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Modeling Agricultural Domestic Support in China: recent policy reversals and two future scenarios

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Abstract

This paper reviews recent development of China's agricultural domestic support policy, especially the switch from taxing farmers and agriculture to providing direct subsidies to grain production and purchased inputs. A model-based quantitative analysis on the effects of these policy changes has been conducted. Simulation results suggest that recent policy changes likely have positively addressed the declared policy objectives in increasing grain production and boosting farm income. Much of the increase in grain production and farm income can be attributed to land reallocation to grain production, cheaper inputs, and extra agricultural employment triggered by the policy changes.

Judging from the rural-urban and west-east income gaps in China, the diminishing share of agriculture in China's economy, and the current political environment, it is expected that the tax cut will be permanent and that government assistance to agriculture and farmers will continue and rise. Two hypothetical future scenarios are simulated. If China uses up all its WTO de minimis support allowances and an assumed Blue Box cap in a manner consistent with its current practices, increased grain production, changing trade pattern seemingly contrary to China's comparative advantage, increased rural employment, and significantly higher farm income (over 16%) will be expected. If alternative, decoupled payments are provided, China's agricultural production and trade will remain unchanged, rural employment stays stable. But as a way of transferring income, the decoupled payments will be more efficient.

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1. Introduction

China's agriculture policy has undergone some fundamental changes in recent years, as ambitious reductions of agricultural taxes and fees have been carried out and direct subsidies to farmers and agricultural productions have been introduced. Total agricultural taxation, including agricultural tax, special agriculture products tax, agricultural tax surcharges, was reduced from CNY 51.7 billion in 2003 to CNY 1.62 billion in 2005.[1] At the same time, the Chinese government has started to provide various subsidies, including direct payments to grain producers based on planting areas, direct subsidies to purchased farm inputs, subsidies to seeds, and subsidies to agricultural machineries. These subsidies amounted to CNY 31 billion and 42.7 billion in 2006 and 2007, respectively.[2] In addition, other forms of assistance to agriculture have also been increased in recent years. In fact, total assistance to farmers and agriculture, including the above mentioned subsidies, has been on the rise even prior to the reform of agriculture taxes. For example, the Producer Support Estimates (PSE) compiled by the OECD (2006) reports only a 4 percent share of total agriculture support in total gross farm receipt in 2000. This share rose to 10 percent in 2003 and remained at 8 percent in 2005 (based on a much larger total value of agriculture production as compared to that in 2003).[3]

This policy reversal – moving from the tradition of taxing farmers and agriculture to providing subsidies – clearly reflects the Chinese leadership's attention to the so-called "San-Nong" problem (i.e. the three agriculture-related issues: agriculture, rural areas, and peasants). The core of the "San-Nong" problem is the relative decline of farm income (as compared to income earned by urban residents) and in connection to this, the rising rural-urban income gap and the East-West regional imbalance in China. Although migrations of rural labors to urban areas and off-farm activities in the rural areas have helped moderate the widening income gaps, rural residents solely

[1] These numbers are collected from the official website of Ministry of Agriculture, China (www.agri.gov.cn).

[2] These figures are mainly gathered from official documents of the Ministry of Finance, China (www.mof.gov.cn) and are presented in Table 2.

[3] The PSE tables for China include more support instruments than agriculture tax and subsidies mentioned in the text, such as market price support, payments based on area planted/animal numbers, on input use, on input constraints, and on overall farming income. In 2005, the total PSE for China was estimated to be over CNY291 billion, including over CNY100 billion on market price support, 13.2 billion payments based on areas planted, 89.8 billion payments on input use, 55 billion on input constraints, and nearly 30 billion payments based on overall farm income.

relying on farm income have nevertheless experienced much slower income growth in recent years. In responding to these challenges, the current Chinese leadership has placed the "San-Nong" problem among its top priorities. For instance, the various "No. 1 documents" of recent years emphasize the need to increase farm income and the importance of maintaining grain self-sufficiency as a way of improving farm income.[4] Reducing/eliminating agriculture tax and introducing direct subsidies are considered essential instruments in achieving these policy objectives. Needless to say, strong economic growth has sped up this policy reversal as agriculture's share in China's GDP is shrinking and the once-vital revenue from agricultural taxations is becoming less and less important to the national treasury.[5]

In light of these policy trends, many interesting research questions emerge. Some of these questions are concerned with the embodied domestic policy objectives. For instance, to what extent have these changes led to the realization of the policy objectives of raising farm income and maintaining grain self-sufficiency? Is the emphasis on grain production consistent with the objective of raising farm income? Are there better ways to achieve these objectives?

Looking ahead, it appears that an about-face of recent policy reversal is unlikely. On the contrary, there are indications that the abolishment of agriculture tax will be permanent and the subsidies will increase in the coming years. Assuming this trend continues, one would also ask whether current subsidy instruments will still be applied in the future, especially in connection to the relevant disciplines on agricultural domestic support contained in the WTO Agreement on Agriculture (AoA). In the case of China, the relevant disciplines are the *de minimis* exemption on the Aggregate Measure of Support (AMS) and the so-called "Blue Box" payments (e.g. those production-limiting programs that are based on fixed area and yields). Should the support paid in the current forms approach or even exceed the applicable exemption ceilings, China

[4] These documents were issued by the Central Committee of the Chinese Communist Party and the State Council of China. There have been ten such documents, all of which addressed issues related to agriculture, rural areas, and peasants. The first five "No. 1 documents" were issued during 1982-1986, whereas the last five were issued during 2004-2008. A brief overview of these documents (in Chinese) can be found at the official Xinhua News Agency's website (http://news.xinhuanet.com/ziliao/2006-02/09/content_4156863.htm), which also contains links to full text to the latest documents. The full text of the 2007 No. 1 Document was publicly released by the Xinhua News Agency on January 29, 2007 (see http://news.xinhuanet.com/politics/2007-01/29/content_5670478.htm)

