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ABSTRACT

Public Finance and the Optimal Speed of Transition*

We develop a general equilibrium model that jointly considers the influence of capital accumulation constraints and of labour market frictions on the process of transition. We endogenize the economic and budgetary costs of different government policies and show that, early in transition, governments ought to subsidize state firms. Provided that inter-temporal commitment is feasible, this policy limits the initial output fall, which relaxes capital accumulation constraints, accelerates transition, and increases welfare. Moreover, by resorting to indirect — instead of direct — taxes, governments can bring the path of transition closer to the first best. Yet, political pressures may induce a policy of excessive subsidization.

JEL Classification: H20 and P20
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1 Introduction

Since the beginning of transition in Central and Eastern European countries, it was clear that productive equipment had to be restructured or replaced, and that a large fraction of the labour force had to change occupation. Clearly, this transmutation was a formidable challenge for economic policy: the social and financial costs were bound to be large, and policy mistakes could make them even larger.

The "Optimal Speed of Transition" (OST) literature (see Boeri 2000, chp 1, and Roland 2000, chp 5, for a survey) deals with this question by analyzing how costs can be maintained within bounds, and which policies maintain transition on track. Yet, the analysis has been rather restrictive. The focus is on *i)* a single policy instrument, *ii)* a single bottleneck in the economy, and *iii)* direct taxes. The first restriction implies that the single policy instrument controlled by the government (usually the direct tax rate or the speed of closure in the state sector) is supposed to directly determine all economic variables, such as the creation of new firms in the private sector, the unemployment rate, and wages. The second assumption entails that, depending on the model, either labour market frictions *or* capital constraints determine the transition path. Finally, by focusing on direct taxes, the literature left public finance questions out of the analysis. The aim of this paper is to address these limitations. We provide an extended model, in which the interactions between labour and capital constraints can be investigated, and we analyze different policy levers and tax instruments that governments can use.

In the OST literature, the process of transition is modeled as the expansion of a new –"private" and high productivity– sector and the phasing out of the old –"state" and low productivity– sector. Hence, transition requires both massive investments and a major reallocation of the labour force. To capture the interactions between these two movements, we introduce labour market frictions as studied by Aghion and Blanchard (1994, AB henceforth) into the dynamic general equilibrium model of Castanheira and Roland (2000, CR henceforth), and make explicit the costs of manipulating the speed at which workers leave the state sector. Finally, we assume that the government can use direct, as well as indirect or lump-sum taxes to leverage finance.

Our results show that the use of direct taxes should be avoided, and that unemployment should be decreasing over transition. This contrasts with the assumption in AB (1994) that only direct taxes can be used, and with their result that unemployment should be constant over time. In contrast with CR's (2000) results, we also show that the government should subsidize state firms early in the transition, in order

to maintain higher output levels. This in turn accelerates transition and increases welfare, because higher output levels ease capital accumulation. However, the government must also be able to commit to decrease subsidies later in transition, so as to maintain restructuring incentives intact. In other words, the budget constraint of state firms must be tightened, but only progressively.[2] This provides a rationale for the accumulation of tax arrears that was observed early in transition: provided that the government commits to decreasing the flow of tax arrears over time, exempting loss-making firms from paying their taxes temporarily does not generate soft budget constraints. Instead, it maintains higher levels of employment early in transition, limits the output fall, and accelerates transition.

These results extend the literature. The seminal paper by Aghion and Blanchard (1994) presents a partial equilibrium model in which the trade-off between the speed of closure and the resulting tax rate is analyzed. They show that transition is sub-optimally slow when unemployment rates are too high (because tax rates become prohibitive) or too low (because wage rates become too high). Burda (1993) and Chadha and Coricelli (1997) also focus on the effect of labour market frictions on the speed of transition, but allow for different tax rates in the state and in the private sector, and Boeri (2000) analyzes the effects of different welfare systems in much greater detail. However, these papers do not consider the income effects of higher unemployment, nor the subsidy costs associated with larger employment in the state sector, and they do not compare the relative merits of alternative tax schemes. Our results thus shed additional light on how government policy should be designed given the initial conditions faced by the country, and can explain why recovery was faster in Central Europe (where subsidies decreased more progressively and commitment was easier to achieve) than in Russia or Ukraine (where subsidies evolved more erratically and political objectives were less clear).

In a different vein, Bertocchi and Spagat (1997), Dewatripont and Roland (1992, 1995), Rodrik (1995), and Roland (1994), among others, study the (dynamic) political economy constraints faced by governments during transition. They show that wrongly designed policies can generate reform reversals. We introduce political constraints in our model by deriving the policy that is desired by the median voter. We show that, in some cases, the median voter may prefer excessive state intervention (too large subsidies), even if this slows down transition and decreases aggregate welfare.

Our stylized model of transition is introduced in Section 2. In Section 3, we

[2] By contrast, most papers in the OST literature *assume* that the government cannot manipulate the budget constraints of firms. This, again, reduces the number of instruments considered in the theoretical analysis.

derive the optimal path of transition, as well as the one that results from a laissez-faire policy. Section 4 derives the optimal policy of the government for a simple case of labour market distortions, and shows why this policy should be financed by indirect taxes. Section 5 shows how this policy is affected when more general labour market conditions are considered and why political constraints may induce the government to select suboptimal policies. Section 6 concludes.

2 The Model

Consumers. The representative agent in the economy is endowed with the following intertemporal utility function:

$$V\left(C(t)\right) = \int_0^{\infty} u\left(C(t)\right) e^{-\rho t}\, dt \tag{1}$$

where ρ is the subjective discount rate, $C\left(t\right)$ is consumption at time t and $u\left(C(t)\right)$ is a Constant Relative Risk Aversion (CRRA) function:

$$\begin{aligned} u(C(t)) &= \tfrac{C(t)^{1-\sigma}}{1-\sigma},\ \sigma \geq 0\,,\ \text{for } \sigma \neq 1 \\ &= \log C(t),\ \text{for } \sigma = 1, \end{aligned}$$

in which $1/\sigma$ is the intertemporal elasticity of substitution.

