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# Appreciation of the renminbi and urban-rural income disparity

GUILLAUMONT JEANNENEY S. AND HUA P.

CERDI, CNRS-Université d'Auvergne

65, boulevard François Mitterrand

63000 Clermont-Ferrand, France

e-mail. s.guillaumont@u-clermont1.fr p.hua@u-clermont1.fr

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## Summary

Although poverty has been significantly decreased in China over the last twenty years, this decrease has been highly unequal across the provinces and has brought increased disparity in urban and rural per capita income. We studied the impact of exchange rate policy on urban-rural per capita income, which was marked by strong real depreciation before 1994 followed by moderate appreciation before stabilizing. We concluded that in the inland provinces where poverty is hardest, real appreciation has attenuated disparity whereas real depreciation had accentuated disparity. This result argues for a revaluation of the renminbi.


JEL: F31, O15, O53, P21

*Key words*: Income inequality, real exchange rate, China, Urban-rural inequality.

## 1. Introduction

Since China decided to reorient towards a market economy in 1978, poverty rates have fallen sharply, with figures showing the proportion of the population living in poverty fell from 53% in 1981 to just 8% in 2001[1]. This decrease in poverty levels has essentially come from the growth of rural incomes driven by expanding agricultural production (Ravallion & Chen, 2007), but has unquestionably been unequal over time and across space. The decrease slowed twice, first in late 1980s then again in the late 1990s, with substantial between-province variation: the annual rate of decreasing proportion of the poor population between 1980 and 2001 ranges from 0% (in six provinces) to 29% (in Guangdong province); coastal provinces appeared to have fared better, as their annual average poverty decrease rate is 16.55% against 8.43% in inland provinces.

However, this favourable trend in poverty figures has been accompanied by increasing income inequality, both within and between rural and urban areas. Figure[2] 1 presents the ratio between city and countryside-based income per capita (measured at 2000 constant prices) from 1985 to 2005 (the period of our analysis), showing that excluding the period 1995-1997, this ratio tended to increase. While urban income was twice rural income in 1985, it reached three times higher in 2005 due to the fact that the real per capita income increased faster in urban areas than rural areas. This increasing inequality is worrying, as it fuels social tensions and may hamper future improvement in reducing poverty. As shown by Ravallion & Chen (2007), between 1980 and 2000, the poverty decrease was weakest in the provinces with the highest initial inequality rates.

As poverty has not fallen equally across all the provinces, urban and rural income inequality has followed different patterns. The annual average change in the urban-rural ratio of per capita income over the period 1985 to 2005 varied from 0.31% in Fujian to 4.02% in Beijing (figure 2).

[1] As assessed by Ravaillon & Chen (2007) with the new poverty lines: 850 yuan in rural areas and 1200 yuan in urban areas at constant 2001 prices.
[2] Data sources for this and the followings figures are given in annex 1, “Definitions and sources of variables”.

Figure 1. Urban-rural real per capita income inequality ratio

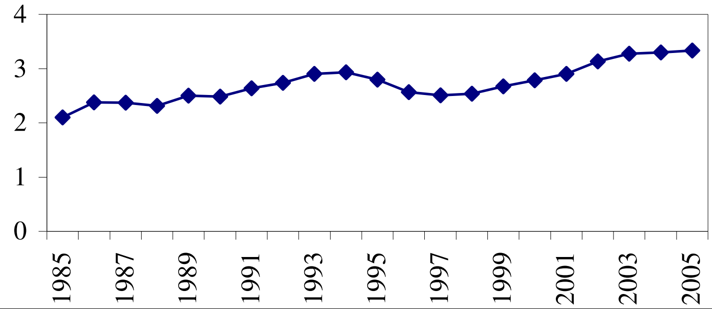
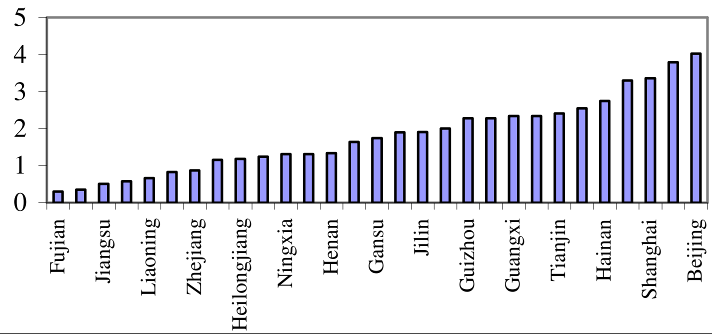


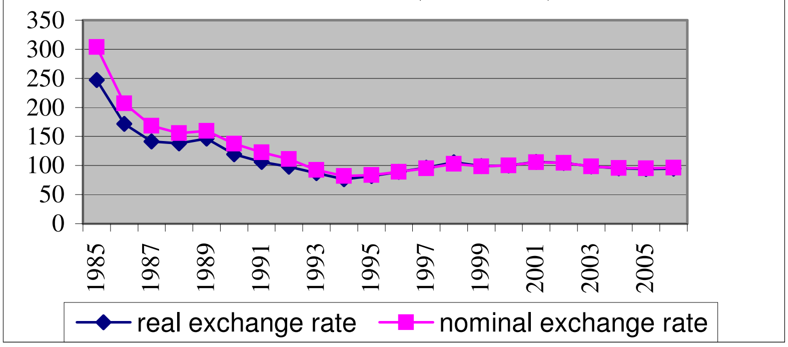

Figure 2. Annual average change in urban-rural per capita income ratio between 1985 and 2005




About ten years ago, we studied how China's exchange rate policy affected changing patterns of urban-rural income inequality (Guillaumont & Hua, 1999 and in this same revue, 2001). We have shown that the depreciation of real effective exchange rate until 1994 accompanying China's open-door policy and the transition towards a market economy (figure 3) explained, at least for the inland provinces, a significant part of the increase in urban-rural income inequality[3]. The driving factor was the fact that Chinese agriculture out put was mainly internationally non-tradable goods. This finding ran contrary to generally accepted opinion that currency depreciation has a positive effect on peasant living standards in developing countries, particularly in Africa (Berg report, 1981; Bourguignon, de Melo & Morrisson, 1991; Guillaumont 1993; Minot 1998). In particular, Bourguignon & Morrisson (1992) employed a computable general equilibrium model to show that devaluation was liable to favor peasants in Indonesia and the Côte d'Ivoire because they export their products.

[3] About 1/3 of the increase in inequality occurring over the period 1985 to 1993.

Figure 3. Nominal and real effective exchange rates of China (2000=100)




Note: a decrease means currency depreciation and an increase means currency appreciation.

