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Full Research Article

Structural change and agricultural diversification since China's reforms

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Abstract. Structural change is considered the major engine in fostering a country's growth. In the agricultural sector, diversification is the commonly used development strategy to increase rural sector's flexibility, and to respond to improving technologies and market conditions. This study examined agricultural development and transformation during China's socio-economic reforms. In particular, it empirically investigated whether the change of China's agricultural structure is consistent with structural change theory and observed outcomes from other countries. The degree of agricultural diversification was quantitatively measured at a regional scale using the Herfindahl index. An underdeveloped province in northwest China was studied to provide insights into the interaction among structural change, agricultural diversification, and implemented development policies. Aggregate-level analyses suggest that China's agricultural transformation pattern is consistent with those of other developing countries. A specific provincial-level analysis shows that environmentally and economically disadvantaged regions are slower to diversify their economy than better endorsed regions.

Keywords. Structural change, growth, agriculture diversification, China

JEL codes. O1, Q12, Q18

1. Introduction

Moving agricultural labour and resources into non-agricultural sectors is considered fundamental to economic growth (Lewis, 1954; Kuznets, 1959; Syrquin, 1988). Structural change theory suggests this transformation is an economy-wide phenomenon, characterised by a decreasing proportion of agricultural output and employment, along with rapid progress of industrialisation and urbanisation (Kuznets, 1966, 1971; Chenery and Syrquin,

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1986a; Timmer, 2007; World Bank, 2007). During this transition, industrialisation and urbanisation create employment opportunities and absorb the displaced rural labour force thus increasing labour productivity, while technological advancement and infrastructure improvement enable agriculture to grow, together with the industrial and service sectors (Timmer, 2009). Meanwhile, the agricultural sector is expected to be more responsive to markets with a diversity of farm products to meet the increasing demand for food variety and quantity, which is stimulated by higher income and growth of the urban population (Pingali and Rosegrant, 1995).

Agricultural diversification has been a policy objective of most developing countries during their structural change process (Timmer, 1997). Asian nations such as Japan, Thailand, and South Korea have been successful in diversifying their agricultural sector (World Bank, 1990). However, diversification of agriculture requires developments in technology, provision of better infrastructure, and well-functioning agricultural markets to support more diversified production. This poses challenges to countries with limited technologies, inefficient agricultural support systems and unfavourable government policies. Therefore, different countries have differing capacities to diversify their agricultural sector. As a result, the extent and patterns of agricultural diversification may differ among countries.

China's fast growth and special paths of transition and development have puzzled scholars about the contradictions between expectations shaped by theory and the observed outcomes (Jefferson, 2008). China had a relatively large rural population (World Bank, 2015), and had a large backlog of underemployed labour in farming, caused by strict regulation on labour migration prior to economic reforms (Oi, 1999). This distinct labour issue could have affected China's agricultural transformation pathway. In addition, the large variations in agricultural endowments, along with disparity in the level of development across regions within China, imply that the processes of agricultural diversification may vary.

Few researchers have attempted to examine agricultural diversification in the process of structural change. In addition, little effort has been made to quantitatively measure and compare the degree of diversification across regions and time (Timmer, 1997). The trend of the Chinese production diversification has been described by several descriptive studies (Huang and Rozelle, 2004; Huang *et al.*, 2012; Carter *et al.*, 2012; Fan *et al.*, 2003; Young 2000). To the author's knowledge, no measurement of the degree of diversification has been used in a study of China's structural change and development. To fill this gap, the present study attempts to quantify agricultural diversification at the national level, to compare the degree of diversification across regions and time, and to investigate agricultural diversification in relation to a region's growth and agro-economic conditions.

The purpose of this study was to better understand the pattern of transformation in China's agricultural sector. The degree of diversification was examined at the regional and national level for the period between 1978 and 2012 using the Herfindahl index. We studied Gansu province to provide insights into the interaction between structural change and agricultural development during China's economic transition.

2. Structural change and agricultural diversification: the conceptual framework

2.1 Economic development and patterns of structural change

Although structural transformation is heavily affected by a country's specific macroeconomic and sectoral policies (Chenery, 1988; Syrquin, 1988; Syrquin, 2006), historical experience indicates that consistent patterns exist. These are a declining share of agriculture in GDP and employment, followed by the rise in industrial and service sectors, and a continuous urbanisation which is induced by rural-to-urban migration (Chenery, 1988; Timmer, 2007; Chenery, 1988). Theoretically, the decline in share of agricultural employment and output raises productivity in agriculture. This change is viewed as the major driver for economic growth for countries at the early stage of development (Kuznets, 1956, 1967; Timmer, 1988; World Bank, 1990).

The phenomenon of shifting labour and resources out of the agricultural sector is explained by two mechanisms: a decreasing share of consumer expenditure devoted to food and agricultural products as income grows (Engel's Law of demand) and the rising productivity in agriculture which generates the resources and then stimulates the expansion of industry and services (Timmer, 1988; World Bank, 1990). The ultimate outcome of structural change is that agriculture becomes homogenous to other sectors as an economic activity, when incomes are high enough and different economic sectors are integrated by well-functioning labour and capital markets. This is emerging in some developed economies (Timmer, 2007).

