

## *The Empirical Analysis of Tea Price Under the Influence of Wage Earner in China*

HE Chen-lei, Nanjing Agriculture University, China

LI Xing-hui, Nanjing Agriculture University, China

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### **Abstract**

The paper reports on the variations of remuneration of tea-picking workers from 2006 to 2015. In addition, weather changes and hot social issues are combined to further explain the causes of such variations. Tea comes in a great many varieties, according to which standards of picking fresh tea leaves vary considerably, and the tea of a high quality usually enjoys an accordingly high picking standard. Since it is impossible to mechanise the production of tea leaves due to lack of standardised tea plantations, workers need to pick tea leaves manually. With the increase of labour costs and the ageing population, there appear big problems with regard to manual-picking. The income of tea-picking workers has increased from 38 RMB to 120 RMB per day in the last decade. A manpower shortage is another big issue, in which case even though employers promise a favourable pay offer, they still fail to employ adequate workers. Granger Causality Test is applied to analyse and conclude the relation between pay offers and tea prices, and at the end of this paper, some suggestions are put forward based on the conclusions which have been drawn previously.

Keywords: labor force; wages; tea price; Granger Causality Test

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## Introduction

Statistical summary of 2013 tea planting and production situation made by China's ministry of agriculture has come out. China tea production enthusiasm continued to heat up, planting area and yield are both increased in 2013. Tea output value exceeds 100 billion RMB for the first time. Planting area and yield of tea sustain the growth over 11 years in China.