[5] In 1950, agricultural tax revenue comprised of 39 percent of China's total tax revenue. This share shrank to 5.5 percent in 1979 and to less than 1 percent in 2004 (Ministry of Finance, China).

might have to re-design its support programs to make them comply with its WTO commitments. One way of doing so without cutting the spending is to switch from the presumably inefficient and trade/production-distorting support instruments to less distorting decoupled instruments which can be classified as Green Box payments.[6]

The purposes of this paper are to provide a first quantitative assessment on the impact of recent policy changes on China's agricultural production, trade and farm income, and to evaluate likely consequences of their possible future developments with a reference to China's WTO commitments on agricultural domestic support.[7] Findings from these exercises will not only contribute to the understanding of these policy trends and their consequences, but also provide useful insights into designing agricultural domestic support in the future for China.

The quantitative exercises underlying the analysis contained in the current paper are conducted within a computable general equilibrium framework where detailed policy instruments relating to agricultural taxation and the new subsidies are represented. This modeling framework also allows for alternative policy instruments to be analyzed in counterfactual scenarios. Budget outlays associated with the policy instruments, collected from official Chinese sources and the OECD's PSE estimates for China, are calibrated to a global database accompanying the model. Together the database and the model are deployed for conducting the quantitative analysis.

The rest of the paper is organized as follows. Section 2 reviews recent agricultural policy development and most recent policy practices in China. How these policy developments fit into China's domestic policy objectives and how they comply with China's WTO commitment are also discussed in this section. In section 3, we document our efforts on modeling recent changes in China's agricultural policy and on constructing various future scenarios. Section 4 reports the results from simulating the various policy scenarios. The last section concludes the paper.

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[6] At the time of writing this paper, the only notification made to the WTO by China concerning agricultural domestic support was submitted in 2006 for the reporting period 1999-2001 (WTO, 2006). The notified current total AMS and Blue Box were both zeros for 2001. However, China did report CNY242 billion Green Box payments for 2001.

[7] To our best knowledge, there are virtually no published quantitative analyses on the effects of recent policy changes on China's farm income and agricultural production. The exception is Gale et al. (2005), which provides a "back of the envelope" calculation suggesting a CNY18 per *mu* (equivalent to 667 square meters or 1/15 hectare) contribution of tax reduction and subsidies to "profit" from three major grains.

2. Recent Development of Agricultural Domestic Support Policy in China

In this section we briefly review most recent agricultural policy development in China (from 2003 to 2007). This discussion is mainly based on data collected from official Chinese sources such as the Ministry of Finance and Ministry of Agriculture and is focused exclusively on the elimination of agricultural tax and the introduction of direct subsidies. For a more comprehensive discussion of China's domestic support policy development for the earlier period of 1995-2005 using the PSE and related estimates of the OECD, readers are referred to Kwieciński and van Tongeren (2007).[8]

2.1. Elimination of agriculture taxes

Agriculture tax had been levied since the establishment of the People's Republic of China and an agricultural tax law was put into force formally in 1958. This tax was typically levied as a percentage of the production value of a given land area, based on historical prices and yields. The average tax rate (including agricultural tax surcharges) as a share of actual agricultural production value fluctuated between 2 and 15 percent from year to year (Ministry of Finance, China). Since 1983, the State Council of China (i.e. China's central government) decided to collect special agricultural products tax in addition to the normal agricultural tax. In 1994, a herding tax was added. In 1950, revenues from agriculture tax were almost 40% of total tax revenue of China, a share that has declining gradually, reaching about 5.5% in 1979 and less than 1% in 2004.

In 2004, the central government of China decided to drastically reduce agricultural taxes and other levies and fees. In that year, special agricultural products tax (other than tax on tobacco) was eliminated (from a level of CNY 2.8 in 2003) and agriculture tax was nearly halved from its 2003 level of CNY 39.2 billion (Table 1). Agricultural tax surcharges were also brought down from CNY9.66 billion in 2003 to CNY 4.89 billion in 2004. In 2005, agricultural tax was further reduced to CNY1.27 billion, and agricultural tax surcharges was brought down to CNY 0.35 billion. In December 2005, The National People's Congress (NPC) of China decided to abolish the agricultural tax law. By 2006, the remaining agriculture tax was totally eliminated nationwide.

[8] Orden et al. (2007) also discussed the PSE estimates for China, using data for the period 1995-2001. Gale et al. (2005) described China's agricultural policy changes up to 2005.

2.2. Introduction of direct subsidies

Accompanying the reduction and elimination of agriculture taxes and fees, the Chinese government has started to introduce various direct subsidies – including direct payments to grain producers based on acreages, direct subsidies to purchased farm inputs including fuels and fertilizers, direct subsidies to improved varieties of seeds, and direct subsidies to the purchase of agricultural machineries – to farmers and agricultural production (see Table 2).

In 2004, CNY11.6 billion from the State Grain Risk Fund was used to directly subsidize grain producers. The distribution of these subsidies roughly follows a two-tier method. First, the central government transfers funds to the provinces based on each province's historical grain outputs as well as the amount of outputs supplied to the market. As such, much of this fund was paid to producers in the main grain producing provinces. This principle reflects the central government's desire in maintaining a certain level of grain output. At the provincial level, the subsidy is further distributed to farmers mainly based on their planting areas because of the administrative burden of figuring out each and every farmer's actual output. This subsidy was further increased to 13.2 billion in 2005 and 14.2 billion in 2006. Latest report indicates that the subsidy would be expected to reach 15.1 billion for 2007 (see Table 2).

