

# Institutional Inertia and the Optimal Pace of Market Reforms\*

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## Abstract

In this paper, we study the impact of institutional inertia on the implementation of market-oriented reform programs. We examine the problem of a government who can introduce efficiency-enhancing reforms to increase the rate of economic growth by inducing, via monetary compensations, low productivity workers to exit the sector. In our baseline scenario without institutional inertia, efficiency gains are sufficiently large to permit the introduction of a full market reform program that is accepted by all workers and does not raise a budgetary deficit in any period. In the presence of institutional inertia, the government is required to compensate subsequent generations of workers to allow for institutional changes associated with the expansion of markets. We show that, under some circumstances, the government prefers to introduce a transition reform program that, at least during the first periods of the reform, preserves workers with intermediate productivity levels in the old non-market system and shifts only high productivity workers to the market system.

*Keywords:* economic reform, institutional inertia, economic growth, deficit, market-oriented policies, fast-moving versus slow-moving institutions.

## 1 Introduction

Why is so hard for governments to introduce market-oriented, efficiency enhancing policies? This question is considered by many to be among the fundamental issues in development and political economy. Without monetary subsidies or transfers, the answer usually relies on the unequal distribution of power between winners and losers of the economic reform. Potential losers are powerful organised groups who can block the reform, either because of their connections within the government or their voting representation. A related explanation, proposed by [Fernandez and Rodrik \(1991\)](#), is that individual uncertainty about who belongs to the losing side generates a status-quo bias. A market-oriented reform that is ex-post beneficial to the majority of the population may be rejected, because some voters do not know, ex-ante, how the reform will affect them.

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Compelling as it is, this argument relies on the absence of transfers and individual uncertainty. Yet governments are increasingly able to offer monetary (or some other form of) compensations to potential losers. Moreover, in some circumstances the uncertainty works asymmetrically, with individual agents being certain of the net gains of a policy shift while the government being aware only of the distribution of gains and losses among the population. Of course, the availability of transfers does not necessarily imply that an efficiency enhancing reform will be immediately implemented, as political constraints can influence the pace of market-oriented reforms. This is a lesson we learned from [Dewatripont and Roland \(1992\)](#), who consider a two-period model with dynamic adverse selection. In their framework, the government can generate efficiency gains by laying off less productive workers in an oversized sector. Since workers have private information about their technology (or, equivalently, their opportunities in a different sector of the economy), the government requires to run a deficit. [Dewatripont and Roland \(1992\)](#) show that, under some circumstances, including no commitment power from the part of the government, it is preferable to adopt gradual reforms. A gradual reform program consists of laying off workers with low productivity in the first period, while keeping workers with medium and high productivity employed in the industry. In the second period, the government proceeds to lay off workers with intermediate productivity while keeping only the most productive workers.

In this paper, we propose a related explanation in favour of a smooth implementation of market-oriented policies. We model a economic reform as the adoption of a new institutional framework for the allocation of a productive resource in a given sector of the economy. To shut down commitment problems related to dynamic adverse selection, our model considers overlapping generations of workers who are endowed with different productivity levels. At the initial period, all workers are employed in a given sector and freely receive a scarce resource directly from the government with equal chances, without regard for their different productivities (for instance, by queuing for the productive resource). We call this allocation mechanism an *egalitarian lottery*. In subsequent periods, the government can promote growth by reforming the system using *market-based allocation mechanisms*, where more productive workers purchase the input at a market-clearing price and less productive workers are offered a subsidy to exit the sector.

Realising efficiency gains is costly because of the asymmetry of information. But in our baseline scenario, these gains are sufficiently large that a full market reform can be introduced without creating any budgetary deficit for the government. In practice, oversized sectors with massive unexploited efficiency gains, for example due to a traditionally significant state presence, do not usually experience a straight switch to market-based allocations. The privatisation of the pension system in several Latin American countries comes to mind. In some countries, notably Chile and Peru, the government adopted a transition period at which old generations of workers were allowed to choose between joining the newly created private pension system or staying in the government-run pension system. Such choice was not offered to younger generations of workers. This type of transition differs from the gradual reform program predicted by [Dewatripont and Roland \(1992\)](#).<sup>1</sup> But our model shows under which circumstances a smooth transition to market

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<sup>1</sup>On gradualism in economic reform programs, see also [Dewatripont and Roland \(1995\)](#) and [Wei \(1997\)](#), among others.

mechanisms is preferred to a direct approach.

The new element in our analysis is a disutility that younger workers suffer when the government adopts changes in the institutional design enjoyed by the older peers, and we call this *institutional inertia*. Older generations of workers transmit to younger generations their ideas about what constitutes acceptable ways to resolve the allocation of scarce resources or related societal problems — acceptable practices in the workplace or the social sphere at large. These practices, which can be related to intrinsic knowledge about the actual workings of an institution, or more general to relatively fixed cultural constructs, enter individual welfare via a disutility occasioned anytime there is an actual change in the institutional design faced by individual workers. In other words, our model studies the interaction between the slow-moving component of institutions, embedded in cultural norms, frictions or adaptation costs, and the formal, fast-moving component of institutions under control of the government.<sup>2</sup>

There is substantial evidence that cultural background affects values for government intervention or redistribution. Guiso et al. (2006) argue that culture impacts the behaviour of economic agents through its effect on political preferences: “how much government should intrude in economic life, promote competition, regulate the market, redistribute income, run a social security program, or nationalize certain industries and businesses.”<sup>3</sup> Moreover, there is also strong evidence that these effects are substantial enough to have an economic impact. For example, the steady rise in female labor force participation during the last century cannot be explained solely in terms of wage increase—see Goldin (1990) for example—a fact that has prompted authors like Fernández (2013) and Hazan and Maoz (2002) to argue that changes in culture and tradition are an important part of the explanation. Institutional inertia works in similar way, as in our model the workers’ backgrounds or past experiences determine, at least so some extent, their views on what constitutes an acceptable way for society to resolve its problems. These views change only slowly, with each generation taking the previous generation institutional context as acceptable. In this way, our model allows us to study the two-way interaction between formal, fast-moving institutions and informal, slow-moving institutions. When evaluating a feasible reform, the government must take into account that the allocation mechanism to be adopted in the current period will impact, through institutional inertia, the worker’s welfare in the next period.

Not surprisingly, the presence of institutional inertia renders impossible for the government to adopt a full market reform program without running a costly budgetary deficit. To be precise, the government cannot switch from the egalitarian mechanism, which provides all workers equal chance of obtaining the productive resource, to a market mechanism without running a period by period deficit. The first generation of workers under the market mechanism requires extra incentives to compensate for the institutional inertia associated with moving away from the egalitarian lottery, and while this compensation diminishes in time as the market reach expands, the budget deficit does not entirely disappear in the second period of the full market reform program. This is because market expansion in the second period changes the actual allocation of resources for less produc-

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<sup>2</sup>For a recent discussion and review of the literature on slow- versus fast-moving institutions, see Roland (2004) and Alesina and Giuliano (2015).

<sup>3</sup>See also Alesina and Fuchs-Schündeln (2007).

tive workers, who then will need to overcome their inertia and adapt to a new exchange method as they enter the market. Without a discount in prices, they will not follow through.

More interestingly, even when it is welfare enhancing to introduce a market-oriented reform, and this can be accomplished with full support of the population by running a budgetary deficit, the presence of institutional inertia may alter the pace of the reform. A transition program considers a dual system during the first period of the market-oriented reform. Under the dual system, workers with low productivity levels are provided subsidies to exit the sector and high productivity workers purchase the input in the market as before, but workers with intermediate productivity levels are allowed to stay in the lottery system. These intermediate workers don't receive a subsidy or pay a price for the input, but obtain it with equal probability. The advantage of using a dual transition mechanism in the first period is that it does not generate a deficit. The disadvantage is that efficiency gains are not fully exploited, which affects both growth rate in this period and, through the availability of resources in the second period, future growth as well. So, even when a market mechanism is implemented in the second period, growth will be lower than when the reform program starts with fully market-based mechanisms. Because market expansion carries always an adaptation cost, a deficit will be necessary to cover discounts for workers who change regimes in the second period.

How does the government resolve this trade-off? We show that there is a cut-off borrowing cost above which the government prefers to use a transition reform package instead of a full market reform package. This is despite the fact that, in the second period, the costs associated with institutional inertia are larger under the transition reform program than under the full market reform program. In a nutshell, savings in the first period from the use of a dual transition mechanism are sufficiently high to compensate for both lower growth and higher institutional inertia costs in the second period, as long as the borrowing costs of the government are not too low. Our results also suggest that worse initial conditions, in the sense of a more severe scarcity problem, favour the use of transition reform programs. Indeed, when the level of aggregate input in the initial period is low, the higher efficiency gains associated with a market-based mechanism are tempered by the higher adaptation costs workers bear when purchasing the resource from the market. As a result, the cut-off borrowing costs that makes the transition reform program preferable to the full market-based reform program diminishes.

