



University of Essex

Department of Economics

## Discussion Paper Series

No. 646 October 2007

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# Dual Track Reforms: With and Without Losers\*

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February 2007

## Abstract

The dual track approach to market liberalization has been widely recognized as the key to the success of the Chinese economic reform. In this paper we study the effectiveness of this strategy in economic environments where the status quo government control is *incomplete*. We show that in a dynamic context contractual arbitrage will emerge, potentially resulting in efficiency losses and/or adverse distributional effects. By establishing a necessary and sufficient condition for the dual-track approach to retain its appeal in a dynamic context, our analysis provides a clear guideline to the broader applicability of this reform mechanism.

*JEL classification: H2, P2, F1*

*Keywords: Dual Track Liberalization, Intertemporal Arbitrage, Pareto Improving Reforms, China*

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\*We would like to thank two anonymous referees, Dan Bernhardt, Hadi Esfahani, Earl Grinols, Eli Katz, Jan Svejnar, Bart Taub, Cecilia Testa, Weiyin Zhang, Li-An Zhou and seminar participants at the ERWIT CEPR meeting in Bern, the Midwest International Economics Meetings in Pittsburgh, SAET VI conference in Rhodes, Beijing University, the University of Illinois and University of Leipzig for useful comments.

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# 1 Introduction

Economic reforms are likely to create losers and too often the difficulties involved in identifying and compensating adversely affected individuals have made major policy changes impossible. For this reason, the dual-track approach implemented in the Chinese economic reforms should be of great interests to policy makers. As Lau, Qian, and Roland (2000) have shown, this mechanism has the potential not only to generate an efficient allocation of resources, but more importantly to do so without creating losers. Some observers have concluded that the “dual-track approach is perhaps the most important aspect of Chinese reforms since it was, at the time, an innovative solution to the political constraints on the direction and speed of reform” (International Finance Corporation (2000)).

Indeed, dual track-like reforms have been attempted in other economic environments. Stiglitz (1998) discusses how the Clinton administration tried to implement dual track like reforms, as in the case of the liberalization of hydroelectric power prices that was proposed in the National Action Plan. The Bush administration’s proposed overhaul of the US social security system also contained features of a dual-track mechanism, in which current retirees are promised unchanged benefits, while younger workers would be allowed to invest in personal accounts. Finally, another interesting example is the recent reform of the Italian labor market, where older workers are kept under existing tenure contracts, while new personnel can be hired according to temporary, short term arrangements.<sup>1</sup>

There is, however, a critical institutional difference between centrally planned economies and market economies. While in the former government control completely dictates almost all economic decisions, in the latter government control is at most *incomplete*. That is, despite government interventions, economic decisions by private agents continue to play a role in determining the resource allocation. This paper asks whether the welfare implications of the dual-track mechanism are the same in these different environments.<sup>2</sup>

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<sup>1</sup>Italy also carried out an important reform of its public retirement system that is characterized by a dual-track approach. Before 1996 workers could retire on the basis of a defined benefit system, guaranteeing up to 80% of the last salary, given an average contribution of 24.7%. The reform introduced in 1996 has obliged people who have worked for less than 18 years to retire according to a new, defined contribution system that for an average contribution of about 32.7%, is expected to return 50-60% of the last salary when the individual retires. People who have worked more than 18 years are instead allowed to stay under the *old* system. This has led observers to estimate that by 1999 over 40% of currently employed workers would still retire using the old, more generous system. See Boeri (2003) for more detailed discussion.

<sup>2</sup>Our paper does not explicitly model other possible institutional differences. For instance, as Murphy,

The dual-track reform strategy can improve efficiency without creating losers because it preserves all the existing rents throughout the reform process. However, in economies where government control is incomplete, the anticipation of a policy change may well induce rational agents to alter their pre-reform behaviors in order to maximize the same rents that the dual-track mechanism tries to maintain<sup>3</sup> and this can either alleviate or exacerbate the pre-reform distortions. Given that the dual track reform represents a Pareto improvement only upon the pre reform allocation, the dynamic welfare effects of anticipated dual track liberalization as compared to having no reform at all are in general ambiguous. This ambiguity will instead not arise in centrally planned economies because of complete government control. For this reason, to fully understand the impact of a dual-track mechanism in the context of a market economy, we need to consider not only how the reform affects the resource allocation after it has taken place, but also how the expectation of a future reform affects the allocation before its introduction.

To this end we extend the analysis by Lau, Qian, and Roland (2000) in two ways. First, while Lau, Qian, and Roland (2000) have implicitly assumed that in the status quo government fiat completely dictates both quantities produced and consumed as well as prices, we allow the status quo intervention to be incomplete, in the sense that in the first period at least some transactions are not dictated by the government.<sup>4</sup> Second, we move beyond their static framework by introducing a simple dynamic model involving two periods, where a dual-track reform taking place in the second period is anticipated in the first.

The basic question we address in this paper is whether, taking into account that the reform will have effects on the allocations in *both* periods, the dual-track liberalization can continue to be Pareto improving as compared to the status quo. By establishing a necessary and sufficient condition for this result to hold, we show that the change in behavior in the

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Shleifer, and Vishny (1992) have pointed out, a strong government must be in place to enforce a dual-track reform, as it was the case in China.

<sup>3</sup>Given that the purpose of a dual-track mechanism is to ‘build consensus’ for a policy change, dual track-like reforms carried out in countries with a democratic tradition have been the subject of vibrant discussions. The recent debate on the reform of the social security system in the US is one obvious example. Even in China, the question of whether the price reform should proceed in a dual track fashion has been the subject of a lively debate both in the policy circle and among the general public. (See for instance ‘Peking polls the masses on prices’ in the *Financial Times*, August 22 1985.)