Another major instrument of direct subsidies to farmers is linked to purchased farm inputs such as fuels and fertilizers. This subsidy, officially named "comprehensive direct subsidy to agriculture production materials" by the Chinese government, was first given in 2006 with a national expenditure of CNY12 billion.[9] It has been reported that it would rise to 27.6 billion in 2007 (Ministry of Finance, 2007), mainly for the purposes of offsetting the high fuel costs to grain producers. The disbursement principle of this subsidy is again according to the area planted (taking into consideration the fact that in some areas it is possible to harvest twice or more in a year).

These two types of subsidies totaled CNY 26.2 billion in 2006 and were expected to reach CNY42.7 billion for 2007, which implies a per *mu* subsidy of CNY 27 nationwide (CNY30 for main grain production provinces and CNY 20 for other provinces).[10]

[9] Previously, prices of these inputs were artificially held low and the producers of these inputs received subsidies from the government,

[10] *Mu* is the traditional measurement of land areas in China. One *mu* equals 666.67 square meters.

In addition to the above subsidies, grain producers also receive additional payments based on the adoption of quality seeds and purchases of agricultural machineries. Seed subsidies reached CNY4.15 billion in 2006 whereas subsidies to machineries were about CNY 600 million in the same year.

2.3. Total assistance to farmers and agricultural production

To summarize, as compared to 2003, in 2006 Chinese farmers at least received extra transfer payment of more than CNY 80 billion, including the abolished tax burden (around CNY 52 billion in 2003) and various direct subsidies (CNY 31 billion in 2006). According to the statistics released by the Ministry of Finance of China, nationwide total spending on supporting agriculture increased from CNY 214.4 billion in 2003 to 339.7 billion in 2006, of which CNY 103 billion (78.2 billion was paid for by the central government) was the transfer payments related to the agricultural tax reform.[11]

2.4. Long term trends and China's WTO commitments on domestic support

The upward trend in providing direct subsidies is in addition to the elimination of taxes and is in spite of high prices of grains in recent years. Indeed, not only direct subsidies are on the rise, but also total producer support to agriculture as measured in the PSE has been increasing in recent years. Will this trend continue? Considering the political decisions on solving the so-called "San-Nong" problem and the campaign of "building a socialist new countryside" made by the current Chinese leadership, one has the reason to believe that the elimination of agricultural taxes will be permanent. It is also probable that total public assistance to agriculture, including direct subsidies, will continue to rise. Assuming this trend continues, a relevant hypothetical scenario for illustration/discussion purposes is one in which China actually uses up all its WTO allowances in a future date.

[11] Although the exact method for calculating the nationwide total spending on supporting agriculture is not made clear in the official documents of the Ministry of Finance, these numbers seem to match the amount listed for the item "total transfer from taxpayers" in the Total Support Estimates (TSE) of the OECD. The total transfer from taxpayers is defined as the sum of the PSE (including market price support which is generally caused by protection measures applied at the border), the General Services Support Estimates (GSSE), and the transfer from producers to consumers (which is often negative as the main component of this item is the market price support paid by consumers to producers). This measure is estimated to be CNY206 billion in 2003 and 302 billion in 2005 by the OECD.

In the Agreement on Agriculture of the WTO, the *de minimis* exemption available to a developing country member is generally set at 10 percent of the member's agricultural production value. In the case of China, this exemption is 8.5 percent as specified in its WTO accession agreement. In addition, China is also allowed to use Blue Box payments. There have been discussions on capping the Blue Box in the Doha Round negotiations and a 5 percent (of total agriculture production value) cap is assumed in this paper to facilitate our following discussion. In addition, as a WTO member, China is also allowed to apply the so-called Green Box payments which are non-distorting or "minimally" distorting. The two limits on the *de minimis* payments and the Blue Box payments set the maximum amount of trade and production distortioning domestic support that China can provide for supporting its agriculture sector. A hypothetical scenario therefore assumes that China provide the two types of support up to their respective limits. Simulating this scenario provides the opportunity to quantitatively investigate how these allowances will be used and what kind of effects can be expected.

3. Modeling agricultural domestic support in China

3.1. The basic model and dataset

We adopt a computable general equilibrium model with agricultural sectoral details for modeling and analyzing recent changes in agricultural domestic support policy in China. This model is a modified version of the well-known global GTAP model (Hertel, 1997). The simulation exercises are based on a recent pre-release of the accompanying GTAP database (version 7).[12] The most recent GTAP version 7 data base (pre-release) covers 101 countries/groups of countries and 57 sectors. For the purposes of this paper, we aggregate the original database to a manageable size of 12 regions (including China and its main trading partners, as well as several aggregated regions covering the rest of the world) and 43 sectors (including all the agriculture and food sectors originally listed in the disaggregated GTAP database).

Important modifications to the standard GTAP model and the accompanying GTAP version 7 data base include:

[12] Documentation of the GTAP-7 database has not yet been made available. Detailed documentation of the GTAP-6 database, however, can be found in Dimaranan (2006)