The slow adoption of market-oriented policies has been recently studied by [Buera et al. \(2011\)](#). Their empirical findings, including the fact that most developing countries exhibit a low and late trend towards market-based reforms, are based on a simple learning model in which the evolution of policymakers beliefs about the desirability of markets is shaped by both their own experiences and that of their neighbours. Importantly, [Buera et al. \(2011\)](#) also show that resistance to markets is a robust property as long as policymakers believe that the impact of economic reform is heterogeneous across countries. But why would this be the case? Our model offers some insights into this question. Under some circumstances, it may be optimal to make a smooth transition towards free markets instead of a big bang approach. Countries differ in their institutional history and in their initial resource levels, and the outcome and the design of optimal policy reforms is influenced by institutional inertia. The way we have modelled such inertia is arguably

crude, omitting the fact that its effects may cross more than one period. But we believe is an important starting point in understanding the interaction of formal, fast-moving institutional design and informal, slow-moving institutional adjustment.

## 2 A Simple Model of Market-Oriented Reforms

We develop a simple overlapping generations model to study the pace of market-oriented reforms under institutional inertia. We consider formal, fast-moving institutions in terms of a design problem —i.e., designing the rules of the game under which the allocation of resources and monetary taxes or subsidies are resolved— while treating institutional inertia as reflecting informal, slow-moving institutions that affect individual behaviour — i.e., the norms, customs and practices that individuals use to assess and adapt to certain social constructs. We choose to abstract from several considerations to focus on the two-way interaction between formal institutions and informal adaptation mechanisms. In particular, in our baseline scenario, efficient market reforms can be implemented even with individual uncertainty, due to the availability of monetary transfers across the different parties involved, and there is no commitment problems.

In each period  $n = 0, 1, 2$ , there is a continuum of agents (workers) of mass one who are born and live for two periods. At the beginning of every period, a benevolent social planner (government) owns  $Q_n \in (0, 1)$  units of a key productive resource in a given sector of the economy. The social planner allocates this aggregate resource among the population of agents who were born in such period. Importantly, only the government has access to  $Q_n$ . A worker born in period  $n$  supplies one unit of labor inelastically and, upon obtaining at most one unit of the resource, transforms it into  $\theta$  units of output. For simplicity, we consider a situation where each worker then sells her individual output back to the government in the next period, in exchange for consumption goods. The government then uses the aggregate output of period  $n$  to obtain access of aggregate input for period  $n+1$  (say, by exchange it in international markets). To focus on efficiency gains of market-oriented reforms in a simple setting, we fix to 1 the rate of exchange between input and output, and between output and consumption goods, and we do not consider individual savings decision.

Workers can be of different abilities, so we consider the productivity parameter  $\theta$  as an independent random variable distributed in  $\Theta = [\underline{\theta}, \bar{\theta}]$  according to the continuous distribution  $F$ , which has positive density everywhere. This is private information of workers. The information specification of heterogeneity in the individual technology of workers is the same for all periods. Moreover, we normalize this random variable so that  $\mathbb{E}[\theta] = 1$ . Since we are considering a finite horizon model, discounting is omitted for simplicity. Workers have linear preferences over the consumption good and any available monetary transfer.

At the beginning of period  $n = 0$ , the government owns  $Q_0 = Q$  units of the input. We assume that there is a severe scarcity problem, letting  $0 < Q < 1/2$ . For this initial period we assume that, perhaps due to tradition, the government guarantees every worker the allocation of the production resource with equal probability. We refer to this as the *egalitarian lottery*. Note that this specification of the initial situation implies that where there are massive unrealised efficiency gains in the aggregate production. But the

egalitarian lottery does not require the government to use of any monetary transfer to keep workers employed in this sector. The utility of a worker born in period  $n = 0$  with productivity parameter  $\theta$ , who receives the private resource with probability  $Q_0 = Q$  is just  $U_0 = \theta Q$ , and the aggregate production at the end of the initial period is just  $Y_0 = \mathbb{E}[\theta Q] = Q$ .

## 2.1 Introducing Market-Oriented Reforms

The egalitarian lottery is not welfare maximising. In other words, the planner could achieve Pareto improvements by allocating more of the productive resource to workers with higher productivity. A more efficient way to allocate the productive resource will enhance aggregate output, and subsidies could be used to compensate workers who are in the losing side. Thus, starting in period  $n = 1$ , the government has the opportunity to introduce market-oriented reforms which here we interpret as moving away from the egalitarian allocation institution.

To formalise the idea of economic reforms, we introduce institutional changes by means of allocation mechanisms. More specifically, the social planner wants to design a *reform program*, i.e., a sequence of mechanisms  $\{\langle q_1, t_1 \rangle, \langle q_2, t_2 \rangle\}$  with the objective of maximizing social welfare (to be defined subsequently) subject to an exogenous cost on transfers  $\beta > 0$  associated for example to the distortionary effects of raising funds via borrowing, taxing, or negotiating assistance programs with an international donor (we are adopting a partial equilibrium approach here).<sup>4</sup> Since there is no informational linkage between periods, because workers operate in this sector for just one period, a mechanism in period  $n = 1, 2$  is simply an allocation rule  $q_n: \Theta \rightarrow [0, 1]$  that dispenses the productive resource among  $n$ -th period workers together with a transfer rule  $t_n: \Theta \rightarrow \mathbb{R}$ . A mechanism  $\langle q_n, t_n \rangle$  is *resource feasible* if it satisfies the resource constraint

$$\int_{\underline{\theta}}^{\bar{\theta}} q_n(\tilde{\theta}) dF(\tilde{\theta}) \leq Q_n. \quad (1)$$

Aggregate resources that the planner possesses at the beginning of period 1 is the aggregate production of the previous period:  $Q_1 = Y_0 = Q$ . But there is room for economic growth when more efficient allocation methods are in place:

$$Y_n = \mathbb{E}[\theta q_n(\theta)], \quad \text{for all } n = 1, 2. \quad (2)$$

It would be possible to introduce aggregate shocks, but we prefer to make our analysis as clean as possible. Note that in our model aggregate output of period  $n$  serves a dual purpose: it is equivalent to aggregate consumption for period  $n + 1$  and aggregate resources that the government owns at the beginning of period  $n + 1$ . A richer model would incorporate consumption and saving decisions from consumers, but we want to maintain simplicity to focus on the interplay between formal institutions and institutional inertia.

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<sup>4</sup>This cost is standard in the economic reform literature —e.g., [Dewatripont and Roland \(1992\)](#).

## 2.2 Institutional Inertia

We are interested in exploring the effects of institutional inertia in the pace of economic reform. This inertia may come from cultural constraints or from related adaptation costs. We have in mind a situation where the old generation of workers passes their knowledge of the institutional setting to the new generation of workers. As long as the allocation institution remains in place, there is no inertia. However, once the government introduces changes in the rules of the game, the new generation of workers incurs in an inertia cost, either because of the need to adapt to the new institutional environment or because of a cultural effect, through values regarding what is acceptable social practice for example, in the utility function. We consider either interpretation as potentially valid. What is crucial in our model is that any deviation in allocation from the old institution generates a disutility.

The utility of a  $\theta$ -agent born in period  $n = 1, 2$  under the mechanism  $\langle q_n, t_n \rangle$ , when reporting  $\hat{\theta}$  to the government is

$$U_n(\hat{\theta}, \theta) = \theta q_n(\hat{\theta}) + t_n(\hat{\theta}) - \kappa \theta |q_n(\hat{\theta}) - q_{n-1}(\hat{\theta})|, \quad (3)$$

where  $0 < \kappa < 1$  captures the weight of institutional inertia. In words, adapting to a new formal institutional setting, a slow process of social or cultural adaptation, determines a bias towards the old institution. Any method of resolving the scarcity problem that differs from it creates a disutility, although the impact of introducing an alternative market structure is tempered by the worker's own productivity. Note that we are focusing the effects of institutional inertia in terms of allocation rules alone, under the premise that money (or a suitable divisible commodity) has a longer history of societal practice and thus workers understand its incentive role.

