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Master programme in International Economics with a Focus on China

Different patterns of agriculture development in China. The spatial-dynamic development trajectories in a cross-regional comparison

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Abstract: Recently the question of agriculture development has been emphasised as an important part of balanced sustainable growth in China. My paper accounts for different growth trajectories and development pace between coastal regions and inland provinces. My interest is more convergence-divergence between agriculture development in different regions than convergence-divergence between rural and urban areas. Nowadays a harmonious society is strongly pronounced by the government authorities and is new strategic aim on policy agenda. My attempt is to assess the efficiency of government actions toward harmonious society that is based on equal living standards and well-off society. Moreover through quantified research over last 20 year I will try to depict the agriculture development pattern. My attempt is to determine factors that have the biggest impact on agriculture growth. Moreover I would like to highlight the inequality in agriculture development in cross-provincial comparison and identify various contributing factors to the total inequality. This approach may indicate specific factors that are likely to improve agricultural performance. The purpose of this paper is to identify available solutions for convergence in the agricultural development that is major policy aim in China. Some important conclusions are drawn. First of the provincial development gap is highly pronounced with coastal provinces pulling ahead and lagging inland provinces. Moreover with the lapse of time and advancing growth of coastal provinces the catch-up process and convergence of inland provinces does not occur. Major determinants of agriculture development have been empirically identified: Labour ratio in favour of non-agriculture sector with special role of TVEs and their labour-absorptive capacity, increasing cultivated area per household, infrastructure: length of roads and railways, investment in irrigation, regional industrial structure and geographical locations. Net subsidies turned out to be inefficient tools for agricultural growth.

Key words: economic growth, agriculture, development, inequality, industrialisation.

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Introduction

As China was and to some degree still is a agrarian country, evaluating history, current condition and prospects for rural development is crucial for a objective assessment of China's economic accomplishments. There are several important issues on agriculture in China that have been analysed by scholars so far. Foremost, the question of food production sustainability is essential for growing population in China (Liu and Lu, 1992). Secondly, dichotomy of incomes in rural areas is a serious problem for authorities as local and mass demonstrations are taking place against unjust opportunities. Excessive labour in agriculture is seen as a major obstacle for efficient production in agriculture. Can expanding industry base support agriculture through labour absorption? Or can it hinder development because of land degradation and policy bias toward industry? As the scope of the challenges facing agriculture worth to consider is too broad for the framework of this paper I will try to concentrate on most interesting for me issues. Therefore relationship between industrialisation and agriculture will be emphasised. It is unprecedented phenomenon on the world's scale that within such a short time country has build-up such an extensive industrial base. It is also widely recognised that agriculture has developed relatively on a lower pace than industry apart from decollectivisation and price reform period (Dasheng, Davis, Wang; 1998). In the light of imperfect labour movements and overpopulation in rural areas, tendencies in rural-urban and rural-rural labour inflows are decisive for agriculture performance. Therefore distribution of labour between industry and agriculture determines how quickly given region can move up the development ladder. My question is whether China can achieve agricultural performance on the same level as developed countries. An empirical analysis can help us to estimate the labour distribution between agriculture and industry and assess the importance of industrialisation, especially in the form of rural industries in overall development of rural areas.

Central to the idea of moving up the development ladder is that all regions should follow this pattern. Certainly time lag can put regions with comparative advantage in agriculture on a lower growth trajectory. It seems that some provinces in China have successfully escaped agriculture-trap; however most of inland west provinces are still stuck on agrarian level of the ladder. Therefore to assess our research question we should look upon recent theory that I am going to support with empirical findings encompassing 20 year of development across 4 provinces in China.

To identify major contributing factors to agricultural growth we should start with theories trying to explain the underlying forces behind development, economic growth and specifically agriculture. To meet these goals this paper is organised as follows: Section 2. Theory Review will focus on hitherto contributions in the field of economic development. Section 3 will shed some light on the history of Chinese agriculture, recent tendencies and statistical data. In my analysis theoretical part has great significance as latter on empirical observation will try to combine them under common denominator of regression model. To meet the aim of my paper certain issues are emphasised. The role of industry in agriculture growth is evaluated with special consideration on labour distribution. The aspect of inequality is reflected in section on fiscal decentralisation. Its goal is to highlight the cause of different development trajectories in China's agriculture. It argues that regional development policies neglecting agriculture, weak central authority commitment for even development are major reasons behind inequality. Section 4 describes conceptual framework for empirical estimation. As a synthesis of section 2-3 in section 5 empirical model is presented. Subsequently the estimation results are presented and discussed. Last section draws conclusions and makes some suggestions on how to improve balanced development of Chinese agriculture.

Theory Review and Topic Analysis

The neoclassical growth theory developed by Solow in 1956 incorporate such factors as productivity growth. This exogenous model includes labour as a factor of production and for the first time takes into account time-varying technology variable distinct from labour and capital. According to the theory diminishing returns of production factors support convergence processes across regions. In a long-run economy should converge into a steady-state equilibrium. In this light both poor countries or poor regions within given country tend to catch-up throughout time with better-off ones. However this condition is undermined by the empirical evidence for the last decades of economic growth in the world. As Romer (1989), Lucas (1988) and other scholars observed Solow's model fails to explain the prevailing international disparities in income levels. Further empirical results will shed some light on the validity of this theorem in China intra-regional analysis.

The neoclassical model is criticised because it doesn't take into account other factors that can influence economic growth such as entrepreneurship, human capital or institutions. That is why new endogenous growth theories try to overcome this limitation by endogenising technological advancements, human capital in the form of knowledge accumulation and technology spillovers. The role of Institutions as a catalyst for economic development is also emphasised in the New Growth Theory. Following the New Growth Theory factors such as public spending, subsidies, research and development investments are active contributants to the self-sustaining productivity increase and sustainable economic growth (Aschauer, 1989, Barro 1990, Demurger, S., 2000). Theodor Schultz (1971, 1972) developed the concept of human capital measured as school and university enrollment. He found on empirical examples that education can improve significantly agricultural output. In this light institutional interventions in education investment, training and medical care are crucial for economic growth (Becker, G., 1964, 1993).

The role of agriculture in general development has been considered from two angles. The first viewpoints supported by Lewis (1954), Hirschman (1958), Fei and Ranis (1964), considers agriculture as a minor, passive force in economic development. It is perceived as a starting point with the supportive function for non-agricultural sectors such as primary industry which is the major engine of growth. In this model agriculture merely provides resources: inputs, capital and labour to propel the growth of rest of the economy. The argument is that since industry and services are more productive than agriculture resources should be allocated in latter in order to modernise economy and augment gross domestic product (Shujie Yao, 2000).

The second theory explains agriculture's role in more complex and interdependent structure, with active role of agriculture in economic development. Agriculture is perceived as an integral part of the economy thus can not be neglected and successful agriculture could propel growth in the rest of economy. It is stressed by Kuznets (1964), Mellor and Lele (1973), Hazell and Roell (1983) that agriculture can provide substantial market for non-agriculture sectors and as a result accelerate growth.

Chinese Agriculture in Facts

Nowadays, even though China accounts only for 9% of total world's cultivated lands, the agricultural output is capable of providing 21% of world's population demand. There is a problem of huge disproportions between agricultural and industrial development. Even though the weight of agriculture in total output has diminished in favour of industry from

56.9% of agriculture-industry output value in 1952 to 18.1% in 1995 (Li Dasheng, John Davis, Liming Wang, 1998), still 50% of labour force is engaged in agricultural activities. The importance of agriculture could be seen in capabilities to provide vast amounts of raw materials for industrial production (Yao, S., 2000). In 1996 2/3 of industrial output or 29% of the total industrial production relied on agricultural inputs¹. With nearly 50% of labour force in agriculture the rural growth can be seen as a key to further economic growth. In the light of global recession and diminishing manufacturing sector, agriculture can be seen as a leverage tool for GDP growth rate.

Naughton, B., Ravallion M., and Shaohao Chen (2007), present in their paper that inequality in China between rural villages increased substantially from 1995 to 2002. On the other hand scholars like Khan and Riskin (1998) state that it has decreased by 10 percent during the same period. Interesting observation is that that the inequality has increased dramatically between industrial rural areas, located close to major industrial cities and agglomerations when compared to remote isolated solely agricultural villages (Ching Kwan Lee, Mark Selden 2006). Taking a long-term perspective total GINI-coefficient in rural areas has increased from the beginning of the modernisation (World Bank, 2002; Whalley and Zhong, 2007; Khan and Riskin, 2001). The overall GINI-coefficient increased from 1978 at the beginning of reform period to 0.47 in 2007 (World Bank, 2002). In rural areas inequality is even more pronounced. The GINI-coefficient rose from 0.212 in 1978 to 0.45 in 1998. Much of the inequality is explained by inter-provincial inequality (Yao, S., 2005).

Moreover the increase in rural income seems to be relatively minimal and insignificant when compared to income increase in urban areas. Urban per capita income was 3 times higher than in the rural areas in 2002. (Rahman Khan A, Riskin, C., 2005). Moreover, the problem of uneven income distribution in rural areas is prevalent. The issue of uneven growth of agricultural sector across China is highlighted (cross-provincial level). Huge disequilibrium is predominant and the labour force mobility is restricted because of 'hukou' registration system. Therefore, my idea is to measure the inequality in rural performance on provincial level. It is claimed that the income gap is mostly attributed to the inter-regional personal income differences (Rahman Khan A, Riskin, C., 2005). This may suggest the weak position of central government in tackling regional disparities. The rural-rural and rural-urban dichotomy could be attributed to fiscal decentralisation that took place in 1990s. In China the average development has been hoisted by the relative minority of the population living in urban areas. This minority large in real numbers (roughly 400 mln) constitute only share of the whole population. It is estimated that approximately 700mln people are still living in rural areas. It is crucial for sustainable development and harmonious society to provide opportunities for this part of agricultural population that is still living on the edge of subsistence level. The progress of development could be assessed on the basis of development ladder and social structure should indicate the direction of change. Certainly in China throughout last 30 year unprecedented number of people has been pulled out of poverty. However the relative underdevelopment of agriculture is noticeable when compared with elevated sectors like manufacturing and stratum of society like in urban areas. World Bank estimations indicates that in 2004 still 10% of population was living under poverty line which was set on 1\$ per day². It must be stressed though that this level reached almost 60% in 1978, hence outstanding 500 mln people have been lifted out of poverty. However the poverty line at 2\$ per day (more appropriate for low-to-middle-income country) indicates that almost 38%

¹ Ministry of Agriculture (1997), p. 424 for 1996.