<sup>4</sup>Our analysis differs from Murphy, Shleifer, and Vishny (1992). They show that in a static setting a dual track reform may lead to an efficiency loss when the separation of the two tracks is not well enforced. We take instead a dynamic perspective and the potential source of additional distortions is the intertemporal arbitrage activities of the agents.

first period must not lead to any surplus redistribution among inframarginal agents and must induce the marginal agents to continue to trade. These two conditions in turn imply that the status quo government policy must involve price fixing for some agents and the government dictating transactions for the rest of the them. If this condition is not met, a policy maker will either have to manipulate the public’s expectations, so that the dual track reform will come as a ‘surprise’, or he will need to make a credible commitment not to use a dual track reform. Our analysis therefore highlights some important caveats to the broader applicability of the mechanism analyzed by Lau, Qian, and Roland (2000).

The remainder of the paper is organized as follows. In section 2, we set up the model, while section 3 analyzes the second–period allocation and reproduces the central result of Lau, Qian, and Roland (2000). We study how the first period allocation responds to the anticipated reform in section 4. In section 5, we evaluate, from a dynamic perspective, the welfare effect of the anticipated dual–track liberalization. The analysis is carried out in two steps. Section 5.1 considers a status quo scenario in which the government does not dictate any transaction, while Section 5.2 investigates the case in which the government initially dictates at least some of them. Section 6 concludes.

## 2 The Model

To introduce our discussion in the simplest possible framework, we follow Lau, Qian, and Roland (2000) and use a partial equilibrium setup, in which a continuum of buyers and producers each demand and supply one and only one unit of a commodity.<sup>5</sup> All agents are price-takers. Differently from Lau, Qian, and Roland (2000), our model has two–periods. In the first, the market is distorted by a government policy. In the second, the government implements a reform aimed at removing this distortion. Buyers’ preferences are time separable and invariant, and producers’ costs remain constant over time. Both sets of agents have a discount factor  $\delta$ , and the commodity is assumed to be perishable.<sup>6</sup>

In the first period, the government intervention can take two forms, each one of which

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<sup>5</sup>For a general equilibrium analysis of the dual–track mechanism, see Lau, Qian, and Roland (1997).

<sup>6</sup>Thus, no agent can arbitrage through storage. Of course, if the commodity was assumed to be storable, *physical* arbitrage could take place as a reaction to an expected reform. As it is shown in the appendix though, *contractual* arbitrage brought about by the dual–track reform mechanism and physical arbitrage by storage work in fundamentally different ways.

is applied to one of two *complementary* segments of the population. For the first segment, the government *dictates* all agents' transactions. That is, the government decides for each producer whether it will produce or not, and for each buyer whether it will buy or not from a producer within this segment. The price at which these transactions take place is also determined by the government, and no resale is allowed. The government policy in this segment of the economy resembles the ones implemented in a centrally planned economy. For the second segment, each agent is free to decide whether to participate or not in a transaction, but the government might fix the price at which the transaction takes place.<sup>7</sup> We say that agents belonging to the first segment are subject to a *complete* intervention, while agents belonging to the second face an *incomplete* intervention. When the first segment does not include any agent, we are in a market economy. When the second segment is empty, we are in a *centrally planned* economy, while if both segments are present, we are in a *mixed* economy.

Following Lau, Qian, and Roland (2000), we assume that the government has no information regarding agents' characteristics (i.e., cost to produce and willingness to pay). Therefore, in the case of complete intervention, the government may force a producer to transact with a buyer whose willingness to pay does not even cover the former's cost of production. In the case of incomplete intervention, the price-setting leads to the need of rationing. Given the lack of information on the part of the government, efficient rationing may not be feasible. Accordingly, we assume random rationing in the sense that agents who are willing to enter a trade will be randomly assigned the opportunity to carry out the exchange.

The second-period reform removes both (complete and incomplete) forms of government intervention. The reform is introduced in a dual track fashion to minimize potential opposition and to overcome the lack of information concerning individual buyer/seller's characteristics (i.e., their preferences and costs to produce). As a result, a "liberalized" and a "regulated" track emerge in the second period. In the former, agents are free to enter new exchanges. In the latter, independently on whether they were subject to a complete or incomplete intervention in the first period, private agents are instead assigned rights and obligations derived from the first period transactions carried out under the original government policy. That is, if private agents exchanged a given quantity at a certain price in

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<sup>7</sup>In this paper we treat a quota as a form of complete intervention, as its presence results in some agents being excluded from the market.

the first period, the very same transaction will be enforced in the second period.<sup>8</sup> As an example, think about the case of a labor market in which, in the first period labor contracts between workers and employers are governed by a union agreement specifying the wage rate. In the second period, the government introduces a reform, which allows newly hired workers to be paid a (lower) market wage rate, but at the same time requires employers to continue to pay the same union-set wage rate to those workers they have previously employed. In other words, a dual track approach requires contracts governing first period transactions to continue to be enforced in the second period.<sup>9</sup> At the same time, the reform calls for the establishment of a liberalized track, where parties can carry out transactions at the prevailing equilibrium market price.

Key to our analysis is that private agents anticipate in the first period the implementation of the dual track reform in the second. As a result, the equilibrium resource allocation in the first period is determined not only by the original distortionary policy, but also by the anticipated second period reform. Therefore, when evaluating dual track liberalization, we need to consider its welfare implications over *both* periods. Specifically, we will compare the equilibrium allocation under dual track liberalization to the *status quo* (i.e., the no liberalization outcome). We say that dual track liberalization achieves a *Pareto improvement* over the status quo if the total (discounted) surplus of *each* private agent over the two periods is greater under dual track than under the status quo.

### 3 The Second Period Resource Allocation

Our analysis of the second period equilibrium reproduces that of Lau, Qian, and Roland (2000). To proceed, it is useful to distinguish between two sets of agents: those who have transacted in the first period and those who have not. Previously active agents must carry

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<sup>8</sup>In a centrally planned economy, this result can be achieved by continuing to enforce plan transactions in the post-reform equilibrium. In an economy where the original government intervention did not involve exclusively complete control, agents need to be able to establish the validity of their pre-reform trades in a court, which can enforce these transactions. In the examples we have discussed in the introduction, the initial transactions were clearly not anonymous and could easily be documented, as for example in Stiglitz's example of liberalization of hydroelectric power prices. More generally, even the repetition of a simple purchase at a department store could be easily enforced, as long as the interested party retains a transaction record like for example the corresponding credit card slip. A similar point has been made by Mandler (2005).

