北京大学中国经济研究中心
China Center for Economic Research

讨论稿系列
Working Paper Series

No. E2008001 2008-04

The Economics of Price Scissors: An Empirical Investigation for China*

Justin Lin[I] Miaojie Yu[II]

China Center for Economic Research, Peking University

NO. E 2008001 April 2008

---

* We thank Joaquim Silvestre, Arne Bigsten, Chia-Shang Chu, Yundan Gong, John Knight, David Li, Zhigang Li, Christer Ljungwall, Jie Ma, Chor-yin Sin, Zheng Song, Yong Wong, Bin Xu, and Dingbo Xu for their helpful comments. We also thank seminar and conference participants at Göteberg University, the 2007 CERC-CCER world economy on China at the Stockholm School of Economics (SSE), the third annual global institute China-Russia international conference, CCER, School of Economics of Peking University, China Europe International Business School (CEIBS), Fudan University, WISE of Xiamen University, and Seoul National University for their comments. We also thank Wei Tian and Min Zhang for their excellent research assistance. All remaining errors are ours.

[I] Director and Professor, China Center for Economic Research, Peking University, Beijing 100871, China. Phone: 86-10-6275-3082, Fax: 86-10-6275-1474, Email: justinlin@ccer.pku.edu.cn.

[II] Assistant Professor, China Center for Economic Research, Peking University, Beijing 100871, China. Phone: 86-10-6275-3109, Fax: 86-10-6275-1474, Email: mjyu@ccer.pku.edu.cn.

The Economics of Price Scissors: An Empirical Investigation for China*

Justin Lin[III] Miaojie Yu[IV]

China Center for Economic Research, Peking University

NO. E 2008001 April 2008

ABSTRACT：The Sah-Stiglitz "Economics of Price Scissors" model, concerning the political economy of price scissors, formulates the optimal terms of trade against peasants. In the present paper, by extending this model to an open economy and allowing agricultural rationing, we first check if the model stands up to China’s data and, if so, we estimate its key structural parameters. Using province-level panel data from 1949-1992, we find that the importance of peasants in the government’s objective function is less than the importance of workers. In addition, the importance of consumption is also less than that of investment. Such findings are consistent the reality in China.

JEL: F1, O1

Keywords: China, Price Scissors, Trade, Political Economy

---

* We thank Joaquim Silvestre, Arne Bigsten, Chia-Shang Chu, Yundan Gong, John Knight, David Li, Zhigang Li, Christer Ljungwall, Jie Ma, Chor-yin Sin, Zheng Song, Yong Wong, Bin Xu, and Dingbo Xu for their helpful comments. We also thank seminar and conference participants at Göteberg University, the 2007 CERC-CCER world economy on China at the Stockholm School of Economics (SSE), the third annual global institute China-Russia international conference, CCER, School of Economics of Peking University, China Europe International Business School (CEIBS), Fudan University, WISE of Xiamen University, and Seoul National University for their comments. We also thank Wei Tian and Min Zhang for their excellent research assistance. All remaining errors are ours.

[III] Director and Professor, China Center for Economic Research, Peking University, Beijing 100871, China. Phone: 86-10-6275-3082, Fax: 86-10-6275-1474, Email: justinlin@ccer.pku.edu.cn.

[IV] Assistant Professor, China Center for Economic Research, Peking University, Beijing 100871, China. Phone: 86-10-6275-3109, Fax: 86-10-6275-1474, Email: mjyu@ccer.pku.edu.cn.

1 Introduction

As introduced by Preobrahensky (1926), the term of "price scissors" refers to how the government in a developing country, especially a socialist country, uses to extract profits from peasants in the rural sector to subsidize workers in the urban sector. As a result, the government in this setting could increase capital accumulation using price scissors. Later, Sah and Stiglitz (1984) (henceforth S-S) proposed an elegant theoretical model to formalize the optimal terms of trade versus peasants by analyzing the government's social welfare function. Perhaps because of the paper's simple but powerful theoretical structure, it was quickly applied in a variety of subsequent theoretical analysis. For instance, Carter (1986) extended the S-S model from a closed-economy to an open-economy setup. Blomqvist (1986) examined the case of indirect taxation from agricultural goods in socialist countries. These studies recognized that price scissors have been important in socialist countries such as former Soviet Union and China.

More importantly, traditional wisdom suggests that governments in socialist countries give more attention to investment than to consumption and more weight to workers than to peasants. However, this wisdom is a *priori*. In this study, we investigate if the view is borne out by China's data. And, if so, to what extent the government favors urban workers over rural peasants and future investment over current consumption.

We develop a theoretical setup based on the S-S (1984) model. To explore the optimal terms of trade versus peasants, the S-S model (1984) used the Bergson-Samuelson social welfare function to assign a relative weight between current consumption and capital accumulation. In addition, welfare from both workers and peasants is equivalent in the mind of the social planner. Such a simplification is helpful for us to estimate two relative weights: the weight of current consumption relative to future investment and the weight of peasants relative to workers.

We estimate related structural parameters to investigate the relative importance of agricultural and industrial sectors and the relative importance of investment and consumption in the social planner's mind by using China's province-level panel data from 1949-1992, during which China used central planning. We tailor and extend the S-S's (1984) theoretical model to fit the case of China by allowing international trade and agricultural rationing. Indeed, China had a low openness ratio but it had never actually been a closed economy even before its economic reforms began in 1978.[1] Moreover, different from S-S (1984) by restricting the weight of welfare between peasants and workers, we allow the model to demonstrate its own flexibility and let data predict the model's magnitude. In line with S-S, we maintain the relative weight between consumption and investment to measure the social value of marginal investment.

In this paper, we also estimate the relative agricultural price elasticity of wages since such data, though essential, are unavailable for our key structural estimations of the relative weight between current consumption and future investment. The estimations of such elasticities may certainly suffer from the usual measurement error problem due to data unavailability, or they may be sensitive to different estimation methods. It is possible such

[1] As pointed out by Naughton (2005), before 1979, China's total trade/GDP ratio was around 10%. It reached its minimum level of 5% in 1970-1971.

measurement errors might create an endogeneity problem for our structural estimations. We therefore address this problem by using appropriate instrumental variables.

So that our empirical specification is close to reality, we also add an extra variable, the famine dummy, in the estimations and test whether it adds explanatory power to our theoretical model. China suffered a nation-wide famine during 1958-1961. Traditional wisdom suggests that such a negative shock would affect the relative weights of the government's objective function. We therefore add a variable to check this traditional belief. The economic rationale is that, if such a variable adds extra explanatory power to our theoretical model, this could be an indication that our theoretical setup is incomplete, therefore suggesting an extension to the theoretical model for better empirical fit.

Our paper joins a small collection of the related papers. Remarkably, very few studies have conducted empirical investigations of the price scissors although the S-S (1984) model makes clear-cut empirical predictions. One exception is Li and Tsui (1990). Different from other theoretical studies that treat the former Soviet Union as the work-horse, they use China as their sample of a developing country to test the Preobrazhensky's First Proposition that price scissors can help a country to extract an industrial surplus for capital accumulation. They find evidence that the relative agricultural price is positively correlated with the capital accumulation. They then explain this unexpected result using the efficiency wage hypothesis. Knight (1995, 1999) provides some interesting findings on the rural-urban divide in China by analyzing changes in various offer curves.

Our findings are important because we are able to retrieve the relative magnitude of consumption and investment in the government's objective function of China. In addition, we also calculate the weight of workers versus that of peasants. Our estimates suggest that the weight of peasants is smaller than that of workers, and the weight of consumption is much smaller than that of investment. Such findings are consistent with China' reality. Hence, our analysis explains China's behavior during its planned-economy era quite well.

One potential limitation of our current approach is that we do not have feasible data on China's disaggregated province-level agricultural trade before 1978. To explore the effects of price scissors on agricultural trade, it therefore is essential to run regressions using panel data. Unfortunately, we cannot access such data from before China's economic reforms. Inspired by the gravity model in trade theory, we therefore seek to estimate the share of manufacturing trade relative to the full trade volume by allowing heterogeneous foreign demand behavior across provinces.

