

CEDI

Working Paper No. 08-14

The Effects of Reforming the Chinese Dual-Track Price System

John Bennett, Huw Dixon and Helen XY Hu

July 2008

CEDI DISCUSSION PAPER SERIES

**Centre for Economic
Development & Institutions
Brunel University
West London
<http://cedi.org.uk>**

The Effects of Reforming the Chinese

Dual-Track Price System*

John Bennett

Department of Economics and Finance, and Centre for Economic Development and Institutions (CEDI), Brunel University, Uxbridge, Middlesex, UB8 3PH; e-mail: john.bennett@brunel.ac.uk

Huw Dixon

Cardiff Business School, Aberconway Building, Colum Drive, Cardiff, CF10 3EU; e-mail dixonh@cardiff.ac.uk

Helen X.Y. Hu

Department of Economics, University of Birmingham, Birmingham B15, 2TT; e-mail: H.Hu.1@bham.ac.uk

23 July, 2008

Abstract

We formulate a microeconomic model of the dual-track price system for households and use it to analyze ‘transitional policy’ reforms, which we characterize as a rise in the plan-track price and a reduction in the plan-track quantity. Each of these reforms has a negative effect on market price, but a positive effect on the weighted average price (CPI). When households are homogeneous, transitional policy reform reduces welfare (if profits are not fully distributed). Under fairly mild assumptions, if households are heterogeneous and resale of goods can occur, transitional policy reform creates losers (state employees) as well as winners (non-state employees).

JEL Classification: P22, D11

Keywords: dual-track pricing; China

* We are grateful to Guy Liu and to the participants at the Chinese Economic Association (UK) Annual Conference, Cambridge, April 2008, for helpful comments.

1 Introduction

In centrally planned economies, such as China prior to 1978, most prices were set by the government alongside quantity targets. When the need for reform was accepted, there arose the question of how to move the economy from planning towards a market-oriented system. In China, reformers chose to keep the existing planned economy, but gradually to build up a free market system alongside it. This was the essence of the Dual Track idea, which was initiated by reform of the price system, through Dual Track Pricing (DTP). This gradualist approach to economic reform, which was partly due to the unwillingness of China's political leaders at the time to take big risks, was to be rolled out gradually across regions and over a long period, with time for trial and error. Beginning with the agricultural sector, DTP became a central part of economic reform in the 1980s, soon being applied to the industrial sector, and in the 1990s it was extended to across the economy and is still operative, for example, for foreign currency exchange rates and housing.¹

Among the first analyses of DTP in the Western literature are those of Byrd (1987) and Sicular (1988), who examine the economic background from which the two-tier system was born and how the two mechanisms of resource allocation

¹The government still subsidizes the cost of accommodation for the employees of state-owned firms. In the extended family the young generation may be buying housing at the market price, but their parents may be employed by state-owned firms and enjoy the 'plan track' subsidy. An intergenerational household may thus be buying housing at both plan-track and market prices.

coexisted in China.² A stylized model of the Chinese economy, with DTP applied to agricultural products, is formulated by Bennett and Dixon (1996). In their model, if the government holds down the dual-track price, i.e., if it restricts the price at which coupons can be used to buy the plan-track quantity of agricultural goods, general economic performance is harmed. The income effect of the lower coupon price results in an increase in nominal demand by households, causing the market price of food to rise. The money wage therefore adjusts upward in free market industries, so that both the quantity of exports and output across the economy fall. Lau et al. (1997, 2000) examine the effects of shifting from central planning to DTP, in the first of these papers at the general equilibrium level and in the second in greater detail for a single good. They show that the introduction of a market track, alongside a plan track in which prices and quantities are fixed, yields a Pareto gain.³ Liu and Song (2003) consider the properties of the household demand function under DTP and make a comparison with the standard household demand model. They then aggregate demand functions for a good and focus on how market price elasticity with DTP differs from that in a free market, but they do not consider the effect of variation of dual track parameters on this market price.

²On the dual track programme overall (not just prices) in the Chinese industrial sector, see Wu and Zhao (1987).

³A recent paper by Che and Facchini (2007) shows that when the plan-track is not fully enforced introduction of DTP may be detrimental to some agents.

There is also a literature evaluating empirically the effects of DTP. Gao et al. (1996) apply Chinese urban food demand data to a DTP model and show that government subsidization of food for urban households led to an increase in market demand, so that the market prices of staple foods were pushed up. Similarly, Liew (1993) finds that government price controls on industrial products increased costs of production, so that removal of these controls would have reduced production cost and increased real national income, as well as diminishing the scope for corruption. Li, et al. (2000) develop a micro-model of the partial privatization of Chinese industries, and show that the decentralization of government control was an essential factor in the rapid growth of private industry in China.

The analysis that we undertake is complementary to that of Lau et al., our focus being the transition from DTP toward a market economy, rather than the transition from planning to DTP. We develop a household demand model in the presence of dual tracks, with allowance for endogenous determination of supply, and we use this model to examine the effects of reducing the role of the plan track; that is, of we consider the effects of raising the plan-track price and reducing the plan-track quantity. To incorporate the resale of plan-track quantities into the model, we assume that there are two different types of household: employees of state-owned enterprises, who benefit from the plan-track subsidy, and the non-state employees, all of whose purchases are at the market price. Under fairly mild

assumptions, relaxation of DTP leads to a fall in welfare for the former and a rise in welfare for the latter.⁴

We also analyze the effects of the relaxation of DTP on the average price of a good, i.e., on the weighted sum of the plan-track and the market price. But although it is the average price that enters the calculation the CPI and inflation, it is the marginal price faced by a household that is primarily what matters for its behaviour, and so when we interpret inflation data, changes in the average price will be less important if they result from changes in the plan-track price and quantity than if they are due to changes in market variables. Indeed, since the role of the plan track is primarily one of redistribution, the inflation resulting from its reform does not necessarily lead to an increase in the market price. We show that an increase in the plan-track price has a positive effect on the market price but a negative effect on the average price, with the strength of these effects depending on the elasticities of demand and supply of the good concerned. This implies that government should be aware that a single policy change could result in significantly different effects on the prices of different goods. We also show that the effect on demand of a market price change is smaller under DTP, than under a full market pricing.

⁴A related welfare discussion is found in Sah and Srinivasan (1988). They define government intervention as a lump-sum procurement of DTP goods (agricultural products), which has no effect on the market price. The effect of government policy on the welfare of rural households is directly through the implied tax.

