ASIA DEVELOPMENT BANK (ADB) AND INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE (IFPRI)

Public Expenditure in Agriculture under a Rapidly Transforming Economy:

The Case of the People's Republic of China

Bingxin Yu, Kevin Chen and Yumei Zhang

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1. Introduction

1.1. Background

In recent years, the Chinese economy has experienced a rapid and fundamental transformation (Table 1). Between 1980 and 2011, China's GDP has expanded to almost 20 times its 1980 value at a breathtaking rate of 10 percent per year. GDP per capita grew from $524 in 1980 to $7, 418 in 2011, averaging 9 percent annually. On the other hand, the demographic structure also shifted dramatically due to urbanization, an aging population and migration. During this period of fast growth, China has transformed from an agriculture-based economy to one based on manufacturing and services. From 1983 to 2012, the share of agriculture in GDP dropped from 34 percent to 10 percent and the share of labor force engaged in the agricultural sector dropped from 67 to 34 percent(Table 2).The labor share has declined at a much slower rate relative to agriculture's GDP share, suggesting that average labor productivity in the agricultural sector is falling behind the non-agricultural sectors. Agriculture now plays a small role in terms of revenue generation or government expenditure allocation, but rural consumers are still essential in domestic consumption. Agriculture's role in trade also declined during the transformation. At the beginning of rural reform, agricultural exports accounted for 22 percent of total exports. By 2011, this share dropped to only 3 percent. The share of agricultural imports decreased at a slower pace, which accounted for 6 percent of total imports in 2012.The most significant shift occurred in 2003, when China became a net food importer(Figure 1).

The structure of agricultural production has shifted along with China's economic transformation. As shown in Table 3, total rice and wheat production increased by less than 1 percent per year despite a drop in cropping areas, implying improved yield. Maize production jumped by 3.5 percent annually, largely due to the growing demand for feed grain. The development of staple grains is dwarfed by impressive growth in high-value crop and animal products. For example, meat output increased from 140 million tons in 1983 to 839 million tons in 2012, growing at 6.2 percent per year. Poultry, fishery and fruit output growth skyrocketed at 9.6, 8.8 and 13 percent per year, respectively. The growth of agricultural output is achieved under declined traditional inputs (land and labor), and is mainly driven by intensified use of modern inputs (machinery, fertilizer and irrigation) (Table 4).Additionally, farmer's private investments in machinery and fertilizer have outpaced public investment in irrigation (Cai and Du 2013).

The economic transformation has profound implications for food production, rural development, poverty reduction, trade balance, employment, migration, and natural resources management. China's agricultural sector development has contributed to and benefited from this rapid

transformation. It has been widely recognized that the rapid agricultural growth in the 1980s triggered China's subsequent economic growth(Fan et al. 2004; Lin 1992; Ravallion and Chen 2007). Since then, China's agricultural sector has made impressive progress, including marked gains in land and labor productivity and agricultural output. As a result, the constant growth in agricultural production has enabled the country to feed more than a fifth of the world's population using an eighth of the world's arable land. The prevalence of malnourishment and poverty has continuously declined and more than 70 percent of the global reduction of the undernourished population can be attributed to China for the period from 1983 to 2012 (FAO 2012).

However, the agricultural sector faces many challenges despite this impressive growth. Swift urbanization and an emerging middle-income class increase the demand for more nutritious and protein-based diets. Moreover, agriculture can be negatively affected by many factors in the supply side, including demographic change, biophysical constraints such as climate change, water shortages, land degradation and other environmental stresses, as well as external trade conditions. The lack of a systematic understanding of the impacts of urbanization, global climate change and water scarcity on agricultural production has prevented the formulation of an effective policy and its integration into the planning of government agricultural expenditures.

Currently, agriculture is still essential for the national food security and income equality of rural households in China (Figure 2). The strategic importance of agriculture has prompted the Chinese government to modernize its agricultural sector through a series of national policies. With food supply constraints growing and demand rising, China's current agricultural policies and the practice of intensified production are increasingly being tested. Public expenditure is one of the most important tools for the government to create a conducive environment and to implement development goals. A comprehensive review of public agricultural expenditure is urgently needed to examine factors that shape and define agricultural production in China. Such a review is particularly timely given the forecasted slowdown of economic growth and fiscal revenue in 2013.

1.2. Objectives

The overall objective is to prepare the policy document based on a systematic review of public expenditure in agricultural production in China. The proposed study has the following six specific objectives:

1) To identify key challenges and constraints faced by Chinese agriculture in a rapidly transforming economy;
2) To review and analyze the budget process in China;
3) To compile and analyze basic data on public expenditure in agriculture in China;
4) To review the impact of public expenditure in agriculture at different administrative levels;
5) To assess gaps of public expenditure in the agricultural sector; and
6) To provide policy recommendations and contribute to the policy process of developing strategies for strengthening the agricultural sector.

1.3. Scope and Method

This study is a qualitative and quantitative appraisal comprised of a combination of desk review and field visits. The desktop review involved synthesizing existing literature on public expenditure in China and selected other countries, with a focus on expenditure in and for agriculture. It draws on the experiences of both public and private sector players, research institutions, and relevant scientific evidence. The information for the field study was gathered through consultations with government representatives and advisers involved in issues related to agricultural development in China in line ministries, research institutes, and universities. The information generated from the desk review and field research is used to identify various gaps and to formulate policy recommendations for public agricultural expenditure in China.

1.4. Structure

The report is organized as follows: Chapter 2 summarizes the constraints and challenges for Chinese agriculture. Chapter 3 reviews the effects of public expenditure in agriculture in terms of economic growth, sector development and poverty reduction with studies in China and other developing countries. China's agricultural policy reform, fiscal system and associated issues are discussed in Chapter 4. Chapter 5 then looks at government expenditure in agriculture and its components at the state, central government and various subnational levels. Chapter6 compares current government expenditure patterns with development goals to identify gaps in public expenditure and knowledge. Finally Chapter 7 summarizes the findings of this study and proposes strategies for government spending in agriculture.

2. Major Challenges and Constraints for China's Agriculture

2.1. Urbanization, Demographics and Migration

Chinese society is undergoing a rapid and unprecedented reconfiguration. First, China's urbanization has outpaced its economic growth since 2006 (Chen, Liu and Tao 2013). About 80 percent of the population lived in rural areas in 1980 and by 2011 more than half of China's citizens were urban residents (Table 1). This trend of urbanization is expected to continue as China maintains its prioritization of urbanization with a target of increasing the urban population by 400 million people in the coming decade.

The second change is related to the demographic distribution of the population. Advances in healthcare and nutrition, combined with the one child policy, have led to the rapid aging of China's population. In 2012, 9.4 percent of the population, or 127 million people, were at age 65 and above in China; by 2030, the number will increase by almost 100 million to 235 million (16.2 percent of population), according to the United Nations (2010). By 2050, nearly a quarter of the population will be over 65 years old(Figure 3).China's demographic shift to an older society will have a profound impact on the Chinese economy and the government's budgetary policy.

The third change is massive labor migration. A series of national policies on industrialization, marketization, urbanization and hukou liberalization have triggered an extensive internal migration. The number of rural migrants exhibited exponential growth (Figure 4)(Cai and Du 2013). By the end of 2012 the number of rural migrant workers reached 263 million, almost 20 percent of the population (MOHRSS 2013).Most migrants are motivated by the desire for higher wages and better opportunities. This is illustrated by the predominantly rural-urban and inland to coastal labor flow: Around 70 per cent of migrant workers are employed in China's eastern areas with two thirds of them working in large or medium cities (ILO 2013).

Although this structure change in employment increases rural income, alleviates rural poverty, and produces urban prosperity, the agricultural sector has exhibited a net loss of productive labor. The average total hours spent per household on the farm has declined from 3, 500 hours in 1991 to 2, 000 hours in 2000 and only 1, 400 hours in 2009 (de Brauw et al. 2012). Cai and Du (2013) also reported that migrants generally spend nearly nine months a year working away from the farm. Most migrants are young males with a secondary education level and mainly work in China's eastern areas in manufacturing and construction (MOHRSS and ILO 2011).With the

concentration of young male migrants, agriculture is left to the females that are left behind. A recent study (Zhong 2012) suggests that as the elderly leave employment and youngsters move out, the aging of the agricultural labor force will speed up, and be followed by a sharp decline in the total agricultural labor force in 20-30 years.

The exhaustion of the demographic bonus and urbanization has pushed up the cost of rural labor. As a result, the agricultural labor to land ratio has increased rapidly since 2003, and rural daily wages doubled from 1998 to 2007 (Christiaensen 2012; Yu, Liu and You 2013; Cai and Du 2013). The labor shortage and income structure change may reduce overall agricultural productivity when farmers cope with the absence of family members and lost productive capacity by reducing their agricultural investment and shifting from multi-cropping to single-cropping. In some cases, significant levels of land abandonment have been reported. Furthermore, as input costs increase sharply, as they have over the past decade, remittances from migrant workers are sometimes insufficient to cover investments to improve production capacity of cropland.

It is worthwhile to point out that agricultural production does not necessarily suffer when household members move away. Recent developments in the labor market have induced changes in farm structure as capitalization and mechanization become attractive. There is a surge in large and medium size tractor use accompanied by a declining agricultural labor-land ratio (Christiaensen 2012; Cai and Du 2013). A recent study by IFPRI finds that increases in productive capital investment can significantly promote the productivity of migrant households who receive remittances. In addition, increased demand for farm machinery from rising wages encourages smallholders to capture the economies of scale from mechanization and remain internationally competitive. Cui and Zhan (2013) also noticed that high production efficiency is associated with reduced labor and intensified mechanization.

2.2. Supply Side Constraints: Resource Scarcity, Climate Change, and Environmental Stresses

A rapidly urbanizing society puts pressure on increasingly scarce resources including water, fuel, food and raw materials. There are also significant alterations of the physical environment in the urbanization process (Chen 2007). The accelerated urban use of productive agricultural land may threaten national food security and environment sustainability, not only through shrinking available soil resources but also through declined soil fertility along with the depletion of water tables.

First, given the recognizable constraints to land availability, accelerated industrialization and urbanization unquestionably lead to further losses of agricultural area. For example, the

development of agricultural land due to urban sprawl results in irreversible loss of soil resources. Second, the urbanization process results in the rapid loss of cultivated land in areas suitable for agricultural production. Soil resources, measured in biotic productivity and suitability, are unevenly distributed in China. The majority of agricultural land with favorable climatic conditions is concentrated in densely populated eastern China, which experienced dynamic economic growth and drastic shifts in its land use pattern. As a result, land with high agricultural potential has been encroached upon by other activities such as industrial zones and the development of townships. Third, soil quality loss influenced by urbanization can further undermine the productive capacity of land. Soil fertility can be significantly reduced by pollution and acidification, which can lead to changes in soil physical and chemical features, such as increased biotic availability of heavy metals, altered soil biodiversity and decomposition of organic matter (Chen 2007). Lastly, changes in crop mix have also changed soil utilization and management. It is reported that plots growing high-value fruits and vegetables tend to lose more nutrients from the soil than cereals, causing fast depletion of nutrients and land degradation.

Water resource constraints are severe as well, particularly in northern China. In 2006, China's per capita water resources were only 24 percent of the world level. The majority (81 percent) of China's water resources is concentrated south of the Yangtze River, illustrating the uneven distribution of water resources. With rising industrialization and urbanization, demand for water has gone up rapidly (Xie 2009). This increased competition has reduced the supply of water to the agricultural sector. There is a clear tradeoff in water use between irrigated agriculture and high-value added industrial production (Cai and Rosegrant 2007). What's more, about one third of the irrigation facilities for the 53.33 million hectares of irrigated farmland have deteriorated after years of neglect (Cui and Zhan 2013). Poor maintenance of water conservation makes precious farmland vulnerable to natural disasters, especially in western China.

Water scarcity is also worsening, and is of particular concern in northern China (Xie 2009), where the North China Plain's shallow water table has dropped from 0-3 meters below the surface in 1950 to the current depth of 65 meters (Zheng et al. 2010; Li, Cui and Zhan 2013). Dietary change and population growth imply additional water needs by 2030, which is estimated to be about 182 to 230 percent of irrigation water use in 2005 (Liu and Saveniji 2008). Future changes in temperature and precipitation associated with climate change, together with accelerated industrialization and urbanization, will further challenge the level of water allocated to agricultural purpose and thereby imperil China's food self-sufficiency(World Bank 2010; Ijjasz and Zhang 2010).

Land degradation caused by soil erosion, salinization and desertification affect about 40 percent of land area, especially in western China(Chen 2007). It is estimated that land salinization negatively affects 8.5 percent of total land area, or 82 million hectares (Chen and Zhang 2010). Excessive use of fertilizer and pesticides further exacerbates the stress on the environment and ecology due to nitrogen and phosphorus eutrophication of China's lake and ground water systems. Pesticide pollution currently affects 16 million hectares while about 27 million hectares of agricultural land face drought, mainly in the northern part of the nation(Chen and Zhang 2010). Plus, the nutrient leakage from overuse of fertilizer and agricultural chemicals is commonly observed in more densely populated grain producing areas, further eroding China's natural resource base.Instead of increasing agricultural output by increasing chemical inputs, it is still possible to maintain yields and cut nitrogen use by at least 30 percent through the application of better agronomic practices (Christiaensen 2012).

China is among the most disaster-prone countries in the world (Nie 2011), as agro-meteorological disasters alone affect 50 million hectares and 400 million people, and result in 2, 000 billion Yuan(about 3 percent of GDP) in damages annually in China (CSNARCC 2011).[1]It is estimated that droughts and floods reduce the country's potential grain output by about 20 million tons every year (Cui and Zhan 2013). The agricultural sector is especially vulnerable to the risks posed by climate change and by natural disasters (Tu et al. 2011; Wang et al. 2008).From 1996 to 2007, crop area afflicted by disaster-related production loss is widespread. It is estimated that 31 percent of total sown area reported at least 10 percent of lower output and 17 percent of area experienced more than 30 percent of production loss caused by disaster (Nie 2011). Such meteorological disaster loss rates translated into an annual grain loss of roughly 51 million tons, or approximately 100 billion Yuan in annual direct economic losses from 1996 to 2003 (Li, Lin and Li 2007). Furthermore, as agriculture remains important in terms of production and employment in China's transitional economy, China is all the more vulnerable to climate-related risks (CNARCC 2007; Tu et al. 2011; Xiong et al. 2009).

Climate change is estimated to increase average temperatures by 0.5-0.8 degrees in China, with alarming increases in the frequency and intensity of extreme weather events (Zhang and Xin 2013;Cruz et al. 2007).The crop land affected by natural disaster such as flood and drought grows steadily from 1980 to 2010, causing tremendous loss of output (Table5). Many studies predict that climate change will continue to intensify in China and that the occurrence of extreme

[1] Beyond immediately disruptive impacts on production, climate shocks are also associated with long-term livelihood impacts such as impaired health, the loss of productive assets, and the destruction of infrastructure (Vermeulen et al. 2010).

weather events and natural disasters associated with climate change will continue to increase (Cruz et al. 2007). However, the impact of climate change to crop production varies considerably across regions and crops(Zhang and Xin 2013). The vulnerability stems from the expansion of agricultural production into marginal areas prone to natural disaster (World Bank 2007a).Insufficient investment in agriculture in China further weakens the sector's resilience to extreme weather events resulting from meteorological disasters and climate change (CNARCC 2007).

2.3. Demand Side Constraints: Dietary Change and Food Safety

Urbanization is accompanied by rising incomes and a burgeoning middle-income class, which have resulted in a rapid shift in dietary patterns from grain-based to protein rich (meat and dairy) and diversified (fruits and vegetables)(Table 6). Annual per capita grain consumption declined from 260 kg in 1983 to 164 kg in 2012 for rural residents and from 145 kg to 79 kg for urban residents. Meanwhile, in both rural and urban areas, the demand for edible oil, meat, poultry and aquatic products has increased dramatically. It is estimated that meat consumption will increase by about 50 percent from 2010 to 2030 (Christiaensen 2012). By 2050 demand for dairy and aquatic products will grow to seven times that of today's level, and demand for fruits and vegetables will double (Huang 2008). This strong demand implies that the demand for feed grains like maize and soybean will rise sharply. The change in food demand requires a considerable shuffle in crop mix and agricultural outputs.

Christiaensen (2012) suggested some possible opportunities associated with food demand dynamics. First, declined demand for staple grains implies less pressure on agricultural land for cereal production, allowing for the future possibility of reallocating agricultural land for alternative use. Second, diversified diet demands more high value products, which requires more labor and less land and water. Third, animal-based products require fast growing feed grains, which will be the driving force of future grain demand. There are other substitutes, including root crops like cassava and potatoes, adding flexibility in agricultural trade and production.

At the same time, despite the enormous efforts of the government, China has been rocked by frequent food safety scandals in recent years, which is caused by many factors from production to food processing and preservation. Soil pollution associated with urban waste, sewage and vehicle exhaust, can lead to increasing cases over food quality safety in China. For example, a spot check of 10 provincial capitals reported that the concentrations of heavy metals exceeded the permissible level of the National Standard for Food Safety in 30 percent of agricultural products (Chen 2007).In addition, in an effort to keep up with demand resulting from increasing income, some farmers are increasingly employing unscrupulous farming methods, including the

use of unsafe levels and sources of fertilizer, pesticides, and other chemicals, which pose threats to both environmental quality and human health. Furthermore, China's population is not only growing but also becoming more urban, which presents its own food safety challenges. While the majority of food was previously produced and consumed locally, now larger quantities of food need to be transported across long distances to reach urban centers across different regions, increasing the risk of contamination. Food safety scandals affect public health, and erode consumer confidence in Chinese agricultural produce. This prevents the agricultural sector from fully exploiting the opportunities from high demand for highvalue and labor intensive products (Christiaensen 2012).

2.4. Increasing Rural-Urban Inequality

In addition to the natural resource constraints, rising rural-urban inequality also poses a difficult policy challenge for agricultural development in China. Despite the rapid growth of the economy as a whole, there has been increasing inequality among the population (Kanbur and Zhang 2005). Income inequality in China, for example, has climbed rapidly over the past two decades. The two main dimensions of inequality are the income disparity between urban and rural areas, and between coastal and inland regions.

Urban-rural inequality is the most important dimension of inequality in China, as agricultural revenue still dominates rural household operation income(World Bank 2009; Cui and Zhan 2013).The Gini coefficient in China has increased from 0.29 in 1981 up to 0.42 in 2009 (Figure 5).The inequality gap enlarges over time, and contributes substantially to overall inequality (Sicular, Yue, Gustafsson, & Li, 2007)(Figure 6).There are four major factors that contribute to the accelerated growth of the income gap, which create challenges for agriculture in terms of capital investment and labor force. First, China's economic reforms replaced collective agriculture with a de-facto system of private farming, resulting in a more unequal distribution of private income between farming and non-farm activities(Khan 2005; Cui and Zhan 2013). Second, the economic reform used to heavily channeled investments towards the urban and industrial sector at the expense of the rural and agricultural sector, resulting in declining incentive in agricultural investment. Third, the institutional barriers for rural migrants to access social services introduce a wide urban-rural income gap and limited their opportunities (Yao, Zhang and Hanmer 2004; Dollar 2007). Fourth, the increased integration of the Chinese economy and international markets generated changing terms of trade between agricultural and non-agricultural goods. Agricultural prices have declined significantly, leading to a rise in inequality (Benjamin, Brandt, Giles, & Wang, 2005).

The regional dimension of inequality is also significant in China, especially the disparity between coastal and inland regions, and grain consuming and selling regions (Figure 7). In 2004, the urban to rural household per capita income ratio was 3.2 and coastal to inland GDP per capita ratio was 2.4, which were among the highest in the world (Luo & Zhu, 2008).This regional disparity can be mostly attributed to the inequality in nonagricultural income. As rural nonfarm enterprises develop rapidly, nonagricultural income has become an important, even dominant, source of rural income and hence has a dis-equalizing effect. Poor households earn a lower proportion of income from wages and other off-farm activities and their greater reliance on agriculture keeps them poorer (Lipton & Zhang, 2006). In contrast, China's advanced provinces have transformed their agricultural sectors and become mainly non-agriculture-based economies with the majority of their rural growth coming from non-farm activities and migration. The diversification out of agriculture and growth of nonagricultural income are proven to be the determining factors in the prosperity of rural areas (Yao, Zhang, &Hanmer 2004).

Increasing inequality in China goes beyond monetary indicators like income and consumption, and it is also reflected in wealth distribution, public service delivery, nutrition, access to jobs and social programs across and within regions and especially between rural and urban areas (World Bank 2007a).If the income gap cannot be bridged, the wellbeing of farmers will evaporate and theagricultural sector will become stagnant, hence long-term development could be jeopardized. Increasing farmer incomes faster will be one of the key policy goals for the Chinese government.

2.5. Increasing International Competition

Since WTO accession in 2001, China's agriculture has become integrated into the global economy, where it faces competition from home and abroad. China's agricultural trade has developed at an explosive speed. Agricultural trade was $176 billion in 2012, of which $113 billion was imports, making China the biggest importer of agricultural products (WTO 2013). China has been running an agricultural trade deficit since 2003, and the deficit surged since 2007(Figure 1).Agricultural import growth outpaced export in 2012, resulting in a near 20 percent increase in the agricultural trade deficit (USDA 2013). Food imports, especially grain imports, contributed to the sharp increase in agricultural imports as 2012import volumes of wheat, maize and rice increased by more than 150 percent from the previous year (Figure 8).

The composition of agricultural trade has also changed dramatically to reflect China's comparative advantage. At the beginning of reform, China exported maize and imported wheat. Today, China is largely self-sufficient in major cereal crops (Figure 9). According to the USDA (2013), the top agricultural imports are soybean (for livestock production) and cotton (for the garment industry). The top agricultural exports are processed wood, prepared meat, horticulture

and aquatic products. This trade pattern is consistent with the factor endowment of a high labor-to-land ratio. Chinese agricultural exports are more focused on products with comparative advantage of labor-intensive and high value-added products, while scaling back on exports of land and water intensive bulk commodities like grains and oilseeds (Christiaensen 2012).

As labor cost rises and international imports of grain become more competitive after the appreciation of Chinese currency, agricultural sector struggles to adhere to the target of 95 percent grain self-sufficiency. According to Gale and Tuan (2007), US soybean becomes price competitive when the exchange rate falls below 7.5 Yuan per US dollar, and US maize becomes competitive when the exchange rate falls below 6.5 Yuan per US dollar. By 2011, the exchange rate falls below both marks, which might be associated with recent rise in imports of soybeans and maize for feed.

With the further appreciation of the Renminbi, cereal production faces increasing competition from the international market. The issue of grain self-sufficiency and competitiveness is further complicated given long standing challenges from the supply side. Increased reliance on imported grains to bridge the growing feed gap can be an alternative, but it could have potentially substantial impacts on international grain markets if policy is implemented in a short period or extended to other feed and food grains.

Table7 summarizes the major issues and challenges suggested by policymakers and top policy researchers during interviews. Food security retains its high priority in the policy agenda since several policymakers and researchers interviewed ranked “meeting increasing demand for food sustainability” as the top challenge for Chinese agriculture. Labor issues are also raising concerns with some interviewees mentioning “rising wage and labor” as the top challenge. Environmental and smallholder sustainability are viewed as top challenges as well.

3. The Impact of Public Expenditure in Agriculture

3.1. Rationale

The rationale for the allocation of public resources to agriculture lies in the basic motivation for public investment in general. Public goods are non-rival and non-exclusive (Mogues et al. 2012). Non-rival goods are defined as those that when consumed by one agent are by no means less available for consumption by another agent. A good is nonexclusive if agents cannot be effectively denied from consuming the good. Nonrivalry implies that social benefits from the public goods are far greater than the private producer benefit, and non-excludability implies that private producers cannot extract compensation for the use of the goods from all consumers.

Given the nature of public goods, private agents tend to underprovide public goods, that is, the amount of goods produced by private producers will be lower than the socially optimal level. This under-provision creates a rationale for the public provision of such goods. In the agricultural sector, a good example of public goods is agricultural R&D.

Based on neoclassical economic theory, Mogues et al. (2012) pointed out motivations for public interventions, namely economic inefficiencies caused by market failures and equity, referred to as the welfarist approach by Coady and Fan (2008). In developing countries market failures can be widespread, particularly in the agricultural sector. Market failure occurs when the market is inefficient and cannot achieve a Pareto optimum. Hoff and Stiglitz (2001) summarized the causes of market failure as externalities, imperfect information, imperfect market competition, and coordination failures.

The efficiency argument of market failure arises from externality. Goods and services are called externalities if the producer cannot capture the full value of outputs (for goods with positive externalities) or does not pay for all the costs (for goods with negative externalities). The additional external value or cost is shared by agents other than the producer him/herself. Agricultural production incurs externalities on many occasions, both positive (improved food production) and negative (pollution from agricultural chemicals), prompting public sector involvement to change production behavior. Examples of policy tools used to support agriculture include publicly financed subsidies for agricultural inputs and agricultural taxes.

Imperfect or asymmetric information can cause market failures because it curtails production if one party is discouraged from taking certain actions that would be beneficial to both parties. Cases of information asymmetries include agricultural insurance and extension (Boucher, Cater and Guirkinger 2008). Smallholder farmers have low bargaining power when faced with imperfect market competition in output sale and input supply (Minten and Kyle 1999). Market failure can also be caused by coordination failures when the economy is operating at a lower equilibrium but a higher aggregate equilibrium output is achievable. Different types of capital investments for agricultural development are a good example. Investments in R&D, extension and infrastructure need to be synchronized to increase agricultural productivity. However coordination failures could lead to poverty traps (Mogues et al. 2012).

In addition to correcting and mitigating economic inefficiencies through public policy, government intervention is needed to improve the distribution of resources and reduce poverty when the market cannot satisfy the basic needs of all households. The equity and poverty rationale of market failure promotes the use of policy tools, such as transfers, to reduce poverty.

Government expenditure in agriculture is especially useful in addressing equality in access to goods and services and income distribution, due to the concentration of poverty in rural area in most developing countries. Coady and Fan (2008) further noted that government interventions could take advantage of the strong synergies that exist by simultaneously improving both efficiency and equity in resource allocation, as market failures are disproportionately observed among the poor.