- Modeling and calibrating China's agricultural domestic support policy into the GTAP model and the version 7 data base. This is described in the next section.
- Dividing total area of land in China into three separated types: arable land, land used for permanent crops, and pasture land. This separation is motivated by the fact that the Chinese government generally discourages farmers from switching land used in grain production to other uses. Moreover, China's territory covers several different climatic zones, each of which is suitable for growing a certain range of products. By dividing the total land area into three broadly defined land types, we avoid the obvious problem of allocating a certain type of land into producing certain products which it normally cannot produce economically (e.g. turning permanent pasture land into rice paddies). Data for making this split has been obtained from the Food and Agriculture Organization of the UN (FAO). Within each land type, in observing changing returns to land, land is allowed to move imperfectly among different products according to a constant elasticity of transformation function characterized by finite elasticities of transformation.
- Allowing for rural unemployment of unskilled workers. In the standard GTAP model, full employment is assumed and wages of unskilled worker are equalized across urban and rural sectors. However, it has long been suggested that there have been hidden unemployment and/or under-employment in China's rural areas. Since the State Statistics Bureau of China only releases data on urban unemployment, there have been only unofficial estimates on the extent of rural unemployment in China (see for example Wolf et al., 2003). Recently, Cai (2007) suggests that "residual" or unemployed/underemployed rural labor was about 105 million in the year 2005, or about 22% of total rural labor in China for that year. By piecing together information from difference sources, Cai further estimates that the "residual" rural labor under the age of 40 was about 52 million in 2005, which was about 10.7% of China's total rural labor. Based on these estimates, we conjecture a simple functional relationship between rural employment of unskilled labor and return to rural labor that specifies how increased return to rural labor stimulates additional rural employment. The additional rural employment shifts out the production possibility frontier for agricultural products and limits the extent of wage hikes for rural labor. As will be seen later in this paper, the employment effect of agricultural subsidies is crucial in determining the welfare effects of recent changes in agricultural policy in China.

3.2. Modeling and calibrating China's agricultural domestic support

We first make a correspondence between China's agricultural policy instruments – which are summarized and quantified in the OECD's Producer Support Estimates (OECD, 2006) – and the relevant policy variables in the GTAP model. Policy instruments in the GTAP model that are relevant for analyzing China's recent agricultural policy changes are output tax/subsidy, intermediate input subsidy, and land and capital based subsidy, all of which are defined as *ad valorem* tax wedges. Where possible, we also place individual instruments into different WTO Boxes according to our understanding of the instruments in relation to the various "boxes" and how they are reported in China's notifications to the WTO. [13] These designations will facilitate our later discussion on the future development of China's agricultural domestic support.

To make the discussion more concrete, we refer to the PSE estimates for China in 2003 (presented in the first two columns in Table 3), a year before China implemented its ambitious agriculture tax reform and hence a good starting point for carrying out our numerical analysis. Furthermore, as these estimates have not been incorporated into the latest GTAP database (version 7 pre-release), we describe how the actual PSE estimates for 2003 are classified and how they are incorporated into the latest GTAP 7 database, which are subsequently used as the starting point for our evaluation of recent policy changes.

Agricultural output tax or subsidy in the GTAP model captures the difference between the producer price and the market price of an agricultural product. A positive difference implies a subsidy whereas a negative difference signals a tax. This instrument is used to model China's agricultural tax on all primary agriculture products in the year 2003 (i.e. prior to the abolishment of agricultural tax). Due to the lack of data on the distribution of agricultural taxes across different products, a simplified assumption has been adopted in our calibration of the database to ensure that the nearly CNY49 billion agricultural tax and agricultural tax surcharges in 2003 are equal-proportionately distributed across all primary agricultural products. The special agri-

[13] The PSE and the various WTO Boxes serve very different purposes. Simply put, the PSE is used to measure border and domestic support policy instruments. The PSE, however, is not the measure used in the WTO negotiations. The WTO Boxes are more of a legal concept useful in negotiating reductions in domestic support policies and do not necessarily reflect the true levels of support to agriculture. For a discussion on the relationship between the PSE and WTO Boxes (or the Aggregated Measure of Support), see Josling et al. (1996) and Orden (2007).

cultural products tax of CNY 2.8 billion is distributed to the vegetable and fruits, and the other crops sectors.

Intermediate input tax/subsidy in the GTAP model is similarly defined to capture the difference between farmers' purchasing price and the corresponding market price of a specific intermediate input used in a specific primary agricultural product. Farmers receive a subsidy (pay a tax) when the difference is negative (positive). The main intermediate input subsidies used by China are the ones on fertilizer, pesticide, seed, other purchased farm inputs (which are considered as "Amber Box" payments), as well as advisory service and pest/disease controls (which are considered "Green Box" payments). For the year 2003, the PSE table shows that these subsidies amounted to CNY 17.9 billion, a number that needs to be calibrated into the GTAP database to form the basis of quantitative analysis. To do so, these subsidies are allocated equal-proportionately to all inputs that are used by all primary agriculture products in China. That is, for intermediate input *i* used in producing product *j*, the share of the calibrated subsidy – denoted as *TFD(i,j)* – in total intermediate input subsidies in agriculture should be equal to the corresponding value share of input *i* used in product *j* in total value of all intermediate inputs in agriculture. This ensures a uniform intermediate subsidy rate for all the intermediate inputs used across all the primary agriculture products.

Land (or capital)-based agricultural subsidy in the GTAP model measures the difference between farmers' rental price over the market rental price of land (or capital). A positive difference implies that farmers pay a tax, whereas a negative difference implies a subsidy in favor of farmers. Before the abolishment of agriculture tax, China used funds on the so-called "Grain for Green" program and made payments to alleviate the effects of natural disasters. These payments are considered as decoupled or "Green Box" subsidies given to arable land in our modeling. More specifically, the reported spending of CNY 66.9 billion for 2003 is assumed to be distributed to arable land used in individual crops according to the production value shares of these crops. In our hypothetical scenarios on future development of China's domestic support, additional land-based payments can either be decoupled payments or are assumed to be given to land used in grain production only. The final item listed in Table 3 is "on farm investment on infrastructure" which are modeled as a subsidy to capital used in all primary agriculture products.