Firms and national income. The economy is closed and composed of two types of firms: unrestructured firms, which we call "state firms," and restructured or *de novo* firms, which we call "private firms". Restructuring is productive because a worker in state firm g generates a value added $A\left(g\right) < 1$, whereas the same worker has productivity 1 when employed in a private firm. To capture the large heterogeneity of productivity in the state sector, we assume that $dA\left(g\right)/dg \leq 0$, that is, we index jobs in state firms from most to least productive. Denoting total employment in sector i by L_i, national income Y at date t is then:

$$\begin{aligned} Y\left(t\right) &= Y_G\left(L_G\left(t\right)\right) + Y_P\left(t\right), \\ &\text{with } Y_G\left(L_G\left(t\right)\right) = \textstyle\int_0^{L_G(t)} A\left(g\right)\, dg, \end{aligned} \tag{2}$$

where Y_G and $Y_P (= L_P)$ represent value added in the state and private sectors respectively. Given the productivity $A\left(g\right)$ of state firms, we also have:

$$\begin{aligned} Y_G'\left(L_G\left(t\right)\right) &= A\left(L_G\left(t\right)\right) \qquad (\gtreqless 0) \\ Y_G''\left(L_G\left(t\right)\right) &= A'\left(L_G\left(t\right)\right) \qquad (< 0). \end{aligned} \tag{3}$$

Transition and capital accumulation. Since the workers' productivity is higher in private firms, they should move from the state sector to the private sector. However,

private firms do not exist at the start of transition. They have to be created by the injection of fresh capital. A simple way to characterize both the size of the private sector and its demand for labor is to assume that private firms have a Leontiev technology, and that a worker can only be productive in the private sector if matched with one unit of capital. In this way, the demand for workers in the private sector is given by the stock of capital in the sector, K:[3]

$$L_P(t) = K(t).$$

Assuming capital depreciation away, capital accumulation is equal to the amount of national savings:

$$\dot{L}_P(t) = \dot{K}(t) = Y(t) - C(t). \tag{4}$$

Labor market. Labor supply is fully inelastic and given by:

$$L^S(t) = \bar{L}.$$

At any point in time, wages are identical in the state and in the private sector and are determined by three arguments: the level of unemployment, $u(t) = \bar{L} - L_G(t) - L_P(t)$, the interest rate $r(t)$, and $\dot{L}_P(t)$ the number of jobs created at time t. Thus: $w(t) = W\left(u(t), r(t), \dot{L}_P(t)\right)$.

This specification of $W(\cdot)$ is quite flexible and can be accommodated for a wide range of labor market specifications. However, we essentially focus on two cases. Labour market imperfections are introduced by assuming an aggregate matching function *à la* Pissarides (1990), Blanchard and Diamond (1992) or AB (1994), in which case wages follow:

$$w(t) = \beta + \gamma \cdot \left(r(t) + \frac{\dot{L}_P(t)}{u(t)}\right), \tag{5}$$

where β and γ are two non-negative parameters.

The second case we consider is that of perfect labour markets, as studied by CR (2000). In this set-up, wages balance labour supply and demand, and drop to zero if there is excess supply:

$$\begin{aligned} w(t) &= A(L_G(t)), && \text{if } A(L_G(t)) \geq 0 \text{ and } L_G(t) + L_P(t) = \bar{L} \\ &= 0, && \text{if } L_G(t) + L_P(t) < \bar{L}. \end{aligned} \tag{6}$$

[3] CR (2000) show that more general production functions can be considered, without affecting the essence of the results.

Finally, we introduce the possibility of labour hoarding by assuming that employing all the population in the state sector is counter-productive, that is some jobs in state firms have negative productivity (for those, operating costs are larger than the value of their output):

$$A\left(\bar{L}\right) < 0. \tag{7}$$

3 Command Optimum and Laissez-Faire

3.1 The Command Optimum

In the next sections, we analyze the optimal policy of the government during transition. However, it is important to derive first the optimal path of transition (the *command optimum*). To this end, assume that a social planner controls all the variables that define the transition path. That is, the central planner controls both the level of consumption (and hence of capital accumulation) and the closure speed of state firms.

The central planner's problem is thus to maximize intertemporal utility (1), subject to the capital accumulation constraint (4) and the labor supply constraint $u(t) \geq 0$. The present value Hamiltonian of the central planner is given by:

$$\mathcal{H}(t) = \left(\frac{C(t)^{1-\sigma}}{1-\sigma} + \lambda(t)\left[Y(t) - C(t)\right] + \mu(t)\left[\bar{L} - L_G(t) - L_P(t)\right] \right) \cdot e^{-\rho t},$$

where $L_P(t)\,(= K(t))$ is the state variable, and $\lambda(t)$ and $\mu(t)$ are the co-state variables associated with the two constraints.

Taking first order conditions (since the programme is globally convex, first order conditions are necessary and sufficient), we find:

$$\begin{aligned}
\frac{\partial \mathcal{H}(t)}{\partial C(t)} &\equiv C(t)^{-\sigma} - \lambda(t) = 0 && (8)\\
\frac{\partial \mathcal{H}(t)}{\partial L_G(t)} &\equiv \lambda(t)\, A\left(L_G(t)\right) - \mu(t) = 0, && (9)\\
\frac{\partial \mathcal{H}(t)}{\partial L_P(t)} &\equiv \lambda(t) - \mu(t) = -\dot{\lambda}(t) + \rho\,\lambda(t) \\
&\Rightarrow \quad -\frac{\dot{\lambda}(t)}{\lambda(t)} = 1 - \rho - \frac{\mu(t)}{\lambda(t)}, && (10)
\end{aligned}$$

and the transversality condition is simply:

$$\lim_{t\to\infty} \lambda(t) \cdot L_P(t) \cdot e^{-\rho t} = 0. \tag{11}$$

Using these conditions, and denoting with a superscript '$*$' the optimal level of the variable, we find:

