Pareto-Improving Economic Reforms through Dual-Track Liberalization

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Abstract

Pareto-improving economic reforms that also simultaneously achieve efficiency can be implemented through a strategy of “dual-track” liberalization. Its success requires the feasibility of the original plan and its continued enforcement by the state. The Chinese experience demonstrates that such a strategy works.

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1. Introduction

Our purpose is to show that, in a competitive general equilibrium context, the “dual-track” strategy for liberalization not only attains full economic efficiency as the “big-bang” strategy but also simultaneously enables a Pareto-improving transition, that is, a transition without losers, from a centrally planned to a market economy. A dual-track strategy may be defined as follows: (1) in one track, the “plan track,” the existing (often inefficient) central economic plan, and the distribution of rents under it, are left intact; and (2) in the other track, the “market track,” liberalization is carried out at the margin, that is, economic agents have both the right and the incentive to participate in the free market provided that the obligations under the original plan are fulfilled. In particular, market resales of plan-allocated inputs and consumption goods, and market purchases of outputs for re-delivery are allowed.

The dual-track strategy is appealing for two reasons. First, liberalization at the margin achieves, or at a minimum increases, economic efficiency. This is because all markets are open under dual-track liberalization (as under big-bang liberalization) and thus any rent transfers are inframarginal. Second, it is Pareto-improving, that is, no one is made worse off and at least some one is made strictly better off. This is because, by maintaining the pre-existing distribution of rents under the original plan, the dual-track strategy implicitly implements lump-sum transfers to compensate any losers under the reforms.

The efficiency property of the dual-track approach can be shown in a straightforward way under the assumption that all markets are open under the economic reform. The Pareto-improving property of the dual-track approach is by construction. Thus, in contrast with the big-bang approach, under which liberalization is carried out with no attempt to preserve the original central plan or distributions of rent, the dual-track approach has significant distributional and political advantages: It minimizes political opposition to reforms ex ante and maximizes political opposition to reversal of reforms ex post (because of the new vested interests created). It is interesting to note that both advocates (e.g., Byrd 1987, 1989 and McMillan and Naughton 1992) and opponents (e.g., Murphy, Shleifer and Vishny 1992 and Sachs and Woo 1994) of the dual-track
approach have not emphasized this crucial “Pareto-improving” dimension.

The efficiency and Pareto-improving properties of the dual-track approach depend on two crucial conditions in addition to the standard assumptions necessary to assure the efficiency of a big-bang competitive equilibrium: (1) the original plan must be feasible; and (2) the state must have the capacity (and credibility) to fully enforce such a plan. The first condition may be reasonably assumed to hold generally. The second condition requires state power during the process of economic reform, but essentially no more than that necessary for contract enforcement in a market economy.

We documented elsewhere (Lau, Qian and Roland, 1996) the Chinese experience with the dual-track strategy for liberalization. The success of the Chinese economic reforms has demonstrated that the dual-track strategy works in practice.

The rest of the paper is organized as follows. The model is introduced in section 2. The efficiency property of a dual-track competitive equilibrium is demonstrated in section 3, whereas the Pareto-improving property is demonstrated in section 4. Brief remarks on the significance of state enforcement of the original plan are made in section 5.

2. The Model

Consider an economy consisting of \( l \) goods (indexed by \( h \)), \( m \) producers (indexed by \( i \)), and \( n \) consumers (indexed by \( j \)). Producer \( i \) has a production set \( Y_i \) with elements \( y_{ij} \in \mathbb{R}^l \). Consumer \( j \) has a consumption set \( X_j \) with elements \( x_{lj} \in \mathbb{R}^l \). The \( l \)th good is leisure, denoted by \( x_{lj} \). Consumer endowment is \( \omega=(\omega_1, ..., \omega_n) \), where \( \omega_j=(0, ..., 0, x_{lj}) \in \mathbb{R}^l \), that is, consumers have only leisure endowment. We adopt the following sign conventions: for producers, outputs are positive and inputs are negative; for consumers, consumption goods (including leisure) are positive.