<sup>9</sup>In addition, if the original government policy involved a transfer (i.e. a tax or a subsidy) to an agent in the first period, the same payment will be made in the second.

out their original transactions as required by the dual track liberalization mechanism. By doing so, the dual track mechanism ensures that in the second period no one can be worse off as compared to the status quo. As in Lau, Qian, and Roland (2000), we further assume that the dual track mechanism allows agents to carry out these transactions by taking advantage of the existence of a liberalized track, *without actually producing or using the commodity*. For instance, an employer can second his former employee (whom he is obliged to hire at the union wage rate) to another employer at the market wage rate, instead of actually using him. By granting previously active agents access to the liberalized track, the dual track mechanism enables them to arbitrage between the market price and the marginal cost (or marginal willingness to pay) of the good/service they are obliged to provide (or entitled to consume). For instance, by seconding his employee at the market wage rate, an employer avoids using the employee whenever his marginal benefit from doing so is lower than the market wage rate. As a consequence, the overall quantity actually consumed in the two tracks is the result of the behavior of those buyers with a marginal willingness to pay larger than  $P^e$ . Similarly, for a given  $P^e$ , the total quantity actually produced in the two tracks will be generated only by those producers with a marginal cost lower than  $P^e$ . This implies that in equilibrium the free-market price must be at the level where the marginal cost equals the marginal willingness to pay, *independently of the original government policy*.

We summarize our observations in the following Lemma, which reproduces Proposition 1 in Lau, Qian, and Roland (2000):

**Lemma 1** *Regardless of the first period government policy, dual track liberalization attains the first best allocation in the second period. Moreover, the equilibrium price in the liberalized track is the same as the competitive equilibrium price. Furthermore, no agent is worse off compared to the first period.*

## 4 *Expectations and Intertemporal Arbitrage*

In a dynamic context, the first period allocation depends on the agents' expectations about the second period reform. Translating the static discussion of Lau, Qian, and Roland (2000) to our dynamic framework,<sup>10</sup> we allow the reform to be anticipated. In this case, agents

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<sup>10</sup>Alternatively, we can think of their analysis as assuming that the liberalization comes as a “surprise”, so that the first period outcome is not affected by the ensuing liberalization.



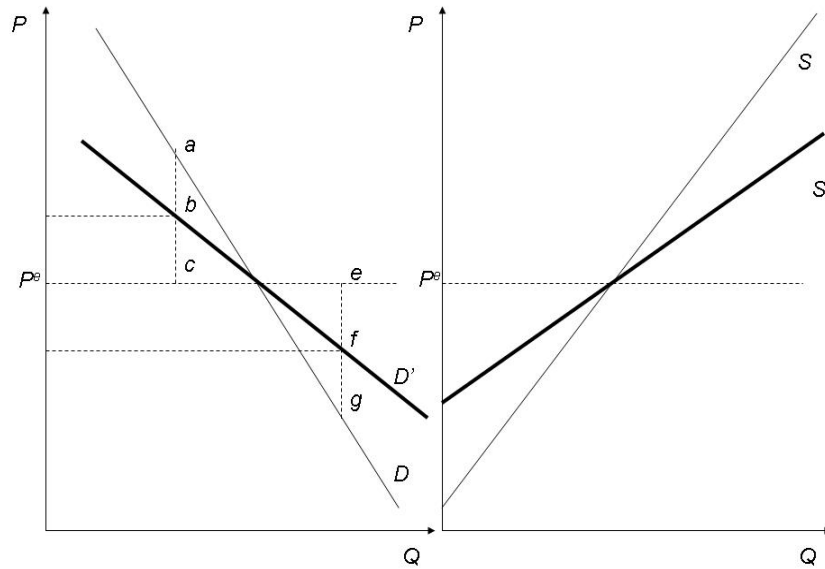


Figure 1: First period strategic demand and supply

who are subject to the incomplete intervention are induced to strategically modify their behavior in the first period in order to take advantage of new arbitrage opportunities; whereas those who are subject to the complete intervention cannot modify their behavior. The opportunities arise because dual track liberalization creates two tracks in the second period, and agents who have engaged in transactions in the first period are entitled to exchange in the regulated track in the second period. Since the prices prevailing in the two tracks may very well differ, agents will attempt to take advantage of such differences by modifying their first period behavior. We refer to these activities as *contractual* arbitrage. For instance, if workers realize that they can lock up the union-set wage rate in the second period by entering a labor contract in the first period, they will be more willing to supply their labor services if the union-set wage rate is substantially higher than the market rate in the second period. The opposite is true for employers.

Figure 1 illustrates how contractual arbitrage alters the first-period behavior of those agents who are subject to the incomplete government intervention. Each point on  $S$  and  $D$  represent respectively the marginal cost ( $MC$ ) and willingness to pay ( $MV$ ) for a particular

seller and buyer that is not subject to incomplete intervention.<sup>11</sup>  $S'$  and  $D'$  represent instead the first period “strategic” supply and demand derived from these contractual arbitrage activities. As the figure shows, the strategic demand rotates around the (non-strategic) demand  $D$  at the second period equilibrium price in the market track which, according to Lemma 1, is equal to  $P^e$ . Similarly, the strategic supply rotates around the (non-strategic) supply  $S$  at  $P^e$ .