Lemma 1 (CR (2000), Proposition 1) *Welfare is maximized when non-productive jobs in the state sector (i.e. with $A(g) < 0$) are discontinued from the outset of transition ($A(L_G^*(0)) = 0$), whereas productive jobs are only discontinued when the private sector faces a short supply of labor ($L_G^*(t) = \min\left[\bar{L} - L_P^*(t), A^{-1}(0)\right], \forall t$). Moreover, the optimal path of consumption is determined by:*

$$\begin{aligned} \frac{\dot{C}^*(t)}{C^*(t)} &= \frac{1-\rho}{\sigma}, \ \forall\ u^*(t) > 0, \quad \textit{and} \\ &= \frac{1 - A(L_G^*(t)) - \rho}{\sigma}, \quad \textit{when } u^*(t) = 0. \end{aligned}$$

Proof. Immediate from (7)-(11). ■

This Lemma provides a useful benchmark with which the outcomes that may arise under different market conditions and government policies can be compared. This benchmark is identical to the optimal path of transition in CR (2000), which can be implemented with a simple policy of laissez-faire in their framework. A limitation of CR (2000), however, is that they only consider the case of perfect labour markets (6), which, as we show below, lies at the heart of their result. For more general market conditions instead, the best policy the government can implement will turn out to be quite different.

To shed light on the determinants of the efficient government policy, let us describe how the economy behaves when the government adopts a laissez-faire stance.

3.2 Transition under Laissez-Faire

In contrast to the command optimum, laissez-faire implies that market forces alone determine consumption, as well as the speed of closure of state firms. For the sake of tractability, we assume that economic agents are price-takers. Given the level of wages, the profit of a state firm g (including capital return) is given by:

$$\pi(g,t) = A(g) - w(t).$$

Clearly, laissez-faire implies that state firm g makes negative profits for any wage level that exceeds its level of productivity. Therefore, the firm stops producing if $A(g) < w(t)$, in which case it pays zero wages, and makes zero profits. The equilibrium level of employment in the state sector at time t (a superscript 'LF' denotes the equilibrium value of the variable under laissez-faire) is thus:

$$L_G^{LF}(t) = A^{-1}(w(t)), \tag{12}$$

and the equilibrium level of output at time t becomes:

$$Y^{LF}(t) = Y_G\left(L_G^{LF}(t)\right) + L_P(t).$$

Then, decomposing national income by factor remuneration yields:

$$Y^{LF}(t) = \underbrace{w(t)\ (L_P(t) + L_G(t))}_{\text{Labor income}} + \underbrace{r(t)\ K(t) + \int_0^{L_G^{LF}(t)} (A(g) - w)\ dg}_{\text{Capital income (private \& state sector)}}. \tag{13}$$

Thus, the objective of the representative agent is:

$$\max_{C(t)}\ \mathcal{H}_P(t) = \frac{C(t)^{1-\sigma}}{1-\sigma} \cdot e^{-\rho t} + e^{-\rho t} \cdot \lambda_P(t) \cdot \left[Y^{LF}(t) - C(t)\right] \tag{14}$$

where $\mathcal{H}_P$ stands for "private sector Hamiltonian". First order conditions then give the equilibrium path of consumption under laissez-faire:

$$\frac{\dot{C}^{LF}(t)}{C^{LF}(t)} = \frac{r(t) - \rho}{\sigma}. \tag{15}$$

It thus remains to derive $r(t)$ to compare the laissez-faire and the "optimal path of transition" outcomes. Since the productivity of a private firm is equal to 1, the return to capital is simply:

$$r(t) = 1 - w(t), \tag{16}$$

which means that laissez-faire is only optimal if wages are perfectly flexible. Hence:

Lemma 2 *Unless wages are perfectly flexible and follow (6), laissez-faire initially generates excessive job destruction, an excessive output fall, and suboptimally slows down transition.*

Proof. By (12), for any wage level $w(0) > 0$, we have $L_G^{LF}(0) < L_G^*(0)$ and $Y^{LF}(0) < Y^*(0)$. Next, a necessary condition for transition to be faster under laissez-faire would be that consumption grows faster in that case than under the command optimum ($C^{LF}(0)$ must be smaller than $C^*(0)$ for accumulation to be faster, and there must exist some point in time, T, at which $C^{LF}(T) = C^*(T)$). However, this contradicts the motion equations $\dot{C}^*(t)/C^*(t)$ in Lemma 1 and $\dot{C}^{LF}(t)/C^{LF}(t)$ with $w^{LF}(t) > w^*(t)$ in (15). ■

This lemma shows that, unless wages are perfectly flexible, laissez-faire induces a double inefficiency.[4] First, labour shedding is suboptimally high early in transition,

[4]Boeri (2000) and Friebel and Guriev (2000) however underline other efficiency costs entailed by excessive wage flexibility. Namely, enterprises that do not pay any wages have weaker incentives to restructure or shed unproductive labour. Similarly, workers without any wealth or social protection cannot quit their job: they become "attached" to their firm. These inefficiency costs are not captured by our representative agent set-up.

and this generates a negative income effect, which reduces the amount of resources available for consumption and savings.[5] Second, wage rigidity generates a substitution effect that negatively affects the savings rate. State intervention will have to correct these two inefficiencies: maintain higher income levels when transition starts, and stimulate investment.

4 Optimal State Intervention in Transition

We are now in a position to analyse how the government should design its policy to bring the path of transition closer to the command optimum. The problem of the government is however different from that of a social planner: while a social planner controls both the speed of closure and the savings level, the government cannot directly control consumption and savings. Instead, private economic agents decide how much they want to consume and invest, given the level of employment and wages. To solve the problem of the government, we work by recursion: first, we derive the path of consumption given total employment and wages from (14) above. Then, like in a Stackelberg game, we derive the optimal policy of the government, taking into account the subsequent influence of its actions on consumption.

Let us define the tools and the constraints faced by the government. First, if the government wants to delay or prevent job separation in the state sector, it must subsidize some state firms. Second, it must levy some taxes to finance its spendings, and we constrain the budget to be balanced at each point in time.

