

Impacts of the US Farm Bill 2008 on China's agricultural production and rural poverty

HAI LIN^{1, 2}, THOMAS GLAUBEN², JUN YANG³, LING-YUN HE¹

¹*College of Economics and Management, China Agricultural University, P.R. China*

²*Leibniz Institute of Agricultural Development in Central and Eastern Europe (IAMO), Germany*

³*Center for Chinese Agricultural Policy, Chinese Academy of Science, P.R. China*

Abstract: Whether the US Farm Bill 2008 has any impacts on China's agriculture, is highly related to the China's rural poverty alleviation and it deserves to be explored to see what will happen. According the existing empirical studies in the past, we expect that the US Farm Bill 2008 will exert an influence on the agricultural production and rural poverty in developing countries, especially China. In order to fully capture such an effect, we link two equilibrium models together: the multinational CGE model – GTAP and the China's partial equilibrium model – the China's Agricultural Policy Simulation and Projection Model (CAPSiM). A scenario based on the US Farm Bill 2008 will be constructed and compared with the baseline. A more liberalized scenario is also built for the simulation. The results have shown that the US Farm Bill 2008 has a little positive impact on the China's farmer income, and that the more liberalized the policy is, the more China will benefit.

Key words: US Farm Bill, China, Poverty, CGE

Whether the domestic support in developed countries will have impacts on the developing countries' agricultural production and the poor, is extensively discussed in the recent years. Domestic support has already been listed as one of the three "pillars" – market access, export subsidy and domestic support – as the major headings of the URAA provisions. The Doha Round negotiation is largely impeded just because of the fierce dispute on the large amount of subsidy of the developed countries on agriculture. Since the EU and the US are the two largest sources regarding the use of EU Common Agricultural Policy and the US Farm Bill, it is argued that they should reduce their support first before any further negotiation. Since the domestic support has already been recognized by all member countries of the WTO as a necessary part in the international trade, it is worthwhile to explore some effects of the new change in the major agricultural exporters. So, it deserves to be investigated whether the the US Farm Bill 2008, which is the most important bill in one of the biggest agricultural exporters and importers in the world, will have any impacts on the world trade and poverty.

A recent study shows that the trade policy, including domestic support, has important impacts on the international trade, agricultural production, price, and, as a consequence, the rural poor whose living mainly depends on agriculture. Many researches confirm that there is a relation between trade and poverty. For example, Hertel et al. (2003) have researched the relation between the trade liberalization (mainly the reduction of domestic support in developed countries) and poverty (especially for poor people whose living mainly depends on agricultural income in developing countries). The research concludes that there exists some link between the global trade liberalization and poverty. However, they point out the different poverty structure in the researched countries results in different poverty effects, especially in the short run. Other research also confirms that there at least exist short-term impacts of the trade liberalization on poverty. Devadoss (2002) and Winters et al. (2003) also think that the developed countries' high domestic subsidies, together with the resulting over-production and exports, have unfairly affected the developing countries agriculture. Since most of the poor

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families depend on agriculture for their employment, the poverty issue becomes a major outcome from developed countries domestic subsidies.

Agricultural production and rural poverty are the most important issues in developing countries, especially in China. China is one of the biggest developing countries and it has a population which accounts for almost one fifth of the world population. It is really a tough job for China's agricultural production to support such a large population. Also, poverty alleviation plays a key role in China. Although China has got an extensive achievement in the poverty alleviation in the past 30 years, there are still many poor people living below the poverty line. However, according to the China National Bureau of Statistics (CNBS), which set 1196 Yuan as the new poverty line in 2009, China has had still 40.07 million rural poor in 2007. While there has been a significant decline in the poverty incidence as outlined above, when considering the 1.25 US dollar per day (in the PPP terms) indicator, the World Bank estimated that in 2004, there were still about 27% (or about 350 million) of China's population living at or below this indicator. Of these 350 million, 99% are from the rural China. Poverty remains persistent in many Western and South-Western provinces, in particular in the remote rural areas.

Although the US Farm Bill domestic support policy may have impacts on the China's agricultural production and rural poverty, there is a little research done on the possible relation. This research will focus on it and it hopes to give an idea on what will have happened.