However, between 1994 and 1998, the Chinese currency actually appreciated in real terms (38%) as it was pegged to the dollar, which itself appreciated vis-à-vis the other main currencies, and the real effective exchange rate has since met low-key fluctuations. From July 2005, China has progressively revalued its currency vis-à-vis the US dollar, a move that may usher in a new phase of real exchange rate appreciation, as long as the revaluation of the renminbi is not offset by a new phase of dollar depreciation on the foreign exchange markets. The accumulation of foreign exchange reserves and the difficulties experienced by the Chinese government in controlling its economic overheat may prompt China to continue to revalue its currency. In this context, we sought to study whether the real appreciation of the renminbi has played a role in reducing urban-rural income inequality (in contrast to the impact of pre-1994 depreciation), especially in the inland provinces where rural residents had been more affected than urban populations by the real exchange rate depreciation and experienced a marked lag in poverty reduction.

Analyzing the relationship between exchange rate policy and patterns of income division between urban and rural areas in China not only carries strong political implications but also presents significant theoretical interest. The estimated relationship between urban-rural income inequality and real effective exchange rates can be used to investigate whether the negative relationship[4] between these two phenomena, which is China specific, continues to hold strong in a different exchange rate policy context, and to test whether real currency devaluation and revaluation has symmetrical effects on relative price and income distribution, using China as a rare opportunity to study this kind of model.

[4] The relationship is negative because to calculate the real effective exchange rate, we used consumption prices in China as the numerator of the fraction and foreign prices as the denominator. This indicator acts as a proxy of the ratio of non-tradable to tradable goods, with an increase reflecting real appreciation, as in figure 3

In the following section, we review the factors building the relationship between real exchange rate and urban-rural real per capita income inequality, and the factors explaining why the impact of real exchange rate differs between inland and coastal provinces. We go on to deduce an explanatory equation of urban-rural income disparity. This estimate, developed across the full panel of Chinese provinces over the 1985-2005 period, allows us to distinguish the impact of real exchange rate according to geographical position of the provinces (coastal and inland) and according to direction of real exchange rate change (appreciation or depreciation); it also allows us to test the temporal stability of this relationship. Two complementary equations are proposed in order to analyze whether real exchange rate changes, in addition to a direct effect on relative prices, also follows indirect transmission channels impacting on urban-rural income disparity, such as trade protection policy or increasing labor productivity. The third section presents variables calculations, econometric methods and estimation results. Despite the fact that i) the econometric method treating endogenous problems of explanatory variables is more refined than the method used in our 1999 and 2001 studies, ii) the period of analysis includes several years of renminbi appreciation, and iii) the control variables are somewhat different, our precedent results are largely confirmed. The political implications are discussed in the conclusion.

## 2. How can real exchange rate influence income distribution between urban and rural areas?

We distinguish direct effects of real exchange rate change due to relative price variations and indirect effects due to the impact of real exchange rates on the other variables that explain urban-rural income disparity.

### 2.1. Impact of real exchange rate via relative price variations

In theory, real exchange rate represents the price of internationally non-tradable goods relative to price of tradable goods. The price of non-tradables depends on domestic-market supply and demand, whereas the price of tradables is supposed to depend on foreign prices and nominal exchange rate. A rise in real exchange rate as defined above (or real appreciation) increases the relative incomes of the agents producing the largest share of non-tradable goods and consuming the largest share of tradable goods; a decrease in real exchange rate theoretically has an inverse effect. Consequently, relative change in urban-rural incomes depends on the types of goods produced and consumed in cities and in rural communities.

Keynesian theory is thought to suggest that the price of goods and services falls less easily than they rise, and consequently that nominal revaluation would have a weaker effect than devaluation on real exchange rates. Since we aime to focus directly on the impact of real exchange rate[5], we expect *a priori* symmetrical effects of rises and falls in real exchange rates.

We suppose that a large share of China's agricultural goods are self-consumed or sold on local markets. This allows us to class this fraction as non-tradable goods, while public companies buy the rest to supply urban markets or exports. The Chinese context therefore appears to differ from other developing countries, in which the majority of agricultural goods (coffee, cacao, tea, oil, etc.) are exported. In contrast, manufactured goods, which are mainly produced in urban areas, largely exported or left to compete with imports, are internationally tradable goods. Although services (non-tradable goods) are more important in urban areas than rural areas, it is reasonable to suppose that rural areas produce a higher proportion of non-tradable goods compared to urban areas.

At the same time, peasants unquestionably consume a larger proportion of foods than urban households that are relatively heavier consumers of manufactured goods. Even though urban households do consume more services (non-tradables), it is likely that rural households consume more total non-tradables than urban households.

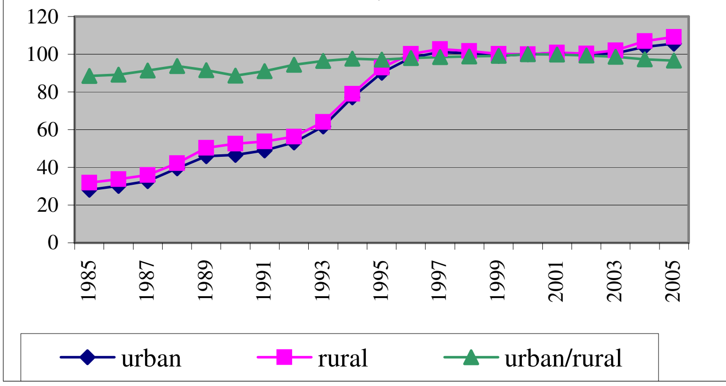
We work to the hypothesis that a rise in real exchange rate (or real appreciation) should relatively favor rural households as producers of non-tradable agricultural goods, even though the impact would be mitigated by a heavier consumption of non-tradables in rural communities than cities; it follows that the real appreciation-induced decrease in consumer prices is stronger in urban than rural areas. Symmetrically, we expect real depreciation to relatively favor urban households by increasing the relative price of internationally tradable industrial goods, even though this effect is mitigated by a heavier urban consumption of tradables, with the result that the depreciation-induced rise in consumer prices is stronger in urban than rural areas. Figure 4 presents the evolution of consumer prices in the two demographics together with their ratios. The ratio effectively follows an upward trend during the period of depreciation (before 1994) before decreasing or stabilizing.