The effect of a subsidy is to loosen the budget constraint of state firms: if the wage level is $w(t)$ and there is no subsidy, any firm with a productivity lower than $w(t)$ will fire its worker(s). To prevent firings, the government can give to the firm a subsidy equal to the difference between the wage level and its productivity: $s(g,t) = w(t) - A(g)$. Thus, subsidies have the potential of increasing employment in the state sector. Subsidies do not make budget constraints "soft": since the government makes its decision before the market, consumers and firms take the actions of the government as given (We discuss the differences between this "pre-committed" path of subsidies and soft-budget constraints below).

Dropping time indices for clarity, total employment in the state sector thus depends on the wage level and on the maximum amount of subsidies the government is

[5] Note however that the reshuffling of economic partnerships induced by transition also has additional negative consequences on output (Blanchard and Kremer (1997), Roland and Verdier (1999)). The output fall captured by Lemma 2 comes on top of these effects.

willing to transfer to a firm, $\bar{s}$:

$$L_G(w, \bar{s}) = A^{-1}(w - \bar{s}). \tag{17}$$

The total amount of subsidies spent, $S_G(w, \bar{s})$, is thus:

$$S_G(w, \bar{s}) = \int_{A^{-1}(w)}^{A^{-1}(w-\bar{s})} s(g, t)\, dg.$$

Finally, the total budget of the government is the sum of subsidies and unemployment benefits. Assuming that the government can levy a lump-sum tax T –alternative tax schemes are studied below–, its budget constraint becomes:

$$T = S_G(\cdot) + b\left(\bar{L} - L_G(\cdot) - L_P\right), \tag{18}$$

where $b(> 0)$ represents unemployment benefits and $L_G(\cdot)$ follows from (17).

Now, we turn to the optimal policy of the government. To maximize welfare, the government must compute:

$$\max_{L_G} \mathcal{H}_G = \left(\frac{C^{1-\sigma}}{1-\sigma} + \lambda\,[Y - C] + \mu\,\left[\bar{L} - L_G - L_P\right]\right) \cdot e^{-\rho t},$$

subject to (17), (18) , and the consumption decision of the representative agent. From (3), we know that $\partial Y/\partial L_G = A(L_G)$ and, by the complementary slackness condition, that $\mu = 0$ if $\bar{L} - L_G - L_P > 0$. Taking the first order condition of this problem with respect to L_G yields:

$$\frac{\partial \mathcal{H}_G}{\partial L_G} = \lambda\, A(L_G) + \left[C^{-\sigma} - \lambda\right] \frac{d\,C}{d\,L_G} - \mu = 0, \tag{19}$$

where consumption is determined by the representative agent who solves (14), which implies that $C^{-\sigma} = \lambda_P$. Subject to this constraint, the government thus maximizes welfare by setting employment to (a superscript '**' denotes the constrained-optimal level of a variable):

$$A(L_G^{**}) = \left[1 - \frac{\lambda_P}{\lambda}\right] \frac{d\,C}{d\,L_G} + \frac{\mu}{\lambda}. \tag{20}$$

Of particular interest in (20) is the term λ_P/λ, that is the ratio between the private and the social co-state variables associated to the capital accumulation constraint. Principles of dynamic optimization teach us that such co-state variables represent the marginal valuation (the shadow value) of the associated constraint (see e.g. Chiang (1992, chp.8) or Kamien and Schwartz (2000, p.136)). Namely:

- λ_P represents the shadow value of capital as measured by a *private* investor,

- λ represents the *social* shadow value of capital.

Thus, $\lambda_P/\lambda = 1$ if wages are perfectly flexible. If wages are not fully flexible, the private return to capital must fall below its social return, and thus entail $\lambda_P/\lambda < 1$.

Next, the influence of state employment on consumption, dC/dL_G, can be decomposed into an income effect (the first term in (21) below) and a substitution effect (the second term):

$$\frac{dC}{dL_G} = \frac{\partial C}{\partial Y}\frac{\partial Y}{\partial L_G} + \frac{\partial C}{\partial r}\frac{\partial r}{\partial L_G}, \tag{21}$$

By the properties of CRRA utility functions, the savings *rate* (and thus the consumption rate) is independent of income:

$$\frac{\partial C}{\partial Y} = \frac{C}{Y} = c(r).$$

In other words, the share of consumption in national income is only determined by the private return to investment. Since $r = 1 - w$, we have:

$$\frac{\partial r}{\partial L_G} = -\frac{\partial w}{\partial L_G} = -\frac{\partial w}{\partial u}\frac{\partial u}{\partial L_G} = \frac{\partial w}{\partial u}. \tag{22}$$

Thus, (21) becomes:

$$\frac{dC}{dL_G} = c(r)\ A(L_G) + c'(r)\frac{\partial w}{\partial u}$$

Given the number of arguments that enter into (20), the resulting constrained-optimal policy is difficult to interpret. For the sake of clarity, we thus start from a simple case, which we extend progressively.

4.1 Sticky wages and lump-sum taxes

Wages are said to be "sticky" when they display downward rigidity and upward flexibility. Sticky wages are worth considering both for their analytical tractability and their empirical relevance. For instance, Grosfeld and Nivet (1999) show that they are empirically relevant in Poland, where wages increase when productivity rises but remain unaffected by productivity decreases. In the framework of our model, sticky wages are also analytically tractable because they drive $\partial w/\partial u$ to zero as long as there is unemployment. We introduce sticky wages by setting β $(> b)$ larger than zero and γ arbitrarily close to zero in (5). Then, (20) becomes:

$$A(L_G^{**}) = \left[1 - \frac{\lambda_P}{\lambda}\right] c(r)\ A(L_G^{**}), \forall u > 0, \tag{23}$$

which implies that:

Proposition 1 *If wages are sticky (i.e. if $\gamma \to 0$ and $\beta > 0$ in (5)), and if the government finances its policy by lump-sum taxes, the (second-best) policy of the government can be divided into three subsequent phases:*
i) *For $L_P(t) < L - A^{-1}(0)$, $\bar{s}^{**} = \beta$, so that all state firms with non-negative productivity keep producing. Unemployment is positive and decreasing;*
ii) *For $L_P(t) \in \left[L - A^{-1}(0), L - A^{-1}(\beta)\right]$, $\bar{s}^{**} = \beta - A(L - L_P(t)) - \varepsilon$, with $\varepsilon \geq 0$, and there is only frictional unemployment;*
iii) *For $L_P(t) \geq L - A^{-1}(\beta)$, $\bar{s}^{**} = 0$ (no intervention), and there is only frictional unemployment.*
Under this policy, transition is strictly faster (and welfare strictly larger) than under laissez-faire, but remains slower than optimal.