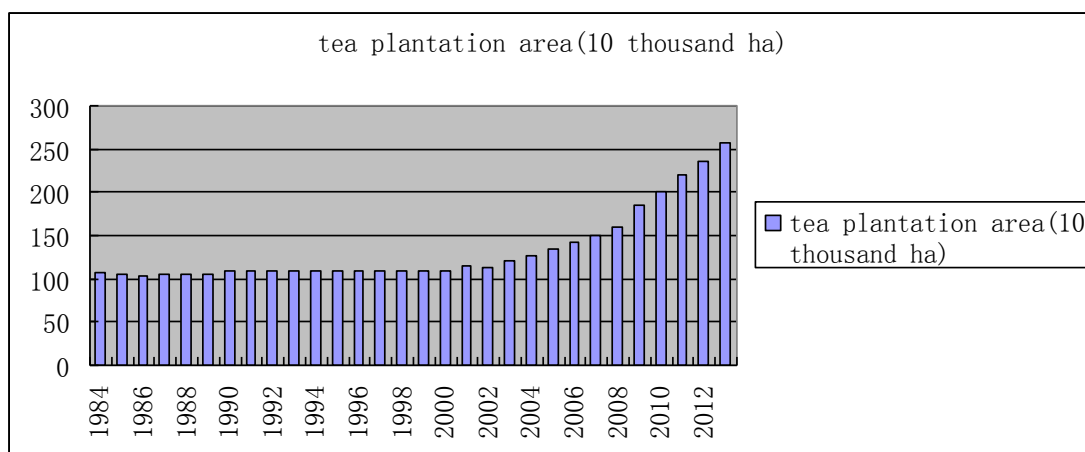


Figure 1: China tea plantation area

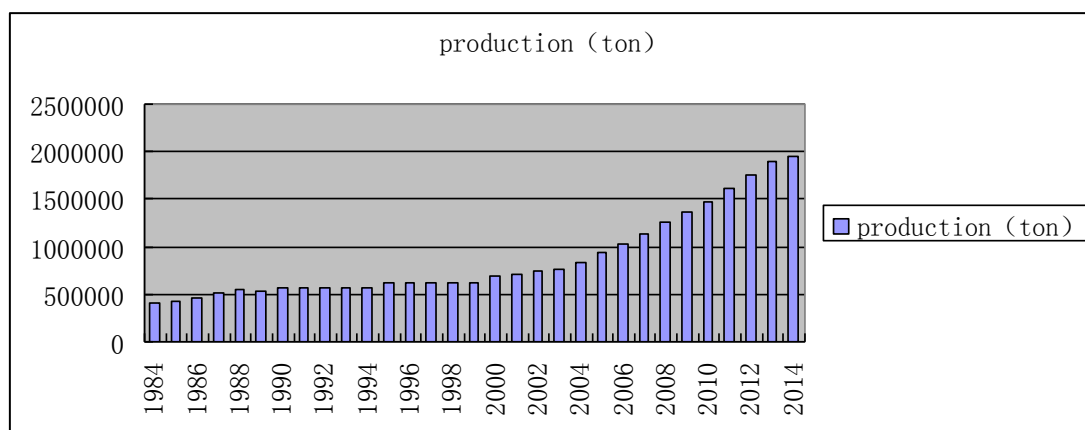


Figure 2: China tea and production

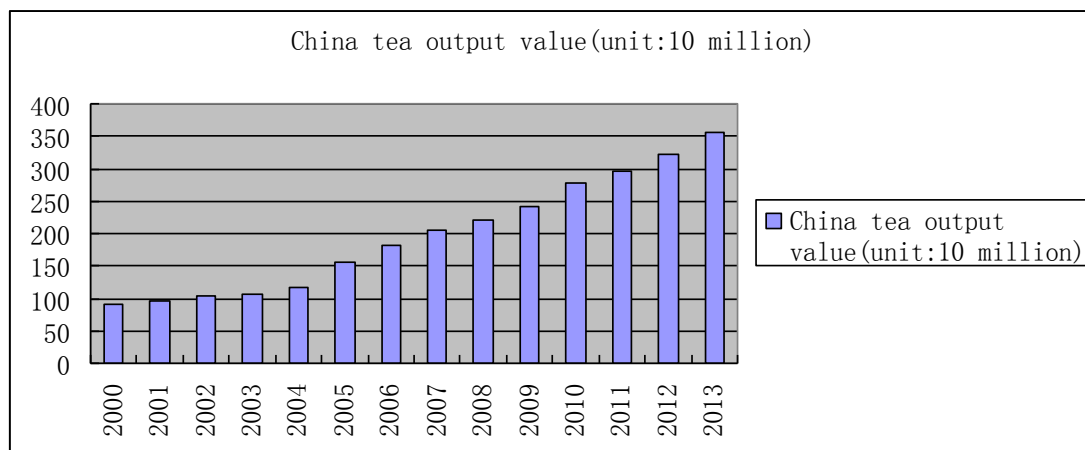


Figure 3: China tea output value

2013, tea garden area of Zhejiang province is 2.77 million mu, tea production is 156,000 tons, the output value is 13.14 billion RMB. Longjing tea production is 23,000 tons among the total production, the output value of Longjing tea is 3.68 billion RMB. In 2014, tea garden area of Zhejiang province is 2.87 million acres, tea production is 169000 tons, year-on-year growth is 4% and 8.2% respectively. Tea garden area and tea yield of Zhejiang province increase with varying degrees every year, more and more local tea farmers go out to Guizhou or Yunnan for teaplanting. 2014 Guizhou tea plantation area is up to 6.11 million mu, takes up 15.8% of the total area of the national tea garden, tea garden area in Guizhou first exceeds Yunnan province and takes the biscuit.

No doubt the continuous growth of production and plantation area, but some hidden trouble in this phenomenon has come out. Take Songyang county of Zhejiang province as an example, Songyang county has 68,962 farmers, tea plantation area is 7,822 ha, that means every farmer owns 1134 km<sup>2</sup> tea garden, 15 tea pickers per hm<sup>2</sup> is suitable. So it is impossible to finish the farm work, the labor shortage problem is more serious compared with ordinary tea. In some cases, even though employers promise a favourable pay offer, they still fail to employ adequate workers. What is the reason of the labor shortage? Is the labor shortage caused by unreasonable wage? This paper sets forth author's position on labor shortage. The labor shortage problem is more and more serious than before. If price has Granger causality to wage, price

changes first, wage changes behind. Wage has a reasonable fluctuation with tea price. But the labor shortage problem has no progress. Whereas, if wage has Granger causality to price, wage changes first, price changes behind.