## 2.3 The Planner's Problem

Since there is no discounting, *aggregate welfare* for period  $n$  is

$$W_n = \int_{\underline{\theta}}^{\bar{\theta}} \left\{ \tilde{\theta} q_n(\tilde{\theta}) - \kappa \tilde{\theta} |q_n(\tilde{\theta}) - q_{n-1}(\tilde{\theta})| \right\} dF(\tilde{\theta}) - \beta \int_{\underline{\theta}}^{\bar{\theta}} t_n(\tilde{\theta}) dF(\tilde{\theta}). \quad (4)$$

As mentioned above, in the initial period the planner uses, by default, the egalitarian lottery interpreted here as the mechanism  $\langle Q, 0 \rangle$ , which delivered aggregate output *and* aggregate welfare equal to  $\mathbb{E}[\theta Q] = Q$ . It should be clear that the planner can continue using the mechanism  $\langle q_n, t_n \rangle = \langle Q, 0 \rangle$  in the remaining periods  $n = 1, 2$ . No adaptation costs are incurred because the formal institution never changes. This stationary outcome generates aggregate output and aggregate welfare equal to  $Q$  in every period, given that there is never the need for monetary subsidies to workers but either is any economic growth.

When the government designs a market-oriented reform program  $\{\langle q_1, t_1 \rangle, \langle q_2, t_2 \rangle\}$  that maximizes aggregate welfare across periods 1 and 2, it is subject to several constraints. First is the borrowing costs, which we take as an exogenous variable throughout the analysis. Moving from the egalitarian allocation rule  $q_0 = Q$  to a more efficient allocation rule may generate a budget deficit. The second constraint from the planner's

perspective is a dynamic resource feasibility constraint. Aggregate resources at the beginning of period 1 are  $Q_1 = Q$ , but the mechanism  $q_1$  determines aggregate output  $Y_1$ , as specified in Equation 2, and therefore aggregate resources in period 2 since  $Q_2 = Y_1$ . With this we capture the idea that more efficient institutions are potentially conducive to economic growth.

The third element that constraints the planner's program comes from the incentive compatibility constraints. The planner has to make sure that in every period  $n$ , every worker is provided with incentives to truthfully report her productivity parameter. Despite the lack of informational link between workers born today and tomorrow, the individual incentive constraints have a dynamic component created by institutional inertia. For each  $n = 1, 2$ , the government must ensure that the mechanism  $\langle q_n, t_n \rangle$  is implementable given institutional inertia coming from the allocation rule  $q_{n-1}$ . Define the *generalized allocation*  $\phi_n$  on  $\Theta$  as

$$\phi_n(\theta) = q_n(\theta) - \kappa |q_n(\theta) - q_{n-1}(\theta)|. \quad (5)$$

With this notation, the utility function of a worker born in period  $n$  and endowed with productivity level  $\theta$ , who behaves as a  $\hat{\theta}$  is given by

$$U_n(\hat{\theta}, \theta) = \theta \phi_n(\hat{\theta}) + t_n(\hat{\theta}).$$

When the productivity parameter is private information, incentive compatibility requires that  $\theta \in \arg \max_{\hat{\theta} \in \Theta} U_n(\hat{\theta}, \theta)$  for all types  $\theta$ . The following characterisation of incentive compatible mechanisms under institutional inertia is obtained using standard methods. Note however that embedded in it is a dynamic restriction on the interaction between the allocation rule recommended by the mechanism in the current period and the prior allocation rule. To spare on notation, let  $U_n(\theta) \equiv U_n(\theta, \theta)$  for all  $\theta \in \Theta$  and for  $n = 1, 2$ .

**Proposition 1.** *In the presence of institutional inertia, the mechanism  $\langle q_n, t_n \rangle$  is incentive compatible if and only if  $\phi_n$  is non-decreasing and the indirect utility of workers born in period  $n$  admits the following integral representation*

$$U_n(\theta) = \underline{U}_n + \int_{\underline{\theta}}^{\theta} \phi_n(\tilde{\theta}) d\tilde{\theta}.$$

*Proof.* The first part is standard, so we focus in showing that  $\phi$  non-decreasing and the integral representation of the indirect utility ensure implementability. Using the indirect utility, we reformulate incentive transfers as

$$t_n(\theta) = \underline{U}_n + \int_{\underline{\theta}}^{\theta} \phi_n(\tilde{\theta}) d\tilde{\theta} - \theta \phi_n(\theta), \quad (6)$$

where  $\underline{U}_n$  denotes the utility of the lowest type. With this payment rule, we can compute

$$U_n(\hat{\theta}, \theta) = (\theta - \hat{\theta}) \phi_n(\hat{\theta}) + \int_{\underline{\theta}}^{\hat{\theta}} \phi_n(\tilde{\theta}) d\tilde{\theta} - \underline{U}_n.$$



Readily,  $U_n(\theta, \theta) - U_n(\hat{\theta}, \theta) \geq 0$  for all  $\theta, \hat{\theta}$  in  $\Theta$ . □

Note that the presence of institutional inertia does indeed impose a dynamic restriction to the class of implementable reform programs. Simple monotonicity of  $q_n$  period by period will not suffice, as the following example shows.

*Example 1.* Let  $\Theta = [0, 1]$ , types are uniformly distributed,  $Q_1 = 1/2$ , and consider the allocation rules for periods  $n = 1, 2$  given by

$$q_1(\theta) = \begin{cases} 3/12 & \text{if } \theta < 1/4, \\ 7/12 & \text{if } \theta \geq 1/4, \end{cases}$$

and

$$q_2(\theta) = \begin{cases} 3/8 & \text{if } \theta < 3/4, \\ 7/8 & \text{if } \theta \geq 3/4. \end{cases}$$

We obtain the generalized allocation rule for period 2:

$$\phi_2(\theta) = \begin{cases} 3/8 - \kappa(3/24) & \text{if } \theta < 1/4, \\ 3/8 - \kappa(5/24) & \text{if } 1/4 \leq \theta < 3/4, \\ 7/8 - \kappa(7/24) & \text{if } \theta \geq 3/4, \end{cases}$$

which is not increasing. Hence,  $q_2$  cannot be implemented when  $q_1$  is the prior allocation rule. As a result, the reform program consisting of allocation rules  $q_1$  and  $q_2$  is not implementable as a whole.  $\diamond$

The final constraint on the government's problem consists of the workers' reservation utility. We abstract from political economy issues by specifying that the planner requires unanimous support for the reform package. Specifically, we assume that the population born in period  $n = 1, 2$  has the ability to halt market-oriented reforms and revert to the egalitarian allocation mechanism. Thus, the reservation utility of a  $\theta$ -agent is given by

$$U_n^r(\theta) = \theta Q_n, \quad \text{for all } n = 1, 2. \quad (7)$$

This way of modelling the participation constraints obviates the possibility of workers taking into account adaptation costs in their evaluation of the outside option. In other words, the egalitarian allocation rule is assumed to be, from an institutional perspective, a viable way of resolving scarcity in every period without incurring in adaptation costs. As the outside option plays a role only in determining the level of subsidy assigned to those who would be excluded from obtaining the good in a market reform, this assumption guarantees that without institutional inertia a full market reform is feasible and budget neutral—and this will serve as a clean baseline scenario.

### 3 The Full Market Reform Program

#### 3.1 Market Reform without Institutional Inertia

Without institutional inertia, using the egalitarian allocation rule  $q_n = Q_n$  every period is not welfare maximising. Without uncertainty regarding workers' productivity, it is clear that the social planner can achieve Pareto improvements by instituting a market mechanism to sell the productive resource to high productivity workers, using the proceeds of these sales to compensate low productivity workers left behind via monetary subsidies. As we now show, in our setting efficiency gains from a market mechanism are sufficiently large to achieve these Pareto improvements, even in the presence of asymmetric information and the distortionary borrowing costs.

Indeed, fix the level of aggregate resources  $Q_n$  for period  $n = 1, 2$ . It is easy to see that, without institutional inertia, the planner can do better by employing the class of market-based allocation rules

$$q_n^c(\theta) = \begin{cases} 0 & \text{if } \theta < \theta_n^c, \\ 1 & \text{if } \theta \geq \theta_n^c, \end{cases}$$

parameterized by a critical productivity level  $\theta_n^c \in \Theta$ . Adapting [Equation 6](#) to this case, it follows that under incomplete information any market-based allocation rule  $q_n^c$  can be implemented with incentive transfers

$$t_n^c(\theta) = \begin{cases} \underline{U}_n^c & \text{if } \theta < \theta_n^c, \\ \underline{U}_n^c - \theta_n^c & \text{if } \theta \geq \theta_n^c, \end{cases} \quad (8)$$

where  $\underline{U}_n^c$  denotes the base utility under mechanism  $\langle q_n^c, t_n^c \rangle$ . Any such mechanism is called a *market mechanism*. In words, under the market mechanism  $\langle q_n^c, t_n^c \rangle$  all workers in period  $n$  with a productivity higher than  $\theta_n^c$  buy the resource at a posted price, while all workers with a lower productivity are excluded from the market but receive a subsidy from the government.