The remainder of this paper is organized as follows. Section 2 introduces on price scissors in the context of China. Section 3 describes the theoretical framework based on the S-S model. Section 4 specifies the econometric methods. Section 5 describes the data, presents the empirical findings, and checks their robustness. Section 6 concludes the paper.

2 Price Scissors in China

Before the economic reforms, the prices of all commodities in China were set by the government. As pointed out by Lin (2003, 2005, 2007), China, like many other less-developed countries (LDC), adopted a heavy-industry-oriented development strategy after gaining its political independence in 1949. Heavy industries were capital intensive. The projects in heavy industries required huge capital inputs and long gestation. However, China was a capital-scarce agrarian economy at that time. Moreover, China's political leaders also emphasized the importance of self-reliance to raise such capital. Therefore, the only way left to the government was to squeeze the agricultural surplus for investments in heavy industries by lowering agricultural prices paid to peasants for their products while raising the prices of industrial products sold to peasants. In a nutshell, under this strategy, it was natural for the government to use price scissors against peasants in favor of industrial development.

Figure 1 helps us to understand the essence of price scissors. Without the government's intervention, the relative price for agricultural products is determined by the market directly and yields $(p_A/p_I)_0$. To squeeze benefits out of peasants for its future investment, the government sets a lower relative price $(p_A/p_I)_1$ for agricultural goods, which yields an excess demand for agricultural goods. In the absence of price adjustments, the government has to import agricultural goods to meet the demand. But this was infeasible since China had scarce foreign reserves in this period. Therefore, the only way left to the government was that it had to ration its agricultural goods. Put another way, the demand curve is regulated to be a vertical. By rationing agricultural goods, not only did the government not have to import agricultural goods but it could also export its agricultural goods to create foreign reserves.

[Insert Figure 1 Here]

Following previous works like Lardy (1983), we define price scissors (p) as the relative ratio between the purchasing price index of farm products (p_A) and the rural retail price index of industrial products (p_I). That is, $p \equiv p_A/p_I$.[2] Figure 2 shows that the relative price index for agricultural goods increases over these years. [3] However, such an increase is not fully attributable to the price scissors against peasants since prices of all commodities were not completely set by the government after 1984.[4]

[Insert Figure 2 Here]

China began its economic reforms in 1978. Instead of adopting shock therapy, China implemented dual-track gradual reforms in its transition to a market economy. As discussed by Lin, Cai, and Li (1996), such a dual-track price system includes two stages. In the first stage, from 1978 to 1984, the government merely focused on adjusting agricultural prices relative to industrial prices.

In contrast, in the second stage, from 1985 to 1992, the government aimed at introducing a market track parallel to the planned track. In this stage, some key commodities were still included in various state plans. The prices for these commodities were set by the government just as before the economic reforms. The prices of the commodities excluded from the state plans were directly determined by the market. Accordingly, there were three types of prices setting during this stage: fixed state-regulated prices, state-guided prices, and market-determined prices. In particular, in 1992, when China's government

[2]As discussed by Li and Tsui (1990), the price ratio could also be measured by an alternative index, $p_A/\tilde{p}_I$, where $\tilde{p}_I$ is the ex-factory price index of industrial goods. In this paper, we measure the price scissors using the p_A/p_I index since there are data missing in the alternative index.

[3]As shown in Figure 2, there was a jump in the purchasing price index of farm products (PPIFP) during 1959-1961 due to the great famine.

[4]Note that the relative agricultural price ratios are higher than one. However, this does not imply that the agricultural price *level* is higher than the industrial price *level* since various price indices are calculated using the Laspeyres formula.

officially adopted its market economy, the weights of both fixed state-regulated prices and state-guided prices accounted for only 7.1% of the entire economy. This decreased to less than 5% in 1999. Put another way, 95% of all commodity prices were determined by market forces by 1999.[5]

3 The Theoretical Framework

Our theoretical model is based on the S-S (1984) model. To fit our model to China's case, we extend the S-S model by allowing both international trade and agricultural rationing. In addition, consumers' utility functions in the S-S (1984) model are also modified to be suitable for empirical estimations.

In our model, the economy consists of two sectors, the rural with population N_a and the urban with population N_m. People are sector-immobile but have identical utility functions. Foe ease of estimation, we specify a quasi-linear utility in the S-S (1984) model:

$$U_j = y_j + u(x_j), \tag{1}$$

where consumer j is from either the agricultural sector (a) or the urban manufacturing sector (m). The sub-utility function is, as usual, increasing and differentiable with x_j. Consumer j's consumption of manufacturing good y serves as the numeraire. Therefore, all wealth effects are absorbed into the manufacturing sector, in the sense that agricultural goods are necessities, whereas manufacturing goods are not necessarily necessities.

The industrial sector uses two factors, capital (K) and labor (L_m), to produce man-

[5] Source: State Planning Commission, Price Administration Bureau; "The Weights and Changes of Three Patterns of Price," *Price in China*, 1997, No. 12.

ufacturing products, whereas the agriculture sector depends on land (R) and labor (L_a). Note that L_m and L_a measure the hours worked by each worker, who are sector-immobile in this setup. This is exactly consistent with China's reality: people are not easy to move freely from region to region because of the residency-control policy (although such restrictions have been eased to some extent). Technologies in both industries have constant returns to scale. Agricultural prices relative to industrial prices, p, are determined by the government. Lower relative agricultural prices imply severe scissors.

A representative peasant with a utility function (1) faces a budget constraint as follows:

$$px_a + y_a = pX(R/N_a, L_a), \tag{2}$$

where X is his/her agricultural production. The *per capita* land endowment is R/N_a since land areas are assumed to be evenly allocated among peasants in China. Accordingly, the representative peasant's indirect utility function, V_a, is:

$$V_a(p, N_a) = \max_{x_a} pX(R/N_a, L_a) - px_a + u(x_a). \tag{3}$$

From the envelope theorem, we have:

$$\partial V_a/\partial p = X - x_a \equiv S_a, \tag{4}$$

where the residual rural surplus, S_a, is defined as $X - x_a$. Similarly, the wage rate (w), which is set by the government, is the unique source of income for urban workers.[6] This suggests that the budget constraint for a representative urban worker is as follows:

$$px_m + y_m = wL_m. \tag{5}$$

[6] Note that workers in China did not have capital endowment explicitly. According to China's constitution, all capital endowments belonged directly to the state.

The representative worker also faces another constraint on agricultural rationing. That is,

$$x_m \leq \bar{x}_m, \tag{6}$$

where $\bar{x}_m$ is the ration for *per capita* urban agricultural consumption. Therefore, we obtain:

$$\partial V_m/\partial p = -\bar{x}_m; \partial V_m/\partial w = L_m. \tag{7}$$

Different from the S-S (1984) model, we allow the country to have some foreign trade (Carter, 1986). At the very least, China was never a closed economy after 1949. Even before its economic reforms in 1978, it traded with some other socialist countries by exporting agricultural products (Naughton, 2005). Given the depressed agricultural relative price, one would expect countries like China that adopted price scissors to import agricultural products to balance the excess demand. However, the government in China imposed rationing on agricultural goods among urban workers. Therefore, the balanced equation for agricultural goods is:

$$E = N_a S_a - N_m \bar{x}_m, \tag{8}$$

where E is agricultural exports. Due to agricultural rationing, China actually exported its agricultural goods, despite domestic demand.