Proof. By backward induction, during the *third* phase, the least productive state worker has a productivity larger than $\bar{w} = \beta$. Downward wage rigidity is thus not binding ($\lambda_P/\lambda = 1$) and, by Lemma 2, a laissez-faire approach ($\bar{s}^{**} = 0$) is thus optimal.
During the *second* phase, the least productive state worker has strictly positive productivity ($A(L_G(t)) > 0$), but setting $\bar{s}(t) = 0$ would generate unemployment, since

$$L_P(t) \leq L - A^{-1}(\beta).$$

Yet, (23) only admits $A(L_G^{**}) = 0$ as a solution when $\lambda_P/\lambda < 1$ and $u(t) > 0$. By contradiction, positive unemployment is thus suboptimal, which implies that subsidies must bring unemployment arbitrarily close to zero. However, the interest rate $r(t) = 1 - w(t)$ is still below the social return to capital, $1 - A(L_G(t))$. Therefore, subsidies must maintain wages at their minimal level, to maximize the savings rate.
During the *first* phase, the private sector is too small to absorb all unproductive workers. Thus, government policy is determined by (23), which again only admits $A(L_G^{**}) = 0$ as a solution.
Since the private return to capital remains below its social return under this policy, Lemma 2 implies that transition is slower than optimal. Yet, under the policy $\bar{s}^{**}$, output is higher than under laissez-faire, whereas the private return to capital remains identical. Thus, transition is faster (and welfare larger) than under laissez-faire. ■

In the presence of sticky wages and when lump-sum taxes are used, the primary objective of the government should thus be to maximize output at each point in time and, as a secondary objective, maintain wages as close as possible to their socially optimal level. As Proposition 1 shows, this requires subsidies to be highest

at the beginning of transition.[6] Later, as the number of restructured firms increases, subsidies should decrease progressively, and only frictional unemployment is needed. Finally, no intervention is required towards the end of transition. This also shows that subsidies should increase if the productivity of pre-existing firms is lower and if wage distortions are more severe, and that a policy of laissez-faire will be most damaging early in transition, when the elasticity of output with respect to subsidies is highest (See CR (2000) for a complementary analysis of the effects of excessive closure early in transition).

Importantly, efficient intervention by the government also requires *intertemporal commitment*. We indeed assumed that, in a game-theoretic interpretation, the government moves "before" enterprises and investors. This implies that, from the onset of transition, firms know they will cease to be subsidized at some pre-determined point in time, which maintains their incentives to restructure. Put differently, subsidies do not create soft-budget constraints (Kornai (1980)) when the government is able to commit to a given path of declining subsidization. By contrast, in the absence of commitment, the government may be induced to constantly refinance loss-making firms (Dewatripont and Maskin (1995)), which would inefficiently increase wages and weaken the incentives to restructure (see also Schaffer (1998) and Roland (2000, chp. 9)). To increase total welfare, a combination of *controlled* intervention (one must avoid excessive subsidization in the first phase, when unemployment is required) and *intertemporal commitment* is thus required.

The contrasted evolutions of successful reformers (most Central and Eastern European countries and the Baltic states) and of less successful reformers (most countries of the CIS, Bulgaria and Romania) is quite consistent with this distinction between limited intervention *cum* commitment on the one hand, and the absence of either one on the other hand. For instance, Coricelli (2001) highlights that most central European countries only progressively reduced the public supply of credit, taking account of the initial absence of private financial institutions. Only later, when private credit developed in the wake of financial liberalization, did the state reduce this public supply of finance, *e.g.* by letting largely loss-making enterprises[7] initially accumulate a relatively large stock of tax arrears (implicit tax exemptions), and reducing the flow of new tax arrears in a second phase. Importantly, there is also evidence that these arrears did not generate excessively soft budget constraints (the interpretation of Schaffer however differs on this point): first, the flow of tax arrears was drying up

[6] Moreover, since Ricardian equivalence must hold when lump-sum taxes are used, results are identical if the government uses debt instead of taxes.

[7] The 10-15% of most unprofitable firms account for 62% and 74% of all arrears in Hungary and Poland respectively (Schaffer (1998)).

rapidly. Second, firms' employment rapidly became increasingly responsive to output in these countries, unlike in Russia (Basu *et al.* (2000), Boeri (2000)). Third, countries implementing this policy of gradual subsidies reduction managed to maintain inter-enterprise and bank arrears at low levels (Schaffer (1998)). By contrast, in less successful countries like Romania and Russia, the flow of tax arrears picked up again as the economic situation worsened, indicating either a lack of commitment by the state or a lack of controlled policy, and inter-enterprise and wage arrears increased substantially. Explicit and implicit subsidies are displayed in Table 1:

Table 1: Budgetary subsidies and tax arrears in percentage of GDP.[1]

Country	**1989**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**
Czech Republic							
Budgetary subsidies	25[2]	7.7	5.0	..	3.1	2.7	2.2
Tax arrears (flow)				1-2	..	..	..
Hungary							
Budgetary subsidies	12	7.4	5.5	4.3	4.5	3.8	3.9
Tax arrears (flow)				1.2	0.7	..	..
Poland							
Budgetary subsidies	10.6	5.1	3.3	3.9	3.3	2.9	2.5
Tax arrears (flow)				1-2	0-1	..	..
Romania							
Budgetary subsidies	5.7	8.1	12.9	5.5	3.8	4.1	4.3
Tax arrears (flow)				1.5	3.1	..	..
Russia							
Budgetary subsidies			14.2	7.3	..	..	6.2
Tax arrears (flow)				..	2.1	1.4	7.3