These expectations are based on the hypothesis that the rural sector is exclusively or principally devoted to agriculture. In reality, since the beginning of China's transition towards a market economy, many industrial activities have appeared in rural areas to absorb the

[5] In other words, once the effect of nominal exchange rate on relative price has been taken into account.

surplus of labor released by agricultural reforms. Consequently, the employment rate in industrial enterprises in rural areas passed from 9% in 1978 to 26.9% in 1994 and 27.5% in 2005. However, as shown previously (Guillaumont Jeanneney & Hua, 1999, 2001), rural industrialization was more extensive in the coastal provinces than the inland provinces[6]. The development of manufacturing industry in the coastal provinces has benefited from many advantages due to the proximity of foreign markets and the trade liberalization and openness policies preferentially applied in coastal areas. Consequently, already in 1994, 60% of rural industrial production stemmed from coastal areas. This is why changes in real exchange rate are expected to have a sharper effect on urban-rural income disparity in inland provinces.

Figure 4. Consumer prices in urban and rural communities, and their ratio




## 2.2. Other explanatory variables

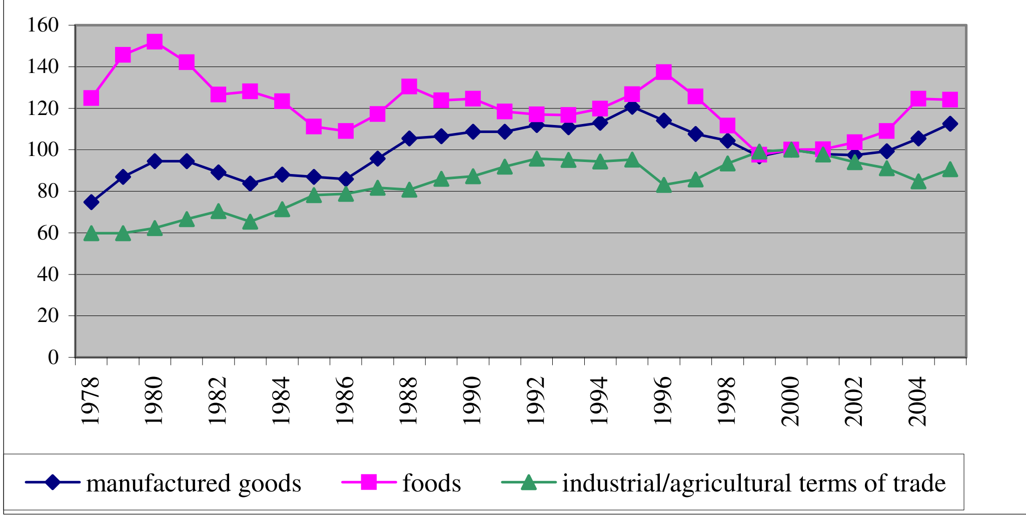
***The administration of prices and trade policy***

The prices of manufactured goods and agricultural goods (when they are tradable) by definition depend on international prices, but also on a possible administration of domestic prices and on trade protection policy (Guillaumont Jeanneney, 1993).

Figure 5 presents world price trends for manufactured goods and foods (expressed in dollars) and their ratio, named industrial-agricultural terms of trade. The figure highlights how this ratio tends to rise, which unquestionably helps explain the increasing disparity of urban-rural income in the long term.

[6] The coastal provinces, eleven in total, are: Beijing, Tianjin, Hebei, Liaoning, Shanghai Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan. The other eighteen 'inland' provinces are: Shanxi, Jilin, Heilongjiang, Henan, Anhui, Hubei, Hunan, Jiangxi, Gansu, Shaanxi, Sichuan, Guizhou, Yunnan, Qinghai, Guangxi, Inner Mongolia, Ningxia and Xinjiang. The autonomous region of Tibet is not included due to a lack of data, while data on Chongqing, which was created in 1997, is merged with data for Sichuan.

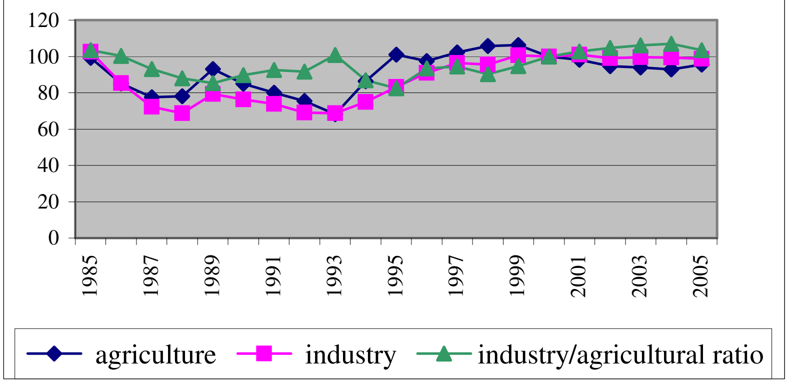
Figure 5 : World prices for manufactured goods and foods, and industrial-agricultural terms of trade




The price of manufactured goods has gradually been liberalized but is still dependent on customs duties and import quotas. Agricultural prices, especially for grain, which is traded by State-led firms, were largely controlled until 2004 (OECD, 2005). Cereals were sent to public firms at administrated prices (within an obligatory delivery framework) or at negotiated prices slightly lower than the prices on local markets. Agricultural protection, defined as the ratio of the price of public purchase from producers to world prices[7], has followed fluctuating patterns depending on whether the governments were more worried about supplying urban food at low prices or defending peasant living standards, notably in order to curb rural migration. The general trend in agricultural protection decreased until 1993, and then marked a short rise before decreasing again until 2004 and rising once again in 2005. However, the situation differs from one staple crop to another (OECD, 2005), and thus from one province to another according to crop specialization. In the meantime, industrial protection decreased regularly until 1993, then increased until the end of 1990s before finally remaining stable over the last ten years (see figure 6).

[7] Concerns here nominal protection; it would have been preferable to use effective protection, which takes into account intermediate consumer prices, but prices for agricultural inputs, which are sometimes subsidized, sometimes taxed, are unavailable, and cannot therefore be taken into account, despite being an important aspect of agricultural policy.