We need to make sure that  $\langle q_n^c, t_n^c \rangle$  is resource feasible and individually rational. The resource feasibility constraint restricts the span of critical types that can be used in a market mechanism. Using [Equation 1](#), resource feasibility translates to the requirement that  $\theta_n^c \geq F^{-1}(1 - Q_n)$ . Finally, the individual rationality constraint in this case means that

$$U_n^c(\theta) = \theta q_n^c(\theta) + t_n^c(\theta) \geq \theta Q_n = U_n^r(\theta).$$

Clearly, the difference  $U_n^c(\theta) - U_n^r(\theta)$  is increasing for all  $\theta \geq \theta_n^c$  and decreasing for all  $\theta < \theta_n^c$ . Thus, to satisfy the individual rationality condition it suffices to obtain that  $U_n^c(\theta_n^c) \geq \theta_n^c Q_n$ , which can be re-written as  $\underline{U}_n^c \geq \theta_n^c Q_n$ . Since the government faces financing costs and lump-sum transfers has no effect on incentives, one sees that the market mechanism provides as few subsidies as possible, determining  $\underline{U}_n^c = \theta_n^c Q_n$  for all  $n = 1, 2$ .

It remains to show that the full market reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$  is implementable. By construction, every market mechanism is incentive compatible in this case.

Without institutional inertia, a full market-based reform program is optimal.

**Proposition 2.** *In the absence of institutional inertia, the welfare maximising reform program among all the incentive compatible reform programs specifies*

$$q_n^*(\theta) = \begin{cases} 0 & \text{if } \theta < \theta_n^*, \\ 1 & \text{if } \theta \geq \theta_n^*, \end{cases} \quad \text{and} \quad t_n^*(\theta) = \begin{cases} \theta_n^* Q_n & \text{if } \theta < \theta_n^*, \\ \theta_n^* Q_n - \theta_n^* & \text{if } \theta \geq \theta_n^*, \end{cases}$$

for  $n = 1, 2$ , where  $\theta_n^* \equiv F^{-1}(1 - Q_n)$  and  $Q_n$  is recursively obtained by setting

$$Q_1 = Y_0 = Q, \quad \text{and} \quad Q_2 = Y_1^* = \mathbb{E}[\theta \mid \theta \geq \theta_1^*] Q_1.$$

Total welfare generated by the optimal reform program  $\{\langle q_1^*, t_1^* \rangle, \langle q_2^*, t_2^* \rangle\}$  is strictly greater than total welfare generated by the repetitive use of egalitarian mechanism  $\langle Q, 0 \rangle$ . Moreover, the optimal reform program is deficit neutral in every period.

*Proof.* Fix aggregate input  $Q_2$  at the beginning of period 2 and a market mechanism  $\langle q_2^c, t_2^c \rangle$ . We have argued that to minimize subsidies the planner set  $U_2^c = \theta_2^c Q_2$  in any market mechanism with critical type  $\theta_2^c$ . Thus, total welfare for the period is

$$\begin{aligned} W_2^c &= Y_2^c - \beta T_2^c \\ &= \int_{\theta}^{\bar{\theta}} \tilde{\theta} q_2^c(\tilde{\theta}) dF(\tilde{\theta}) - \beta \int_{\theta}^{\bar{\theta}} t_2^c(\tilde{\theta}) dF(\tilde{\theta}) \\ &= \mathbb{E}[\theta \mid \theta \geq \theta_2^c] (1 - F(\theta_2^c)) - \beta \theta_2^c \{Q_2 - 1 + F(\theta_2^c)\}. \end{aligned}$$

The benevolent planner now chooses a critical type  $\theta_2^c$  to maximize this expression, subject to period 2 resource constraint  $\theta_2^c \geq F^{-1}(1 - Q_2)$ . The first term in the right-hand side is decreasing in  $\theta_2^c$ . Because of the resource constraint, so is the second one. Thus, the planner optimally sets  $\theta_2^* = F^{-1}(1 - Q_2)$  as the solution to the above problem. With this choice of critical type, aggregate transfers for the last period are

$$T_2^* = \theta_2^* \{Q_2 - 1 + F(\theta_2^*)\} = 0.$$

Thus, in the last period, the best market mechanism entails the usage of the allocative efficient allocation rule, conditional on aggregate input at the beginning of that period, and a transfer rule that is deficit neutral in the aggregate. Solving backwards, the best market mechanism in period  $n = 1$  entails the allocative efficient allocative rule  $q_1^*$  and the revenue neutral transfer rule  $t_1^*$ , where the critical type is  $\theta_1^* = F^{-1}(1 - Q_1)$ . Note this determines maximal aggregate outcome

$$Y_1^* = \mathbb{E}[\theta \mid \theta \geq \theta_1^*] Q_1 > Q_1 = Y_0$$

for period 1. Since  $Q_2 = Y_1^*$ , this initial level of aggregate resources in period 2 generates maximal aggregate outcome

$$Y_2^* = \mathbb{E}[\theta \mid \theta \geq \theta_2^*] Y_1^* > Y_1^*.$$

Total welfare for periods is now given by

$$W_1^* + W_2^* = \{1 + \mathbb{E}[\theta \mid \theta \geq \theta_2^*]\} \mathbb{E}[\theta \mid \theta \geq \theta_1^*] Q$$

which is strictly greater than total welfare under the egalitarian mechanism  $2Q$ .  $\square$

From [Proposition 2](#) it follows that the *unique* market reform program that is incentive compatible, resource feasible, individually rational and deficit neutral entails using the efficient market mechanism  $\langle q_n^*, t_n^* \rangle$  with critical type  $\theta_n^* = F^{-1}(1 - Q_n)$  in every period  $n = 1, 2$ . Intuitively, moving from the egalitarian rule to the first-best rule can be interpreted as the introduction of a full market-based reform program in which resources can be purchased at the market-clearing price  $\theta_n^*(1 - Q_n) > 0$ . To guarantee unanimous approval to the reform package across periods, the government simultaneously provides workers excluded from the market with a flat payment (i.e., a lump-sum subsidy) equal to  $\theta_n^* Q_n$ . Because surplus created is maximized at the efficient allocation rule, expected revenues from selling the good are sufficient to offset subsidies.

Note, incidentally and not surprisingly, that the rate of optimal output growth is diminishing in time (because  $\theta_2^* < \theta_1^*$ ):

$$\frac{Y_2^*}{Y_1^*} = \mathbb{E}[\theta \mid \theta \geq \theta_2^*] < \mathbb{E}[\theta \mid \theta \geq \theta_1^*] = \frac{Y_1^*}{Y_0}.$$

### 3.2 Market Reform with Institutional Inertia

In the presence of institutional inertia, we shall ask whether or not the social planner can introduce a market-based reform program that yields higher social welfare while maintaining resource feasibility, individual rationality, and deficit neutrality. Suppose that the government is planning to implement a reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$ . While not welfare enhancing, in a world without institutional inertia the government has the option of contracting the reach of the market mechanism in period 2. But when workers bear adaptation costs, the introduction of a market mechanism in period 1 will affect workers' welfare in the next period through the inertia component of the utility function. Our first observation is that, due to the incentive compatibility constraints embedded in a reform program under institutional inertia, it is not possible to diminish market reach throughout periods.