METHODOLOGY

The paper will use the GTAP (Global Trade Analysis Project) model and the CAPSiM model together to simulate the economic behavior of the US Farm bill policy change and the China's agricultural production and rural income. For the US Farm Bill, the relation between its policy change and the world trade change can be more easily simulated using the GTAP. However, for the China's agricultural production, the GTAP model is limited due to its shortage of the detailed information on China. The CAPSiM has a detailed information on the China's agricultural production, consumption and trade. The link between the GTAP and CAPSiM can utilize both models advantage to give a better result. It is not the first time for the method to be used. The method has already been used to analyze the trade change and the China agricultural production (Huang et al. 2004a). Also

there are some other similar linkage models for the EU CAP (Balkhausen et al. 2008) and the world trade (Bourguignon et al. 2008).

Before the simulation, we need to modify the GTAP model according to the US Farm Bill's policy change and the China's agricultural policy change.

Modifications to the GTAP database 7

The GTAP is a multinational general equilibrium model used by more than 6000 researchers to analyze the different world trade related issues. The GTAP can analyze the different policy impacts on the regional economy. Built on the multinational level trade flow data with the regional specified input/output function, the GTAP can aggregate sectors or regions flexibly to analyze different trade arrangement impacts. According to Hertel (1997), the structure of the GTAP can be summarized as based on the regional production, consumption and trade. Different households, governments and producers face a different production function or demand function. The balance can be attained by saving and investment. All the regional economies can be linked by the international trade. The GTAP database records the detailed production, consumption and trade data of different regions. The latest version available now is the GTAP database 7, which has the disaggregation of 57 sectors and 113 regions. Actually, the GTAP database has already incorporated all the three "pillars" of the agricultural trade policy – producer subsidies, import tariffs and export subsidies, even since its version 6 (Dimaranan and McDougall 2006). The GTAP database Version 7 makes some advancement in subsidies, for example, it updated the export subsidies data to 2004, the given support rates for all crop in the EU 25 and other countries with the subsidies data (Narayanan 2008).

However, we need some modification on the GTAP. According to our research, the database still needs to be aggregated to 21 sectors and 12 regions. Also, the recursive dynamic method is used here to get more reliable results (Walmsley et al. 2000; van Meijl and Tongeren 2002; Huang et al. 2004b). GDP in different region is exogenously specified, while the technological progress is endogenously decided (Huang et al. 2004b). The GDP and population change data for China come from the estimation of Huang et al. (2003b) and Toth et al. (2003). Other China macro-economic variables change came from Huang et al. (2004b), as can be seen in Table 1.

Some other factors have also been considered besides the assumption above. China has continued to adjust the tariff policy according to the agreement on accessing the WTO up to 2010. Also the Multifibre

Table 1. Assumption on the exogenous variable: 2004–2012 (% per year)

	Endowment				
	unskilled labor	skilled labor	capital	real GDP	population
Mainland China	0.9	4.2	9.0	7.8	0.7
ASEAN	1.7	4.4	5.3	5.9	1.6
Other Asian countries	1.9	4.9	4.6	5.3	1.6
Australia and New Zealand	1.0	0.3	3.8	3.5	0.9
Japan and Korea	-0.5	-0.4	2.3	2.7	0.3
USA	0.9	0.5	3.0	2.8	0.8
Canada and Mexico	1.6	2.1	4.6	3.6	1.4
South America	1.2	4.4	3.7	4.6	1.5
EU 25	0.0	-0.4	2.9	2.8	0.0
Rest of the World	2.3	2.7	3.6	4.5	2.1

Arrangement (MFA) was abolished on January 2005. And the EU enlargement is considered in the simulation, too. The non-tariff barrier is also considered. The new tariff data is used to update the GTAP database by the method mentioned in Malcolm (1998).

CAPSiM simulation

The China's Agricultural Policy Simulation Model (CAPSiM) is an equilibrium model developed by the Center for Chinese Agricultural Policy (CCAP). To be more specific, the CAPSiM is a partial equilibrium model for 19 crop, livestock and fishery commodities, including all cereals (4 categories), sweet potatoes, potatoes, soybean, other edible oil crops, cotton, vegetables, 2 kind of fruits, other crops, 6 livestock products, and 3 fishery sectors, which account for more than 90% of the China's agricultural output. The model served for the analysis on the China's policies change to agricultural production, consumption, price and trade in China (Huang et al. 2003a). It is the first comprehensive model for examining the effects of policies on the China's and regional food economies as well as the household income and poverty.