Literature on development economics also shows that there is a substantial gap between agriculture's share of GDP and its share of employment during the course of a nation's growth. This gap indicates the differences in the factor productivity between agricultural and non-agricultural sectors, reflected in the concentration of poverty in agricultural and rural areas (Timmer and Akkus, 2008). Therefore, narrowing this gap is critical in fostering growth and alleviating poverty for developing countries, especially when they are facing globalised market competition, together with the pressure of rapidly growing urban populations and non-agricultural sectors contending for already scarce land and water resources (Timmer, 2007; World Bank, 2007).

However, agriculture alone cannot improve economy-wide productivity. Productivity growth involves a reciprocal interplay between the agricultural and non-agricultural sectors, and the sectoral exchange fundamentally mirrors the equilibrium between rising income and changing proportions of demand and supply, while development in agriculture enhances growth in other sectors through links between consumption and production (Chenery, 1988). At different development stages, countries face different growth problems; thus, agriculture is required to respond differently. Transforming economies like China have recently moved from relying on agriculture for growth and employment (agriculture based countries, World Bank, 2007), to the stage of facing rising rural-urban income disparities and persistent rural poverty. The recommended strategy to reduce the disparities for those countries is to diversify into high-value horticulture and livestock in response to rapidly growing domestic and international demand (World Bank, 2007). This agricultural diversification process involves integrating output into markets, substituting traded inputs for non-traded inputs, and shifting mixed production to monoculture farming to capture economies of scale (Pingali and Rosegrant, 1995; Chavas, 2008). From the

production perspective, agricultural diversification is viewed as a transformation of food production from subsistence to commercial systems, a course of agricultural sector diversification and commercialisation accompanied by farm-level production specialisation (Pingali, 1997; Timmer, 1997).

The patterns of structural change and the trend of agricultural diversification are proposed to be predictable and uniform, and have been witnessed in most industrialised countries (Timmer, 1997; World Bank, 1992, 2007). Compared with developed countries, the current developing nations have been transforming in different historical, demographic, economic, and agro-climatic contexts, in addition to the variation in natural resource endowment, opportunities, and constraints across countries and regions (Losch *et al.*, 2012).

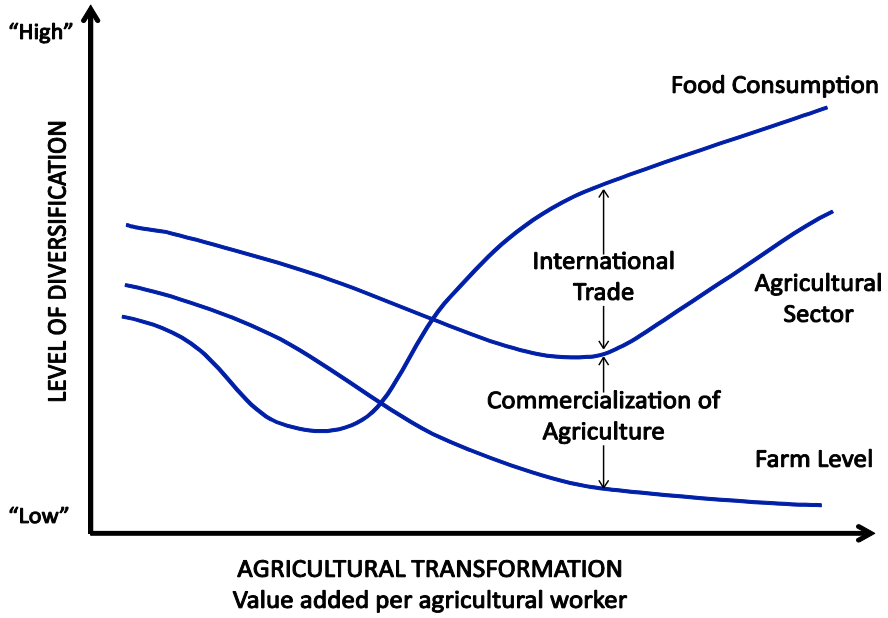
2.2 Agricultural transformation leads to production diversification

Timmer (1988; 1997) suggests that agricultural transformation inevitably experiences four critical stages. In the first phase, increasing agricultural productivity generates a farm surplus. During the second phase, farm surplus stimulates the non-agricultural sectors to expand. In the third stage, the improved infrastructure and markets further support resources and outcomes to flow out of the farm sector. Finally, at the end of the agricultural transforming stage, agriculture integrates into the whole economy and its role in an economy is no different from industry and services. Those four diversification stages are part of the overall transformation process. Based on historical transformation experiences in Asian countries, Timmer (1997) illustrates that trends of the diversification process can differ at the economy, the agricultural sector, and the individual farm level. Demonstrated in Figure 1, the vertical axis indicates the degree of diversification[1], and the horizontal axis shows the course of transformation. The entire economy, measured by the diversity of food consumption, and the agricultural sector become more diversified when resources are being shifted out of agriculture. At the farm level (individual fields within a single farm, and/or single farms within a region) the degree of diversification declines while the agricultural productivity increases, measured by rising value added per agricultural worker. The decreasing diversification/increasing specialisation are facilitated by the improvement of credit and labour markets during structural change, enabling farmers to capture the economies of scale by specialising their production (Coelli and Fleming, 2004; Pingali, 1997; Timmer, 1997)

From a policy perspective, agricultural diversification is regarded as a crucial strategy to increase the flexibility of the rural sector and to respond to improving technologies and market conditions. The macro-level agricultural diversification is also considered as a cushion against the adjustment costs caused by transforming resources to protect farmers against price fluctuations when the economy is being integrated into the world market (Timmer, 1988 and 1997; World Bank, 1988 and 1990). Meanwhile, the diversified agricultural sector potentially expands rural small and medium-scale industry (processing, marketing, and other labour-intensive services), and in turn absorbs the displaced labour force from agriculture The advantage of diversifying traditional grain-dominated production into higher income demand elasticity products are that countries increase the flexibil-

[1] Timmer's (1997) study is conceptual; no attempts are made to quantitatively measure the diversification degree. However, approaches such as the concentration ratio or the Herfindah index are suggested for empirical studies.