3.2. International Evidence on the Impact

There is a huge body of literature on the positive impact of public expenditures on agriculture and rural development in developing economies, as reviewed by Fan and Rao (2008), Fan and Brzeska (2010) and Mogues et al. (2012). Public spending can be grouped into spending in agriculture (agricultural R&D, extension, irrigation, and rural infrastructure) and spending for agriculture (health, education, roads, and telecommunication). The impact of public expenditures on development includes the growth effects of output increases and poverty effects.

3.2.1. Growth Impact of Public Spending in Agriculture

Most empirical evidence suggests that public investment in agriculture provides positive returns. A simulation by Diao et al. (2010) found that if the public investment increases by 1 dollar for the overall agricultural sector, agricultural GDP is estimated to expand by 3.1 dollars. The incremental impact on GDP is even higher due to production and consumption linkages to nonagricultural sectors.

Within the agricultural sector, public expenditure can be further distinguished by investment type, commodity or geographic location. The internal rate of return (IRR) is widely used to measure the results of investment. It refers to the return to an investment by the value of the future return of the investment, and higher rates of return indicate better investment results.

Rosegrant, Lasryno and Perez (1998) examined the contribution of technology investment in four crops and found that research, extension and irrigation investments are the major factors in output growth in the long run. The paper also demonstrated different impacts of research, irrigation and extension. Agricultural R&D investments are found to have the largest effect on the output growth of maize, cassava and soybean, but investment in extension ranks the highest for rice production. The study also reported the positive effects of investment in irrigation. Research was proven to have the biggest impact in improving productivity (yield) and promoting modern input use (fertilizer), followed by irrigation and extension.

Extensive reviews of research and extension programs corroborate that returns to agricultural research and extension is very impressive. The majority of applied research programs yields high returns in Evenson's (2001) assessment: four-fifths of applied research programs report IRR above 20 percent, and two-fifths report IRR between 20 and 60 percent. Similarly, about 60 percent of the extension programs included in the review have IRR greater than 20 percent, and two-fifths between 20 and 60 percent. Using a comprehensive meta-dataset, Alston et al. (2000) estimated the mean IRR is 65 percent and the median, 42 percent, for research and extension programs. The average and marginal benefit-cost ratios are generally far greater than unity, implying that public investment in agriculture is socially efficient when compared with other types of public investments (Alston 2010).

Evenson (2001) noted that there are more applied agricultural research programs with high IRRs (above 40 percent) than extension programs. Alston et al. (2000) also showed that the mean return of programs that combine research and development is 47 percent, which is about half the level of that of research only or extension only programs at 80 percent. The result is further confirmed by a regression of IRR over research or extension investment, where the return to extension alone is 58 percent lower than returns to exclusive research (Alston et al. 2000).

The impact of government expenditure in agriculture can differ by crop and high returns are observed for commodities with shorter production cycles. Diao et al. (2010) argued for agricultural investment favoring staple crops for its growth and poverty reduction impact. Public expenditure in agriculture consistently generates positive returns in Rwanda, regardless of the subsector. The economy-wide return to public investment in staple production is 3.6 dollars for every extra dollar spent. Root crops reported the highest economic returns to investment, followed by grains. Export crops offer the lowest return to investment, but the return is still above one. Similarly, Evenson (2001) and Alston et al. (2000) also reported returns to research and extension investment in crops like rice, maize, wheat and horticulture are 25 percent higher than investment in the general agricultural sector, while returns to investment in forestry and fishery can be 94 percent lower. Recent studies in Thailand (Suphannachart and Warr 2011) and Uganda (Benin et al. 2011) estimate the IRR of agricultural research at between 8 and 36 percent.

There is a regional pattern in the impact of agricultural expenditure. Diakosavvas (1990) calculated the agricultural output elasticities of current and capital expenditures. In Africa and Latin America, the output elasticities of current expenditure are greater than the elasticities of capital expenditure while the trend is reversed in Asia. High returns to public spending in capital are observed in Ghana as well (Benin et al. 2012). Evenson (2001) stated that Asia tops the

returns to investment in applied research, as IRR is above 20 percent in more than 90 percent of cases. IRRs are also high in Latin America. The vast majority of reviewed programs report IRR above 20 percent, and about one quarter of IRR studies is higher than 60 percent. Although falling behind Asia and Latin America, strong returns are still observed in Africa. More than 70 percent of reviewed programs have IRRs that are greater than 20 percent and IRR is more than 60 percent in nearly 30 percent of programs. Lipton and Zhang (2006) pointed out that rapid growth of land and water productivity in agriculture has been the key to regional progress out of poverty, mostly through technology adoption, spending on research and development, reduced taxes and fees, and relaxed migration policies.

The findings above show that diminishing returns does not apply to agricultural research and extension, and there are vast variations across regions, commodities and types in agricultural expenditure. However, high returns to public spending in agricultural research and extension appear robust over time, regardless of country and method used, highlighting the substantial underinvestment in agriculture, especially R&D.

3.2.2. Growth Impact of Public Spending for Agriculture

Unlike the components of agricultural spending, such as research, irrigation or extension, or of investment targeted at certain commodities, some studies have compared the performance of aggregate agricultural expenditure with that of other sectors. These sectors might not directly affect agricultural output, but their development can influence the growth of the overall economy through enhanced productivity, like education and health(Table 8). Cross-country analyses by Easterly and Rebelow (1993) and Milbourne, Otto and Voss (2003) indicated that the coefficients of agricultural spending on economic growth are not statistically significant, while expenditures on education, housing and urban infrastructure, transportation and communication contributed positively and significantly to economic growth. Mosley, Hudson and Verschoor (2004) presented that the share of agricultural expenditure in GDP has a positive and significant impact on poverty reduction with poverty elasticity of 0.43, which is smaller than that of education, housing and social services, but higher than that of health. Agricultural spending is ranked behind road infrastructure and education in terms of income generation, due to the weak linkage between spending and agricultural performance (Mogues 2011).

Given the high returns to agricultural research, it is important to compare the returns to public expenditures in agricultural R&D with other forms of public spending to understand the priority of public investment. Results on the returns to public spending, measured in terms of agricultural production, are summarized in China, India, Thailand, Uganda and Indonesia. The comparison

shows that spending in agricultural R&D always tops different types of public spending, but the relative merits of rural infrastructure, education and irrigation vary by country (Table 9).

Declining returns over time is observed in a study of India over 3 decades by Fan, Gulati and Thorat (2008). At the initial stage of Green Revolution in the 1960s and 1970s, subsidies and infrastructure investment produced similar returns. But the returns to subsidies diminished while the returns to investment remained strong and kept growing in the next two decades. Mogues et al. (2012) also compared studies on the impact of investment under different natural endowments in India, China and Uganda. In addition to the high returns to R&D, the highest agricultural income growth was found in the area with least favorable biophysical conditions.

3.2.3.The Poverty Impact of Public Spending

In addition to growth impact, public expenditure in agriculture can reduce poverty. Based on a study of government expenditure on animal husbandry and dairy, Dastagiri (2010) found that public expenditure in livestock not only increased output value but also reduced rural and national poverty. Returns to public spending in terms of poverty may differ considerably by country (Table 10), but investments in infrastructure and agricultural R&D generally far exceed other types of expenditure (Mogues et al. 2012).

The results suggest that investment in agriculture is the key to achieving the dual objective of growth and poverty reduction. Similar to the findings of agricultural growth effects, the poverty reduction effects of subsidies exhibited a sharp decrease in poverty impacts in India between the 1960s and 1990s, while the magnitude of the decrease is much slower for investment in rural infrastructure, R&D and education. Spatially, an inverse relationship between poverty reduction and agricultural potential exists regardless of continent (Mogues et al. 2012).

3.3. China's Evidence on the Impact of Public Spending in Agriculture

3.3.1. The Impact of Public Spending on Agriculture in China

Many studies linked government expenditure in agriculture with sector development. Li (2009) illustrated that local fiscal expenditure for agriculture had a positive e impact on regional agricultural growth in 1995-2006, with output elasticities ranging between 0.27 and 0.32. Agricultural expenditure contributed to agricultural growth as a direct input in Li's (2012) study. Yang(2012) confirmed the causality relationship, and attributed about 4 percent of agricultural GDP growth to expenditure in supporting agriculture and 5 percent to agricultural investment, with a time lag of 4 years. The long-term relationship between agricultural expenditure and agricultural GDP is examined by Wu (2012). In the short-run, the impact of agricultural expenditure on agricultural GDP peaked in 6 years after the shock.

Agricultural research, conventional inputs and institutional reforms contributed to the rapid agricultural production growth in the early stage of reform. Fan and Pardey (1992)pointed out that agricultural research was the second largest source of agricultural output growth and accounted for about one-fifth of the growth in 1965-1989, while the effect of institutional reforms on productivity declined over time. Wang and Zhang (2002) reported that public investment contributed significantly to agricultural growth in Jiangsu province over the period of 1975-1996. They ranked the highest return in agricultural R&D, followed by education, electricity and irrigation. Qian (2005) examined the marginal return rate of agricultural investment to the growth of agricultural output value and found investment in agricultural science and technological produced the highest return, followed by rural education and rural infrastructure. Using a dynamic Computable General Equilibrium (CGE) Model, Xu et al. (2011) found that the impact of public expenditure in agricultural sector spills to other sectors. Increased spending in agricultural R&D and irrigation contributes to economic growth, improves production and helps lower grain prices. The annual economic rate of return reached 23.2 percent for agricultural R&D, or 1.3 kg of grain production. Irrigation also produces high returns of 14.9 percent, or 0.8 kg of grain. Subsidies are not broad-based interventions because they increase farmers' income but decrease urban income. In terms of economic returns, agricultural R&D ranks as the top investment, followed by irrigation spending. Wu and Fang (2012) compared different types of spending in and for agriculture and gave the following ranking: agricultural R&D, comprehensive agricultural development, rural infrastructure and rural social service.

3.3.2. The Impact of Public Spending on Agricultural Productivity in China

Total factor productivity (TFP) is defined as output growth that cannot be explained by input increase. Economic theory and empirical evidence suggest that increased agricultural productivity is important in development because it frees up resources through resource reallocation and provides raw material for the development of other sectors(Cao and Birchenall, forthcoming). It also contributes to higher income and hence higher demand by rural population for inputs, goods and services produced by the non-agricultural sector (production and consumption linkages).

Compelling evidence suggests that agricultural TFP is the major driver of agricultural growth in China and a large proportion of agricultural growth in China can be attributed to productivity improvement (Fan et al., 2006; Nin-Pratt, Yu and Fan 2009;Fuglie 2010;Yu, Liao and Sheng 2013; Wang et al. 2013). Growth in TFP is mostly propelled by technical progress, which in turn comes primarily from new technologies released by the national agricultural research system (Fan et al., 2006). Fan (1991) found that the average annual growth rate of agricultural TFP was about 2.1 percent during 1965–86, and more than one-third of the growth can be attributed to

technical progress. Fan (2000) showed that the overwhelming majority of agricultural GDP growth can be attributed to input increases before 1979, while productivity growth accounts for 71 percent of the agricultural GDP growth since 1979. New technology was found to have a remarkable impact on agricultural productivity (Fan and Pardey 1992). Zhu (1994, 1997, 2002) calculated the contribution of agricultural technological progress to growth was 28 percent in 1986-1990, and increased to 45 percent in 1995-2000.

Among different types of public spending, agricultural R&D gives the highest rate of returns in agricultural productivity, far above any other types of public expenditure (Fan, Zhang and Zhang, 2004). Zhu (2004) associated high grain yield with public investment in agricultural R&D. Huang and Rozelle (1996) noted that technical change was one of the most important factors that contributed to agricultural growth during the entire reform period, particularly after 1984, as confirmed by Hu and Huang (2008). Nin-Pratt, Yu and Fan (2009) estimated TFP of Chinese agriculture averaging 2.1 percent per year, and TFP growth accelerated in in the post reform period, which can be largely attributed to agricultural R&D(Table 11). Yu, Liao and Sheng (2013) reported similar annual TFP growth rate of 2 percent, predominantly coming from technical progress.

In addition to technical progress, public expenditure contributes to agricultural growth through other channels including efficiency improvement and subsidy. Lin (1992) found that all reform measures together accounted for less than half of the growth in agricultural output during the 1978–84 period, mainly coming from increased input use and efficiency improvement. Li and Qian (2004) confirmed the contribution of expenditures on scientific research and infrastructure construction to farm efficiency. Yang and Zhang (2010) confirmed that public investment in agriculture promotes agricultural technical efficiency in Jilin province. However, the progress of technology is mainly driven by subsidy, rather than by productive investment, highlighting the inefficient allocation of agricultural expenditure. Other studies attributed improved agricultural technical efficiency to public investment in infrastructure such as irrigation and electricity (Wang and Jiang 2009).He (2012) examined agricultural policy in China and found a high impact of input subsidy, compared with area payment. The positive contribution of agricultural expenditure to agricultural GDP, mainly through efficiency improvement, was reported by Li (2012).

3.3.3. The Impact of Public Spending in Agriculture on Poverty, Food Security and Inequality in China

Promoting agricultural and rural development through public investment can lead to poverty reduction (World Bank 2009). Fan, Zhang and Zhang (2004) demonstrated that spending in education and agricultural R&D yields the best results if poverty reduction is the paramount policy goal. Zhang, Wang and Chen (2012) proved that public infrastructure investment can not

only substantially stimulate economic growth through increased productivity, but also reduce poverty and rural-urban income inequality. Fan et al. (2003) indicated that crop research has helped reduce large numbers of rural poor people. It is estimated that every $1 million invested at the International Rice Research Institute (IRRI) in 1999 would lead to more than 800 or 15, 000 rural poor people lifted above the poverty line in China and India, respectively. Wheat research cut the number of rural poor in China from 2.7 million in 1982 (1.4 percent of rural poor population) to 1.7 million in 1998 (4 percent of rural poor population).Agricultural research also contributed to a large drop in urban poverty through lower food prices because they often spent more than half of their income on food (Fan, Fang, and Zhang 2003).

New technology helps eliminate the food insecurity of millions of farmers in developing countries. Fan et al. (2003) measured rice varietal improvement research and found that it accounted for about one-fifth of total value of production over the last two decades in both China and India. They estimated that the benefits of wheat and varietal improvement research conducted by China and the International Maize and Wheat Improvement Center(CIMMYT) amounted to $1.1 billion dollars and $6.1 billion (measured in 2000 constant prices) in 1982 and 1998, about 11.9 to 22.7 percent of the total output value of wheat, respectively. Government investment in rural infrastructure was proven to smooth volatility of domestic food production and lower expenses for food imports (Huang, Rozelle and Rosegrant 1999).

Government production-enhancing investments, such as agriculture R&D, irrigation, rural education, and infrastructure, not only play a vital role in promoting growth, they are also key instruments for governments to reduce inequality. Fan, Zhang and Zhang (2002) showed that every 10, 000 Yuan of investment in agricultural R&D could help 7 persons people move out of poverty in China at the national level, while the same amount of money could help more than 30 people move out of poverty in western China. Zhang and Fan (2004) further argued that investment in rural education and agricultural R&D in the western region of China has the largest and most favorable impacts in reducing inequality and Ravallion (2002) made the case that public investment in rural roads can generate equal and efficient gains in living standards in lagging, poor areas of China. Public investment can reduce regional inequality and contribute to agricultural GDP simultaneously if it is targeted at some lagging rural areas. Research and infrastructure in agriculture show diminishing returns in the East, but often higher returns in the northwest and southwest regions (Lipton and Zhang, 2006).Fan, Kanbur and Zhang (2009) confirm that focusing on agriculture in lagging areas reduces regional inequality.Studies also showed that agricultural research could contribute to equality among farmers and regions (Pray et al. 2000 2001; Huang and Rozelle 1996; Lin 1992).With rising labor cost and business relocating

inland, the returns of income and poverty reduction with respect to rural roads and other infrastructure will remain high in the near future.

Overall, past growth in agriculture has been much more effective at reducing poverty and inequality than similar growth in other sectors for China (Ravallion & Chen, 2004). Future progress will depend on accelerated farm productivity growth and labor productivity. As the World Bank's (2013c) projection report states, China will see more rural-urban migration, higher rural productivity and income, and less urban-rural inequality in 2030. The share of employment in agriculture is estimated to fall to 12.5 percent in 2030, which demands the growth of labor productivity and income in agriculture because closing the productivity gap between agriculture and the other sectors is the only way to lower urban-rural as well as regional income inequality.

In summary, public investments in and for agriculture are motivated by market efficiency improvement to address market failure and the reduction of inequality and poverty.A rich array of literature yields the consensus that public spending on agricultural R&D is key for agricultural growth and poverty reduction, implying underinvestment in this area. Compelling evidence also suggests that technology progress is the main driver of productivity and production growth in China. The impact of other types of agricultural investments can vary according to individual development goals, which suggests that policymakers should prioritize different agricultural investments judiciously.

4. The Evolving System for Public Expenditure in Agriculture in China

4.1. China's New Agricultural Policy: from Taxing to Supporting

Agricultural reform has triggered and supported China's phenomenal economic growth and agricultural policy remains a central part of the reform (Fan et al. 2004; Lin 1992; Ravallion and Chen 2007; Cao and Birchenall, forthcoming)and resulting in a gradual transition from a centrally planned economy towards a socialist market economy.

During the reform period, agriculture and rural areas more generally provided two major boosts to China's development. The first came from a major transformation in the policy environment in agriculture in the early 1980s when the tightly controlled commune system was replaced by the Household Production Responsibility System (HPRS) in which individual farmers were allowed to lease land from the collectives, becoming largely autonomous in their decision, and responsible for profits or losses from their operations. The second began in the late 1980s when in order to employ workers leaving agriculture and to avoid large-scale migration to the cities, sub-national governments were encouraged to promote the growth of rural non-agricultural

industries, commonly known as township and village enterprises (TVEs). These enterprises were the main vehicle for absorbing workers leaving agriculture, necessary for China's growth and development. A uniqueness of China's experience in the late 1980s and in the 1990s was that the bulk of the shift in employment took place within rural economy rather than through migration from rural to urban areas (OECD2005).

Up to the late 1990s, the principle agricultural policy objective was to increase agricultural production, especially of food grains. Gradually, more attention was given to supporting rural incomes to address the issue of the growing income gap between urban and rural populations. Accordingly, policies aimed at raising agricultural incomes were adopted with a fundamental shift from taxing agriculture to supporting it. This shift in focus coincided with China's accession to the WTO in 2001 which placed China's support policies within a framework of internationally recognized rules and regulations. Income support policies were further strengthened through the adoption of the highest priority document of the central authorities for 2004 (Document No. 1). This document put forward a set of agricultural policy measures which, through their increasing geographical and commodity coverage, became key channels for providing support to China's agriculture.

Following the 2004 Document No. 1, all subsequent annual versions concentrated on various aspects of agricultural and rural development issues as summarized in Table 12. The 2011 Document focused on water conservation to achieve sustainable use of water resources within the next ten years; the 2012 Document on investment in agricultural science and technology to help boost agricultural production and farmers' incomes; and the 2013 Document on transition to larger-scale farms through the creation of large individual–operated farms, family farms, co-operatives and contracting arrangements between farmers and companies (OECD2013).

The evolution of the agricultural expenditure policy reflects the shifts in policy focus since the reform, which can be summarized in three stages (Cui and Zhan 2013). In 1979-1993, agricultural expenditure was slanted towards ensuring the supply of agricultural products, implementing productive input subsidy and cutting agricultural tax. However, investment in agricultural infrastructure dropped considerably due to shifted focus to non-agricultural development. In the 1990s, rural income growth lagged behind urban income growth, resulting in a growing income inequality. The level of agricultural expenditure increased steadily in the period of 1994-2002, supported by brisk economic growth. The Rural Tax and Fee Reform (RTFR) is the most important fiscal system reform, along with other reforms including adjustments to the tax sharing system, fiscal management reform and other rural fiscal reforms. RTFR started in 2001, and it was designed to cut down rampage practices of off-budget finance

at the local government level and integrated the local finance into the budget with oversight from higher level governments, and significantly reduces the overall burden on farmers.

It is fully recognized that solving the problems of agriculture and rural development is the key to achieving the vision of a modern, harmonious and creative society by 2030 (World Bank 2013c). However, many constraints in production persist and new challenges emerge. First, instead of closing inequality, the disparity between urban and rural income further enlarged. Second, agricultural land decline can be a threat to the strategic goal of national food security and food self-sufficiency. The government has established a target of 95 percent grain self-sufficiency and instituted a dynamic quota of 120 million hectares of land to be preserved for agricultural purposes.

A series of policy reforms were introduced as part of the policy package to promote rural development and to address the challenges of growing inequality and resource constraints. An important, but also symbolic, change in China's approach to agriculture was the abolition of the long established agricultural tax after thousands of years of application, which was effectively implemented by early 2006. Agricultural subsidies were increased substantially with the policy objectives of shrinking the rural-urban income gap and encouraging food production to ensure grain self-sufficiency.

In addition, many new programs were introduced to expand the coverage of the social safety net and improve social services in rural areas. Building a "New Socialist Countryside"(NSC) is seen as a top strategy to promote development. It serves multiple purposes of increasing rural incomes, transforming the countryside, and mitigating rural-urban disparity through infrastructure investment, agricultural modernization, the expansion of public services and accelerated urbanization. In 2003, China adopted the New Cooperative Medical Scheme (NCMS), which is a voluntary health insurance program for rural residents funded by enrollee contributions and subsidies from central and local governments. NCMS has been expanded to almost all counties within a decade. Medical Assistance health-expense safety-net program was launched by the Ministry of Civil Affairs in 2003. The program is designed to help specified vulnerable groups with NCMS contribution and copayment. The government also focuses on the implementation of nine-year compulsory education in rural areas by enforcing the waiving of tuition feesin rural areas. There are other rural safety net programs including minimum living stipend and support for disadvantaged households. These initiatives reflect increasing government commitment to addressing rural-urban inequality and the priority of rural poverty reduction through social welfare programs.

4.2. The Budgeting Process

The budget is the key in resource allocation and public management in the public financial management process. A general budget process involves four stages: preparation, review and authorization, execution with adjustment oversight by the legislation, and final reporting and auditing (Deng and Peng 2011). Sometimes the process also includes the formulation of the national development strategy and policy to guide budget strategies (Mogues 2012). In China, the budget is first prepared under the overarching five-year national development plan, then reviewed and approved by the People's Congresses after modifications. The budget is executed,which is followed by the recording of financial transactions and activities and then by possible revision with legislative approval. At the end of the fiscal year (which coincides with the calendar year), final accounts of payments and annual reports are prepared for auditing.

The state budgeting process involves several levels of sub-national governments. There are five levels in the budgeting system corresponding to the five nested hierarchical levels of government in China: central, provincial, prefecture, county, and township. At each level of the hierarchy, the budget consists of the budget of all administrative agencies and institutions (Chan 1996). Each level of the government should have an independent budget that must be reviewed and approved by the People's Congresses at the same level. From the level of township and above, the overall budget includes the aggregate budget of all lower levels plus the budgets of administrative agencies and institutions at its corresponding level, which will be reviewed, approved and submitted to the level above. The process of sequential review, approval and submission is repeated to build the local government's overall budget. The local government's overall budget is eventually combined with the central government's overall budget to generate a unified public budget at the national level. As a result, the state budget of China consists of the budget of the central government and the combination of the local budgets at various levels. Revenue sharing is arranged in a similar way across different levels.

The introduction of the 1994 Budget Law has fundamentally changed the way in which revenues and budgets are split between the central and local governments. It aims to ensure government revenue, especially that of the central government, and restructure central-local revenue sharing arrangements. The key component of the tax reform is the introduction of the "Tax Sharing System" to assign government revenues. The central government receives revenues from custom duties, consumption taxes, the tax of central enterprises, railroads, banks and insurance companies, and tax on offshore oil extraction. The revenue base of local governments consists of business taxes, taxes on local enterprises, real estate taxes, individual income taxes, vehicle taxes, state land sales revenues and taxes on local land-based resources. The major shared tax is the value-added tax, which is 75 percent central and 25 percent local (World Bank 2002). The 1994

Budget Law stipulates that the central government covers national defense and foreign policy, central government administrative costs, large-scale construction projects and infrastructure development, scientific and technical projects and major higher education institutes.Local governments have to shoulder the cost of many functions including social welfare, social services (education, health, culture, sport, and science), infrastructure, and local government administrative costs.

The 1994 reform brought in the centralization of revenues at the central and provincial levels (World Bank 2002). Although the central government's share of revenue stabilizes between 50-55 percent of total revenue, the central share of total expenditures has fallen steadily to less than 20 percent since 2009 (China Statistical Yearbook 2012). The World Bank (2002) pointed out that fiscal resources are more concentrated at the provincial and central level, instead of being shared with sub-provincial levels. One direct consequence is the shifting of focus away from the rural sectors because resources are reallocated from the country and lower levels to the provincial level.

4.3. Reforms – Accountability, Governance, and Decentralization

Since the introduction of the "reform and opening"policy in late 1970s, China has adopted a series of budgetary reforms to accommodate the changing role of the state and the control over the budget process. The reform includes the 1994 Chinese Budgetary Law, departmental budget reform in 2000, centralized treasury management in 2001, and the State Procurement Law in 2002 (Ma 2009). In terms of information management, a new government financial management information system was introduced in 2000. Another reform was implemented in 2005 to establish a new classification system, the modified Government Finance Statistics (GFS) system, for revenue and expenditure in the budget. The broad package of reforms in budget preparation and implementation aims to improve the transparency and accountability of the government, as well as the prioritization of government expenditure.

However, China's budgeting system reform is not finished yet due to the pervasive lack of regularity and discipline in the political process and administration. The prominent issue is that institutions for a well-controlled budgeting system have yet to be established. One of the most fundamental principles of public finance is the separation of the ownership of, decision making on, and management of public funds to cut costs and avoid rent seeking behavior in the fiduciary setting (Deng and Peng 2011). Legislative bodies (the People's Congresses in China) are expected to act as the guardians of the public interest with the authority in approve and execute budgetary decisions. The approved budget is viewed as a legally binding document and it is a

powerful tool which allows citizens to know how taxpayers' money is spent (Lee, Johnson and Joyce 2008).