The government exported agricultural goods at a given global price (p^w), which was higher than the domestic agricultural price due to the artificial price depression at home. The markup ($\epsilon \equiv p^w - p$) was collected as a part of the government surplus. Therefore, we have governmental surplus (G) as follows:

$$G = N_m[Y(K/N_m, L_m) - wL_m] + \epsilon E. \tag{9}$$

That is, the government obtained a surplus from two sources: the industrial surplus and net agricultural trade surplus. The industrial surplus is measured by the profit retained in the industrial sector. The last term on the right-hand-side (RHS) of (9) is the agricultural trade surplus. Different from usual setups in the trade literature to specify the tariff-like markup as a function of the domestic price, the difference between domestic prices and the rest of the world is random and irregular since the domestic price was set by the government *arbitrarily*.[7]

The government maximizes its aggregate welfare by choosing the optimal relative price. Following the S-S (1984) model, the government has the following objective function:

$$\Omega = N_a V_a + \beta N_m V_m + \delta G. \tag{10}$$

The first term on the RHS of (10) measures the aggregate welfare from the agricultural sector, while $N_m V_m$ is the aggregate welfare from the industrial sector. The coefficient, β, measures the relative weight of the agricultural sector and the industrial sector in the government's objective function. Note that the government had surplus from both sectors (G). The coefficient, δ, measures the social value of the marginal investment, which could be treated as the relative weight of consumers' surplus (consumption) and investment. We assume that the government in China preferred capital accumulation for investment over

[7] Of course, one possible extension is to consider such a markup as a non-linear function of agricultural prices.

consumption and it also favored urban workers over rural peasants. However, these are a *priori* assumptions. Our main interest in this paper is to estimate the two weights, β and δ, in the government's objective function.

By substituting (9) into (10), we obtain:

$$\Omega = N_a V_a + \beta N_m V_m + \delta N_m [Y(K/N_m, L_m) - wL_m] + \delta \epsilon E. \tag{11}$$

To determine the optimal terms of trade relative to peasants, we take the partial derivative of the government's social welfare function, Ω, with respect to p, and set it zero:

$$\frac{d\Omega}{dp} = \frac{\partial \Omega}{\partial p} + \frac{\partial \Omega}{\partial w}\frac{dw}{dp} = 0. \tag{12}$$

By algebraic manipulation as shown in Appendix A, we obtain the equilibrium condition as follows:

$$pE - (\beta - 1)pN_m \bar{x}_m + (\beta - \delta)(N_m w L_m)\eta = 0. \tag{13}$$

Note that the first term of (13), pE, is agricultural exports. The second term, $pN_m\bar{x}_m$, is aggregate agricultural urban consumption with rationing, which is observable from the data. Included in the last term, $N_m w L_m$, is aggregate urban wages, and η is the wage elasticity with respect to the relative price of agricultural goods, which is defined as $\eta \equiv (dw/dp) \cdot p/w$.

4 The Econometric Model

Equation (13) sheds light on the essence of our empirical specification. The provincial governments are expected to have the same government objective function as the central authority since, under the planed economy system in China, all local governments are strictly monitored and controlled by the central government. Hence, our empirical specification relies on a province-level panel data set. However, there is no particular directional guidance for the inclusion of an error term in the econometric model. We first consider a specification as follows:

$$C_{it} = 1/(\beta - 1) \cdot A_{it} + (\beta - \delta)/(\beta - 1) \cdot \eta W_{it} \tag{14}$$

$$= \gamma_1 \cdot A_{it} + \gamma_2 \cdot \eta W_{it} + \zeta_i + \phi_t + \mu_{it}, \tag{15}$$

where the regressand is the agricultural urban consumption under rationing ($C \equiv pN_m\bar{x}_m$). It is mainly affected by agricultural exports ($A \equiv pE$), urban wages ($W \equiv N_m w L_m$), and the relative agricultural price elasticity of wages (η). The subscript i indicates the province and t indicates the year. The error term is considered like any other factor that affects agricultural urban consumption but not considered in our theoretical model. It can be decomposed into three components: (1) province-specific fixed effects, ζ_i, which capture unobserved province-specific time-invariant fixed effects; (2) year-specific time-variant fixed effects, ϕ_t; and (3) an idiosyncratic effect, μ_{it}, with zero expectation and heteroskedastic variance, σ_i^2. Our main objective in the remainder of the paper is to estimate the two structural parameters, $\hat{\gamma}_1 \equiv 1/(\beta - 1)$ and $\hat{\gamma}_2 \equiv (\beta - \delta)/(\beta - 1)$.

[Insert Figure 3 Here]

Without a doubt, such a specification is not unique to estimating (12). We could consider at least two other optional empirical specifications. The first is to move agricultural exports (A_{it}) to the left-hand-side (LHS). In this way, the other two variables, C_{it} and ηW_{it}, serve as regressors. Alternatively, we can also take the term ηW_{it} as the regressand and put A_{it} and C_{it} on the RHS. Thus, it is natural to ask which specification is the most suitable one. We adopt Specification (14) for following reasons.

First, compared to the alternative specification, which treats agricultural exports as the regressand, Specification (14) allow us to dodge the difficulty of data unavailability. As mentioned above, province-level agricultural trade data before 1978 are inaccessible. A feasible way to address this challenge is to calculate an approximation by using information on province-level GDP and total output of the industrial sector, which is specified shortly. However, such an approximation could suffer from some measurement errors. In econometrics, there is nothing wrong with putting it on the LHS since we could allow such a measurement error to be incorporated into the error term. But we still suffer from the second problem: we do not have data on the price elasticity of wages on the RHS. Any estimation or data approximation of this elasticity could create another source of measurement error on the RHS.

Similarly, we can make ηW_{it} the regressand. Clearly, the measurement error of the calculated price elasticity would be passed through the error term. However, since we have no data on agricultural trade, the measurement error from the approximation of agricultural trade could easily cause our estimation to be biased. Hence, we avoid this approach and focus on Specification (14) instead.

4.1 Agricultural Export

To estimate (14), we need province-level agricultural export data. Unfortunately, such disaggregated trade data before 1978 are unavailable. We only have national-level data before 1978. To resolve this empirical challenge, we construct an approximation for the "true" province-level agricultural export data by using the gravity trade model.

The gravity equation in the trade model predicts that export volume is directly proportional to the exporter's GDP. This prediction holds at the disaggregated industry level and the province level (Helpman, 1987). Put another way, province i's exports (T_{it}) are directly proportional to its output (Q_{it}). Therefore, we have $T_{it} = \theta_{it} Q_{it}$ where θ_{it} measures the share of foreign demand for province i's products in year t.[8] By the same token, the share of foreign demand for province i's manufacturing products is θ_{it}^m. That is, $M_{it} = \theta_{it}^m Q_{it}^m$, where Q_{it}^m is province i 's output of manufacturing commodities at year t. Accordingly, we can construct a proxy for manufacturing exports given $M_{it} = s_{it}^m (Q_{it}^m / Q_{it}) T_{it}$, where $s_{it}^m \equiv \theta_{it}^m / \theta_{it}$ measures the ratio of demand for manufacturing products relative to that for all commodities. Agricultural exports (A_{it}) are the difference between total exports (T_{it}) and manufacturing exports (M_{it}): $A_{it} = T_{it} - M_{it}$.[9] That is, agricultural exports are:

$$A_{it} = T_{it} - s_{it}^m (Q_{it}^m / Q_{it}) T_{it}. \tag{16}$$

Note that we have data on Q_{it}^m, Q_{it}, and T_{it} . In contrast, the relative demand ratio, s_{it}^m, is left for estimation.

[8] For example, if $\theta_{it} = 1$, then all province i's products are exported. Conversely, if $\theta_{it} = 0$, then province i exports no commodities.

[9] Note that China's exports from the service sector were very small in the period 1949-1992 (Naughton, 2005).

Agricultural exports after 1978 were directly calculated by the difference between province-level agricultural production and province-level agricultural consumption (*i.e.*, urban plus rural). Note that we do not directly use foreign trade data since inter-province trade, which is taken into account after 1978, is allowable based on our setup. However, we are unable to do so before 1978 and we have found no significant way to the estimates due to data restrictions.

