relative prices that applied for countries of CEE. Another example is former Yugoslavia,

where the economic system was officially titled as market planned system and allowed decentralized decision-making of firms and relatively large autonomy to their managers.<sup>7</sup>

In light of these differences in terms of initial liberalization, it is insightful to observe the predictions of our model for different values of initial distortions. In Figure 1, we show the relationship between initial distortions and employment. An increase in initial distortion,  $\tau_y$ , increases (decreases) the pre-transition employment in sector  $x$  ( $y$ ). For example, for  $\tau_y$  equal to 0.65 and baseline values for remaining parameters, employment shares of sectors  $x$  and  $y$  are 0.825 and 0.175, respectively. As a consequence, employment in sector  $x$  ( $y$ ) also increases (decreases) in the transition period. These increases are, however, less than proportional, as more workers find it beneficial to move from sector  $x$ . The employment shares in sectors  $x$  and  $y$  are 0.617 and 0.257, making total employment equal to 0.874, much lower than in the baseline case with  $\tau_y$  equal to 0.4. We can conclude that in countries with larger initial distortions, we could observe larger aggregate output decline.

Although, in the interest of space, we do not fully characterize the equilibria, it is useful to convey some additional insights which are also conveyed in third column of Table 9. Comparing with the baseline case, the share of workers that move between official sectors increases from 0.07 to 0.11, while the share of workers that move to informal economy increases from 0.075 to 0.09. The outflow of workers to informal economy grows at lower rates because the government budget constraint offsets the incentives partly. More workers move from sector  $x$  to informal economy, smaller is the tax base and lower can be  $\beta$ , the parameter determining the size of government benefits. At  $\tau_y$  equal to 0.65,  $\beta$  is only 0.88, which implies maximum government transfer of 0.73, which is less than in the baseline case. At this point it is useful to make a remark on budget deficits and dynamic effects neglected in the present framework. In a dynamic model, we could allow for government deficit in the period of output decline and allow for larger temporary output declines. Majority of transition governments resorted to budget deficits, which allowed for potentially much larger output declines.

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<sup>7</sup>Nevertheless, political leaders did intervene in the functioning of these firms e.g. by selective allocation of credits, subsidies or foreign exchange for imports of materials.

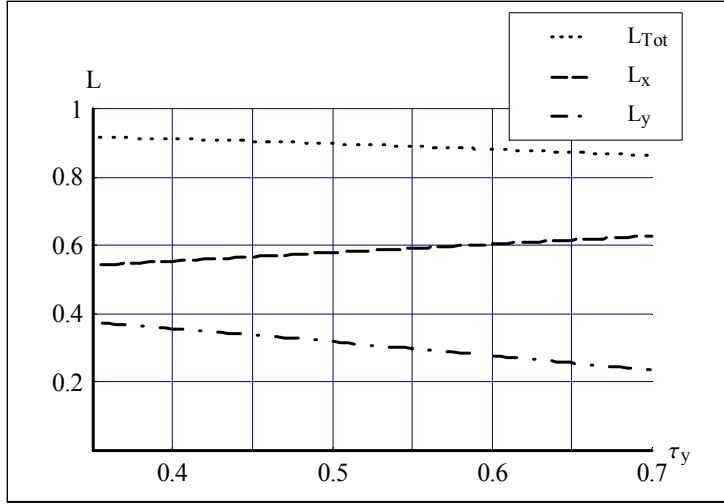


Figure 1: Employment and initial distortions

Another important and related issue is complete vs. partial liberalization. In the section 2, we note that governments did not completely liberalize the markets, one of the reasons being that they anticipated even worse output declines than we actually observed. For obvious reasons, the analysis of this issue cannot be properly tackled in a static model. However, given the setup of the model, partial liberalization is equivalent to full liberalization of initially less distorted economy and can generate temporarily milder output decline.