The approach that we develop can be applied to any situation in which the market is mixed with price regulation. This applies, in particular, to economies that are still ‘socialist,’ or have not progressed far in the transition from socialism. For example, Cuba has operated a ‘segmented’ market system for many years that is similar to DTP, and in time of crisis it has increased the plan-track element to try and protect the standard of living of the poor (Togores and Garcia, 2004). The DTP model may also be seen as a natural way of modelling black markets associated with rationing, and it may be adapted to any situation in which the market is mixed with price regulation, including reform of the electricity market, reform of the national health system, and of any market in which free and regulated prices co-exist.

The rest of the paper is organized as follows. In Section 2 the basic model with a homogeneous household is introduced. The weighted average price is defined and the marginal effects on this average price and on the household’s welfare resulting from changes in policy variables are derived. In Section 3 the model is extended to cover two types of household and the possibility of resale of goods is allowed for. A simple welfare analysis of the winners and losers from reform of DTP is undertaken. Section 4 concludes, while proofs are given in an appendix.

2 A Representative Household Model

Consider an economy with two representative commodities, X and Y . The representative household's consumption of X and Y are denoted by x and y , respectively. We shall assume that commodity X is subject to DTP, while commodity Y is the *numéraire* (this can be viewed as leisure or as a composite commodity). The (relative) market price of X is denoted by p , while the market price of Y is unity. The household has an endowment of Y , which, for simplicity, we normalize to unity. In the absence of DTP the household would face the standard utility-maximization problem,

$$\begin{aligned} & \max_{x,y} U(x,y) \\ & \text{subject to } px + y \leq 1. \end{aligned}$$

Marshallian demand can be expressed as a function of marginal unit price and full income, m . Here, m is simply the endowment of Y , and so the Marshallian demand function for X is $x(p, 1)$.

With DTP, however, the household can purchase X on the 'plan track' up to the quantity \bar{x} at unit price \bar{p} . Any quantity above \bar{x} has to be purchased on the 'market track' (i.e., on the free market) at unit price p , where $p > \bar{p}$. Because we are considering a single representative household in this section, the issue of

whether it is possible for a household to trade the quantities bought on the plan track (or, equivalently, the ‘coupons’ entitling purchase on the plan-track) does not arise. The household’s problem is to solve

$$\begin{aligned} & \max_{x,y} U(x, y) \\ \text{subject to } & \bar{p}x + y \leq 1 \quad \text{when } x \leq \bar{x}; \\ & px + y \leq 1 + (p - \bar{p})\bar{x} \quad \text{when } x > \bar{x}. \end{aligned} \tag{1}$$

Here, if $x \leq \bar{x}$, the marginal (and intra-marginal) price facing the household is \bar{p} , while full income is the same as in the absence of DTP. However, if $x > \bar{x}$ the marginal price facing the household is the market price p . Since \bar{x} intra-marginal units are obtained at the price \bar{p} , full income must be adjusted to allow for the implicit subsidy $(p - \bar{p})\bar{x}$ that purchase at this lower price involves (see Dixon 1987; Bennett and Dixon 1996). Hence, $m = 1 + (p - \bar{p})\bar{x}$, and the Marshallian demand function becomes

$$\begin{aligned} x &= x(\bar{p}, 1) \quad \text{when } x \leq \bar{x}; \\ x &= x[p, 1 + (p - \bar{p})\bar{x}] \quad \text{when } x > \bar{x}. \end{aligned} \tag{2}$$

The arguments of the Marshallian demand function are the parameters of the

budget constraint, which is depicted in Figure 1. In the absence of DTP the household begins with an income of one unit of Y and can trade from $(0, 1)$ along the line of slope $-p$. With DTP the household begins at the same place on the y -axis, but can trade along the line of slope $-\bar{p}$ from $x = \bar{x}$, i.e., up to point $(\bar{x}, 1 - \bar{p}\bar{x})$, which is denoted by A in the figure. If the household purchases in this range its budget constraint is fully represented by the intercept $y = 1$ and the slope $-\bar{p}$. From \bar{x} to $B(0, \bar{x} + \frac{1-\bar{p}\bar{x}}{p})$ on the horizontal axis, it can only purchase additional units of X by trading along the line of slope $-p$. The same points could be reached if, instead of facing DTP, it faced the price p for all units and had an endowment of Y equal to $1 + (p - \bar{p})\bar{x}$, as shown by point $C(0, 1 + (p - \bar{p})\bar{x})$. Combining the segments for $x \leq \bar{x}$ and $x > \bar{x}$, the entire budget constraint is represented by the kinked thick line.

Fig 1 about here.

From (2), given that $p > \bar{p}$, a change in the free market price p has no effect on x if $x \leq \bar{x}$; but if $x > \bar{x}$,

$$\frac{dx}{dp} = x_p + \bar{x}x_m.$$

We assume throughout that $x_p < 0$ and $x_m > 0$,⁵ and so the sign of dx/dp is

⁵A subscript is used to denote the partial derivative with respect to the variable subscripted.

unclear here. However, denoting the compensated Slutsky term by S , we have⁶

$$x_p = S - xx_m. \quad (3)$$

Eliminating x_p , we therefore obtain

$$\frac{dx}{dp} = S - (x - \bar{x})x_m < 0. \quad (4)$$

Since $S < 0$, we have that $dx/dp < 0$. The presence of the DTP quantity \bar{x} in (4) makes the income effect of a market price change smaller, since it only applies to the market-track portion of consumption. It also implies that the effect on demand of a market price change is smaller under DTP than under a full market regime.

2.1 The Supply Function

Under DTP, some output is supplied at the plan-track price, but we assume that total supply will be determined by the marginal price p , i.e., by the market price.