To understand how  $S'$  and  $D'$  are derived, let us consider the buyers’ decision (the problem faced by the producers is similar), starting with a buyer for whom  $MV > P^e$ . From Lemma 1, we know that the buyer will always consume in the second period. If he enters a transaction in the first period, his total payoff for the two periods will be

$$(1 + \delta)(MV - P).$$

given that he is locked into the first period price  $P$ . If he does not enter a transaction in the first period, he will be able to trade in the market track at the price  $P^e$  in the second period. Thus his total payoff will be

$$\delta(MV - P^e).$$

The buyer is indifferent about whether or not to carry out a transaction in the first period when

$$\begin{aligned} (1 + \delta)(MV - P) &= \delta(MV - P^e), \\ \text{or } P &= \frac{MV + \delta P^e}{1 + \delta}. \end{aligned}$$

Thus for example when  $\delta = 1$ , a buyer with marginal willingness to pay equal to  $a$  will have a “strategic willingness to pay” in the first period equal to  $b = \frac{a+c}{2}$ , as illustrated in Figure 1.

Consider, on the other hand, a buyer for whom  $MV < P^e$ . As we have discussed earlier,

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<sup>11</sup>We do not incorporate in this picture the supply and demand of those agents under complete intervention, as their transactions are dictated by the government and therefore they do not respond to the anticipated dual track liberalization. However, as we will discuss in section 5, the presence of these agents does affect the market equilibrium price in the second period when the dual track reform is implemented.

such a buyer will never actually consume the product in the second period, but will instead sell the commodity back to the market track.<sup>12</sup> For such a buyer, transacting in the first period leads to a (positive or negative) profit  $P^e - P$  in the second, since he can use the liberalized track to fulfill his obligation. Consequently, the total payoff for such a buyer to transact in the first period is

$$MV - P + \delta(P^e - P).$$

If, on the other hand, the buyer does not engage in a transaction in the first period, he will be free from any obligation to trade in the second, and will not enter in a transaction at that time since  $MV < P^e$ . Consequently, a buyer with  $MV < P^e$  is indifferent between buying or not in the first period at the price  $P$  when

$$\begin{aligned} MV - P + \delta(P^e - P) &= 0 \\ \text{or } P &= \frac{MV + \delta P^e}{1 + \delta}. \end{aligned}$$

In Figure 1, a buyer with the marginal willingness to pay  $g$  has a “strategic willingness to pay”  $f = \frac{e+g}{2}$  when  $\delta = 1$ .

We have thus derived the “strategic” willingness to pay  $P$ , given a buyer’s true marginal willingness to pay  $MV$  and the second period equilibrium price  $P^e$ . Likewise, we can derive the “strategic” willingness to produce  $P$ , given a buyer’s marginal cost to produce  $MC$  and the second period equilibrium price  $P^e$ . Rewriting  $MV = D^{-1}(Q)$  and  $MC = S^{-1}(Q)$ , we characterize the “strategic” demand  $D'^{-1}(Q, P^e)$  and the “strategic” supply  $S'^{-1}(Q, P^e)$  in the following

**Lemma 2** *Let  $P^e$  be the second period equilibrium price in the liberalized track. Among agents who are subject to incomplete government intervention only, the first period supply in anticipation of the dual track liberalization is given by*

$$S'^{-1}(Q, P^e) = \frac{S^{-1}(Q) + \delta P^e}{1 + \delta}$$

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<sup>12</sup>In the case of a labor market, this means that an employer, who is compelled to hire his old employees with the value of marginal product of labor lower than the market wage rate, will second these workers.

and the corresponding first period demand is given by

$$D'^{-1}(Q, P^e) = \frac{D^{-1}(Q) + \delta P^e}{1 + \delta}.$$

## 5 The Dynamic Welfare Implications of Dual Track Reform

We are now ready to evaluate whether, from a dynamic perspective, *anticipated* dual track liberalization is efficiency enhancing and Pareto improving as compared to the status quo. As it turns out, the answer to this question depends on whether the status quo government policy involves or not *complete* intervention. To illustrate the point, we begin with the case of a market economy, where there is only incomplete intervention, and consider next the situation of a mixed economy, where some individuals are instead subject to complete intervention.

### 5.1 Price intervention in a market economy

In a market economy no transaction is dictated by the government in the status quo. As a result, in the second period the equilibrium price  $P^e$  is determined by the intersection of the agents' marginal willingness to pay and of the agents' marginal costs to produce, as shown in Figure 2.

Suppose that in the first period the government fixes the price at  $P_1 < P^e$ . In the first period, if agents do not anticipate future policy changes, the quantity exchanged will be  $Q_1$ , so that  $S^{-1}(Q_1) = P_1$ . When a dual track liberalization is instead expected, sellers have an incentive to withhold their sales in the first period, in order to avoid being locked into a contract fixing the low price  $P_1$ . At the same time, buyers have an additional incentive to transact in the first period so as to lock up the low price  $P_1$ . This implies that the first period excessive demand persists under the anticipated dual track liberalization. Let  $Q_1^d$  be the equilibrium quantity transacted in the first period under the anticipated dual track liberalization. Following Lemma 2,  $Q_1^d$  is given by

$$P_1 = \frac{S^{-1}(Q_1^d) + \delta P^e}{1 + \delta},$$

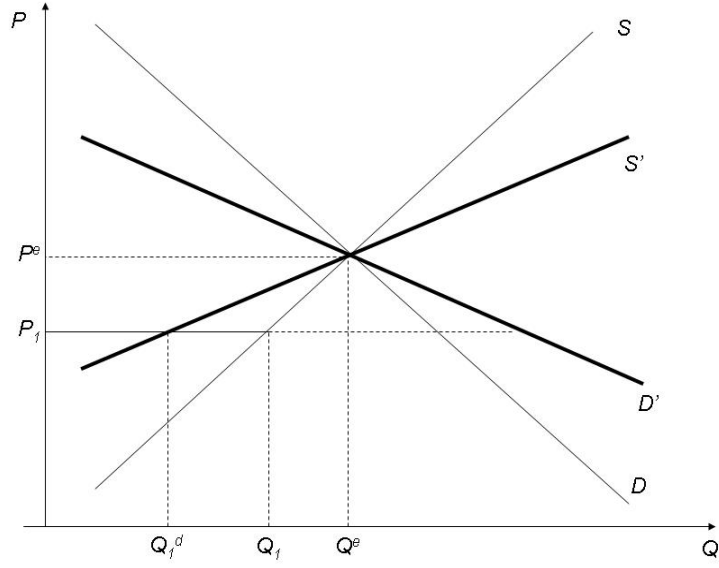


Figure 2: Price setting without complete intervention

or

$$\begin{aligned}
 S^{-1}(Q_1^d) &= P_1 + \delta(P_1 - P^e) \\
 &< P_1 \\
 &< S^{-1}(Q_1).
 \end{aligned}$$

In other words, *contractual arbitrage* exacerbates the shortage in the first period as  $Q_1^d < Q_1$ .