It should be noted that the standard GTAP model treats the above policy instruments as *ad valorem* tax wedges. To make sure that the budget outlays under the various instruments reported in Table 3 are correctly represented in the modified GTAP database, in the actual calibration process we choose to target the budget outlays while allowing the tax wedges to adjust.[14]

3.3. Policy scenarios and their calibration

Based on the modified GTAP 7 database, the following policy scenarios are constructed and simulated:

a. Scenario A: the abolishment of agricultural taxes, the introduction of direct subsidies to grain producers, direct subsidies to purchased inputs by grain producers, and increased subsidies to grain seeds. This scenario is conducted to gauge the effects of the so-called "reducing peasants' burden" policy initiatives. Spending on these subsidies is assumed to reach the level of 2005 (reported in Column 3 in Table 3) and the shocks to the corresponding *ad valorem* instruments in the model are conducted in a way to lock in these targeted spending levels, as follows:

First, output taxes for all agriculture products are reduced to zero in the experiment. Second, the newly introduced direct subsidy to grains is modeled as land-based payment for land used in grain production. This subsidy is increased from zero in the starting base data to CNY13.2 billion in 2005. The exact amount distributed to land used in a certain crop is proportional to the historical planting areas for that crop. Since returns to land vary across different crop sectors in China, such an allocation of the subsidies results in different *ad valorem* subsidy rates for different crops. Third, input-based subsides (fertilizer, pesticide, and seeds, etc.) are increased from the 2003 base level of CNY 6.1 billion to the 2005 baseline level of CNY 56.8 billion.[15] This is

[14] This is done by "swapping" the exogenous tax wedge with the normally endogenous budget outlays so that the latter becomes exogenous and can then be shocked into the level reported in Table 3. Changing the budget outlays is carried out via a GTAP program called "altertax" (Malcolm, 1998).

[15] According to the latest number from the PSE table, CNY 45 billion was used as subsidies to input uses, including payment made to state-owned agricultural input manufacturers to cover their losses resulting from selling pesticide, fertilizer and mulching film to farmers at the state administered price. It appears from latest official Chinese documents that direct subsidies for purchasing these inputs (also including fuel) have been offered farmers, having reached CNY 12 billion in 2006. It is not clear whether the subsidies paid to input producers have been reduced accordingly. In this paper,

done by imposing a homogenous increase in the subsidy rates across all primary agriculture products.

Simulating Scenario A leads to these policy instruments reaching the targets discussed above. These targets are reflected in the updated GTAP database following the simulations. This updated database then become the baseline for conducting the two subsequent hypothetical scenarios on further development of China's agricultural domestic support.

a. Scenario B1: a hypothetical situation where China decides to increase its spending on subsidizing agricultural and farmers. This scenario is constructed in the context of the agriculture agreement of the WTO and China's WTO accession commitment. It is assumed in the scenario that China will exhaust its domestic support "allowances" permitted by the WTO. These allowances include Blue Box payments valued at 5 percent of the value of China's agriculture production, and an 8.5 percent (based on the value of its "normal" agricultural production) *de minimis* payment on a non-product specific basis. Since China's domestic support spending in the baseline (i.e. scenario A) is well below the permitted levels, simulating this scenario implies an increase of both types of payments from the baseline. The detailed assumption applied in this scenario is as follows.

Among the instruments used in the baseline (i.e. scenario A), direct subsidies given to grain producers are given according to historical planting areas and as such modeled as Blue Box payments. The assumed 5 percent Blue Box cap in this scenario implies that these subsidies need to be increased from the baseline level of CNY 13.2 billion to 121 billion, which is roughly 5 percent of the agricultural production value around the year 2004, according to the PSE table for China. Note that by increasing direct subsidies to land used in grain production, additional arable land will move into grain production and away from non-grain production. This in turn will increase the output of grains. However, because of the inflow of additional arable land, the percentage increase in the per *mu* subsidies will fall short of the percentage increase in total direct subsidies.

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we *assume* that the subsidies offered to farmers were in addition to the subsidies given to the input producers. This results in a higher amount of total intermediate subsidies at around CNY 56.8 billion.

There are numerous scenarios in which the *de minimis* allowance can be used, because many instruments can be considered trade and production distorting. For illustration and discussion purposes, in this paper we assume that all the current non-blue box payments in the baseline are considered and remain part of the *de minimis* exemption. We then allocate the remaining *de minimis* allowance within the 8.5 percent limit – valued around CNY 149 billion – as output subsidies applied to all primary agricultural products.[16, 17]

To summarize, this scenario introduces a new agriculture output subsidy of CNY 149 billion, maintains the same input-based subsidies of CNY 56.7 billion, and increases the direct subsidies to grain production (tied to land used in grain production) from CNY 13.2 billion to 121 billion. Taken together, this implies a total non-green box support of CNY 326.8 billion, representing an increase of non-Green Box support by roughly CNY 267 billion over the baseline level.

a. Scenario B2: a hypothetical scenario where China decides to spend the additional Blue Box and *de minimis* allowances – valued at around CNY 267 billion (which are over and above the current payments in baseline scenario A; see Table 3) in a "decoupled" manner. Similar to the recent reform of the Common Agriculture Policy of the European Union, we assume that these decoupled payments are given as a uniform payment to all arable land, regardless of the production choices made by land-owners among different crop products. These payments will augment farmers' income without distorting their production decisions. Therefore, these decoupled payments may be considered Green Box instruments which are not currently disciplined and capped by the WTO. Our modeling and implementation of these payments in the model follow Frandsen et al. (2003) and Jensen and Yu (2006).

[16] We adopt the following simplifying assumption in distribution this amount across products: each product receives an equal *ad valorem* output subsidy. Note that this instrument is exactly the opposite of the agricultural tax previously levied on agriculture outputs.

[17] By only considering non-product specific *de minimis* payment, we avoid the more technical interpretations on how much support a country can actually spend within its *de minimis* limit. Moreover, this also simplifies the way the shocks in the scenario are generated (see footnote 17). For a more rigorous discussion on the classification and measurement of domestic support instruments in WTO negotiation, see Brink (2007).