The supply function (in per household terms) is assumed non-decreasing in p ; that

⁶A different form of Slutsky equation for DTP is formulated by Liu and Song (2003). Whereas we specify market price as the parameter that is varied, in their specification the plan-track quantity plays this role. Also, whereas we have the household's total demand for X as the endogenous variable, they have the household's market demand.

is, the elasticity of supply with respect to p , ϵ_p^s , is non-negative:

$$x^s = x^s(p); \quad \epsilon_p^s = \frac{1}{x^s} p x_p^s \geq 0. \quad (5)$$

For simplicity, we shall assume throughout that the plan-track quantity is no greater than the profit-maximizing supply at the plan-track price:⁷

$$\bar{x} \leq x^s(\bar{p}).$$

The plan-track price for suppliers is assumed equal to the plan-track price for consumers. Thus, compared to the market economy, the DTP system operates as a tax on suppliers, transferring to consumers a portion of profit. If we denote the profit function corresponding to (5) as $\pi(p)$, then total profit under DTP is

$$\Pi = \pi(p) - (p - \bar{p})\bar{x}.$$

2.2 The CPI

In this section we explore how changes in plan-track parameters affect the *weighted average* P of the plan-track and market prices for the representative DTP good

⁷Given that $\bar{x} > 0$, this implies that variable costs are covered at the plan-track price.

X , where⁸

$$P \equiv \frac{\bar{x}}{x}\bar{p} + \frac{x - \bar{x}}{x}p. \quad (6)$$

Here, since X is representative of the basket of DTP goods, we shall refer to P interchangeably, as the consumer price index (CPI) or the average price, according to context. However, when we consider heterogeneous households in Section 3, the average prices paid will differ across households and so we shall define the CPI to be a weighted average of these average prices.

The condition for market clearing is

$$x[p, 1 + (p - \bar{p})\bar{x}] = x^s(p). \quad (7)$$

This is depicted in Figure 2, where U is an indifference curve and the equilibrium occurs at E . Here, P is represented by (minus) the slope of the line connecting E with the endowment point on the y -axis. This is the ratio, when consuming x , of the amount of Y forgone to the quantity x . Given that $x^s > \bar{x}$, we have that

⁸Here, we use a linear function for the weighted average price P , but other formulae, such as Cobb–Douglas, could be used. The important thing is that P should depend on both the plan-track and the free-market prices.

$$p > P > \bar{p}.$$
⁹

Fig 2 about here.

To analyze the role of DTP in price liberalization, we consider the effects of an increase in \bar{p} or a decrease in \bar{x} (we call each of these reforms ‘transitional policy’) first on the free market price and then on the CPI.

Proposition 1 *In a representative household model, transitional policy reduces the market price, i.e., $\frac{dp}{d\bar{p}} < 0 < \frac{dp}{d\bar{x}}$.*

An increase in the plan-track price \bar{p} cuts the implicit subsidy $(p - \bar{p})\bar{x}$ given to the household, thereby reducing its full income. Consequently, its demand for X falls, negatively affecting the market price p . The market equilibrium shifts along the supply curve. If this has a positive slope the quantity supplied is reduced, so that the overall fall in p is dampened. A decrease in the plan-track quantity \bar{x} reduces the implicit subsidy, with effects that are qualitatively the same as just described. Thus, the market equilibrium price falls when the government steadily shifts the DTP system to a competitive market regime.

According to (6), the direct effect on the CPI, P , of an increase in the plan-track price \bar{p} is positive. However, since $dp/d\bar{p} < 0$, there is also a negative indirect

⁹In China, a high inflation rate was officially recognized in the late 1980s, when the government began price liberalisation, starting with an increase of the interest rate. Tight controls were re-instituted in the austerity programmes of 1986 and 1988, reducing government expenditure and freezing some long-term capital investments. However, the controls were relaxed later to allow the growth of the non-state sectors, and regulated prices were raised (Lin 2004). In line with our analysis, inflation of the average price was partly due to an increase of plan-track price.

effect on the CPI through the induced change in the market price. Let ϵ_p denote price elasticity of demand and ϵ_m the income elasticity of demand. Our next proposition gives the effects of reform of DTP on the CPI.

Proposition 2 *If X is normal and its supply is non-decreasing in price p , transitional policy inflates the CPI, i.e., $\frac{dP}{d\bar{p}} > 0 > \frac{dP}{d\bar{x}}$.*

We therefore have a paradoxical situation: when the government raises the controlled price, the CPI is pushed up but the market equilibrium price is reduced. The effects of a higher level of \bar{p} , with \bar{x} constant, are illustrated in Figure 3, in which the supply of X is also fixed (we assume that $\bar{p} < p$ throughout). As in Figure 2, the household is at equilibrium point E initially. When \bar{p} is raised the plan-track segment of the budget line, the downward-sloping line from point B (0, 1), rotates clockwise about point B. Assuming momentarily that p is unchanged, the budget line becomes BCD, the sharpness of the kink having been reduced. The household consumes at point F on CD, which, given that X is normal, is to the left of E. As there is now an excess supply of X , its market price p falls; i.e., the right-hand portion of the budget line rotates anti-clockwise around point C. Given that the quantity of X supplied is unchanged, the rotation occurs until the quantity of X demanded is at its original level. The new solution is at point G. Recall that the average price of X in the original situation was minus the slope of BE. Thus, it

has changed to minus the slope of BG, and therefore the CPI has increased.¹⁰

Fig 3 about here.

Our analysis indicates that if the plan-track price of a good is raised, the price observed in the market will fall, but that the CPI will rise. In a fuller model, however, the role of commodity Y might be specified further. Suppose that Y is leisure time for the urban household and that leisure is normal. A rise in \bar{p} results in a fall in the quantity of leisure consumed; i.e., there is an increase in the quantity of urban labour supplied. If the supply of manufactures therefore rises, this will have an offsetting, negative, effect on the price level for the economy as a whole. A reduction in \bar{x} has similar effects.

As an illustration of these effects, consider the ‘first-round inflation’ that occurred in China in the late 1980s and was regarded as a major set-back to Chinese economic reform (Bell et al., 1993, and Jaggi et al., 1996). In contrast to the ‘second-round inflation’ in 1995, which is generally attributed to over-investment in urban areas (Gang, 1994) this was primarily caused by changes in government policy under the dual-track system. To bolster incentives for farmers, from 1979 onwards, the government increased procurement prices and permitted farmers to

¹⁰The discussion of the diagram here does not cover what happens if the supply of X changes. However, as long as the transitional market price falls, the respond of supply has no effect on our results.

trade excess output at market prices; but food was still allocated to urban residents at a low price by the plan-track system. This contributed, during the first half of 1980s, to an enormous increase in the government's budget deficit.¹¹ To alleviate this problem, in 1985 the procurement system was switched from a mandatory purchase quota system to a voluntary contract procurement system (in effect reducing \bar{x}), with the aim of encouraging farmers to sell more products in the free market. This switch led to substantial inflation of the average food price P , and consumer price inflation rose steadily from 8.8% in 1985 to 17.8% in 1989 (State Statistical Bureau, 2003, p. 313).¹²

2.3 Welfare

We have seen how a change in the plan-track price affects the market equilibrium and CPI. The CPI is the price that should be used for calculating the various price indices in the economy, and hence the rate of inflation. However, as argued in Bennett and Dixon (1995, 1996), if we are interested in household behaviour the most relevant price is the *marginal price*, which under DTP is the market price p . Furthermore, using the indirect utility function, it plays an important role in

¹¹According to Gang (1994) the budget deficit grew by 100%, 99.1% and 284.3% in 1983, 1985 and 1988 respectively. As economic reform in urban areas only began in 1986, this increase in the government deficit was mainly from the rise in procurement price and investment in rural areas.