Globally, the legislature has been playing an increasing role in the budgeting process (Deng and Peng 2011). In the case of China, although the legislative branch has the authority to approve and oversee the budget, the Ministry of Finance and finance bureaus at the lower levels of the government control the budget (Ma 2009). This arrangement essentially facilitates the concentration of decision making and management of the budget in the government. Deng and Peng (2011) discussed the deficiency of budgeting authorities in the legislative branch, including the lack of the authority to amend a budget, the timing of budget approval, and problems associated with insufficient information, capacity and time to review the budget. This in turn, brings out a lack of budgetary transparency and accountability, including a consistently wide gap between the adopted and the final budget, in that the budget is not adhered to with substantial revision by the government without legislative approval, and corruption and misuse.

Second, the budget process is fragmented and managed by multiple government agencies. The capital budget is mainly determined by the National Development and Reform Commission (NDRC) and the Ministry of Science and Technology, while the recurrent budget is managed by the Ministry of Finance (MOF), with NDRC and MOF having the greatest decision power in rural development (Wong 2007; World Bank 2007a). More than a dozen line ministries and agencies are involved in agricultural and rural outlays, as listed in Table 13(World Bank 2007a;Han 2009;Wang 2013).There has been an influx of new agricultural and rural development programs in China, calling for strengthened coordination from the planning stage. The complicated nested hierarchical administrative structure introduces additional heterogeneity in program implementation, further underscoring the importance of interagency coordination. Take agriculture for example, agricultural activities could be financed by the central government, local government, or jointly financed (World Bank 2007b).At the central government level, the Ministry of Agriculture's budget comes from a number of ministries, commissions, departments and bureaus. At lower government level, agriculture-supporting funds come from multiple sources with similar goals, producing inefficient resource allocation. Fragmentation, duplication and poor coordination have substantially undermined the effectiveness and transparency of resource allocation. There is an urgent need to integrate and coordinate the budgeting process.

Third, a substantial proportion of off-budget expenditures continued going unreported and unaccounted for, falling outside the scrutiny of the People's Congress and the general public. Partly due to the prohibition of running a deficit, local governments have to use large amounts of self-raised funds to support infrastructural investments. The use of off-budget revenue and

expenditure is not transparent and is poorly monitored or tracked, creating adverse spending incentives for local governments. Wong (2007) suggested that the overheating of the Chinese economy is partially attributable to the government's pursuit of off-budget revenue in land sales and real estate development.

The abolition of the agricultural tax, increased agricultural subsidy and introduction of rural social service programs succeeded in enhancing accountability and reining in extra- and off-budgetary resources, but it also led to significant tax base reduction for local authorities and created a huge gap in rural finance (World Bank 2007a). To help offset the revenue loss, transfers from the central and provincial governments were introduced. However, Xu et al. (2007) showed that the transfer payment could not fully offset the revenue reduction agricultural tax elimination. For example, subsidies from higher-level government only replaced about 35 percent of the pre-reform revenue in Henan province (World Bank 2007a). Although the objective of these reforms is to help local government restore fiscal balance, they add extra expenditure and administrative responsibilities at the county and township levels, with resources and allocative authority centralized at the county level. In addition, the fiscal shortfall varies considerably by region and by administrative level, with the township being hit the hardest (World Bank 2007a).

Other issues in the budgeting process include the lack of a comprehensive oversight authority on spending by the MOF, insufficient coordination between the central and local governments, weak revenue forecasting, ambiguous budget accounting and inefficient management of financial transactions (Chan 1996; OECD 2006; Wong 2007; Ma 2009; Deng and Peng 2011).

4.4. International Comparison of China's Fiscal System

Compared to other countries, the Chinese fiscal system is unique in many aspects, including its organizational structure. First, it is highly decentralized and local governments account for the majority of the overall state budget (World Bank 2002; OECD 2006; Wong 2007). Funds from the central government are only a small portion of the state budget and account for less than 20 percent of the total government expenditure in recent years (China Statistical Yearbook 2012). The four sub-national levels of the government take the majority of government expenditure, with the largest share at the prefecture and country level (Deng and Peng 2011). There is no optimal level of fiscal decentralization in economic theory (World Bank 2007a). But the ratio of the central government to state budget in China is remarkably lower than that of other countries, as on average developing countries only devote 14 percent of total budgetary expenditure to sub-national governments, while OECD countries allocate 32 percent (Dollar and Hofman 2006).

Among large countries, with the exception of Japan, most countries allocate more than half of their total expenditure to the central government.

Second, sub-provincial level governments shoulder heavy expenditure burdens for the provision of social services and welfare. In most countries social security and welfare are usually provided by the central government. In China, local governments contributed nearly 90 percent of total expenditures in education, health, culture and science in 1999(China Statistics Yearbook various years). Governments at the prefecture and county level are fully responsible for social security and welfare programs, which explain the high allocation of total expenditure to subnational agencies as local governments play a vital role in providing public goods. More than three quarters of rural local government expenditures are devoted to social services, administration and economic services (World Bank 2007a).More than half of local expenditure is allocated at county and township levels, which provide the backbone support for human resource development. For example, county and township level governments finance 61 percent of agricultural operating expenses, 65 percent of education expenses and 55 percent of health expenditures in 2004 (World Bank 2007a).

Third, the responsibility of financing infrastructure projects also rests with the local governments. This designates local governments not only the main provider of social development, but also the developer of physical infrastructure and agricultural and industrial development in China. Investment in infrastructure is essential to service provision and economic development. Since local governments are largely self-financed and are not allowed to run deficits, the provision of social services is subject to the local fiscal condition. The incentive of promoting economic growth leads local officials to prioritize more visible infrastructure projects over social services with delayed impacts. However, program funding from the center is typically inadequate and comes with the condition of matching funds from the local government. The matching fund can exceed the local finance capacity, compromising the program impact and coverage due to underfunding. Persistent fiscal burdens can lead to an implementation bias against poor regions or individuals, and undercut the equalizing effect. The intensified budgetary pressures on the local government implies potential mismatched revenues and expenditure assignments, leading to extractive behavior and forcing local governments to resort to off-budget funds in public service provision (Ma 2009; World Bank 2002, 2005b).

Fourth, the financial system is characterized by substantial inter-government transfers and extra-budgetary expenditure. Intergovernmental transfers are used all over the world to meet vertical fiscal gaps, equalizing across regions and address externality. The level of transfer is higher in China than industrialized and many developing countries and it grows rapidly (Bahl and Wallace

2004). It is estimated that more than 40 percent of consolidated subnational expenditures were supported by transfers in the 1990s, and it rose to above 50 percent in 2004 (World Bank 2002, 2007a). In some lagging countries, classified as "poor", more than 60 percent of the total budget comes from transfers.Many key expenditure items depend on transfers, with the intent of addressing fiscal imbalance, strengthening local fiscal capacity and providing equal access to public services. However, empirical studies have revealed inefficient use of fiscal transfers and misaligned resource allocation with local prioritization, as well as precision targeting (Duan and Zhang 2009; the World Bank 2007a, 2007b; OECD 2006).Another issue in the financial system is the local governments' high reliance on extra- and off-budgetary revenue, which can range upward of 20 percent of GDP (Wong 1998;World Bank 2002). Given the misalignment between revenue and expenditure, local governments are motivated to keep funds in extra- or off-budgetary accounts, sometimes in the form of excessive fees and taxes from users and local residents.

Fifth, regional disparities in service and spending between poorer inland provinces and the wealthier coastal provinces are largely due to the uneven fiscal decentralization between spending needs and resources at local levels. The regional divergence in China is high and local governments in different regions face different fiscal conditions in spending autonomy and availability of resources. In 2003, per capita spending in the richest province is more than 8 times that of the poorest province in China (David and Hofman 2006). While the revenue ratio between the richest and the poorest state is only 2.3 in Brazil and 10 in Vietnam, larger regional variations are observed in Russia (above 40), the Philippines (28), and Indonesia (22). What's more disturbing is the fact that there is more pronounced inequality within provinces (World Bank 2002; David and Hofman 2006). Transfers were designed to equalize resources across different regions, but its disbursement is closely associated with the performance of the local economy (Figure 10).

Local governments in China vary considerably in revenue generation, and the variation is supposed to be addressed by transfers from higher levels of government. But the level of transfers can only partially mitigate regional difference, resulting in large disparities in the level of public spending (OECD 2006; the World Bank 2005a).This in turn translates into large disparities in the level, quality and access of service provision. In addition, the mismatch of resources and spending responsibility at the local government level has contributed to the inequalities between rural and urban areas and across provinces because of resource inequality. Within the framework of decentralization the inequality in budgetary expenditure across localities has been growing (World Bank 2002, 2005a, 2009, 2012), despite evidence that the

fiscal transfer became less regressive over time, and slightly equalized in the 2000s (Persson and Erikson 2006; World Bank 2012).

This is especially challenging in the poor counties with unfavorable biophysical conditions, where the total expenditures are almost all used to cover personnel costs. As a result, critical social services like health and education are not sufficiently provided for by the local government due toa lack of funds and capacity. This contributes to the income inequality surge in recent years between rural and urban areas and across local jurisdictions.

5. Public Expenditures in Agriculture in China

5.1. Definitionand Source

Public expenditure in agriculture is an important indicator of support for agricultural development. However, in China, a precise assessment of public expenditure in agriculture is impeded by terminological inconsistency over time and across different contexts(Li and Zhu, 2007).There are four definitions of public expenditure in agriculture widely used in statistical yearbooks and government reports:1) government expenditure that supports rural production and the departmental operating costs related to agriculture, forestry, water and meteorology; 2) government expenditure in agriculture;3) government expenditure in agriculture, forestry and water conservancy; 4) government expenditure for "San Nong" (agriculture,rural areas and farmers). Definition1 and 2 were used prior to 2006in accordance with the fiscal classification system originally developed by the Soviet Union, with definition 2 encompassing definition 1 and thereby entailing a larger statistical scope. The Chinese government adopted a new budget classification system in accordance with the United Nations Classification of the Functions of Government (COFOG) in 2007 (pls refers to Appendix).As a result, definition 2was replaced with definition3, which explains their close similarity, however, there are some significant distinctions. First of all, definition 3 encompasses all expenditure on water conservancy even though expenditure on irrigation and rural water supply are the only such expenditure items that are closely related to agriculture, and these only accounted for 26%-30% of total expenditure on water conservancy [2] .As a result, this formulation yields larger estimates of government expenditure on agriculture. Second, some expenditure items were included in definition2, but excluded in definition 3, such as expenditure in natural ecology protection, natural forest protection, the Grain for Green and Grain for Grass program, meteorology management, and sea management. According to definition 4, public expenditure for "San Nong" is not a separate

[2]We calculate the ratio according the data from the national government expenditure budget tables of 2010 and 2011.

budget expenditure item, and it is aggregated from a number of expenditure items. Expenditure for “San Nong” sheds light on support for agricultural production, subsidization of farmer incomes and expenditure on rural social affairs such as education, culture, sanitation and healthcare. It also provides insight into the status of the reclamation of rivers and lakes as well as the development of infrastructure such as rural roads, forests and drinking water facilities(Ni 2013).Ultimately, expenditure for “San Nong” yields a comprehensive picture of the variegated forms of support for agricultural and rural development and it is very popular among and widely used by policymakers. We compare the statistical scopes and components of the four definitions in Table 14.

Most of the data of public expenditure in agriculture comes from the government expenditure budget tables published in the China Statistical Yearbook, the China Financial Statistical Yearbook, the China Rural Statistical Yearbook, the annual report of Ministry of Finance “The Basic Situation of China's Finance” and other government reports. Table 15 lists details about data, including sources, definitions and available years.We describe the scale, trend, structure of government expenditure in agriculture and its regional distribution in the following section. All data on expenditure in this section are comparable using 2010 constant prices.

5.2. The National Scale, Structure and Trend of Public Spending in Agriculture

The Chinese government has continued to prioritize the improvement of agricultural productivity and the promotion of rural development, and has paid increased attention to these policy areas since 2003. Government expenditure for “San Nong” has expanded rapidly. Expenditure for “San Nong” increased from 1, 603.6 billion Yuan in 2008 to 2, 820.4 billion Yuan in 2011(MOF, 2012).In addition, the average annual growth rate of “San Nong” expenditure was 16.71%, which was 3.48 percentage points higher than the growth rate of total government expenditure at the time. The share of expenditure for “San Nong” in total government expenditure expanded from 25% in 2008 to 27.2% in 2011.Central and local government expenditure for “San Nong” accounted for about 35% and65% of total expenditure for “San Nong”, respectively. And local government direct expenditure for “San Nong” increased faster than that of the central government during 2008-2011 (the real annual growth rates were 22.49% vs. 17.7%, respectively). Details are presented in Table 16.Central expenditure for “San Nong” has increased from 335.55 billion Yuan in 2003 to 1113.62 billion Yuan in 2012 (budget data), and the cumulative total investment on “San Nong” exceeded 6, 000 billion Yuan. The share of central government expenditure for “San Nong” in total central government expenditure increased from 13.7% to 19.2% (Figure 11).

In recent years, the government has implemented policies more favorable for rural development, such as free education up to grade 9 and the new rural cooperative medical system, with expenditure for rural social development becoming the biggest "San Nong" expenditure, accounting for 55% (1, 565.91billion Yuan) in 2011 and increasing with the fastest real annual growth rate of18.62% during 2009-2011.Government expenditure that supports agricultural production accounted for 35% of the total expenditure for "San Nong", and subsidies for farmers and the stockpiling cost of agricultural outputs each accounted for around 5% during 2009-2011(Figure 12).Expenditure that supports agricultural production also increased rapidly, but with slower growth rates than that of expenditure for rural social development, which enjoyed a real annual growth rate of 17.05%during 2009-2011 and reached 992.55 billion Yuan in 2011. This would suggest that the government had begun to acknowledge the inefficiency of direct subsidies for farmers. Subsidies for farmers were relatively stable compared with previous years, and had an annual growth rate of -0.48%. With the raising of the grain purchase price floor in recent years and the implementation of the temporary purchase policy, the stockpiling cost of agricultural outputs increased to 135.36 billion Yuan in 2011, with an annual growth rate of 14.32% during 2009-2011.

The scale of government expenditure in agriculture, forestry and water conservancy are very similar to the San Nong expenditure to support for agricultural production. The amount reach 942.84 billion Yuan in 2011. Its share in total government expenditure was 9 percent during 2007-2011. The growth rate was faster with an annual real growth rate of 25.45% during 2007-2011 (Figure12).The growth rate of government expenditure in agriculture clearly exceeded the growth rate of total government revenue, and met the requirements of the Agriculture Law of the People's Republic of China. Although, as discussed in section 5.1,it is difficult to compare public expenditure in agriculture pre- and post-2007,it is clear that public expenditure in agriculture expanded at an accelerating rate that exceeded the growth rate of total government expenditure after 2003. Public expenditure in agriculture during 1978-2006 was relatively small and increased slower, especially during 1978-2002.Public expenditure for agriculture in 2006 was 390.952 billion Yuan, which accounted for 7.85% of total government expenditure. The average annual growth rates of government expenditure in agriculture during 1978-2002 and 2003-2006 were2.71% and 12.5%, respectively, and the overall average annual growth rate during 1978-2006 was only 3.77% (Figure13).

5.3.Central and local Government Expenditure in Agriculture: Scale, Structures, and Trends

The central government introduced tax rebates and transfer paymentsin1994. Only a small fraction of the central fiscal revenues was directly used as central government expenditure, and a

considerably larger part of China's central fiscal revenues was used as tax rebates and transfer payments, which became a form of local government fiscal revenue and was managed by the local government as well. The shares of central government expenditure (including transfer payments from the central government) and local government expenditure (excluding transfer payments from the central government) in national total government expenditure were 51.66% and 48.34%in 2011, respectively. The tax rebates and transfer payments amounted to 3992.12 billion Yuan, which accounted for 77.8% of the central government's fiscal revenues (5132.732 billion Yuan) in 2011. The tax rebates and transfer payments were equivalent to 43% of local government expenditure.

The transfer payments of the central government were mainly used to support agriculture, social security and employment, transportation, education and health, which accounted for 10.94%, 10.55%, 7.43%, 5.69% and 4.20% of the total transfer payments in 2011, respectively. Central government transfer payments for agriculture, forestry and water conservancy were the largest of these, amounting to 436.9 billion Yuan in 2011. Most of the central government funding for agriculture was transferred to the local government (92.3%),and only 8.7% (41.7 billion Yuan) was directly managed by the central government in 2011.Central government transfer payments for agriculture became one of main sources for local government expenditure, and accounted for nearly half (45.88% in 2011) of total local government expenditure for agriculture(Table17).

In recent years, total local government expenditure and expenditure for agriculture, forestry and water conservancy increased faster than that of the central government. During 2008-2011, the real annual growth rates of total central and local government expenditure were 13.83% and 21.55%, respectively. The growth rates of central and local government expenditure for agriculture, forestry and water conservancy were 17.80% and 32.16%, respectively during 2008-2011. Due to the faster growth of local government expenditure, local government expenditure for agriculture, forestry and water conservancy exceeded that of the central government, which accounted for 51.58% of total national government expenditure for agriculture, forestry and water conservancy in 2011.

At the central government, a large number of agencies are involved in providing support to rural areas and the most of these are the Ministry of Finance (MOF) and the National Development and Reform Commission (NDRC), which account for around two-thirds of the total budget, followed by the Ministry of Communications (which has been merged into the Ministry of Transport), the Ministry of Health and the Ministry of Education (OECD, 2009).The Ministry of Agriculture(MOA) is responsible for a relatively large number of programs focused on technological improvement and on extension services, but fiscal transfers linked with these

programs are small (less than 1% of the total amount)(OECD, 2009). The total MOA expenditure budget was only 37.4 billion Yuan, which only accounted for 2.3% of total central government direct expenditure. The Ministry of Agriculture (MOA) is responsible for a broad range of rural issues, but its actual financial impacts on rural and agricultural development are rather limited.

5.4. Regional Government Expenditure in Agriculture: Scale, Structures, and Trends

Regional governments manage the scale and structure of their agricultural spending according to the local agricultural development context and related fiscal revenue. Due to variation in regional economic development trends, regional government expenditure in agriculture is also characterized by spatial differences.

5.4.1. Regional Government Expenditure in Agriculture

The data on provincial government financial support for "San Nong" is not available. According to the data for provincial expenditure for agriculture, forestry and water conservancy (including funding from central government transfer payments), we calculate government expenditure in agriculture in four regions: western, central, eastern and northeastern. There are two distinguishing features of regional government expenditure in agriculture.

First, the regional allocation of government expenditure for agriculture was uneven. Government expenditure for agriculture, forestry and water conservancy in the eastern area accounted for 33 percent of total expenditure for agriculture, forestry and water conservancy, which was less than its share of the population and GDP during 2007-2011. In the western area, the share of agricultural expenditure was 34 percent, which was proportionate to the population share, but larger than its GDP share. However, in the northeastern area, both total government expenditure and agricultural expenditure accounted for about 10 percent of the national total, which was larger than its population share(Figure 14).The regional average of per capita agricultural public expenditure increased from 256 Yuan in 2005 to 1396 Yuan in 2011 with an average annual growth rate of 33%. The per capita agricultural expenditure in the northeastern area increased from 549 Yuan in 2005 to 1974 Yuan in 2011 and was ranked the highest, followed by the eastern area. It is very interesting to note that big changes took place in the central and western areas during 2005-2011.For the western area, the per capita agricultural expenditure was lower than that of the eastern area at the beginning, but increased with the fastest growth rate of 37% due to favorable regional support policies and exceeded that of the eastern area in 2011 and reached1540 Yuan. Although per capita public agricultural expenditure in the central area increased rapidly, its expenditure was still too low and was only equivalent to about 74% and 53% of the average level and of the northeastern level in 2011, respectively. The tremendous

variability in the central and western areas suggests that agricultural expenditure tends to be more influenced by government policies and central transfer payments given the weak tax base of the local economy. This indicated that the regional disparity became smaller after 2005due to the success of the coordinated regional development strategy in addressing inequality.

Secondly, government expenditure in agriculture in all regions kept rising during 1978-2011, but the growth rates differ among regions and changed overtime. During the period of 1978-1994, government expenditure in agriculture in the central area increased with the slowest growth rate of less than 3%.During 1994-2003, the average annual growth rate of public expenditure in the western area was only 5%, and11%, and 7% in the eastern and central regions, respectively. After 2003, expenditure in all regions increased rapidly, and both the growth rates of the central and northeastern areas rose to 18% during 2003-2006, and in the western area, the growth rate even reached 29% during 2007-2011.The growth of regional government expenditure in agriculture exceeded that of total government expenditure in 2003, and its share in total government expenditure increased as well(Figures 15 and 16).

5.4.2. Provincial Government Expenditure in Agriculture – the Case of Jiangsu and Yunnan

Many studies mention regional disparities in agricultural expenditure, which are caused by differences in resource availability, local endowments and agricultural policies (OECD 2006; World Bank 2005a). We compared the share of agricultural expenditure in total government expenditure and the share of agricultural GDP in total GDP in 2011. The shares of expenditure for agriculture, forestry, water conservancy in total government expenditure among all provinces varied from 4% to 17% in 2011. The average share of agriculture in provincial government expenditure was 10.3 percent, slightly higher than the average share of agricultural GDP in total GDP at 9.1%. But situations varied greatly from province to province. In only 14 out of 31 provinces were agricultural expenditure shares higher than agricultural GDP shares. Most of these provinces, such as Beijing, Shanghai, Zhejiang and Jiangsu, are located in highly urbanized eastern regions. In contrast, many provinces with a considerable agriculture base report small agricultural expenditure shares, indicating that the resources allocated to agriculture are not proportionate to the role of agriculture in their economies.

We compare the growth rate of government agricultural expenditure, total expenditure and total revenue for all of the provinces at three stages: 1994-2003, 2003-2006, and 2007-2011. It is interesting to see that during the period of 1994-2003, the growth rate of agricultural expenditure was slower than that of the revenue and expenditure in most provinces, with the exception of Hubei and Jiangxi. The trend reversed in 2003-2006, and agricultural expenditure grew faster

than total revenue and total expenditure in more than half of the provinces. The situation continuously improved afterwards, almost all provinces prioritized agriculture and rapidly increased expenditure in agriculture.

Detailed data in Jiangsu and Yunnan provinces allow us to examine the composition of agricultural expenditure at the provincial level. Jiangsu is an eastern coastal province that generates a total GDP value equivalent to 40 percent of India's GDP. Its economy is highly export-oriented and agriculture only contributed about 6 percent of GDP in 2011 (NBS 2013). GDP per capita in Jiangsu was above $10,000 in 2012, the highest of all Chinese provinces (excluding municipalities).In sharp contrast with Jiangsu, GDP per capita in the province of Yunnan was about $3,500 in 2012, and about 16 percent of GDP came from agriculture in 2011.

The Case of Jiangsu Province. The data we used is from the Jiangsu province Department of Finance2011 budget of special expenditure for people's lives. Most expenditure on agricultural and rural areas was channeled through "San Nong", and was almost twice the total amount of social spending earmarked for rural areas in Jiangsu province. Within spending classified as "San Nong", about 42 percent is allocated to agricultural subsidy. Comprehensive agricultural input subsidy is the largest subsidy, accounting for about a quarter of total "San Nong" expenditure in Jiangsu. About 33 percent of "San Nong" expenditure was used for productivity augmentation, including comprehensive agricultural development, irrigation and rural infrastructure. The remaining "San Nong" spending goes to promoting manufactured goods consumption and improving living conditions in rural areas. Transfers from the central government are an important strategy for rural development, even in a coastal province with advanced industrial and service sectors. The expenditure structure in Jiangsu province demonstrated that transfers still accounted for 27 percent of education expenditure and 33 percent of health education in 2007 (Table 18). Reliance on transfers intensified in social protection (47 percent) and in the agricultural sector (66 percent). The investment priority of agricultural and rural areas is reflected in the allocation of provincial level expenditures. About 44 percent of education expenditure was earmarked for rural education and more than three quarters of health expenditure was used to support NCMS. More than two-thirds of social protection spending was devoted to the new old-age pension system for rural residents and rural subsistence allowances(Table 19).

The Case of Yunnan Province. The survey data on government expenditure for agricultural projects in Yunnan province in 2008-2010 conducted by the Chinese Academy of Agricultural Engineering of the Ministry of Agriculture is used to investigate government expenditure for agriculture. The survey data showed five main features of government agricultural investment at

the provincial level. Firstly, provincial expenditure for agriculture was mainly provided by the central government. In Yunnan province, 80 percent of total expenditure in agricultural project scammed from the central government and the rest was provided by the provincial government. Secondly, agricultural subsidy was the largest expenditure item and accounted for nearly two-thirds of total expenditure for agriculture. Nearly all (94%) of the total value of agricultural subsidies was provided by the central government. Subsidy is also the main form of transfer payment from the central government to the local government. The share of subsidy in total central government expenditure was about three-quarters during 2008-2010.Thirdly, government expenditure for the agriculture supply chain ranked second and received about 9 percent of the total value of expenditure for agriculture. Fourthly, each of the government expenditure items for agricultural disaster, agricultural insurance, agricultural R&D, agricultural extension and training accounted for 5~6%. In addition, the central government served as the main funding source of expenditure for agricultural disaster, agricultural insurance, agricultural extension and training, agricultural R&D, and accounted for 65%, 78%, 63% and 56%of the total funding, respectively. Fifthly, although the provincial government provided the lion's share of expenditure for rural infrastructure construction, land consolidation, environmental protection, agricultural product quality safety, poverty reduction, and agricultural monitoring data, the scale of this provision was relatively small, as it only accounted for about 1%of the total expenditure amount for each item. Finally, provincial government expenditure in agriculture increased rapidly. The annual growth rate of provincial expenditure for agriculture was 23%, which was faster than that of central expenditure (11%) during 2008-2010(Figure 17).