The exacerbated shortage means that, as compared to the status quo, some additional buyers are rationed out and hence become worse off in the first period. Moreover, because they are rationed out in the first period, they will have to purchase the commodity at the price  $P^e > P_1$  in the second. Thus these users must be worse-off as compared to the status quo, even inter-temporally. Dual track liberalization can therefore not be Pareto improving in the dynamic sense. An analogous argument can be made if the government sets instead the first period price  $P_1 > P^e$ . We summarize our discussion in the following:

**Proposition 1** *Suppose that the government status quo policy takes the form of an incomplete intervention involving price setting. Then the anticipated dual track liberalization is*

*never Pareto improving.*

To understand the intuition behind this proposition, it is useful to focus on the behavior of the marginal agent (producer or buyer) who earns zero surplus in the status quo. When the reform is implemented with the dual-track approach, the marginal agent continues to receive zero surplus in the second period as long as he transacts in the first. Anticipating the dual track reform, this agent will be better off by withdrawing from the first period transaction. This is because, with the government setting the price in the status quo, the marginal agent's counterpart will earn a positive surplus almost surely (because of random rationing). By withdrawing from the first period transaction, the marginal agent avoids being locked into the first period price by the dual track mechanism. As a result, this positive surplus will be redistributed between the two agents following the price control removal and the marginal agent will receive a positive surplus. As the marginal agent withdraws from the transaction, his counterpart, who earns a positive surplus under the status quo, will no longer be able to enjoy a positive surplus in the first period. To make things worse, the inability to trade in the first period also means that the marginal agent's counterpart is no longer able to take advantage of the dual-track mechanism in the second period, which is designed to preserve the positive surplus he would have otherwise enjoyed under the status quo. Consequently, he becomes worse off in both periods.

## 5.2 A mixed economy

In a mixed economy, there are both agents whose transactions are dictated by the government, as well as agents whose transactions are subject to incomplete government intervention. This has an important implication. With both types of intervention at play, demand and supply from agents that are subject to the incomplete intervention in the first period will no longer determine the equilibrium price in the second period. In fact, because in the segment where the government imposes the complete intervention in the first period, agents are arbitrarily ordered or not to transact, the second-period equilibrium price  $P^e$  can be anywhere relative to the demand and the supply of agents that are subject to the incomplete intervention. Figure 3 illustrates the point. In the left panel the second-period equilibrium price  $P^e$  is above the point where  $D$  and  $S$  intersect. In the right panel, on the other hand, it is below. Notice that, in either cases, when a dual-track reform is implemented both

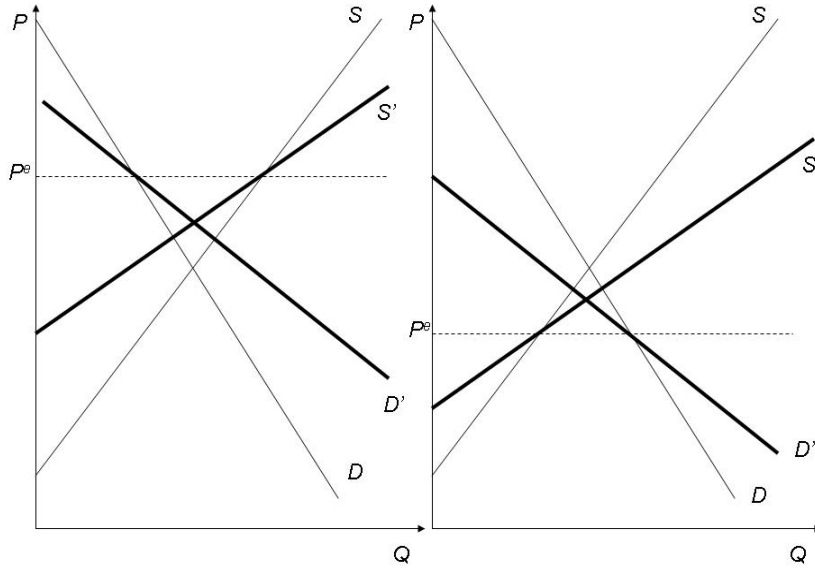


Figure 3: The second-period equilibrium with complete intervention in the first period

the strategic demand and the strategic supply rotate in correspondence of the second-period equilibrium price  $P^e$  i.e. around the true marginal willingness to pay,  $D$ , and the actual marginal cost to produce,  $S$ , respectively.

The presence of a group of agents subject to complete intervention in the first period makes it possible for a dual track reform to alleviate the first-period distortion and implement a Pareto improving outcome. To see this, consider Figure 4. Here we illustrate the case where, in addition to the complete intervention on a group of agents, the government directly sets the price,  $P_1$ , for the rest of the economy. In the status quo, the output equals  $Q_1$  in the first period, whereas it equals  $Q_1^d > Q_1$  in the first period when a dual-track reform that removes both forms of government intervention is anticipated. By revealed preferences, agents participating in the transactions involving quantities  $Q_1^d - Q_1$  must be better off, *regardless how the additional amount is rationed among buyers who are willing to participate in these transactions*. Interestingly, given that rationing is random, it is possible that some buyers may *willingly* withdraw from the first-period transaction in anticipation of the upcoming dual-track reform. However, by revealed preferences, they are also better off. In fact, we can establish the following