Concerning to tea price, after president Xi Jinping came into power, the past tea industry relied on the government procurement extremely decrease, 90% of high-price tea commodity drop by 16.3% on price year on year, tea industry will suffer a cold winter with the deepening reform. There is still green tea of last year storing in the villagers' houses when the new tea season is coming. On December 8, 2013, General Office of The CPC Central Committee and General Office of The State Council announced the new revision of The Regulation for Domestic Official Reception of The Party And Government Organs, special local product are strictly prohibited on the list of the new revision, naturally, tea products are strictly prohibited. Indeed, the previous public funds consumption has given rise to "corruption economy", many high-end goods and high-end enterprises take full advantage of social corruption to obtain windfall. For a long time China's tea companies spend much effort on high-end products positioning their products as "business etiquette tea" in the hope of corruption. Although these enterprises are rich, but there is no denying that these companies also encourage corruption. Nowadays the days of these enterprises are hard, however this depression of "corrupt economy" is a blessing. How to adjust business model to adapt to the new market pattern allows of no delay.

Policy reasons are the appearance, the structural contradiction of supply and demand is the source of the problem. Since GDP develop alone is unsustainable, it is inevitable for China economy to deepen reform and adjust structure, also including the tea production. China turns to a population aging society, the labor cost rising year by year prompted us to go the new way like mechanization and intelligentize.

### **Methods and results**

The data used in this paper are from China Tea Circulation Association and Songyang government reports (2010-2014 monthly average price data of SongYang southern tea

market). The wage data are collected from field research of author in July 2012 and January 2015. The original data is tea picker's wage of per kilogram tea leaves, then combined with the workers' sum of labour, transfer to monthly wage. Because the logarithmics has no effect on cointegration relationship between variables and can eliminate the heteroscedasticity, the logarithmics of the data is applied. The prefix "LN" is added to variables to express logarithmics, "DLN" means the first difference of the logarithmics variables. All the calculation are operated by software gretl. This paper is based on VAR model, the steps in detail are as follow, ADF test, Cointegration tests and Granger causality test.

Our estimation strategy is as below. First, if wage and price do not have unit roots, that means both wage and price are stationary, then we can do Granger causality test on original data. However when both wage and price are non-stationary, the cointegration between wage and price is tested. And if they are cointegrated, Vector Error Correction Model is used to test causality. But if wage and price are not cointegrated in, Granger causality test is used on differenced series.

In statistics, a unit root test tests whether a time series variable is non-stationary using an autoregressive model, if unit root exists, the time series are non-stationary. This paper uses ADF(Augment Dickey-Fuller) test, the main model related are as follows:

$$\text{Model 1} \quad \Delta x_t = (\rho - 1)x_{t-1} + \sum_{i=1}^p \theta_i \Delta x_{t-i} + \varepsilon_t \quad (1)$$

$$\text{Model 2} \quad \Delta x_t = \alpha + (\rho - 1)x_{t-1} + \sum_{i=1}^p \theta_i \Delta x_{t-i} + \varepsilon_t \quad (2)$$

$$\text{Model 3} \quad \Delta x_t = \alpha + \beta t + (\rho - 1)x_{t-1} + \sum_{i=1}^p \theta_i \Delta x_{t-i} + \varepsilon_t \quad (3)$$

The null hypothesis is  $H_0 : \rho = 1$ . The test will start from Model 3. The result lists on table 1.

Table 1  
*Augmented Dickey-Fuller Test Result*

Variables	Constant	trend	Lag order	$\tau$ -stat	$\tau$ -critical value (1%)	$\tau$ -critical value (5%)	conclusion
LNPRICE	Yes	Yes	4	-1.47	-4.04	-3.45	Non-stationary
DLNPRICE	Yes	No	4	-6.99	-3.51	-2.89	Stationary*
LNWAGE	Yes	Yes	4	-1.41	-4.04	-3.45	Non-stationary
DLNWAGE	Yes	No	4	-7.48	-3.51	-2.89	Stationary*

Note: include seasonal dummies,\* means stationary under 1%  $\tau$ -critical value.

It can be seen from Table 1 that the original time series are non-stationary, however the first differences time series are stationary. So the original time series are integrated of order 1, there may be a cointegration relation between them.

If there is a linear combination of integrated variables that is stationary, such variables are said to be cointegrated. For our model we suppose the linear combination as  $LNWAGE_t \sim I(1)$  and  $LNPRICE_t \sim I(1)$ , and  $LNWAGE_t$  is regressed on  $LNPRICE_t$  as

$$LNWAGE_t = \beta_0 + \beta LNPRICE_t + u_t \quad (4)$$

When residual  $u_t$  is stationary, LNWAGE and LNPRICE are cointegrated. This paper chooses Engle–Granger two-step method, that is, we estimate equation (4) by ordinary least squares, and test stationary on the estimated residuals by ADF test.