¹²By 1990, a national trading centre for grains was established and agricultural wholesale markets were developed throughout the country, symbolically ending the dual track system for agricultural products in China (Jaggi et al., 1996).

measuring household welfare.

First, consider of the representative household model. Corresponding to $U(x, y)$, given that $x > \bar{x}$, the indirect utility function for the representative household is

$$v = v[p, 1 + (p - \bar{p})\bar{x}]. \quad (8)$$

Proposition 3 *Transitional policy changes decrease the welfare of the representative household, i.e., $\frac{dv}{d\bar{p}} < 0 < \frac{dv}{d\bar{x}}$.*

Thus, household indirect utility is reduced by the reforms of raising \bar{p} and lowering \bar{x} , despite the increase that may occur in the average price. However, this result would not necessarily arise if we were also to consider the general equilibrium ramifications. Reform will increase the profits of the SOEs: the change in profits of the SOEs is exactly equivalent to the change in the implicit subsidy $(p - \bar{p})\bar{x}$ induced by the reforms. Since the DTP is in effect a lump-sum transfer from the producer to the consumer, reform merely serves to redistribute away from the consumer to the producer. In this case, a household covered by the DTP system would be a loser from the full liberalization of prices. However, in a capitalist economy the profits of the firm find their way into the household's budget constraint and so such reforms would not reduce welfare. This implies that when resale is not possible, or is limited, convergence of the plan track price to the higher, market price level is damaging for households, though state collects more profits from SOEs.

3 Heterogeneous Households

We now drop the assumption that households are homogeneous, for we can then allow for the possibility of resale. Resale of agricultural products emerged in the late 1980s, though it has never been officially recognized. A common sight then was the man with a bicycle wandering in cities, buying official coupons for food and clothes at a lower price and selling them back to state supply agents at the government issue price. However, resale has been heavily regulated in some markets, such as foreign exchange (Jaggi et al., 1996) and there are some products, such as housing, for which resale has not been not commonly practiced.

For simplicity, we assume that there are no effective legal restrictions or other frictions on resale. Commodity X therefore exchanges in the resale market at the market-clearing price p . Rather than allowing a continuum of types, we focus on a case of particular relevance to the Chinese economy. There are two types of household in the model, which we index by the superscripts 1 and 2. The proportion α of urban residents is assumed to be employed in the state sector (type-1 households), while the proportion $1 - \alpha$ comprises residents employed in the urban non-state sector (type-2 households).¹³ A type-1 household is allocated a plan-

¹³For simplicity, we exclude the ‘floating population’ of rural workers unofficially inhabiting urban areas. Although there has been some relaxation of the Chinese household registration (hukou) system since the late 1990s, it is still very difficult for rural workers without urban citizenship to find a stable job in urban area. So the wage rate differs significantly between floating urban residents and permanent urban residents. Brooks and Tao (2003) show that the percentage of permanent urban residents employed in state units, which we represent by α in this paper, was 67.0, 73.0, 76.4 and 43.9, in 1980, 1990, 1995, and 2000 respectively.

track ration \bar{x} , while a type-2 household is allocated no ration at all. We also allow for different endowments of Y being held by the two types.

The representative type-1 household faces the problem

$$\begin{aligned} & \max_{x^1, y^1} U(x^1, y^1) \\ \text{subject to } & px^1 + y^1 \leq \bar{y}^1 + (p - \bar{p})\bar{x} \equiv m^1, \end{aligned} \tag{9}$$

where \bar{y}^1 is its endowment of Y . Unlike in (1), the budget line is not kinked. Because resale is possible, household 1 can be thought of as always selling its entire plan-track allocation to gain the implicit subsidy $(p - \bar{p})\bar{x}$, and then buying the amount it wishes to consume. The implicit subsidy is a component of its full income m^1 .

The problem for the representative type-2 household is

$$\begin{aligned} & \max_{x^2, y^2} U(x^2, y^2) \\ \text{subject to } & px^2 + y^2 \leq \bar{y}^2 \equiv m^2. \end{aligned} \tag{10}$$

Because a type-2 household does not receive a plan-track allocation of X , its full income m^2 is simply its endowment \bar{y}^2 .

The solutions to (9) and (10) yield the Marshallian demand functions

$$\begin{aligned}x^1 &= x[p, \bar{y}^1 + (p - \bar{p})\bar{x}] \\x^2 &= x(p, \bar{y}^2).\end{aligned}$$

Total demand for X is

$$x = \alpha x^1 + (1 - \alpha)x^2.$$

Corresponding to (4), we have

$$\begin{aligned}\frac{dx^1}{dp} &= x_p^1 + x_m^1 \bar{x} = S^1 - (x^1 - \bar{x})x_m^1; \\ \frac{dx^2}{dp} &= x_p^2.\end{aligned}\tag{11}$$

Although $dx^2/dp < 0$, dx^1/dp may take either sign. Without the possibility of resale, as discussed above, the household can only gain the implicit income when it consumes more than its government subsidy. With resale, the type-1 household gains an implicit income, even though it consumes less than the government subsidy \bar{x} . Eq. (11) shows that when the consumption x^1 of DTP goods for a type-1 household is smaller than the plan-track quantity \bar{x} , dx^1/dp is only negative if the compensated demand change is numerically greater than the income effect, and vice versa. However, when the consumption of DTP goods is greater than the plan-track quantity for a type-1 household, dx^1/dp is always negative. In Figure 4

we demonstrate how an increase in market price can increase the consumption of X by a type-1 household. As \bar{x} and \bar{p} are fixed, an increase in market price raises the implicit income of the type-1 household. This is depicted as the clockwise rotation around point A of the budget line from BC to LN. The tangency of an indifference curve with the new budget line occurs at M, which is the new equilibrium for the type-1 household. In this case the increase in p causes the type-1 household to consume more (moving from E to M).¹⁴

Fig 4 about here.