**Lemma 1.** *Suppose the social planner uses a reform program involving a market-based allocation rule  $q_n^c$  in every period  $n = 1, 2$  in the presence of institutional inertia. Then it must be the case that  $\theta_2^c \leq \theta_1^c$ .*

*Proof.* Recall that  $q_0(\theta) = Q = Q_1$  for all  $\theta$ . Thus, the lemma follows from the fact that, in this case, the generalized allocation in period 1 is

$$\phi_1^c(\theta) = q_1^c(\theta) - \kappa |q_1^c(\theta) - Q_1|,$$

and in period 2 is

$$\phi_2^c(\theta) = q_2^c(\theta) - \kappa |q_2^c(\theta) - q_1^c(\theta)|.$$

The generalized allocation  $\phi_1^c$  is non-decreasing for any critical type  $\theta_1^c$  since  $0 < Q_1 < 1/2$  (although this is a sufficient condition, not a necessary one; we can obtain monotonicity by letting  $\kappa$  be sufficiently small). Thus, once the critical type  $\theta_1^c$  has been determined, the requirement that  $\phi_2^c$  be non-decreasing implies  $\theta_2^c \leq \theta_1^c$ , as desired.  $\square$

Under slow adaptive institutional legacies, the generalized allocation for periods 1 and 2 under market mechanisms are given by

$$\phi_1^c(\theta) = \begin{cases} -\kappa Q_1 & \text{if } \theta < \theta_1^c, \\ 1 - \kappa(1 - Q_1) & \text{if } \theta \geq \theta_1^c, \end{cases} \quad \text{and} \quad \phi_2^c(\theta) = \begin{cases} 0 & \text{if } \theta < \theta_2^c, \\ 1 - \kappa & \text{if } \theta_2^c \leq \theta < \theta_1^c, \\ 1 & \text{if } \theta_1^c \leq \theta. \end{cases}$$

Notice that the expression for  $\phi_2^c$  captures the fact that the market reach in period 1 affects workers' adaptation costs in period 2. From [Proposition 1](#), the full market reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$  can be implemented if and only if transfers take the form

$$t_1^c(\theta) = \begin{cases} \underline{U}_1^c + \kappa\theta Q_1 & \text{if } \theta < \theta_1^c, \\ \underline{U}_1^c + \kappa\theta Q_1 - (1 - \kappa + 2\kappa Q_1)\theta_1^c & \text{if } \theta \geq \theta_1^c, \end{cases}$$

and

$$t_2^c(\theta) = \begin{cases} \underline{U}_2^c & \text{if } \theta < \theta_2^c, \\ \underline{U}_2^c - (1 - \kappa)\theta_2^c & \text{if } \theta_2^c \leq \theta \leq \theta_1^c, \\ \underline{U}_2^c - (1 - \kappa)\theta_2^c - \kappa\theta_1^c & \text{if } \theta_1^c \leq \theta. \end{cases}$$

If  $\kappa = 0$  we go back to the standard model. This incentive compatible transfer scheme provides a lump-sum subsidy to the workers who are excluded from the market to compensate for their losses, and charges a positive price to workers who buy the productive resource in the market. Note however that the comparison between allocation in period 1 for a given type and allocation in period 2 makes a difference in terms of payment. To check for the individual rationality constraints, using the expression for the indirect utility in [Proposition 1](#) obtains

$$U_1^c(\theta) = \begin{cases} \underline{U}_1^c - \kappa(\theta - \underline{\theta})Q_1 & \text{if } \theta < \theta_1^c, \\ \underline{U}_1^c - \kappa(\theta_1^c - \underline{\theta})Q_1 + (1 - \kappa(1 - Q_1))(\theta - \theta_1^c) & \text{if } \theta \geq \theta_1^c, \end{cases}$$

and

$$U_2^c(\theta) = \begin{cases} \underline{U}_2^c & \text{if } \theta < \theta_2^c, \\ \underline{U}_2^c + (1 - \kappa)(\theta - \theta_2^c) & \text{if } \theta_2^c \leq \theta \leq \theta_1^c, \\ \underline{U}_2^c + (1 - \kappa)(\theta_1^c - \theta_2^c) + (\theta - \theta_1^c) & \text{if } \theta_1^c \leq \theta. \end{cases}$$

As before, we need to make sure that  $U_n^c(\theta) \geq U_n^r(\theta)$  for all  $\theta \in \Theta$  and  $n = 1, 2$ . Since  $U_n^r(\theta) = \theta Q_n$ , for period  $n = 1$  the difference between these two utilities is strictly decreasing for all  $\theta < \theta_1^c$  and strictly increasing for all  $\theta > \theta_1^c$ . Intuitively, because all types lower than  $\theta_1^c$  receive the good with zero probability, they must be equally compensated for the allocation mechanism to be incentive compatible. But since a higher type in this case means a larger difference between not getting the good and getting with good

with probability  $Q_1 > 0$ , the loss is increasing in types. Thus, to show that the market mechanism  $\langle q_1^c, t_1^c \rangle$  elicits voluntary acceptance from all workers, it suffices to verify that  $U_1^c(\theta_1^c) \geq U_1^r(\theta_1^c)$ , or equivalently that

$$\underline{U}_1^c + \kappa \theta Q_1 \geq (1 + \kappa) \theta_1^c Q_1.$$

When  $n = 2$ , things are a bit more complicated. The difference between  $U_2^c$  and  $U_2^r$  is still decreasing for all  $\theta < \theta_2^c$  and increasing for all  $\theta > \theta_1^c$ . On the other hand, the slope of the difference between critical types  $\theta_2^c$  and  $\theta_1^c$  depends on whether  $1 - Q_2 \geq \kappa$ , in which case the slope is positive, or  $1 - Q_2 \leq \kappa$ , in which case the slope is negative. To model a situation where the starting point of market reforms is a low level of aggregate resources and inertia matters, but not overwhelmingly so, we make the following supposition on the production technology available to workers.

**Assumption 1.** The weight of institutional inertia  $\kappa$  satisfies  $\kappa \leq 1 - Y_1^*$ .

Since  $Q_2 = Y_1^c \leq Y_1^*$ , this condition implies that aggregate input level  $Q_2$  at the beginning of period 2 satisfies  $1 - Q_2 \geq \kappa$ . When this condition holds, the minimal lump-sum transfers to ensure individual rationality are

$$\underline{U}_1^c + \kappa \theta Q_1 = (1 + \kappa) \theta_1^c Q_1, \quad \text{and} \quad \underline{U}_2^c = \theta_2^c Q_2.$$

Aggregate transfers per period are therefore

$$T_1^c = \theta_1^c \{F(\theta_1^c) - 1 + Q_1 + \kappa(1 - Q_1)(1 - F(\theta_1^c)) + \kappa F(\theta_1^c) Q_1\}, \quad (9)$$

$$T_2^c = \theta_2^c \{F(\theta_2^c) - 1 + Q_2 + \kappa(1 - F(\theta_2^c))\} - \kappa \theta_1^c (1 - F(\theta_1^c)). \quad (10)$$

We saw in the previous section that without institutional inertia, the efficient market mechanism introduced in every period was able to provide Pareto improvements for everyone with neutral aggregate transfers. When adaptation costs are taken into account, this is impossible. The government needs to run a deficit to compensate workers who are excluded from the sector in a market mechanism.

**Proposition 3.** *Under slow adaptive institutional inertia, there is no incentive compatible market-based reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$  that simultaneously satisfies resource feasibility, individual rationality and does not raise a deficit.*

*Proof.* Fix a reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$ . Using Equation 9 and Equation 10, aggregate transfers across periods can be written as

$$T_1^c + T_2^c = \sum_{n=1,2} \theta_n^c \{F(\theta_n^c) - 1 + Q_n\} + \kappa \{\theta_2^c (1 - F(\theta_2^c)) - \theta_1^c Q_1 (1 - 2F(\theta_1^c))\}.$$

Note that the period  $n$  resource feasibility constraint requires  $F(\theta_n^c) \geq 1 - Q_n$ . Differentiating aggregate transfers with respect to  $\theta_1^c$  obtains

$$F(\theta_1^c) - 1 + Q_1 + \theta_1^c f(\theta_1^c) + \kappa Q_1 [2\theta_1^c f(\theta_1^c) - 1 + 2F(\theta_1^c)] \geq 0,$$

where the inequality comes from the fact that  $F(\theta_1^c) \geq 1 - Q_1 \geq \frac{1}{2}$ . Differentiating aggregate transfers with respect to  $\theta_2^c$  obtains

$$F(\theta_2^c) - 1 + Q_2 + \kappa(1 - F(\theta_2^c)) + \theta_2^c f(\theta_2^c)(1 - \kappa) \geq 0,$$

because of the resource feasibility constraint in period 2. Thus, to minimize total transfers, the planner sets critical types equal to those associated with the efficient market mechanisms:  $\theta_n^c = \theta_n^* = F^{-1}(1 - Q_n)$  for  $n = 1, 2$ . Minimal aggregate transfers equate under a full market reform are then

$$T_1^* + T_2^* = \kappa\theta_2^*Q_2 + \kappa\theta_1^*Q_1(1 - 2Q_1) > 0. \quad \square$$

*Remark.* In a one period model the impossibility of improving upon the egalitarian lottery under cultural constraints is independent of the level of initial resources available in the economy, although one expects the mass of negatively affected consumers to vanish as  $Q \rightarrow 1$  or  $\kappa \rightarrow 0$ . However, the above result for a two period reform program, as stated, uses the fact that initial resources are scarce, i.e.  $Q_0 = Q_1 < \frac{1}{2}$ .