Figure 1. The relationship between diversification and agricultural transformation.



Source: Timmer (1997).

ity of their faming systems, efficiently allocate resources, reduce rural poverty and sustain productivity (World Bank, 1990 and 1992).

Diversification at different stages and different economic levels reflects long-run and short-run agricultural development issues, calling for different policy priorities. In the short-run, problems are narrowed to the micro-level response to price changes, and require producers to adjust production with alternative crops and activities rapidly (World Bank, 1988). However, producers' ability to respond to market signals can be influenced by technologies, market conditions, and households' characteristics such as education and risk-aversion. Thus, appropriate policies are vital to facilitate changes of crop patterns and activities, and to deal with unstable food prices and concern over food security. Apparently, the short-run policy priorities are to increase the flexibility of production systems, and to guide farmers towards activities that are more responsive to market demand and prices. Outcomes from those policies would be poverty reduction and improvement of income distribution (World Bank, 1988, 1990 and 1992).

3. Structural change and agricultural transformation in China: an overview

3.1 Distinctive economic features, consistent transformation patterns

Over the past three decades, China has undergone an impressive and rapid structural change; its agricultural sector has achieved significant progress in increasing productivity,

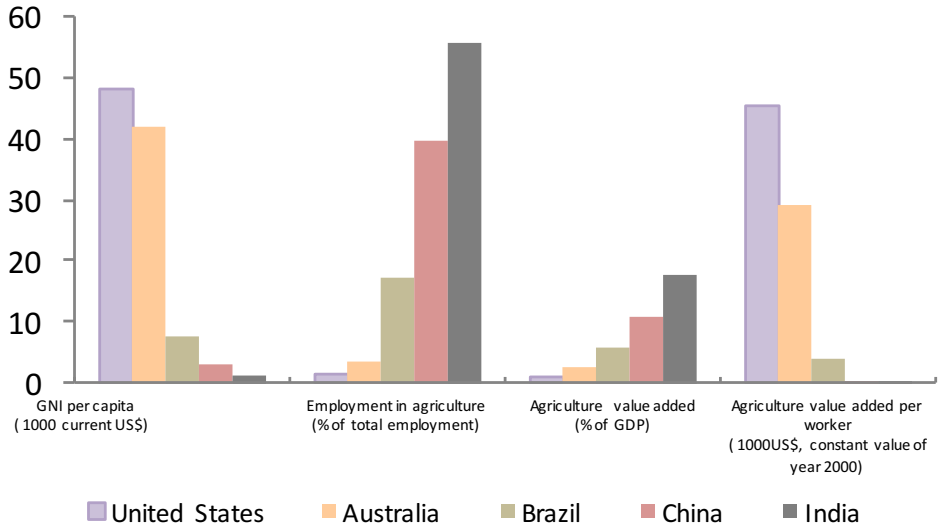
diversifying products, and alleviating poverty. Agriculture has significantly contributed to the nation's growth; however, its relative contribution to GDP continues to decline. A large part of the labour force has been reallocated from agricultural to non-agricultural sectors, and the share of agricultural employment decreased from 68.7% in 1980 to 34.8% in 2011. Agricultural value calculated in GDP declined from 30% to 10% in the same period (World Bank, 2015). More importantly, households' consumption patterns have changed; demand has increased for meats, fruits and vegetables. The share of staple crops in total agricultural output dropped from 82% in 1970 to less than 50% of GDP in 2008 (Huang *et al.*, 2010). Impressively, 58% of the world's horticulture, and 67% of the world's aquaculture production increases were generated by China since the mid-1980s (World Bank, 2007).

It is widely accepted that China's overall transformation has followed a traditional line of growth, with the agricultural growth as the precursor to the economic development (United Nations, 2006; World Bank, 2007). However, compared to other developing countries, China had, and to some extent still has, some distinctiveness prior to its reforms. The most distinguishing characteristic is its planned governance system, namely, central control over prices allocation of inputs and outputs and financial flows. This centrally controlled system, along with pursuing "a capital intensive heavy industry oriented-development-strategy in a capital-scarce agrarian economy" (Lin *et al.*, 1996) resulted in imbalanced economic structure, frail institutions, and weak incentives (Brandt and Rawski 2008). These negative consequences have in turn caused inefficiency in performance and productivity. Research indicates that technical efficiency in state owned enterprises was relatively low as a result of overstaffing and underutilisation of capital resources (Lin *et al.*, 1996). It is also suggested that Chinese socialism, especially the planned system, detained the economy inferior to its production frontier (Brandt and Rawski, 2008).

Moreover, the low efficiency of China's economy was a consequence of the government-controlled monopoly of finance, telecommunications, and steel sectors. This large proportion of state-run enterprises was an outcome of the preferentially promoted large industry during the Maoist era. The large manufacturing was aimed at building the state's ability of producing capital goods and military supplies for the consideration of self-sufficiency and national security (Brandt and Rawski, 2008; Lin *et al.*, 1996). This distinctive institutional feature potentially affected China's reform path. In 1980, when the reform was initiated, China's share of manufacturing was larger than most low-income and middle-income countries. Along with the heavily discounted service sector, China's distorted economic composition is presumed to have affected its growth pathway and the progress of structural change (Heston and Sicular, 2008).