² Ravallion, Martin, and Shaohua Chen, (2005), China's (Uneven) Progress Against Poverty. *Journal of Development Economics*.

are still below this level³. Social dichotomy and polarization is well visible and reflected in GINI-coefficient numbers. The most neglected and marginalised groups are peasants in the remote west provinces. The concept of marginalisation explains the discrimination of certain groups in the distribution of scarce resources attained throughout transformation. But it is not measured only in economic terms but also encompass political participation and social capital (Sanders, R. 2007). Social (class) disadvantage is observable in all aspects of live: beginning from education, employment through political influence, earnings and geographical constrains.

The interesting aspect is that there is no single mechanism (property rights or for example productivity through mechanisation) or prescription that could be applied to every possible county in China and result in similar outcomes. There must be local adjustments to the successful model. The locality and even time perspective, horizon requires considering multiple mechanism working on different levels. An explanation that stresses a single mechanism, whether it will be the property rights, rule of law or government interventions, etc. confronts a fundamental challenge if we put all these cases together. As suggested by the fact that property rights may account for the success of the Wenzhou model but fail to justify the validity of the Sunan model.

To understand peculiarities of Chinese agriculture we should take historical perspective and examine factors potentially shaping agriculture performance and their spatial conditionings.

Historical perspective over Agriculture and Industrial development

The role of agriculture in the course of China's development has been crucial, where agriculture accounted for almost 50% of the GDP proportion at the beginning of reform period. This means that China at that time was agrarian country and national growth rates depended mostly on the performance of agriculture sector. When in 1978 Deng Xiaoping introduced 4th modernisation reform, the emphasis was shifted on industry as a primary driving force of development. This structural change shifts the overall growth contribution burden from agriculture to industry. Together with the economic growth, the share of agricultural product output value in GDP and agrarian population tends to decrease over time (Shujie Yao, 2000). Engel's law predicts that together with increase of disposable income as a result of development, the consumer's basket changes over time in favour of value-added manufacturing products with relatively small increase on food products expenditure (Engels, E. 1896; Timmer C.P *et al.* 1983). It is because food demand elasticity is less than 1 and in China for some grain products is approaching zero. China in spite of ongoing industrialisation and outstanding economic growth for the last decades is still dependent on primary industry.

Table. 1 *Output Value and Labour in Primary Industry, Secondary and Tertiary Industry*

China (2007) NBS	Primary Industry	Secondary and Tertiary Industry
Output value (GDP in 100 mln yuan)	28.627.00	228,679
Labour (10000 persons)	31,444	45,546

**Source: Data obtained from National Bureau of Statistics, China, 2007.*

³ JIN LIQUN (2007), China's poverty reduction initiatives on right track, *ChinaView Online* http://news.xinhuanet.com/english/2007-10/16/content_6888061.htm.

As we can see from the table, labour in primary industry accounts for 40% of total labour. These numbers indicate that China is still in the phase of moving from agrarian country to industrial country. The output/income per capita ratio for primary industry is: 9104,12 Yuan and for secondary and tertiary industry is 50208,36 Yuan. To conclude the output/income per capita ratio of primary industry is only 18% of that for secondary and tertiary industry. It indicates that agriculture is labour-intensive and low value-added.

Table 2. Industrial structure of rural household operation in the East, Middle and West parts

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Table 12 Industrial structure of rural household operation in the East, Middle and West parts

Region	Rural households		Agricultural households		
	% Agricultural households	% Non-agricultural households	% With no Off-farm income	% With off-farm income	% With mainly off-farm income
East	84.71	15.29	52.75	42.51	4.74
Middle	94.71	5.47	66.70	23.44	9.86
West	95.8	4.20	70.27	26.01	3.72

Source: Derived from National Bureau of Statistics of China (2002,c)

* Table derived from Cuddy, M., Lijun, Q., (2007), *The Rural Economy in China and Russia-what is the difference? Is there a lesson from Russia?*

From the above table we can see that eastern regions are in more favourable situation when it comes to the number of non-agricultural households and off-farm income. In western provinces households almost solely rely on agricultural production with little prospects for extra income from industrial or services sector. The differences in developmental pattern could be explained by structural differences in the labour allocation.

Considering the historical perspective of structural transformation, it is often the case in developing countries that the policy bias toward rapid industrial growth led to a tremendous failures. The targets for rapid growth were unattainable, and the outcomes resulted in low efficiency for both agriculture and industry. China tried to induce industrial growth in Great Leap Forward (GLF), but because of poor planning, inadequate resources and unrealistic ambitions the GLF caused the greatest famine in the history of modern China. The new strategy for transformation in 1980/1990 was much more successful, with more balanced growth, more efficient production system under HRS and improved incentives for agricultural production.

We can find a very interesting observation made by Yao, S. (2000), that the periods of economic prosperity and economic boom corresponds with a more favourable agricultural policies launched by the Chinese government. Therefore policies supporting agriculture can produce higher rates of overall growth, which means that agriculture performance has still significant impact on total GDP level.

Reforms: Household Responsibility System and dualistic market structure

The reform implementation in the countryside started with the bottom-up development of household responsibility system (HRS). This process has started in 1978 at the local – village level and took evolutionary form introduced first by peasants disappointed with collective system in Anhui and Zhejiang provinces. Government was reluctant to accept the new form of production as it was perceived as a menace to the collective consciousness of communism ideology. However as first examples proved those decollectivised communes achieved better

results both in production and income. Latter on new system was permitted in regions struggling with poverty and underproduction, improving significantly economic situation. The HRS based on individual household accounting and quota-fixed contracting system with the lapse of time gained great popularity among farmers and quickly spread out informally across the country. Peasants could use their property rights: (1) to use land, even though they were not the owners but land was subcontracted for fixed time period (2) to make decisions what to produce, at least after exceeding fixed-quota (3) the right to appropriate profits and losses out of land (4) the right to sell products on market. Finally government endorsed new system and at the end of 1984 almost 95% of the households adopted new system. The new has system improved work incentives (Lin, 1987), and lowered transaction costs as the labour supervision was now equal zero. The argument for government was clear: improved productivity and on the other hand authorities could retain their influence over agriculture by fixed-quota system. The advantages for peasants were obvious – improved labour monitoring (system more fairly metering peasants effort), thus better incentives to work as each household was responsible for its own production. As a consequence this system provided more just and fair profit and losses distribution. Moreover, household could produce and sell on market products over fixed-quota and earn extra profits. This brought better distribution of resources according to market forces as above-quota products could be chosen freely by farmers. This production flexibility allowed to farm more profitable grains, crops or fruits and as a consequence capital accumulation took place with allocation in marginal products (Feder et al., 1992; Krusekopf, 2002). Furthermore the prices on above-quota market were unregulated by government. All the HRS characteristics made farmers better-off and provided substantial funds for the further investment, for example: machinery, fertiliser or to start up small rural enterprise. As a result the growth of agriculture was impressive during 1979-1985 with average growth rate of 7.4% (China Statistical Yearbook, NBS). Certainly HRS produced different outcomes across Chinese provinces. Some of the provinces achieved greater growth than others, nevertheless growth rate in all provinces across China has boosted off in early 1980s. The differences of growth rates could be accounted for both natural endowments, prices at market for above the fixed-quota products and regional policy.

Role of Industry Development over Agriculture

Many agrarian countries found themselves in dominant-agriculture trap with little prospects for catching-up process and high growth rates. With deficiency of capital and infrastructure both agriculture and industry can not flourish. Authors like Zhou Yingying, Han Hua, Stevan Harrell (2007), claim that it is possible to achieve higher growth rate and households income levels through the surplus of labour in household that seeks non-agricultural jobs, like opening small business, working in the factory etc. Then the accumulation of capital is possible and further investment can be done both in industry or agriculture.

Taking a broad horizon over Chinese economic growth trajectory we can observe a shift from labour intensive toward more capital intensive activities. This shift is certainly a sign of development and structural change. This process can be called climbing the development ladder. A dialectic approach can explain the structural change taking place across sectors and time.

With decreasing significance (in terms of percentage share in GDP) of primary industry and more emphasis on services and value-added industry China is entering a new phase of growth. The sequence pattern of development identified by Rozelle, M. and Huang (2006) identifies agriculture as a starting point (1) agriculture dominant economy, (2) migration dominant, (3) local enterprises dominant (4) industry employment dominant. The whole

process is possible through policy interventions, investment, marketisation, and opening-up and technological progress.