#### 4.5.2 Variation of adjustment costs

The role of adjustment costs in explaining the output decline is crucial. If  $\kappa$  was nil, workers would only move between official sectors, and aggregate output would not decline. Similarly, if adjustment costs are prohibitive for all workers in sector  $x$  and there are no benefits to participation in informal economy, no worker would decide to move and output would be unchanged. If we continue to assume no benefits to informal economy, employment lost due to adjustment costs is a hump-shaped function of adjustment costs parameter. Thus, for intermediate values of adjustment costs output decline could be largest.<sup>8</sup>

In the present setup, we are not interested in output decline because workers bear adjustment cost to earn higher wage rate. We are interested, how an increase in adjustment costs interacts with informal economy benefits. In Figure 2, we can see that an increase in  $\kappa$ , which is a simultaneous proportionate increase of adjustment costs for all workers in sector  $x$ , makes movement between official

<sup>8</sup>Atkeson and Kehoe (1996) argued in favor of output decline that takes place because workers invested in adjustment costs. However, evidence of low mobility of workers between sectors (Boeri, 2000a) contradicts this explanation.



sectors more costly and thus more workers either stay in sector  $x$  and move to informal economy. Therefore, the share of those working in sector  $y$  unambiguously decreases.

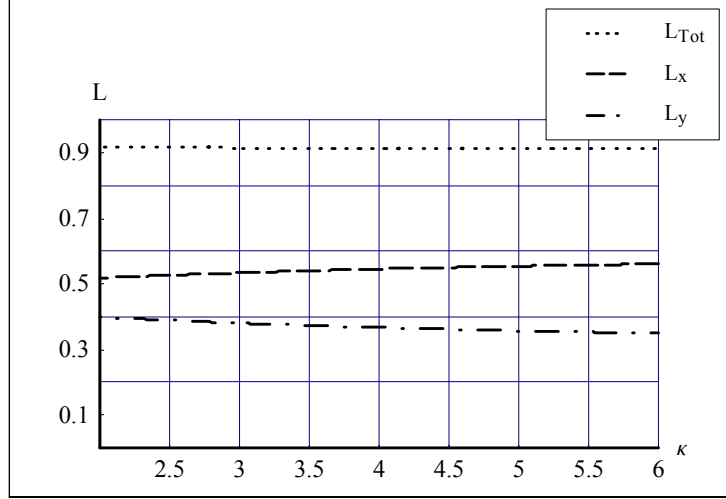


Figure 2: Employment and adjustment costs

In fourth column of Table 9, we can also find the equilibrium specification for alternative value of adjustment cost and compare it to baseline values. The share of movers between official sectors for lower value of  $\kappa$  is 0.112, almost 0.05 higher than in the baseline case. Similarly, the share of movers to informal economy is 0.068, which is slightly less than in the baseline case. The share of workers that stay in sector  $x$  for lower  $\kappa$  is 0.519, which is 0.036 less than in the baseline case. Accordingly, employment share in sector  $y$  for lower  $\kappa$  is, 0.40 almost 0.05 higher than in the baseline case. The last key difference between the two cases is probably in the wedge between wages in official sectors, which is much lower for lower  $\kappa$ .

#### 4.5.3 Variation of transition tax rate and reservation wage

In this section we are interested in relationships between government benefits and reservation wage on one side and labor flows and output on the other side. Since the government benefits parameter,  $\beta$ , and the transition tax rate,  $\tau$ , are positively related for all admissible equilibria (equilibria that feature both types of flows from sector  $x$ ,  $L_{xy}$  and  $L_{xu}$ ), we vary the transition period tax rate instead.<sup>9</sup>

<sup>9</sup>Standard Laffer curve features a hump-shaped relation between a tax rate and total tax collected. The setup of this model features this relationship. However, since an increase in tax rate increases an outflow of workers from sector  $x$ , the relative price of good  $x$  increases and thus stops the incentive for outflow of workers and further output decline. As a consequence, the relationship between the tax rate and the mass of taxes is positive. The case where the

The effects of changes in either the transition tax rate or the reservation wage on labor flows are very similar. In Figures 3 and 4 we show the effects of varying  $\tau$  and  $u_R$  on employment shares. Increases of either of the two decrease the shares of employment in official sectors. Consequently, aggregate employment and output decline more at higher values of  $\tau$  and  $u_R$ .