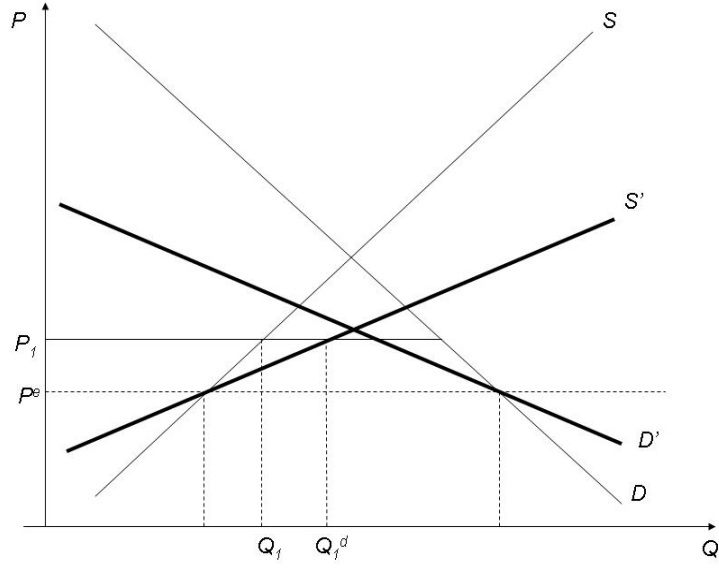


Figure 4: Price setting with complete intervention

**Proposition 2** *Suppose that the government status quo policy involves incomplete intervention over a group of agents along with complete intervention over the rest. Then anticipated dual track liberalization is Pareto improving if and only if*

- a) *the incomplete intervention takes the form of price-setting; and*
- b) *fixing the status quo price  $P_1$ , the second-period equilibrium price  $P^e$ , satisfies one of the following conditions:*

$$P^e \geq P_1 \quad \text{and} \quad S'(P_1, P^e) \geq D(P_1); \quad \text{or} \quad (1)$$

$$P^e \leq P_1 \quad \text{and} \quad D'(P_1, P^e) \geq S(P_1). \quad (2)$$

The proof is straightforward and is again omitted. Condition (1) states that if the second-period price  $P^e$  rises above the first-period controlled price  $P_1$ , the producers' strategic response must continue to allow the marginal buyer to carry out his transaction in the first period. The workings of this condition is illustrated in the left panel of Figure 5. Given the first-period price  $P_1$ , the second-period equilibrium price  $P^{e*}$  must lie in the range indicated by the arrow in order for the dual-track reform to be Pareto improving. Condition (2) states



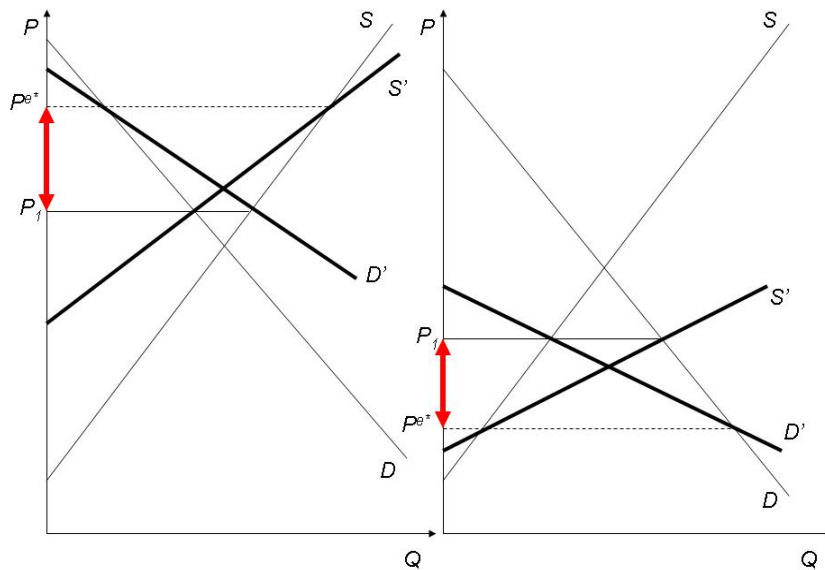


Figure 5: Extent of complete intervention for a Pareto-improving dual-track reform

instead that the buyers' strategic response must continue to allow the marginal producer to carry out his transaction in the first period. The workings of this condition is shown in the right panel of Figure 5, where the arrow illustrates, for a given  $P_1$ , the range of  $P^e$  at which the dual-track reform is Pareto improving.

To understand the logic of this proposition, notice that an anticipated dual-track reform only preserves the amount of surplus agents actually obtain in the first period, and not the surplus they would obtain in the status quo. Thus, for an anticipated dual-track reform to be Pareto improving as compared to the status quo, it is necessary that the reform avoids a redistribution of social surplus in the first period, which implies that the incomplete government intervention must involve price fixing.

Furthermore, for the anticipated dual-track reform to be Pareto improving, the agents' strategic response must alleviate the first-period distortion, so that no one will be forced out of first-period transactions and hence lose access to the protection brought about by the dual-track mechanism. This implies that the reform must give the marginal agent, who receives zero surplus in the status quo, an additional incentive to trade in the first period and must at the same time guarantee that his counterpart will continue to participate in the first period transaction. For the marginal agent, this additional incentive is represented by the

possibility of locking in the first period price and carry out transactions at that price after the reform has occurred. For this incentive to be present, it must be the case that  $P^e > P_1$  if the marginal agent is a buyer, while  $P^e < P_1$  if the marginal agent is a seller. In other words, the second period equilibrium price must move in the “wrong” direction, given the nature of the government policy on the agents subject to incomplete intervention. For this to be the case, the transactions dictated by the government must have forced a distortion that is in the same direction as the distortion brought about by the government policy. That is, if the price control leads to excessive supply among agents subject to incomplete intervention (and hence the marginal agent is a buyer, as in the left panel of Figure 5), the complete intervention must have either forced supply or constrained demand among the rest of the agents<sup>13</sup> and vice versa.

In addition, as shown in Figure 5, the distortion created by the complete intervention must be severe enough. In the left panel of Figure 5, this means that the removed excessive supply is sufficiently large so that  $P^e \geq P_1$ ; whereas in the right panel, this means that the removed excessive demand is sufficiently large so that  $P^e \leq P_1$ .