4. Results

In this section simulation results are reported, mainly on changes of China's agriculture outputs, exports and imports (presented in Table 5), as well as the implied effects on economic welfare and farm income (reported in Table 4). Numbers reported for Scenario A are changes/percentage changes from the 2003 base, whereas results reported for Scenarios B1 and B2 are changes/percentages from the same 2005 baseline defined as the post-simulation database following the shocks contained in Scenario A.

4.1. Effects of abolishing agricultural tax and providing direct subsidies (Sce. A)

Abolishing agricultural tax on primary agriculture products – which are assumed to be uniform across these products – generally boost outputs of these products. However, the introduction of direct subsidies (modeled as a land-based subsidy) and the increased input- based subsidies to grain production further reduces the cost of producing grains and hence expands their outputs. From Table 5, it can be seen that outputs of rice, wheat and other grains increase by 0.9, 6.3 and 2.1 percent, respectively. With the assumption of no productivity progresses in the agriculture sectors, these increases have been partially made possible by drawing land from the non-grain agricultural sectors.[18] Furthermore, part of the unemployed or underemployed rural labors is attracted into agricultural production (a 1.2 percent increase in rural unskilled labor), especially in the production of grains.

Increased domestic production of grains and other agriculture products implies improved trade balances of these products due to increased exports (e.g. 19.9 percent for other grains and 48.4 percent for wheat) and reduced imports (8.3 percent for other grains and 17.2 percent for wheat), as can be seen from Table 5.

The above results seem to suggest that the simulated policy changes do serve the purposes of increasing grain production and improving the self-sufficiency of grains, as compared to the baseline that mimics the pre-reform situation (i.e. the 2005 base). Do these changes help improve farm income (which is the other important objective of these policy changes)? According to our simulation results, total factor income in primary agriculture rises by 8 percent following these policy changes (Table 4). This overall increase in farm income can be understood by the large increases in returns to production factors used in agriculture, in particular land and rural unskilled labor. Due

[18] The re-allocation of land amongst agriculture products actually leads to a contraction of the "other crops" sector, despite the abolishment of the output tax.

to the finite elasticity of transformation governing the allocation of different types of land across products, average rental prices of different types of land are shown to be different. Rental price of arable land increases the most (over 16 percent on average), followed by that of pasture land and permanent crops (11.5 percent and 7.1 percent, respectively). As for returns to rural unskilled labor, the increase of 3.8 percent is not as dramatic, reflecting the model assumption of unemployment/under-employment in the rural areas. In addition to the above, rural employment is also shown to increase at 1.2 percent, thereby augmenting the increase in overall farm income.

The economic welfare consequence of these policy changes also appears to be positive. The calculated welfare gains (measured in equivalent variations) of US$2,255 million are due to the increased employment in agriculture, which shifts out the production possibility frontier of the economy, and a comparable gain in the terms-of-trade. In contrast, the joint allocation efficiency effects of abolishing agriculture tax and introducing direct subsidies are slightly negative, due to the large overall increases in government assistances.

4.2. Effects of exhausting WTO domestic support "allowances" (Scenario B1)

In this scenario, with the output subsidies (within the 8.5 percent *de minimis* limit) equally distributed to all primary agriculture products, all outputs are boosted significantly (see Table 5). The extra acreage-based subsidies to grain farmers (the assumed Blue Box payments), however, alter the expansion patterns across products. Outputs of rice, wheat and other grains increase by respectively 1.6, 12 and 1.8 percent over the 2005 baseline level. For a few other agricultural sectors – most notably oil seeds and other crops – outputs actually decline. Again, these output changes can be attributed to the inter-sectoral land reallocation and the increased rural employment. For instance, uses of arable land in wheat and other grains increase substantially (by 12 and 5.8 percent, respectively), thereby reducing land available to non-grain products. Increased grain production leads to improved net trade positions for China in these products, with more dramatic increases in their exports and decreases in their imports (than what have been reported from Scenario A). However, the trade balance pattern reverses for those products of which outputs decrease (e.g. oil seeds, other crops, vegetables and fruits, etc). These production and trade pattern changes suggest that the additional subsidies aiming at increasing grain production may have the side-effect of creating mismatches between China's trade pattern and the commonly be-

lieved comparative advantages of China in producing labor-intensive agricultural products.[19]

With both the *de minimis* and the assumed blue box allowances being fully used, simulation results show that total agriculture factor income increases by 16.2%. This result can be partially explained by significantly higher land rental prices, especially for the land used in grain sector (increased by over 40 percent). Rental price of land in the non-grain sectors also increase due to the assumed increase in output subsidies, but to a less extent (12 percent for land used for growing permanent crops and 15.7 for pasture land). In addition, increases in both the wage rate for rural skilled labors (4.7 percent) and in rural employment (1.5 percent) also play important roles in augmenting overall farm income.

Speaking of economic welfare, the additional subsidies assumed in this scenario lead to larger negative allocation efficiency effects to the Chinese economy, estimated to be US$1.65 billion.[20] However, increased rural employment (of unskilled labor) results in a gain of nearly US$1.6 billion. Coupled with a small positive terms of trade effect, the overall welfare effect (EV) turns out to be positive but very small at US$ 103 million.

It is worth noting that the welfare result is obtained by not considering how the funds for the subsidies are raised. Through the computation of an additional scenario where an income tax hike is explicitly assumed for purposes of paying for these subsidies, we observe similar allocation efficiency and employment effects but a much larger, negative terms-of-trade effect, and a much larger welfare loss.[21]

[19] For a detailed discussion on comparative advantage and China's agricultural trade patterns, see Carter and Li (2002).

[20] In comparison to the increase in total government assistance to agriculture, this number appears to be quite small. In a general equilibrium model such as GTAP, subsidies are subtracted from national income whereas the derived increases in factor income are added. Welfare losses from the subsidies as a distortion are due to their efficiency effects, as the subsidies encourage inefficient domestic production. Unlike price-based instrument, these subsidies actually reduce prices which in term generate offsetting consumer gains.