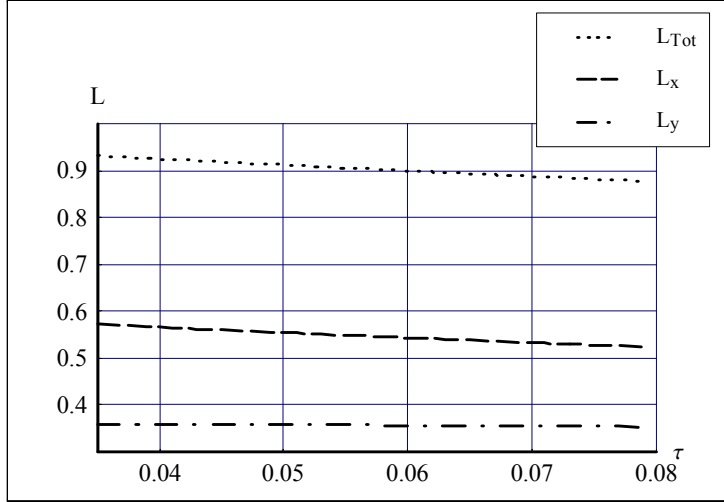


Figure 3: Employment and tranistion tax rate

In fifth and sixth column of Table 9, we show the equilibria for alternative (higher than baseline) values of  $\tau$  and  $u_R$ , which convey more information about the underlying mechanism of increasing output decline. Given an increase in reservation wage and government benefits ( $w_x$  is fixed to 1), labor market equilibrium conditions (17) cannot be satisfied unless  $L_{xu}$  and  $L_{xy}$  increase. The decrease in a flow  $L_{xy}$  is, however, smaller than  $L_{xu}$  as a decrease in relative wage,  $w_y$ , helps to satisfy the labor equilibrium conditions with lower flows between official sectors. The effects of variations of  $\tau$  and  $u_R$  differ, however, in one important aspect. An increase in  $u_R$  that creates larger outflow of workers for given tax rate can support smaller amount of government benefits. Smaller mass of benefits divided by a larger number of inactive workers can only be achieved if the benefits scheme is more modest, that is  $\beta$  is reduced.

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relationship could be positive is ruled out as it would feature a decline in output also in sector  $y$ .

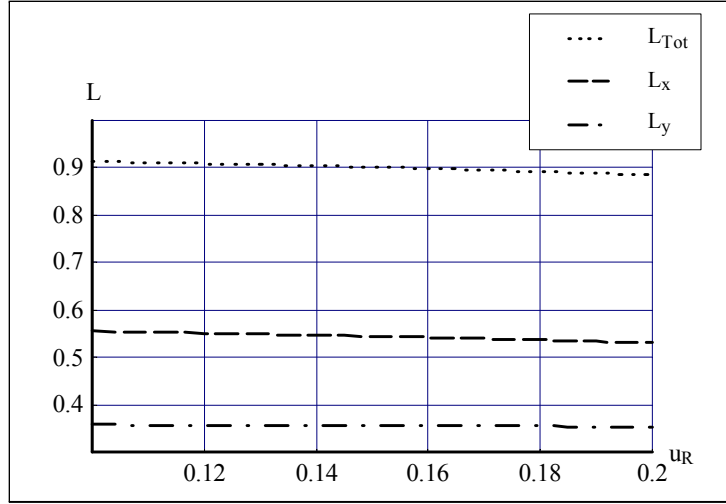


Figure 4: Employment and reservation wage

Note that balanced government budget puts an effective constraint on the extent of output decline due to government transfers or reservation wage. As we note above, budget deficits were common in these countries and allowing for budget deficit generated output decline would be larger.

#### 4.5.4 The political economy of the model

Economists and general public expected large welfare gains after implementation of a set of reforms. These gains were usually related to efficiency gains in re-allocation of factors and productive efficiency. While public support may have been initially larger due to unreasonable beliefs in fast growth, the progress of reforms was not so smooth and sooner or later started to reflect the trade-offs people were facing. In the model we develop, large share of workers may be worse off after price liberalization. Since rational voters anticipating this shock would have blocked such reforms, establishing the relations between some of the model's parameters and public support for reforms seems like an interesting exercise .

The analysis, however, should be considered only as an exercise, as we abstract from many features of reality. Apart from assumed rationality of workers, we also neglect the benefits of increasing productive efficiency. This aspect of benefits could only be properly introduced in dynamic models. However, if a large part of technological progress is neutral, we can speculate that our predicted support for price liberalization suffers from a downward bias. We also consider only the direct form of democracy, where workers have a no abstention, Yes/No vote on full price liberalization.