The CAPSiM includes 2 major modules in terms of the supply and demand balance for each of 19 commodities. The supply includes production, import and stock changes. The demand includes food demand (specified separately for rural and urban consumers), feed demand, industrial demand, other demand, and export demand. Marketing clearing is reached simultaneously for each agricultural commodity and all 19 commodities (or groups). At last, the production and consumption can be projected for the income computation and poverty evaluation. The CAPSiM

model is used here to simulate the agricultural economic impacts of the international trade shock.

Some new features are added in the CAPSiM to assess the poverty impacts of the policy change on agricultural production and rural income in China.

First, to make the model easier to be linked to the GTAP model, the CAPSiM model is rewritten using the GEMPACK software developed by the Monash University. Both the GTAP and the CAPSiM are in the GEMPACK format now, which makes the simulation more feasible.

Second, some production-income parameter is set to link the rural income with agricultural production. The parameter is largely based on the CCAP own database collected during different researches on agricultural production, consumption and trade.

Third, the households are divided into different income groups to test different impacts for different income groups. Because we want to consider the income impact on different income groups, the rural household group is equally divided into 10 income groups using the grouped data from the China's National Statistic Bureau.

Linkage of the GTAP and CAPSiM

The linkage of the GTAP and CAPSiM has gained some new developments to analyze the poverty issue in China. Due to the difference between the GTAP and CAPSiM, some modifications are needed. The GTAP includes all the sectors of the economy, both agriculture and non-agricultural sectors, which makes it more efficient in the simulation for the policy shock on the production and price change in all sectors. However, according to the China's rural poverty,

a more detailed information inside the agricultural industry is not available in the GTAP, thus the CAPSiM is needed to give more insight on what will have happened. The CAPSiM also has its shortcomings regarding the lack of the multinational analysis and the non-agriculture analysis. By linking the two models together, the researchers hope to get a more near-reality analysis to give a more accurate insight.

Several modifications are needed in the linkage model. The main linkage process includes using the same macro-economic assumption, the match of agricultural sectors and the data transfer. First, due to the different model specification, the GTAP and the CAPSiM both need to be set using the same macro-economic parameters, for example, the China's GDP development and the population change. Second, the classification of sectors is not the same between the two models, so that some matching work is needed. So, we should match them first. In the matching work, some sectors, such as potatoes, pork and chicken, which are clearly classified in the CAPSiM, are not individually defined in the GTAP. Therefore, the researchers use the proportion got from the China's Statistical Yearbook to divide the GTAP sector to fulfill the sector disaggregation work. The linkage can be fulfilled by transferring the trade shock impacts from the GTAP to the CAPSiM after the matching work. The research adopts the price change transfer.

THE US FARM BILL SCENARIO

As to the US Farm Bill policy change, we need to build the baseline and scenario for the simulation. First, we need to have a short review on the US Farm Bill's policy change. Then the scenario is built based on the review.

The US Farm Bill is the main agricultural related policy in the US. It is usually revised and reissued every 5 years. The latest Farm Bill is the *Food, Conservation, and Energy Act of 2008* (US Farm Bill 2008). The US Farm Bill 2008 made some modification to the US Farm Bill 2002 (USDA 2008). We will first check the difference between US Farm Bill 2002 and 2008. Then the baseline and scenario will be built according to the analysis.

The difference between the US Farm Bill 2002 and 2008

In our analysis, we focus on the title of the Commodity Programs. The reason is that it is the main source for the domestic support in the US Farm Bill. Although the other titles are becoming more and more

important in the US Farm Bill, they are not the major part so far. Also, the method that incorporates the other titles' policy change to the GTAP model still need to be developed.

For the Commodity Programs, it can be divided into 3 parts, which are the Direct Payments, the Counter-Cyclical Payments (CCPs) and the Marketing Assistance Loans (FSA 2008a, 2008b; European Commission 2009). The government set a certain condition for the concerned agricultural products, according which the subsidies can be computed for the farmers. There are also some modifications on the operational affair, which will not be considered here.

First, there is no change in the Direct Payments for wheat, corn, grain sorghum, barley, oats, upland cotton, soybeans, peanuts and other oilseeds. The Direct Payment on rice is only kept for the long-grain rice, medium-grain rice. In summary, the total payments according to this part may decrease.