[1]Data from Schaffer (1998), Gao and Schaffer (1998), Guriev and Ickes (2001)

[2]Former Czechoslovakia

Coricelli (2001) further shows that the unfolding of events was quite different in most CIS countries, where the state immediately liberalized financial markets, and where the lack of fiscal discipline by the government implied an rapid dry-up of financial resources for existing enterprises. Moreover, tax arrears were much less targeted towards the most unprofitable firms – they only account for 44% of tax arrears in Russia (Schaffer (1998)). As a consequence, barter trade and inter-enterprise arrears increased significantly, and firms became very little responsive to market incentives, since neither market prices nor wages could influence their decisions anymore (Basu *et al.* (2000), Gaddy and Ickes (2002)). This indicates that the excessive tightening of subsidies early in transition eventually made the budget constraints of state firms

much softer in these countries.[8]

Summing up, we interpret the presence of subsidies and tax arrears differently from Schaffer (1998). In his view, tax arrears systematically soften the budget constraint of loss-making firms, and thus reduces their incentives to restructure. Instead, Proposition 1 makes clear that subsidies are quite purposeful, provided that the government commits to reducing them subsequently. Moreover, the evidence provided by Coricelli (2001) highlights that this policy of (explicit or implicit) subsidization of loss-making firms was going in parallel with a progressive and controlled liberalization of financial markets. Tax arrears, in this case, might have mainly been a substitute for the missing supply of private capital; a temporary aid to delay the closure of loss-making firms, which in light of Proposition 1 is necessary to limit the amplitude of the output fall.

4.2 Tax instruments

Proposition 1 assumes that the government uses lump-sum taxes. However, such taxes are generally unavailable in practice. In this section, we analyze two alternate –and more realistic– means of financing this policy, and show that lump-sum taxes are actually not even socially desirable: first, we analyze classical the case of direct taxes, which are shown to slow transition even more than lump-sum taxes. Then, we show that the government can implement the first-best path of transition if it finances its policy with the help of indirect taxes. We still assume sticky wages in this section, and relax this assumption in the next section.

Direct taxes. Typically, the tax base of the government is the sum of all revenues perceived by the different agents of the economy. In our representative-agent setting, these revenues are the sum of output and transfers. Thus, if the government

[8] Other implicit subsidies were used in CIS countries: first, the implementation of efficient bankruptcy laws was delayed. Even though this effectively maintains higher employment levels in the old sector, it also generates perverted incentives, and thus hinders restructuring. Second, oil prices are maintained below cost (i.e. below export prices) in Russia. However, this does not target subsidies towards largely loss-making firms, generates distorted signals as to which enterprises should restructure, and undermines the credibility of the government, since it is politically difficult to subsequently increase energy prices. By contrast, exempting only a *small* fraction of state firms from paying their taxes generates political commitment: a majority of the population would vote in favour of also requesting the minority to pay taxes.

imposes a flat tax rate τ to all sources of revenues, its total tax receipt T is:[9]

$$\begin{aligned} T &= \tau\left(Y + b\left(\bar{L} - L_G(\cdot) - L_P\right) + S_G(\cdot)\right) \\ &\quad \text{where: } Y = L_P + Y_G\left(L_G(\cdot)\right) \text{ and } L_G(\cdot) = A^{-1}(w - \bar{s}). \end{aligned}$$

Then, the balanced-budget constraint imposes that:

$$\tau = \frac{S_G(\cdot) + b\left(\bar{L} - L_G(\cdot) - L_P\right)}{Y + S_G(\cdot) + b\left(\bar{L} - L_G(\cdot) - L_P\right)},$$

and a side-effect of also taxing capital income is that consumers only take *after-tax* returns to capital, r_n, into account. It is immediate to check that the consumption path then becomes:

$$\frac{\dot{C}}{C} = \frac{r_n - \rho}{\sigma}, \text{ where } r_n = (1 - \tau) r.$$

Finally, in the presence of these taxes, (20) becomes:

$$A\left(L_G^{**}\right) = \left[1 - \frac{\lambda_P}{\lambda}\right]\left(c(r_n)\, A\left(L_G^{**}\right) - c'(r_n)\frac{\partial \tau}{\partial L_G} r\right), \forall u > 0.$$

It follows that:

Proposition 2 *If wages are sticky (i.e. if $\gamma \to 0$ and $\beta > 0$ in (5)), and if the government finances its policy by direct taxes, the (third-best) policy of the government induces yet slower transition, and higher unemployment in the first phase of transition, than if lump-sum taxes are used.*

Proof. Since the after-tax return to investment is lower under a direct tax scheme than under the lump-sum tax scheme, the savings rate and the speed of transition are also lower, by Lemma 2. Next, $\partial\tau/\partial L_G > 0$ for $\bar{s} = \beta$, $\forall \beta > b > 0$. Thus, $A\left(L_G^{**}\right) > 0$ in the first phase of transition, which implies that unemployment must remain suboptimally large in this phase. ■

Proposition 2 simply restates the known result that direct taxes slow growth, which, in the framework of our model, translates into a slower speed of transition. Note however that this result only holds in comparison to a lump-sum tax scheme. This third-best path of transition may still be faster than a pure laissez-faire policy, since subsidies to unrestructured state firms also have a positive income effect.

[9] Results remain unaffected if transfers are not taxed. By contrast, the results in Proposition 2 do depend on the assumption that the government maintains a balanced budget (see also Chadha and Coricelli, 1997).