Before we turn to factors affecting public support for reforms, we shortly discuss the distribution of utility levels for different types of workers. In the pre-transition period, all workers have the same wage and thus the same utility levels. In Figure 5, we plot such distributions for two levels of initial distortions, where

$\tau_y$  equals to 0.4 and 0.6 and denote them  $U_{p,\tau_y=0.4}$  and  $U_{p,\tau_y=0.6}$ , respectively. We can see that larger initial distortions were related to lower level of pre-transition utility for all workers and thus removal of larger distortions should have larger political support.

In the transition period, heterogeneity of adjustment costs and government transfers generates diverging levels of utilities. In further analysis, we find it useful to order agents in the following way: workers that stay in sector  $y$ , movers between sectors  $x$  and  $y$ , workers that stay in sector  $x$  and movers to informal economy. The order is similar to ordering according to age, apart from preceding workers in sector  $y$ . By construction, workers that stay in sector  $y$  are the winners in transition as they gain most. They are followed by movers of either type and workers that stay in sector  $x$ . In Figure 5, we again plot distributions of utility levels for two values of initial distortions and denote them  $U_{\tau_y=0.4}$  and  $U_{\tau_y=0.6}$ . We can see that smaller initial distortions generate smaller inequality of utility after price liberalization.

Now, let's compare the share of voters that support reforms for different values of initial distortions. In the case of large distortions, Figure 5 shows unanimous support for price liberalization. In case of smaller distortions, the support is smaller, as the threshold utility level is higher and share of support for reforms is much lower. What is intuition behind this result? Given large initial distortions, society enjoys lower welfare in the pre-transition period as it consumes suboptimal bundle of goods and more can be gained from price liberalization. Although large distortions also imply larger losses of less desired goods produced in sector  $x$  due to outflow of workers, this reduction of utility is compensated by a change of consumption bundle in favour of good  $y$ .

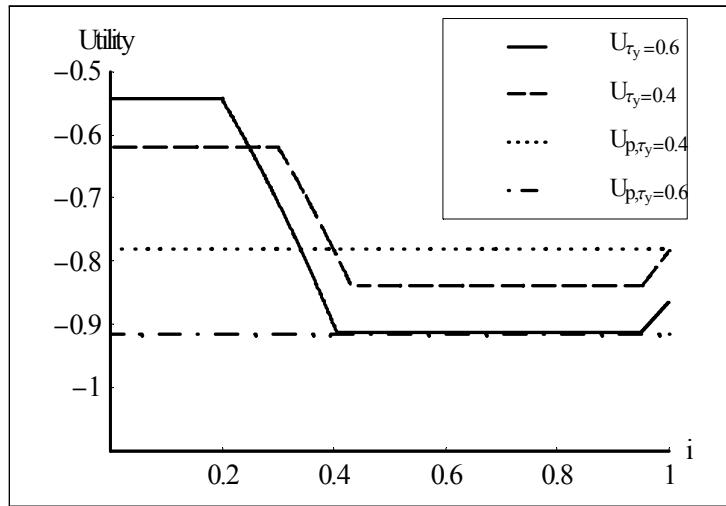


Figure 5 : Distribution of utility in pre-transition and transition equilibria

Although we have not considered manipulation of  $\alpha$  in the analysis so far,

the support for reforms in fact crucially depends on it. Given the setup of the model, larger  $\alpha$  implies larger initial employment in sector  $x$ . Since these workers are more likely to be losers after price liberalization, the reforms are going to be implemented only for values of  $\alpha$  that are low enough. In Figure 6, we illustrate this relationship between  $\alpha$  and share of voters that support reforms for baseline values of parameters and  $\kappa$  equal to 1.5. Only for  $\alpha$  below 0.4, majority of voters would support price liberalization.

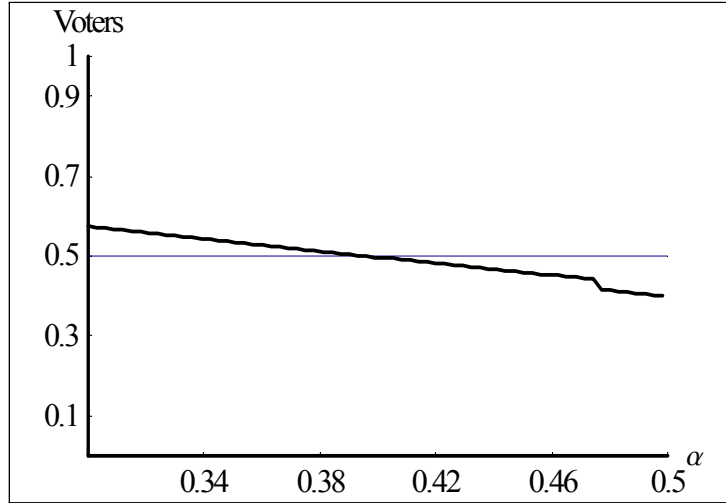


Figure 6: Support for reforms and  $\alpha$  (baseline parameter values and  $\kappa = 1.5$ )