Second, for the Counter-Cyclical Payments (CCPs), the government set a set of target prices, which will bring on the government subsidies if the market price and the Direct Payments cannot reach the target price. The target price for wheat, corn, grain sorghum, barley, oats, soybeans and other oilseeds is increased; the target price for peanuts and upland cotton is unchanged and decreased, respectively. Dry lentils, small chickpeas and large chickpeas are added to the CCPs for the first time. At a first glance, the total subsidies in this part may increase due to increasing in many sectors. However, the world market price of agricultural products is relatively high after the 2007's sharply rise. The actual subsidies may not increase, they even may decrease.

Third, for the Marketing Assistance Loans and Loan Deficiency Payments (LDPs), the Commodity Loan Rates acts as the protect price for the agricultural products concerned. If the market price falls below the Commodity Loan Rates, the Commodity Credit Corporation will pay for the difference. The commodity loan rates for wheat, corn, grain sorghum, barley, oats and graded wool are increased; the commodity loan rates for soybeans, other oilseeds, upland cotton, ELS cotton, peanuts, non-graded wool, mohair and small chickpeas are unchanged; the commodity loan rates for dry peas and lentils are decreased. Large chickpeas were added to the LDPS for the first time in the new Bill. To sum up, the total payments in this part may either increase or decrease, which depends on the market price.

In the separate subtitle of the US Farm Bill 2008, the loan rates or payment rate for sugar, butter, nonfat dry milk and cheese the also increased in the new Bill. There is also a certain new limit on the total

amount of subsidies the farmer can get from the government. The result on the total subsidies also depends on the price.

Baseline and scenarios

From the analysis above, the total domestic support analysis above give us a general picture on what happened in the new Farm Bill. However, using the new Farm Bill alone, we cannot get any information on whether the domestic support will increase or decrease in the next 5 years. We need a future price information to build the scenario. Unfortunately, we do not have the perfect data. We will use a substitute method to build the scenario. Then a more liberalized scenario also is built for comparison.

To figure out the issue, we use the CCC Net Outlays by the Commodity & Function and CCC Net Budgetary Expenditures of the USDA as an instrument. The USDA Commodity Estimates Book (2009) gives detailed subsidies data in the form of the CCC expenditure on each agricultural product in every year. From the budget data, we compute different US commodity subsidies as it can be seen as in Table 2. We can find in the table that the budget increases first, and then it decreases at last. In the last line of the table, the percentage of the total subsidy are listed as a reference on how the computed subsidies can represent the US domestic support. The numbers show that the commodity subsidies list here represents about two third of the total subsidies in average in the budget year of the US Farm Bill 2008. The subsidies not listed here are mainly from the title of the Conservation in

the US Farm Bill 2008, which will not be discussed for the reasons mentioned above.

Baseline

Using the data above, we can build the US Farm Bill 2008 scenario. Since the GTAP 7 database (with 2004 data) has already integrated the US Farm Bill 2002 domestic support information, we use the GTAP 7 database as a baseline. In the baseline, we do not change any domestic support policy in the US. All the domestic support policy is kept in the status quo.

US Farm Bill 2008 scenario

The difference between the Farm Bill 2002 and 2008 as listed in Table 2 is used as the policy shock, that is, the US Farm Bill 2008 scenario. The shock is mainly incorporated to the updated GTAP data to get the 2012 result. We call it scenario 1, hereinafter.

The totally liberalized scenario

As a comparison, we also developed a more liberalized scenario. In the totally liberalized scenario, we remove all form of subsidies, whether they are subsidies to commodity or to land. We call it scenario 2, hereinafter.

The international trade shock impacts will be transferred to the CAPSiM to get the poverty impacts on rural China. The CAPSiM model can also simulate the baseline and 2 scenarios. The results will be given in the next section.

Table 2. The US commodity subsidies summary (million dollars)

Commodity	2004	2008	2009	2010	2011	2012
Course grain	2 816	2 141	2 637	2 216	2 340	1 870
Wheat	1 173	869	1 298	1 048	1 143	896
Rice	1 130	301	574	405	406	334
Cotton	1 372	1 631	2 684	2 923	2 272	1 320
Dairy	549	0	1 064	523	472	464
Soybeans	595	446	644	538	899	584
Oil	259	159	106	130	176	111
Sugar	61	-35	0	0	0	0
Wool	12	6	9 007	8	8	8
Total	7 955	5 519	2 329	7 792	7 716	5 586
Percentage of the total subsidy	76	72	48	67	66	66

Course grain includes corn, grain sorghum, barley, oats, etc, but corn accounts for the major part of the subsidies.