[21] The negative terms of trade effect due to the income tax can be explained in relation to the closure rule applied in the model which specifies the equality between the difference between savings and investment and national trade balance. With a substantial income tax hike, rate of return on capital falls below the corresponding international rate of return, resulting in less investment from the "global bank". Therefore, the trade balance must adjust upwards, leading to a deteriorated terms of trade.

To summarize, by filling both the *de minimis* allowance and the assumed Blue Box cap, China would be able to significantly increase its grain outputs, improve its net trade positions in grains (but worsen those in a few non-grain agricultural products), and substantially raise farm income. But doing so would result in two conflicting welfare effects: a positive effect from extra agricultural employment and a negative allocation efficiency effect.[22]

4.3. Effects of exhausting WTO domestic support "allowances" using decoupled instrument (Scenario B2)

If the additional spending discussed in section 4.2 is used in a decoupled manner – as a uniform payment to agricultural land, regardless of where the land is used – simulation results show agricultural outputs in China will remain unchanged and there will be no changes to China's agricultural trade. This implies stable rural employment, a result that is different from what is expected from the "coupled" subsidies discussed in Scenario B1 in section 4.2.

In this case, the decoupled payments are essentially income transfers to the owners of land, as they do not draw additional resources (e.g. rural labor, arable land, and capital) into the subsidized activities and do not cause inefficient reallocation of these resources across different agricultural activities. As such, they are considered non-distorting. Indeed, simulation results show higher increase in the returns to arable land (66 percent), as compared to the same result reported in scenario B1. Consequently, total agriculture factor income rises by 17.2 percent, which is again higher than the 16.2 percent increase reported in Scenario B1 with the same amount of government spending, indicating that decoupled payments are more efficient in raising farm income.

However, because of these subsidies generate no production and trade distortions to the economy (other than transferring income from one branch of the population to another), relative prices remain virtually unchanged and no incentives have been created to attract more rural labor into agriculture production. As such, virtually no change in welfare is observed from the simulation results.[23]

[22] It is needed to point out that the cost of raising the fiscal resources for paying for the subsidies is not considered.

[23] The modeling assumption of one representative household also ensures that income transfer within that representative household generates no changes to aggregated demands.

5. Summary and concluding remarks

This paper first reviews recent development of China's agricultural domestic support policy, especially the switch from taxing farmers and agriculture to providing direct subsidies. From data collected from the Ministries of Agriculture and Finance of China, it appears that abolishing agriculture tax means a loss of government revenue in excess of CNY 50 billion per year. Most recent report also suggests that direct subsidies to grain producers exceeded CNY 42 billion in 2007. In addition, the Chinese government continues its other agriculture assistance programs under the name of "building a socialist new countryside". These changes mandate some quantitative analyses on their impacts with regard to the declared policy objectives.

Based on the description of recent policy development, this study offers a model-based quantitative analysis on the effects of these policy changes. Simulation results suggest that recent policy changes likely have positively addressed the two policy objectives in increasing grain production and farm income. Specifically, results show that grain production increases, the trade balance of grain improves, and overall farm income as measured by total factor income in agriculture is estimated to rise by 8 percent. Much of the increase in grain production and farm income can be attributed to land reallocation to grain production, cheaper inputs, and extra agricultural employment triggered by the policy changes. Measured in terms of equivalent variation, the efficiency effect from reducing agricultural tax and introducing subsidies appears to be very small, whereas increased rural employment generates noticeable welfare gains (which offset the efficiency losses from introducing the direct subsidies).

Judging from the wide rural-urban and west-east income gaps currently existing in China, the declining shares of agriculture outputs in China's GDP and taxation in China government revenue, and most importantly the political consensus at the highest level on the importance of improving the livelihood of China's rural citizens, we expect that the abolishment of agriculture tax will be permanent and that government assistance (including direct subsidies) to agriculture and farmers will continue and rise. Based on this belief, two hypothetical scenarios of China's domestic agriculture support in the future are developed with reference to the WTO limits set on these subsidies. In the first scenario, we assume that China uses up all its WTO *de minimis* support allowances and the assumed Blue Box cap, in a manner that is consistent with current practices (including output subsidies and land-based grain subsidies). In the second scenario, we explore alternative ways of providing the same amount of support (i.e. a uniform, land-based subsidy). Simulations of these two scenarios provide

further insights into possible consequences on grain production, trade, rural employment, farm income and economic welfare. Results from the first scenario show large increases of grain production over the baseline, a changing trade pattern seemingly contrary to China's comparative advantage, increased rural employment, significantly higher farm income (over 16%), and large negative allocation efficiency effect which is almost offset by the welfare gains derived from increased employment. In contrast, results from the second scenario show that agricultural outputs and trade in China remain unchanged, rural employment stays stable. But as a way of transferring income, the decoupled payments seem to be more efficient and cause virtually no production distortions to the economy (hence no welfare implications).

Several limitations of the study need to be noted. First, the study aims at providing a first quantitative analysis on China's domestic support programs using a global model with no details on different types of households and regional/provincial disaggregations. A national model with regional details and multi-household may generate complementary results. Second, the paper does not formally consider how the funds for supporting agriculture are raised. It is conceivable that such funds can come from taxations in the urban sector. A more sophisticated model with the division between rural and urban households would be more desirable. Last, simplified assumptions regarding rural-urban migration and rural unemployment are applied in the modeling. More realistic and refined treatment of these assumptions may lead to quantitatively different results. All these limitations point out to future directions for research in this area.