In the framework of the model governments have also a choice of system of redistribution. So far, we have seen that, larger  $\tau$  or  $\beta$  contributed to a larger output decline. That also implies that for larger values of  $\tau$ , smaller share of voters should be willing to support reforms. In Figure 7, we show the support for price liberalization by different groups of voters for different values of  $\tau$ . Given the values of parameters, support for reforms by workers that stay in sector  $x$  is essential to persuade also the median voter as she works in sector  $x$ . When tax rate exceeds certain threshold and they remove their support, price liberalization would not be possible. support changes with higher tax rates as they can consume less goods. The support by all workers in official sector declines with increases in tax rate. The only group that increases in numbers and its support are inactive workers.

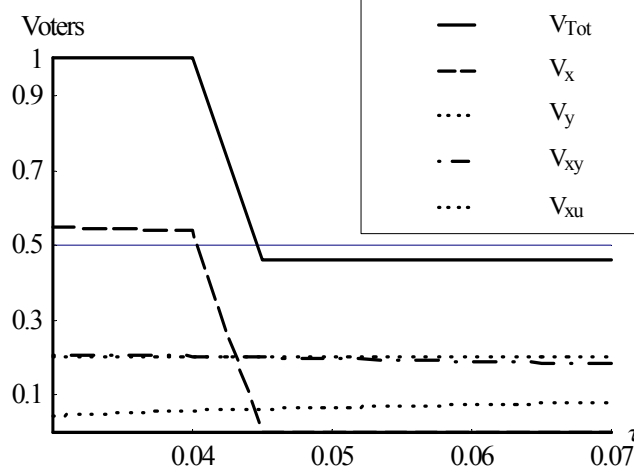


Figure 7: Support for price liberalization and tax rate ( $\tau$ )

We can conclude that, given the present setup, governments that introduced larger transfers to inactivity generated larger output declines and reduced welfare. In fact, the policies of "bribing" voters to support would work only if voters were irrational.

#### 4.5.5 The measurement issues

In the analysis so far, we have not properly discussed the behavior of aggregate output after price liberalization. Instead, we focused on sectorial employment, which was under the assumptions of unit productivities equal to sectorial output. For calculation of aggregate output, however, we need relative prices. We can use four possible relative prices to calculate the aggregate growth rate: (1) current producer relative prices ( $P_t$ ), (2) past producer prices ( $P_{t-1}$ ), (3) current consumer prices ( $C_t$ ) and (4) past consumer relative prices ( $C_{t-1}$ ). The formula for calculation of aggregate growth rate is:

$$g_{ij} = \frac{x_t + y_t \left( \frac{p_y}{p_x} \right)_j^i}{x_{t-1} + y_{t-1} \left( \frac{p_y}{p_x} \right)_j^i}, i = t, t-1; j = C, P. \quad (21)$$

Note that the difference between consumer and producer prices is in the treatment of taxes. Producer prices are pre-tax prices. Using past producers prices, that is pre-transition prices, the relative price of good  $y$  is 1 for the baseline case and therefore growth of output is equal to total employment. However, if we evaluate growth using past consumer relative prices, aggregate output exhibits growth. The main reason for this is that good  $x$  was subsidized and good  $y$  taxed and therefore this relative price is higher than producer relative price. Larger are initial distortions, larger is initial consumer relative price of good  $y$  and larger

is output growth. Growth calculated at current relative prices (pre-tax and after tax are the same!) is higher than that calculated at past producer relative price and lower than that calculated at past consumer relative price. In Figure 9, we show the relation between initial distortions and these three measures of aggregate output growth.<sup>10</sup>