The third feature of China's economy prior to reforms was its long isolation from deep engagement with the global economy. Combined with the Communist Party's self-sufficient tendencies and the partial trade embargo led by the USA, China was restricted in its global market participation (China joined the WTO in 2001). This very limited participation in the world markets deprived Chinese producers of global competition. Under the central plan and control system, neither import nor export was sensitive to exchange rates or relative prices. The composition of Chinese trade was consequently not linked to its comparative advantage (Branstetter and Lardy, 2006). This isolation from the international economy enlarged the gap between China's achievements and potential, and also prevented world market prices from stimulating domestic production (Brandt and Rawski, 2008).

Figure 2. Comparison of structural change and growth among China and selected countries.



Sources: World Development Indicators for 2008, World Bank, 2011.

Aside from features of the planned system, dominance of the state sector, and the isolation from world markets, a rural-urban gap, in both economic and institutional terms, was another feature unique to China's initial condition. The "dual track" structure which was formed to ensure a collectivized agricultural production in rural areas and the concentration on heavy industry in urban areas resulted in segmentation between the rural and urban sectors. In addition, the strict residency system (Hukou), a heavy urban bias on education, health care, housing, and pensions have contributed to the disparity between rural and urban development. It is well recognised that restrictions on rural resource mobility (mainly labour migration) have constrained structural change and caused stagnation in agriculture(Benjamin and Brandt, 2002).

It appears that China has several fundamentally distinct institutional, political and economic policy settings compared to other economies. This begs the questions of whether this uniqueness has made China a special case regarding economic composition, and whether China's overall structural constitution is consistent with its development stage. Figure 2 compares China with countries at different growth levels (the USA, Australia, Brazil, and India), using the World Development Indicators to measure agricultural development in relation to gross national income (GNI) [2] across countries (Figure 2). In 2008, agriculture's share in China's employment and GDP were higher than the

[2] GNI per capita (formerly GNP per capita) is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. Agriculture value added per worker is a measure of agricultural productivity. Value added in agriculture measures the output of the agricultural sector (ISIC divisions 1-5) less the value of intermediate inputs. Agriculture comprises value added from forestry, hunting, and fishing as well as cultivation of crops and livestock production. Data are in constant 2000 U.S. dollars.

USA, Australia and Brazil, respectively. By contrast, its agricultural productivity is higher than India, indicating China's development of the agricultural sector is consistent with its overall economic level.

A number of comparative investigations have drawn similar conclusions. For example, focusing on both distinctive and common features, Heston and Sicular (2008) examine the post-1978 Chinese economy in comparison to averages for low-, middle- and high-income countries. The results show that China's structural change has followed the general international pattern since 1980. Its development has been associated with a decline in agriculture's relative importance in the economy, a rising industry, and expansion of the service sector. Timmer (2007) compares the general growth pattern of fifteen countries, suggesting that "China is unique in its rapid growth and in the structural patterns that growth has induced in employment and GDP. But China is not unique in the distributional consequences of its growth"[3] .

From different perspectives, several other studies have concluded consistently that China's structural change has fitted surprisingly well into the conventional views of development economics. Herrmann-Pillath (1994) stated "China is an enfant terrible of the mainstream theory of transformation", and "it was the way in which China went about in reforming its system that makes the country's reform experience unique" (Hofman and Wu, 2009). The reforms during China's transition period have followed logical prescriptions mainstream economics would recommend, that is, the development of incentives, mobility, price flexibility, competition and openness (Lin *et al.*, 1996; Brandt and Rawski, 2008). This conventional economic transformation and growth in China has been unexpected to most economists' contention, especially from the political economics perspective (for a detailed debate on this topic, see Arrighi, 2007; Harvey, 2005).

Coexisting with uniqueness and consistency, the transformation in the agricultural sector has contributed to China's impressive growth significantly. Large-scale labour move from agricultural to non-agricultural sectors reduced the employment in agriculture from 69% in 1978 to 35% in 2011 (World Bank, 2013), despite the fact that the growth of productivity in agriculture was the major driver of labour reallocation. Agricultural value added per worker increased from 224 to 785(constant 2005 US$) between 1980 and 2013 (World Bank, 2013). During the same period, agricultural value added in GDP declined from 30% to 10%. The above figures show that the relative importance has continued to decline, however, agriculture has been the major contributor to structural change in China's economy.

3.2 Transformation in agriculture, stages and policies

China initiated rural reforms in 1978. A series of strategies and policies were implemented to improve farmers' incentives and develop the rural economy. Among others, decollectivisation was a major driver to improve Total Factor Productivity in the early stage of reform (Lin, 1992); the effort to restructure the rural economy through institutional change created strong incentives for Chinese small famers to use inputs more efficiently,

[3] The fifteen countries are: Bangladesh, Brazil, China, India, Indonesia, Japan, Korea, Malaysia, Nepal, Nigeria, Pakistan, Papua New Guinea, Philippines, Sri Lanka, and Thailand.

including human capital (Ash, 1988). It is estimated that the change in incentive structure increased agricultural output by 20% to 30% without any claim on additional resources from the rest of the economy (Lin, 1988; McMillan *et al.*, 1989).