The agriculture was the foundation and financier of industrialisation throughout the history of PRC. This phenomenon could be analysed from two angles – cause of current situation and its consequences on agriculture's future condition that is the object of our interest. First of all, we should focus on the role of agriculture as a foundation of industrial growth during modernisation period. Agriculture laid foundation for boosting manufacturing sector during 80s. The top priority of central government was to foster and develop industry to achieve 4th modernisation, sometimes regardless the consequences on other economy sectors. Therefore agriculture served as a commodity, capital and labour supplier for exponential growth of industry. Each resource accumulated in agriculture as a surplus was devoted for industrial investment. Together with the industrialisation progress the agriculture stopped to be a supplier of industry; however its growth could not unfold entirely as it was still discriminated but now only in the form of under-investment from the state. Nowadays there is strong emphasis in policy agenda to shift government support in favour of agriculture, to carry out harmonisation strategy. Policy of industry subsidising agriculture (PISA) (*yigong bunong*), is a realisation that agriculture needs external help to catch-up, and national economy needs agricultural growth to foster composed and sustainable development. The subsidies could be analysed from two angles. First of all they should bring substantial increase in quality and quantity of farm production, foster technological progress and investment. They must be effective method of funds allocation, which means that there is a high probability of subsidies misuse and mismanagement due to the policy and regulation gap. On the other hand agricultural subsidies should not hinder development of the rest of economy, especially in the rural areas, as successful agriculture depends on successful rural economy and *vice-versa*. It was the case in rural China that funds for subsidies were collected from prospering enterprises (mostly Township-Village Enterprises), taking the majority of their assets (Zhaohui Hong, 1996). In research carried out to examine effect of PISA on grain production little evidence was found in favour of PISA. It didn't stimulate peasant's incentives to work as well⁴.

Second approach is based on Kaldor hypothesis, which states that industry is a propelling force for the whole economy, especially agriculture. Scholars Hansen and Zhang (1996), provided empirical support in favour of Kaldor's hypothesis in specific case of China. The regional disparities of agriculture across China's provinces could be partially explained by the condition of industry in a given province. Basically, the inequalities between regions are likely to come from the current stage of a given province on the development ladder. High rate of industrialisation among coastal provinces and simultaneously better-off condition of agriculture makes us suspect that there is a causality between those two variables. As a result of a specific industrial base the inland regions tend to lag behind in terms of output-capital ratio. The supplementing role of industry over agriculture development can take place in three dimensions:

- (1) labour surplus transfer
- (2) government policy
- (3) rural industry

An agrarian countries are characterized by excessive labour in agriculture. Together with flourishing new sectors new prospects for growth are open. Country can escape labour trap through transferring labour into new sectors with high demand for labour. Central to this explanation is the availability of non-agriculture activities. Those are significantly increasing

⁴ Group of Land Research Project, *op. cit.*, p.92.

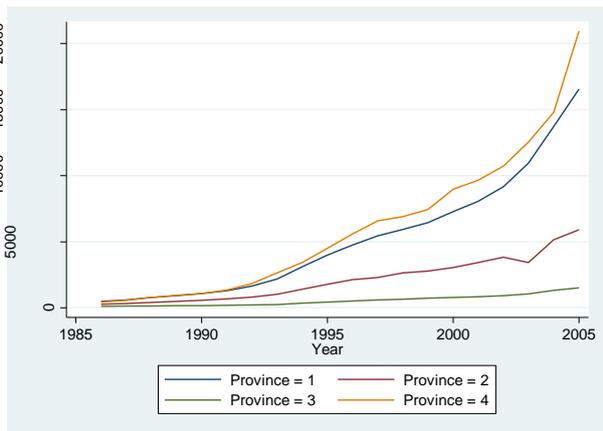
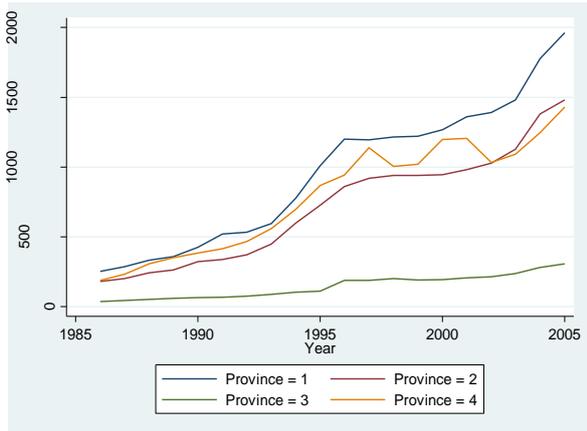
total income level and provide capital accumulation. Secondly, rural industry is very important for agriculture, as it expands market for agricultural products and *vice-versa*. Labour-absorption is more probable on a big scale. Finally, successful industry can provide substantial financial revenue to local government that could be then redistributed to agricultural development.

Table 3. GDP of Agriculture, Forestry, Animal Husbandry and Fishery in China for Province1 = Shandong, Province2=Sichuan, Province3=Gansu, Province4=Guangdong.

Table 4. GDP of Industry and Services Sector in China. Province1 = Shandong, Province2 = Sichuan, Province3 = Gansu, Province4 = Guangdong.

(Table 3)

(Table 4)



*Source: Data derived from dataset. Various editions of Statistical Yearbook were used.

As we can see on the graphs above provinces with higher industry growth dynamics and initial level achieve also higher level of GDP in Agriculture, Fishery, Animal Husbandry and Forestry, with more prospective growth rate in the future.

The whole process is likely to end up working as a self-sustaining reciprocal circle. After transferring resources from agriculture to support industrial growth, manufacturing sectors achieves sufficient level of development with capital and goods accumulation processes taking place. The surplus in terms of capital and production there, can enable reversed transfer of resources, and thus leverage agricultural development. Government is in possession of financial revenues, now taken from manufacturing sector that could be devoted to support agricultural production. The return of industrial enterprises profits to the local budget can result in further investment in rural infrastructure – boosting productivity like irrigation, providing market access like roads and railways (Chien-Hsun Chen (2002) or sparking-off technological progress through mechanisation. In the course of agricultural development the market is capable of taking more manufacturing products (machinery and consumers goods) as it is in a possession of increasing capital resources. The process of agricultural mechanisation requires a substantial inputs from industry, creating a strong backward linkage (Yao, S., 2000). Together with flourishing agricultural sectors a rise of agro-industry producing tool, machinery and fertilisers can significantly improve rural economy, as most of the new manufacturing factories are located at the countryside, run by former farmers, and hence have information and market proximity advantage. Rural industry, especially in form of Township Village Enterprises (TVE), supplying agriculture is an efficient mechanism of labour relocation. Coexistent development of rural industry and agriculture can increase rural household’s net income. This equilibrium situation makes growth more balanced. Thus the prosperous industry both in the form of private or TVEs can lead to substantial improvements in the sphere of agriculture

Certainly agriculture production can not be as profitable as manufacturing or services, but is an essential determinant of sustainable growth especially in such a vast country as China, where balanced and comprehensive growth of each sector is needed. It is very important to reduce poverty, found especially in agricultural sites in remote west, and create opportunities better than those on the edge of subsistence level.

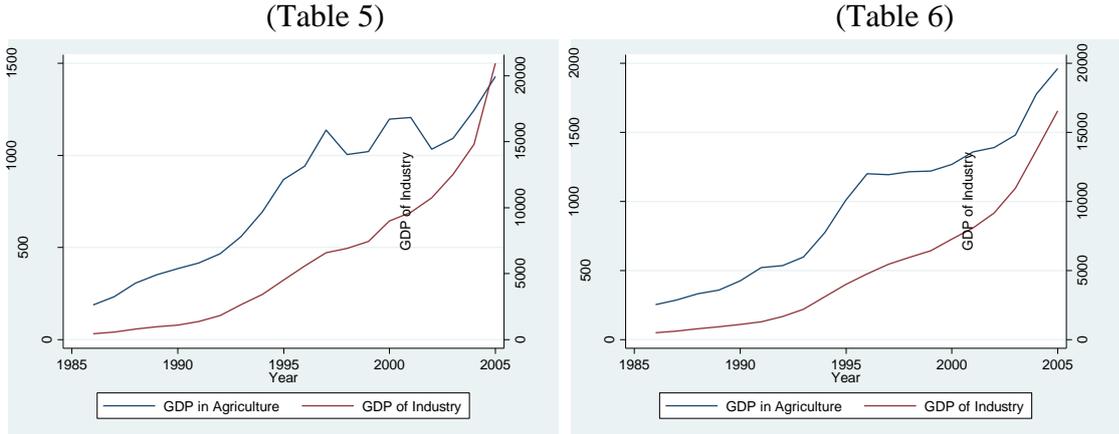
Potential Shortcomings of Industrial Growth on Agriculture development

As noted before due to the policy bias development of agriculture could be neglected or even retarded in favour of manufacturing growth. A rapid growth in non-agricultural sectors was assisted by outstanding resource transfer out of agriculture (Shujie Yao, 2000). This favourism of non-agricultural sectors can occur as resources drainage and its disproportional distribution. Due to the industrial resources demand coupled with over-consumption both in the commodities and capital agriculture can suffer from resource depletion. Government can manipulate agricultural commodities prices to lower the industrial input prices. This can lead to disturbance on farm product market, lower farmer’s net income and thus seriously slow down agricultural development. During transformation period peasants were highly taxed so local government could collect greater revenues, required for capital-intensive industrial investments. Tax on agricultural products and land has increased massively throughout industrialisation. The dual pricing system induced invisible tax and situation where farmers were unable to sell their products on market at higher prices before providing the fixed-quota required by government. In this situation agricultural subsidies has also relatively decreased in favour of industry. In the light of lagged agricultural development lack of subsidies hinders the catching-up process. The majority of funds were directed to support industry instead of improving irrigation systems, introducing mechanisation and preventing natural disasters often occurring in the China’s countryside.

Moreover industrial development may have some adverse effect on agricultural development, such as abuse of farmland, depletion of resources and a shift toward non-farm activities that threaten grain-production self-sufficiency.

Table 5. GDP of Agriculture and Industry in Guangdong.

Table 6. GDP of Agriculture and Industry in Shandong.



*Source: Data derived from dataset. Based on Statistical Yearbook (various editions) and All-China database.

As we can see from above graphs (for Guangdong and Shandong provinces) the GDP of industry is on a much higher level which is obvious as agriculture is less value-added and capital-intensive production, but the pace of growth is also in favour of industry.