4.2 Relative Agricultural Price Elasticity of Wage

There are three possible ways to obtain wage elasticity with respect to prices. The first is to use data from previous studies. To the best of our knowledge, very few studies, if any, provide such elasticities over the years in this study. The second possible way is to calculate elasticities directly by definition, $\eta_{it} \equiv [(dw/dp) \cdot p/w]_{it}$, which is technically feasible. However, this does not make sense economically. The elasticity should not be expected to vary across provinces given that each province in China rarely had autonomy under the central planning system. It also should not fluctuate frequently over the years since the main economic indicators and important economic policies were determined by five-year national plans. Therefore, the only way is to estimate the price elasticity of wages indirectly. We therefore consider a two-way, fixed-effect specification as follows:

$$\ln w_{it} = \alpha + \eta \ln p_{it} + \vartheta_i + \lambda_t + e_{it}, \tag{17}$$

where the estimated coefficient, $\hat{\eta}$, is interpreted as the elasticity of wages with respect to relative prices of agricultural goods. As usual, the province-specific and year-specific fixed effects control for other unspecified factors. We could undoubtedly suspect that there are some measurement errors in this simple specification. It may be a good benchmark specification, but it is certainly noisy since we have no idea about the "true" specification of a reduced-form estimation. In other words, the endogeneity issue caused by measurement errors may be a concern in (14). Two-stage least square (TSLS) estimation is a powerful econometric method to control for endogeneity issues created by measurement errors.[10] We therefore address the endogeneity issue by adopting appropriate instruments.

However, it is reasonable to believe that such an elasticity should be different when the economy faces a structural change. We therefore estimate the elasticities by separating the entire period 1949-1992 into three sub-period, using 1978 and 1992 as the two cut-off points. The results are reported in Table 2.

Now, we combine (14) with (17) to derive the new equilibrium condition for the estimations:

$$C_{it} = 1/(\beta - 1) \cdot T_{it} + (\beta - \delta)/(\beta - 1) \cdot \eta W_{it} - s^m/(\beta - 1) \cdot (Q_{it}^m/Q_{it}) T_{it}. \tag{18}$$

To ease of the estimations, we presume that the relative demand ratio for manufacturing products is identical across provinces and years: $s_{it}^m = s^m$. One might suspect that such a simplification could cause some bias since China's trade pattern before 1978 was different from that after 1978. Before 1978, China exported almost only agricultural commodities. We therefore add an indicator, I_t, (which equals one after 1978 and zero otherwise) into the empirical specification as follows:

$$C_{it} = \gamma_0 + \gamma_1 \cdot T_{it} + \gamma_2 \cdot \hat{\eta} W_{it} + \gamma_3 \cdot (Q_{it}^m/Q_{it}) T_{it} \cdot I_t + \zeta_i + \phi_t + \mu_{it}, \tag{19}$$

[10] Wooldridge (2002, chapter 5) provides a careful analysis of this topic.

where $\hat{\gamma}_1 = 1/(\beta - 1)$, $\hat{\gamma}_2 = (\beta - \delta)/(\beta - 1)$, and $\hat{\gamma}_3 = s^m/(1-\beta)$. Put another way, when we consider cases before 1978, the term $(Q^m_{it}/Q_{it})T_{it} \cdot I_t$ disappears given that $I_t = 0$. Therefore, the export volume simply equals the agricultural export volume.

5 Data and Empirical Results

In this section, we first describe the data sets used in the analysis followed by a presentation of our benchmark empirical results. To control for the endogeneity problem, we then offer an analysis of the validity of the instruments. Finally, we close the section with a discussion of China's economy in different periods.

To estimate (19), we need data on urban agricultural consumption (C_{it}), total export (T_{it}), aggregate wages (W_{it}), province-level manufacturing output (Q^m_{it}), total output (Q_{it}), and price elasticity of wages (η). As mentioned above, data on price elasticity of wages are unavailable but the magnitudes can be estimated instead. Data on China's exports in our sample are converted from US dollars to Chinese Yuan using the *spot* official exchange rates. In addition, we choose 1950 as the base year for the relative price index. All data can be directly accessed from *China Compendium of Statistics, 1949-2004,* published by the China Bureau of Statistics. Table 1 presents the basic statistical information for each variable.

[Insert Table 1 Here]

5.1 Benchmark Estimates

Table 2 presents the estimates of the relative price elasticity of wages. Column (1) reports the whole period of our sample (1949-1992). The rest of Table 2 considers three different perturbations for different time periods: Column (2) is for 1949-1977, Column (3) is for 1978-1984, and Column (4) is for 1985-1992.

[Insert Table 2 Here]

Following (17), we first run the fixed-effect estimations for different time periods. It turns out that the relative price elasticity of wages is -0.083 for the whole period though statistically insignificant. The economic rationale is straightforward. The lower the agricultural relative price is, the higher the urban wage is. Note that the lower agricultural relative price implies a larger price scissors. When the government imposes a strong price effect on peasants, urban workers' real income will increase relatively since they consume necessary goods at a very low cost.

As shown in Table 2, the coefficients on the agricultural relative price elasticity of wages are all negative. Most of them are statistically significant except for period 1978-1984. It is not a surprise to have measurement errors for such estimated magnitudes given that we have no idea about the "true" reduced-form specification of the effect of prices on wages. But, as mentioned above, we can address this problem by using the instrumental variables approach.

Our benchmark OLS estimation results of Specification (19) are reported in Column (1) of Table 3. The coefficient of urban agricultural consumption, $\hat{\gamma}_1$, is 0.01 but statistically insignificant. Correspondingly, the coefficient of the product of the price elasticity and the urban wages, $\hat{\gamma}_2$, is -19.58. After controlling for the province-specific and year-specific fixed effects in Column (3), the coefficient of $\hat{\gamma}_1$changes to be significant.

5.2 Endogeneity and Instrumental Variables

The endogeneity problem of Specification (19) could come from measurement errors in the price elasticity. As mentioned above, we do not have data on agricultural relative price elasticity of wages. Instead we use the OLS estimated coefficient obtained from Specification (17). It is natural to suspect that there are measurement errors between the estimated elasticity coefficient and the "true" inaccessible data.

To identify the accurate weights in the government's objective function, we needs to control for the endogeneity problem. Otherwise, the related estimates would be suspect. A powerful econometric technique to address the endogeneity is to perform two-stage generalized method of moments (GMM) estimations by adopting appropriate instrumental variables. Note that the equilibrium condition (13) implies no causal relationship among each variable. Therefore, the GMM estimation is an ideal approach. Moreover, GMM requires fewer assumptions on the error term and has the ability to generate heteroscedasticity-robust standard errors as compared to the general least squares method (Hall, 2004).

We use investment in capital construction and fixed-asset investment in innovation as instruments of the price elasticity for following reasons. Lower investments in innovation and capital construction, which are signals of insufficient investment by the government, would push the government to depress agricultural prices much more (a lower relative price), which in turn would lead to higher real wages. Indeed, the negative relationship between investments in innovation and capital construction and wages are confirmed by our samples. The simple correlation between investment in capital construction and wages is -0.93 while the one between investment in innovation and wages is -0.94.

Moreover, estimates from the two stages of GMM offer supporting evidence for the instrument's validity. An instrument (*i.e.*, fixed-asset investment in innovation *or* capital construction) is good if it affects the regressand (*i.e.*, urban agricultural consumption) through and only through the instrumented variable (*i.e.*, price elasticity of wages). To justify this, we perform several useful tests as follows.

First, we perform Anderson's (1984) canonical correlation likelihood-ratio test to check whether or not the excluded instruments (*i.e.*, fixed-asset investment in innovation and investment in capital construction) are correlated with the endogenous regressor. The null hypothesis that the model is under identified is rejected at the 1% level. Second, we go a step further to see whether or not such instruments are weakly correlated with the price elasticity of wages. If so, then the estimates will perform poorly in this two-step GMM. Luckily enough, the Cragg and Donald (1993) F-statistics provide strong evidence to reject the null hypothesis that the first stage is weakly identified at a highly significant level. Third, the Anderson and Rubin (1949) χ^2 statistic rejects the null hypothesis that the coefficients of the endogenous regressors jointly equal zero. Fourth, the Hanson-Sargen over-identification test also confirms that the instruments are valid (p-value = 0.45). In short, all of these statistical tests give us sufficient confidence that the instruments perform well, and, therefore, the specification is valid.