Actually, a corollary of Proposition 2 is that positive subsidies are also needed to maximize the speed of transition, even if the government could maintain unemployment benefits arbitrarily close to zero. However, subsidies would be lower in this case than in Proposition 2, since the speed of transition is maximized when the tax rate is maintained closer to its minimum level. This result is in turn reminiscent of AB (1994).

Indirect taxes. Since direct taxes generate further inefficiencies, the government might instead want to use a consumption tax. In this case, the tax base is equal to total consumption. If the government imposes a (flat) indirect tax ι on consumption, its budget is balanced when:

$$\iota = \frac{S_G(\cdot) + b\left(\bar{L} - L_G(\cdot) - L_P\right) + B}{C},$$

where B represents some lump-sum social benefit distributed to the population. Taking account of this indirect tax in the representative agent's decision problem, it is easy to verify that the consumption path follows:

$$\frac{\dot{C}}{C} = \frac{r - \rho - \frac{\dot{\iota}}{\iota}\frac{\iota}{1+\iota}}{\sigma},$$

and thus that a falling rate of taxation ($\dot{\iota} < 0$) induces faster-growing consumption (*i.e.* higher savings rates). Hence:

Proposition 3 *There exists a policy $\{S_G, B, \iota\}$ that allows the government to reproduce the command optimum (first best).*

Proof. The government can set subsidies to state firms S_G in a way to restore the optimal speed of closure, $L_G^*(t)$, and separately set $B(t)$ such that $r - \frac{\dot{\iota}}{\iota}\frac{\iota}{1+\iota} = 1 - A(L_G^*)$, in which case the path of consumption $C(t)$ must be identical to $C^*(t)$. Since the paths of output, consumption, and savings are the same as under the command optimum, the whole path of transition is also optimal. ■

Thus, from a welfare point of view, indirect taxes should be preferred to lump-sum taxes, which are themselves more efficient than direct taxes. The rationale for this result comes from the combination of the adverse income and substitution effects we underlined in Section 3. That is, subsidies correct the income effect, but only indirect taxes generate the desired substitution effect: falling indirect taxes serve the same purpose as a subsidy to investment, at smaller budgetary costs.

5 General wage formation scheme and political constraints

The above results only hold for sticky wages, that is when wages remain equal to β for any positive unemployment level. If instead wages are sensitive to unemployment, that is if γ is sufficiently large in (5), any reduction in unemployment generates some increase in wages, and thus some decrease in savings. This increased sensitivity of consumption and savings implies that the optimal level of unemployment must be higher than in the case of sticky wages. That is, frictional unemployment is necessary throughout the whole path of transition, for the same reasons as in AB (1994). Using (20) and assuming again lump-sum taxes for the sake of tractability, we indeed find:

$$\begin{aligned} A\left(L_G^{**}\right) &= \left[1-\frac{\lambda_P}{\lambda}\right]\left[c\left(r\right)A\left(L_G^{**}\right)+c'\left(r\right)\frac{\partial w}{\partial u}\right],\ \forall u>0 \qquad (24)\\ &= \frac{\left[1-\frac{\lambda_P}{\lambda}\right]c'\left(r\right)\frac{\partial w}{\partial u}}{1-\left[1-\frac{\lambda_P}{\lambda}\right]c\left(r\right)}\ (>0). \end{aligned}$$

How are our previous results affected when general wage formation scheme are considered? In the first phase of transition, the constrained-optimal level of unemployment can already be quite large with sticky wages (see Propositions 1-3). Intuitively, the sensitivity of wages with respect to unemployment is then likely to remain small even under this general wage formation scheme, and the optimal policy that results from (24) should then be close to the policy derived in Proposition 1. Data confirm this intuition: in the first years of transition, *i)* the vacancy-to-unemployment ratio was quite small (0.01 in Poland and Romania, 0.04 in Slovakia, 0.06 in Hungary and 0.11 in Slovenia),[10] *ii)* real wages remained basically constant or were falling (Basu *et al.* (2000), Boeri (2000)), and *iii)* wages were very inelastic with respect to unemployment (Grosfeld and Nivet (1998), Basu *et al.* (2000)). Later in transition, however, the sensitivity of wages with respect to unemployment is likely to increase, which then implies a more rapid reduction of subsidies than advocated in Proposition 1. Thus the general result which states that subsidies must be highest in the first years, and subsequently decrease remains valid.

Importantly, additional measures can also be designed to limit upward wage flexibility: Poland for instance introduced the *Popiwek* in 1990, which imposed an increasing rate of taxation when wages were growing faster than the national norm. As de Crombrugghe and de Walque (1997) argue, beyond its macroeconomic objectives, such a policy also aimed at avoiding decapitalisation, *i.e.* maintain the capital of state firms in operation for a longer period, which goes along the results of Proposition 1.

[10] Data from OECD (1995).

However, in addition to this effect, the *Popiwek* also reduces wage sensitivity and limits the financial costs of subsidization, which in our framework makes it easier to bring the path of transition closer to the command optimum.

Also of interest are the political economy constraints implied by (24). This first order condition holds in case the representative agent (*i.e.* the *average* consumer in the economy) is considered. However, transition is known to have generated an increasing level of inequality in these countries, which has even become a major social and economic problem (see *e.g.* Klugman *et al.* (2002)).