Figure 6. Industrial and agricultural protection rates and their ratio

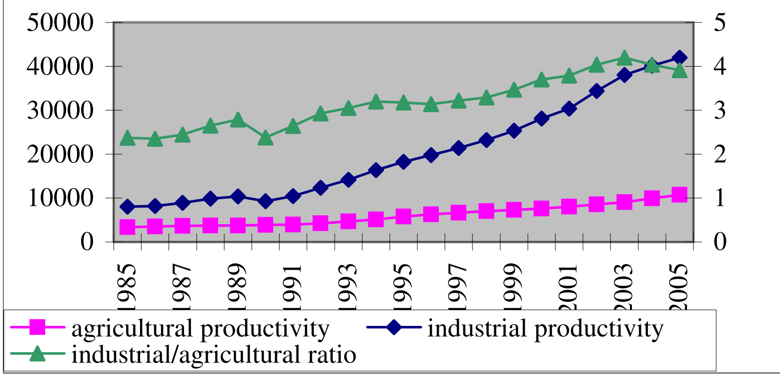



As real depreciation increases the competitiveness of national producers *vis-à-vis* foreign producers, it is possible that depreciation is accompanied by a decrease in protection, with real appreciation following an inverse pattern. This reaction logically depends on initial protection levels and is not necessarily symmetrical in the case of rising or falling exchange rates. Furthermore, this reaction may be different in industrial and agricultural sectors. The challenge is to identify the extent to which relative industrial-agricultural protection policy is influenced not only by the relative evolution of world industrial-agricultural dollar prices but also by the real exchange rate. Given that industrial protection is traditionally higher than agricultural protection, we suppose that relative industrial-agricultural protection tends to decrease faster in the case of exchange rate depreciation and increase faster in the case of exchange rate appreciation. Figure 6 highlights that despite some fluctuations, industrial protection relative to agricultural protection generally decreased until 1995 but has increased ever since. It may be that the effect of real exchange rate on relative protection constitutes one of its channels of transmission to industrial price relative to agricultural price, thus mitigating the impact of real exchange rate on urban-rural income disparity.

***Trends in industrial productivity relative to agricultural productivity***

Relative incomes from industry and from agriculture depend not only on relative prices in the two sectors but also on relative increases in productivity. One fundamental factor to be considered here is that since 1990, industrial productivity has increased much faster than agricultural productivity (see figure 7 showing the evolution of labor productivity in industry and in agriculture). Do changes in real exchange rates impact on this difference?

Figure 7. Industrial and agricultural labor productivity




We have thus far supposed a positive relationship between real exchange rate appreciation and efficiency, especially in industrial firms (Guillaumont Jeanneney & Hua, 2006). The rationale is twofold. Real appreciation corresponds to a price rise in internationally non-tradables relative to tradable goods. As non-qualified labor is a typical non-tradable good, real exchange rate appreciation means an increase in real labor remuneration expressed in tradable goods[8]. This increase may lead to improvements in worker productivity, particularly in a country where the wages of unskilled workers are still very low. The hypothesis of a positive relationship between labor remuneration and labor productivity was developed as early on as 1957 by Leibenstein (1957), who stressed that in developing countries, excessively low wages might damage worker health and working capacity. He also showed that worker motivation acts on efficiency, an effect he termed “X-efficiency” (Leibenstein, 1966). This effect can act on poor populations, whether peasants or industrial employees.

Another effect concerns the industrial sector in particular. Since the increase in remuneration caused by real exchange rate appreciation also benefits skilled workers, it may also curb their emigration (Harris, 2001). However, China had suffered from a significant ‘brain drain’, and returning thanks to better remuneration for skilled workers. Moreover, it is likely that real appreciation globally exerts positive effects on the productivity of industrial

[8] In terms of tradable goods and thus consumer goods, composed of two types of goods.

enterprises by intensifying foreign competition. Firms may be compelled to close their less efficient factories. Either way, the result is a form of "creative destruction" benefiting the most efficient enterprises. It is also possible that a real appreciation pushes firms to improve their technical efficiency in a context of monopoly or collusive oligopoly (Krugman, 1989).

The argument is the following. Managers only benefit from part of the profit generated by better management or stronger effort, since a share of this profit goes to the company owners. In the case of monopoly, managers do not choose the exertion that maximizes profit (as Marshall said, the best profit of a monopoly is a quiet life). In the case of oligopoly (due to new foreign competitors and, in China, due to competitors localized in the other provinces), the managers will choose a higher level of effort not only because this strategy may increase profits in the short run, but also because the reduction in costs dissuades competitors from producing and thus avoids price cuts. The spin-off from this strategic yield is an additional benefit that may push the management effort closer to its optimum.[9]

Finally, it is possible that real exchange rate appreciation exerts a favorable effect on technical progress because, by reducing the relative cost of equipment imports and increasing wages, it favors a more capitalistic production and the adoption of more innovative technologies due to foreign machine imports[10].

We make the hypothesis that real appreciation can contribute to increasing relative urban-rural labor productivity, and inversely for real depreciation; this constitutes a second indirect transmission channel of real exchange rate on income disparity. Again, this indirect effect of real exchange rate might mitigate the favorable impact of real appreciation on the relative living standards of rural populations

The variables identified above only imperfectly resume the factors likely to influence urban-rural income disparity. In our previous study, we introduced the relative level of

[9] See Krugman (1989), p. 133.
[10] The effect of real exchange rate on technical progress is not so clear.

primary education, but it did not prove statistically significant. Other potential explanatory variables could include different measures of infrastructure, but it is reasonable to expect the impact of these variables to work essentially through productivity, which is already taken into account[11].

**2.3. The model to be estimated**

The previous theoretical hypotheses can be modeled schematically, as follows.

In cities, as in rural areas, real per capital income "y" can be expressed by the following identity:

$$y = \frac{Y}{Pc.N} = \frac{P\ Q}{Pc\,N}$$

where Y = nominal income

P = production price

Pc = consumer price

Q = added value allocated to households, used principally to pay labor

N = population.

By naming:

Pnt and Pt as production prices of non-tradable goods and tradable goods[12],

Pcnt and Pct as consumer prices of non-tradable goods and tradable goods

α and β as shares of non-tradable goods in production and consumption,

it follows that $P = P_{nt}^{\alpha} Pt^{1-\alpha}$ and $P_c = P_{cnt}^{\beta}.P_{ct}^{1-\beta}$ .

By defining real exchange rate as relative price of non-tradables compared to tradables, supposed identical for produced goods and consumed goods, i.e. $\rho = \frac{Pnt}{Pt}$ or $\frac{Pcnt}{Pct}$, and knowing that the price of tradables is a function of world price (expressed in yuans), $P^*$ multiplied by protection ratio θ, i.e. $Pt = f\left(P_t^*.\theta\right)$ and $Pct = g\left(P_{ct}^*.\theta c\right)$, we obtain:

$$y = \frac{f(P_t^*.\theta).\rho^{\alpha}.Q}{g(P_{ct}^*\theta_c).\rho^{\beta}.N}$$

[11] In our previous study, we did not introduce relative productivity in the estimations, but only a trend intended to capture structural changes in productive systems.

[12] i.e. index t for *tradable* and index nt for *non-tradable*.

Added value distributed to households $\frac{Q}{N}$ can be expressed as a function of labor productivity $L$, i.e. $\frac{Q}{N} = h(L)$.