5.4.3 Village Level Government Expenditure in Agriculture - the Case of Guizhou

At the village level, it is found that government spending has been increasingly focused on social welfare, and has been concentrated in roads, housing and drinking water sanitation, however, there is an acute shortage of investment in agricultural production related to irrigation, feeder roads, pest control, conservation and extension(Fan, Chen and Li, 2013). Village level public expenditure is closely related to agricultural production due to its direct impact on farmers and farms. The case study used three waves of public investment survey data collected from 17 nature villages within three administration villages in Guizhou province, conducted by the International Food Policy Research Institute (IFPRI), the Chinese Academy of Agricultural Sciences (CAAS) and Guizhou University. Guizhou province is one of the poorest inland mountainous regions, whose GDP per capita is about half of the national average. This case study gives us an idea of the public investment situation in poor areas. The survey data included public investments for road/bridge construction, electricity, drinking water, irrigation, environmental protection, land management, radio and television, and methane, and covered

nearly two decades between 1992 and 2010. All expenditures are converted to 2010 constant prices. There were three main characteristics of village-level public expenditure according to the survey data.

Firstly, the scale of public investment at the village level is small, and fluctuates significantly over time. Even at the level of detail of a 5-year average, the total amount of investment shifts quickly and without any specific pattern. For example, total expenditure would average below 100, 000 Yuan in 1996-2000 and be boosted by an abrupt one-time investment of 1.4 million Yuan for environmental protection in 2000. Total expenditure increased after 2005in the three villages, reflecting the heightened profile of investment in rural development (Figure 18). In many cases, village administrations were stripped of tax revenues after the RFTR and became heavily dependent on transfers from higher levels of government for their operation (Jin and Chen 2013).

Secondly, the composition of village expenditure changed constantly and resources were allocated on a project by project basis. In most cases, support for a project can appear one year and then disappear the next, due to the project's discontinuation (Figure 19). The unpredictability of expenditure patterns is the result of a high degree of dependency on rural development funds provided by the central government and managed by specific government agencies (Figure 18).These funds are out of villages' control, which clearly undermines village fiscal autonomy and disrupts the progress of projects (Fan, Chen and Li 2013).

Third, investment in infrastructure is the driving factor behind village finance in recent years. Since 2000, road construction has been a top priority in expenditure, accounting for about half of total village expenditure, followed by drinking water. Investments are concentrated in social welfare and visible projects like roads, housing and drinking water. However, there is only negligible investment in productivity improvement related activities (irrigation, flood and drought equipment, land conservation, extension and pest control). This huge investment gap needs to be addressed to ensure long-term food security and poverty reduction. The dominance of capital investment in infrastructure including roads, irrigation and drinking water is consistent with other village level studies (World Bank 2007a; Li et al. 2006;Luo et al. 2007;Fan, Chen and Li 2013; Jin and Chen 2013).

Fourth, the higher levels of government have assumed primary responsibility for financing village infrastructure, but the volatility in project size and timing underscores the fragmented and unsystematic nature of agricultural development planning at the grassroots level. Han (2009) reported similar symptoms in two poor counties. Each county reported 38 agricultural supporting

projects in 2004, with projects related to irrigation, forestry, agriculture, finance, poverty reduction and subsidy, funded and implemented by multiple bureaus. The lack of coordination and resource consolidation leads to confusion, dispersed resources, and projects unaligned with local needs.

Finally, the structure and level of village investment vary tremendously. The average total investment in 2006-2010 ranges from 285, 000 Yuan in village 1 to 130, 000 Yuan in Village 2 and a mere 5,000 Yuan in village 3. Village 1 and village 2 were located in remote mountainous areas with poor transportation and poor soil fertility, while village 3 is near the county center and enjoys relatively good infrastructure and high incomes. More investments are allocated to road access and drinking works in village 1, which also experienced the fastest growth in investment. Again, it reflects government development priorities in rural and less developed areas as the poor villages are compensated for their revenue loss (World Bank 2007a). In addition, the impacts of recent reforms are most pronounced in poor and agriculture-dominated villages. Total investment increased in all villages from 2000-05 to 2006-10, but the poorest villages gained more than their better endowed counterparts.

5.5. The Composition of Public Spending in Agriculture

5.5.1. The Structure of Public Spending in Agriculture

Within government expenditure in agriculture, forestry and water conservancy, agricultural expenditure constituted the largest expenditure item and accounted for 43.18 percent in 2011. Expenditure for water conservancy followed as the second largest expenditure item at 260.28 billion Yuan and accounted for 26.19% in 2011 due to the government's emphasis accelerating the development of water conservancy in the central government 2011 No 1 document. As mentioned above, only irrigation projects and rural drinking water amounted to 46.1 billion Yuanand23.1 billion Yuan in 2011, and accounted for less than 30% of total expenditure on water conservancy. Additional expenditure for water conservancy included the spending on the South-to-North water diversion project, totaling 68.89 billion Yuan in 2011, which accounted for 0.69% of the expenditure for agriculture, forestry and water conservancy. Government expenditure for forestry accounted for 8.82% of this group of expenditures. The rural comprehensive reforms aimed to provide subsidies for the village council and the branches of the party and the villager's committee, and also to reduce rural debts, its expenditure was 88.76 billion Yuan in 2011, which exceeded the expenditure for forestry, accounting for 8.93 percent. Expenditures for poverty reduction and comprehensive agricultural development were relatively small at 54.53 billion Yuan and 38.65 billion Yuan, and accounting for 5.49 percent and 3.89 percent in 2011, respectively. 2.89 percent was used for other expenditure items (Table 20).

5.5.2 The Main Items of Public Expenditure in Agriculture

16 important expenditure items, such as agricultural subsidies, agricultural environmental protection, countryside road construction, comprehensive agricultural development, poverty reduction, irrigation, agricultural research, agricultural technology extension and training, agricultural organization and industrialization, are presented in Table 21. The total expenditure of the 16 items was 468.7 billion Yuan in 2011. It showed an upward trend with an annual real average growth rate of 10.22% during 2009-2011. Detailed descriptions of major agricultural production related expenditure items are listed in Table 23.And some important expenditure items are discussed below in the following section

i) Agricultural Capital Construction

The scale of expenditure in agricultural capital construction fluctuates gradually overtime[3]. The expenditure in agricultural capital construction remained at a very low level, around 20~40 billion Yuan during 1978-1998, and was suddenly increased to the highest level of 101.66 billion Yuan in 1998 for the rebuilding of some infrastructure which was destroyed by flood disasters. After 1998, public expenditure in agricultural capital construction remained at the level of 70~80 billion Yuan, and was only 62 billion Yuan in 2006.The share of agricultural capital construction expenditure in total capital construction decreased from 11% in 1978 to 6% in 1985, rose to approximately 20% in the early 2000s, and decreased to 11.5% in 2006 (see detail in Figure18).

ii) Agricultural Subsidies

Since 2004, the agricultural tax was abolished and four specific agricultural subsidies were allocated and promoted in the countryside, such as direct support payments, general subsidies for purchasing agricultural supplies, seed subsidies and machinery subsidies. Total agricultural subsidies increased from 145.2 billion Yuan to 140.6 billion Yuan with an annual real growth rate of 30.09% during 2004-2011. Agricultural subsidies grew rapidly during 2004-2007, and exhibited stable growth during 2008-2011. The share of agricultural subsidy in total expenditure in agriculture, forestry and water conservancy was about 13%~15% during 2008-2011.Although the subsidy scale is large, per capita subsidy is still low. The per capita subsidy for rural residents is only about 200 Yuan per capita in 2011.

Direct support payments, seed subsidies and machinery subsidies were launched in 2004, and general subsidies for purchasing agricultural supplies were launched in2006. Direct support

[3]The data of expenditure in agricultural capital construction is only available up to 2006.

payments in 2011 amounted to 81.6 billion Yuan and accounted for 61.17% of total subsidies to agriculture. Seed subsidies were provided forrice, wheat, maize, cotton, and soybeans and rapeseed. Seed subsidies for potato and highland barley were implemented in Tibet, and peanut subsidy trials were undertaken in some peanut areas. The standard seed subsidy value was 10 Yuan per mu for wheat, maize, soybean and rapeseed, seed subsidy for wheat in Xinjiang was 15 Yuan per mu. And subsidy for early rice was increased to 15 Yuan per mu. Seed subsidies were 20.4 billion Yuan and accounted for 15.56% of total subsidy expenditure in 2011. Agricultural machinery subsidy increased rapidly in recent years and covered over 180 different kinds of agricultural machinery in most agricultural counties. Agricultural machinery subsidy increased from 0.1 billion Yuan in 2004 to 16.6 billion Yuan in 2011, which accounted for 12.45% of total expenditure on subsidy. Direct support payments decreased slightly to 14.3 billion Yuan in 2011, accounting for 10.46% of the total expenditure on subsidy (Table22).

iii) Expenditure on Irrigation

As one of the most important types of agricultural infrastructure, irrigation investment was increased substantially after 2009.The national government budget for irrigation increased from 22.26 billion Yuan in 2009 to 46.07 billion Yuan in 2011. The investments for water resources and irrigation increased rapidly during 1998 -2000 and 2008-2010 as part of the effort to stimulate the economy following the financial crises in 1997 and 2007. The total investment during these two phases was more than 100 billion Yuan. But agricultural irrigation only accounted for a small part (14%) of the total investment during1996-2010.The investment in irrigationreached33.4 billion Yuan and its share in total water conservancy investment rose to 18% in 2010(MOW, 2011). Due to growth of investment in irrigation, the new annual effective irrigated area was about 0.2 million ha(Table 23).Irrigated area increased from about 44 million hectares in the 1980s to 50 million hectares in the 1990s and exceeded 60 million hectares in 2010, and reached its highest historic level of about 62 million hectares in 2011, at which time the ratio of irrigated area in arable land was50.68%.

iv) Expenditure on Comprehensive Agricultural Development

Expenditure on comprehensive agricultural development was a special central government fund for activities related to agricultural resource development and comprehensive utilization to support agricultural development, strengthen agricultural infrastructure, improve the basic condition of agricultural production, optimize the structure of agriculture and rural development, and improve production capacity. The investment mechanism of comprehensive agricultural development was government-led, private sector -matched and civilian operated with

government support. Comprehensive agricultural development funds were used for rural land management, agricultural industrial management, and science and technology demonstration. The total investment in these three projects accounted for 90% of the total expenditure for comprehensive agricultural development in 2011. The expenses for land management were the most important, reaching 27.3 billion Yuan in 2011 and accounting for almost three quarters of the total expenditure on comprehensive agriculture development. The expenditure for agricultural industrial operation and technology demonstration were 6 billion Yuan and 0.075 billion Yuan, accounting for 16.32% and 0.20%, respectively.

The investment for comprehensive agricultural development had an upward trend during 1988-2011, increasing from 4.6 billion Yuan in 1988 to 36.7 billion Yuan in 2011 with an annual average growth rate of 9.43%. As shown in Figure19, the investment increased rapidly during 1988-1991, while it remained stable during 1992 -1994 and 1995-2003, it continued to rise but stabilized at around 25 billion Yuan during 2004-2007. But after 2008, it increased faster with an annual growth rate of 12.43%.

v) Expenditure on Agricultural Research and Development (R&D)

A great deal of evidence from developed and developing countries show R&D to be the main engine of agricultural productivity growth (Alston et al. 2009). China has become the largest system in the world (Stone 1988;Fan and Qian 2005). Government investment in agricultural R&D increased rapidly in the last decade and ended a period of stagnation in the 1990s with more than a 10% annual real growth rate. From the total funding of all agricultural research institutes, agricultural R&D spending was 14.9 billion in 2008, and 13.2 billion Yuan was from the government. Government funds were the main funding source for agricultural research with a share of about 90% in total funding. Agricultural R&D accounted for about 10% of the total research expenditure during the last decade(Figure20). The intensity of agricultural R&D is underestimated at only around 0.4. The agricultural research expenditure used here was only for research institutes. Agricultural R&D intensity was estimated at about 0.5-0.6 percent (Hu et al., 2007), which was still much lower than the world average of 1 percent for developing countries. China's main public agricultural research focus was oncrops, which accounted for more than half of all research activity in 2008, followed by agricultural services (15 percent), forestry (9 percent), livestock (6 percent), and water conservation (6 percent) (Chen et al 2012).The role of scientific innovation to enhance agricultural production capacity was emphasized in the 2012 No. 1Document,and China will continue to increase R&D spending in the future.

vi) Expenditurefor Agricultural Environmental Protection

The 18th Party Congress proposed that ecological civilization construction be prioritized and mainstreamed into China's sustainable development. The expenditure for agricultural environmental protection covers a wide array of activities, but due to data limitations, we only list five representative expenditure items, such as agricultural natural resource conservation and utilization, natural forest protection, natural ecology protection, Grain for Green, and Grain for Grass. Total investment in the five was 583 billion Yuan, with an annual growth rate of 8.8%. The expenditure for grain for green accounted for a large share, nearly 60%(Table 24).

vii) Expenditure on Poverty Reduction

Poverty reduction funding was mainly used to support agricultural production, including expenditures for rural infrastructure construction, production development, social development, interest subsidies for loans and rewards for providing loans to poor people and special grants for "Sanxi"4 agricultural construction, which accounted for 70% of total poverty reduction funding. The expenditure for agricultural infrastructure ranked the highest with 23 billion Yuan in 2011, which accounted for 44 percent of total poverty reduction funding. The expenditure for promoting production development increased from 6.4 billion Yuan in 2009 to 11.3 billion Yuan in 2011 with the fastest annual growth rate of 33.26%, and accounted for 22 percent of total poverty reduction funding. Expenditures for social development, interest subsidies for loans and rewards for providing loans to poor people amounted to 0.8 billion Yuan and 1.1 billion Yuan, respectively, while special grants for "Sanxi" agricultural construction amountedto 0.3 billion Yuan in 2011 (Table 25).

6. Assessment of Public Expenditure in Agriculture in China

6.1. Overall Assessment

A number of key points can be made from the above literature review and data analysis. First, the precise assessment of government expenditure in agriculture has been complicated by data limitations, the lack of a systematic expenditure classification, and the application of different definitions of public spending in agriculture by various statistical sources.

Second, China entered a turning point in its fiscal policy towards agriculture in 2003. It shifted from taxing agriculture to supporting agriculture. The most significant reform was the tax and fee reform with an introduction of fiscal transfer payments from the central to local government and direct subsidies to farmers.

Third, with its recent policy directions, China has broadened the scope of its agricultural policy, aiming to solve issues such as agricultural productivity, farmers' income, and the delivery of rural public services. China has made a great effort to increase the level of government spending used to address Sannong issues, especially in recent years. Agricultural expenditure in China declined in the 1980s, but has quickly recovered and even exhibited explosive growth, reaching $78 billion (in 2005 constant prices) in 2009-10 (IFPRI 2013). Moreover, the size and growth rate of rural social spending has outpaced agricultural spending in China.

Fourth, the current definition of "San Nong" expenditure includes many non-agriculture-related expenditure such as water conservancy, forestry, meteorology etc. As a result these official figures of public expenditure in agriculture typically overestimate the government's fiscal contribution to agriculture. Moreover, one should not equate public expenditure in agriculture to the agricultural support measures defined by the OECD or the WTO.

Fifth, the effectiveness and efficiency of public expenditure in agriculture have suffered from a complex governance framework and sector fragmentation. Horizontal and vertical coordination in actual policy design has remained limited as there is no formal mechanism that integrates all public expenditure in agriculture.

6.2. Is Overall Public Spending in Agriculture Adequate?

As indicated above, an assessment of public spending gaps in agriculture in China is challenging given the data limitations, changing expenditure classification, and the application of different definitions of public spending in agriculture by various statistical sources. To assess whether or not public spending is adequate in China, one would need to know a) total agricultural investment required, b) gap of meeting the required investment, and c) gap for public spending. Unfortunately no such information is readily available or easy to compute. At the global level, there is a consensus that agriculture is significantly underinvested in (IFPRI 2008, 2009). The World Bank (2006) and Global Development Initiative (2012) estimated a shortfall of agricultural investment (excluding capital investment) in the amount of $100 billion in developing countries each year.

The MOA's Office of Modern Agricultural Demonstration Districts has estimated that an additional $150-600 million investment(including capital investment) will be required to modernize the agricultural sector in a typical county (MOA 2012). Given the 2, 862 counties and county-level divisions in China, an additional investment ranging from$0.43-1.73 trillion will be

required to modernize China's agriculture at the county level alone. Assuming such modernization would take place from 2014 to 2030, it will require an additional investment of 150-630 billion Yuan each year at current price levels.

Despite the rapid increase and its sheer size, agricultural spending in China is also low when compared with developed economies. Per capita agricultural expenditure was about $57 in 2010 (at 2005 constant prices), far below the level of developed Asian countries, such as Japan ($126) and Korea ($226) (IFPRI 2013). The share of agriculture in total expenditure declined from 10 percent in 1990 to 7.8 percent in 2000, and the shared remained below 8 percent until 2008 (Figure24). Only in recent years, has the agricultural share increased to about 9 percent of total government budgetary expenditure.

It is also important to note that the current definition of "San Nong" expenditure includes many non-agriculture expenditures such as water conservancy, forestry, meteorology, etc. As a result these official figures of public expenditure in agriculture typically overestimate the government's fiscal contribution to agriculture. Moreover, one should not equate public expenditure in agriculture to agricultural support measures defined by the OECD or the WTO.

6.3. Non-optimal Structure and Poor Governance of Public Expenditure in Agriculture

Based on the discussion in section 5, a few key points can be made regarding the structure of public spending in agriculture in China. First, there is inadequate and uneven local public spending in agriculture. Second, there is inadequate public spending on agricultural R&D, for example, less than 1% of agricultural GDP was spent on agriculture. Third, there is low government expenditure in the crucial "final mile", for example, a small share of water conservancy is dedicated to improving the farming irrigation system.Fourth, there is inadequate public spending on agricultural infrastructure with a declining share of agriculture in infrastructural expenditure and a declining share of farming irrigation in water conservancy expenditure. Fifth, there is inadequate public spending on new development priorities such as rural social services, food safety, sustainable development, and value added food value chain development

A few key points can also be made on the governance of public expenditure in agriculture in China. First, there is serious fragmentation of public expenditure in agriculture with more than eighteen different ministries involved in the process. Second, the share of MOA in public

agricultural spending is surprisingly low. Third, administration cost accounts for a dominant share of public agricultural spending. Fourth, there is poor targeting of agricultural subsidy.

It is particularly worthwhile to note that poor governance and the low efficiency of agricultural expenditure in agriculture are viewed as the most prominent issues by the majority of the policymakers and researchers interviewed (Table 7).

6.4. International Perspective

Since 2000, the growth of the total government budget allocated to agriculture outpaced other major developing economies in East and South Asia (Figure 21). Given the tremendous size of China's population, per capita expenditure is also used to ensure cross-country comparability. Per capita agricultural expenditure rose steadily since the 1990s, and China has surpassed many countries in the region in this regard (Figure 22). China's agricultural spending is quite high relative to the size of its agricultural sector at about 21 percent in 2010, ranked top among its developing neighbors (Figure 23).

Schultz (1953, 1978) identified different agricultural problems faced by countries at both ends of the wealth spectrum. Low-income economies with high population growth and threatened by food shortages are inclined to tax agriculture to push down the food prices of non-farm workers. On the other hand, protecting and subsidizing agriculture to achieve income parity are the principal policy instruments in high-income economies with low population growth and stagnant food demand growth. Hayami (2007) further extended the concept and demonstrated the shift of government policy objectives in the process of economic development. He added another agricultural problem faced by countries advancing from low-income to middle-income status, which is the conflict between the goals of ensuring food security and increasing farm income to reduce inequality.

Byerlee, de Janvry and Sadoulet (2009) argued that agriculture has multiple functions for development: triggering economic growth, reducing poverty, narrowing income disparities, providing food security, and delivering environmental services. In China, the main policy priorities regarding agricultural development also encompass several objectives: ensure food security and food self-sufficiency by investing in rural productivity improvement; encourage sustainable agriculture through natural resource conservation and climate change adaptation; and close inequality through agricultural transformation and rural development.

China is at a critical point where it its transition and the trend of rapidly increasing inequality can be reversed through further inclusive growth, development and integration. The challenge for the

Chinese government lies in moving up to high-income status and avoiding the "middle-income trap" of failing to continue to advance into the ranks of high-income countries (Aiyar et al. 2013). Policymakers in many countries that underwent economic transformation faced similar problems in the process and their experiences can help China to attain its ambitious development goals. The experience of other countries in using agricultural policies before and during the early stages of rapid industrial expansion can be very helpful in China's transformation. Several East Asian economies, including South Korea, Taiwan and Japan, have succeeded in maintaining growth momentum after attaining middle-income status. Together with experiences in Latin America, general policy prescriptions to reduce inequality center on comprehensive regional development strategies, improved social protection, enhanced access and quality of health and education services, and increased social transfer.

Japan reached the middle-income stage by the first decade of the 20th century through the promotion of labor-intensive manufacturing. During that time the objective of agricultural policy was to ensure an adequate supply of cheap food to support low wages for the industrial sector. The Japanese government favored productivity-enhancing investments in developing and distributing improved seed and agronomic practices, mechanization, extension and irrigation. The food supply was secured but farm incomes relative to non-farm incomes dropped sharply in the 1920s and 1930s, exacerbating inequality. Responding to the changes and farm bloc lobbying, the focus of agricultural policy shifted to support agricultural production through price supports (rice import duties and procurement), rural infrastructure construction (road and rice storage), credit, and tax reduction. Denison and Chung (1976) concluded that Japan's growth is partially attributable to improved input quality via upgraded human capital through health and education for workers. Only after the 1970s when Japan reached high-income class, was the country able to afford a widespread farm price support program to improve the terms of trade between agriculture and non-agriculture and reverse farm income decline.

Thailand also faced a similar issue of growing income inequality during very rapid growth based on labor-intensive industrialization. Under the political instability of the mid-1970s, the Thai government changed its policy stance from taxing to supporting the agricultural sector, which included the reduction of rice export taxes, farmer credit, fertilizer subsidy and the construction and upgrade of rural roads. These policies, which aimed to address emerging rural-urban inequality, were very similar to those adopted by the Japanese government in the 1930s. However, these producer support programs are viewed as having a very limited impact and as insufficient to fully close the income gap, resulting in the persistent concentration of poverty in the agricultural sector (Dixon 1999; Hayami 2007).

In addition to agricultural development, industrial development strategy provides another modality for improving agricultural labor productivity. Taiwan provides a successful example of widespread small- and medium-scale enterprises over rural areas, which gives farmers easy access to non-farm employment and cuts the cost of inter-sectoral labor reallocation. In the case of the US, the construction of canals, railways and the telegraph system linked the west to the rest of the country in the 1800s, which facilitated the exchange of commodities and information and hence accelerated the urbanization process. China's early reform experience confirms that the growth of rural non-agricultural industries is essential in closing the rural-urban income gap during the early 1980s. Afterwards, rural-urban and regional inequality rose at an alarming rate in China, partly because of the concentration of industrialization in the coastal areas.

Experiences in other countries suggest that widening inequality is common among developing economies rising from the low-income to the middle-income stage due to the loss of agriculture's comparative advantages, but the trend can be offset if agricultural productivity could grow at a speed parallel to that of the non-agricultural sector (Hayami 2007). Intensified investment in agricultural R&D, rural infrastructure and services and human capital all prove to be effective measures to attain the dual objectives of food security and inequality reduction through elevated agricultural productivity. Farm mechanization offers an additional tool to increase the capital intensity of agriculture but the associated economy of scale can be a challenge in China's smallholder agriculture.

7. Knowledge Gaps and Policy Recommendations

7.1. Knowledge Gaps

Our assessment of public spending in agriculture has been hampered by several knowledge gaps that will need to be addressed in the future.

First, improvement in the availability, accessibility and timeliness of information calls for improved transparency in tracking and monitoring government expenditure with disaggregated details. The concept of "SanNong" is problematic as a measure and provides only a limited spending breakdown, seriously undermining the usefulness of the measure. The components of agricultural expenditure are not easily comparable with other sources of information due to the vagueness of the definitions involved. Even when the same term is used, the figures under "SanNong" can be different from other sources, which can cause user confusion, as in the case of agricultural subsidy (World Bank 2007b).

Second, policy analysis at the sub-national level is greatly constrained due to the lack of detailed expenditure data. Inconsistent reporting and the lack of clear guidelines further impede the investigation of the impact of public expenditure in several issue areas. One area for improvement is central transfer. Although total transfer from the central to provincial governments is reported in national statistics outlets, there is no breakdown even at the provincial level or by projects to enable the examination of investment priorities reflected through this channel. Another issue is the disaggregation of expenditure, either by economic classification (labor cost and capital investment) and by functional classification (irrigation, extension, agricultural R&D).

Third, there is an urgent need to quantify the required investment in agriculture to achieve certain development goals. Currently there are no quantifiable targets for government expenditures in current agricultural legislation and policies on the resources needed. Although a general national target is often set, it is unclear how much expenditure is required at different government levels. A good example is agricultural R&D. The country aims to increase the intensity of agricultural R&D from the current level of 0.5 percent to 1.5 percent in 2020 and to 2 percent in 2050 (Chen, Flaherty and Zhang 2012).This implies that a minimum of 43 billion Yuan(in 2005 constant prices) must be invested in agricultural R&D to maintain the average yield growth rate of 1995-2005, which translates to an annual growth rate of 15 percent in agricultural R&D from 2005 to 2020.

Fourth, it is hard to estimate private investment in agriculture. Private investment includes farmers' investment and corporate investment. Farmers' investment refers to spending at the farm level to directly increase agricultural productivity such as irrigation, machinery and agricultural chemicals. Corporate investment takes place along the whole supply chain to promote agricultural activities, including processing, transporting and storing agricultural inputs and outputs. Clear strategies need to be formulated so that private investment can complement public expenditure to increase farmers' incomes, promote small farms and agribusiness, and strengthen food production and quality.

Fifth, there is an apparent lack of understanding of public expenditure in agriculture at the local county and township levels. The county and township is the key to ensuring continuous growth in public expenditure in agriculture but they have faced tremendous fiscal challenges since the fiscal reform in 2003.Moreover, the county is well situated to integrate various sources of agricultural expenditures from the central and provincial governments (Luo and Chen 2008).

Sixth, there is no clearly delineated monitoring and evaluation mechanism to measure and evaluate the efficiency, effectiveness and impact of agricultural projects. The lack of awareness and understanding of the impacts of urbanization, global climate change and water scarcity on agricultural production has also prevented the formulation of an effective policy and its integration into the planning of government agricultural expenditures.