Furthermore, in order for the marginal agent to continue to trade in the first period, his counterpart must be willing to do so as well. When this happens, the counterpart will be locked into the price  $P_1$  in the second period, instead of being able to transact at  $P^e$ . Therefore, for the marginal agent counterpart to remain in the transaction in the first period, this second period opportunity loss must be outweighed by the amount of surplus the counterpart receives through the first period transaction.<sup>14</sup>

To summarize, for the anticipated dual-track reform to be Pareto improving, it is necessary that (1) the incomplete intervention involves price setting, (2) the complete intervention forces a distortion that is in the same direction as the distortion created by the incomplete intervention and (3) the first distortion while limited in scale must be sufficiently large relatively to the second one. It is easy to see that these conditions are also sufficient. As long as the marginal agent and his counterpart continue to carry out the first-period transaction at

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<sup>13</sup>As a result, when the complete intervention is lifted, either the forced supply will disappear or the prohibited demand will surface, causing  $P^e$  to rise above the intersection of  $D$  and  $S$ , as shown in the left panel of Figure 5.

<sup>14</sup>This implies that the distortion created by the complete intervention must be limited. In the case of Figure 5,  $P^e$  must not be higher than  $P^{e*}$  in the left panel, and  $P^e$  must not be lower than  $P^{e*}$  in the right panel.

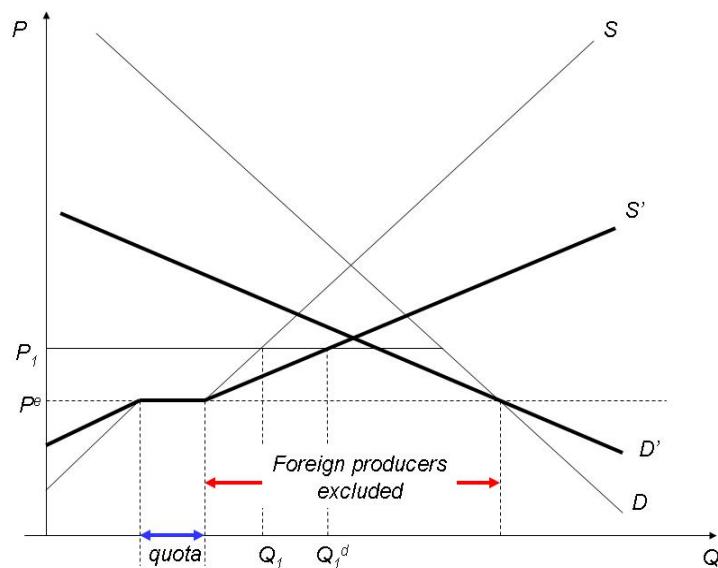


Figure 6: Application: Domestic price control together with exclusion of foreign producers

the same price as under the status quo, no one can be worse-off in the first period compared to the status quo. From Lemma 1, all agents must be at least as well as off in the second period as in the first period. Hence the reform must be Pareto improving as compared to the status quo.<sup>15</sup>

As an application of the preceding analysis, consider a small open economy for which the status quo policy involves price setting in the domestic market and a quota that limits foreign competition. In particular, only a limited number of foreign buyers or producers are allowed to trade in the domestic market at the fixed price. Figure 6 illustrates this situation, where  $S$  and  $D$  indicate the first-period supply and demand in the domestic market (including those foreign suppliers that are allowed to enter under the quota) respectively.

**Corollary 1** *Suppose that the status quo policy is domestic price fixing, combined with an import or export quota. Let  $P_1$  be the domestic price fixed by the government. Then, domestic cum trade liberalization is Pareto improving if and only if either condition (1) or condition (2) of proposition 2 holds.*

<sup>15</sup>In fact, we can apply this result to the case of a quota and show that a dual track reform will never be Pareto improving. This is because we can think of a quota as the government imposing complete intervention on a group of agents, and impose no price controls on the other.

A number of policy implications can be drawn from Corollary 1. First, as long as the first-period price,  $P_1$ , and the world price  $P^e$  satisfy conditions (1) or (2), the anticipated dual-track reform is Pareto-improving regardless of the size of the quota. Second, if the government imposes an import (or export) quota under the status quo, an anticipated dual-track reform can be Pareto improving only if the government status quo policy also fixes the domestic price so that it creates excessive demand (or supply, respectively). Third, in order for the dual-track reform to be Pareto improving, it is necessary that the domestic price is higher than the world price when the status quo policy involves an import quota, and vice versa when the status quo policy involves an export quota instead.

## 6 Conclusions

The remarkable success of China's transition from a centrally planned to a market economy raises the question of the extent to which the lessons from the Chinese experience can be applied elsewhere. In this paper, we have addressed this issue by examining the broader implementability of the dual-track approach to market liberalization. We begin our analysis with a careful definition of "elsewhere", that is economies where policy interventions do not completely dictate prices and quantities and market signals continue to play a role. In this setting we have argued that a dynamic perspective should be taken to evaluate the welfare implications of a dual-track liberalization.

Extending the static analysis carried out by Lau, Qian, and Roland (2000) to a simple two-period model, we have been able to establish a necessary and sufficient condition for a dual-track liberalization to be Pareto-improving from a dynamic perspective, and we have shown how this condition could be satisfied for instance in a small open economy. Thus, our analysis offers some important lessons to policy makers interested in reforms without losers.

When this condition is not met, a dual-track approach can be effective only if the policy change is implemented as a surprise.<sup>16</sup> Otherwise, a policy maker may need to credibly commit himself to *not* implement the reform in the dual track fashion.

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<sup>16</sup>The dual track approach could also be effective if the contract to be enforced is one signed in the distant past, so that agents are not able to strategically react to the announced policy change. Of course, enforcing old contracts presents additional difficulties – i.e. transactions records may not be readily available – and at the same time transactions carried out in the distant past may not reflect agents' current preferences or cost conditions.