Finally, we provide an easy-to-interpret version for the validity of the instrument. We add both the fixed-asset investment in innovation and the investment in capital construction as exogenous regressors. If these two variables have a direct effect on agricultural net exports, then we would expect the estimated coefficients to be statistically significant. However, as shown in the last column of Table 3, they are statistically insignificant at the 5% level.[11] This again affirms that these two variables affect the regressand through and only through the channel of the instrumented variables.

Columns (2) and (4) of Table 3 show the estimation results using the IV approach. The IV estimation results are broadly consistent with those from the OLS estimates. Column (4) reports the fixed-effect IV estimates. The coefficients for the two key variables, T_{it} and ηW_{it}, are statistically significant and very close to those in the FE estimates in Column (3).

5.3 Robustness Checks

China suffered from a country-wide famine that lasted for around three years during 1959-1961. We wonder if China's government adjusted the objective function when it faced this a negative shock. In Table 4, we add one more control variable, dummy of famine (*i.e.*, equals to one for years 1959-1961 and zero otherwise), to check if our estimation results reported in Table 3 are robust. After controlling for the two-way fixed effects, the coefficients of all variables are very close to those in Table 3. In addition, the famine had a negative effect, though insignificant, on lowering urban agricultural consumption. Such

[11] We also take fixed-asset investment in innovation and investment in capital construction as extra regressors, separately, and also find that they are statistically insignificant.

a finding is also broadly consistent with China's reality during that period.

[Insert Table 4 Here]

We have already explored the heterogeneity of the price index in different periods. Similarly, China's trade pattern has changed over the years. Before 1978, the year that China began its economic reforms, the components of China's foreign trade were relatively simple. The openness ratio (*i.e.*, the sum of exports and imports relative to the GDP) was only around 5%. Most of China's exportable goods were agricultural products (Naughton, 2005). In the late 1970s, China also began to export oil because the petroleum production from China's main field in Daqing, Heilongjiang, began to soar. Later, China's foreign trade expanded steadily during the 1980s. The openness ratio increased from 0.13 in 1980 to 0.34 in 1992. China's exports also diversified from an initial heavy dependence on primary commodities to a mix of primary goods and manufacturing products. The share of exported primary goods decreased from 49.7% in 1980 to 20.0% in 1992. In contrast, the share of exported machinery and transportation equipment increased from 4.65% in 1980 to 15.5% in 1992.[12]

Given that China's economy structure was quite different before and after 1978, we first split our sample spread into two different periods using 1978 as a cut-off year. We also take 1985 as another cut-off point since the economic reforms before and after 1985 were quite different as introduced above. Table 5 reports the estimation results for 1978-1992 by using

[12] The data source is *China Statistical Yearbook (2006)* published by the National Bureau of Statistics of China.

precise province-level agricultural export data.[13] Various econometric approaches suggest that urban agricultural consumption is positively correlated with agricultural exports, but negatively correlated with the product of wages and price elasticity. The two key coefficients, $\hat{\gamma}_1$and $\hat{\gamma}_2$, are statistically significant in all specifications. The magnitude of $\hat{\gamma}_2$ is much lower than its counterpart for the whole period, 1949-1992. Column (5) provides an easy-to-intrepret version on the validity of the instruments during the 1978-1992 period.

[Insert Table 5 Here]

We go further to specify the period after 1978 into two sub-periods: 1978-1984 and 1985-1992. We report the estimation results in the lower parts of Table 6. The signs of the two key coefficients are consistent with those in Table 5. Most of the estimates are significant. The only exception is the coefficient $\hat{\gamma}_1$ during the period 1978-1984 in the IV fixed-effect estimations, which is discussed below.

[Insert Table 6 Here]

5.4 Weights Identification

Based on the estimation results obtained from Tables 4-6, we are ready to retrieve the weights in the government's objective function. We normalize the weight of the agricultural sector as a unity in (10). Accordingly, the relative weight of the manufacturing sector is β in the government's objective function. δ measures the relative weight of investment relative to consumption. By comparing (18) to (19), we can precisely identify the magnitudes of

[13] We do not report estimation results for years 1949-1977 here since data on agricultural trade before 1978 are completely unavailable.

the weights: $\beta = 1/\hat{\gamma}_1 + 1$and $\delta = (1 - \hat{\gamma}_2)/\hat{\gamma}_1 + 1$. We are therefore able to retrieve these weights once the estimates of both β and δ are statistically significant.

The results on the weights are presented in Table 7. We first report the weights when estimated without controlling for endogeneity and the fixed-effect specification. As seen in the top section in Table 7, the OLS estimates suggest that the relative weight for urban workers is insignificant. The calculated weights from the OLS estimates indeed have some bias due to the endogeneity problem. Hence, we go a step further to calculate the relative weights in the government's objective function after controlling for endogeneity.

The two coefficients are significant in the IV fixed-effect estimate, which suggests that the weight for urban workers is 39.5 while the weight for future investment is 945.2. The strikingly high number is beyond our expectations,[14] but its implication is very clear: the welfare of urban workers was more important than that of peasants in the view of China's government during the planned economy era. China's government also cared more about investment than about consumption. In addition, the weight for investment is much larger than the weight for workers. We therefore conclude that China's government paid much more attention to investment than to workers during 1949-1992.

[Insert Table 7 Here]

We expect that things were different before and after 1978. Before the economic reforms, the primary objective of China's government was to develop its heavy industries so that China could catch up with the advanced countries like the U.S. and the U.K. as

[14] The large number of δ comes from the relatively large magnitude of the estimated coefficient, $\hat{\gamma}_2$, which in turn is caused by the lack of precise province-level data on agricultural exports.

soon as possible (Lin, Cai, and Li, 1994). But, since the reforms in 1978, the government has paid more attention to improving citizens' living standard. In other words, government has cared less about investments and more about consumption since the economic reforms began. Our estimation results provide evidence to support this dynamic change. As seen in the middle section of Table 7, the IV fixed-effect estimates suggest that, during the 1978-1992 period, China still paid more attention to investments than to consumption ($\delta = 8.26$). It also cared about urban workers more than about rural peasants ($\beta = 8.25$). However, the magnitudes of these two weights shrank dramatically compared to those before 1978.

The bottom section of Table 7 reports the weights in the government's objective function during two different stages of its economic reforms. During 1978-1984, the weight for investments for 1978-1992, 8.26, is smaller than its counterpart for 1978-1984, 30.6, but larger than that for years 1985-1992, 7.00. This implies that China's government lost interest in its heavy industries over the years. Similarly, we find that China's government also was more egalitarian toward both rural peasants and urban workers over the years.

Interestingly, the structural parameter, β, was insignificant for 1978-1984 in the IV fixed-effect estimate. This is exactly consistent with China's reality. At the initial stage of the economic reforms, the government did not have a clear direction for its reforms. Indeed, its reform logic was usually described as "crossing the river by groping for the stone".

6 Concluding Remarks

Fully guided by a theoretical model introduced by S-S(1984), in the present paper, we estimate the structural parameters in the government's objective function of China. We find that the weight attached to the welfare of workers is much higher than that to the welfare of peasants. Furthermore, the government also paid much more attention to future investment than to current consumption. Overall, our estimates suggest that an augmented version of S-S's (1984) model fits China's reality quite well, and it is also useful in explaining the magnitude of political consideration in the government's mind.

Like other structural parameter estimates, our estimates enjoy several advantages. First, since our estimates closely depend on a theoretical model, we are able to see the connection of each structural variable. Second, the structural parameter estimates are also helpful in avoiding the arbitrage specifications that commonly occur in reduced-form estimates. The economic meaning of each corresponding estimated coefficient is also clear. The magnitudes of the structural variables in our specification are not only statistically but also economically significant.