This makes it possible to express income disparity between urban areas u and rural areas r, termed D, as the ratio of per capita income calculated for each area. Expressing as logarithms leads to the following income disparity equation:

$$LnD = \gamma_1 \ln \frac{P^*_{tu}}{P^*_{tr}} + \gamma_2 Ln \frac{\theta_u}{\theta_r} + \gamma_3 Ln\rho + \gamma_4 Ln \frac{L_u}{L_r} + \gamma_5 Ln \frac{P^*_{cr}\theta_{cr}}{P^*_{cu}\theta_{cu}}$$

where $\gamma_3 = (\alpha_u - \alpha_r) + (\beta_r - \beta_u)$

Consequently, urban-rural per capita income disparity D is a function of international terms of trade between goods produced in urban areas and rural areas, relative protection of these goods, the real exchange rate, whose elasticity depends on relative share of non-tradable goods produced and consumed in cities and in rural areas, and finally, of relative labor productivity ratio in each area. The last terms in the equation, corresponding to the ratio of tradable consumer goods in rural areas and urban areas, disappears from the equation if one supposes that this price, which is dependent on foreign prices and protection ratios, is identical in the two areas. The equation to be estimated becomes:

$$LnD = \gamma_1 \ln \frac{P^*_{tu}}{P^*_{tr}} + \gamma_2 Ln \frac{\theta_u}{\theta_r} + \gamma_3 Ln\rho + \gamma_4 Ln \frac{L_u}{L_r} \qquad \text{(Eq. 1)}$$

The ratio of urban-rural world production prices will be assimilated to the ratio of world industrial-agricultural prices, and the protection rates for urban and rural areas correspond to protection rates of manufactured goods and agricultural goods, respectively. Labor productivity is assimilated as industrial productivity in urban areas and agricultural productivity in rural areas.

In order to analyze whether the impact of real exchange rate on income inequality is different between coastal and inland provinces, we add a multiplicative variable of real exchange rate and a dummy equal to 1 for coastal provinces. In the same way, to verify the symmetry between the impacts of real appreciation and real depreciation, we multiply the real exchange rate by a dummy variable equal to 1 for real appreciation years, i.e. 1988, 1989, from 1995 to 1998, 2000, 2001, and 2004.

Furthermore, it is possible that since 1994, agricultural liberalization, by increasing the impact of market price or eventually narrowing the gap between the kinds of goods (tradable or not) produced in rural and urban areas, has played a role in mitigating the impact of exchange rate on urban-rural income disparity. Thus, we shall introduce a multiplicative variable of real exchange rate and a dummy equal to 1 for the years 1885-1994.

We then estimate the ratio between urban consumer prices and rural consumer prices as a function of real exchange rate in order to test the hypothesis that non-tradable goods representing a higher share of rural consumption than urban consumption, with the result that price ratio is a decreasing function of real exchange rate.

Finally, to test whether real exchange rate exerts indirect impacts on urban-rural income disparity by influencing industrial-agricultural protection policies or relative labor productivity in two sectors, we estimate two complementary equations by relating these variables to real exchange rate. We then replace these control variables in the income disparity equation with their fractions that are not explained by real exchange rate; this allows us to estimate the direct and indirect effects of real exchange rate on income disparity.

Consequently, we estimate three supplementary equations.

$$Ln\frac{P_{Cu}}{P_{Cr}}=\lambda Ln\rho+trend \qquad \text{(Eq.2)}$$

$$Ln\frac{\theta_u}{\theta_r}=\phi Ln\rho+\varphi Ln\frac{P_u^*}{P_r^*}+trend \qquad \text{(Eq. 3)}$$

$$Ln\frac{L_u}{L_r}=\chi Ln\rho+trend \qquad \text{(Eq. 4)}$$

We introduce into these equations the same multiplicative dummy variables of ρ as in equation 1.

### 3. Econometric estimation

The panel estimation covers the period 1985-2005 and concerns 29 provinces. All variables are calculated at 2000 constant prices and expressed in logarithms (see annex 1 for definitions and sources of variables).

### 3.1 Calculations of variables

The urban-rural disparity in real per capita income is equal to the ratio between urban real per capita income and rural real per capita income. According to the definition of the *State Statistical Bureau* of China, urban income corresponds to the available income of urban families, i.e. to total income less income taxes, property taxes and social contributions. Rural income, which corresponds to the net income of rural families, is the total income of rural families minus expenditures for production activities, fixed capital amortizations, taxes, and gifts to parents and friends outside the rural area. Urban income and rural income are deflated by urban and rural consumer prices, respectively.

The real exchange rate, considered here as the relative price of internationally non-tradable goods compared to tradable goods, is approximated by a real effective exchange rate. The real effective exchange rate indices of the Chinese provinces are calculated on the basis of year 2000=100 as the ratio of consumer price index of the considered province to the average consumer price index of its fifteen foreign trade partners[13] (defined as a function of geographical import origins in 1998[14]), all prices being expressed in the same currency[15]. Consequently, an increase of real exchange rate corresponds to an appreciation of the Chinese currency or a decrease of relative price of tradable goods.

Given that until 1993, China used two exchange rates, i.e. official rate and swap rate, the renminbi-dollar exchange rate is calculated for the period 1985-1993 as a weighted average of these two exchange rates, taking foreign exchange retention ratios as weights. The calculated weighted pre-1994 nominal exchange rate of the renminbi to the dollar is not equal for each province because swap rates differed between provinces (Khor, 1993). Although all the Chinese provinces shared the same single nominal exchange rate from this point on for the rest of the estimation period, their real effective exchange rates have evolved at different rates because they have different foreign trade partners and inflation rates.

The international terms of trade (expressed in dollars) of industrial goods compared to agricultural goods are approximated as the ratio of prices of developing countries' manufactured goods to world food prices. The relative ratio of industrial-agricultural goods protection rates is the ratio of industrial protection rates to agricultural protection rates. The protection rate of industrial goods is measured as the ratio of Chinese industrial prices relative to export unit value of manufactured goods in developing countries, converted into yuan, whereas the protection rate of agricultural goods is measured as the ratio between purchase

[13] We unfortunately had to eliminate several ex-Soviet Union countries due to a lack of data on exchange rates.

[14] This is the only year for which we obtained China's *General Administration* of *Customs* data on import origin for different provinces. We therefore suppose that each province kept the same partners throughout this period. We also used real effective exchange rates, supposing that the weights of each province are the same as national averages for China; this is not an ideal hypothesis given China's size and the specializations of each province, as confirmed by econometric results (not presented here).

[15] $TCER=\prod_{i=1}^{15}(TCN_{ic}\frac{P_c}{P_{fi}})^{\alpha_i}$, where TCER represents the real effective exchange rate of the renminbi, $TCN_{ic}$ is the nominal bilateral exchange rate of the renminbi in terms of currency of foreign partner i with i=1…..15. $P_c$ and $P_{fi}$ correspond to consumer price indices of the Chinese province and the country, i, respectively. $\alpha_i$ are the weights of partners calculated as a function of import origins in 1998, with $\sum \alpha_i = 1$.

prices for agricultural goods from peasants and export unit value of Chinese agricultural goods expressed in dollars, again converted into yuan.