The question remains whether industrial growth *per se* can elevate agricultural development level. Data for last 20 years of Chinese development reveals that this argument is invalid. With increasing gap between industrial and agricultural sites across China we can conclude that catching-up process based only on industrial growth without any external factor is not possible. Findings of authors such as Won, Lin (1992) and Yao, S. (2000), support the argument that agriculture did not benefit from the growth of other sectors. There are important determinants of the agricultural growth that can't be provided solely by industrialisation. These factors are commodity prices, government finance, productivity, policy strategies designed to support agriculture specifically and migration.

Agricultural Growth and aspect of labour distribution

Labour and its composition is an important ingredient of development, especially in so overpopulated country as China. Economic growth is accompanied by the labour transfers from agriculture to industry and services, however in China such relocation was mostly confined to rural areas (Yao, S. 2000). The absence of local employment alternative hindered the allocation of extensive labour force. The creation of off-farm employment opportunities is crucial for a agricultural restructurisation. Labour restructurisation induces more efficient incentive system. The rural industry was very important in facilitating labour transfer and easing the burden of overpopulation and excessive labour in agriculture. It can absorb the labour surplus in agriculture and in consequence increase productivity through consolidation of cultivated land or more efficient usage of technology. The crucial issue in rural agricultural areas is low income and living standards of peasants, especially in western provinces. This situation can be ascribed to factor endowments that keep the labour in agriculture which can't provide as high incomes as in urbanised and industrialised regions. The initial conditions before modernisation also play active role. Former industrial base, now expanding in manufacturing boom can facilitate shift of labour towards new sectors with prospects for higher income. The development can be stimulated through policy interventions or hindered when inadequate measures were taken. Policies interventions can shape spatial developmental patterns for example by creating new forms of non-agricultural employment or investment policies.

The phenomenon of imperfect labour allocation in China could be explained by restrictive migration system. The prospects of migration to more developed coastal regions are limited because of the '*hukou*' registration system. Suppressed migration according to market forces can hamper labour allocation in restructuring economy. The provincial barriers limit migration only to provincial borders. Hence, inter-provincial is much lower than intra-provincial migration (Zhang, L., 2005). In provinces with profound manufacturing sectors intra-provincial migration facilitates more efficient labour allocation from agriculture to new industries. Moreover, it is empirically proved by De Brauw, A., & Rozelle, S. (2008), that provinces with high migration rates are characterised by higher investment rates, at least in housing and durables. However, mostly labour relocation is circumscribed and freeing labour processes cannot take place. To move up the development ladder a shift of labour resources from low to high productivity sectors must occur (Fogel, R., 1993). That was the scenario of the successful Asian-tigers growth. Some provinces lack a diversified economy therefore labour transfers are restricted. In provinces with dominant position of the State-Owned-Enterprises (SOE) and agriculture but with absence of private and township-village initiatives the labour transfers are not likely to take place. SOEs sector is rather stable when it comes to employment creation, not as dynamic as a private or collectively-owned type. In provinces with state monopolies the existence of private entities is undermined by state interest in remaining market monopoly.

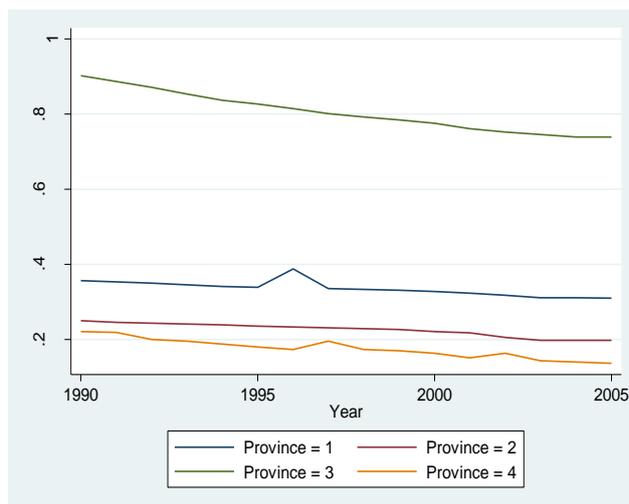
Infrastructure

In the literature of economic growth infrastructure is emphasised as a crucial foundation for economic development (Fan, Zhang, 2004). Comprehensive infrastructure can effectively lower transaction cost on the market. As found by Chen and Lin (2002), rural infrastructure projects in irrigations, transportation (roads and railways), primary products market and weather forecasting services can increase production through decreasing transportation and dealing costs lowering the overall production expenditure (Peng, 2002). Projects such as irrigation minimise the risk and enhance predictability thus in general improve production efficiency. On the other hand deficient rural infrastructure can hamper agricultural production and induce technological lag (Li, Z., Liu, X., 2009). The rural infrastructure investment projects can substantially release potential of agricultural production (Feng, *et al.*, 2004). Existence of well-developed transportation routes and railways can facilitate commodity and labour movement, thus provide better market access and resources allocation. The main reason behind under-investment in remote areas is basically inaccessibility of those areas.

Cultivated area per household, scatter land and obstacles to productivity increase

Chinese landscape differs significantly from region to region. In some areas we can find fertile lands and on the other hand some regions are struggling with infertile deserts or degraded soil hindering agricultural production. Basically, when it comes to production China's farm land is characterised by land fragmentation caused by reforms introduced more than two decades ago (Nguyen, Cheng & Findlay, 1996; Wu, Liu & Davis, 2005).

Table 7. Cultivated Area per Household in China. Province1 = Shandong, Province2 = Sichuan, Province3 = Gansu, Province4 = Guangdong.



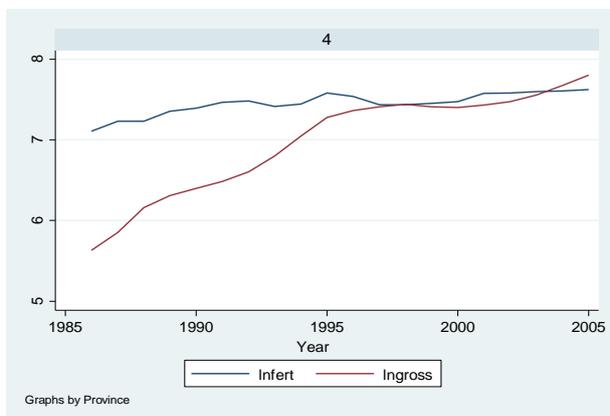
Source: Data derived from dataset.

In 2003 the per capita arable land was only 0.106 Ha – 40% of world average (CSLAB 1996, Liu 2000, Lin & Hob 2003). As we can notice from our sample there is an ongoing decline of cultivated land over the last 20 years (Table 7). As noted by authors Fleiser and Liu (1992), farm land and crop consolidation among households could contribute to increase in agricultural productivity in China. Hence, it's reasonable to consider process of cultivated land distribution and readjustments over time and potential impact on agricultural development through technological progress and hence

productivity increase. The actions undertaken by government to increase cultivated area were inconsistent and resulted in no increase whatsoever. On the one hand land reclamation did not outweigh the loss caused by land removal. The loss of land was mainly due to the pasture, expansion of industry and urbanisation process. Important contributor to the shrinkage of cultivated has brought Grain-for-Green project launch by central government. The aim is to

turn over 340,000 hectares of cultivated land back to forest and 430,000 hectares of bare mountains and lands solely in West China⁵. It is estimated that each 1000 RMB increase in GDP cause a 1.36 hectare loss of cultivated farmland (Zhao, J *et al.* 2007). This tremendous land lost could have an advert effect on general agricultural productivity and can undermine the scale operations as the agricultural population is still increasing but available farmable land is decreasing. The issue remains of how to secure sustainable food supply, especially with soaring prices and unstable world's market for farm products. Authors like Brown (1995) are concerned about China's self-sufficiency to provide enough food in the future. China's goal was to gain self-sufficiency of grain production. This aim was completed with 95% of domestic demand coming from domestic production. However the issue of sustaining high productivity growth rates to satisfy increasing demands of increasing population remains on the top of policy agenda. The problems arise as the fertiliser use can provide relatively lower increment in gross output value than before. It's due to the overuse of fertiliser in some provinces, land degradation and little prospects for the further productivity increase.

Table 8. Logarithm of fertiliser use and logarithm of Gross Output Value in Guangdong.

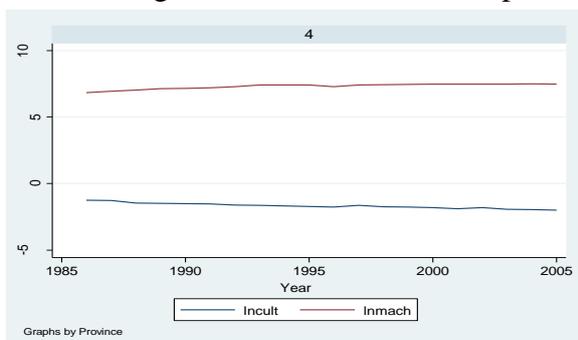


For example increase in fertiliser use in Guangdong is not adequate to the increase in output. It means that there could be a serious limitation in the magnitude of fertiliser usage to increase gross output value in the future only through application of more chemical fertiliser. National accounts indicate that 108.2% increase in chemical between 2000-2001 was accompanied only by 103.8% increase in gross agriculture output value⁶.

*Source: Data derived from dataset

In economic growth literature and especially agriculture science we can find that scale operations tend to influence positively agriculture productivity (Wang *et al.*, 1996). This phenomenon is clearly observable in USA, where agriculture production takes place on a huge farms where inputs can be used more efficiently. The successful development of coastal regions could be attributed to lesser land fragmentation and ongoing land-consolidation processes which resulted from rapid development of non-agricultural industries in coastal provinces and successful policy aiming at reallocation of labour.

Table 9. Logarithm of Cultivated land per Household and logarithm of machinery use.