Seventh, despite the emphasis of food safety, sustainable development, and inequality by the government, it is hard to gauge the magnitude of resources allocated to these issues. For example, although food safety is included in agricultural spending, it underestimates the total government spending in overseeing and tracking food through the whole supply chain from the producer to the consumer.

Eighth, there is a lack of a methodology for the systematic measurement of public expenditure in support of the agricultural sector. The expenditures need to be categorized according to their economic characteristics to facilitate further analysis of the extent to which expenditures are addressing policy objectives. It must also take into consideration how the proposed classification fits with the classifications used by the COFOG, OECD, and WTO to facilitate international comparison.

7.2. Policy Recommendations

The Chinese government faces formidable challenges in improving the effectiveness of its expenditure in agriculture .China's budget reform is far from finished as inefficiencies are rampant in the highly decentralized and hierarchical administrative system. It is recognized that the reform and its implementation will be a long-term effort to improve public sector performance and balance multiple development objectives for agriculture and rural areas. Table 7 indicates that more than half of policymakers and researchers interviewed ranked "improving the governance and efficiency of China's public expenditure in agriculture" as the top policy recommendation. The following policy recommendations are made in the report.

7.2.1 Improving the Governance of Public Expenditure in Agriculture

First, responsibilities need to be explicitly clarified to increase budgetary certainty, transparency, accountability, efficiency and sufficiency, vertically at different levels of administration. There are no clear mandates and responsibilities of the different levels of government agencies to reflect the goals specified in national development plans and to represent the priorities of residents within the administrative border. An integrated agricultural expenditure system will streamline the decision making, and monitoring and supervision processes. Observations at the grass-roots level highlighted that many programs are created and managed in an ad hoc and un-

systematical fashion from above, resulting in overlapping responsibilities, partial and/or inefficient implementation, and the under-provision of essential public services. The accountability and efficiency of local governments will benefit from clearly delineated responsibilities, especially in poor regions with small tax bases.

Second, horizontal coordination across government agencies is a huge challenge. Multiple ministries and agencies are involved in agriculture related activities and each agency has its own priorities, causing gaps and overlaps of responsibilities and spending inefficiency. A centralized mechanism is needed to comprehensively oversee agricultural programs and to ensure that different ministerial development plans impacting the agricultural sector are designed, budgeted, implemented and monitored in a coordinated manner to reflect coherent development strategies. Efficiencies can be improved if interagency coordination is in place and each agency's role and responsibility are clearly outlined and streamlined. Since the organizational structure of agricultural spending is mirrored at the subnational level, the coordination process should also take administrative structure into consideration.

Third, effective ways to integrate various sources of agricultural expenditure at the county level and provincial levels need to be identified. There are some good pilots of public expenditure funding integration at the county level aiming to improve the efficiency and effectiveness of agricultural investment.

Fourth, there is limited farmer involvement in the planning, provision, and monitoring of public expenditure in agriculture. The accountability of service providers and governments to farmers, communities, and stakeholders is weak.

Fifth, the monitoring and evaluation of agricultural investment needs to be strengthened. Agricultural investment efficiency can be improved through the establishment of a performance evaluation system for the entire project lifecycle. The evaluation system should include the establishment of measurable performance indicators, evaluation criteria and methods and institutional management.

7.2.2 Alignment of Public Agricultural Expenditure with Development Priorities and Better Targeting

First, given land and water constraints, changing demand patterns and the uncertainty posed by climate change, growth in TFP will be the key to fostering long-term production growth and improving smallholder competitiveness. Historically, agricultural technology is considered a key factor in driving the remarkable achievement in Chinese agriculture through improved productivity, which in turn calls for the rapid expansion of agricultural R&D to sustain future

growth. Investment in agricultural R&D includes the development of new technologies for climate resilient and high yield varieties, sustainable land management and agronomic practices, and water and energy conservation. There is an urgent need to cope with demographic change by increasing agricultural R&D in labor saving technology for mountainous and small plots and promoting mechanization. Research spending also needs to be aligned with ongoing agricultural structural change by increasing research in high value products and agri-food processing. The investment gap in agricultural R&D is considerably large. For example, Nin-Pratt and Fan (2010) estimated that the annual growth rate of agricultural R&D needs to be doubled from the current level of 3.5 percent in order to double the agricultural productivity growth rate and number of people escaping poverty from 2008 to 2025.

Second, there is a need to continuously increase agricultural infrastructure investment with a particular emphasis on small infrastructure in rural areas. With increased budgeting for water-related and agricultural infrastructure investment, measures need to be in place to ensure that an adequate share goes to small infrastructure such as field irrigation to benefit agriculture and farmers directly.

Third, urbanization and agricultural transformation requires investment in human capital, technology and rural infrastructure to facilitate agricultural labor transferring to non-agricultural employment. These investments will fundamentally increase agricultural productivity and hence improve the terms of trade of the agricultural sector. Empirical evidence suggests high payoffs from investments in rural infrastructure, education and health when compared with other types of agricultural spending.

Fourth, fiscal resources needed to be prioritized across activities to ensure the optimal use of public funds. For example, the agricultural subsidy policy should be reconsidered to effectively achieve the policy objectives of increasing grain production and maintaining economic and environmental sustainability while abiding by WTO commitments. One option is to scale down input subsides with better targeting, and another option is to expand income support programs that are decoupled from production decisions to supplement farmers' income with optional conditions. Yu and Jensen (2010) confirmed that decoupled payment is a better policy option because it is a uniform payment to all arable land regardless of the crop choice, essentially becoming an income transfer to land users. Unlike input subsidies, decoupled payment is considered non-distortive because it does not cause inefficient resource allocation across agricultural activities by diverting scarce public resources from better uses. The application of decoupled payment will not change agricultural output, trade, rural employment or relative price, but it will result in higher farm income increases when compared with input subsidy.

Government expenditurein stockpiling grain, oilseeds and cotton also deserves a careful review. The objectives of ensuring a strategic supply and cutting down inefficiencies need to be balanced when considering the reduction of subsidies.

Fifth, substantial resources need to be devoted to ensuring that China's expanding economy and population do not come at the expense of its food safety. The government needs to improve food safety monitoring by enhancing the capacity of monitoring agencies and consumers as well as developing tools to keep up with increasingly complex food production systems. Institutional innovations and coordination can help monitor smallholder farmer compliance with food safety standards. The government also plays the lead role in promoting understanding of agriculture-related disease transmissions.

Finally, huge regional and provincial variations imply that the promotion of modern technology and agricultural diversification should be tailored to local conditions. The impact of public investment can be enhanced significantly if spatial variations are taken into consideration at the policy planning and implementation stages. Productivity and income responses could differ starkly across different agro-ecological conditions and local economy structures. In some regions with challenging geographic conditions, poor infrastructure and poor information access prevent local producers from benefiting from market conditions. Investment in tackling constraining factors and improving rural access to basic services can yield high returns in poverty alleviation and inequality reduction.

7.2.3 Establishing a Long Term Funding Mechanism to Support Agriculture

First, it is essential to ensure the continuous growth of public expenditure in agriculture by various levels of governments, including central, provincial, prefectural, county, and township. A monitoring system needs to be in a place to ensure that the growth rates of public expenditure in agriculture by various levels of governments will be higher than that of general public revenue, as required by the "Agricultural Law" in China. Given the new challenges faced by Chinese agriculture, it is important not only to increase the total fiscal expenditure to support agriculture, but also to increase its share in the total public expenditure.

Second, it is critical to reform the fiscal system to enhance the local government's capacity to support agriculture. Since more than 70 percent of public expenditure in agriculture occurs at the local government level, strengthening local government's expenditure in agriculture will be a key to ensuring continuous support to agriculture. With the fiscal difficulty the counties face, it is unrealistic to expect that the counties would be able to provide or increase agricultural expenditure under the current mismatched revenue and responsibility structure. Adequate

funding has to be allocated to ensure public service delivery at the local level and to improve equality in the quality and accessibility of public service. This can be achieved through a combination of increased funding sources (local tax, donor support and private investment) and efficient transfers so that local government has the required resources to perform essential services. A comprehensive reform from the central government is needed to rebalance expenditure responsibilities to match local financial capacity to align revenues and responsibility and relieve the heavy fiscal burden of local governments.

Third, it is essential to establish a system to encourage agricultural investment from nongovernment sources such as banks, corporate capital (domestic and foreign), and farmers. Private and social investment is crucial for China's agricultural modernization. A long-standing problem of capital flight from rural to urban areas needs to be corrected to ensure adequate investment in agriculture in China. Public expenditure needs to be invested in such way as to attract and complement private and social capital into agriculture and rural areas. For example, increased public funding of extension can accelerate the transfer of new technologies to farmers, including sustainable agronomic practices and new varieties that are climate change resilient. Improved access to inputs and high-value supply chains and markets such as fruits, vegetables, and dairy products is another way of encouraging private investment. Government spending in improving access to rural services is crucial to attracting the private sector, including establishing institutional arrangements (for example producer cooperatives), risk management (for example weather-based index insurance) and financial services (for example community banking and market information).

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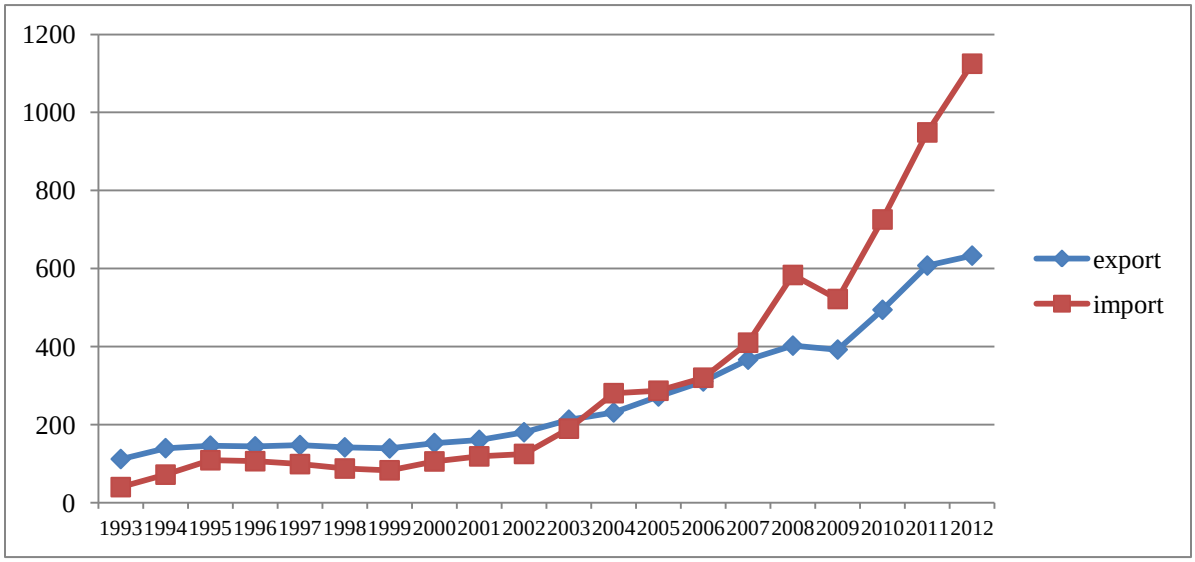
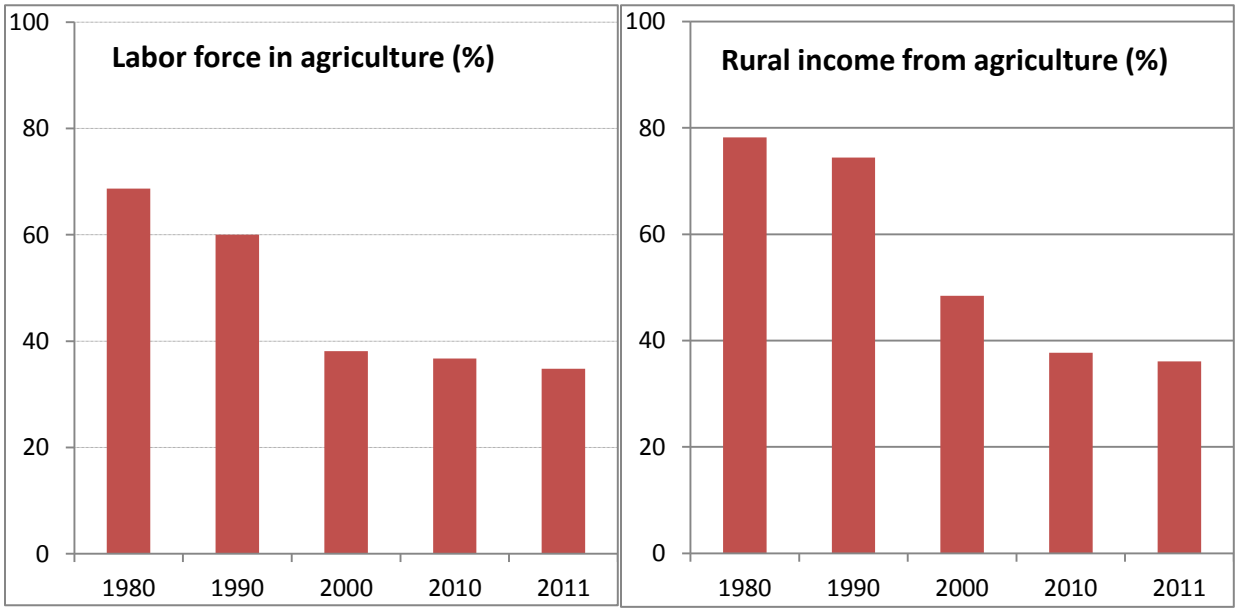
Figures

Figure 1. China agricultural trade, billion US dollars



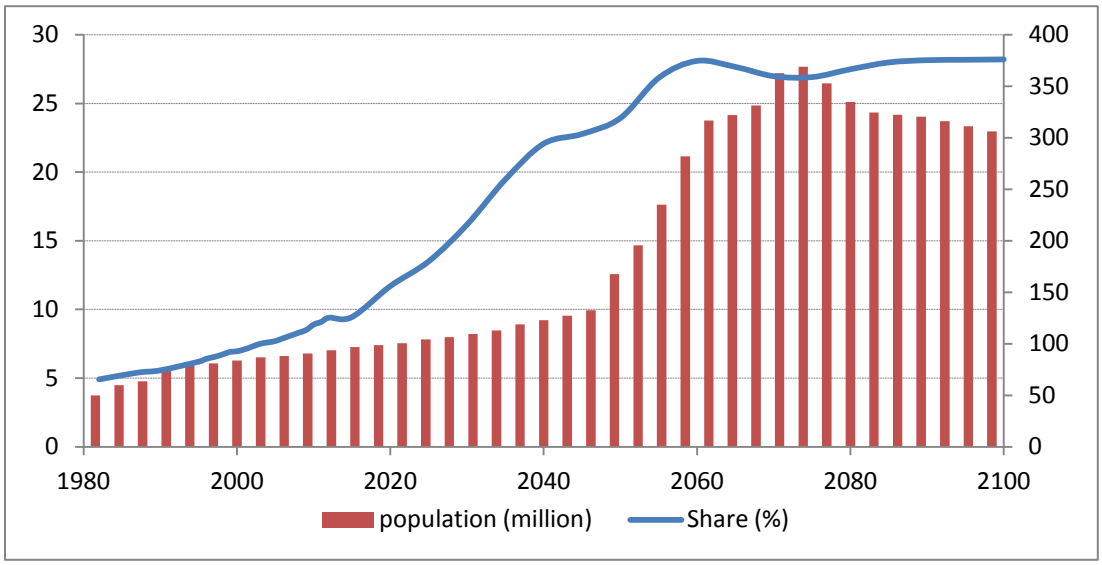
Source: WTO (2013).

Figure 2.Agriculture in rural employment and income



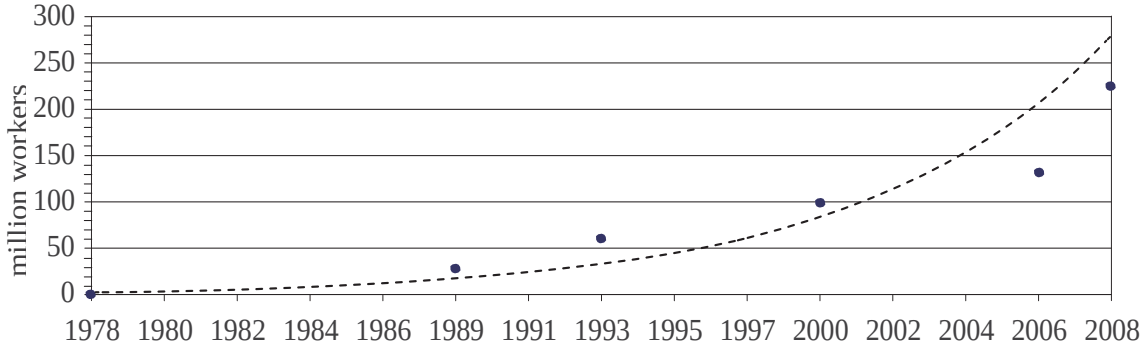
Source: China Statistics Yearbook (various years).

Figure 3. China's aging population



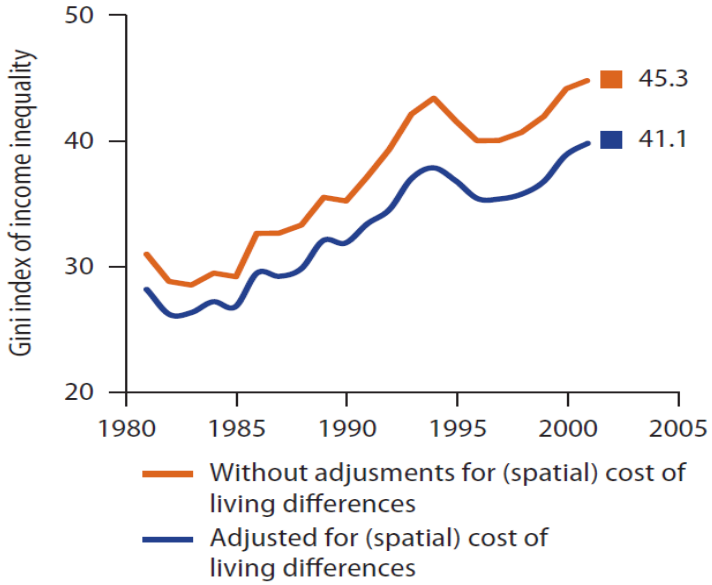
Source: China Statistics Yearbook (various years) and United Nations (2010).

Figure 4. Number of rural migrant workers



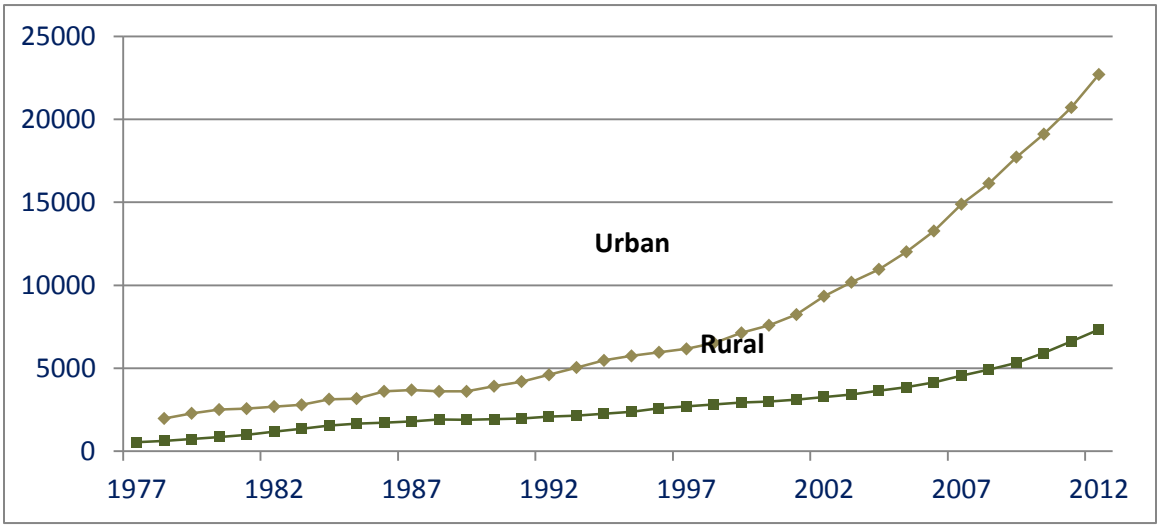
Source: MOHRSS and ILO (2011).

Figure 5.Gini coefficient in China



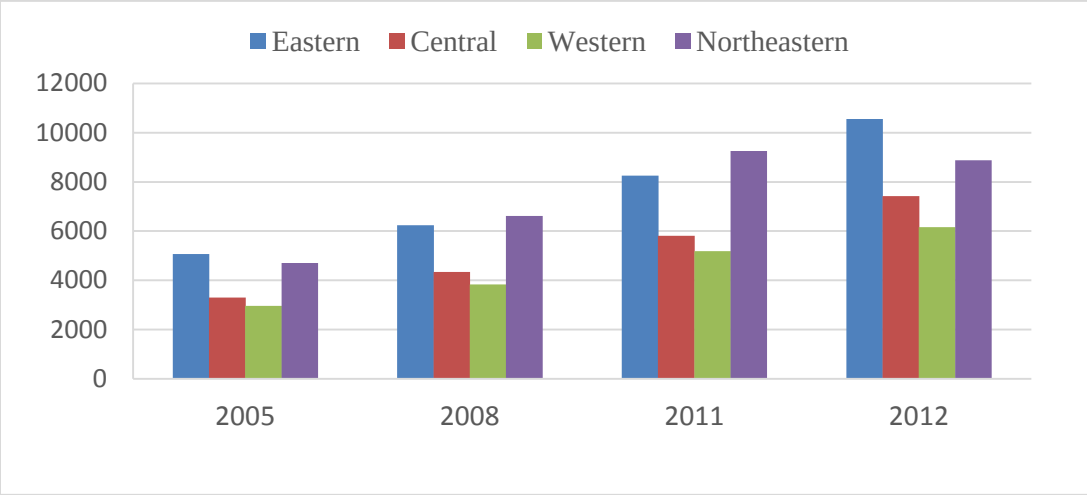
Source: World Bank (2013b).

Figure 6.Per Capita Rural and Urban Household income, Yuan at 2010 constant price



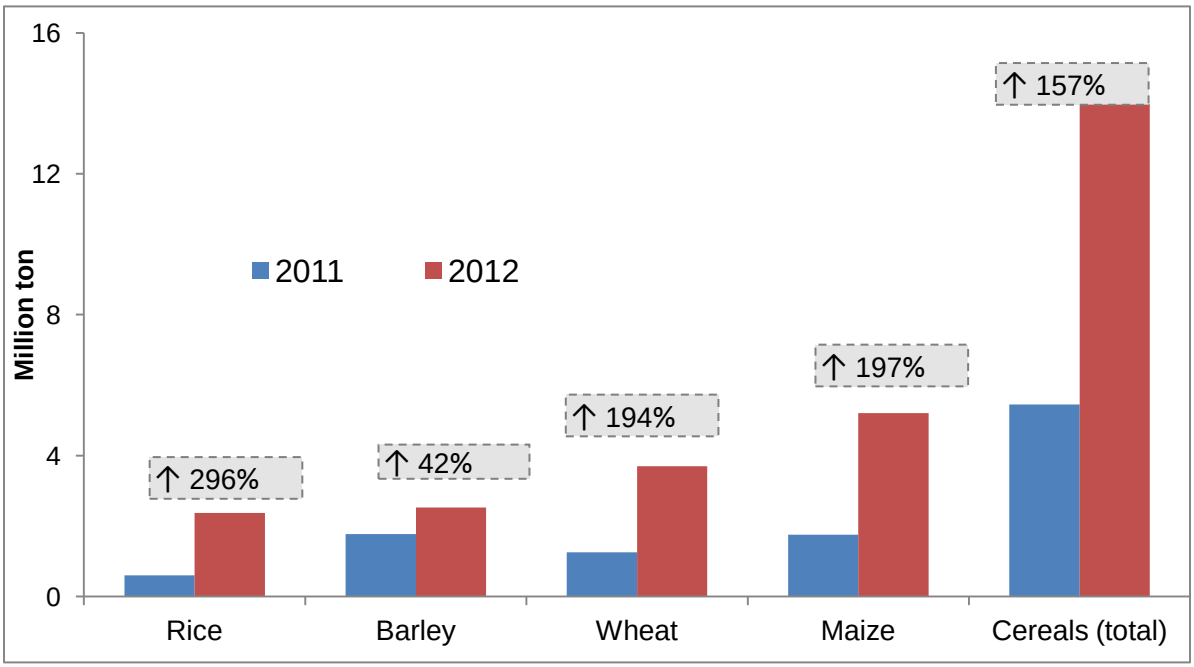
Source: China Statistical Yearbook (various years).

Figure7.Regional per capita income of rural households, Yuan



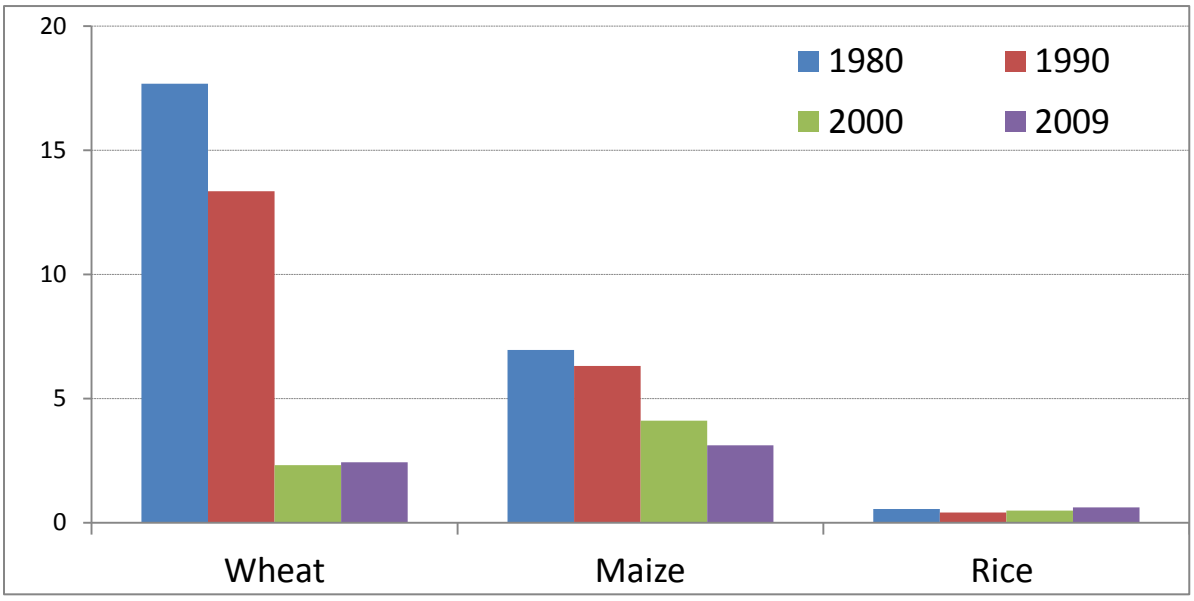
Source: China Statistical Yearbook (various years).