When income inequality increases, the wedge between the average and median levels of income typically increases. In our model, we can introduce income inequalities by letting wages and social benefits differ among agents. The optimization problem of some agent j then becomes:

$$\max_{C_j} \mathcal{H}_j = \left(\frac{C_j^{1-\sigma}}{1-\sigma} + \lambda_j \left[(1-\tau) \left(w_j + b_j + r\, K_j + \phi_j\, \Pi_G \right) - C_j \right] \right) \cdot e^{-\rho t}.$$

Solving this problem in the same way as (14), we find that, in equilibrium:

$$C_j^{-\sigma} = \lambda_j.$$

Then, to derive the policy that maximizes the welfare of this agent, we substitute for this constraint into (24), which yields:

$$A\left(L_G^{**}(j)\right) = \frac{\left[1 - \frac{\lambda_j}{\lambda}\right] c'(r) \frac{\partial w}{\partial u}}{1 - \left[1 - \frac{\lambda_j}{\lambda}\right] c(r)}, \ \forall u > 0. \tag{25}$$

In turn, this implies that:

Proposition 4 *For $\gamma > 0$, the discrepancy between the level of subsidies desired by the median and the average agent in the economy is increasing in inequality and decreasing in the unemployment rate.*

Proof. Let j represent the median-income agent. Using (24) and (25), we have:

$$A\left(L_G^{**}\right) - A\left(L_G^{**}(j)\right) = \frac{\lambda\left(\lambda_j - \lambda_P\right)}{\left(\lambda + c(r)\left(\lambda_j - \lambda\right)\right)\left(\lambda + c(r)\left(\lambda_P - \lambda\right)\right)} c'(r) \frac{\partial w}{\partial u}.$$

Thus, $A\left(L_G^{**}\right) - A\left(L_G^{**}(j)\right)$ increases in $\lambda_j - \lambda_P = C_j^{-\sigma} - C^{-\sigma}$ and in $|\partial w / \partial u|$. In turn, $\lambda_j - \lambda_P$ is increasing in inequality since, by the properties of CRRA utility functions, a lower income for j compared to the national average implies a reduction in C_j / C. Finally, by (5), low unemployment levels increase $|\partial w / \partial u|$. ■

This proposition implies that popular pressure for excessive subsidization will mount as inequality increases. That is, absent an efficient social safety net, voters demand protection by means of a larger state sector. According to our results, however, this only has substantial policy implications if unemployment is also low. As discussed above, in most central European countries, unemployment was sufficiently large in the beginning of transition to lessen the elasticity of wages with respect to unemployment. In this case, the policy preferred both by the median and the average agent is to set $\bar{s} \simeq \beta$. If instead wage sensitivity and inequality are large ($\lambda_j > \lambda$), the efficient policy would still be to set $\bar{s} < \beta$ (*i.e.* $A(L_G^{**}) > 0$), but the median-income agent may prefer to increase $\bar{s}$ beyond β (*i.e.* $A(L_G^{**}) < 0$). The benefit to the median income agent is that employment and wages increase early in transition, which increases his/her income. However, this policy comes at the expense of yet a smaller rate of accumulation, and thus generates a slower speed of transition.

The relative welfare costs of laissez-faire and excessive subsidization of course depend on the parameters of the model. Yet, our results highlight that, when the country's weak institutions prevent the government from committing to a policy of moderate and decreasing subsidization, two types of suboptimal policies can arise. On the one hand, the government may want to pursue with transition. In this case, it might be easiest to commit to no policy at all (laissez-faire), which reinforces the initial output fall and slows transition because of the negative income effect. This policy pattern seems to have been "chosen" by countries like Russia or Ukraine. On the other hand, subsidies might be turned into a soft budget constraint, and the government then be tempted to revert to the paternalistic policy underlined by Kornai. As the cases of Belarus and Uzbekistan suggest, this policy can actually limit the output fall, both by maintaining higher income levels early in transition and by preventing the "disorganization" effects underlined by Blanchard and Kremer (1997) and Roland and Verdier (1999). However, even though such a policy may please the median-income agent in the economy, it also prevents economic "reorganization," *i.e.* the restructuring of existing firms or the creation of new ones. This result thus provides a theoretic rationale for Fischer and Sahay's (2000) pessimistic assessment of the future growth prospects of Belarus and Uzbekistan.

6 Conclusions

This paper develops a stylized general equilibrium model of transition that captures the joint influence of labour markets imperfections and capital accumulation constraints. We show that, because of labour market imperfections, laissez-faire policies

generate an excessive output fall and a suboptimally slow transition. In contrast, committing to a policy of moderate and decreasing subsidization corrects the adverse consequences of labour market imperfections, in particular when the government resorts to a consumption tax (and not to direct taxes).

Since commitment is needed to achieve such an outcome, an extra insight provided by the model is that "strong institutions" are needed to limit the amplitude and/or the duration of the output fall. Our results indicate that, when the government is not able to commit, two types of suboptimal policies may be chosen. First, the government may adopt a laissez-faire stance (no subsidies), at the cost of a larger output fall early in transition, and a slower recovery in later stages. Moreover, if laissez-faire generates soft budget constraints because of inter-enterprise arrears, recovery will be even slower. The case of Russia roughly fits this pattern: the lack of both public subsidies and private finance forced firms to accumulate large interenterprise and wage arrears, which in turn made them less responsive to market incentives. The second type of inefficient policy that may emerge is one of excessive subsidies. Because of political pressures, the government can indeed be constrained to over-subsidize state firms, in order to increase employment and wages. The short-run benefit of such a policy is to limit the amplitude of the initial output fall. However, it also generates long-run costs, which take the form of suboptimally low returns to investment, and thus slows down restructuring and transition.

An intuitive interpretation of this result is that, in countries where institutions appear to be strong only when the state is authoritarian, there is a temptation to abandon reforms and revert to a strong control of the economy by the state. Uzbekistan and Belarus seem to fit this pattern, and generate a risk of contagion: the apparent success of these policies (smaller output falls were indeed observed in these countries) makes this policy option look increasingly attractive to a number of citizens and academics in slowly growing transition countries. Our results however highlight that this success is only illusory: the efficient policy that we derive in this paper imposes a commitment to decrease subsidies during transition, and thus contradicts the "paternalistic" approach apparently adopted by Belarus and Uzbekistan and already criticized by Kornai.

Some related issues, such as how reforms should be designed to strengthen institutions, how welfare systems affect political incentives, or which are the effects of capital market imperfections, are not addressed in this model. However, our results show that state intervention is required *even* if financial and goods markets are perfect and if workers do not experience any mobility cost, like in Friebel and Guriev (2000). Thus, when additional market imperfections are present, committed state

intervention is even more likely to be productive. In other words, even though these market imperfections would certainly alter the details of the optimal policy derived in this paper, they should not affect the positive lessons of our results.

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