3.1 Effects on Price Indices

The market-clearance condition is now

$$\alpha x^1[p, \bar{y}^1 + (p - \bar{p})\bar{x}] + (1 - \alpha)x^2(p, \bar{y}^2) = x^s. \quad (12)$$

¹⁴Figure 4 represents the case in which the household consumption of the DTP good is less than the plan-track quantity allocation. When, instead, it consumes more than this allocation, starting at a point on AC, the price change causes it to shift to a point on AN.

Differentiating (12) and combining it with the Slutsky equation (3) for each type of household yields

$$\frac{dp}{d\bar{p}} = \frac{\alpha\bar{x}x_m^1}{\Delta}, \quad (13)$$

$$\frac{dp}{d\bar{x}} = \frac{-\alpha(p - \bar{p})x_m^1}{\Delta}. \quad (14)$$

where

$$\Delta = \alpha S^1 + (1 - \alpha)S^2 - x_m^1(x^s - \alpha\bar{x}) - (1 - \alpha)x^2(x_m^2 - x_m^1) - x_p^s. \quad (15)$$

If $x_m^1 \leq x_m^2$ and $x^s - \alpha\bar{x} \geq 0$, then, given that $S^1 < 0$ and $S^2 < 0$, we have $\Delta < 0$.

Since both types of household face the same market price p , the condition $x_m^1 \leq x_m^2$ holds for many common specifications of preferences. Thus, homothetic and quasi-homothetic preferences with linear Engel curves have $x_m^1 = x_m^2$. Furthermore, much of DTP has been of necessities - for example, many foods and housing. To the households employed in the non-state sector, without the direct allocation from the plan-track, those goods may be considered more as luxuries compared to the households with government subsidy, who pay less for those goods in money terms. Therefore, we view $x_m^1 < x_m^2$ as a reasonable assumption, reflecting a concave Engel curve. $\alpha\bar{x}$ is the total ration allocated by the central planning system, which is part of the total supply of X . This gives our next proposition.

Proposition 4 *Assume that $x_m^1 \leq x_m^2$ and $x^s - \alpha\bar{x} \geq 0$. With resale, transitional policy reduces the market price, i.e. $\frac{dp}{d\bar{p}} < 0 < \frac{dp}{d\bar{x}}$.*

Thus, we have found that the effect of transitional policy on market equilibrium price is negative, with or without the opportunity for resale of the rationed quantity.

The next question is, what do we mean by the CPI now? In effect, each type of household faces a different average price, since the mix of market- and plan-track differs between them. The type-1 household faces an average price $\left(\frac{x^1 - \bar{x}}{x^1}\right)p + \frac{\bar{x}}{x^1}\bar{p}$, while the type-2 household faces an average price that is the same as the market price, p . Since the type-1 household buys the proportion $\frac{x^1}{x}$ of the total goods supply, where x denotes total demand for good X , while the type-2 household buys the proportion $\frac{x^2}{x}$, the CPI can be written,

$$P = \alpha \frac{x^1}{x} \left[\left(\frac{x^1 - \bar{x}}{x^1} \right) p + \frac{\bar{x}}{x^1} \bar{p} \right] + (1 - \alpha) \frac{x^2}{x} p \quad (16)$$

where $\frac{\bar{x}}{x}$ is the ratio of goods allocated through the plan-track to the total supply, which is multiplied by the proportion of the population that is officially covered by the plan-track system, to obtain the proportion $\alpha \frac{\bar{x}}{x}$ of DTP goods. Given (12), (16) simplifies to,

$$P = p - \alpha \frac{\bar{x}}{x^1} (p - \bar{p}). \quad (17)$$

When the resale market is available, the two types of household face the CPI above. Compared to Eq. (6), the CPI is reduced when resale is possible, as $\alpha < 1$. When the proportion $\alpha = 1$, and the two models become the same.

Proposition 5 *Assuming that $x_m^1 \leq x_m^2$ and $x^s - \alpha\bar{x} \geq 0$, with resale, transitional policy increases the CPI, i.e., $\frac{dP}{d\bar{p}} > 0 > \frac{dP}{d\bar{x}}$.*

We conclude that with or without the possibility of resale, transitional policy conditionally deflates the market price while inflating the CPI of DTP goods.

3.2 Winners and Losers

With the two types of household and resale, the indirect utility functions are

$$\begin{aligned} v^1 &= v[p, \bar{y}^1 + (p - \bar{p})\bar{x}]; \\ v^2 &= v(p, \bar{y}^2). \end{aligned}$$

Using these functions, we obtain our last proposition.

Proposition 6 *When resale is possible, transitional policy reduces the welfare of a type-1 household, i.e., $\frac{dv^1}{d\bar{p}} < 0 < \frac{dv^1}{d\bar{x}}$; but it raises the welfare of a type-2 household, i.e., $\frac{dv^2}{d\bar{p}} > 0 > \frac{dv^2}{d\bar{x}}$.*

Irrespective of whether resale is possible, transitional policy reduces the implicit subsidy component of the type-1 household's full income and therefore re-

duces its welfare. Without resale, transitional policy has no effect on the welfare of a type-2 household; but with resale, since transitional policy causes the market price to go down, the welfare of a type-2 household rises. When the DTP system is being transformed toward a the full market economy, it creates both winners and losers, in terms of welfare.

This is a striking comparison to Lau et al. (1997, 2000), who consider an economy in which the existing plan-track obligations must still be fulfilled, so that rents implicit in the plan are maintained, but agents are free to produce and trade at the margin, thereby creating the opportunity for Pareto gains. In contrast, in our analysis the value of lump-sum transfers from suppliers to consumers is endogenously determined, so that the value of rents is not maintained. Thus, the reform from DTP to a fully market economy is not Pareto improving. Since the potential loss of rents may generate opposition, this suggests that the latter stage of reform may involve political problems that are not present in the earlier stage.