The well-studied policy implemented in this period was the Household Responsibility System (HRS), a bottom-up initiated plan which shifted production from a collective system to a family-based management, and enhanced farmers' motivations to adopt new technology and thus sped the diffusion of new technology (Lin, 1992). As a result, grain output increased by 4.7% per year during the period 1978 to 1984, and the real value of gross output in the farm sector doubled between 1978 and 1989. This remarkable production growth was accompanied by a significant diversity of China's agricultural production and food consumption patterns. Cash crops like cotton and oilseeds, along with meat production increased quickly. For instance, annual growth of cotton production was 19.3% between 1978 and 1984 (Huang *et al.*, 2008; Hofman and Wu, 2009). During the same period, both rural and urban households' share of grain consumption reduced dramatically due to rising incomes and falling grain prices (Huang *et al.*, 2008).

Commencing in 1985, further reforms focused on market extension and price regulation. The intention to initiate commercial exchange and agricultural investment was realised by replacing the state monopoly purchase and supply with a part-contractual, part-free market exchange system (Ash, 1988). After a long period of restriction in agricultural prices, those reforms enabled market prices to become the basis of farmer production and marketing decisions (Rozelle and Huang, 2006). The development of domestic markets and the agricultural trade liberalisation (especially the accession to the World Trade Organisation) have considerably narrowed the differences between international and domestic market prices for many commodities. Especially after China's accession to WTO in 2001, agriculture has entered a stage of all-round reform and opening-up. China has abolished non-tariff border measures, converted non-tariff measures into tariffs and adopted tariff cuts and "binding" to accommodate further reform and opening-up and participate in international market competition(MOA, 2015). Consequently, price changes and farmers' incentives have been directly affected by world markets (Huang *et al.*, 2008). World market prices became an active stimulus for China's agricultural diversification, for instance, the large-scale reallocation of cultivated acreage from staple crops to vegetables, horticulture and other labour-intensive alternatives occurred only after the government ended its policy of setting domestic grain prices above world market level (Brandt and Rawski, 2008). These developments also attributed to Chinese government's pro-farm policies to enhance small farmers' marketing alibility and competitiveness. For example, the Vegetable Basket Program (VBP) has significantly boosted production of vegetables, meat, dairy products, and aquatic products (MOA, 2012).

Diversification in farm production has been significant, stimulated by price policy, market liberalisation, and technological improvements. Between 1978 and 2002, the percentage of grain crops in total sown area reduced from 80% to 65%, and has maintained at above 68% since then. Absolute grain production even decreased by 16% from 1998 to 2003 (Carter *et al.*, 2012). By contrast, vegetable sown area increased 5.7% annually; the output of fruits increased thirty-fold. Over the same period, the livestock and fishery sector rose from 14% and 2% to 31% and 10%, respectively (NBSC, 1978-2012).

4. Quantifying agricultural diversification in China

4.1 Method

The Herfindahl index is a statistical measure of concentration, commonly used in diversification research to indicate the extent of specialisation (Pope and Prescott, 1980; Culas, 2006). The Herfindahl index of product concentration is defined as:

$$P_{it} = A_{it} / \sum A_{it} \tag{1}$$

$$H_{rt} = \sum P_{it}^2 \tag{2}$$

In Equation (1) A_i is the value of product *i*, $\sum A_i$ is the sum of farm products' value. Thus P_{it} is the value share of product *i* in total farm value in time t. In Equation (2), H_{rt} is the Herfindahl index, computed by the sum of farm products' value share squared.

Because this study examines agricultural diversification, the Herfindahl concentration/specialisation index was inverted to formulate a diversification index, to make the demonstration more illustrative and straightforward. The diversification level for region r at time (year) t is:

$$D_{rt} = 1 - H_{rt} \tag{3}$$

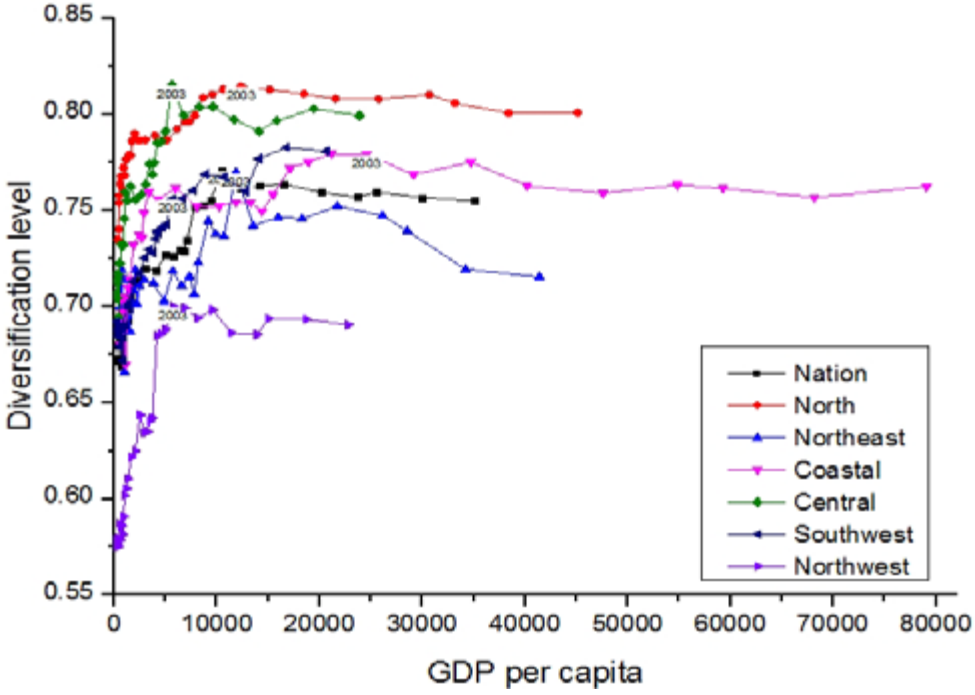
The value of diversification index D_{rt} ranges from 0 to 1, and larger values denote higher degree of agricultural diversification, lower values indicate greater specialisation.