In order to test cointegration we estimate equation (5) as below,

$$\log wage = -0.26 + 0.90 \log price \quad (5)$$

$\tau$ -stat for unit root test for residual of equation (5) is -0.33. Then we cannot find the cointegration between wage and price.

As we confirm price and wage are non-stationary but their first difference are stationary. In order to test causality, we construct Vector Auto Regression model for difference log as below,

$$DLNWAGE = \beta_0^w + \sum_{i=1}^k \gamma_{t-i}^{ww} DLNWAGE_{t-i} + \sum_{i=1}^k \gamma_{t-i}^{wp} DLNPRICE_{t-i} \quad (6)$$

$$DLNPRICE = \beta_0^p + \sum_{i=1}^k \gamma_{t-i}^{pw} DLNPRICE_{t-i} + \sum_{i=1}^k \gamma_{t-i}^{pp} DLNWAGE_{t-i} \quad (7)$$

The relationship between price and wage is present in a long term and not cointegration. Here we mention about Granger causality test. The Granger causality test is conducted between first-order differenced wage and price. The Granger causality test is a statistical hypothesis test for determining whether one time serie is useful in forecasting another, first proposed in 1969. The direction of the causality is sensitive to lag value. This paper use AIC to choose lag value, the optimal lag order is 4.

Null hypothesis are as below:

$$\gamma_{t-1}^{wp} = \gamma_{t-2}^{wp} = \dots = \gamma_{t-k}^{wp} = 0 \quad (8)$$

$$\gamma_{t-1}^{pw} = \gamma_{t-2}^{pw} = \dots = \gamma_{t-k}^{pw} = 0 \quad (9)$$

Equation (8) is for causality of price to wage, equation (9) is for causality of wage to price.

Table 2  
*Granger Causality Test Result*

Variables	Null hypothesis	F-stat	p-value	conclusion
DLNPRIC E	Wage has no granger causality to price	1.65	0.0332	Wage has granger causality to price
DLNWAG E	Price has no granger causality to wage	1.68	0.0328	Price has granger causality to wage

Table 2 shows the causality test result, the p-value of F test for “wage has no granger

causality to price” is 0.033, so the null hypothesis, wage has no granger causality to price, is rejected. That is, wage has granger causality to price. Similarly, the p-value of F test for “price has no granger causality to wage” is 0.033, so the null hypothesis, price has no granger causality to wage, is rejected. That is, price has granger causality to wage.