4 Conclusion

In this paper we formulate a rigorous microeconomic model of the DTP system for households. We use this model to analyze ‘transitional policy,’ which we characterize as a reduction in the plan-track quantity and a rise in the plan-track price. We identify three different price indices for DTP goods: the plan-track price, the

free-market price and the weighted average price (CPI). We consider how the market price and the CPI change when plan-track policy variables (price and quantity) are adjusted during the reform process. A message of the paper is that we need to be careful in interpreting price or inflation data in transition economies because the measured CPI does not always reflect ‘true’ prices.

We show that reform leads to a reduction in the free market price but an increase in the CPI. An implication is that under a dual-track system inflation can result from transitional policy or from market factors (demand and supply). In China, when the market track was still relatively small compared to the plan track, variation in the rate of inflation of the CPI was primarily caused by changes of government policy through plan track prices and quantities; that is, the government still had a considerable influence over the economy through these fiscal controls. However, as transitional policy shrinks the plan track, the government’s ability to control over inflation diminishes, and insofar as it attempts to do so through significant variation of the plan-track prices and quantities for commodities still in the dual-track system, considerable distortions in resource allocation will result.

To allow for the possibility of resale, we consider two different types of household: state employees, who benefit from the plan-track subsidy, and the non-state employees, all of whose purchases are at the market price. Under relatively mild

assumptions (e.g. linear Engel curves) transitional policy leads to a fall in the welfare of state employees. Non-state employees, who have been the engine of growth in China, experience an increase in welfare. Whilst we have developed the partial equilibrium framework for understanding DTP, an extension would be to embed it in a simple general equilibrium framework. This would involve modelling firms (both SOE and private) and the government.

Appendix 1: Proofs

Proposition 1

From (7), $(x_p + x_m \bar{x})dp - x_m \bar{x}d\bar{p} + x_m(p - \bar{p})d\bar{x} = x_p^s dp$. Hence, using (3) to eliminate x_p , we have

$$\frac{dp}{d\bar{p}} = \frac{x_m \bar{x}}{S - (x - \bar{x})x_m - x_p^s} < 0; \quad (18)$$

$$\frac{dp}{d\bar{x}} = \frac{-(p - \bar{p})x_m}{S - (x - \bar{x})x_m - x_p^s} > 0. \quad (19)$$

Proposition 2

Differentiating (6) w.r.t. \bar{p} , we then obtain ¹⁵

$$\frac{dP}{d\bar{p}} = \frac{dp}{d\bar{p}} + \left(1 - \frac{dp}{d\bar{p}}\right) \frac{\bar{x}}{x} + (p - \bar{p}) \frac{\bar{x}}{(x)^2} x_p \frac{dp}{d\bar{p}}. \quad (20)$$

By assumption,

$$\epsilon_p = \frac{p}{x} \frac{dx}{dp} < 0, \quad (21)$$

$$\epsilon_p^s = \frac{p}{x^s} \frac{dx^s}{dp} > 0. \quad (22)$$

¹⁵We use brackets with superscript 2, $(x)^2$ to define x square function. The superscript 2 without brackets represents variables for the type-2 household.

Substituting (21) into (20) gives

$$\frac{dP}{d\bar{p}} = \frac{\bar{x}}{x} + \left(\frac{x - \bar{x}}{x} + \frac{p - \bar{p}}{p} \frac{\bar{x}}{x} \epsilon_p \right) \frac{dp}{d\bar{p}}.$$

Substituting for $\frac{dp}{d\bar{p}}$ from (18) and using $x = x^s$ gives

$$\frac{dP}{d\bar{p}} = \frac{\bar{x}}{x} \frac{1}{S - (x - \bar{x})x_m - x_p^s} \left[S - \frac{x}{p} (\epsilon_p^s - \frac{(p - \bar{p})\bar{x}}{m} \epsilon_m \epsilon_p) \right] > 0. \quad (23)$$

Differentiating (6) w.r.t. \bar{x} , we obtain

$$\begin{aligned} \frac{dP}{d\bar{x}} &= \frac{dp}{d\bar{x}} - \frac{\bar{x}}{x} \frac{dp}{d\bar{x}} + \frac{1}{x} (\bar{p} - p) + (p - \bar{p}) \frac{\bar{x}}{(x)^2} x_p \frac{dp}{d\bar{x}} \\ &= \left(\frac{x - \bar{x}}{x} + \frac{p - \bar{p}}{p} \frac{\bar{x}}{x} \epsilon_p \right) \frac{dp}{d\bar{x}} - \frac{1}{x} (p - \bar{p}). \end{aligned}$$

Substituting for $\frac{dp}{d\bar{x}}$ from (19) and using $x = x^s$, we obtain

$$\frac{dP}{d\bar{x}} = -\frac{p - \bar{p}}{x} \frac{1}{S - (x - \bar{x})x_m - x_p^s} \left[S - \frac{x}{p} (\epsilon_p^s - \frac{(p - \bar{p})\bar{x}}{m} \epsilon_m \epsilon_p) \right] < 0. \quad (24)$$

Proposition 3

Differentiating (8), and using Roy's identity,

$$\frac{dv}{d\bar{p}} = v_p \frac{dp}{d\bar{p}} + v_m \left(\frac{dp}{d\bar{p}} - 1 \right) \bar{x} = -v_m \left[\frac{dp}{d\bar{p}} (x - \bar{x}) + \bar{x} \right].$$

Hence, substituting for $\frac{dp}{d\bar{p}}$ from (13), we have

$$\frac{dv}{d\bar{p}} = -v_m \bar{x} \left[\frac{S - x_p^s}{S - (x - \bar{x})x_m - x_p^s} \right] < 0.$$

Similarly, assuming $p > \bar{p}$ and $v_m > 0$, it is found that

$$\frac{dv}{d\bar{x}} = v_m \left[-\frac{dp}{d\bar{x}}(x - \bar{x}) + (p - \bar{p}) \right] = v_m(p - \bar{p}) \left[\frac{S - x_p^s}{S - (x - \bar{x})x_m - x_p^s} \right] > 0.$$

Proposition 5

Differentiating (17) w.r.t. \bar{p} yields

$$\frac{dP}{d\bar{p}} = \alpha \frac{\bar{x}}{x^1} + \left[\alpha \frac{\bar{x}}{x^1} \frac{p - \bar{p}}{p} \epsilon_p^1 + (1 - \alpha \frac{\bar{x}}{x^1}) \right] \frac{dp}{d\bar{p}}. \quad (25)$$

$$\frac{dP}{d\bar{x}} = -\frac{\alpha}{x^1} (p - \bar{p}) + \left[\alpha \frac{\bar{x}}{x^1} \frac{p - \bar{p}}{p} \epsilon_p^1 + (1 - \alpha \frac{\bar{x}}{x^1}) \right] \frac{dp}{d\bar{x}}. \quad (26)$$