Our study also has implications for China. Although the phenomenon of using price scissors against peasants officially ended in the early 1990s. China's government still maintains various price controls in some areas. The manipulated exchange rate policy is an excellent example. It is true that today's price controls differ from the price scissors used against peasants, but, in essence, the economic meaning behind these policies is, to some extent, similar in terms of the government's political concern.

As in any ambitious attempt to marry a complicated structural parameters model to imperfect data, we have made a variety of compromises here. Since we do not have disaggregated data on province-level agricultural exports before 1978, we use a proxy or estimated value as a substitute. Clearly, it would be better to use the "actual" data to estimate the government's objective function in China, which could be a possible avenue for future research.

References

[1] Blomqvist, Ave (1986), "The economics of Price Scissors: comment," *American Economic Review* 76, pp. 1188-91.

[2] Carter, Michael (1986), "The economics of Price Scissors: comment," *American Economic Review* 76, pp. 1192-4.

[3] China Bureau of Statistics (2005), *China Compendium of Statistics, 1949-2004*, China Statistics Press.

[4] Hall, R. Alastair (2004), *Generalized Method of Moments*, Oxford University Press.

[5] Helpman, Elhanan (1987), "Imperfect Competition and International Trade: Evidence from Fourteen Industrial Countries," *Journal of the Japanese and International Economics* 1, pp. 62-81.

[6] Knight, John (1995), "Price Scissors and Intersectional Resource Transfers: Who Paid for Industrialization in China?" *Oxford Economic Papers*, 47(1), pp. 117-35.

[7] Knight, John and Lina Song (1999), "The Rural-Urban Divide. Economic Disparities and Interactions in China," Oxford: Oxford University Press.

[8] Lardy, Nicholas (1983), *Agriculture in China's Modern Economic Development,* New York: Cambridge University Press.

[9] Li, Dominic and Tsui, Kai Y., (1990), "The Generalized Efficiency Wage Hypothesis and the Scissors Problem," *Canadian Journal of Economics*, 23 (1), pp. 144-58.

[10] Lin, Justin Yifu (2003), "Development Strategy, Viability, and Economic Convergence," *Economic Development and Cultural Change* 51(2), pp. 277-308.

[11] Lin, Justin Yifu (2005), "Viability, Economic Transition and Reflection on Neoclassical Economics," *Kyklos*, 58(2), pp. 239-264.

[12] Lin, Justin Yifu (2007), *Development and Transition: Idea, Strategy, and Viability*, Marshall Lectures (2007), Cambridge University, forthcoming.

[13] Lin, J., F. Cai, and Z. Li (1996), *The China Miracle: Development Strategy and Economic Reform*, the Chinese University Press.

[14] Naughton, Barry (2005), *The Chinese Economy: Transitions and Growth,* The MIT Press.

[15] Preobrazhensky, Evgeny (1926), *The New Economics*, Oxford: Clarendon Press, 1965.

[16] Sah, R. Kumar and Stiglitz, Joseph (1984), "The Economics of Price Scissors," *American Economic Review*, 74, pp. 125-38.

[17] Sah, R. Kumar and Stiglitz, Joseph (1986), "Price Scissors and the Structure of the Economy," *Quarterly Journal of Economics*, 102(1), pp. 109-134.

[18] Sah, R. Kumar and Stiglitz, Joseph (1986), "The economics of Price Scissors: reply," *American Economic Review* 76, pp. 1195-9.

Appendix A

From (11), we know that

$$\Omega = N_a V_a + \beta N_m V_m + \delta N_m [Y(K/N_m, L_m) - wL_m] + \delta\epsilon E.$$

To determine the optimal terms of trade against peasants, we take the partial derivative of the government's social welfare function, Ω, with respect to p, and set it zero:

$$\frac{d\Omega}{dp} = \frac{\partial\Omega}{\partial p} + \frac{\partial\Omega}{\partial w}\frac{dw}{dp}$$

$$\begin{aligned}
&= N_a \frac{\partial V_a}{\partial p} + \beta N_m \frac{\partial V_m}{\partial p} + \beta N_m \frac{\partial V_m}{\partial w}\frac{dw}{dp} - \delta N_m L_m \frac{dw}{dp} \\
&= N_a S_a - \beta N_m \bar{x}_m + N_m L_m (\beta - \delta)\frac{dw}{dp} \\
&= (N_a S_a - N_m \bar{x}_m) - (\beta - 1) N_m \bar{x}_m + N_m L_m (\beta - \delta)\frac{w}{p}(\frac{dw}{dp}\frac{p}{w}) \\
&= E - (\beta - 1) N_m \bar{x}_m + (\beta - \delta)\frac{w}{p} N_m L_m \eta \\
&= 0,
\end{aligned}$$

where the second equality is from (4) and (7). The third equality rearranges the term $\beta N_m \bar{x}_m$, the fourth equality is from (8) and defines the price elasticity of wages as $\eta \equiv (dw/dp) \cdot p/w$. Finally, we multiple p on both sides to obtain Specification (13):

$$pE - (\beta - 1) p N_m \bar{x}_m + (\beta - \delta)(N_m w L_m)\eta = 0.$$

$\blacksquare$

Appendix Table 1: Main Notation of the Models

Symbol	Definition
	Panel A: Theoretical Framework
p	Agricultural price relative to industrial price
w	Hourly wage
η	Wage elasticity relative to price
N_a, N_m	Population of the rural and urban sectors, respectively
L_m, L_a	Hours worked by the representative in manufacturing and agricultural sectors, respectively.
V_a,	A representative peasant (a)'s indirect utility
V_m	A representative worker (m)'s indirect utility
x_j	Consumer j's agricultural consumption, $\forall j = a, m$
$\bar{x}_m$	Ration of urban worker's agricultural consumption
y_j	Consumer j's manufacturing consumption, $\forall j = a, m$
X	Production of agricultural goods
Y	Production of industrial goods
K	Capital input for the manufacturing sector
R	Land input for the agricultural sector.
S_a	Residual rural surplus: $S_a = X - x_a$
G	The government's surplus
Ω	The government's objective function
β	Relative weight between peasants and workers
δ	Relative weight between consumption and investment
ϵ	Agricultural trade markup
	Panel B: Empirical Specification
A_{it}	Value of agricultural exports in province i in year t: $A_{it} = pE_{it}$
T_{it}	Value of total exports, which is the sum of agricultural and manufacturing exports given $T_{it} = A_{it} + M_{it}$
M_{it}	Value of agricultural export which equals $M_{it} = s^m_{it}(Y^m_{it}/Y_{it})T_{it}$ where $s^m_{it} \equiv \theta^m_{it}/\theta_{it}$.
Q_{it}	Total output level of province i in year t
Q^m_{it}	Output level of manufacturing products in province i in year t
C_{it}	Agricultural consumption from urban workers, $C_{it} = pN_m x_m$
ϑ_i	Province-specific fixed effects for Specification (16)
λ_t	Year-specific fixed effects for Specification (16)
ζ_i	Province-specific fixed effects for Specification (18)
ϕ_t	Year-specific fixed effects for Specification (18)
W_{it}	Urban wages, $W_{it} = N_m w L_m$
μ_{it}	Idiosyncratic random variable