The urban-rural relative productivity ratio is calculated as industrial labor productivity divided by agricultural labor productivity. Labor productivity in industry is approximated by real GDP (2000=100) in the secondary sector divided by the number of secondary-sector employees[16]. Agricultural labor productivity is calculated as agricultural production in real terms divided by the number of agricultural-sector employees.

Finally, we introduce three dummy variables, each are equal to 1, for coastal provinces for the years 1985-1994, and for the years of real renminbi appreciation, respectively.

### 3.2. Econometric method

The Im-Pesaran-Shin panel unit root test is applied to all the variables except for terms of trade variable which is only a temporal series, and thus the ADF test is run. The results of these tests led to reject the null hypothesis of non-stationarity.

The results of Breusch and Pagan LM test and the Hausman specific test indicate that we cannot reject the hypothesis of a fixed-effect model (see bottom of the tables 2 to 5). The principal potential econometric problem is endogeneity of explanatory variables, a difficulty that is met in all the estimations on macroeconomic data due to simultaneity bias, measurement errors of variables (a particularly serious problem in China), and the risk of omitted variables. Given that the results of the Durbin-Wu-Hausman test did not allow us to reject the endogeneity of explanatory variables (see the bottom of the tables 2 to 5), we treated both the endogeneity problem and the problem of structural heterogeneity of the provinces by using the system estimator of the one-step Generalized Moment Model (GMM) of Blundel & Bond (1998).

**Table 1. Im-Pesaran-Shin panel unit root test on the variables**

| | *Panel t-statistics*[a] | P-value |
|---|---|---|
| Urban-rural real per capita income disparity | -7.994 | 0.000 |
| Real effective exchange rate | -3.846 | 0.000 |
| Industrial-agricultural terms of trade | -3.555 | 0.007 |
| Industrial-agricultural protection rates ratio | -3.822 | 0.000 |
| Industrial-agricultural productivity ratio | -3.768 | 0.000 |

*Notes: a = except for terms of trade (ADF test).*

[16] It would naturally have been preferable to use industrial production, but industrial production changed content in the 1990s, making it impossible to obtain a homogeneous temporal series.

This GMM system estimation approach combines an equation in levels in which lagged first-difference variables are used as instruments and a first-difference equation in which the instruments are lagged variables in levels. Blundel & Bond showed that this estimator is more powerful than the first-differences estimator derived from Arellano & Bond (1991), which gives biased results in small samples with weak instruments. These lagged variables were completed by the addition of other instrumental variables. Indeed, Guillaumont Jeanneney & Hua (2002) show that by applying the Balassa-Samuelson hypothesis to the Chinese provinces trading simultaneously with other Chinese provinces and with foreign partners, the real effective exchange rate of each province is a function of the ratio of the province's GDP to the GDP of China as a whole, as well as to the average GDP of its foreign trade partners[17]. The validity of these instruments is tested by using the Sargan over-identification test. The results do not allow us to reject the hypothesis on the validity of lagged variables in levels and in difference as instruments. The instruments are therefore independent of error terms.

### 3.3 Results

Table 2 gives the results of income disparity estimation with all previously-defined control variables. The elasticity of real effective exchange rate therefore makes it possible to measure direct impacts resulting from relative price changes of non-tradable goods compared to tradable goods produced and consumed in the urban and rural areas. The results fit well to theoretical model, the estimated coefficients with variable instrumentation being higher than the within-estimate coefficients.

Real exchange rate appreciation tends to decrease urban-rural income disparity (while depreciation exerts an inverse impact) in the inland provinces only, since the coefficient of real exchange rate multiplied by the coastal dummy variable equals 0.31 and its absolute value is almost the same as that of real exchange rate for all the Chinese provinces, but with an inverse sign (-0.33). The variable for real exchange rate multiplied by appreciation years is not significant, suggesting that real exchange rate appreciation has the same impact as real exchange rate depreciation. Finally, the coefficient, certainly weak (-0.03), of real exchange rate multiplied by a dummy variable equal to 1 for the first period of estimation (before 1994) is negative (as is the real exchange rate coefficient) and significant, suggesting a weak decrease in the impact of real exchange rate on income disparity during the second period[18],

[17] Source : IMF *International Financial Statistics.*

[18] The results of the Chow test in fact allow us to reject the hypothesis of equal coefficients for the two periods.

and could mean that the kinds of production and consumption (or the division between tradable and non-tradable goods) in urban and rural areas tends to be weakly closer.

The tables 3 to 5 can be used to analyze the transmission channels through which real exchange rate impacts urban-rural income inequality. Table 3 presents the regressions of urban-rural consumer prices ratio on real exchange rate. The negative sign and the significant value of the elasticity of the prices ratio vis-à-vis the real exchange rate indicate that urban households probably consume proportionally less non-tradable goods than rural households, in both coastal and inland provinces, as the prices of non-tradables are increasing with real appreciation.. The higher absolute value of the coefficient before 1994 suggests that the difference in urban and rural consumption patterns seems to be larger during the first period. As it mitigates the real exchange rate impact on inequality, this difference may partly explain why real exchange rate impact on inequality is weaker after 1994.

The estimations in table 4 show that the relative protection rates are negatively dependent on international industrial-agricultural terms of trade and positively dependent on real exchange rate. During the periods of exchange rate appreciation, the government is more anxious about the competitiveness of industry than of agriculture, which is less challenged from outside. This phenomenon is more marked in the coastal provinces where manufacturing industry is located, and which is challenged from outside, while several inland provinces are specialized in heavy industry. The estimation of relative productivities indicates an important and positive impact of real exchange rate, suggesting that real appreciation has a positive impact on industrial productivity[19], probably especially in inland provinces.

When the relative protection rates and the relative productivities are purged from the real exchange rate effect and then are introduced into the equation of urban-rural income inequality (table 5), the impact of real exchange rate appreciation (relatively favorable to rural areas in the inland provinces) is probably mitigated (elasticity slides from -0.43 to -0.38 in the last column in tables 2 and 5). In the coastal provinces, it is possible that the real appreciation becomes relatively favorable to urban areas (as the protection benefiting industry becomes reinforced).

[19] Mathematically, this result may also signify that appreciation exerts a negative effect on agricultural productivity via a phenomenon of discouragement among peasants suffering competition from outside, but this interpretation would run contrary to the idea that in China, agricultural goods are largely non-tradable goods.