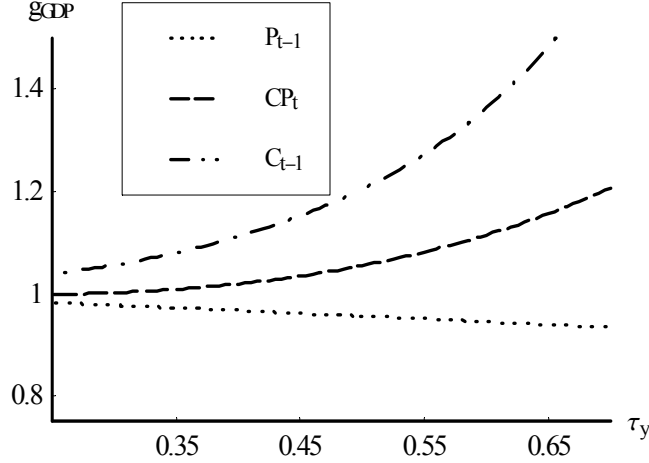


Figure 8: Growth of aggregate output evaluated at different relative prices

This problem of output growth at past consumer prices, is only relevant if the relevant mechanism for output decline indeed worked through distortionary taxes and subsidies applied to revenues. If other mechanisms that were not reflected in initial relative prices were used by social planners, this problem is less important. In particular, if we interpret initial distortions as the difference between preferences or social planner and decentralized consumers, than relative prices are always the same and output depends only on dynamics of labor. There is no doubt, however, irrespective of measures that output declined in some sectors more than others grew.

The model that we displayed here can be interpreted as sectorial model. In that case, we could observe output decline in all economic sectors, within which previously subsidized (taxed) firms declined (grew).

## 5 Conclusions and policy implications

In this paper we develop a simple static model where price liberalization can lead to output decline. We interpret price liberalization as elimination of distortionary

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<sup>10</sup>Note that interpretation of output decline due to difference between preferences or social planner and decentralized consumers, does not suffer from this computational feature. In that case relative prices are always 1.

taxation and thus a shift in relative prices. Contrary to the prevalent opinion, prices in the sectors initially subsidized increase and thus demand declines, while sectors initially taxed prices decline and demand rises. A change in relative prices is, however, just a necessary condition to generate output decline. If labor is freely mobile, a change of relative prices just creates incentives for labor to reallocate, while the net effect on output depends on prices used to evaluate output growth. In line with Boeri (2000a, 2000b) observations on surprisingly low mobility of workers between sectors and evidence on adjustment cost provided in EBRD Transition Report 1997, we assume that workers are facing adjustment cost in mobility of labor. In extreme case, as in Gomulka and Lane (2001), adjustment costs may be prohibitive and no worker moves between sectors. Then output does not change at all. Gomulka and Lane (2001) assume that wages are predetermined and thus workers are made redundant. Assuming that wages are pre-determined and thus workers are made redundant, is not realistic. In Russia, where workers did not have alternatives, wages indeed adjusted. As Boeri (2000a) pointed out, workers need to be "bribed" to accept redundancy. This is the reason why we assume government transfers and informal economy reservation wage. Thus two assumptions are needed: adjustment cost and sufficiently high utility to inactivity.

Note that output decline could take place in all sectors just by allowing some workers to retire earlier. Similarly, firms in whole economy may decide to under-report the actual sales to tax authorities for reasons of tax evasion. These two cases are two additional explanations of output decline and may be ascribed to smaller control of government over firms, which may be considered part of liberalization process. We believe that this explanation may be more pertinent to countries of former Soviet Union, where institutional system may have collapsed after the initiation of reforms. In CEE, relative prices may have triggered outflow of workers only in firms, where prospects were more uncertain.

There is an important issue whether the model laid out can explain output decline in all sectors. We believe that it can, if we interpret the two sectors as part of the whole economy. Distortionary taxes and subsidies, did not work through revenues but assumed other forms. It is sufficient to imagine economy, where in each sector there are heterogeneous firms in terms of labor productivity and workers face adjustment costs. Than removal of these distortions could stimulate workers to inactivity and generate output decline in all economic sectors. Thus this explanation may not be entirely impotent in explaining output decline across all economic sectors.

We also show that support for price liberalization depends positively on the extent of initial distortions. The gain of changing the consumption bundle towards desired one, is in that case larger, despite the losses suffered from labor outflows. In addition to this, rational voters are less likely to support reforms if government introduces redistributive mechanisms that generate larger output decline.



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