Finally, the analysis we have carried out furthers our understanding of the Chinese experience. In fact, it allows us to identify one of the key factors in the success of the Chinese reforms. That is, China began as a centrally planned economy, where the planning authority completely dictated all trades both in terms of prices and quantities, thus eliminating the possibility for agents to react to the forthcoming reform.

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## Appendix

To highlight the role of *contractual arbitrage*, our analysis so far has focused on perishable goods. In this appendix, we extend it to consider the case of non-perishable goods. With non-perishable goods comes the possibility to arbitrage by storing. In what follows, we investigate the difference between *contractual arbitrage* and what we will call *physical arbitrage*, i.e. arbitrage by storage, and whether the possibility to carry out physical arbitrage might eliminate the contractual arbitrage brought about by the dual track reform.

For simplicity we will set our analysis in the context of a market economy, where no transaction is dictated by the government. As before, we assume that each buyer and each producer can consume and produce respectively one unit of the good in each period. Anticipating a price change, both agents can store the good, but a fraction  $1 - k \in [0, 1)$  of it deteriorates over the period and becomes unusable.

Let  $P^e$  and  $P_1$  respectively be the second-period and the first-period price. A producer will decide to store his output in the first period to sell it in the second if and only if

$$\delta k P^e - P_1 > 0.$$

A buyer can carry out physical arbitrage by acquiring an additional unit of the good in the first period for two purposes. He can either buy to stock up for resale in the second period, in which case he will engage in arbitrage if and only if

$$\delta k P^e - P_1 > 0$$

or he will buy an additional unit of good in the first period in order to consume it in the second period. In this case, he will engage in arbitrage if and only if

$$\delta k M V - P_1 > \delta(M V - P^e).$$

In equilibrium physical arbitrage implies that

$$\delta k P^e \leq P_1$$

In other words, the first-period price may dictate the level of the second-period equilibrium

price. Furthermore, we have that

$$\delta k MV - P_1 \leq \delta k(MV - P^e) \leq \delta(MV - P^e)$$

In other words, in equilibrium a buyer never arbitrages to consume the good in the second-period.

We can notice immediately a number of differences between contractual and physical arbitrage. Unlike the *contractual* arbitrage condition outlined in section 4, the arbitrage incentive induced by the possibility of storing the good is independent of the producer's characteristics. Furthermore, differently from *contractual* arbitrage, physical arbitrage can take place only if  $P^e > P_1$ , whereas the former can take place when either  $P^e > P_1$  or when  $P^e < P_1$ . More importantly, physical arbitrage means that the second-period resource allocation will be distorted,<sup>17</sup> whereas the second period resource allocation is efficient under a dual track reform, despite *contractual* arbitrage.

Next, let us consider the effects of a dual track reform in the presence of a non-perishable good. Some observations can be drawn immediately. Physical arbitrage does not change our previous analysis of contractual arbitrage when the status quo policy involves only price-setting that leads to excessive demand in the first period. Second, physical arbitrage is irrelevant to our previous analysis also if, without it, the second-period market clearing price satisfies the condition  $P^e \leq \frac{P_1}{\delta k}$ .<sup>18</sup> Third, physical arbitrage eliminates the contractual arbitrage we described earlier if and only if (1) the status quo policy involves price setting that creates excessive supply in the first period, (2) without arbitrage through storage,  $P^e > \frac{P_1}{\delta k}$ , and (3)  $\delta k = 1$ .

Figure 7 illustrates why the three conditions above are sufficient for physical arbitrage to eliminate contractual arbitrage. In this example, the original government intervention involves price fixing in the first period that generates excess demand. If the economy is liberalized, the second period market price is expected to rise. However, if  $\delta k = 1$ , physical arbitrage implies that  $P^e = P_1$  in equilibrium. When this happens, there is no incentive for any party to strategically respond to the forthcoming dual-track reform. If instead  $\delta k < 1$ ,  $P^e > P_1$  even after physical arbitrage and thus there will still be incentives to respond to

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<sup>17</sup>This is because the actual supply is no longer equal to the true marginal cost.

<sup>18</sup>In this case there would be no incentive to store the good in the first period.

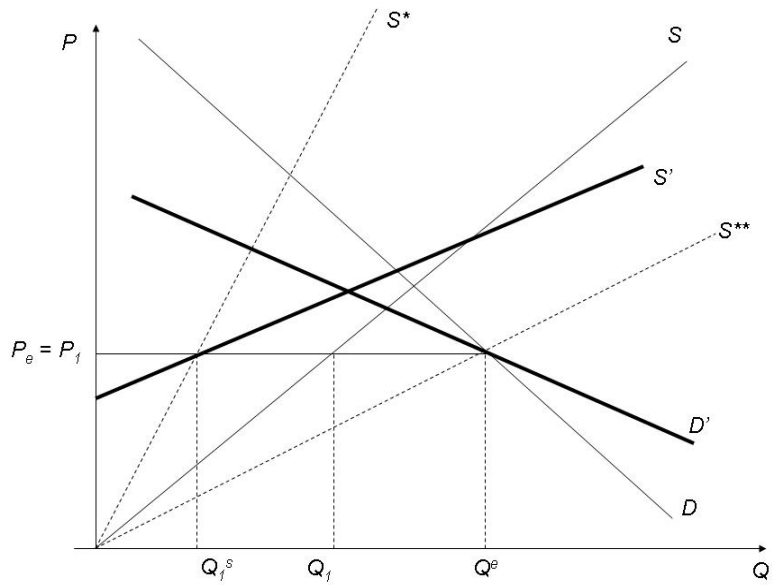


Figure 7: Contractual arbitrage and arbitrage through storage

an anticipated dual-track liberalization. As a result, arbitrage by storage will not eliminate the possibility of *contractual* arbitrage.

Thus, we have shown that while the *contractual* arbitrage brought about by a dual-track liberalization and *physical* arbitrage by storage are related, they are fundamentally different both in terms of their working as well as in terms of their welfare implications.