Households with small farms tend to apply less machinery as the investment doesn't bring expected increase in the productivity. Moreover the machinery productivity relatively decreases together with shrinkage of cultivated land per household. Even though on the graph there is incremental use of machinery, we can expect it would be much greater with higher ratio of cultivated

⁵ People's Daily Online, March 30, 2000. Business. Grain-for-Green Projects Take-off in West China.

⁶ All-China, Data Centre. ACMR, Data on Consumption of Chemical Fertiliser and Gross Output Value of Farming.

area per household. The increase in machinery means that some households introduce tractors or basic machinery for the first time, instead of increasing their machinery base to boost the productivity. Another aspect is associated with a land tenure. In China peasants do not own the land but subcontract it on a fixed period (usually 50 year). The land tenure is a serious obstacle for a land consolidation process and can also exert influence over the farmers' production behaviour like investment incentives (Wen, 1995; Yao, 1995; Li, G., *et al.*, 1998). Wen (1989, 1995) asserts that poor and insecure land tenure was the reason for relatively slow growth in the agriculture. The insecure land tenure, mostly because of short tenure period and local authorities interference can hamper agricultural productivity. With a short term tenure any long-term investments on land are burdened with a risk. Secondly, land-use rights, are not subjected as a collateral for credit, therefore indirectly slowing down any potential investment in land (Krusekopf, C.C., 2002; Feder, Onchan, Chalamwong, & Hongladarom, 1988). The market for land doesn't exist therefore land transferring and distribution between farmers is restricted. The variation of land transfers over regions in China might be an underlying force behind unequal pace of development. The intensity of land transfers depends on the availability of non-farm employment (Krusekopf, 2002). However another problem emerges. Even though land is a scarce asset in China it is misused or often abandoned. To be a user of a land you must be identified as a peasant. Those who managed to engage in non-agriculture activities tend not to give away their land rights. Hence their land is being abandoned, not used in any way, therefore contributing significantly to the overall land inefficiency. To sum up productivity issues concerning land fragmentation are problematic for agricultural development. Healthy land concentration and consolidation process is necessary to support scale operations and application of machinery. How to perform land consolidation? The marketisation of land rights and legal system allowing conversion of land into shareholding cooperatives or other forms of collective enterprises could solve problems afflicting agriculture. Granting longer tenure agreement can enhance security of property rights. To avoid abuse of land a better land-use supervision system with market for land-use rights can work out. Government can stimulate land consolidation and enlargement through tax system incentives aimed at land reclamation. It could be supplement by lower tax based on output not merely land-use right.

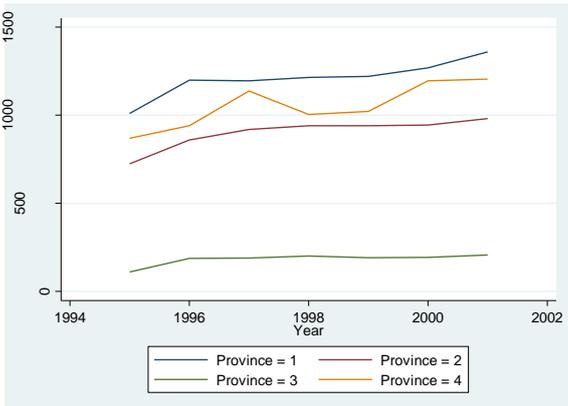
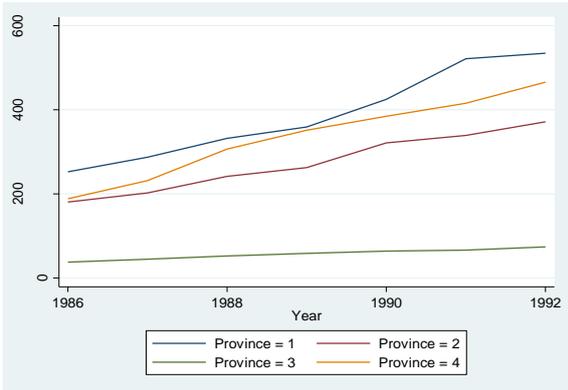
Fiscal Decentralisation and aspect of inequality

Apart from historical factors and natural endowments fiscal federalism gave foundation for a different patterns of development. The autonomy of local government (when it comes to industrialisation or agriculture) and policy that was undertaken resulted in different economic outcomes.

While considering the economic achievement, we should also emphasise that China has changed from one of the most egalitarian country to one of the most unequal countries in the world. Despite the rapid growth of agriculture after decollectivisation period 1979-1984 and following years Chinese agriculture sector has been relatively neglected in the policy agenda. This process has strengthened through fiscal decentralisation. Each province was given more authority in the sphere of a tax collection and its redistribution in form of subsidies. Jurisdictions were supposed to compete for investment, hence enhancing efficiency and productivity. The role of central government has decreased, creating situation with insufficient central funding as the revenue was retained by the local government, vague national policies and inability to foster balanced growth across provinces. As local government sought revenues at all cost to propel industrial growth, agriculture was the sector to provide these funds. As it was seen, only broad manufacturing base could provide future revenues thus make particular province better-off. All the policies were biased in favour of

manufacturing sector, with discriminating exploitation of agriculture. Even though countryside required more investment in infrastructure, public goods, social security, all the expenditures aimed at expanding industrial base. Local government was in power to fix farm product prices, wages, labour rights and migration restrictions. In this period some of the provinces adopted the best choice optimum and achieved greater prosperity. Hard budget constrain on the local government induced better management and better resources distribution. Other provinces lagged behind as they could not collect sufficient revenues (as the region was not rich enough before in terms of resources), lacked entrepreneurship or fertile agricultural land. In consequence the investment was hindered both in infrastructure, human capital or innovation. Such a province was devoid of central support that was crucial to laid foundations – such as roads, railways, irrigation and schools – the basic ingredients of development. There was no uniform policy to foster agricultural growth. Provincial barriers together with registration system *hukou* have firmly limited inter-provincial migration. As a result the development trajectories differs across China’s regions, certainly it is to some extent because of the regional endowments, but regional and central policy has played active role in shaping current inequalities between provinces. We can see from the table the growth dynamics in Agriculture were greater before fiscal federalism. Fiscal reforms in 1994 cumbered the pace of agriculture growth.

Table 10. GDP of Agriculture, Forestry, Animal Husbandry and Fishery from 1986-1995.
Table 11. GDP of Agriculture, Forestry, Animal Husbandry and Fishery from 1996-2005.
 (Table 10) (Table 11)



*Source: Data derived from dataset.

Township and Village Enterprises

The development of rural economy was driven by the rise of township village enterprises (TVEs) (Zhaohui Hong, 1996). They are collectively owned entities, not private but run and controlled by the local community, township or village governments. The key functions of TVEs is employment creation and revenue generation. They are likely to enhance local development and growth. Job creation can facilitate employment circulation and labour distribution (Jin & Qian, 1998). In the case of agriculture and abovementioned problems with labour surplus this mechanism proved to be efficient as an absorption platform. It is estimated that TVEs have provided roughly 23 percent of the total rural labour⁷. TVEs were the engines of a tremendous productivity increase not only in industrial economy, but as we can suspect in agriculture production. For example the output value in the most prominent province of TVEs

⁷ (The Chinese Communist Party should prohibit the crisis of unemployment from massive instability, *Zhongshi Zhoukan* (The China Time Business Weekly), No. 113, 1994, Editorial p.3.

- Zhejiang accounted for 65 percent of the total industrial output value and its number reached 500,000⁸ employing 7 750 000 people which is more than 1/3 of the total rural labour⁹. TVEs as an efficient form of revenue accumulation, were a substantial channel for capital redistribution. The policy of industry subsidising agriculture was mostly based on the capital accumulated by TVEs. In total TVEs contributed approximately 50 percent of the total agricultural subsidies provided by the government¹⁰. TVEs and their concentration tend to attract the attention of authorities. The local environment is created by TVEs owners. In consequence the investments are done in the infrastructure that links the remote regions with major communication and transportation routes. Moreover, informal subsidies by TVEs were promoted through the local government. It was in the form of grants, services like transporting, irrigating, fertilising etc. This service assistance was widespread because 68.3% of villages received such support from TVEs¹¹. Furthermore, we can hypothesise that TVEs are superior to private business in terms of supporting agriculture development. TVEs tend to locate close to the resources base and community/town/village. Their production is more farm-oriented. Private enterprises are not constrained by the location requirement – they mostly exploit this opportunity and relocate to a more prosperous locations in East. Therefore the labour-creation of private business is lesser in the remote west provinces, than TVEs, because private initiatives don't appear on such a scale there as TVEs could. A critical component of sustainable TVEs growth that could pull agriculture development is to prolong the production chain by promoting processing in order to raise added value, which presents opportunities for TVEs. The agri-food industry needs to catch up with developed countries, where the ratio of processing output value to agricultural output was at 3 to 1, compared to 0.6 to 1 in China. Currently only 30 per cent of TVEs are involved in this sector. During modernisation period in China TVEs had a major contribution to overall economic growth. The peak of TVEs as a form of ownership in mid-90s contributed roughly 50% to national gross industry output with 5 mln job creation per year. Now, simultaneously with the relative decline of TVEs in favour of a private enterprises the income gap between rural areas (with dominant TVEs) and urban has widened sharply.