## 4. Conclusion

Our analysis shows that the impact of the real appreciation of the Chinese currency on urban-rural real per capita income disparity is symmetrical to the impact of real depreciation. Furthermore, this impact is far from being ignored. Considering only the direct effects of relative price change and the last column of table 2, a 20% appreciation in the renminbi (which is not unlikely) may lead to an 8.4% decrease in urban-rural real per capita income inequality in the inland provinces, which would represent a drop from 3.29 in 2005 to 3.02. If indirect effects are taken into account, the resulting decrease, at 7.6%, is less appreciable.

This favorable impact of real exchange rate appreciation on urban-rural income disparity in the inland provinces, where the inequality is sharpest, may not itself win out the decision of the Chinese government to revalue its currency, even though does objectively constitute a positive argument. The will of the Chinese government to only gradually revalue the renminbi may be explained by a more important concern of stiffer reaction from urban populations than from rural populations in the inland provinces.

In the future, appreciation of the renminbi may have different consequences from those highlighted in this study. If the agricultural markets are completely liberalized to the extent that agricultural goods become internationally tradable, China will join the classic model, in which real currency depreciation (and not appreciation) is favorable to peasants. However, if China's booming growth persists in driving an increase in world food prices, then China's rural communities, which are not entirely peasant-based and look set to become less so, can be expected to buy these goods more expensively. The appreciation of the currency may therefore exert a favorable effect inducing a less significant rise in the price of agricultural goods, which we have supposed to account for a greater share of rural consumption than urban consumption.

Table 2. Direct effects of real exchange rate on urban-rural income disparity

| | Fixed Effect | System GMM | Fixed Effect | System GMM | Fixed Effect | System GMM | Fixed Effect | System GMM | Fixed Effect | System GMM |
|---|---|---|---|---|---|---|---|---|---|---|
| Real exchange rate | -0.07* (-1.81) | -0.22*** (-7.34) | -0.20*** (4.50) | -0.33*** (-5.24) | -0.12*** (-3.24) | -0.22*** (-4.70) | -0.07* (-1.81) | -0.21*** (-1.62) | -0.25*** (-6.01) | -0.43*** (-3.33) |
| Real exchange rate * coastal provinces | | | 0.33*** (6.18) | 0.31*** (2.87) | | | | | 0.33*** (6.64) | 0.56** (2.07) |
| Real exchange rate * dummy variable before 1994 | | | | | -0.02*** (-3.37) | -0.03*** (-5.38) | | | -0.02*** (-8.34) | -0.03*** (-5.66) |
| Real exchange rate * dummy variable for appreciation years | | | | | | | 0.000 (0.02) | -0.0003 (-0.09) | | |
| Ratio of industrial/agricultural protection rates | 0.22 (2.24) | 0.28** (2.43) | 0.23*** (5.80) | 0.27*** (2.28) | 0.20*** (5.06) | 0.29*** (2.66) | 0.22*** (5.23) | 0.23* (1.78) | 0.21*** (5.51) | 0.28*** (2.74) |
| Industrial/agricultural international terms of trade | 0.77*** (11.02) | 0.59*** (5.93) | 0.77*** (11.3) | 0.60*** (6.04) | 0.45*** (5.90) | 0.45*** (5.78) | 0.77*** (10.95) | 0.63*** (6.19) | 0.15*** (6.00) | 0.43*** (5.85) |
| Ratio of industrial/agricultural labor productivity | 0.05*** (3.84) | 0.12*** (2.51) | 0.05*** (3.71) | 0.12*** (2.84) | 0.01 (1.03) | -0.04 (-1.00) | 0.05*** (3.81) | 0.12*** (2.56) | 0.01 (0.79) | -0.03 (-0.82) |
| Breusch and Pagan LM test [b] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Hausman specific test [b] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| DWH endogeneity test[b] | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| Sargan overidentification test[b] | | 0.99 | | 0.989 | | 0.991 | | 0.989 | | 0.987 |

Notes: b. P value. T-statistics corrected for heteroscedasticity via the White test are indicated in brackets. ***=significant at level of 0.01; **=significant at level of 0.05; *=significant at level of 0.1. All variables are given as natural logarithms.

Table 3. The transmission channel of real exchange rate via consumer price

| Dependant variable | Urban-rural consumer price ratio | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Within | GMM | Within | GMM | Within | GMM | Within | GMM |
| Real exchange rate | -0.09*** | -0.09*** | -0.08*** | -0.22** | -0.12*** | -0.11*** | -0.10*** | -0.09*** |
| | (-10.23) | (-7.11) | (-7.05) | (-1.97) | (-11.7) | (-8.95) | (-10.73) | (-7.41) |
| Real exchange rate * costal provinces | | | -0.05*** | 0.37 | | | | |
| | | | (-2.97) | (1.34) | | | | |
| Real exchange rate * dummy variable before 1994 | | | | | -0.009*** | -0.01*** | | |
| | | | | | (-5.34) | (-5.34) | | |
| Real exchange rate * dummy variable of appreciation years | | | | | | | 0.005*** | 0.005*** |
| | | | | | | | (6.06) | (8.59) |
| Trend | 0.005*** | 0.005*** | 0.005*** | 0.005*** | 0.002*** | 0.002*** | 0.004*** | 0.004*** |
| | (18.8) | (6.43) | (18.9) | (5.43) | (3.55) | (3.49) | (16.06) | (5.75) |
| Breusch and Pagan LM test [b] | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Hausman specific test [b] | 0.00 | | 0.00 | | 0.00 | | 0.05 | |
| DWH endogeneity test[b] | | 0.000 | | 0.00 | | 0.000 | | 0.000 |
| Sargan overidentification test[b] | | 0.298 | | 0.8414 | | 0.8343 | | 0.4833 |

Notes: b. P value. T-statistics corrected for heteroscedasticity via the White test are indicated in brackets. ***=significant at level of 0.01; **=significant at level of 0.05; *=significant at level of 0.1. All variables are given as natural logarithms.