The Status Quo (prior to reform): The economy is characterized by central planning in the following sense. There exists a national production plan \( v=(v_1, ..., v_m) \) where \( v_i \in \mathbb{R}^l \) for each producer \( i \), and a national consumption plan \( c=(c_1, ..., c_n) \) where \( c_j \in \mathbb{R}^l \) for each consumer \( j \). Let \( q=(q_1, ..., q_l) \) be the plan price, with \( q_i \) normalized at unity. Producer \( i \) produces exactly \( v_i \) with planned profit (loss) \( \pi_i = q_i v_i \), which is allocated to each consumer in the fixed proportion \( \theta_i \). Consumer \( j \) receives income equal to \( q(\theta_j c_j) + \sum \theta_j \pi_i \) and
consumes \( c_j \) with utility \( u_j(c_j) \). This is the extreme version of central planning, under which there is no discretion and no market at all. An economy under central planning is characterized by \((v, c, q, \theta)\). We assume that the original plan is feasible, which requires:

1. \( v_i \in Y_i \) for all \( i \) (The production plan for each producer is feasible);
2. \( c_j \in X_j \) for all \( j \) (The consumption plan for each consumer is feasible, in particular, \( c_j \leq \bar{x}_j \));
3. \( \sum_i v_i = \sum_j c_j \) (Material balance holds for the economy as a whole); and
4. \( q c_j \leq q_i \bar{x}_i + \sum_t \theta_i \pi^n_t \) for all \( j \) (The consumption plan for each consumer is affordable at the plan prices)\(^2\).

**The Big-Bang Strategy:** Under the big-bang strategy of economic reform, the central plan is abolished and all markets are instantaneously open. Producers are completely free to plan their production so as to maximize profits subject to their production sets and consumers are completely free to maximize their utility functions given their initial endowments.

**The Dual-Track Strategy:** Under the dual-track strategy:

1. The original central plan \((v, c, q, \theta)\) remains intact in the following sense. The rights and obligations of the producers and the consumers under the plan to receive and to deliver at plan price \( q \) continue to be fully enforced by the state.
2. All markets are instantaneously open. Market resales of plan-allocated goods and purchases of goods for redelivery are allowed. Each good now carries two prices: in addition to the plan price \( q \), there is a market price \( p=(p_1, \ldots, p_l) \).
3. Producers are permitted to retain all incremental profits, provided that all the quota obligations to deliver and to receive are fulfilled. Otherwise it is free to plan its production and trading activities, in particular, to sell, or offer to sell, expected input quota deliveries.
4. All consumers are completely free to maximize their utility functions given their initial endowments, including reselling plan-allocated consumption goods on the market.

**Producer behavior:** Producer \( i \) makes production decision \( y_i \in Y_i \) and trading decision \( s_i \) and \( t_i \) to

\(^2\) The excess money balances of the consumers, as well as the planned profits of the producers, if any, in this centrally planned economy are of no consequence because they cannot be used.
maximize profits, subject to the fulfillment of delivery obligations $v_i$, where $s_i$ and $t_i$ are respectively the sale and purchase (both taken to be non-negative) of goods by producer $i$ at market prices. Thus, the maximized profit of the producer is given by:

$$
\pi_i = \max \{ qv_i + ps_i - pt_i \mid y_i \in Y_i, v_i + s_i = y_i + t_i \},
$$

that is, planned deliveries (and receipts if negative) of goods plus sales to the market must be equal to the own production plus purchases from the market. Substituting $s_i - t_i = y_i - v_i$, we obtain:

$$
\pi_i = \max \{ qv_i + p(y_i - v_i) \mid y_i \in Y_i \} = \max \{ py_i \mid y_i \in Y_i \} - (p-q)v_i.
$$

We note that since $v_i$, $p$ and $q$ are given, whatever maximizes $\{ py_i \mid y_i \in Y_i \}$, unconstrained, also maximizes profit under the quota fulfillment constraints. The production behavior of the producers are hence identical under the big-bang and the dual-track reforms. The difference is only in the trading behavior. Under big-bang equilibrium, there are no quota deliveries and no pure trading is required. Under dual-track equilibrium, if $y_{ih} < v_{ih}$, $s_{ih} - t_{ih}$ will be negative, implying net purchases of good $h$ from the market to meet the delivery quota, and if $v_{ih} < y_{ih}$, $s_{ih} - t_{ih}$ will be positive, implying net sales of good $h$ to the market from own production. Trading outputs and inputs to fulfill plan quotas may involve a “wash sale,” that is, a simultaneous sale and purchase of the same good, possibly for different quantities and transacting with different parties. This enables producers to undo the quota constraints.