The planner now has to look for a market-based reform program that maximizes total welfare subject to the resource and the participation constraints. We consider the resource feasibility constraint as a short term hard constraint: at the beginning of every stage  $Q_n$  is given, and those are the aggregate resources the planner allocates in period  $n$ . We also treat the participation constraint as hard: the government needs unanimous support from the (targeted) population of workers to maintain the market-based reform and not revert to the egalitarian solution.<sup>5</sup> Thus, as before, the resource constraint is expressed in the condition that  $\theta_n^c \geq F^{-1}(1 - Q_n)$  for every period  $n = 1, 2$ . We have already obtained the per period lump-sum transfers that minimize borrowing costs for the planner. Similarly, from [Proposition 3](#) we conclude that aggregate transfers are minimised by setting the critical type as low as possible.

By construction, a full market-based reform program  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$  is incentive compatible, individually rational, and minimizes lump-sum transfers. Thus, the problem of the benevolent planner can now be stated as:

$$\max_{\{\theta_1^c, \theta_2^c\}} \sum_{n=1,2} \int_{\underline{\theta}}^{\bar{\theta}} \left\{ \tilde{\theta} q_n^c(\tilde{\theta}) - \kappa \tilde{\theta} |q_n^c(\tilde{\theta}) - q_{n-1}^c(\tilde{\theta})| \right\} dF(\tilde{\theta}) - \beta \sum_{n=1,2} T_n^c$$

subject to  $\theta_n^c \geq F^{-1}(1 - Q_n)$ , for  $n = 1, 2$ . The solution of this problem is given in the next result.

**Proposition 4.** *In the presence institutional inertia, the welfare maximising reform program among all the incentive compatible, individually rational, resource feasible market*

<sup>5</sup>Alternatively, we take as  $\Theta$  to be the measure of population whose support is essential for the government —be it a majority of the workers' population or a composition of powerful groups in the economy.

reform programs  $\{\langle q_1^c, t_1^c \rangle, \langle q_2^c, t_2^c \rangle\}$  specifies

$$\begin{aligned}
q_n^*(\theta) &= \begin{cases} 0 & \text{if } \theta < \theta_n^*, \\ 1 & \text{if } \theta \geq \theta_n^*, \end{cases} \quad \text{for } n = 1, 2, \\
\hat{t}_1^*(\theta) &= \begin{cases} (1 + \kappa)\theta_1^* Q_1^* & \text{if } \theta < \theta_1^*, \\ (1 + \kappa)\theta_1^* Q_1^* - (1 - \kappa + 2\kappa Q_1^*)\theta_1^* & \text{if } \theta \geq \theta_1^*, \end{cases} \quad \text{and} \\
\hat{t}_2^*(\theta) &= \begin{cases} \theta_2^* Q_2^* & \text{if } \theta < \theta_2^*, \\ \theta_2^* Q_2^* - (1 - \kappa)\theta_2^* & \text{if } \theta_2^* \leq \theta \leq \theta_1^*, \\ \theta_2^* Q_2^* - (1 - \kappa)\theta_2^* - \kappa\theta_1^* & \text{if } \theta \geq \theta_1^*, \end{cases}
\end{aligned}$$

where  $\theta_n^* = F^{-1}(1 - Q_n)$  and  $Q_n$  is recursively obtained by setting

$$Q_1 = Y_0 = Q \quad \text{and} \quad Q_2 = Y_1^* = \mathbb{E}[\theta \mid \theta \geq \theta_1^*] Q_1.$$

*Proof.* From the above discussion, we write the total welfare of the planner's problem under a market-based reform program as

$$\begin{aligned}
\sum_{n=1,2} W_n^c &= (1 - \kappa) \int_{\theta_2^c}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) + \int_{\theta_1^c}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) \\
&\quad + \kappa Q_1 \left\{ \int_{\theta_1^c}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) - \int_{\underline{\theta}}^{\theta_1^c} \tilde{\theta} dF(\tilde{\theta}) \right\} - \beta \sum_{n=1,2} T_n^c.
\end{aligned}$$

We have already argued in [Proposition 3](#) that total aggregate transfers are increasing in each critical type  $\theta_n^c$ . In addition, the critical type  $\theta_2^c$  enters total welfare through the first term in the right-hand side of the above expression, therefore total aggregate welfare is decreasing in  $\theta_2^c$ . Finally, differentiating total welfare with respect to  $\theta_1^c$  confirms that it is also decreasing in this variable. Thus, the planner chooses  $\theta_n^* = F^{-1}(1 - Q_n)$ , for periods  $n = 1, 2$ .  $\square$

Summing up, the desired market reform program introduced by the benevolent planner will increase aggregate output per period to  $Y_n^* = \mathbb{E}[\theta \mid \theta \geq \theta_n^*] Q_n$ . So output growth is not hindered by institutional inertia under the welfare maximising market reform program. At the same time, to implement it the planner needs to raise funds in order to compensate losers, because now the introduction of the new institution demands compensating the adaptation costs.

## 4 The Transition Reform Program

We start again in a situation where there is scarcity of resources and the government has, until this point, resolve the allocation problem via a non-market institution, i.e., an egalitarian lottery. Under institutional inertia, which can be interpreted as capturing slow-moving institutional restrictions in the sense of [Roland \(2004\)](#), we have already shown that it is possible to introduce a pure market mechanism that generates efficiency



gains at the cost of assigning subsidies to workers who are priced out of the market for the productive resource. But there are several other non-market allocation mechanisms that a central government may use to allocate resources. Here we want to explore if a transition program can improve welfare in comparison with a full market-based program. Despite the bias towards status quo in the worker's utility function, it is not obvious that a less than fully market-oriented reform program would improve welfare. This is because efficiency gains are diminishing over time.

A *dual transition mechanism*  $\langle q_n^d, t_n^d \rangle$  has an allocation rule defined by means of critical types  $\underline{\theta}_n^d$  and  $\bar{\theta}_n^d$  in  $\Theta$ , with  $\underline{\theta}_n^d \leq \bar{\theta}_n^d$ , and allocation probability  $\tilde{q}_n \in (0, 1)$ , such that

$$q_n^d(\theta) = \begin{cases} 0 & \text{if } \theta < \underline{\theta}_n^d, \\ \tilde{q}_n & \text{if } \underline{\theta}_n^d \leq \theta \leq \bar{\theta}_n^d, \\ 1 & \text{if } \theta > \bar{\theta}_n^d. \end{cases}$$

In words, a transition mechanism excludes from the market those whose productivity type is lower than  $\underline{\theta}_n^d$  and assigns the private good for sure to those whose productivity type is higher than  $\bar{\theta}_n^d$ . All other agents receive the good with probability  $\tilde{q}_n$ . The accompanying transfer rule  $t_n^d$  is design so that the transition mechanism is incentive compatible. As in case of the market-based mechanisms, the dynamic component of incentive compatibility in a reform program imposes some restrictions on dual transition mechanisms.

**Lemma 2.** *Under institutional inertia, suppose the social planner uses a reform program that involves transition allocation rules  $q_n^d$  for period  $n = 1, 2$ . Then it must be the case that  $\tilde{q}_1 \leq \tilde{q}_2$ ,  $\underline{\theta}_2^d \leq \underline{\theta}_1^d$  and  $\bar{\theta}_2^d \leq \bar{\theta}_1^d$ .*

*Proof.* Similar to the proof of [Lemma 1](#) and therefore omitted.  $\square$

It will become clear that the purpose of transition mechanisms is to avoid, at least to some extent, the disutility associated with changing institutional regimes. Thus, recalling that aggregate resources at the beginning of period 1 are given by  $Q_1 = Y_0 = Q$ , we focus on dual transition mechanisms  $\langle q_n^d, t_n^d \rangle$  where the allocation rule is defined by

$$q_n^d(\theta) = \begin{cases} 0 & \text{if } \theta < \underline{\theta}_n^d, \\ Q_1 & \text{if } \underline{\theta}_n^d \leq \theta \leq \bar{\theta}_n^d, \\ 1 & \text{if } \theta > \bar{\theta}_n^d. \end{cases}$$

The incentive compatible transfer rule  $t_n^d$  associated with  $q_n^d$  is constructed using [Equation 6](#), see [Proposition 1](#). Thus, the transition mechanism  $\langle q^d, t^d \rangle$  is incentive compatible by design. Given initial resources  $Q_n$  at the beginning of period  $n$ , the resource feasibility constraint under a dual allocation rule is expressed now as

$$Q_n \geq \frac{1 - F(\bar{\theta}_n^d)}{1 - F(\bar{\theta}_n^d) + F(\underline{\theta}_n^d)}. \quad (11)$$