4.2 Data

Six categories of farm products were included in the index computation: grain, cotton, rapeseed, vegetables, fruits, and livestock. Fishery and forestry products were not included due to data being incomplete for some provinces. Considering crop and livestock production account for 86% (in 2010) to 95% (in 1978) of output-value share in China's agricultural economy, the exclusion of fishery and forestry production in the computation would have very little impact on formulating the diversification indices.

Farm output data were extracted from China's Statistical Yearbook (NBSC, 1978-2012), price information was from the China compendium of statistics between 1949 and 2008 (NBSC, 2010) and China Yearbook of Agricultural Price Survey (NBSC, 2004-2012). Farm values were calculated as outputs multiplied by prices, and then applied into equation (1)-(3) to compute diversification indices for individual provinces. Indices were further used to aggregate regional and national diversification. Six regions were grouped based on similarities in agricultural endowments and level of economic development, following the classification by Carter and Lohmar (2002). The specific categorisation was: 1) North (Beijing, Tianjin, Hebei, Shanxin, Inner Mongolia, Henna, and Shanddong); 2) Northeast (Heilongjiang, Jilin, and Liaoniang); 3) Central (Anhui, Jiangxi, Hubei, and Hunan); 4) Coastal (Shanghai-Jiangsu, Zhejiang, Fujian, Guangdong, and Hainan); 5) Southwest (Chongqing, Sichuan, Guizhou, Yunnan, and Guangxi); 6) Northwest(Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xingjiang).

Figure 3. Diversification level and GDP per capita for national average and six regions, 1978-2012.



5. Results

5.1 Agricultural diversification in relation to growth: regional comparison

Figure 3 shows the association between diversification and GDP per capita for the national average and the six aggregated regions. Overall, the agricultural sector has been more diversified. Notably, the diversification level had a remarkable increase before GDP per capita reached about 5,000 Yuan (approximately 1,811 US dollars). Once GDP per capita exceeded 15,000 Yuan, the agricultural diversification level remained unchanged or slightly declined for all the cases.

Moreover, the diversification level decreased during 2003-2007 in most regions. This sharp decline could be partially explained by the nationwide policy effort to increase grain production at the time. A series of policies were implemented to stimulate farmers' grain production and the relative profitability of grain production, when grain production decreased by 16% between 1998 and 2003. These policies included ending agricultural taxes, directing subsidy payments to grain producers, grain crop support price, input subsidies for fertiliser and farm equipment, and increased investment in infrastructure (Carter *et al.*, 2012).

The above pro-grain government policies effectively encouraged grain production, area planted with grain recovered to 1997 levels, and the share of grain's output to the agricultural sector rose (Liu *et al.*, 2008). The decline of production diversification

between 2002 and 2007 was attributed to this grain production rise/concentration, as grains (rice, wheat, and maize) account for more than 50% of crop production.

The patterns of China's agricultural diversification support Timmer (1997) that agriculture tends to be more diversified at macro levels in the early stage of development. China's practice further suggests that government's policy, in particular, encouraging grain production, was effective in changing the diversification degree at the national and regional levels. Moreover, the degree of diversification varies among regions at the same growth level/GDP per capita. Studies in other developing countries indicate that besides the growth of GDP, agricultural diversification is closely related to the degree of market development, especially the level of growth prior to agricultural transformation, and the relative importance of agriculture in the region (Dorsey *et al.*, 2005). This is true in the Chinese case; for example, the Northwest and Southwest regions were at similar growth levels between 1978 and 2002, but the Southwest region was higher in the agricultural diversification level, owing to its comparatively developed markets and infrastructure, and the intensification of the piggery and feedstuff industries (Carter *et al.*, 2012). By contrast, the Northwest region has had low agro-ecological potential (rainfall, soils, topography), underdeveloped markets and infrastructure (isolated from demand centres and coastal areas for exporting), and higher share of agriculture in the region's GDP. Consequently, agriculture in this area is diversified least among the six regions.

The comparisons above suggest that the rate of agricultural diversification is related to comparative advantage (natural resources, access to markets), development levels (education, access to information, markets) and the relative importance of agriculture in the regions. For instance, the coastal region is the most developed area in China, with the highest average GDP per capita (Figure 3). Production diversification levels in this zone, however, are relatively low among the six regions. This can be explained by the fact that the rapid urbanisation and industrialisation in this region has led to grain production decline and the importance of agriculture in the economy to diminish relatively faster.