Substituting for $\frac{dp}{d\bar{p}}$ from (13) and using $x = x^s > x^1$, we obtain

$$\frac{dP}{d\bar{p}} = \frac{\alpha \frac{\bar{x}}{x^1} [\alpha S^1 + (1 - \alpha)S^2 - (1 - \alpha)x^2 x_m^2 - x_p^s - \alpha x_m^1 (x^s - x^1)]}{\alpha [S^1 - x_m^1 (x^1 - \bar{x})] + (1 - \alpha)(S^2 - x^2 x_m^2) - x_p^s} > 0.$$

Similarly, substituting for $\frac{dp}{d\bar{x}}$ from (14), we have

$$\frac{dP}{d\bar{x}} = \frac{-\alpha \frac{(p-\bar{p})}{x^1} [\alpha S^1 + (1-\alpha)S^2 - (1-\alpha)x^2 x_m^2 - x_p^s - \alpha x_m^1(x^s - x^1)]}{\alpha[S^1 - x_m^1(x^1 - \bar{x})] + (1-\alpha)(S^2 - x^2 x_m^2) - x_p^s} < 0.$$

Proposition 6

For a type-1 household, using Roy's identity,

$$\frac{dv^1}{d\bar{p}} = v_p^1 \frac{dp}{d\bar{p}} + v_m^1 \left(\frac{dp}{d\bar{p}} - 1 \right) \bar{x} = -v_m^1 \left[\frac{dp}{d\bar{p}} (x^1 - \bar{x}) + \bar{x} \right].$$

Hence, substituting for $\frac{dp}{d\bar{p}}$ from (13), we have

$$\frac{dv^1}{d\bar{p}} = -v_m^1 \bar{x} \left[\frac{\alpha x_m^1 (x^1 - \bar{x})}{\Delta} + 1 \right].$$

We have seen in the text that if $x_m^1 < x_m^2$, then $\Delta < 0$. Using this with the assumption in case 1, that $x^1 - \bar{x} \leq 0$, it is seen here that $\frac{dv^1}{d\bar{p}} < 0$.

Similarly,

$$\frac{dv^1}{d\bar{x}} = v_m^1 (p - \bar{p}) \left[\bar{x} + \frac{\alpha (x^1 - \bar{x}) x_m^1}{\Delta} \right]$$

and so $\frac{dv^1}{d\bar{x}} > 0$.

Likewise, for a type-2 household, as Proposition 3 holds, that is $\frac{dp}{d\bar{p}} < 0 < \frac{dp}{d\bar{x}}$,

$$\frac{dv^2}{d\bar{p}} = -v_m^2 x^2 \frac{dp}{d\bar{p}} > 0; \quad \frac{dv^2}{d\bar{x}} = -v_m^2 x^2 \frac{dp}{d\bar{x}} < 0.$$

When $x^1 - x > 0$, we have $-1 < \frac{\alpha x_m^1(x^1 - \bar{x})}{\Delta} < 0$, as $\alpha x_m^1(x^1 - \bar{x}) < |\Delta|$. Then,

$$\frac{dv^1}{d\bar{p}} = -v_m^1 \bar{x} \left[\frac{\alpha x_m^1(x^1 - \bar{x})}{\Delta} + 1 \right] < 0$$

Similarly,

$$\frac{dv^1}{d\bar{x}} = v_m^1 (p - \bar{p}) \left[\bar{x} + \frac{\alpha(x^1 - \bar{x})x_m^1}{\Delta} \right] > 0.$$

References

- [1] Bell, M.W., K. Kochlar and H.E.Khor (1993), 'China at the threshold of a market economy,' Occasional Paper No.107. Washington: IMF.
- [2] Bennett, J., and H.D. Dixon (1995), 'Macroeconomic equilibrium and reform in a transitional economy,' *European Economic Review* 39, p.1465-1485.
- [3] Bennett, J., and H.D. Dixon (1996), 'A macrotheoretic model of the Chinese economy,' *Journal of Comparative Economics* 22, p.277-294.
- [4] Brooks, R., and R. Tao (2003), 'China's labour market performance and challenges,' IMF Working Paper, WP/03/210.
- [5] Byrd, W. A. (1987), 'The impact of the two-tier plan/market system in Chinese industry,' *Journal of Comparative Economics* 11, 295–308.
- [6] Che, J., and G. Facchini (2007), 'Dual track liberalization: with and without losers,' *Journal of Public Economics* 91, 2291-2306.
- [7] Dixon, H. D. (1987), 'The general theory of household and market contingent demand,' *The Manchester School of Economics and Social Studies* 45, 287–304.
- [8] Gang, F. (1994), 'Incremental Changes and Dual Track Transition: Understanding the Case of China,' *Economic Policy* 9, 100-122.

- [9] Gao, X. M., E.J. Wailes and G.L. Cramer (1996), 'Partial rationing and Chinese urban household food demand analysis,' *Journal of Comparative Economics* 22, 43–62.
- [10] Jaggi, G., M. Rundle, D. Rosen and Y. Takahashi (1996), 'China's economic reforms: chronology and statistics,' Peterson Institute for International Economics Working Paper 96-5, Washington D.C.
- [11] Lau, L. J., Y.Y. Qian and G. Roland (1997), 'Pareto-improving economic reforms through dual-track liberalization,' *Economics Letters* 55, 285–292.
- [12] Lau, L. J., Y.Y. Qian and G. Roland (2000), 'Reform without losers: an interpretation of China's dual-track approach to transition,' *Journal of Political Economy*, 108, 120-143.
- [13] Li, S., Li, S. and W.Y. Zhang (2000), 'The road to capitalism: competition and institutional change in China,' *Journal of Comparative Economics* 28, 269–292.
- [14] Liew, L. (1993), 'Rent-seeking and the two-track price system in China,' *Public Choice* 77, 359-375, 1993.
- [15] Lin, J. Y. (2004), 'Lessons of China's transition from a planned economy to a market economy,' Leon Kozminski Academy of Entrepreneurship and Man-

agement (WSPiZ) and TIGER Distinguished Lectures Series n.16, Warsaw, 17 December, 2004.