Source: Author's Computation from the Commodity Estimates Book (2009)

RESULTS

The simulation results for the 2 scenarios will be reported together to see the difference. Changes in agricultural trade, production and rural are listed. The possible relation is discussed in the following.

Macroeconomic results of the world

Macroeconomic results show a little impact found. The equivalent variance (EV) is used as a proxy for the welfare change measurement. The GDP quantity index (%) is used to see the impacts of different scenarios. Export and import changes are reported for both agricultural and non-agricultural products. The US welfare increases in both scenario 1 and scenario 2, which is mainly due to the reduction of direct subsidy. While at the same time, the other countries, including China, will record a loss due to the higher price. As a result, the US export less agricultural products and other countries import less. Then, the US import more agricultural products as the other countries' agricultural products become relatively cheaper than in the baseline. And the countries export more than in the baseline. However, all the impacts account for only a very small part of GDP for all regions, which is less than 0.1% as it is listed in the Table 3.

Agricultural production changes in China

According to the analysis above, the US Farm Bill may affect China's agriculture in two ways. One impact is from the direct trade by exporting more ag-

Table 3. The macro-economic impacts on different regions in the scenarios (comparing to the baseline, 2013, million US)

	China	USA	Other
Scenario 1			
EV	-26	593	-754
Agri export	42	-1 167	730
Agri import	-55	53	-941
Non-agri export	-102	626	-1 158
Non-agri import	-16	-450	46
Scenario 2			
EV	-149	1 217	-1 501
Agri export	73	-4 520	3 226
Agri import	-507	104	-2 666
Non-agri export	-539	3 015	-5 436
Non-agri import	-136	-2 167	575

Source: Author's simulation results

ricultural products due to the decreasing price with more subsidies. The other impact may be from the international price change due to the large amount of the US agricultural exports and imports, which will indirectly affects the China's agricultural exports and imports.

For the impact on the China agricultural production, the simulation result shows a different impact direction for different agricultural products, although the impacts are very small. Figure 1 shows the quantity change of agricultural production in China. It can be seen that after the removal of subsidy for the main subsidized crops in the US, maize, wheat and soybean production in China will increase, although it is only a small part of the total production. For the other crops, we will find that rice, potatoes, cotton and oil products will also increase, which shows that China will benefit from the removal of the US subsidy. Other products remain almost the same as before. For maize, wheat and soybean, the exports increase in both scenarios. The others productions' changes are small. Almost all imports reduce due to the increase of production.

Rural income changes and poverty

As to the simulation results, the US Farm bill really has some effects on the world agricultural trade and the agricultural production and rural poverty in developing countries, including China. Rural income in China increases in total, but there are differences in different income groups and regions. As shown in Table 4, the highest income group will benefit more than the lowest income group, which may result in the enlargement of the income gap. The richer farmers will produce more tradable crops and sell to the market for a higher revenue. So, the high-income

Table 4. The impacts on agricultural income by different income groups (Yuan, comparing to baseline in 2013)

	Agricultural income change	
	Yuan	%
Scenario 1		
National average	1.42	0.07
Lowest income group	0.66	0.10
Highest income group	1.89	0.07
Scenario 2		
National average	5.47	0.28
Lowest income group	2.19	0.33
Highest income group	9.62	0.34