#### 4.1 The Dual Transition Mechanism for Period 1

The generalized allocation  $\phi_n^d$  in Equation 5 is now, for period  $n = 1$ ,

$$\phi_1^d(\theta) = \begin{cases} -\kappa Q_1 & \text{if } \theta < \underline{\theta}_1^d, \\ Q_1 & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ 1 - \kappa(1 - Q_1) & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

From Proposition 1, we can use these expressions to construct the incentive compatible transfers:

$$t_1^d(\theta) = \begin{cases} \underline{U}_1^d + \kappa\theta Q_1 & \text{if } \theta < \underline{\theta}_1^d, \\ \underline{U}_1^d + \kappa\theta Q_1 - (1 + \kappa)\underline{\theta}_1^d Q_1 & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ \underline{U}_1^d + \kappa\theta Q_1 - (1 + \kappa)\underline{\theta}_1^d Q_1 - (1 - \kappa)\bar{\theta}_1^d(1 - Q_1) & \text{if } \theta > \bar{\theta}_1^d. \end{cases} \quad (12)$$

To obtain lump-sum transfers, recall that outside option is  $U_1^r(\theta) = \theta Q_1$ . We write the expression for the indirect utility  $U_1^d$ :

$$U_1^d(\theta) = \begin{cases} \underline{U}_1^d - \kappa(\theta - \underline{\theta})Q_1 & \text{if } \theta < \underline{\theta}_1^d, \\ \underline{U}_1^d - \kappa(\underline{\theta}_1^d - \underline{\theta})Q_1 + (\theta - \underline{\theta}_1^d)Q_1 & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ \underline{U}_1^d - \kappa(\underline{\theta}_1^d - \underline{\theta})Q_1 + (\bar{\theta}_1^d - \underline{\theta}_1^d)Q_1 + (1 - \kappa(1 - Q_1))(\theta - \bar{\theta}_1^d) & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

From this expression, it is clear that the difference  $U_1^d - U_1^r$  is decreasing on the interval  $[\underline{\theta}, \underline{\theta}_1^d]$ , constant on the interval  $[\underline{\theta}_1^d, \bar{\theta}_1^d]$ , and increasing on the interval  $(\bar{\theta}_1^d, \bar{\theta}]$ . Thus, to check for workers' voluntary participation of the reform program it suffices to verify that  $U_1^d(\underline{\theta}_1^d) \geq U_1^r(\underline{\theta}_1^d)$ . Clearly, in order to minimize aggregate transfers the planner sets

$$\underline{U}_1^d + \kappa\underline{\theta}Q_1 = (1 + \kappa)\underline{\theta}_1^d Q_1.$$

The dual transition mechanism  $\langle q_1^d, t_1^d \rangle$  is incentive compatible by designed. It will be clear that the incentive transfers associated with it admit the following interpretation: low productivity workers who are excluded from the market receive a lump-sum compensation; high productivity workers who participate in the market pay a positive price and receive the productive resource for sure; finally, workers in between these groups neither receive a compensation nor pay the posted price, but get the resource for free with probability  $Q_1$ , i.e., they are kept under the non-market egalitarian lottery. Thus, we can interpret  $\langle q_1^d, t_1^d \rangle$  as a transition system that smooths out the introduction of market-oriented reforms for those workers who would have been losers under a pure market mechanism.<sup>6</sup>

We now show that under a condition on the distribution of productivity levels across workers, it is possible for the government to construct a transition mechanism that balances the budget in period  $n = 1$ .

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<sup>6</sup>For an alternative view on transition mechanisms, see Lau et al. (2000).

**Assumption 2.** Let  $\alpha = \frac{1+\kappa}{1-\kappa} > 1$  be given. There exists a type  $\hat{\theta}$  in  $\Theta$  that satisfies

$$Q_1 = \frac{1 - F(\alpha\hat{\theta})}{1 - F(\alpha\hat{\theta}) + F(\hat{\theta})}, \quad \underline{\theta} \leq \hat{\theta} < \alpha\hat{\theta} \leq \bar{\theta}.$$

Notice that the above sufficient condition is stated in terms of the primitives of the problem,  $F$ ,  $Q_1 = Q$  and  $\kappa$ . It is easy to see that this condition becomes harder to fulfil as  $Q \rightarrow 1$ , but recall that we are assuming a low starting point of  $0 < Q < \frac{1}{2}$ . This does not mean that the planner cannot introduce a transition mechanism, but that doing so will likely run a budget deficit. We obtain the following important result under [Assumption 2](#).

**Proposition 5.** *Under institutional inertia, there exists an incentive compatible dual transition mechanism  $\langle q_1^d, t_1^d \rangle$  that satisfies resource feasibility and individual rationality, and further generates zero deficit for the government.*

*Proof.* A dual transition mechanism  $\langle q_1^d, t_1^d \rangle$  is incentive compatible by design. Moreover, we set  $\underline{U}_1^d$  to be such that  $\underline{U}_1^d + \kappa\theta Q_1 = (1 + \kappa)\underline{\theta}_1^d Q_1$  to ensure full participation with minimal transfers. Thus, it remains to show that one can choose critical types  $\underline{\theta}_1^d \leq \bar{\theta}_1^d$  in  $\Theta$  that make aggregate transfers vanish and respect the resource constraint. Our [Assumption 2](#) ensures the existence of types  $\underline{\theta}_1^d = \hat{\theta}$  and  $\bar{\theta}_1^d = \alpha\hat{\theta}$  that make the resource feasibility constraint bind. With this choice of critical types, one writes

$$Q_1 = \frac{1 - F(\bar{\theta}_1^d)}{1 - F(\bar{\theta}_1^d) + F(\underline{\theta}_1^d)} \quad \text{and} \quad 1 - Q_1 = \frac{F(\underline{\theta}_1^d)}{1 - F(\bar{\theta}_1^d) + F(\underline{\theta}_1^d)}.$$

Replacing these two terms in the expression for aggregate transfers yields to

$$T_1^d = \int_{\underline{\theta}}^{\bar{\theta}} t_1^d(\tilde{\theta}) dF(\tilde{\theta}) = \frac{F(\underline{\theta}_1^d)(1 - F(\bar{\theta}_1^d))}{1 - F(\bar{\theta}_1^d) + F(\underline{\theta}_1^d)} \{(1 + \kappa)\underline{\theta}_1^d - (1 - \kappa)\bar{\theta}_1^d\}.$$

But this last expression vanishes, because of our selection of critical types.  $\square$

## 4.2 Implementing a Transition Reform Program

Consider the expression for aggregate welfare across periods generated by a market-based reform program. It is clear that the social planner faces a trade-off between using the efficient market mechanism in period 1, which generates a costly deficit but greatly improves efficiency, and using a revenue neutral transition mechanism that generates lower aggregate resources for period 2. Since growth rates are diminishing over time, it is not clear that the government would prefer to sacrifice efficiency gains in period 1 in exchange for a neutral deficit, specially taking into account that a big push for markets in the first period lowers adaptation costs in period 2.

In this section, we explore this trade-off. To simplify the analysis, we shall consider a situation in which aggregate output produced in period 1 by the transition mechanism  $\langle q_1^d, t_1^d \rangle$ , denoted by  $Y_1^d$ , is sufficient to introduce a market mechanism in period 2 in an incentive compatible way —recall the restrictions imposed by [Lemma 2](#). We will construct

such a reform program now. We stress that our qualitative results do not change without the next assumption, but making it simplifies the statements and proofs.<sup>7</sup>

**Assumption 3.** Suppose that  $\underline{\theta}_1^d$  and  $\bar{\theta}_1^d$  are critical types determined in Proposition 5 with the resulting transition mechanism  $\langle q_1^d, t_1^d \rangle$ . Then it is the case that

$$\mathbb{E}[\theta q_1^d(\theta)] = Y_1^d \geq 1 - F(\underline{\theta}_1^d).$$

This assumption ensures that in period 2 the social planner can implement the market mechanism in an incentive compatible way, since we would have that aggregate resources at the beginning of period 2 are precisely  $Q_2^d = Y_1^d \geq 1 - F(\underline{\theta}_1^d)$ . Hence, under Assumption 3 we can choose critical types  $\underline{\theta}_2^d = \bar{\theta}_2^d = \theta_2^d$  in a way that maximizes output by setting

$$\theta_2^d = F^{-1}(1 - Q_2^d).$$

The transition reform program  $\{\langle q_1^d, t_1^d \rangle, \langle q_2^d, t_2^d \rangle\}$  can be now fully determined. It prescribes a dual transition mechanism  $\langle q_1^d, t_1^d \rangle$  for the first period, during which low productivity workers ( $\theta < \underline{\theta}_1^d$ ) are driven out of the market but receive a subsidy, high productivity workers ( $\theta > \bar{\theta}_1^d$ ) are sold the resource for a positive price, and workers in the middle of the productivity range are kept under the lottery system where they don't pay a price or receive a monetary transfer, but instead obtain the input with probability  $Q_1$ . This transition mechanism is fully specified by  $\underline{\theta}_1^d, \bar{\theta}_1^d$  and  $U_1^d$ , which determine the details of the transfer scheme:

$$t_1^d(\theta) = \begin{cases} (1 + \kappa)\underline{\theta}_1^d Q_1 & \text{if } \theta < \underline{\theta}_1^d, \\ 0 & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ -(1 - \kappa)\bar{\theta}_1^d(1 - Q_1) & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