Figure8. China cereal imports in 2011 and 2012



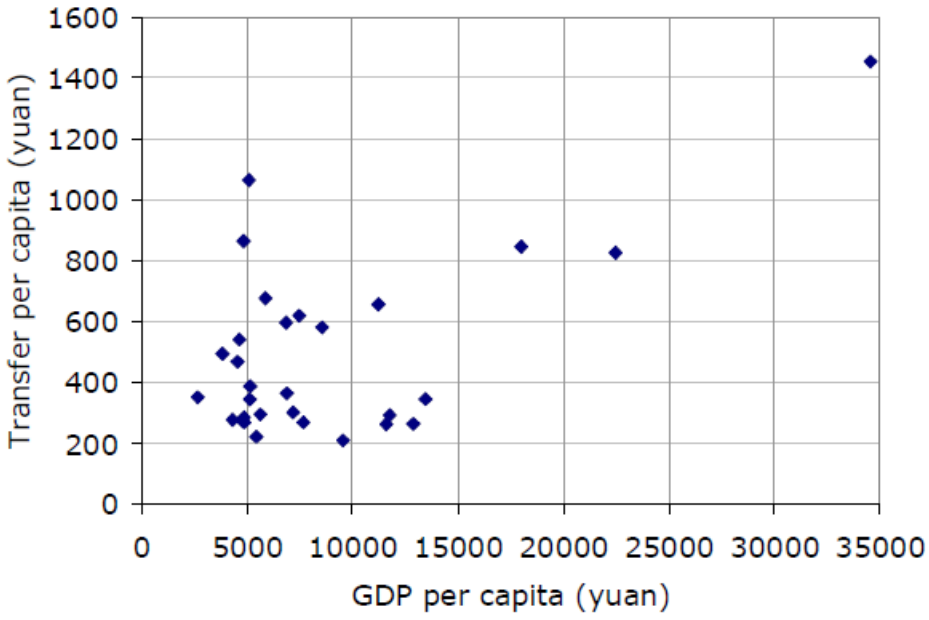
Source: MOA (2013).

Figure 9. China cereal foreign trade interdependency, percent



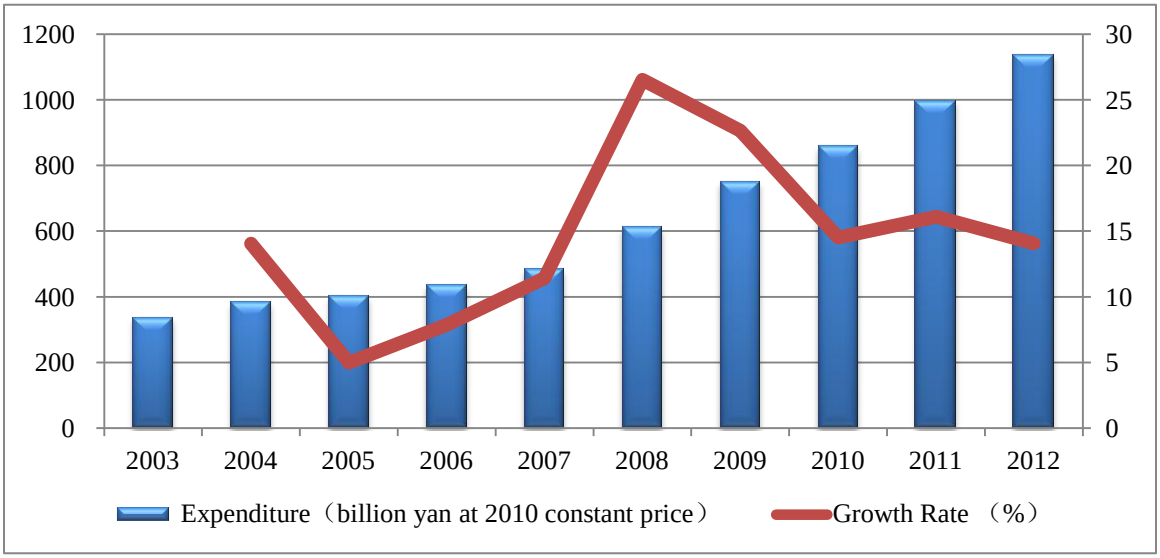
Source: FAOSTAT (2013).

Figure 10.The size of transfer and local economy strength



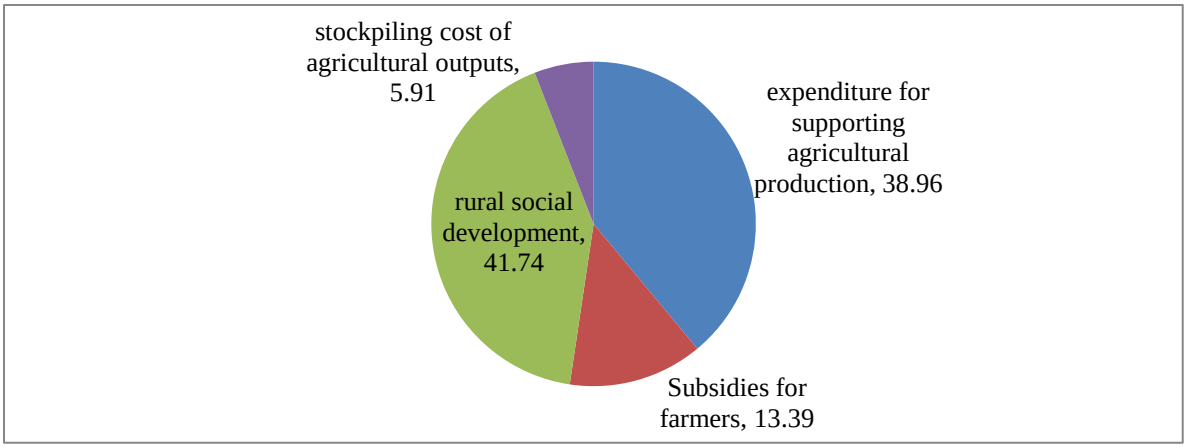
Source: World Bank (2005a) based on MOF (2004).

Figure 11. The central government expenditure scale for "San Nong"



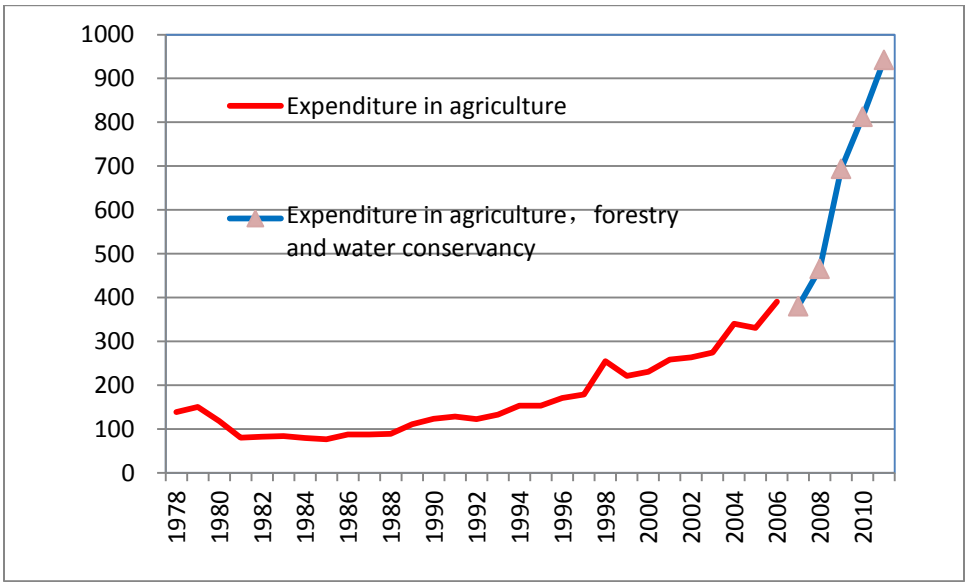
Source: The basic situation of China's finance (MOF 2008-2011).

Figure 12. The structure of Central government expenditure for "San Nong" of 2011, percent



Source: The basic situation of China's finance (MOF2008-2011).

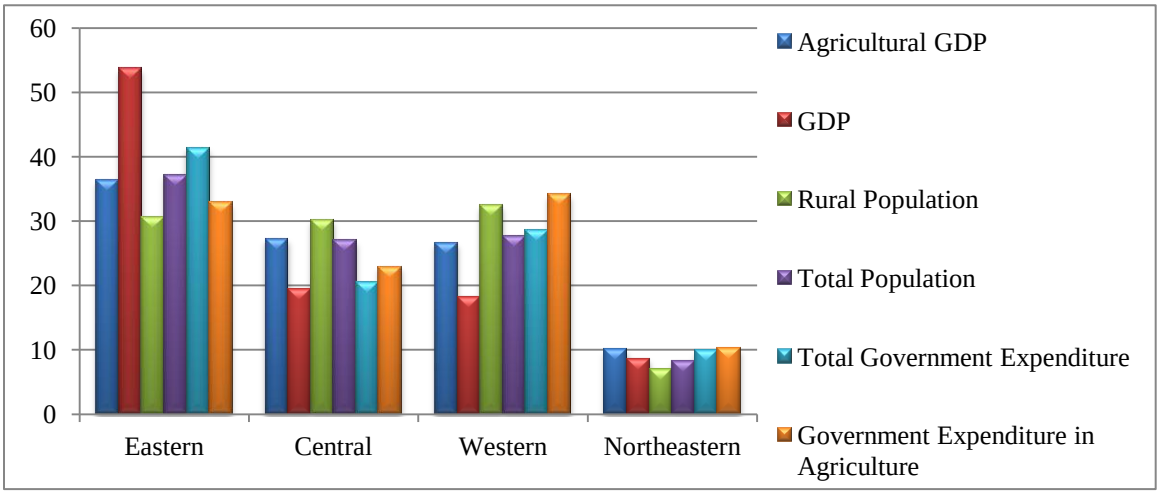
Figure13. Expenditure for agriculture, billion Yuanat 2010 constant price



Note: Data of 1978-2006 are expenditure in agriculture, and data of 2007-2011 are expenditure in agriculture, forestry and water conservancy.

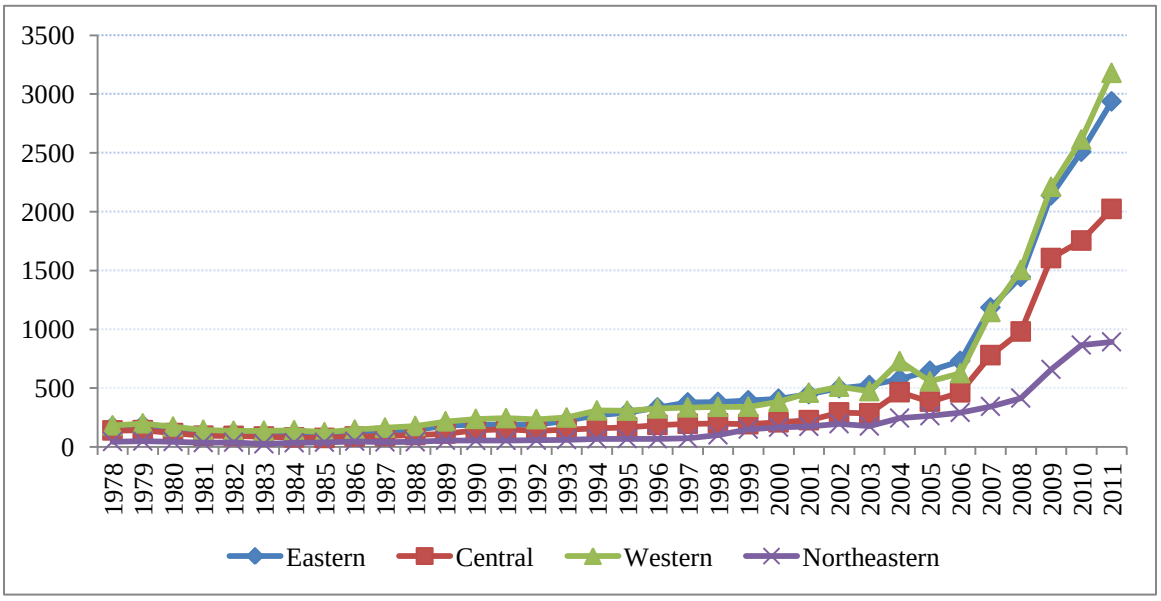
Source: China statistical yearbook (various years).

Figure 14. The regional average share of GDP, population and government expenditure during 2007-2011, percent



Source: China Statistic Yearbook (2008-2012).

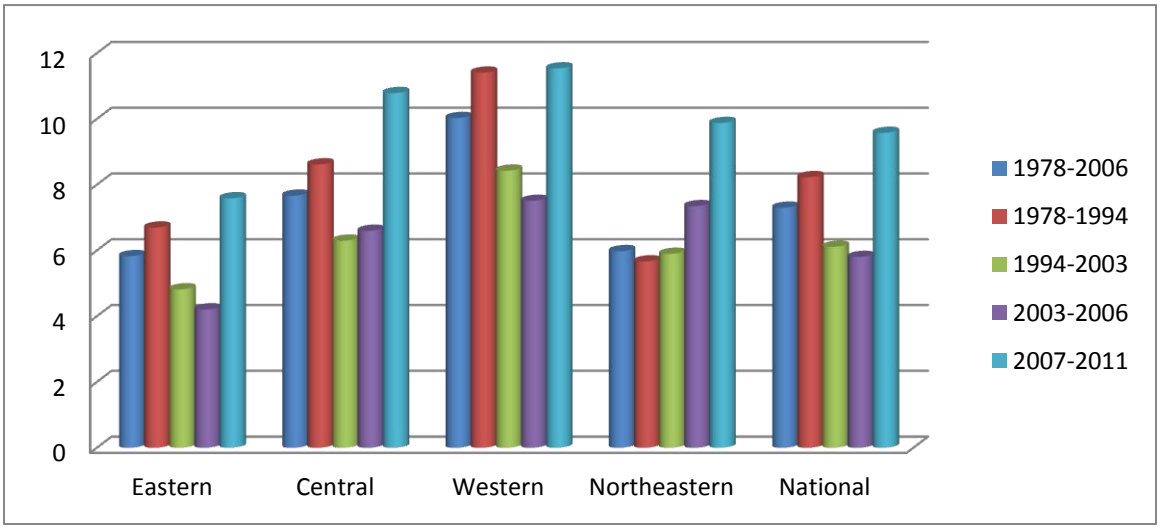
Figure 15. Regional government expenditure in agriculture, billion Yuan at 2010 constant price



Note: Data of 1978-2006 are expenditure in agriculture, and data of 2007-2011 are expenditure in agriculture, forestry and water conservancy.

Source: China statistical yearbook (various years).

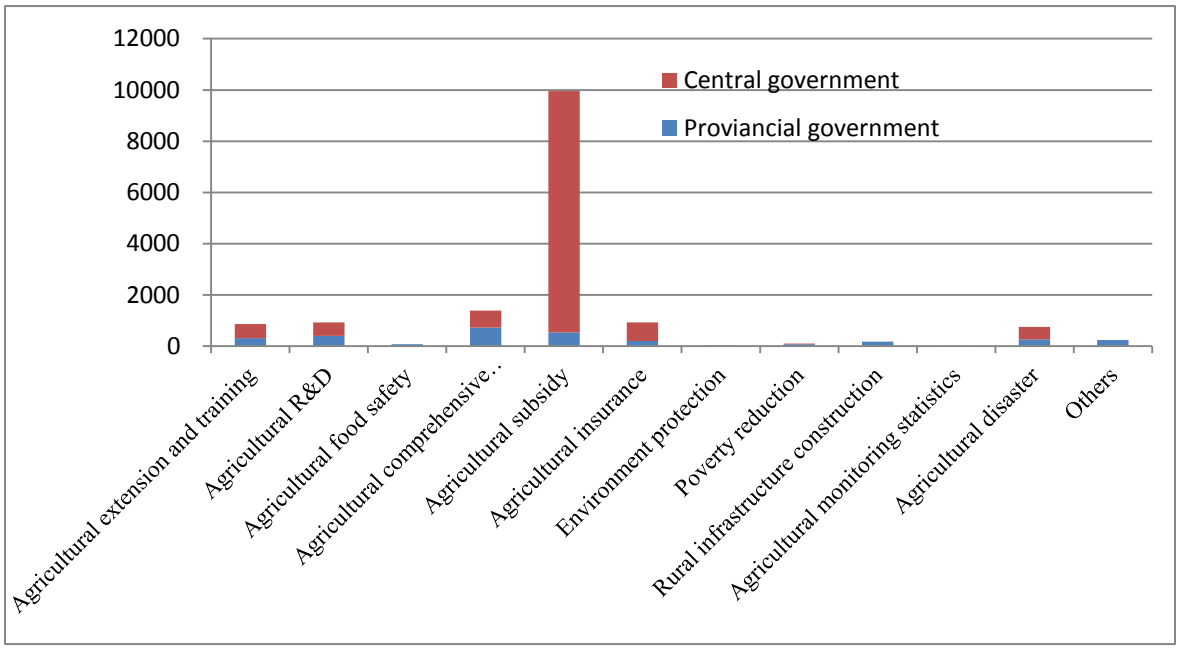
Figure 16. Average share of public expenditure in agriculture in total public expenditure, percent



Note: Data of 1978-2006 are expenditure in agriculture, and data of 2007-2011 are expenditure in agriculture, forestry and water conservancy.

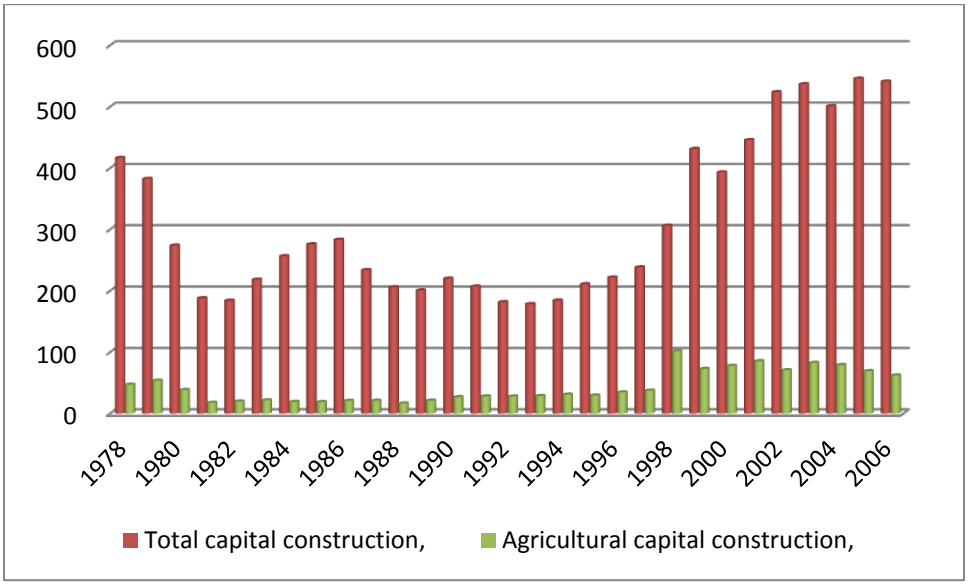
Source: China statistical yearbook (various years).

Figure 17. The accumulative public investment inagriculture from central and provincial government in Yunnan province during 2008-2010, million Yuan at 2010 constant prices



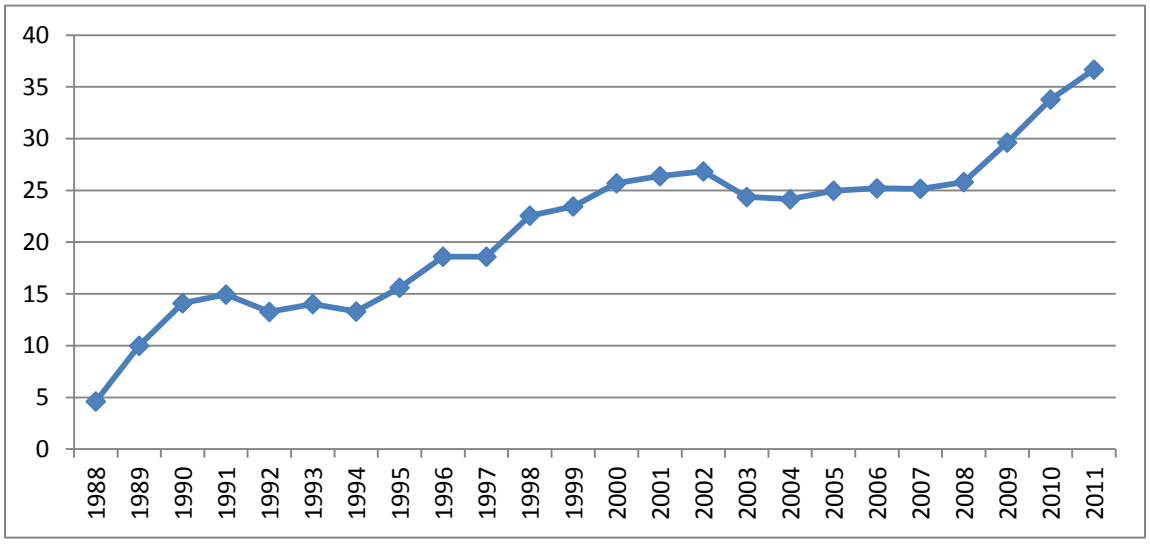
Source: Yunnan survey data.

Figure18.Public expenditure in capital construction, billion Yuan at 2010 constant price



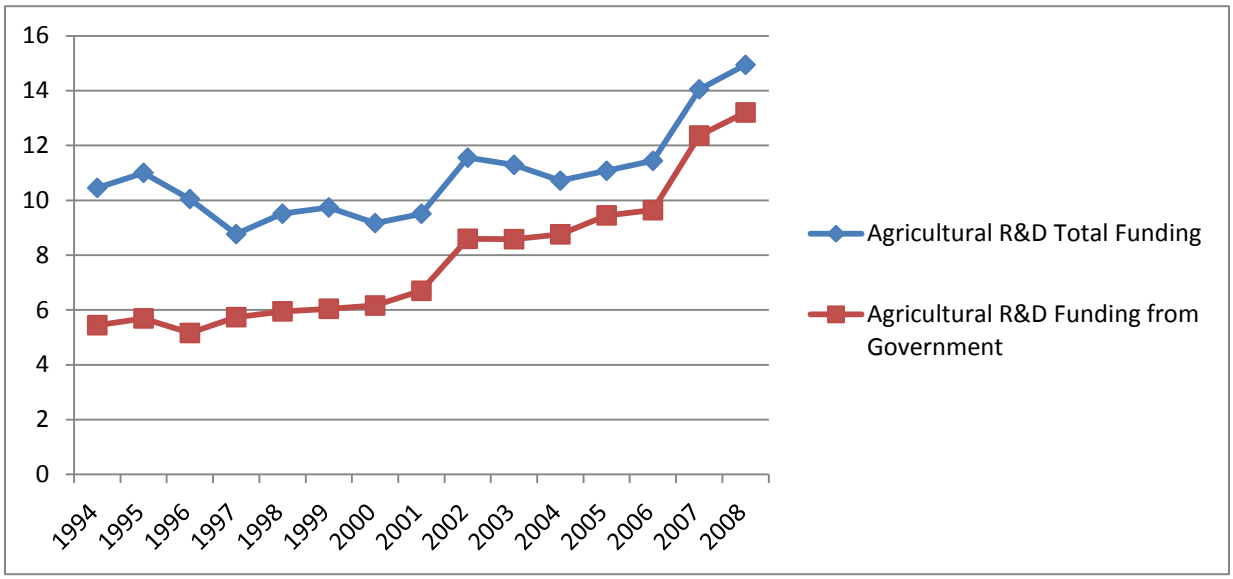
Source: China Statistical Yearbook (various years).

Figure 19. Expenditure for comprehensive agricultural development, billion Yuan at 2010 constant prices



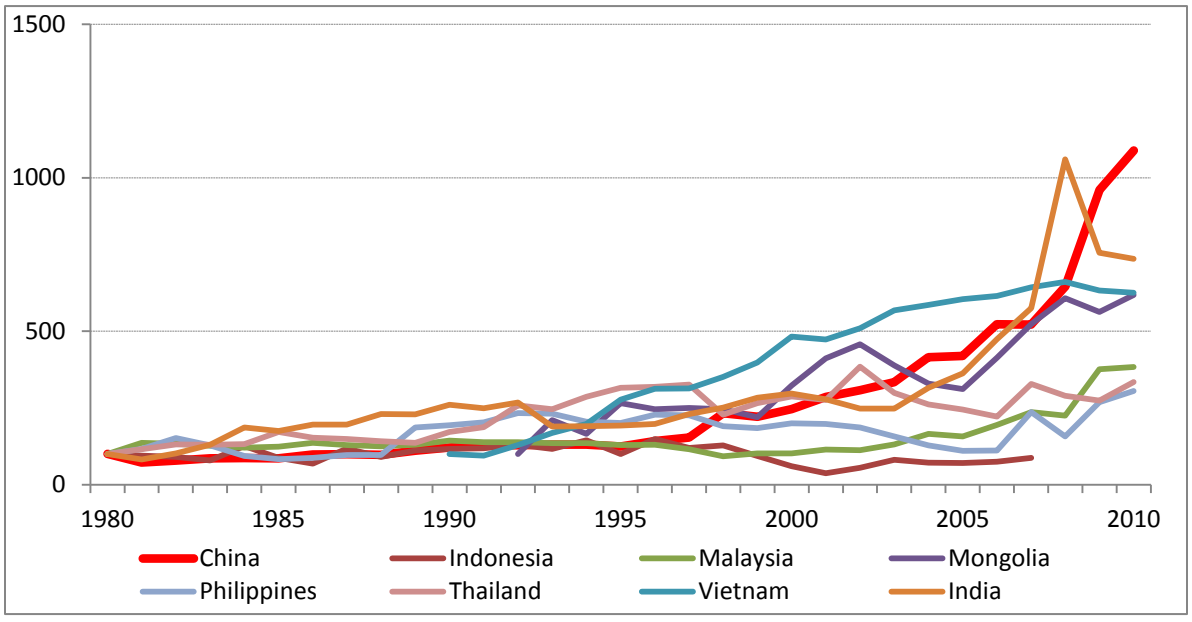
Source: China Comprehensive Agricultural Development Yearbook (2011).