Source: Author's simulation results

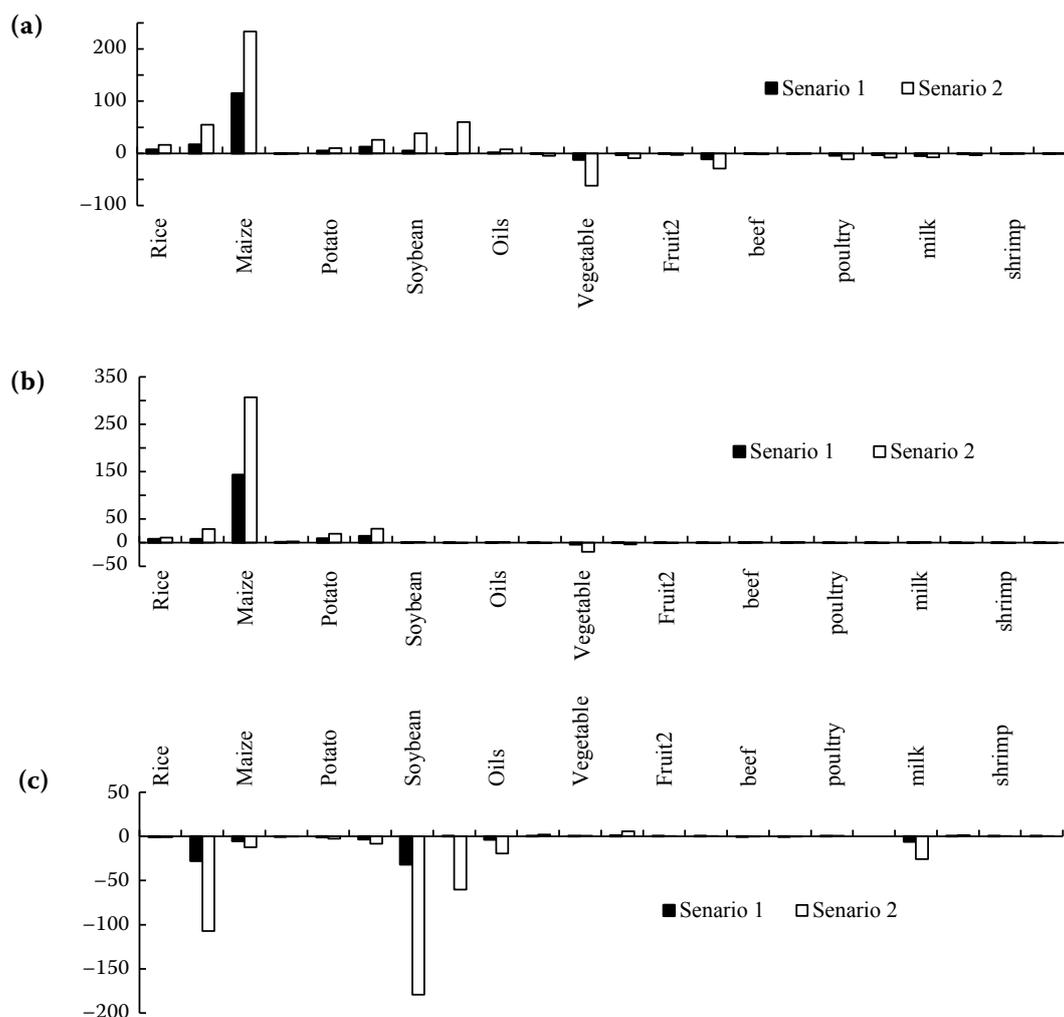


Figure 1. Different impact of the scenario 1 and scenario 2 on agricultural productions, export and import comparing to the baseline (figure a, b and c respectively, 1000 tons)

Note: Several products are not showed because of small numbers

group will benefit more from the reduction of the US agricultural subsidy and the subsequent price increase.

CONCLUSIONS

Using the GTAP-CAPSiM linkage model, we can analyze the impact of the US Farm Bill on the China's agricultural production and rural poverty. The methodology investigates it mainly through the transmission mechanism of the international trade (price) due to the reduction of the US subsidy. Thus the China domestic price change according to the international price and production changes.

The main result shows little impacts found, while some preliminary analysis shows a different direction of the impacts on different agricultural products. The grain products, which are the main subsidized crop in

the US, change more than others and decline in the total production and export of the US, while China benefits from it and increases its grain production. Other products have a lower impact than grain and small changes.

Rural income change is only a very small part of the total income and it should not be overestimated; only the income gap between the richest and the poorest should be taken care of. Thus, the poverty issue in the analysis may be some further enlargement of the income gap. So, some redistribution of income may be needed to help the poor to catch the benefit of the trade liberalization.

In summary, the US Farm Bill's changes really the China's agricultural production and rural income, but the total impact is not that large. But for the rural poverty alleviation, it really should be considered to make more favorable results from the policy change.

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Contact address:

Hai Lin, College of Economics and Management, China Agricultural University, No. 17 Qinghuadong Road, Beijing 100083, PR China
e-mail: linhai@cau.edu.cn; linh8610@gmail.com