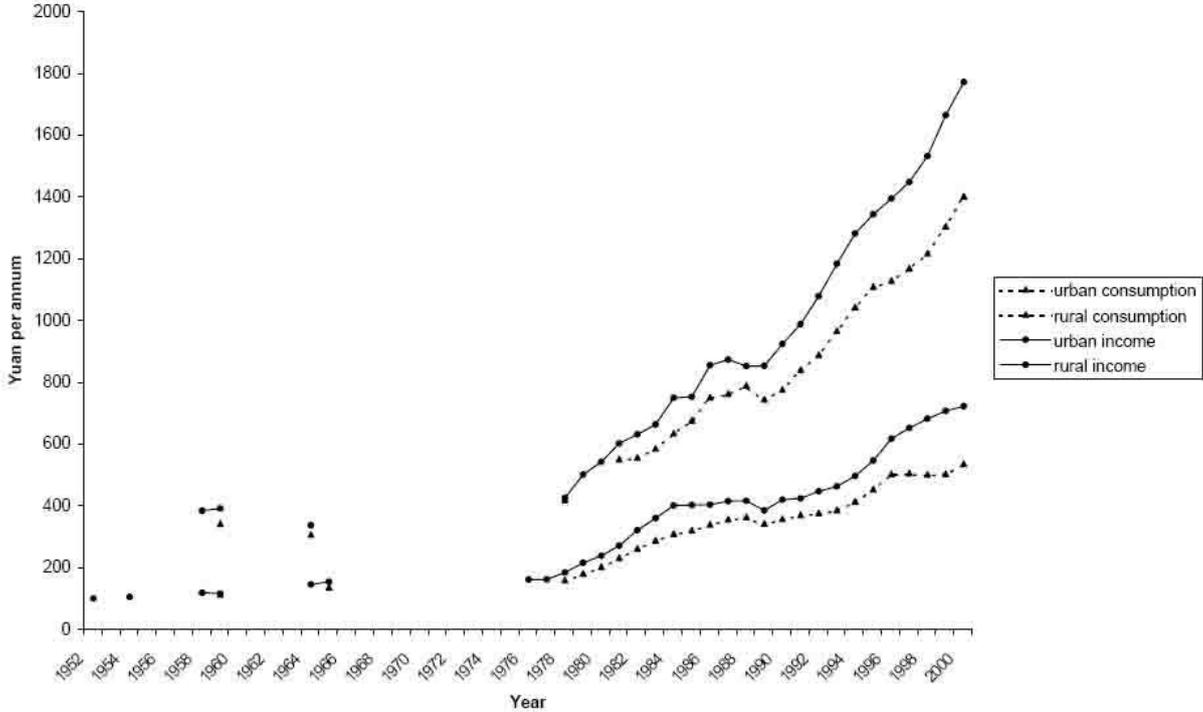
⁸ Zhaohui Hong (1996), Industry Subsidising Agriculture: China's TVEs, *China Report* 1996 32(59) pp. 59-70.

⁹ Data for 1994, China Statistical Yearbook (1995), Total Rural Labour consist of Agriculture, Animal Husbandry, Fishery and Forestry, Industry, Construction, Transportation, Wholesale, Retail Sale, Food Services and Storage and others.

¹⁰ Chen Jiyeuan and Han Jun (Eds) (1993), *Zhongguo nongcun gongyehua daolu* (The Road of Rural Industrialisation in China), Beijing Zhongguo shehui kexue chubanshe, p. 63.

¹¹ Zhaohui Hong (1996), Industry Subsidising Agriculture: China's TVEs, *China Report* 1996 32(59) pp. 59-70.

Table 12. National data on urban and rural income and consumption in China 1952-2000.



*computed by Knight, J., Li Shi, and Lina Song, (2004).

Period between 1994 and 2000 when fiscal federalism was introduced and TVEs entered stagnation in terms of growth has seen unprecedented divide between rural and urban areas. This of course was mostly caused by the flourishing industry and relative lag in the agriculture. On the other hand we can assume that government on local or provincial level in worse-off regions could not encourage industrialisation through the development of TVEs and thus job creation was hindered. In consequence majority of labour remained concentrated in farm activities. However we should pay attention to the fact that due to the worse natural endowment (soil fertility, irrigation) western regions couldn't accumulate enough capital to start-off industrialisation. We can notice that the ratio of TVEs is much higher in the East than in West. Eastern TVEs are larger, more dynamic, technologically more advanced, have more assets per employee, are more profitable, more dependent on own finances for investment and absorb a larger percentage of rural employment than in the West (Cuddy, M., Lijun, Q., 2007). Certainly concentration effect of TVEs took place in Coastal areas. In the light of abovementioned arguments of positive role of TVEs on agriculture we can explain regional disparities in China.

Even though the TVEs are no longer perceived as a driving force of labour transformation, we can notice that the real number of people employed in TVEs is still increasing within our research period. It means that TVEs are still labour producing enterprises. On the other hand we should emphasise that TVEs have lost their dominant position as a job-creators in favour of other industrial initiatives – private business and foreign enterprises.

Conceptual and methodological framework

The phenomenon of China's development is co-existence of a number of diversified patterns of development which is a source to broadly understood inequality. My research question oscillates around issue of convergence or divergence between the rural and particularly agricultural areas across China. I want to address the important question what makes particular provinces more successful in bringing higher GDP growth and subsequently per capita income. Therefore I want to check for particular factors that contribute the most to agricultural growth.

Basic factors accounting for agricultural growth, development pace and provincial characteristics

We can divide factors shaping agriculture growth into following categories: First of all production input should be taken into account such as labour, capital, chemical fertiliser, machinery power, irrigated and cultivated area. Furthermore we can identify external factors that can affect agriculture development such as education, infrastructure and industry development. The agricultural productivity can be affected by technological progress measured for example by machinery usage. Moreover institutional aspect should take an active role in agriculture growth. In this category we can consider loans to agriculture and net subsidies devoted to agriculture, forestry, fishery and animal husbandry. Below we can find brief description of factors contributing to agriculture growth.

Table 1 Determinants of Economic Growth 1986-2005

Explanatory Variable	Symbol	Basic regression	
		No. of Regions	No. of Observations
1. Investment and Technology			
1.1 Total Power of Machinery		4	80
1.2 Roads and Railways Length		4	80
2. Rural Labour			
2.1 Agriculture Labour to Non-Agriculture Labour Ratio		4	80
2.2 Employment in TVEs		4	59
3. Land			
3.1 Irrigated Area per cultivated land		4	80
3.2 Application of Chemical Fertiliser		4	80
3.3 Cultivated Area Per Household		4	64
3.4 Cultivated Area Suffering from Natural Disasters		4	67
4. GDP and Gross Rural Output Agriculture and Industry			
4.1 Share of Industry and Services in GDP		4	80
5. Public Finance			
5.1 Net subsidies		4	80
5.2 Loans to Agriculture		4	80
6. Initial Conditions – GDP level			
7. Farm products price Index			
8. Education, Secondary School Enrollment		4	80

Labour Ratio

Labour ratio is computed as the ratio of agriculture-labour to non-agriculture-labour. This ratio can describe labour force composition changes over time. We can trace transformation towards more non-agriculture employment with the lapse of time when the ratio is decreasing.

Initial Conditions

Initial Conditions are measured by GDP per capita level. Lagged GDP per capita variable can measure convergence or divergence process throughout examined period of time. To capture the impact of initial condition a logarithm of GDP per capita level will be used.

Property Rights

It is extremely difficult to measure property rights. Due to the paucity of data and ambivalent notion of property rights which don't find direct reflection in databases it is difficult to measure and find proxies for Property Rights. Some scholars like Chien-Hsun Chen (2002) use control variables capturing effect of property rights like: sown area, entrepreneurship and secondary school enrollment. Unfortunately land-tenure statistics are not available therefore I was not able to gather data on average land-tenure and examine how secure tenure arrangements are strengthening property rights and affect individual incentives to work.

Education

In literature great significance is attributed to education level as a factor improving productivity in agriculture (Chen, Huffman and Rozelle, 2006; Lu, Z., Liu, X., 2009). The education is measured as a secondary school enrollment, but the effect should be considered from two angles, especially we should distinguish direct and indirect impact of education. We can assume that the larger the number of students the more productive agriculture performance is. This direct relationship means that educated farmers utilise their knowledge on land, on farming activities. However, that's only one side of the coin. Now, when we consider that in average village the school enrollment is below national average, then finding a village with high number of educated kids doesn't mean that they are going to stay in their home. Mostly they choose to pursue further education – High School, University etc. They won't stay and do basic farming activities as all their skills won't be used fully. What plays role is the drainage of these young people. It means that actual population of village decline, household shrinks *ipso facto* alleviating the per capita income. Furthermore, successful students can provide capital from their more profitable jobs in industry or elsewhere. Those students create more diverse countryside economic environment with more job array. They are capable of land buy-outs and opening non-agriculture initiatives.

Agricultural Loans and Net Subsidies

Capital accumulation among households is crucial to boost-off investment in the rural areas. However with low net income per households and low rate of savings it is extremely difficult to accumulate sufficient funds. Therefore in development economics the role of external help is emphasised as a factor significantly contributing to growth. This 'artificial' injection of funds can laid the foundation of self-reliant developmental process in the future. Net subsidies are measured as a difference between tax on agriculture and funds supporting agriculture production.

Share of Industry in GDP

Share of Industry determines where exactly particular province is on a development ladder. We expect that higher contribution of Industry and Services in the GDP

determines higher total GDP growth. The impact on agriculture could be ambivalent, but expected to be positive.

Machinery Power and Application of Chemical Fertiliser

Machinery power and chemical fertiliser are signs of a modern agriculture. These inputs improve efficiency and agricultural productivity. Chemical fertiliser can boost gross output value of a farm products. Machinery such as tractors facilitates farm work and allows for a greater productivity. Machinery is measured in total power of farm machinery (kW), and fertiliser usage is measured in tons.

Cultivated Land (per Household)

As noted before China is struggling with scattered farm plots and low ratio of cultivated land per household. The cultivated land can hinder productivity because the scale operations could not be applied. The usage of a machinery and investment in small scattered farm plots brings less efficiency than in a large consolidated households. Cultivated land per household is measured in hectares.

Length of Roads and Railways

Through this variable we can measure accessibility and connectivity of a given province. It gives as a picture of market access and proximity and therefore flow of products. It encompasses export-capabilities and circulation of inputs and outputs. It is good proxy for infrastructure and communication. Kilometers scale is applied to measure length of roads and railways.