Figure20.Agricultural R&D Funding, billion Yuanat 2010 constant price



Source: China Statistical Yearbook on Science and Technology(various year)

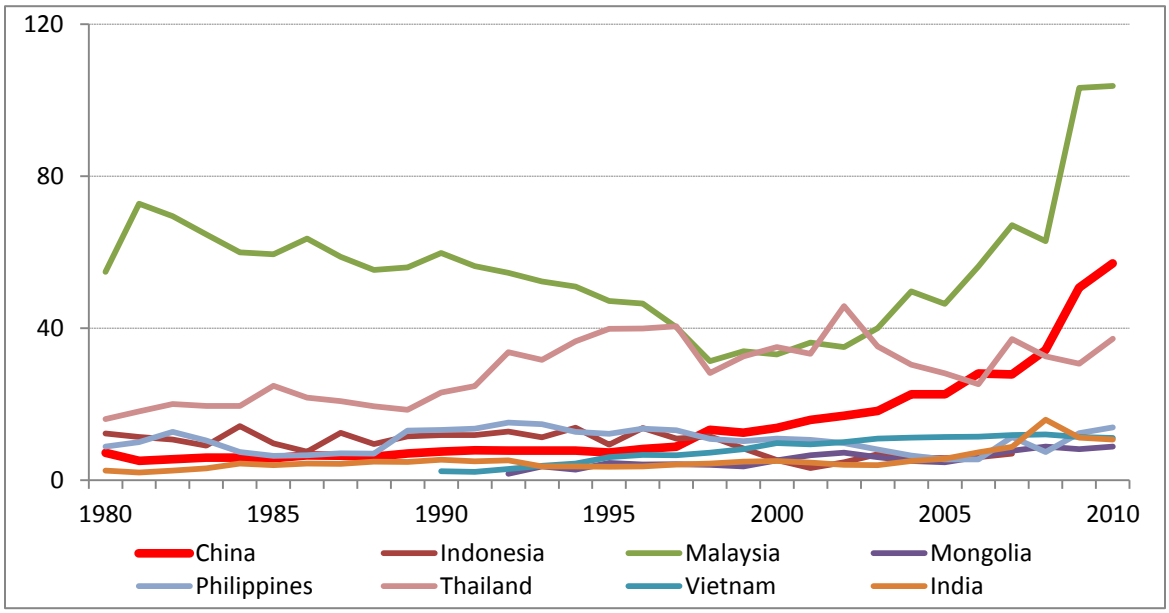
Figure 21. The level of agricultural spending in Asia, 1980=100



Note: Definition of agricultural spending follows COFOG definition in other countries (UN 2013), and agricultural spending in China is defined as expenditure in agriculture 1978-2006 and expenditure in agriculture, forestry and water conservancy in 2007-2010.

Source: IFPRI (2013).

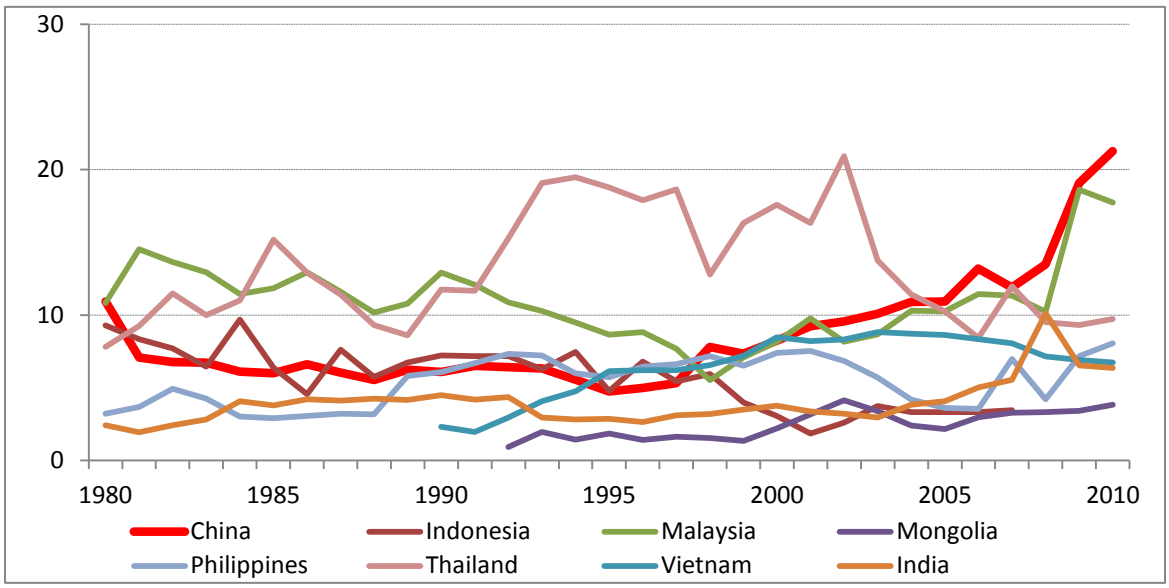
Figure 22. Per capita agricultural spending in Asia, 2005 constant US$



Note: Definition of agricultural spending follows COFOG definition in other countries (UN 2013), and agricultural spending in China is defined as expenditure in agriculture 1978-2006 and expenditure in agriculture, forestry and water conservancy in 2007-2010.

Source: IFPRI (2013).

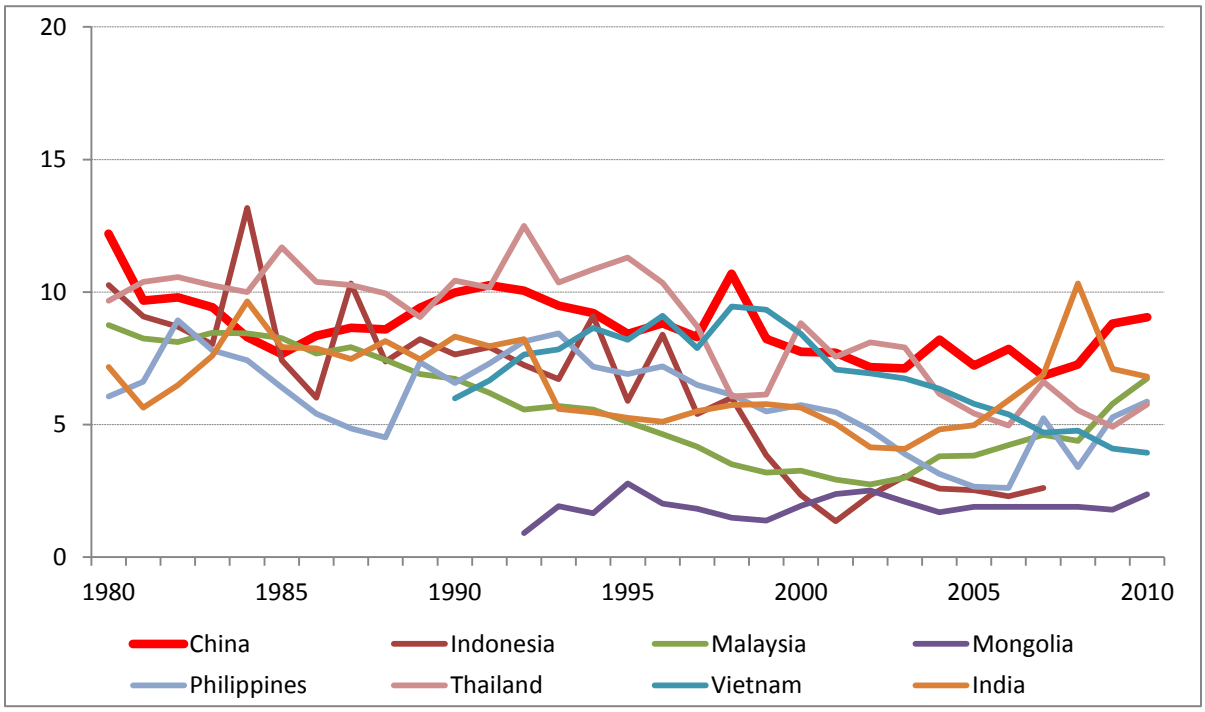
Figure 23. Ratio of agricultural spending to agricultural GDP in Asia, percent



Note: Definition of agricultural spending follows COFOG definition in other countries (UN 2013), and agricultural spending in China is defined as expenditure in agriculture 1978-2006 and expenditure in agriculture, forestry and water conservancy in 2007-2010.

Source: IFPRI (2013).

Figure 24. Share of agriculture in total expenditure in Asia, percent



Note: Definition of agricultural spending follows COFOG definition in other countries (UN 2013), and agricultural spending in China is defined as expenditure in agriculture 1978-2006 and expenditure in agriculture, forestry and water conservancy in 2007-2010.

Source: IFPRI (2013).

Tables

Table 1. Transformation in Chinese economy

	1980	1990	2000	2010	2011	Annual growth rate (%)
GDP (2005 PPP)	183	445	1, 199	3, 246	3, 548	10.0
GDP per capita (2005 PPP)	524	1, 101	2, 668	6, 819	7, 418	8.9
Urbanization (%)	19.4	26.4	35.9	49.2	50.5	3.2
Life expectancy (years)	67.0	69.5	71.2	73.3	73.5	3.2
Agriculture in GDP (%)	30.2	27.1	15.1	10.1	10.0	-3.5
Agriculture in labor force (%)	67.1	60.2	50.0	36.7	34.8	-2.1
Agriculture exports(Bill. $)	4.4	10.1	16.4	51.6	64.6	9.1
Food exports(Bill. $)	3.1	7.9	13.6	44.2	54.2	9.6
Agriculture in export (%)	24.2	16.2	6.6	3.3	3.4	-6.1
Agriculture imports(Bill. $)	6.5	7.9	19.5	108.3	144.7	10.5
Food imports(Bill. $)	3.2	4.6	9.0	59.6	75.5	10.7
Agriculture in imports(%)	32.5	14.7	8.7	7.8	8.3	-4.3

Source: World Bank (2013a) and World Trade Organization (2013).

Table 2. The Role of agriculture in national economy, percent

Year	Agriculture in GDP	Agriculture in employment	Rural consumption in retail	Agriculture in revenue	Agriculture in government expenditure	Agriculture in bank loans	Agriculture in import	Agriculture in export
1983	33.9	67.1	51.4	4.2			26.6	22.3
1984	33.1	64.2	52.5	3.7			18.5	22.6
1985	29.8	62.4	53.0	2.1	8.3		12.1	24.5
1986	28.5	41.5	52.1	2.1	7.9		12.0	24.5
1987	28.3	60.0	51.7	2.4	8.0		14.8	22.0
1988	27.2	59.5	50.8	3.1	7.9		16.8	22.0
1989	26.4	60.1	50.0	3.1	9.4		17.1	20.5
1990	28.4	60.2	48.5	3.0	10.0	6.8	16.1	17.2
1991	26.2	60.0	47.0	2.9	10.3	6.7	13.7	15.8
1992	23.6	58.6	45.5	3.4	10.1	6.7	12.0	14.5
1993	21.5	56.0	44.6	2.9	9.5	6.5	8.1	13.7
1994	21.6	53.3	43.9	4.4	9.2	4.9	10.8	12.9
1995	20.8	52.2	43.2	4.5	8.4	3.1	9.3	9.4
1996	20.4	50.5	43.2	5.0	8.8	3.1	7.1	8.4
1997	18.3	49.9	43.4	4.6	8.3	4.4	7.0	8.2
1998	18.0	49.8	38.9	4.0	10.7	5.1	7.0	7.5
1999	17.6	50.1	38.7	3.7	8.2	5.1	5.0	6.9
2000	16.4	50.0	38.2	3.5	7.8	4.9	5.0	6.3
2001	15.8	50.0	37.4	2.9	7.7	5.1	4.9	6.0
2002	15.3	50.0	36.7	3.8	7.2	5.2	4.2	5.6
2003	14.6	49.1	35.0	4.0	7.1	5.3	4.6	4.9
2004	15.2	46.9	34.1	3.4	7.5	5.5	5.0	3.9
2005	12.5	44.7	32.8	3.0	7.2	5.9	4.3	3.6
2006	11.8	42.6	32.5	3.1	6.5	5.9	4.0	3.2
2007	10.8	40.8	32.3	3.2	6.8	5.9	4.3	3.0
2008	10.7	39.6	30.3	3.1	7.2	5.9	5.1	2.8
2009	10.3	38.1	32.8	4.1	8.7	5.8	5.2	3.3
2010	10.1	36.7	31.9	4.1	9.0	5.4	5.2	3.1
2011	10.0	34.8	31.8	3.8	9.1	5.4	5.4	3.2
2012	10.1	33.6	31.9	3.8	9.6	5.7	6.1	3.0
Annual growth rate (%)	-4.4	-1.9	-2.1	0.8	-0.5	0.3	-5.1	-8.3

Source: Data of 1983-2011 are from China Agricultural Development Report (MOA various years), data of 2012 from China Statistical Abstract (2013) and data ofagriculture in bank loans come from China Financial Institution Loans Report of 2012(The People's Bank of China, 2013).

Table 3. Agricultural production, millions tons

Year	Rice	Wheat	Maize	Soybean	Fruit	Meat	Poultry	Aquatic products
1983	1689	814	682	98	95	140		55
1984	1783	878	734	97	99	154	15	62
1985	1686	858	638	105	116	177	16	71
1986	1722	900	709	116	135	193	19	82
1987	1743	859	792	125	167	200	22	96
1988	1691	854	774	117	167	221	27	106
1989	1801	908	789	102	183	235	28	115
1990	1893	982	968	110	187	253	32	124
1991	1838	960	988	97	218	275	40	135
1992	1862	1016	954	103	244	298	45	156
1993	1777	1064	1027	153	301	357	27	182
1994	1759	993	993	160	350	374	76	214
1995	1852	1022	1120	135	422	433	94	252
1996	1951	1106	1275	132	465	375	83	281
1997	2007	1233	1043	147	509	429	98	360
1998	1987	1097	1330	152	545	467	106	391
1999	1985	1139	1281	143	624	483	112	412
2000	1879	996	1060	154	623	492	121	428
2001	1776	939	1141	154	666	512	121	437
2002	1745	903	1213	165	1438	534	125	457
2003	1607	865	1158	154	1452	562	131	471
2004	1791	920	1303	174	1534	589	135	490
2005	1806	975	1394	164	1612	628	146	511
2006	1826	1045	1455	160	1724	655	151	529
2007	1860	1093	1523	145	1814	687	145	475
2008	1919	1125	1659	165	1922	728	153	490
2009	1951	1151	1640	150	2040	765	160	512
2010	1958	1152	1773	151	2140	793	166	537
2011	2010	1174	1928	145	2277	797	171	560
2012	2042	1210	2056	128	2406	839	182	591
Annual growth rate (%)	0.4	0.9	3.5	1.6	12.9	6.2	9.6	8.8

Source: Authors' compilation from China Agricultural Development Report (MOA various years), China Agricultural Statistical Year Book (2013) and China Statistical Abstract (2013).

Table 4.Agricultural output and inputs index, 1988=100

Year	Output	Sown area	Labor	Machinery	Fertilizer	Irrigation
1988	100.0	100.0	100.0	100.0	100.0	100.0
1989	103.4	101.9	103.0	105.6	110.1	101.2
1990	113.2	103.0	120.7	108.0	121.0	106.8
1991	110.5	102.0	121.2	110.6	131.0	107.8
1992	112.3	100.4	120.0	114.0	136.8	109.5
1993	115.8	100.4	116.8	119.7	147.2	109.8
1994	112.9	99.5	113.6	127.2	154.9	109.9
1995	118.4	99.9	110.2	135.9	167.8	111.1
1996	128.0	102.2	108.0	145.0	178.7	113.5
1997	125.4	102.5	108.0	158.1	185.9	115.5
1998	130.0	103.3	109.1	170.1	190.7	117.8
1999	129.0	102.8	110.9	184.4	192.6	119.8
2000	117.3	98.5	111.8	197.8	193.6	121.3
2001	114.9	96.3	112.9	207.6	198.6	122.2
2002	116.0	94.3	113.6	218.0	202.6	122.5
2003	109.3	90.3	112.3	227.2	206.0	121.7
2004	119.1	92.3	108.0	240.9	216.5	122.8
2005	122.8	94.7	103.7	257.4	222.6	124.0
2006	126.4	95.3	99.0	272.9	230.1	125.6
2007	127.3	95.9	95.3	288.2	238.5	127.4
2008	134.2	97.0	92.8	309.3	244.6	131.8
2009	134.7	99.0	89.6	329.2	252.4	133.5
2010	138.7	99.8	86.6	349.1	259.7	136.0
2011	144.9	100.4	82.5	367.8	266.4	139.0
Annual growth rate (%)	1.0	-0.3	-1.1	6.1	3.9	1.3

Source: Authors' compilation from China Statistics Yearbook (various years).

Table 5. The share of disaster covered and affected area and ratio of grain yield reduction in China, percent

Year	Covered area	Drought	Flood	Others	Affected area	Drought	Flood	Others	Output reduction	Drought	Flood	Others
1981	27.4	17.7	5.9	3.8	12.9	8.4	2.7	1.8	11.3	7.3	2.4	1.6
1982	22.9	14.3	5.8	2.8	11.1	6.9	3.0	1.2	9.6	6.0	2.5	1.1
1983	24.1	11.2	8.4	4.5	11.3	5.3	4.0	2.0	9.9	4.6	3.5	1.8
1984	22.1	11.0	7.4	3.8	10.8	4.9	3.7	2.2	9.3	4.4	3.1	1.8
1985	30.9	16.0	9.9	5.0	15.8	7.0	6.2	2.6	13.3	6.4	4.8	2.2
1986	32.7	21.5	6.3	4.8	16.4	10.2	3.9	2.3	13.9	8.9	3.0	2.0
1987	29.0	17.2	6.0	5.9	14.1	9.0	2.8	2.2	12.1	7.5	2.5	2.2
1988	35.1	22.7	8.2	4.2	16.9	10.6	4.2	2.1	14.6	9.3	3.5	1.8
1989	32.1	20.0	7.7	4.3	16.7	10.4	4.0	2.2	13.9	8.7	3.3	1.9
1990	25.9	12.3	8.0	5.7	12.0	5.3	3.8	3.0	10.6	4.8	3.3	2.5
1991	37.1	16.7	16.4	4.0	18.6	7.1	9.8	1.8	15.8	6.5	7.7	1.6
1992	34.4	22.1	6.3	6.0	17.4	11.4	3.0	2.9	14.7	9.6	2.6	2.5
1993	33.0	14.3	11.1	7.7	15.7	5.9	5.8	4.0	13.7	5.5	4.8	3.3
1994	37.1	20.5	11.7	4.9	21.2	11.5	7.2	2.4	17.0	9.3	5.6	2.1
1995	30.6	15.6	8.5	6.4	14.9	6.9	5.1	2.8	12.8	6.3	4.0	2.6
1996	30.8	13.2	11.9	5.7	13.9	4.1	7.1	2.7	12.4	4.5	5.6	2.4
1997	34.7	21.8	7.4	5.5	19.7	13	3.8	2.9	15.8	10.2	3.2	2.4
1998	32.2	9.1	14.3	8.7	16.2	3.2	8.9	4.1	13.7	3.3	6.9	3.6
1999	32.0	19.3	5.8	6.9	17.1	10.6	3.2	3.2	14.1	8.6	2.6	2.8
2000	35.0	25.9	4.7	4.4	22.0	17.1	2.8	2.1	16.9	12.9	2.2	1.8
2001	33.5	24.7	3.9	4.9	20.4	15.2	2.3	2.9	15.9	11.8	1.8	2.3
2002	30.4	14.3	7.9	8.1	17.6	8.5	4.8	4.3	14.0	6.7	3.7	3.5
2003	35.8	16.3	12.6	6.9	21.3	9.5	8.1	3.8	16.8	7.5	6.2	3.1
2004	24.2	11.2	4.8	8.2	10.6	5.5	2.4	2.6	9.6	4.7	2.0	2.8
2005	25.0	10.3	7.0	7.6	12.8	5.5	3.9	3.5	10.8	4.5	3.2	3.1
2006	27.0	13.6	5.3	8.1	16.2	8.8	3.0	4.4	12.7	6.7	2.4	3.6
2007	31.9	19.1	6.8	6.0	16.3	10.5	3.3	2.5	13.7	8.6	2.8	2.3
2008	25.6	7.8	4.1	13.7	14.3	4.4	2.3	7.6	11.5	3.5	1.9	6.1

2009	29.8	18.4	5.5	5.8	13.4	8.3	2.4	2.7	12.0	7.4	2.2	2.4
2010	23.3	8.3	10.9	4.1	11.5	5.6	4.4	1.6	9.9	4.2	4.2	1.5
Average	30.2	16.2	8.0	6.0	15.7	8.4	4.4	2.9	13.1	7.0	3.6	2.5

Source: China Agricultural Development Report (MOA various years).

Table 6. Annual Per Capita Food Consumption, kg per capita

	Grain		Vegetables		Edible oil		Meat		Poultry		Aquatic products	
Year	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
1983	260	145	131	165	3.5	6.5	10.0	19.9	0.8	2.6	1.6	8.1
1984	267	142	140	149	4.0	7.1	10.6	19.9	0.9	2.9	1.7	7.8
1985	257	135	131	144	4.0	5.8	11.0	18.7	1.0	3.2	1.6	7.1
1986	259	138	134	148	4.2	6.2	11.8	21.6	1.1	3.7	1.9	8.2
1987	259	134	130	143	4.7	6.4	11.7	21.9	1.2	3.4	2.0	7.9
1988	260	137	130	147	4.8	6.7	10.7	19.8	1.3	4.0	1.9	7.1
1989	262	134	133	145	4.8	6.2	11.0	20.3	1.3	3.7	2.1	7.6
1990	262	131	134	139	5.2	6.4	11.3	21.7	1.3	3.4	2.1	7.7
1991	256	128	127	132	5.7	6.9	12.2	22.2	1.3	4.4	2.2	8.0
1992	251	112	129	125	5.9	6.7	11.8	21.4	1.5	5.1	2.3	8.2
1993	252	98	107	121	5.7	7.1	11.7	20.8	1.6	3.7	2.5	8.0
1994	258	102	109	121	5.7	7.7	11.0	20.2	1.6	4.1	3.0	8.5
1995	260	97	105	119	5.8	7.6	11.3	19.7	1.8	4.0	3.4	9.2
1996	256	95	106	119	6.1	7.7	11.9	20.4	1.9	5.4	3.7	9.3
1997	251	89	107	115	6.2	7.7	12.7	19.0	2.4	6.5	3.4	9.3
1998	250	87	109	114	6.2	7.6	13.2	19.2	2.2	6.3	3.6	9.8
1999	248	85	109	115	6.2	7.8	13.9	20.0	2.5	4.9	3.8	10.3
2000	250	82	112	115	7.1	8.2	14.6	20.1	2.9	7.4	3.9	11.7
2001	239	80	109	116	7.0	8.1	14.5	19.2	2.9	7.3	4.1	12.3
2002	237	79	110	117	7.5	8.5	14.9	23.3	2.9	9.2	4.4	13.2
2003	222	80	107	118	6.3	9.2	15.0	23.7	3.2	9.2	4.7	13.4
2004	219	78	107	122	5.3	9.3	14.8	22.9	3.1	8.4	4.5	12.5
2005	209	77	102	119	6.0	9.3	17.1	23.9	3.7	9.0	4.9	12.6
2006	206	76	101	118	5.8	9.4	17.0	23.8	3.5	8.3	5.0	13.0
2007	200	78	99	118	6.0	9.6	14.9	22.1	3.9	9.7	5.4	14.2

2008	199	59	100	123	6.2	10.3	13.9	22.7	4.4	8.0	5.2	11.9
2009	189	81	98	123	6.3	9.7	15.3	24.2	4.3	10.5	5.3	15.5
2010	181	82	93	116	6.3	8.8	15.8	24.5	4.2	10.2	5.2	15.2
2011	171	81	89	115	7.5	9.3	16.3	24.6	4.5	10.6	5.4	14.6
2012	164	79	85	112	7.8	9.1	16.4	24.9	4.5	10.8	5.4	15.2
Annual growth rate (%)	-1.4	-2.6	-1.4	-1.0	1.8	1.7	1.7	0.7	6.3	5.1	4.8	2.9

Source: Authors' compilation from China Agricultural Development Report (MOA various years) and China Statistical Abstract (2013).