Table 4. The transmission channels of real exchange rate via other explanatory variables

| Dependant variable | Ratio of industrial/agricultural protection rates | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Within | GMM | Within | GMM | Within | GMM | within | GMM |
| Real exchange rate | 0.45*** | 0.27*** | 0.43*** | 0.18*** | 0.46*** | 0.32*** | 0.45*** | 0.27*** |
| | (14.28) | (10.34) | (11.7) | (3.64) | (13.1) | (12.79) | (15.1) | (10.12) |
| Real exchange rate * coastal provinces | | | 0.03 | 0.22** | | | | |
| | | | (0.61) | (1.92) | | | | |
| Real exchange rate * dummy variable before 1994 | | | | | 0.005 | 0.02*** | | |
| | | | | | (0.85) | (5.20) | | |
| Real exchange rate * dummy variable of appreciation years | | | | | | | -0.02*** | -0.02*** |
| | | | | | | | (-7.32) | (-15.5) |
| International industrial/agricultural terms of trade | | -0.81*** | | -0.72*** | | -0.73*** | | -0.70*** |
| | | (-12.30) | | (-10.83) | | (-10.9) | | (10.9) |
| Trend | -0.002*** | 0.007** | -0.002** | 0.001** | -0.002 | 0.02*** | 0.0002 | 0.01*** |
| | (-2.23) | (2.38) | (2.23) | (2.31) | (-0.45) | (4.52) | (0.30) | (3.04 |
| Breusch & Pagan LM test [b] | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Hausman specific test [b] | 0.08 | | 0.08 | | 0.10 | | 0.06 | |
| DWH endogeneity test[b] | | 0.000 | | 0.000 | | 0.000 | | 0.000 |
| Sargan overidentification test[b] | | 0.993 | | 0.992 | | 0.992 | | 0.994 |
| | Ratio of industrial/agricultural labor productivity | | | | | | | |
| Real exchange rate | 0.59*** | 0.50*** | 0.54*** | 0.69*** | 0.46*** | 0.45*** | 0.59*** | 0.57*** |
| | (6.79) | (8.97) | (5.28) | (6.89) | (4.80) | (5.65) | (6.80) | (9.53) |
| Real exchange rate * coastal provinces | | | 0.13 | -0.34* | | | | |
| | | | (0.86) | (-1.75) | | | | |
| Real exchange rate * dummy variable before 1994 | | | | | -0.04*** | -0.04** | | |
| | | | | | (-2.89) | (-2.24) | | |
| Real exchange rate * dummy variable of appreciation years | | | | | | | -0.003 | -0.002 |
| | | | | | | | (-0.44) | (-0.29) |
| Trend | 0.03*** | 0.03*** | 0.03*** | 0.03*** | 0.02*** | 0.02*** | 0.03*** | 0.03*** |
| | (12.6) | (7.15) | (12.57) | (7.15) | (2.93) | (2.63) | (12.02) | (6.73) |
| Breusch and Pagan LM test [b] | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Hausman specific test [b] | 0.11 | | 0.07 | | 0.10 | | 0.09 | |
| DWH endogeneity test[b] | | 0.002 | | 0.000 | | 0.00 | | 0.00 |
| Sargan overidentification test[b] | | 0.994 | | 0.993 | | 0.992 | | 0.994 |

Notes: see table 2.

Table 5. Total effects of real exchange rate on urban/rural income disparity

| | Fixed effect | System GMM | Fixed effect | System GMM | Fixed effect | System GMM | Fixed effect | System GMM | Fixed effect | System GMM |
|---|---|---|---|---|---|---|---|---|---|---|
| Real exchange rate | 0.01 (0.03) | -0.08** (-1.99) | -0.11*** (-2.58) | -0.15*** (-3.24) | -0.06* (-1.67) | -0.15*** (-3.85) | 0.01 (0.33) | -0.08* (-1.81) | -0.19*** (-4.58) | -0.38*** (-3.09) |
| Real exchange rate* coastal provinces | | | 0.33*** (6.18) | 0.31*** (2.87) | | | | | 0.33*** (6.64) | 0.63** (225) |
| Real exchange rate * dummy variable before 1994 | | | | | -0.02*** (-3.37) | 0.04 (1.54) | | | -0.02*** (-8.34) | -0.02*** (-3.48) |
| Real exchange rate * dummy variable of appreciation years | | | | | | | 0.000 (0.02) | -0.0003 (-0.09) | | |
| Ratio of industrial/agricultural protection rates | 0.22 (2.24) | 0.28** (2.43) | 0.23*** (5.80) | 0.27*** (2.28) | 0.20*** (5.06) | 0.29*** (2.66) | 0.22*** (5.23) | 0.23* (1.78) | 0.21*** (5.51) | 0.28*** (2.74) |
| Industrial/agricultural international terms of trade | 0.77*** (11.02) | 0.59*** (5.93) | 0.77*** (11.3) | 0.60*** (6.04) | 0.45*** (5.90) | 0.45*** (5.78) | 0.77*** (10.95) | 0.63*** (6.19) | 0.15*** (6.00) | 0.43*** (5.85) |
| Ratio of industrial/agricultural labor productivity | 0.05*** (3.84) | 0.12*** (2.51) | 0.05*** (3.71) | 0.12*** (2.84) | 0.01 (1.03) | -0.04 (-1.00) | 0.05*** (3.81) | 0.12*** (2.56) | 0.01 (0.79) | -0.03 (-0.82) |
| Breusch & Pagan LM test [b] | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| Hausman specific test [b] | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 | |
| DWH endogeneity test[b] | | 0.00 | | 0.00 | | 0.00 | | 0.00 | | 0.00 |
| Sargan overidentification test[b] | | 0.99 | | 0.989 | | 0.991 | | 0.989 | | 0.987 |

Notes: b. *P*-value. T-statistics corrected for heteroscedasticity via the White test are indicated in brackets. ***=significant at 0.01; **=significant at 0.05; *=significant at 0.01.

All variables are given in natural logarithms.

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Annex 1: Definitions and sources of variables

| Name of variables | Method of calculation | Source |
|---|---|---|
| D : Urban-rural income inequality | Urban real per capita income divided by rural real per capita income (2000 constant prices) | *China Statistical Yearbook* |
| ρ: real effective exchange rate | Consumer price in a province relative to average consumer prices of its trade partners, expressed in same currency | FMI, *International Financial Statistics - Direction of Trade*<br>Khor, 1993 |
| $\frac{P_u^*}{P_r^*}$ : International terms of trade (in dollars) of industrial/agricultural goods | Ratio of manufactured goods prices in developing countries compared to world food prices | *United Nations International Trade Statistics Yearbook and the Monthly Bulletin of Statistics*<br>IMF, *International Financial Statistics* |
| $\frac{\theta u}{\theta r}$ : relative ratio of industrial/agricultural goods protection rates | Ratio of industrial protection rate relative to agricultural protection rate | *China Statistical Yearbook*, *China Yearbook: Rural Households Survey* |
| $\frac{\frac{Qu}{Nu}}{\frac{Qr}{Nr}}$ : relative ratio of industrial/agricultural productivity | Ratio of labor productivity between industry and agriculture | *China Statistical Yearbook* |
| $\frac{Q_u}{N_u}$ : labor productivity in industry | Real GDP of the secondary sector divided by the number of employees in the sector | *China Statistical Yearbook* |
| $\frac{Q_r}{N_r}$ : labor productivity in agriculture | Agricultural production in real terms divided by the number of employees in the sector. | *China Statistical Yearbook* |