## Discussion and conclusions

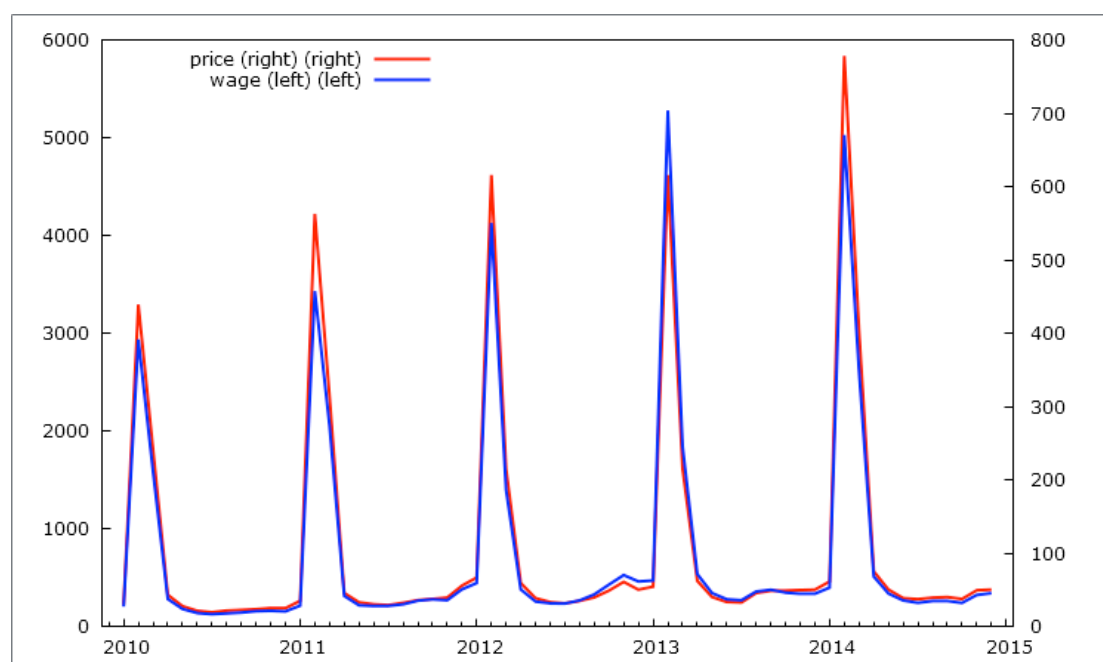


Figure 4: Graph of monthly price and wage (¥)

Price is the granger reason for wage, wage is the granger reason for price. It is uncertainty about labor shortage caused by wage. Wage has a reasonable fluctuation with tea price. But the labor shortage problem has no progress. Actually labor shortage problem exists across China. The possible reasons for labor shortage of tea industry maybe aging of population, urbanization, Lewis turning point, demographic dividend, instability, labor intensity, welfare or others.

It must be admitted that China's "demographic dividend" is indispensable to rapid economic development over the past 30 years. However, with the change of China's



population structure, "demographic dividend" is diminishing marginal benefit, the structure of the Chinese economy is faced with pressing problems.

The working-age population stipulations in China is regarded as men for 16 ~ 60 years old, women for 16 ~ 55 years old. The latest figures released from the national bureau of statistics show that China's working-age population in 2014 is less than last year by 3.71 million people, the labor population is falling off for the third consecutive year. In 2012, China's working-age population declined for the first time.

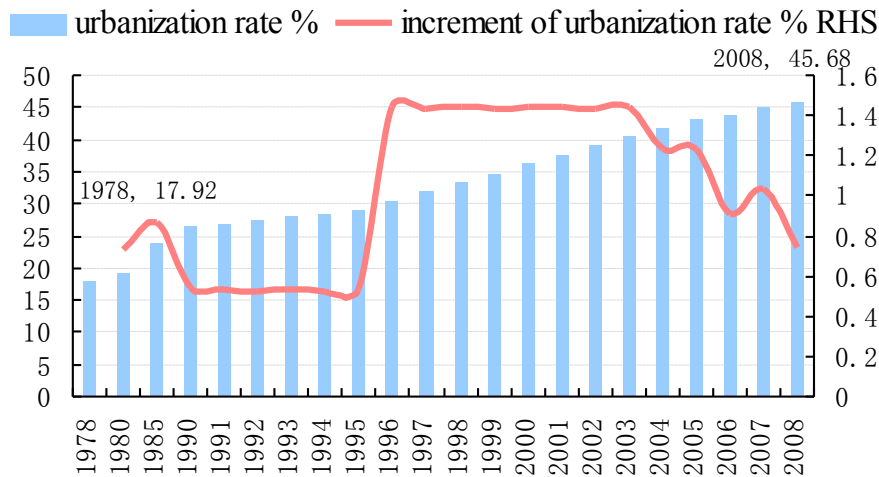
Table 3  
*Working-age population in China*

year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Working-age population	9419	9506	9583	9668	9748	9993	10028	9372	9195	9158
	7	8	3	0	4	8	3	7	4	3

Data source: Statistical Communiqué of the People's Republic of China on the National Economic and Social Development from 2005 to 2014

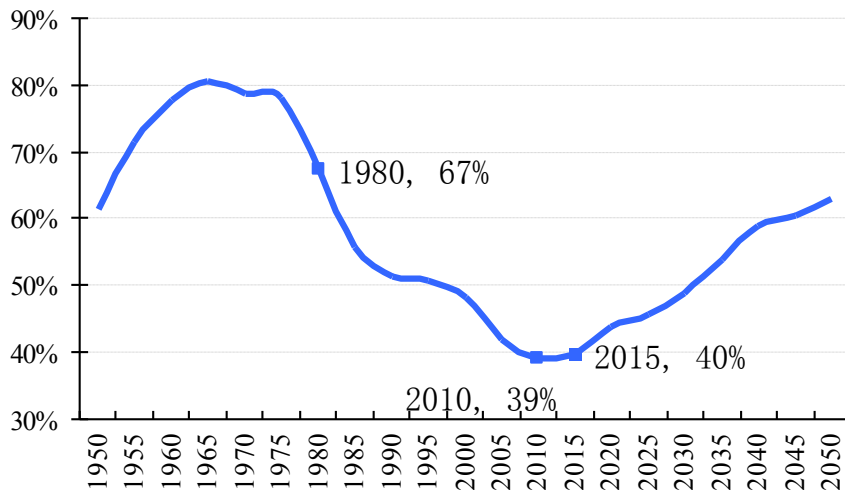
The peak of the population came in the 1960s. More than 20 million people was born per year on average from 1962 to 1974, China had accumulated 300 million labor forces during the ten years. These baby boomers become the main force to the economy development after China's reform and opening.