Table 7 Summary of interviews with key policymakers and researchers, July 2013

Respondent	The most important challenge of Chinese agriculture in the next 10-15 years	The most important issue in Chinese agricultural spending in the next 10-15 years	The most important public agricultural expenditure policy recommended to ensure Chinese agricultural development in the next 10-15 years
1	Rapidly rising wage and labor shortage	Structure of agricultural spending not efficient or effective	Provide financial support to farming whenever possible fiscally
2	Increase scale of farm and production service provision	Ensure farmers receive more support	Transparency in government spending and integration
3	Structure of agricultural spending not efficient or effective	Low efficiency from lack of coordination	Institutions: land, house registration, employment, health, education etc.
4	Labor transition and rural labor training	Structure of agricultural spending not efficient or effective	Institution reform to better incentives
5	Cereal imports	Structure, performance and efficiency	Comprehensive institution reform
6	Producing safe food under increasing environmental pressure	Integrating to increase fund use efficiency	Clarification of responsibilities among central and local governments
7	Sustainability	Targeting right recipient for right policy goal	Introducing fiscal policy system that has consistent policy goal and instruments
8	Small size of operation	Unclear policy goal with inappropriate design	Provide agricultural input service sectors
9	Labor saving and agricultural mechanization	Lack of public spending to provide research supportand public extension service for agricultural mechanization	Introducing fiscal policy system that has consistent policy goal and instruments
10	Adequate food supply	Problematic incentive for officials	Including agriculture in the performance scorecard of officials
11	Increasing demand and limited supplying capacity	Too much spending in agricultural production causing environmental degradation	Continuous increase of agricultural capital expenditure
12	Balance between providing food and other ecosystem services such as clean water, clean air and biodiversity	The deteriorating agricultural extension service	Increase investmentin agricultural R&D and extension

13	Food safety	Efficiency and priorities	Increase support to public goods like roads, R&D, farmers' education and environment protection
14	Low farmer income	Not line up with the WTO agricultural support measures	Increase targeted support to specific crop through expanding amber box
15	Government's excessive administrative measures to stimulate output and control prices.	The current "grain output responsibility system" by local officials which have created huge inefficiency	Abolish the policy mentioned in column 2 and rely more on markets.
16	To meet increasing meat and food demand	Low efficiency	Increase productivity enhancing expenditure
17	To increase migration in which % of agriculture in GDP is similar to % of agricultural labor in total employment	Increase % of expenditure on rural public services	Make distinction on the policies to benefit farmers and these to increase agricultural output
18	To meet food demand and increase farmers' income	Consistency with broad policy objectives	Increase expenditures on improving environment
19	Resource limits such as land and water	Improve targeting and consistent with priorities	Increase expenditures on irrigation and agricultural insurance
20	To meet increasing food demand	Improving structure and efficiency	To adjust to fit with national priorities

Source: Authors' compilation.

Table 8. Rank of the impact of public spending on economic growth

	Easterly and Rebelow(1993)	Milbourne, Otto and Voss (2003)	Mosley, Hudson and Verschoor(2004)	Mogues (2011)
Education	1	1	1	2
Housing and urban infrastructure	2		2	
Transport and communication	3	2		1
Industry and mining	4			
Agriculture	5	3	3	3
Health	6			
Methodology	Pooled regression with decade average	Extension of augmented Solow-Swan growth model	Pro-poor (public) expenditure index	Multistage analysis

Source: Authors' compilation.

Table 9. Rank of the impact of public spending on agriculture

	China	India	Thailand	Uganda	Indonesia
R&D	1	1	1	1	1
Education	2	3	3	3	
Roads	3	2		2	
Telecommunication	4				
Irrigation	5	4	4		2
Extension					3
Electricity	6	8	2		
Rural development		5			
Soil and water		6			
Health		7		4	

Source: Authors' compilation.

Table 10. Rank of the impact of public spending on poverty reduction

	China	India	Thailand	Uganda
Education	1	3	3	3
R&D	2	2	2	1
Roads	3	1	5	2
Telecommunication	4			
Electricity	5	8	1	
Rural development	6	4		
Irrigation	7	7	4	
Soil and water		5		
Health		6		4

Source: Authors' compilation.

Table 11. Rank of the impact of public spending in China

	Outcome	Education	Agriculture R&D	Rural infrastructure	Irrigation
Fan, Zhang and Zhang (2004)	Poverty reduction	1	2	3	4
	Agriculture	2	1	3	4
Wang and Zhang (2002)	Agriculture	2	1	3	4
Qian (2005)	Agriculture	2	1	3	
Xu et al. (2011)	GDP		1		2
	Grain output		1		2
Jiang (2012)	Agriculture	1	3	2	4
Wu and Fang (2012)	Agriculture	3	1	2	
Yu and Fan (2012)	Agriculture				

Source: Authors' compilation.

Table 12 Contents of No. 1Policy Document

Year	Theme
2004	Boost farmers' income
2005	Strengthen rural work and improve agricultural production capacity
2006	Construct a New Socialist Countryside
2007	Develop modern agriculture and promote the construction of a New Socialist Countryside
2008	Fortify the foundation of agriculture
2009	Achieve steady agricultural development and sustained income increases for farmers
2010	Speed up coordinated development between urban and rural areas and further cement foundation of agricultural and rural area development
2011	Accelerate development of water conservancy
2012	Invest in agricultural science and technology for sustained agricultural growth
2013	Accelerate agriculture modernization and strengthen the vitality of rural areas

Source: Xinhua News Agency (2013).

Table 13. Major ministries and departments related to central "San Nong" expenditure

Ministry	Key Departments	Responsibility
Ministry of Finance	Dept. of Agriculture	Manage and allocate funds for poverty alleviation and disaster relief
	State Office for Comprehensive Agricultural Development	Organize and implement agriculture integrated development and manage expenditures for integrated development
National Development and Reform Commission	Dept. of Regional Economy	Balance regional development; establish development planning for old revolutionary, less developed, border, and poverty areas; work for food planning
	Dept. of Rural Economy	Important problems with agriculture and rural development; balance agriculture, forestry, irrigation, and meteorology planning and development
Ministry of Agriculture		Agriculture and rural development
Ministry of Water Resources	Dept. of Rural Irrigation	Organize and implement policies related to rural irrigation; construct a rural irrigation infrastructure and service network; water supply and conservation in rural areas
	Dept. of Water and Soil Conservation	Organize and supervise policies related to environmental protection of nature; implement integrated development of the natural environment
Ministry of Science and Technology	Dept. of Rural and Social Development	Organize and implement technology planning and policies related to agriculture and rural development
Ministry of Education	Dept. of Basic Education	Organize and implement 9-years of compulsory education; reduce illiteracy and semi-illiteracy
Ministry of Health	Dept. of Grassroots Health and Maternal and Infant Health	Organize and implement policies related to rural health
Ministry of Civil Affairs	Dept. of Social Welfare	Organize and implement policies related to the elderly, handicapped, orphans, 5 guarantees, and other low income groups
	Dept. of Relief	Manage and distribute materials and capital for natural disasters; implement dibao and tekun institutions
Ministry of Human Resources and Social Security	Dept. of Rural Social Security	Rural social security
	Dept. of Disaster Relief	Rural disaster relief
Ministry of Housing and Urban-Rural Development	Leading Group of Between County and Rural Roads	Standardize and rebuild roads between counties and rural areas

	Dept. of Rural and Urban Planning	Organize and establish policies related to rural construction
Ministry of Transport	Leading Group of County and Rural Road	Design and upgrade county and rural road
Ministry of Commerce		Promotion of rural consumption
Ministry of Environmental Protection		Natural resource conservation
Ministry of Land and Resources		Monitor and protection of land use
State Forestry Administration		Manage and planning of forestry
State Council Leading Group Office of Poverty Alleviation and Development		Design and coordination of economic development strategy in poor areas
National Population and Family Planning Commission		Health and family planning
China Meteorological Administration		Weather forecast, coordinate coping with weather event

Note: Ministry of Health and National Health and Family Planning Commission were merged in 2013 to form National Health and Family Planning Commission.

Source: Authors' compilation.

Table14.Components of different definitions of public expenditure in agriculture

Item	Government expenditure that supports rural production and the department operating fees related to agriculture, forestry, water and meteorology	Expenditure in agriculture	Expenditure in agriculture, forestry and water conservancy	"San Nong" expenditure
Agriculture	√	√	√	√
Forestry	√	√	√	√
Water conservancy	?	?	√	?
(1) Irrigation	√	√	√	√
(2) Rural people and animal drinking water	√	√	√	√
(3) Soil and water conservation	?	?	√	?
(4) Water monitoring	?	?	√	?
(5) Other expenditure for water conservancy*	?	?	√	?
South-to-north water diversion			√	?
Integrated agricultural development	√	√	√	√
Rural integrated reforms			√	√
Poverty reduction	√	√	√	√
Other expenditures in agriculture, forestry, water conservancy	?	?	√	√
Meteorology	√	√		?
Costs and interests of agricultural products storage				√
Rural social development				√
Agricultural capital construction	√	√		?
Agricultural Science And Technology Promotion Funds	√	√		√

Agricultural R&D				√
Natural ecology protection	√	√		√
Natural forest protection	√	√		√
Green for grain	√	√		√
Green for grass	√	√		√
Subsidies for agricultural tax				√
Agricultural capital construction		√	√	√
Agricultural science and technology funds			√	√
Rural relief funds			√	√
Others	?	?		?

Source: Authors' compilation.

Note: √indicates that the item is included in the definition, a blank cell indicates that the item is excluded from the definition, and ?indicates that it is not clear whether or not the item is not included.

*: other expenditure for water conservancy includes many items, such as administration fees, hydraulic engineering construction, operation and maintenance cost of water project, river basin management in the Yellow and Yangtze River basins, prophase work of water conservancy, water conservancy law enforcement and supervision, water resources management and protection, hydrologic forecasting, flood control, droughtresistance, promotion and training of hydrological technology, transaction costs of three gorges project construction, special fund for providing continuing aid to residents relocated to make way for the construction of large and medium-sized reservoirs, transaction costs of three gorges project construction, transaction costs of three gorges project construction, information management,immigration spending of the water conservancy construction, other water conservancy expenses.

Table 15.Data source, available year and definition of government expenditure in agriculture

source code	Data source	Available year	Definition	Note
A	Government expenditure budget tables	2003-2006	Government expenditure that supports rural production and the department operating fees related to agriculture, forestry, water and meteorology	Simple information
		after 2007	government expenditure in agriculture, forestry and water conservancy	Detailed information after 2008
B	China Financial Statistical Yearbook	1992-2006	Government expenditure that supports rural production and the department operating fees related to agriculture, forestry, water and meteorology	Similar with source A
		after 2007	government expenditure in agriculture, forestry and water conservancy	Similar with source A
C	China Statistical Yearbook	1949-2006	government expenditure in agriculture	Similar with source A, but with more specific items
		after 2007	agriculture, forestry and water conservancy	Similar with source A, but lack detail information
D	China Rural Statistical Yearbook	after 2007	“San Nong” expenditure	only central government expenditure
E	The Basic Situation of China's Finance	after 2009	“San Nong” expenditure	Expenditure at national, central and local government level

Source: Authors’ compilation.

Table 16.National government expenditure for “SanNong”, billion Yuan at 2010 constant price

Year	Total government expenditure	Government expenditure for “San Nong”	Local government expenditure for “San Nong”	Central government expenditure for “San Nong”	The share of expenditure for “San Nong” in total government expenditure	The local government share of “San Nong” expenditure(%)	The central government share of “San Nong” expenditure(%)
2008	6421	1604	993	611	25	61.91	38.09
2009	7882	2070	1321	749	26.3	63.81	36.19
2010	8987	2421	1563	858	26.9	64.57	35.43
2011	10365	2820	1824	996	27.2	64.69	35.31
			Average annual growth rate (%)		Average share(%)		
	17.31	20.71	22.49	17.70	26.49	63.95	36.05

Source: The basic situation of China's finance(2008-2011).

Table17.Central and local government expenditure, billion Yuanat 2010 constant price

Year	Central government total	Central government direct expenditure	Central Transfer payment to Local	Local government total	Local government direct	The share of transfer payment in central government	The share of transfer payment in local government
			Total	expenditure			
2008	3630.8	1369.1	2261.6	5051.8	2790.1	62.29	44.77
2009	4526.6	1575.9	2950.6	6305.9	3355.2	65.18	46.79
2010	4831.8	1598.7	3233.1	7388.4	4155.3	66.91	43.76
2011	5354.4	1566.8	3787.6	8798.3	5010.7	70.74	43.05
Agriculture, forestry and water conservancy							
2008	277.8	32.9	244.9	456.7	211.8	88.16	53.62
2009	361.7	32.9	328.8	661.3	332.5	90.90	49.71
2010	388.1	38.8	349.3	774.1	424.8	90.01	45.13
2011	454.0	39.5	414.5	903.3	488.8	91.29	45.88

Source: National public financial expenditure account table (MOF2008-2011).

Table 18. “San Nong” expenditure in Jiangsu province

Fund source	Province	Transfer	Total	Share of transfer	Share in total “Sannong”
	(Million Yuan)			(%)	(%)

Subsidies	182.0	6, 529.5	6, 711.5	97.3	42.0
Comprehensive agricultural development	1, 248.8	1, 023.3	2, 272.1	45.0	14.2
Infrastructure support	1, 120.0	413.0	1, 533.0	26.9	9.6
Irrigation	850.0	623.0	1, 473.0	42.3	9.2
Promotion of rural consumption	430.0	1, 276.5	1, 706.5	74.8	10.7
Sanitation and energy	668.0	424.1	1, 092.1	38.8	6.8
Poverty reduction	392.8	1.1	393.9	0.3	2.5
Training and coop support	301.6	5.2	306.8	1.7	1.9
Disaster relief	16.0	236.0	252.0	93.7	1.6
Family planning	226.0	1.3	227.3	0.6	1.4
Total	5, 435.2	10, 532.9	15, 968.2	66.0	100.0

Source: Finance Department of Jiangsu Government (2013).

Table19. Fund source and allocation in Jiangsu province

Fund source	Province	Transfer	Total	Share of transfer (%)
	(Million Yuan)			
Education	3247.7	1565.1	4812.7	32.5
Of which: rural education	1441.0	649.9	2090.9	31.1
Health	2777.0	1006.8	3783.8	26.6
Of which: NCMS	2127.0	763.8	2890.8	26.4
Social protection	3252.1	2961.9	6343.2	46.7
Of which: rural social protection	2171.7	1833.0	4004.7	45.8
Sannong	5435.2	10532.9	15968.2	66.0
Share of rural in expenditure (%)				
Education	44.4	41.5	43.4	
Health	76.6	75.9	76.4	
Social protection	66.8	61.9	63.1	

Source: Finance Department of Jiangsu Government (2013).

Table 20. Government expenditure for agriculture, forestry, water conservancy and meteorology and its composition, billion Yuan at 2010 constant price

Year	Total	Agriculture	Forestry	Water conservancy	South- to – North water project	Poverty reduction	Agricultural comprehensive development	Rural integrated reforms	Others
2008	454.40	227.89	42.40	112.27	-	32.04	25.16	-	14.65
2009	672.04	382.69	53.21	151.96	-	37.48	28.68	-	18.02
2010	812.96	394.94	66.73	185.65	7.84	42.35	33.78	60.79	20.88
2011	993.76	429.12	87.65	260.28	6.89	54.53	38.65	88.76	27.88
Average annual growth rate(%)	26.47	20.31	24.12	28.95	-16.62	16.33	12.43	38.53	20.74
Share in2011(%)	100.00	43.18	8.82	26.19	0.69	5.49	3.89	8.93	2.81

Source: The national public financial expenditure account table (2008-2011).

Table 21.Main agricultural productive expenditure items, billion Yuan at 2010 constant prices

Expenditure item	2009	2010	2011	Annual growth rate(%)
Agricultural subsidy	117.2	138.9	156.0	15.4
Agricultural environment protection	74.5	73.4	75.7	0.8
Countryside road construction	32.8	13.4	12.7	-37.7
Poverty reduction	38.7	42.3	51.7	15.6
Comprehensive agricultural development	29.6	33.8	36.7	11.3
Irrigation	23.0	30.7	43.7	37.9
Agricultural technology extension and training	19.7	28.4	28.4	20.0
The organization of agriculture and industrial management	11.4	12.4	10.6	-3.7
Pest control	11.3	11.3	11.5	0.8
Agricultural insurance subsidy	10.8	11.1	12.1	5.5
Rural public goods	9.6	13.2	18.9	40.7
Agricultural research	7.2	8.1	8.4	7.6
Agricultural product safety	3.5	4.0	3.8	4.4
Agricultural product processing and promotion	3.1	3.4	3.3	3.5
Disaster relief	1.4	4.7	5.2	90.0
Total	394.0	429.2	478.6	10.2

Source: The national public financial expenditure account table(MOF 2008-2011), agricultural research data is fromChina Statistics of Science and Technology(2010-2012).

Table 22. Agricultural subsidies during 2004-2011, billion Yuan at 2010 constant prices

Year	Direct support payment	General subsidies for purchasing agricultural supplies	Seed subsidy	Machinery subsidy	Total
2004	16.9	0.0	4.2	0.1	21.2
2005	17.8	0.0	5.1	0.4	23.3
2006	17.5	14.8	5.0	0.7	38.0
2007	16.9	30.9	6.2	1.3	55.3
2008	15.4	73.4	12.7	5.7	107.2
2009	19.6	78.1	20.5	13.4	131.7
2010	15.1	83.5	20.4	15.5	134.5
2011	14.3	81.6	20.9	16.6	133.4
Annual growth rate(%)	-2.3	40.7	25.9	107.0	30.1
Share in total subsidy in 2011(%)	10.7	61.2	15.7	12.5	100.0

Source: MOA (various years).

Table 23.National water conservancy and irrigation investment, billion Yuan at 2010 prices

Year	Water conservancy investment	Irrigation Investment	Share of irrigation in totalwater investment (%)	Increased new effective irrigation area (1000 km2)
1996	58.2	5.7	9.7	
1997	73.7	7.2	9.7	141.9
1998	103.2	13.1	12.7	
1999	101.7	5.7	5.6	
2000	111.6	10.1	9.0	126.9
2001	88.9	12.5	14.1	
2002	91.6	11.4	12.5	156.5
2003	79.9	16.4	20.5	147.0
2004	95.7	12.8	13.3	252.1
2005	78.5	14.4	18.3	98.7
2006	81.7	13.5	16.5	139.5
2007	88.3	11.6	13.2	314.1
2008	93.9	12.0	12.7	275.4
2009	166.6	25.6	15.4	550.5
2010	186.1	33.4	18.0	355.6
	Annual growth rate (%)			
1996-2010	8.7	13.5		
2008-2010	40.8	67.2		

Source: China's Ministry of Water Resources (various years) andChina water statistical yearbook (various years).

Table 24. Government expenditure for agricultural environment protection, billion Yuan at 2010 constant prices

Year	Agricultural natural resource conservation and utilization	Natural ecology protection	Natural forest protection	Grain for green	Green for grass	Total
2009	4.8	5.5	8.3	45.3	3.8	67.7
2010	6.6	11	10.4	37.1	3.7	68.9
2011	15.5	12.9	14.2	29.3	1.9	73.8
Structure ratio(%)	12.78	14.02	15.67	53.08	4.46	100
Average annual growth rate(%)	79.23	52.64	30.63	-19.57	-28.56	4.4

Source: The national public financial expenditure account table(MOF 2009-2011).

Table 25. Expenditure for National Poverty Reduction and its composition, billion Yuan at 2010 constant prices

Expenditure item	2009	2010	2011	Annual growth rate (%)	Structure (%)
Poverty reduction total expenditure	38.71	42.35	51.73	15.6	100
Administration fees	1.45	1.63	1.92	9.77	3.7
Rural infrastructure construction	21.17	21.35	23	4.25	44.47
Production development	6.36	9.85	11.3	33.26	21.84
Social development	0.41	0.72	0.84	16.62	1.62
Interest subsidy for loans and reward for providing loans to poor people	0.86	1.06	1.12	14.32	2.17
Special grant For “sanxi” agricultural construction	0.34	0.35	0.3	-5.82	0.57
Other	8.14	7.39	13.25	27.59	25.62

Source: The national public financial expenditure account table (MOF2009-2011).

Appendix

Since 2007, the Chinese government adopted a new budget classification system in accordance with the Classification of the Functions of Government (COFOG) by the United Nations (2013). The government budget classification has three nested levels. Level 1 is the most aggregated and level 3 is the most detailed. Expenditures at level 3 are designed by function, activity, industry and objective.Central government expenditure is also reported in 3 levels, with about 20 categories at level 1 and level 3 as the most disaggregated data available on public expenditure. Categories of central government expenditure at level 1 are listed in Table 15, along with their corresponding classifications under the government's design and COFOG structure. Table1 demonstrates that the categories used in central government budget reporting do not conform to the budget classification systemdesigned by the government, nor the COFOG definition. In addition, the central government budget classification mixes functional classifications (either government's own or COFOG) at different levels. For example, the central government budget category of "land and meteorology" combines twodistinct functions ("land resource" and "meteorology")under "general public services",level 1 of the government's designed budget classification. But the COFOG system assigns the two items in two level one functional classifications: "general public services" and "economic affairs". Both items can be traced down to level 3 in COFOG.

Table2 reported selected sub-categories of central government spendingrelated to agriculture and rural development. Agriculture spending is defined as government expenditure in agriculture, forestry and water conservancy in the central government budget (definition 3). It includes eight level 2 sub-categories: agriculture, forestry, water conservancy, south-to-north water diversion, poverty reduction, comprehensive agricultural development, rural integrated reform and other agricultural expenditures. Each level 2 sub-category can be further broken down into level 3 items. For example, under the level 2 sub-category of "water conservancy", there are several level 3 items related to agricultural production and rural development: flood, drought, irrigation and rural drinking water.

Appendix Table1.Categories of central government budget and its corresponding government functional classificationsand COFOG after 2006

Central government budget category	Government expenditure classification		COFOG		
	Level 1	Level 2	Level 1	Level 2	Level 3
General public services	General public services		General public services		
Financial supervision	Industry, commerce and finance	Financial affairs	General public services	Executive and legislative organs, financial and fiscal affairs, external affairs	Financial and fiscal affairs
Land and meteorology	General public services	Land resource	General public services	General services	Other general services
	General public services	Meteorology	Economic affairs	General economic, commercial, and labor affairs	General economic and commercial affairs
Interest payment for domestic and foreign debts	General public services	Debt	General public services	Public debt transactions	Public debt transactions
Foreign affairs	Foreign affairs		General public services	Executive and legislative organs, financial and fiscal affairs, external affairs	External affairs
National defense	National defense		Defense		
Public security	Public security		Public order and safety		
Education	Education		Education		
Science and technology	Science and technology		General public services	Basic research	
			General public services	R&D general public services	
			Economic affairs	R&D economic affairs	

Culture, sport and media*	Culture, sport and media		Recreation, culture, and religion		
Social safety net and employment	Social safety net and employment		Social protection		
Social insurance fund	Social safety net and employment	Social insurance fund	Social protection		
Post-earthquake recovery and reconstruction	Social safety net and employment	Natural disaster assistance	Social protection	Social protection N.E.C.	
Medical and health care	Medical and health care		Health		
Environmental protection	Environmental protection		Environmental protection		
Urban and rural community affairs	Urban and rural community affairs		Housing and community amenities		
Housing security	Urban and rural community affairs	Urban and rural housing	Housing and community amenities	Housing development	
Agriculture, forestry and water conservancy	Agriculture, forestry and water conservancy		Economic affairs	Agriculture, forestry, fishing and hunting	
Transportation	Transportation		Economic affairs	Transport	
Exploration, power and information	Industry, commerce and finance		Economic affairs	Fuel and energy	
			Economic affairs	Mining, manufacturing and construction	
			Economic affairs	Communication	
			Economic affairs	Other industries	
Commerce and services	Industry, commerce and finance	Commerce	Economic affairs	Other industries	Distributive trades, storage, and warehousing

Grain and oil reserves	Industry, commerce and finance	Grain and oil reserves	Economic affairs	Agriculture, forestry, fishing and hunting	Agriculture
Reserve funds	Other expenses	Reserve funds	General public services	General public services N.E.C.	
Other expenses	Other expenses	Other expenses	General public services	General public services N.E.C.	
Local tax refund	Transfer	Local tax refund	General public services	Transfers of a general character between different levels of government	
Transfer to local government	Transfer	Transfer to local government	General public services	Transfers of a general character between different levels of government	

Note: Religion is under "general public service".

Source: Authors' compilation.

Appendix Table 2. Selected sub-categories of central government related to agriculture after 2006

Government expenditure classification	Central government budget category		
Level 1	Level 1	Level 2	Level 3
Education	Education	General Education	Expenditure to cover compulsory education debt
		Additional education expenditure	Rural primary and secondary school construction
			Rural primary and secondary school equipment
Social safety net and employment	Social safety net and employment	Subsidy to social insurance fund	Subsidy for New Rural Social Pension System
		Rural subsistence security system	Rural subsistence security system
		Other rural social relief	Five guarantees system
			Other rural social relief expenditure
Medical and health care	Medical and health care	Grassroot health institute	Township Health Center
		Medical insurance	New cooperative medical scheme
			Rural medical assistance scheme
Environmental protection	Environment protection	Natural ecology protection	Rural environment protection
		Green for grain	
		Green for grass	
Agriculture, forestry and water conservancy	Agriculture, forestry and water conservancy	Agriculture	Extension and training
			Pest control
			Food safety
			Land protection
			Disaster relief
			Agricultural subsidies
			Agricultural-processing
			Rural infrastructure
		Forestry	
		Water conservancy	Flood
			Drought

			Irrigation
			Rural drinking water
		South-to-north water diversion	
		Poverty reduction	Support for "Sanxi" agricultural construction
		Comprehensive agricultural development	Land management
			Technology demonstration
		Rural integrated reforms	Subsidy to rural affairs
			Subsidy to water expenses
		Other agriculture, forestry and water conservancy	
Transportation	Transportation	Subsidy for petroleum price reform	Subsidy for rural passenger transport
		Expenditure of vehicle purchase tax	Rural road construction
Industry, commerce and finance	Exploration, power and information	Electricity regulation	Rural power grid construction
Industry, commerce and finance	Commerce and services	Commerce	
Industry, commerce and finance	Grain and oil reserves	Grain and oil reserves	Reserve for Cotton, sugar, cotton, meat, fertilizer, agricultural chemical, tea, wool
Industry, commerce and finance	Financial supervision	Finance affairs	Rural finance development
Urban and rural community affairs	Housing security	Affordable housing program	Housing project for nomads in ethnic minority areas
			rural dilapidated housing rehabilitation

Note: Religion is under “general public service”.

Source: Authors’ compilation.