In period 2, the transition reform program prescribes a mechanism that coincides with a market mechanism, in that there is now a single critical type  $\theta_2^d < \underline{\theta}_1^d$  determining the cutoff below which workers are excluded from the sector in exchange for a subsidy, and above which workers acquire the resource for sure in exchange for a price. Note however that in period 2 the transfer scheme is composed of four different elements, instead of the usual three associated with a fully market-based mechanism. Institutional inertia compound with the application of a transition mechanism introduce complexities in the pricing structure of the second period. Indeed, the generalized allocation in period 2 is given by

$$\phi_2^d(\theta) = \begin{cases} 0 & \text{if } \theta < \theta_2^d, \\ 1 - \kappa & \text{if } \theta_2^d \leq \theta < \underline{\theta}_1^d, \\ 1 - \kappa(1 - Q_1) & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ 1 & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

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<sup>7</sup>Otherwise we would need to extend the analysis to  $N$  periods. The social planner would then use a dual transition mechanism for the first  $n$  periods until aggregate output permits a change to a full market-based mechanism.

The expression for the indirect utility  $U_2^d$  for workers born in the second period is

$$U_2^d(\theta, \theta) = \begin{cases} \underline{U}_2^d & \text{if } \theta < \theta_2^d, \\ \underline{U}_2^d - (1 - \kappa)\theta_2^d + (1 - \kappa)\theta & \text{if } \theta_2^d \leq \theta \leq \underline{\theta}_1^d, \\ \underline{U}_2^d - (1 - \kappa)\theta_2^d - \kappa\underline{\theta}_1^d Q_1 + (1 - \kappa(1 - Q_1))\theta & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ \underline{U}_2^d - (1 - \kappa)\theta_2^d - \kappa\underline{\theta}_1^d Q_1 - \kappa(1 - Q_1)\bar{\theta}_1^d + \theta & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

From this expression, it is clear that the difference  $U_2^d - U_2^r$  is decreasing for all  $\theta < \theta_2^d$  but increasing afterwards. Thus, the productivity type  $\theta_2^d$  determines the amount of the lump-sum transfer, which is  $\underline{U}_2^d = \theta_2^d Q_2^d$ . Transfers for the second period are now

$$t_2^d(\theta) = \begin{cases} \theta_2^d Q_2^d & \text{if } \theta < \theta_2^d, \\ \theta_2^d Q_2^d - (1 - \kappa)\theta_2^d & \text{if } \theta_2^d \leq \theta \leq \underline{\theta}_1^d, \\ \theta_2^d Q_2^d - (1 - \kappa)\theta_2^d - \kappa Q_1 \underline{\theta}_1^d & \text{if } \underline{\theta}_1^d \leq \theta \leq \bar{\theta}_1^d, \\ \theta_2^d Q_2^d - (1 - \kappa)\theta_2^d - \kappa Q_1 \underline{\theta}_1^d - \kappa(1 - Q_1)\bar{\theta}_1^d & \text{if } \theta > \bar{\theta}_1^d. \end{cases}$$

We can now easily compute aggregate transfers in the proposed reform program  $\{\langle q_1^d, t_1^d \rangle, \langle q_2^d, t_2^d \rangle\}$ . By construction  $T_1^d = 0$ . After some simplifications, we see that

$$T_2^d = \kappa\theta_2^d Q_2^d - \kappa Q_1 \underline{\theta}_1^d - \kappa Q_1 (1 - Q_1) \{1 - F(\bar{\theta}_1^d) + F(\underline{\theta}_1^d)\} (\bar{\theta}_1^d - \underline{\theta}_1^d).$$

To compute aggregate welfare, recall that  $W_n^d = \int_{\underline{\theta}}^{\bar{\theta}} \theta \phi_n^d(\theta) dF(\theta) - \beta T_n^d$ . After some manipulations, we see that total aggregate welfare in the transition reform program is given by

$$\begin{aligned} \sum_{n=1,2} W_n^d &= (1 - \kappa) \int_{\theta_2^d}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) + \kappa Q_1 \left\{ \int_{\underline{\theta}_1^d}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) - \int_{\underline{\theta}}^{\underline{\theta}_1^d} \tilde{\theta} dF(\tilde{\theta}) \right\} \\ &\quad + Q_1 \int_{\underline{\theta}_1^d}^{\bar{\theta}_1^d} \tilde{\theta} dF(\tilde{\theta}) + \int_{\bar{\theta}_1^d}^{\bar{\theta}} \tilde{\theta} dF(\tilde{\theta}) - \beta T_2^d. \end{aligned}$$

### 4.3 Comparing Reform Programs under Institutional Inertia

The main difference between the purely market-based reform program and the transition reform program is that the second uses a dual transition mechanism in the first period. This has two consequences. On the one hand, transfers in the first period are zero instead of negative as would be in the market-based mechanism, which is welfare enhancing as it reduces total deficit generated by the reform program. On the other hand, aggregate output at the beginning of period 2 is lower in the transition program than in the market-based program, and this sets up a lower growth rate for the economy, which has a negative impact on welfare. Whether a benevolent planner should use a purely market-based reform program or a transition reform program depends of course of fundamentals —  $Q$ ,  $\kappa$  and  $F$ . But it also depends on the borrowing costs. In particular, one obtains:

**Proposition 6.** *Suppose  $\theta(1 - F(\theta))$  is a concave function on  $[\underline{\theta}, \bar{\theta}]$  with global maximum at  $\hat{\theta} < \theta_2^*$ . In such case, there exists a  $\beta^*$  such that*

$$\sum_{n=1,2} W_n^d(\beta) - \sum_{n=1,2} W_n^*(\beta) \geq 0, \quad \text{for all } \beta \geq \beta^*.$$

*Proof.* Fix  $\beta$  and consider the difference in welfare generated by the transition and market-based reform programs. Since  $\underline{\theta}_1^d < \theta_1^* < \bar{\theta}_1^d$  and further  $\theta_2^* < \theta_2^d$ ,

$$\begin{aligned} \sum_{n=1,2} W_n^d - \sum_{n=1,2} W_n^* &= -(1 - \kappa) \int_{\theta_2^*}^{\theta_2^d} \tilde{\theta} dF(\tilde{\theta}) + Q_1 \int_{\theta_1^d}^{\bar{\theta}_1^d} \tilde{\theta} dF(\tilde{\theta}) \\ &\quad - \int_{\theta_1^*}^{\bar{\theta}_1^d} \tilde{\theta} dF(\tilde{\theta}) + \beta \kappa \left\{ \theta_2^* Q_2^* - \theta_2^d Q_2^d \right\} \\ &\quad + \beta \kappa \left\{ \theta_1^* Q_1 (1 - 2Q_1) + \underline{\theta}_1^d Q_1 + Q_1 (1 - Q_1) \Omega (\bar{\theta}_1^d - \underline{\theta}_1^d) \right\}, \end{aligned}$$

where  $\Omega = 1 - F(\bar{\theta}_1^d) + F(\underline{\theta}_1^d)$ .

Since  $\theta_2^* Q_2^* = \theta_2^* (1 - F(\theta_2^*))$  and similarly for  $\theta_2^d Q_2^d$ , we can use the fact that  $\hat{\theta} < \theta_2^*$  to conclude that the first term in brackets in the above expression is positive. Also, all the terms inside the last brackets are positive. Thus, we can find a  $\beta^*$  such that  $\beta \geq \beta^*$  implies  $\sum_n W_n^d \geq \sum_n W_n^*$ , as desired.  $\square$

What Proposition 6 states is that when the government faces sufficiently high borrowing costs, a full market reform is not optimal. Instead, the social planner should introduce a transition mechanism for the first period to allow workers to adjust to the new institutional setting. Doing so restricts efficiency gains but cancels the deficit the government would have incurred in a full market-based reform.

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