However, quotas still have effects the distribution of incomes through the redistribution of the profits of the producers and more directly through the planned allocations of consumer goods. We note that $\pi_i = (\pi_i - \pi_i^{\text{in}}) + \pi_i^{\text{in}}$, where $\pi_i^{\text{in}}$ is the pre-existing pre-reform planned profit of producer $i$ and $(\pi_i - \pi_i^{\text{in}})$ is the incremental post-reform profit (which must be positive, otherwise the producer would have remained at the status quo). The pre-reform planned profits continue to be distributed in accordance with $\Theta$ whereas the incremental post-reform profits are taken to be distributed in accordance with $\Theta^*$, not necessarily equal to $\Theta$. Both the efficiency and the Pareto-improving properties of the dual-track strategy are independent of how the profits of the producers are distributed either before or after the reform.

Consumer behavior: Consumer $j$ maximizes utility subject to budget constraints:

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3 We introduce both gross sales and purchases, $s$ and $t$, rather than simply net sales at market prices for the purpose of making explicit the possibility of simultaneous purchase and resale of the same good.
\[
\max \left\{ u_j(x_j) \left| p(x_j-c_j) + q_j \leq q_j, \sum_i \pi_i^{\theta_q} + \sum \pi^s \theta_{q_i^s} (\pi_i^s - \pi^s), x_j \leq \bar{x}_j \right. \right\} \\
= \max \left\{ u_j(x_j) \left| px_j \leq (p-q)c_j + q_j, \sum_i \pi_i^{\theta_q} + \sum \pi^s \theta_{q_i^s} (\pi_i^s - \pi^s), x_j \leq \bar{x}_j \right. \right\}.
\]

Here quotas also have effects on the distribution of incomes and hence on aggregate consumer demands.

Consumers are permitted to sell, at market prices, the plan-allocated consumption goods.

**Definition**: \((p, y, x, s - t, 2^*, T, q, v, c, \theta)\) is a dual-track competitive equilibrium if:

1. Each producer maximizes profits subject to fulfilling all obligations under the plan;
2. Each consumer maximizes utility subject to budget constraints; and
3. \(\Sigma y_i \geq \Sigma x_j\), that is, aggregate market net final supply is greater than or equal to aggregate market net final demand.

### 3. Efficiency of a Dual-Track Equilibrium

We assume the same conditions that otherwise also assure full economic efficiency of a big-bang competitive equilibrium, that is, free disposal, non-satiation of consumers, absence of non-convexities in either the production or the consumption sets, price-taking behavior, and zero transactions costs. We have (Arrow and Hahn, 1971):

**Proposition 1**: Under the standard assumptions on \(Y, X\) and preferences, there exists a competitive dual-track equilibrium with \(p > 0\).

**Proposition 2**: Every dual-track competitive equilibrium with \(p > 0\) is efficient.

Note that a dual-track competitive equilibrium defined in section 2 above is simply a competitive equilibrium with a modified set of initial endowments: positive endowments of the plan-allocated inputs and consumer goods and negative endowments of the plan-mandated outputs and labor-hours. Thus, existence and efficiency of a competitive equilibrium are guaranteed under the standard conditions.