5.2 Agricultural transformation and its interdependence with non-agricultural sector in underdeveloped regions: the case of Gansu province

To further investigate the interaction between agricultural and other sectors, Gansu province in Northwest China was closely studied. Gansu Province is one of the poorest regions in China. In 2012, average rural per capita income was 4,507 Yuan (the lowest in China), accounting for only 57% of the national average 7,917 Yuan (NBSC 2013). In terms of agricultural conditions, Gansu is poorly endowed with natural resources, one-fifth of the cultivated land is terraced, and annual average rainfall ranges from 50 mm in the west and 550mm in the east (Gansu Yearbook Editorial Board, 2012). Growth in Gansu's agricultural sector has been considerably slow with very low productivity, accounting for 2.3% of China's rural employment but contributes only 1.3 % of the value of Chinese farm production (Brown *et al.*, 2009).

By contrast, the industrial sector in Gansu experienced special growth in the 1950s, when substantial government investments were shifted from coastal cities into interior regions for security considerations (Brandt and Rawski, 2008). The average annual growth rate in industry was 15.28% between 1952 and 1978, compared with 6.27% for the overall Gansu economy (Yue, 2009). During this time, emphasis was placed on establishing

the province's heavy industry. State-owned enterprises, like mining, petroleum refining and drilling, have been the backbone of Gansu's industrial development. As a result, 90.7% of industrial output was from state-owned enterprises (SOEs) in 1978, which was second highest in China, and much higher than national average (77.6%) and Guangdong Province (67.9%) located in coastal region (Table 1).

Gansu's industry-prioritised development strategy intensified agriculture's inferior situation and resulted in a distorted economic structure. When the economic reforms started in 1978, Gansu's industrial share was higher than the national average, and the agricultural share was low with respect to its development level (Figure 4).

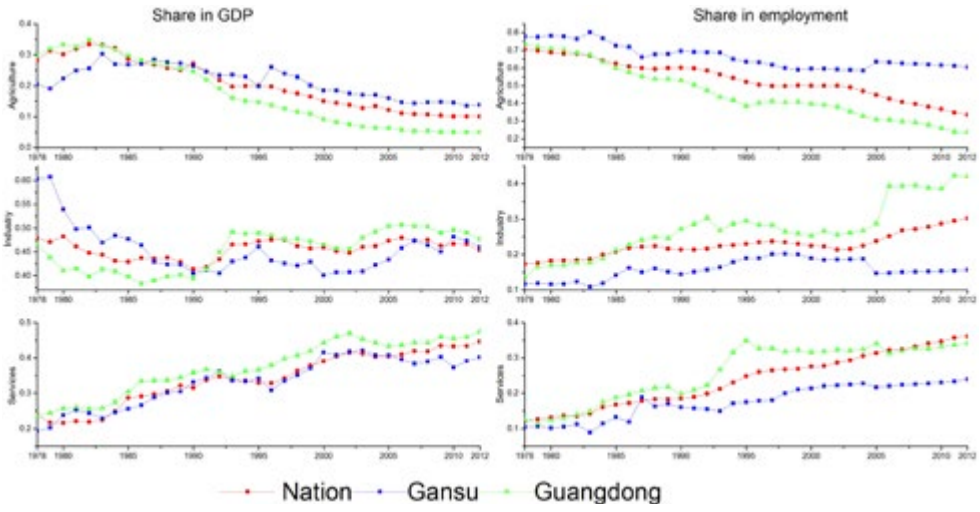
Consequently, Gansu experienced a catch-up growth period in agriculture between 1979 and 1985; the average farm labour productivity growth rate exceeded the industrial sector (4.30% compared to -6.51%, Appendix Table A), and the productivity gain was

Table 1. Regional share of industrial output by ownership (Percent), 1978-1990.

	1978		1985		1995	
	SOEs	COEs	SOEs	COEs	SOEs	COEs
Nation	77.6	22.4	64.9	32.1	54.6	35.6
Guangdong	90.7	9.2	88.1	11.9	78.1	18.0
Gansu	67.9	25.5	53.3	30.0	41.0	34.1

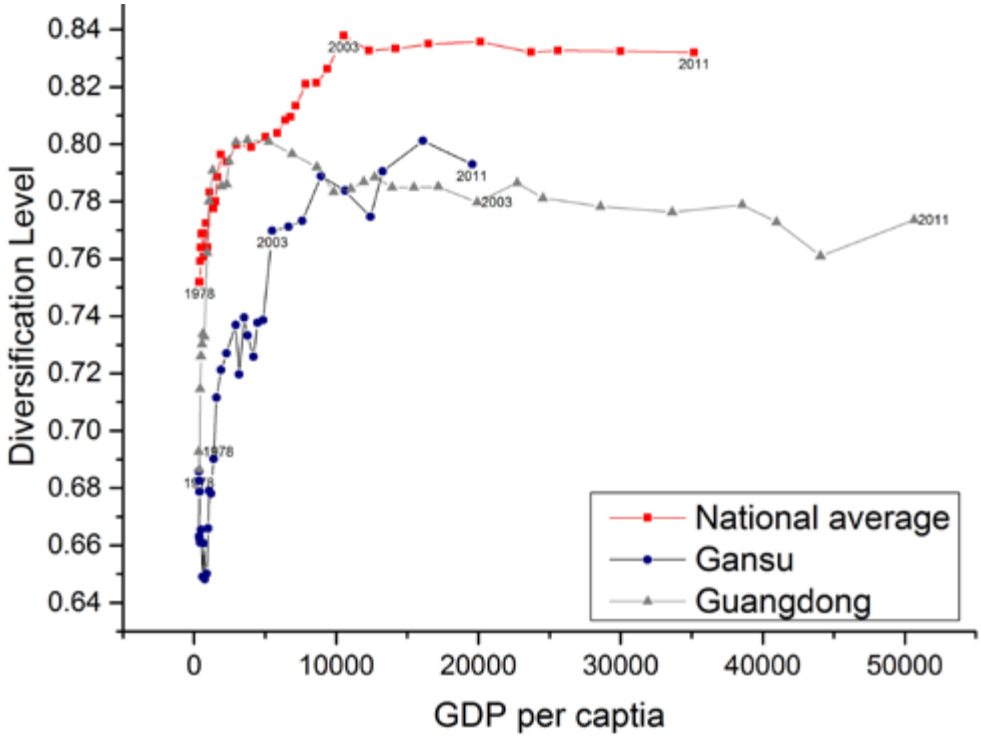
Source: Wei, 2013, p105.
Note: SOEs refers to state-owned enterprise, COEs refers to colletive-owned enterprise.