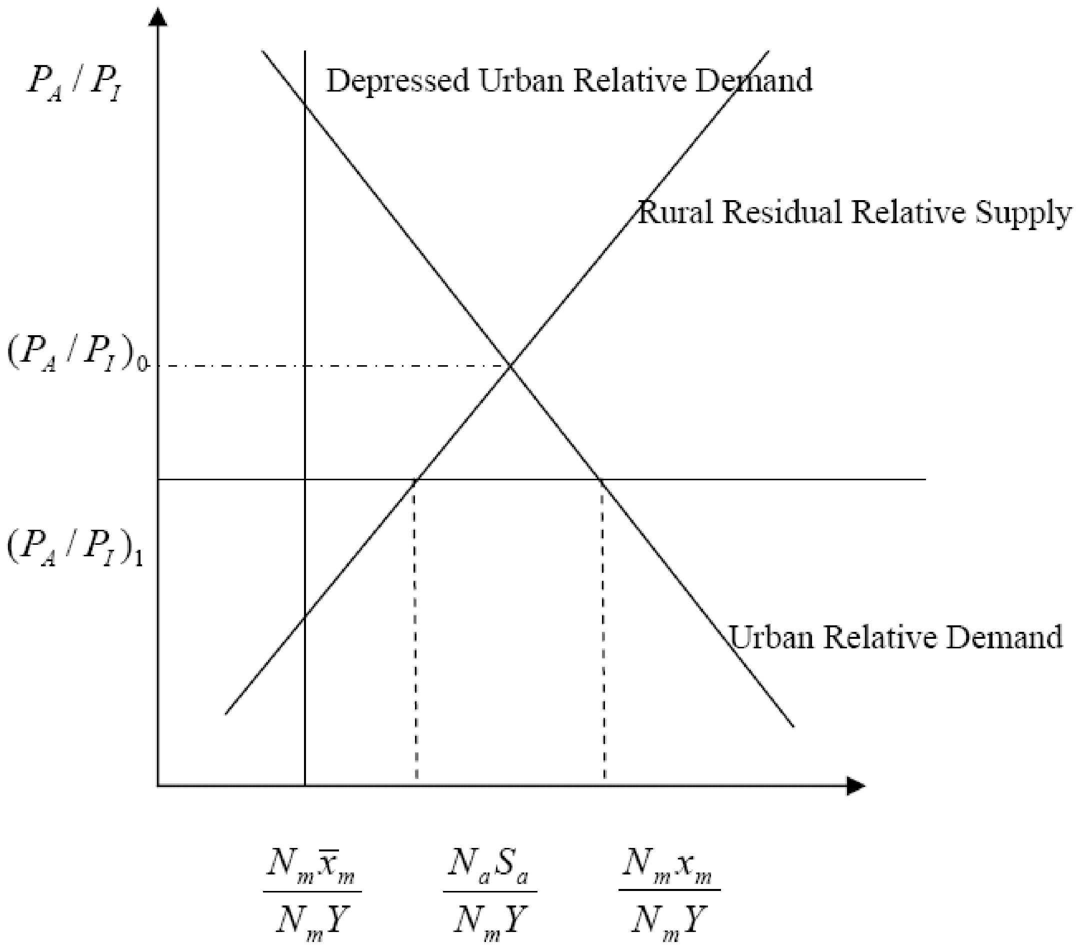

Figure 1: Price Scissors, Agricultural Rationing, and Trade

Notes: When the government creates a price scissors $(\frac{P_A}{P_I})_1$ against the peasants, the market has excess demand for agricultural goods, $\frac{N_m x_m}{N_m Y} - \frac{N_a Sa}{N_m Y}$, where S_a is the per capita rural residual agricultural supply. Therefore, the country experiences import demand pressure on agricultural goods. However, the agricultural rationing for urban workers, as shown by the vertical line for the urban agricultural relative demand, $\frac{N_m \bar{x}_m}{N_m Y}$, not only offsets such import demand but also creates agricultural excess supply, $\frac{N_a S_a}{N_m Y} - \frac{N_m \bar{x}_m}{N_m Y}$. Accordingly, the country exports agricultural goods under the effects of both price scissors and rationing.

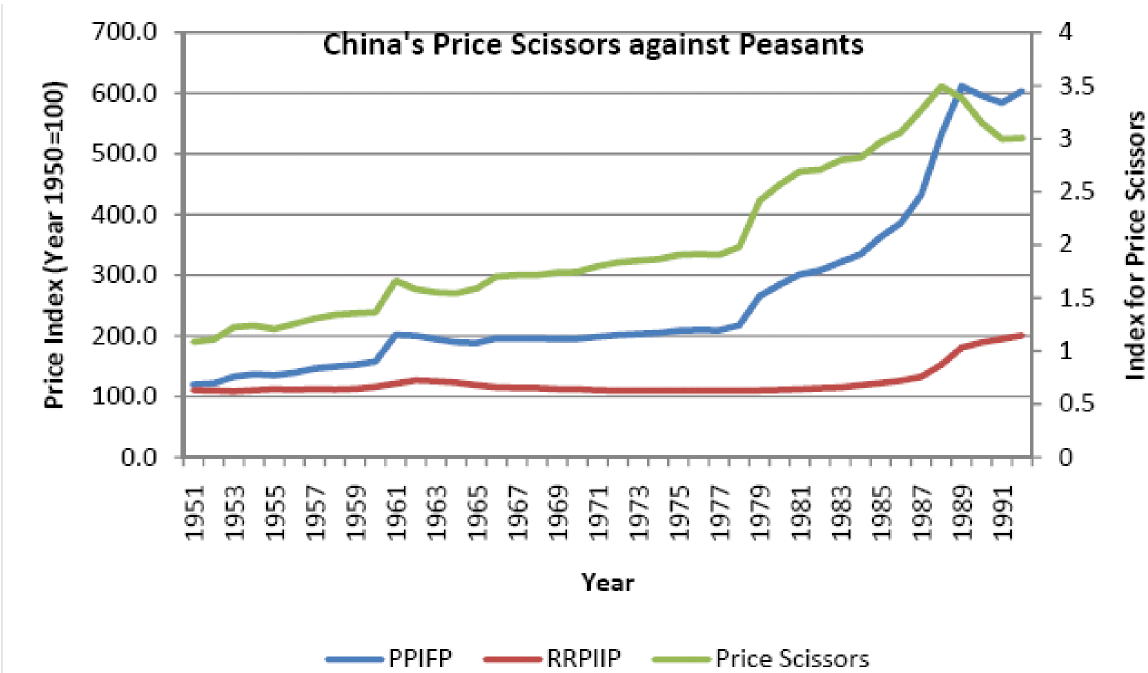

Figure 2: China's Various Price Indices

Notes: the price scissors are defined as the relative ratio between the purchasing price index of farm products (PPIFP) and the rural retail price index of industrial products (RRPIIP). Sources for such data are from the "China Compendium of Statistics, 1949-2004" by China Statistics Press, 2006.

Table 1: Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Total Exports	127.53	597.04	0	10148.27
Workers (Million people)	333.52	217.59	14.7	1045.2
Average Wage (Yuan)	1088.29	667.99	105.2	4273
Total Wages	42.25	48.08	0.69	345.55
Relative Agricultural Price Index (Year 1950=100)	212.90	89.19	97.60	682.62
Urban Consumption of Agricultural goods	62.17	88.05	0.04	679.96
Investment in Capital Construction	94.56	106.08	2.28	921.75
Fixed-Asset Investment in Innovation	16.26	20.32	0.01	128.57

Sources: Data are from "China Compendium of Statistics, 1949-2004" by China Statistics Press, 2006. Unless specified, units for all variables are 100 million yuan.

Table 2: Estimated Agricultural Relative Price Elasticity of Wages

Wage Elasticity	1949-1992	1949-1977	1978-1992	1978-1984	1985-1992
FE Estimates	-0.083	-0.293**	-0.117**	-0.049	-0.130**
	(-0.94)	(-3.40)	(-2.23)	(-0.69)	(-2.40)

Notes: Numbers in parenthesis are t-value. **(*) denotes significance at 1 (5)% respectively. Province-specific and year-specific fixed effects are not reported here to save space, though they are available upon request.