- [16] Liu, G.S. and H. Song (2003), 'A dual-price demand theory for economies under transition,' *Journal of Chinese Economics and Business Studies*, 1, 185-203.
- [17] Sah, R. K. and T.N. Srinivasan (1988), 'Distributional consequences of rural food levy and subsidized urban rations,' *European Economic Review* 32, 141–159.
- [18] Sicular, T. (1988), 'Plan and market in China's agricultural commerce,' *Journal of Political Economy* 92, 283–307.
- [19] State Statistical Bureau (2003), *China Statistical Yearbook*, China Statistics Press, Beijing.
- [20] Togores, V. and A. Garcia (2004), 'Consumption, markets, and monetary duality in Cuba,' in J. Dominguez, O.E. Perez Villanueva, and L. Barberia, eds., *The Cuban Economy at the Start of the Twenty-First Century*, Cambridge, Mass.: Harvard University Press, 245-295.
- [21] Wu, J. L. and R.R. Zhao (1987), 'The dual pricing system in China's industry,' *Journal of Comparative Economics* 11, 309–318.

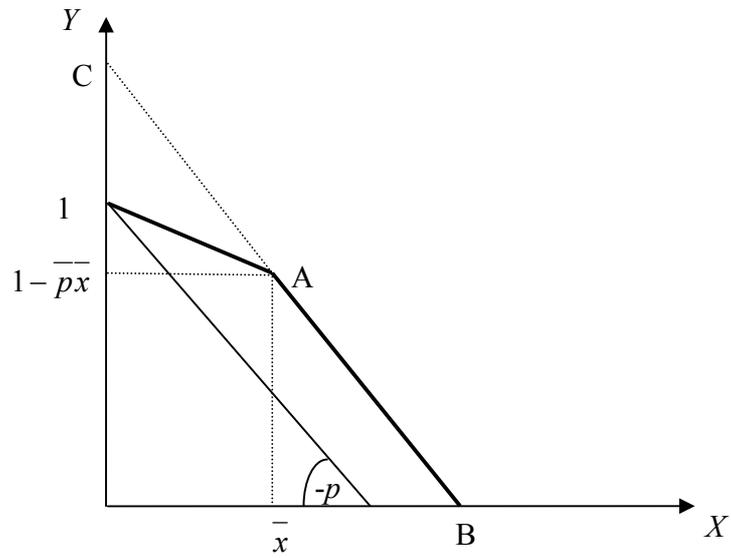


Figure 1: The Budget Constraint under DTP

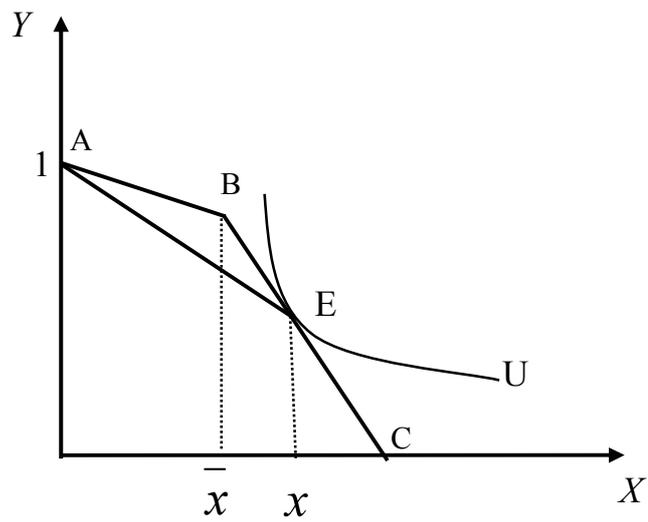


Figure 2: The Average Price of a DTP Good

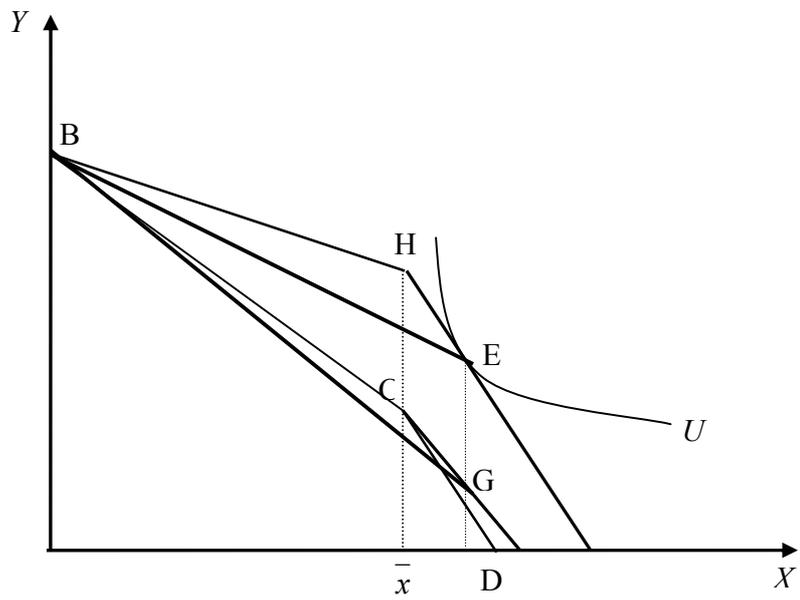


Figure 3: An Increase in the Plan-Track Price

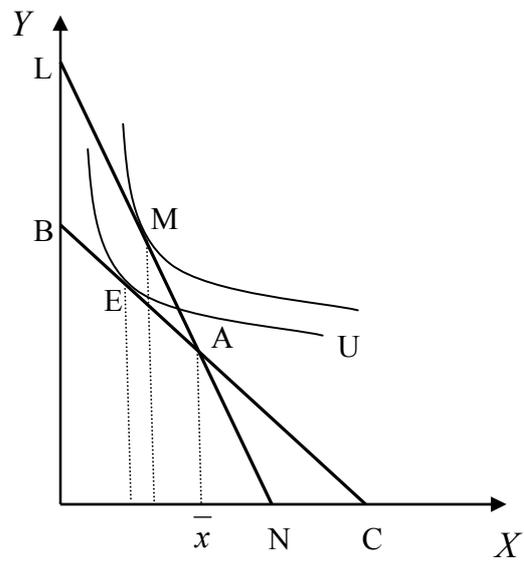


Figure 4: The Effect on a Type-1 Household of an Increase in the Market Price