Figure 4. Sectoral shares in GDP and employment, Gansu province and national average.



Sources: China statistical yearbook, and Gansu yearbook, 1978-2012.

Figure 5. Patterns of agricultural diversification, Gansu province in comparison with Guangdong and national average.



attributed to the province-wide effort of grain self-sufficiency (Yue, 2009). The share of agriculture in GDP started declining when labour started shifting to the industrial and services sector after 1985, indicated by the declining agricultural employment (Figure 4) Between 1978 and 1990, Gansu's sectoral composition had restructured, coincided with a rapid growth of non-state enterprises and an enormous decline of the share of industrial output produced by SOEs (Wei, 2013).

The compositional distortion in Gansu's economy before reforms and the later on efforts to optimise the industrial structure were reflected by its change in diversification patterns. As shown in Figure 5, Gansu's overall agricultural diversification was at lower lever in the early reform period (1978-1995), compared to the Guangdong province and national average. This is consistent with its low annual growth rate of 6.0%, in contrast to the annual growth of 10.8% and 7.5% for Guangdong and national average, respectively (Wei, 2013). As mentioned earlier in section 2.2, the level of production diversification in a region's rural economy is closely associated with its overall growth. Agricultural diversification is driven by income growth and increasing urbanisation to meet the shift of dietary patterns away from cereals-dominated to a variety of livestock products, fruits, and vegetables (World Bank, 2007).

The process of diversification in Gansu's agricultural sector indicates that agricultural diversification is affected by the non-agricultural sector and the process and progress of

structural change. The growth pathway provides some insights into how sectoral composition in the early stage of transformation affects diversification in the rural economy. Diversification in the agricultural sector maybe constrained if farms cannot move out to higher productivity sectors and agriculture's share in employment stagnates. This is supported by findings from Brandt *et al.* (2008) suggesting that provinces with a relatively large state sector at the start of reforms are likely to experience slow growth. The present study shows that the capital intensive and low-labour-absorbing state sector indeed posed higher initial barriers to Gansu's rural labour mobility, and subsequently slowed the pace of structural transfer and economic growth.

6. Concluding remarks

From a historical and regional perspective, this study examined agricultural development and transformation during China's socio-economic reforms. In particular, it examined the theory that economic development results in agricultural diversification at the national and regional levels. Aggregate-level analyses suggest that, although economic growth in China is unique, its pattern of agricultural transformation is consistent with those of other developing countries. The agricultural sector becomes more diversified as the economy grows.

The findings of this study further show the significance of regional comparative advantages (for example, natural endowments, market functionality, and the activity of non-state-owned enterprises) that determine how much a region can transfer its labour out of agriculture, and how quickly this region can narrow the gap between agriculture's share of GDP and increasing employment to reduce poverty and rural-urban disparity. This research provides insights into the specific circumstances of farmers in less-favoured regions, demonstrated by the surveyed households in the Gansu province of Western China, where the region is still in an early stage of the economic transition, and the smallholders could be constrained from increasing their incomes and integrating into the restructuring of agro-food markets.

To implement the agriculture-for-development agenda, the promotion of high-value farm activities and non-farm employment, and the provision of infrastructure to support diversification in agriculture and rural economies are recommended policies (World Bank, 2007). The insights of this research clarify that a discussion of patters of agricultural diversification/specialisation, and the strategy of agriculture-for-development, must be region and settings-specific. For the less-favoured smallholder in Western China, a more effective strategy might be to establish efficient value chains, enhance smallholders' competitiveness and facilitate their market access. By improving markets, especially the missing institutions for credit, technical support and insurance, smallholders can be encouraged to specialise in high-value activities and integrate into the market.

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Appendix

Table A. Growth of labour productivity in national average and Gansu, 1978–2012.

	Labour productivity Real GDP per worker					Average annual growth rate			
	1978	1985	1995	2005	2012	1978–1985	1985–1995	1995–2005	2005–2012
Nation									
Agriculture	363	642	1029	1599	3454	8.50%	4.82%	4.51%	11.63%
Industry	2513	2904	5517	11763	17200	2.09%	6.63%	7.86%	5.58%
Services	1784	2412	3565	7626	14206	4.40%	3.98%	7.90%	9.29%
Gansu									
Agriculture	244	328	354	830	1471	4.30%	0.75%	8.90%	8.53%
Industry	4804	2998	2748	9809	18946	-6.51%	-0.87%	13.57%	9.86%
Services	1725	1724	2208	6229	10818	-0.01%	2.51%	10.93%	8.21%