Table 3: Estimates for Structural Parameters (1949-1992)

Econometric Methods[a]	(1)	(2)	(3)	(4)	(5) IV
Regressand (Urban Agricultural Consumption)	OLS	IV	FE[b]	IV+FE[b]	Included
Total Exports (T_{it})	0.01	0.02	0.02**	0.03**	0.03*
	(0.52)	(1.16)	(2.22)	(2.33)	(1.80)
Product of Urban Wages and Elasticity (ηW_{it})	-19.58**	-20.31**	-22.71**	-23.55**	-18.21**
	(45.57)	(33.24)	(50.63)	(33.91)	(15.76)
Manufacturing Exports ($\frac{Q^m_{it}}{Q_{it}} T_{it} I_{it}$)	0.02	-0.01	-0.04	-0.05*	-0.05
	(0.56)	(0.27)	(1.46)	(1.77)	(1.12)
Investment in Capital Construction					0.45
					(1.56)
Fixed Asset Investment in Innovation					-0.013
					(0.08)
F-statistics	1687.3‡	1990.3‡	446.1‡	33,374‡	1256.2‡
First-Stage F-statistics		376.36			
Anderson Likelihood-ratio statistic		710.1‡			
Cragg-Donald F statistic		1944.1‡			
Anderson-Rubin χ^2 Statistic		627.4 ‡			
Shea Partial R^2		0.83			
Sargen Over-identification Test		0.58			
p-value of Sargen Over-identification Test		0.45			
R^2	0.97	0.96	0.95	0.94	0.96
Prob.>F or Prob.>χ^2	0.00	0.00	0.00	0.00	0.00

Notes: a. Numbers in parenthesis are the t (z)-values. **(*) denotes significance at 1 (5)%. ‡ indicates p-value of the statistic is less than 0.01.

b. Time-specific and province-specific fixed effects are included.

Table 4: Augmented Model Estimations (1949-1992)

Econometric Methods[a]	(1)	(2)	(3)	(4)	(5) IV
Regressand (Urban Agricultural Consumption)	OLS	IV	FE	IV+FE[b]	Included
Total Exports (T_{it})	0.01	0.01	0.02**	0.03**	0.03*
	(0.53)	(1.17)	(2.22)	(2.33)	(1.80)
Product of Urban Wages and Elasticity (ηW_{it})	-19.61**	-20.35**	-22.71**	-23.55**	-18.24**
	(45.18)	(32.98)	(50.63)	(33.91)	(15.77)
Manufacturing Exports ($\frac{Q_{it}^m}{Q_{it}} T_{it} I_{it}$)	0.02	-0.01	-0.04	-0.05*	-0.05
	(0.55)	(0.29)	(1.46)	(1.77)	(1.13)
Dummy of Famine	2.96**	6.82**	-8.97	-7.77	5.85**
	(3.14)	(4.34)	(0.92)	(0.51)	(4.92)
Investment in Capital Construction					0.45
					(1.55)
Fixed Asset Investment in Innovation					-0.01
					(0.08)
F-statistics	1536.7[‡]	2003.5[‡]	446[‡]	33374[‡]	1492.1[‡]
First-Stage F-statistics		348.5[‡]			
Anderson Likelihood-ratio statistic		705.0[‡]			
Cragg-Donald F statistic		1914.8[‡]			
Anderson-Rubin χ^2 Statistic		618.8[‡]			
Shea Partial R^2		0.83			
Sargen Over-identification Test		0.57			
P-value of Sargen Over-identification Test		0.45			
R^2	0.97	0.96	0.95	0.94	0.96
Prob.>F or Prob.>χ^2	0.00	0.00	0.00	0.00	0.00

Notes: a. Numbers in parenthesis are the t (z)-values. **(*) denotes significance at 1 (5)%. ‡ indicates p-value of the statistic is less than 0.01.

b. Time-specific and province-specific fixed effects are included.

Table 5: Estimates for Structural Parameters (1978-1992)

Econometric Methods[a]	(1)	(2)	(3)	(4)	(5) IV
Regressand (Urban Agricultural Consumption)	OLS	IV	FE	IV+FE[b]	Included
Aggregate Exports (A_{it})	0.19**	0.21**	0.14**	0.13**	0.20**
	(3.89)	(4.26)	(5.67)	(5.43)	(4.02)
Product of Urban Wages and Elasticity (ηW_{it})	-0.002**	-0.002**	-0.002**	-0.002**	-0.002**
	(30.30)	(28.54)	(21.16)	(18.08)	(16.42)
Investment in Capital Construction					0.016
					(0.02)
Fixed Asset Investment in Innovation					0.249
					(1.15)
F-statistics	1269.55‡	1156.9‡1	427.62‡	364.28‡	732.53‡
First-Stage F-statistics		103.36‡			
Anderson Likelihood-ratio statistic		71.76‡			
Cragg-Donald F statistic		152.25‡			
Anderson-Rubin χ^2 Statistic		219.62 ‡			
Shea Partial R^2		0.74			
Sargen Over-identification Test		0.17			
P-value of Sargen Over-identification Test		0.68			
R^2		0.99	0.99	0.98	0.97
Prob.>F or Prob.>χ^2	0.00	0.00	0.00	0.00	0.00

Notes: a. Numbers in parenthesis are the t (z)-values. **(*) denotes significance at 1 (5)%. ‡ indicates p-value of the statistic is less than 0.01.

b. Year-specific and province-specific fixed effects are included.

Table 6: Estimations for Different Periods

Regressand: Exports[a]	(1) OLS	(2) IV	(3) FE[b]	(4) IV+FE[b]
	Period 1949-1992			
Total Exports (T_{it})	0.01	0.01	0.02**	0.03**
	(0.53)	(1.17)	(2.22)	(2.33)
Product of Urban Wages and Elasticity (ηW_{it})	-19.61**	-20.35**	-22.71**	-23.55**
	(45.18)	(32.98)	(50.63)	(33.91)
	Period 1978-1992			
Agricultural Exports (A_{it})	0.19**	0.21**	0.14**	0.13**
	(3.89)	(4.26)	(5.67)	(5.43)
Product of Urban Wages and Elasticity (ηW_{it})	-0.002**	-0.002**	-0.002**	-0.002**
	(30.30)	(28.54)	(21.16)	(18.08)
	Period 1978-1984			
Agricultural Exports (A_{it})	0.08**	0.07**	0.04	0.03
	(3.89)	(5.26)	(1.49)	(1.18)
Product of Urban Wages and Elasticity (ηW_{it})	-0.00**	-0.00**	-0.01**	-0.00**
	(38.98)	(18.44)	(9.57)	(4.01)
	Period 1985-1992			
Agricultural Exports (A_{it})	0.27**	0.30	0.30**	0.17**
	(5.05)	(5.89)	(6.18)	(6.07)
Product of Urban Wages and Elasticity (ηW_{it})	-0.002**	-0.002**	-0.002**	-0.002**
	(24.11)	(11.73)	(25.92)	(20.96)

Notes: a. Numbers in parenthesis are the t (z)-value. **(*) denotes significance at 1 (5)%.
b. Year-specific and province-specific fixed effects are included.

Table 7: Identifications of the Weights

Econometric Methods	(1) OLS	(2) IV	(3) FE	(4) IV+FE
	Whole Period			
Weight on Urban Workers (β)	101	67.7†	44.5†	39.5†
Weight on Future Investment (δ)	2062‡	1424.3‡	1031.7‡	945.2‡
	Period 1978-1992			
Weight on Urban Workers (β)	6.40†	5.97†	5.83†	8.25†
Weight on Future Investment (δ)	6.42‡	5.99‡	5.84‡	8.26‡
	Period 1978-1984			
Weight on Urban Workers (β)	14.3†	14.5†	28.7	30.4
Weight on Future Investment (δ)	14.4‡	14.6‡	28.9‡	30.6‡
	Period 1985-1992			
Weight on Urban Workers (β)	4.70†	4.00†	4.32†	6.98†
Weight on Future Investment (δ)	4.71‡	7.07‡	4.32‡	7.00‡

Notes: Numbers in this table are calculated from Table 6. $\dagger(\ddagger)$ indicates that the estimate of $\hat{\gamma}_1$ ($\hat{\gamma}_2$) is significant at the 5% level. The parameters β and δ are calculated from the corresponding estimated coefficients, $\hat{\gamma}_1$and $\hat{\gamma}_2$, by $\beta = 1/\ \hat{\gamma}_1 + 1$ and $\delta = (1 - \hat{\gamma}_2)/\hat{\gamma}_1 + 1$.