The dual-track competitive equilibrium is realized with the enforcement of the rights and obligations under the plan by the state. However, the enforcement is in terms of the transfers of the market values of the quota deliveries. For example, at a dual-track competitive equilibrium, it is possible for producer \(i\) to fulfill its obligation by simply paying the planned recipient(s) of its quota output of the first good \((p_1-q_1)v_{i1}\) without physically delivering the good. In principle, the planned recipient(s) can then purchase the good in the market.
at price $p_i$ (the planned recipients are also obligated to pay $q_i$ for the quota deliveries). It is also possible for the producer to purchase all or part of its delivery obligations from the market at $p_i$ and then re-deliver the goods to planned recipient(s) at $q_i$. Thus, the plan-allocated delivery quotas can be viewed as the combination of a (put) option on the part of the planned producer(s) to sell at price $q$ to the planned recipients and a (call) option on the part of the planned recipients to take from the planned producer(s) also at price $q$. These options on the underlying goods are freely transferable on the market at price $p - q$. Because they both have the same strike price $q$, at equilibrium, only one of the two options has a positive market value. They in turn entitle their holders to sell or purchase the underlying goods at price $q$. Similarly, the plan-allocated consumption goods quotas can be viewed as ration coupons that are also freely transferable on the market.\(^4\)

There is thus nothing to prevent a producer from buying back from the market, at equilibrium, delivery obligations (call options) in the good that it is supposed to deliver under the plan, thus reducing or even eliminating the necessity of making physical delivery (and actual production). Under this scenario, it is possible that the equilibrium aggregate gross output of a good may be less than the planned aggregate gross output, in which case full physical delivery of the planned aggregate gross output becomes impossible and technically the plan is not fulfilled, at least not in physical terms. And yet there will be no complaints about the non-fulfillment of plan obligations from anyone because the producers and consumers have all received or given value for their rights and obligations under the plan and in fact are at their optimized levels of profits and utilities.

Physical delivery will not be possible for good $h$ if $\sum y^+_i < \sum v^+_i$, where $y^+_i$ and $v^+_i$ are the positive components of the equilibrium and planned production of good $h$ by producer $i$. If the state planning commission insists on actual physical delivery of the planned production, even though the producers and consumers do not demand it, then a dual-track competitive equilibrium as described above may not be able to satisfy it. This leads to the question of “physical implementability”:--whether a given dual-track competitive equilibrium can be implemented if physical delivery of quotas is required.

**Definition:** A dual-track competitive equilibrium is physically implementable if $\sum y^+_i \geq \sum v^+_i$.

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\(^4\) There is also a put element here. The planned producer can require the planned consumers to take their quota delivery at price $q$. 
Physical delivery requires that the equilibrium aggregate gross output be no less than the planned aggregate gross output. If this condition is satisfied, the plan quotas can be physically fulfilled at equilibrium. Our concept of physical implementability may be contrasted to the constraints introduced by Byrd (1989) that $y^*_{-i} \geq v^*_{i}$ and $y^*_{i} \leq v^*_{-i}$, where $y^*_i$ and $v^*_i$ are the negative components of respectively the equilibrium and planned production of producer $i$, on the producers’ behavior. Byrd’s constraints rule out the purchase of outputs for redelivery and the resale of plan-allocated inputs (however, Byrd does not indicate how such prohibitions can be actually enforced). Our dual-track strategy does not impose such conditions. Our physical implementability condition introduced here is strictly weaker Byrd’s conditions because ours is implied by Byrd’s but not vice versa.

Is physical implementability likely to be a serious problem in practice? The fact that most consumption goods are rationed under central planning precisely indicates that these goods are in short supply and the response to dual-track liberalization should in all likelihood be a rise, rather than a fall, in the equilibrium aggregate production of the goods. The growth of the economy will also increase both the intermediate and the final demands and hence equilibrium aggregate gross output. It is therefore reasonable to assume that physical implementability can be satisfied in the process of transition.