Cultivated area (hectars) with irrigation system (Ratio)

This ratio is calculated by dividing hectares of cultivated by hectares of irrigated area in a given province. Irrigation systems improve arable land, makes harvests more predictable, especially in areas struck with natural disasters. It is potential tool for productivity increase, as harvest could be done few times per year, depends on the crops. For China the ratio of cultivated land with irrigation system is still very low. Apart from the natural conditions like vast territory and deserted areas, still only 50% of arable land has access to irrigation.

Employment in TVEs

This variable represents the effect of township and village enterprises employment over agriculture. As mentioned before TVEs served as an off-farm labour creation engines, especially during 1990s. The rural industry when compared to urban industry is more accessible for peasants therefore can facilitate labour transformation and can support agriculture directly through higher demand for agriculture inputs.

Dummy Variables

I divided my research period under investigation into two sub-periods. First periods encompasses years from 1986 to 1995. The late 80s are the years of relative stagnation of agriculture. On the other hand in early 1990s economic reforms were introduced to support

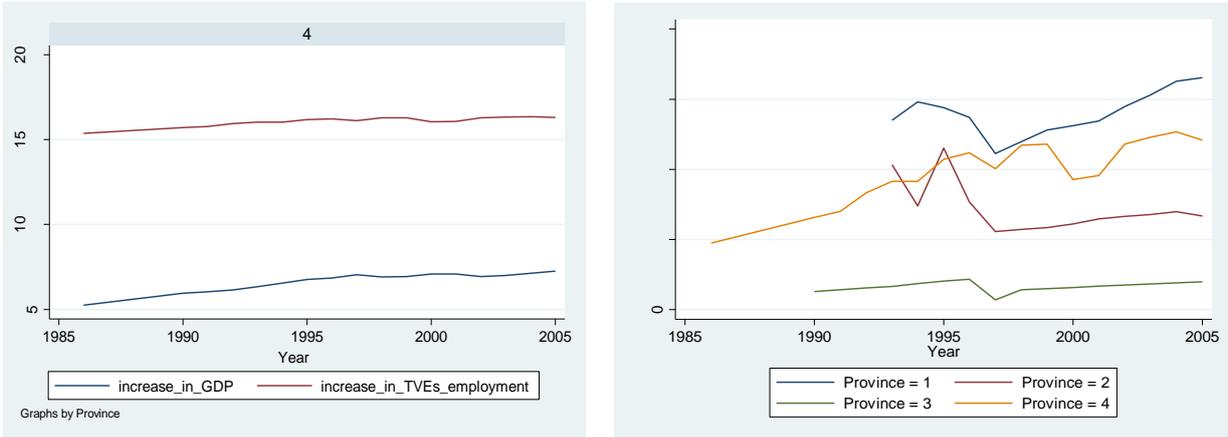
agricultural growth. Furthermore fiscal decentralization could play a significant role in agriculture development. I expect that their effects could be visible in the second half of 90s. Therefore second period starts in 1996 and ends up in 2005. The second period is also perceived as a time of divergence in terms of the growth levels. Starting from the 90s inequality between provinces has risen rapidly both between rural-urban areas and between rural areas.

In my regression analysis I imply dummy variable for Western or Coastal regions, with an attempt to measure the performance of western regions when compared with coastal counterparts. Having coastal province as a dummy we can depict that having all economic variables (above independent variables); there is a tendency for greater GDP growth. We can identify the coastal regions-specific factors explaining their higher economic development. Simultaneously we can check whether western provinces tend to lag behind, and whether catching-up process in provinces with lower GDP level exists.

Coastal Provinces

The coastal provinces are characterised by a dense population, relatively well-developed infrastructure and rich industry base with proximity to the urban centers. Sectors dominant in coastal industry are concentrated around processing, technology, textile and exportable manufacturing which mean that they are value-added with high price and relatively small production cost. Coastal provinces enjoyed policies encouraging FDI – through tax allowances and preferential treatment. Those FDI’s went to the rural areas as urban industry was dominated by the SOEs. Development of rural industries was based on a rural farm-labour. The aim was to establish light labour-intensive industry to produce exportable products.

Table 13. GDP increase and TVEs employment increase in Shandong.
Table 14. TVEs Employment in Shandong, Sichuan, Gansu and Guangdong.



**Source: Data derived from dataset.

I have chosen Guangdong and Shandong as an exemplary model for successful transformation. Guangdong is highly developed region, both in agriculture and industry. It went successful way throughout the transformation from the 6th at the national rank in 1981 to the 1st / 2nd in 1990s. Noteworthy in Guangdong during the rapid growth a dominant form of ownership was the collectively-owned and managed enterprises. Table 14 presents superiority

of Shandong and Guangdong in terms of TVEs employment. At the same time we observe causality between GDP increase and TVEs employment (Table 13).

Of course private sectors has grown at the same pace as in other regions but was overshadowed by collective form of ownership (Islam, 1991; Oi, 1995; Lau 1994) (found in Graham E., Johnson Yuen-fong Woom, 1997). Guangdong government has introduced a restrictive law against land degradation and supported it with the policies of land reclamation. Only specially designed areas could be transformed into non-agriculture sites. A law was introduced, restricting permanent urban settlement of the rural population in large cities like Guangzhou (Siu, 1990; Woon, 1993; Xu and Li, 1990), therefore forcing local workers to establish local enterprises like TVEs instead of migrating to big cities and pursuing job opportunities there. Guangdong's comparative advantage was proximity to Hong-Kong, where the major investment came from. Small-size businesses were subsidies by Hong-Kong export producers. Manufacturing products were exported to Hong-Kong and forwarded to Europe and US. Hong-Kong initiatives were driven by a low input costs: labour, materials minimal regulations and cheap land. As a result Guangdong succeeds as a major industrial base with vast job-creation. For example Wantong is a large multi surnamed village which in 1979 almost 85% of labour forced remained in Agriculture. The situation changed dramatically in 90s and in 1994 only 27% remained in agriculture. Most of the labor force was transferred to collective enterprises and joint ventures (Johnson G.E., Woon Y.F., (1997). Shandong is another successful province in terms of agriculture as it ranked 1st in 1993 compared to other provinces.

Western Provinces

Western provinces are characterised by a very difficult natural conditions: hilly, mountainous, deserted terrain, with low productivity as a consequence and rather disperse population across vast land. The comparative advantage of western regions is mostly in agriculture production and resources. Industry base consists of heavy industry, metallurgical processing, resources mining and raw materials, which means that the products are with small added value and with high production costs. The FDI inflow is marginal, with little prospects for spillover effect. Western provinces were discriminated in terms of government support like infrastructure investment. Low quality of land is prevalent with low migration ratios due to the registration system restrictions. The major problem is an inaccessibility of remote villages, poorly-developed infrastructure, therefore extra transportation costs and weak industrial base. The infrastructure build-up is essential to incorporate these remote poverty-struck regions into retail market. It is important to connect distant production sites with agglomeration centers as it brings substantial increase in demand.

In my analysis I have chosen Sichuan and Gansu Provinces as representatives of Mid-West provinces. Sichuan province is a typical agricultural province. Gansu on the other hand is rich in mineral resources; therefore mining sector is dominant in economy, although agriculture production includes cotton, linseed oil, maize, melons, millet, wheat and medical herbs.

With all variables described we can draw our research hypothesis

Hypothesis

- Input quality and quantity such as fertiliser use can significantly improve agriculture productivity; therefore contribute significantly to the agricultural growth.

- Machinery usage as a proxy for household's investment in production tools stimulates productivity rate. The machinery productivity however depends on cultivated area per household.
- Cultivated area per household determines agricultural development. Low ratio of cultivated area per household can hinder machinery usage, scale operations and in the consequence lower total productivity.
- The above-average development of agriculture in one region depends on the development of TVEs at that time in this particular region. I expect that TVEs has played essential role through labour-absorption capacity. The major differences in agricultural growth and in consequence dichotomic trajectories of development stems from the successful or debacle TVEs policy.
- Government support is important as a factor sparking-off agricultural growth, especially in the lagged, remote western provinces. Hence, loans to agriculture and subsidies should exert positive influence over agricultural growth.
- Well-developed infrastructure in form of comprehensive roads and railways system can facilitate agricultural development through connecting villages to new absorptive markets. It can also improve export abilities or particular regions.
- Education level measured by secondary school enrollment improves productivity in agricultural production.
- Initial historical conditions can affect development pattern of provinces in China.
- Second period between 1996-2005 is characterised by more severe development divergence between agricultural regions than at the first period (1986-1995) of our research analysis. The reforms of fiscal decentralisation severely affected balanced development between provinces in China.

Dataset and estimation method

The data used in this study was compiled from four Chinese provinces and observations encompass 20 years (1986-2005), that could depict the ongoing changes in agricultural development¹². To measure development, independent variable of GDP growth rate will be used. However the process of transition and changing economic structures in China can make this analysis partial and incomplete investigation. Certainly, dataset does not include whole country (29 provinces), thus any general conclusions on national policy are exposed to be bias. To depict the different development patterns across China we can measure the change of particular independent variables in chosen provinces over time and conclude which strategy was the most beneficial for agriculture only in provinces under our observation. Certainly we can get specific answer to the question what was the most important ingredient of growth but only in regard to these 4 provinces. To avoid this limitation this study gathers provinces with different economic background, from diverse geographical areas. Thus each province could represent a group of provinces with similar characteristics. To estimate my model I am using panel data analysis method. The panel estimation method makes it possible to combine cross-sectional and time-series dimension of the data. We estimate growth equation by using Barro-type framework (1991) and Sala-i-Martin (1992). It allows for examining conditional convergence using the endogenous growth model and checking for inequality by adding to a Solow-type equation a set of variables

¹² All the data were gathered from Statistical Yearbook of China (various editions), (NBS) China Rural Statistical Yearbook, China Agricultural Yearbook and Provincial Statistical Yearbooks (various editions for Guangdong, Shandong, Gansu and Sichuan). Moreover All-China database was found very useful to fill in missing observations or compose whole variable.

reflecting disparities in the steady-state equilibrium. We want to check for differences in inputs that are likely to enhance productivity such as: mechanisation, fertilizer and factors exogenous to agriculture production – share of industry, labour ratio, schooling, infrastructure and geographical dimension.