In 2013, the national bureau of statistics adjusted the working-age population statistics scope of 16 ~ 60 years old. The results showed that the 16 ~ 60 years old working-age population is 919.54 million people decreasing by 2.44 million people than last year. , China's working-age population has absolute decline for three consecutive years since 2012.The decline will not change in the short term.



Data Source: China NBS

Figure 5: China urbanization rate



Data Source: UN Population Prospects, 2008 Revision

Figure 6: Dependency Ratio

Urbanization rate increased from 17.9% in 1978 to 45.7% in 2008, dependency ratio has reached its lowest point in 2010 and will now increase. Urbanization attracts more rural residents to work in cities. As far as the global development, many countries are stuck in bottleneck problem of economic growth after reaching middle-income level, China has entered into upper -middle income countries by the world bank's 2011 standard. Although China is changing population policy now, it will not get effect instantly.

Instability is another fatal reason for the labor shortage problem in tea industry. It can be seen from figure 4 that the fluctuation of tea farmers' income is giant. The evaluation of the characteristics of the tea is rated in the condition of the normal production process, spring tea, a bud with a leaf and a bud with two leaves, owns good quality after winter. Therefore the price of spring tea is high and tea farmers work whole day in the spring, they just sleep a little hours everyday. Of course their income is high. However their income is not optimistic in other seasons, especially in winter. So most of the tea farmers look for other work chance in other seasons to support their family.

### **Suggestions**

The labor shortage situation will last for a long time. China must find a way to solve this big problem in tea production of agriculture. Agricultural mechanization uses advanced and applicable agricultural machinery and equipment, improves the conditions of agricultural production and operation, constantly improves the level of agricultural production and the process of economic and ecological benefits. There is no doubt that Agricultural mechanization is a fundamental reform to solve this big problem in tea production of agriculture. However is it the right time to put mechanization out?

The types of tea are rich, and different tea has different quality standard of fresh leaves picking, especially the famous high-quality tea, which has very high quality standard of fresh leaves picking. Because of non-compliance of tea plantation cultivation, mechanization of agriculture has limitation, thus picking by hand is significant. Though the efficient of handcraft is low, the handwork is easy to learn than machine operation. Moreover, the quality of picking is better than machine without a doubt. Therefore most of China tea plantations adopt handwork picking.

Some scholars started with slogan of agricultural mechanization as early as the 1950s. Half a century has passed, agricultural mechanization has not completely accomplished in China, agricultural mechanization development in China is still stumbled by regional imbalanced.

Women tea-picking workers are in the majority. For the educated rural people choose other works, most tea-picking workers receive less education. The majority of them have an education level of only primary school, or even below. Women need to take care of children and do other housework, so they do not have enough time to meet the demand of labor.

Government should establish credit guarantee mechanism, support leading enterprises to attract social capital, encourage small plants to set up joint-stock enterprises and upgrade. Government provides the tea enterprises with subsidy and offer the tea farmers skill training. Government should safeguard that workers are given fair treatment in employment and salary and establish a sound social security system for workers. Help the workers organize themselves into supportive networks. Set up special offices or agencies at the destinations to provide services for workers. Government works as a good guider, guiding the migrant tea pickers refer to phenology from south to north.

Employers should pay more attention on workers' humanistic concern. The tea pickers often come from other provinces, they uproot themselves and move to the tea area in search of a better life. They worried about their children and hometown. Better accommodations ensure the workers to be relieved. Other subsidies are necessary to attract nonlocal workers like traffic and high temperature subsidy.

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**Contact email:** [hechenlei1992@foxmail.com](mailto:hechenlei1992@foxmail.com)