Table 1 Agricultural tax reform in China: 2003-2005 (million CNY)

	2007	2006	2005
Agriculture tax	1,272	20,403	39,220
Special agricultural products tax	0	0	2,828
Agriculture tax surcharge	351	4,894	9,660
Agriculture tax			
Total	1,622	25,297	51,709

Source: various documents from the website of Ministry of Agriculture, China.

Table 2 Agricultural Subsidies in China: 2004-07 (million CNY)

Types of subsidies	2007	2006	2005	2004
Grain production	15,100	14,200	13,200	11,600
Purchased inputs in grain production	27,600	12,000	n/a	n/a
Seeds in grain production	n/a	4,150	n/a	n/a
Dairy cows	n/a	100	n/a	n/a
Agri. Machineries	n/a	600	300	n/a
Total	42,700	31,050		

Source: Various documents from the website of Ministry of Finance, China.

Table 4 Simulation results: welfare and farm income (US$ million)

	Baseline 2005 (Scenario A)	Scenario B1	Scenario B2
Allocation efficiency	-380.2	-165,0.6	-3.6
Endowment effects	128,6.4	156,1.6	-31.9
Terms-of-trade effects	155,8.9	226.3	1.3
Total welfare	225,5.3	102.8	-34.0
Agriculture factor income (% change)	8.0	16.2	17.2

Source: authors' calculations.

Table 3 Policy instruments in base year and in simulated scenarios (million CNY)*

	2003 Base	Baseline 2005 (Scenario A)	Scenario B1	Scenario B2
Agricultural output tax	-51,923	0	0	0
Domestic support				
Total output subsidy, consisting of:	0	0	149,016	0
Output subsidy given to all agricultural commodities (de minimis)	0	0	149,016	0
Total intermediate input subsidy, consisting of:	17,871	70,884	70,792	70,815
Fertilizers, Pesticide, seed subsidies allocated to all crops (de minimis)	6,125	56,814	56,722	56,745
Advisory service & pest/disease control allocated to all commodities (Green)	11,746	14,070	14,070	14,070
Total land subsidies, consisting of:	66,860	98,508	206,352	357,813
Land-based payments allocated to grain productions** (Blue Box)	0	13,200	121,045	13,200
Decoupled land payment (Green Box)	0	0	0	259,306
Grain for Green program allocated to all crops (Green Box)	43,582	55,386	55,386	55,386
Natural disasters payments allocated to crops (Green Box)	23,278	29,922	29,922	29,922
Total capital subsidies, consisting of:	26,980	30,428	30,428	30,428
On farm investments infrastructure allocated to all commodities (Green Box)	26,980	30,428	30,428	30,428
***Total domestic support payments	111,711	199,819	456,588	459,056

* Numbers presented in this table are mainly sourced from the OECD PSE estimates for China (OECD, 2006). The designations of the different instruments to the various WTO "Boxes" reflect the authors' understanding and treatment these instruments in the model, with the references to China's official notification to the WTO (WTO, 2006)
** Five percent of China's agricultural production value was roughly CNY 122,045 million in 2004, which is the assumed Blue Box ceiling applied to the land-based payments.
*** The *de minimis* limit for China is 8.5 percent of the value of production. In 2004 that limit was CNY 207,476 million. Therefore, the maximum amount of non-green box domestic support in scenario B1 is assumed to be CNY 329,521 million (*de minimis* + Blue Box). Potential complications arising from the possibility of using both product-specific and non-product specific *de minimis* payments have been ignored in generating this overall limit.

Table 5 Simulation results: percentage changes in domestic production, export and import in China

	Domestic outputs			Exports			Imports		
	Baseline 2005 (Sce.A)	Scenario B1	Scenario B2	Baseline 2005 (Sce.A)	Scenario B1	Scenario B2	Baseline 2005 (Sce.A)	Scenario B1	Scenario B2
paddy rice	0.9	1.6	0	11.3	91.4	-0.1	-15.2	-35	0.1
wheat	6.3	12	0	48.4	199.5	0	-17.2	-29.5	0
other cereal grains	2.1	5.8	0	19.9	65.1	0	-8.3	-21.2	0
vege and fruits	0.3	-0.6	0	-0.9	-12.1	0	0.5	7.8	0
oild seeds	1.2	-3	0	-4.7	-20.7	0	0.1	2.6	0
sugar beet and cane	0.2	-0.3	0	-1.7	-27.3	-0.1	0.4	16.7	0
plant fiber	0.6	-2.1	0	7.5	-9.6	0	-2.7	2.9	0
other crops	-3.6	-10.7	0	-6.1	-17.7	-0.1	1.9	5.6	0
cattle, sheep, goats, horses	0.8	1	0	7.2	9.8	0	-5	-3.1	0
other animals	2	2.3	0	10.1	13.1	0	-4.9	-4.1	0
raw milk	0.5	0.8	0	12.9	24.3	-0.1	-5.5	-8.6	0
wool and silk cocoons	2.2	2.8	0	25.9	36.8	-0.1	-8.5	-11.4	0
beef and veal	1	1.6	0	2.4	5	0	0.6	0.8	0
other meats	3.7	5.5	0	26.5	35.1	-0.1	-11.1	-14.4	0.1
vegetable oild and fats	-0.1	-0.8	0	-1.8	-2.5	0	0.9	0.8	0
Dairy	0.8	1.1	0	0.3	-0.4	0	0.9	1.5	0
processed rice	0.3	0.5	0	0.5	10.5	0	0	-5.1	0
Sugar	0.3	-1.8	0	-1.6	-6	0	0.4	1.4	0
other foods	0.6	0.1	0	0.1	-2	0	0.2	1.1	0

Source: authors' calculations.

Note: results reported for baseline 2005 (scenario A) are percentage changes from the 2003 base; results reported for both Scenarios B1 and B2 are percentage changes from the baseline 2005.

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