Moreover, the failure of physical implementation can also be effectively circumvented in practice. The general equilibrium model considered above is essentially a timeless one in which all transactions take place simultaneously at equilibrium. In real life a plan is typically executed over a period, say a year. If the plan period is subdivided into a sufficiently large number of sub-periods, say 365, then in each sub-period producer $i$ will produce $y_i/365$ and be required to deliver $v_i/365$. For simplicity, suppose there is only a single producer of good 1, producer 1, both under the plan and in equilibrium. Suppose further that the equilibrium $y_{1i}$ is only one-half of $v_{1i}$. Thus, physical implementability apparently fails. However, producer 1 can meet his physical delivery obligations as follows. He produces and physically delivers $v_{1i}/365$ for the first period at the plan price and then simultaneously repurchases half of it from the market at the market price. In the second sub-period, producer 1 produces $(1/2)v_{1i}/365$ and delivers it together with the other half repurchased in the first sub-period, thus fulfilling again his physical delivery obligations, but then also simultaneously repurchases an amount equal to half of his deliveries from the market. He continues this pattern of
production cum recycling until the end of the year. He would have produced \((\frac{1}{2})(366/365)v_{11}\) or \(1/365\) more than the equilibrium gross output \((\frac{1}{2})v_{11}\). He would have physically delivered exactly \(v_{11}\), as required by the plan. His profits would have been reduced by \((\frac{1}{2})p_{1}v_{11}/365\), a small amount compared to the total. Hence, we conclude that physical implementability is not in practice a real problem.

4. The Pareto-Superiority of a Dual-Track Equilibrium

Pareto-improving economic reforms, that is, reforms with no losers and at least one winner, are obviously politically appealing. The problem is that in most situations there is no readily available strategy to implement Pareto-improving economic reforms because of the lack of information. The dual-track strategy makes use of existing information and hence can be readily executed.

Proposition 3: The strategy of dual-track liberalization is Pareto-improving.

The dual-track approach is Pareto-improving by construction. The key is initial feasibility. Since all producers and consumers have the same delivery quotas and plan-allocated inputs, both before and after the reform, and in addition, they have both the incentive and the autonomy to act on the margin, they cannot be worse off (in particular, they can elect to do nothing more than under the plan, which remains feasible under dual-track reform). Thus, the potential difference between a dual-track competitive equilibrium and a big-bang competitive equilibrium is not in efficiency, but in the distribution of income. However, precisely because the distribution of income will be different, a dual-track competitive equilibrium can be expected to be different from a big-bang competitive equilibrium, even though both equilibria will be efficient under the standard assumptions.

The fundamental insight here is that the dual-track strategy provides implicitly a set of feasible lump-sum transfers (transfers that are independent of the actions of the individual economic agents) to compensate the losers of the economic reforms. One of the problems of the big-bang strategy is that it may be too costly to organize explicit transfers to compensate such losers, even though in principle the gains outweigh the losses. First, finding a set of feasible lump-sum transfers to make everyone better off, or at least as well off as before, is informationally difficult if not impossible. The dual-track strategy simply utilizes the information contained in the original plan, whereas the big-bang strategy disregards such information. Note
that with the dual-track strategy, it is not even necessary to know, either ex ante or ex post, who the potential losers of the economic reforms may be. Second, establishing new institutions to carry out the transfers may also be costly. The dual-track strategy implements the lump-sum transfers by simply enforcing the original plan through existing institutions. No new institutions such as tax authorities or welfare agencies need to be established. Thus, the dual-track strategy is able to solve both informational and institutional problems at relatively low costs by making efficient use of existing information (the plan) and existing institutions (the state planning commission).

5. State Enforcement of the Original Plan

In order for the dual-track strategy to work, the state must be able to enforce the original plan. Without state enforcement, there is no incentive for the economic agents to honor the obligations under the plan, and the dual-track approach degenerates into the big-bang approach.

Our model differs from the model of Murphy, Shleifer and Vishny (1992) in both the definition of dual-track and the implications of state enforcement of the original plan. In their model, the market track is not open to everyone. The state firms are bound by planned prices and are not allowed to buy or sell freely at the market prices. Thus inefficient input diversion may occur, and that diversion can only be stopped by state enforcement of quotas. Thus, state enforcement of quota is essential for increasing efficiency. In contrast, in our model, the market track is assumed to be fully liberalized, that is, every one, including state firms, has the right to transact at the market prices; therefore efficiency is guaranteed regardless of state enforcement of the original plan. State enforcement is required in our model not for efficiency, but to insure the Pareto-improving property.

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