To sum up the growth equation looks like:

$$GDP_growthrate_{it} = \alpha_i + \eta_t + \beta y_{it-1} + \gamma X_{it} + \phi Z_{it} + \psi W_{it} + u_{it}$$

where GDP_growthrate is a logarithm form of GDP in agriculture, y represents level of real GDP per capita from previous year. The index $i=1,2,3, \dots$ represents provincial cross-sectional data and $t=1,2,3, \dots$ represents provincial time-series data. 'X' consists of variables describing inputs for agricultural production (land, labour, fertiliser, machinery). Variables under 'W' tries to capture the differences in regional economic structure (Share of Industry, Labour ratio) and differences in reform implementation through government interventions (net subsidies, loans to agriculture) and 'Z' contains measures on geographical location and infrastructure endowments such as irrigation systems, roads and railways. η_t and α_i are time- and province-specific parameters. Two variables have a lagged form. First of all GDP (-1) measures initial conditions and how previous record affects the level of GDP in the next year. We want to check whether there is a advantage of having greater GDP that transforms into higher growth rate, namely whether there is possibility for catch-up process, convergence and whether or not diminishing returns to scale are at work. With a negative GDP(-1) variable sign the hypothesis of conditional convergence will be invaild. Secondly the net subsidies are lagged by one year. The explanation behind this operation is that subsidies are usually 'active' after one year. For example after fiscal year subsidies are assigned to a given farmers, mostly it takes a couple of months to receive them, therefore any potential investments can work out after approximately one year or even more. Moreover the magnitude of government support mostly depends on the last year performance.

Before running regression several test should be performed to choose the model specification. Hausman test indicates that a fixed-effect model is preferred to a random-effect model. The fixed-effect model controls for possible unobservable effects that are constant across regions over time. The fixed-effect model is estimated with constant slopes and different intercepts for given province. The disadvantage of fixed-effect model is that we can investigate only confined effect of our sample. Given the multiplexity of peculiar provincial ingredients it might be imposible to get robust quantified data in this case. However there are several arguments behind presenting estimations from both fixed-effect and random-effect. As noted by Demurger, S., (2000), it is a effective way to check for the robustness of our regression estimates. Moreover Mody and Srinivasan (1998) stress that random-effect model depicts a composite picture as it takes into consideration the within and between perspectives.

Estimation results:

Growth Determinants of Agriculture 1986-2005					
Explanatory Variable	Random Effect (1)	Fixed Effect (2)	Random Effect with dummy (3)	FGLS (4)	GLS2 (5)
GDP (-1)	.7348*** (0.000)	.7164*** (0.000)	.5146*** (0.000)	.7348*** (0.000)	.7231*** (0.000)
Labour Ratio Agriculture to Non-Agriculture	.4977*** (0.000)	.5270*** (0.022)	.7083*** (0.000)	.4977*** (0.000)	.4604*** (0.000)
Agricultural Loans	-.0539 (0.365)	-.0436 (0.512)	-.0723 (0.189)	-.0539 (0.288)	-.0906* (0.057)
NetSubsidies (-1)	-.0855*** (0.009)	-.0778*** (0.015)	-.0670*** (0.012)	-.0855*** (0.002)	-.0706*** (0.004)
Share of Industry and Services in total GDP / GDP of Industry	-.4832 (0.176)	-.1960 (0.581)	-.2086 (0.471)	-.4832 (0.113)	-.2805 (0.355)
Machinery Power	-.0713 (0.696)	-.0246 (0.920)	.0412 (0.735)	-.0713 (0.647)	-.0756 (0.601)
Length of Roads and Railways	.7896 *** (0.000)	.2300 (0.435)	.2599* (0.109)	.7896*** (0.000)	.7641*** (0.000)
Cultivated Area	.7437*** (0.006)	-.0379 (0.926)	.2162* (0.076)	.7437*** (0.001)	.7406*** (0.001)
Fertiliser Use	.0683 (0.472)	.0782 (0.409)	.0394 (0.635)	.0683 (0.400)	.0408 (0.651)
Secondary School Enrollment	.0187 (0.637)	.0143 (0.699)	.0077 (0.806)	.0187 (0.580)	.0252 (0.525)
Employment in TVEs	.1580 *** (0.065)	.1863 ** (0.072)	.1546* (0.091)	.1580** (0.031)	.1765*** (0.012)
Irrigated Area (per cultivated area)	.5361 *** (0.069)	.2494 (0.403)	.3658** (0.041)	.5361** (0.033)	.6003*** (0.013)
Dummy variable					
Coast			-.1431 (0.440)		
Period2 – 1996-2005			.1519** (0.014)		
CoastPeriod2				.0583 (0.402)	
Number of Observations	48	48	48	48	48
Adjusted R-square	0.9604		0.9762/ 0.9762		
Breusch-Pagan	0.2934		0.1830		

*FGLS – Heteroskedastic Panel, FGLS2 – corrected for autocorrelation

The GLS method is used to correct model for any potential heteroskedasticity. The GLS method is used to estimate model by feasible generalised least squares (FGLS) and if iterated it will produce maximum likelihood parameter estimates. We can run FGLS regression that will fit the model with panel-level heteroskedasticity. To avoid the problem of serial correlation FGLS2 estimates the model assuming common (AR1) autocorrelation across panels. Breusch-Pagan tests for homoskedasticity. BP test results are smaller than chi-square critical distribution at 5% significance level, suggesting that model is homoskedastic.

Estimation results

The coefficient on lagged GDP per capita growth rate indicates that the process of convergence across provinces in our sample does not take place. The robust results attest in favour of strong divergence. Provinces with prior higher GDP rate tend to develop on a higher pace. It supports my hypothesis that agricultural sector in China develops on a dualistic trajectory. The isolated inland provinces have little prospects for a catch-up processes. The dichotomy between well-off and worst-off regions is likely to widen with the lapse of time, unless actions are taken to leverage the economic standard and development position in those provinces. Potential factors contributing to the general level of development (or hindering it) are described and analysed below on the basis of empirical results.

Labour ratio between agriculture labour and non-agriculture labour supports the argument that agriculture is overpopulated. It also shows that labour relocation to non-farm activities can effectively improve productivity in agriculture through better allocation. Income from off-farm employment tends to be higher than from farm activities, hence regions with well-developed rural industry can provide higher wages for rural population. The changing pattern of labour distribution in favour of industry – increasing ratio, has strong positive influence on agriculture growth. The coefficients significant at 1% level suggest strong robustness of estimate.

Loans to agriculture. Even though only at 2GLS method loans are found to be significant at 10%, the sign of coefficients are negative. We can assume that the improvements in financial development on growth are ambiguous, especially for countries/regions that are below certain financial threshold. As Rioja and Valev (2004) empirical results suggest the relationship between financial development and growth could be non-linear. They assert that the improvements could be marginal for countries/regions with not-comprehensive financial structures when compared with much stronger positive effect on countries/regions above financial threshold. It might be true for worst-off agricultural sectors. The impact of loans is small and insignificant; however the negative sign is puzzling especially for 2GLS method. As the loans are assigned only through governmental institutions, without any alternatives there might be bias in the institutional allocation. Furthermore we can assume that the majority of loans were in form of personal credit that was used for current consumption instead of investment in production tools. The same problem appears with net subsidies for agriculture.

As we can see from table below net subsidies results are quite puzzling at the first glance. However the explanation behind negative impact of subsidies over agriculture could be described through the shortcomings of policy agenda and particularly PISA program. PISA program (industry subsidising agriculture) put a heavy burden on rural economy, especially TVEs. The utilisation of subsidies was not monitored, with vast mismanagement and embezzlement. Farmers tended to appropriate financial support on non-farm production and living expenses, because farming was not profitable enough (Zhaohui Hong, 1996). Paradoxically, positive net subsidies cumbered the economic development of rural areas. At the end PISA didn't bring any positive effects in the farm production but has devastated rural

economy, by putting too heavy burden on rural industry, especially TVEs. Most of the funds for subsidies came from TVEs, not central government, and there was no schedule or projection on future subsidies, as they were gather on a *ad hoc* basic depending on requirements from agriculture and local policy (Zhaohui Hong, 1996). We can conclude that net subsidies at least in the form that took place in China didn't function well. Furthermore subsidies slowed down the development of rural economy by exploiting TVEs. We can stress that healthy rural industry with expanding TVEs can provide better performance of agriculture than direct subsidies in the form that took place in China. On the other hand agricultural loans should be more efficient instrument of support. Possible explanation is that to receive a loan you normally have to document how you are going to use funds given to you. Therefore capital efficiency is better than in the case of subsidies. In our case we can not say much about efficiency of loans as the results are insignificant.

The positive TVEs employment coefficient reveals that this specific form of ownership has contributed significantly to the agriculture development. We can point out important function of TVEs as an absorptive shelter for excessive labour force. Because the results are strongly significant we can say that TVEs enhanced agricultural growth. The impact of TVEs is moderate which means that it is rather indirect factor shaping rural welfare.

The coefficient for the length of roads and railways (proxy for transportation and infrastructure) also exhibits a positive sign, which means that provinces with a higher proportions of roads and railways have higher rates of agricultural growth. Furthermore the length of roads and railways has a direct impact on products and materials circulation cost. It allows for a lower transaction costs and improves market accessibility. The coefficient is significant apart from the fixed-effect model, and generally exerts great influence on agricultural growth.

Another significant coefficient is the cultivated land with irrigation system. This variable turned out to be highly significant, (again apart from fixed-effect model). China vast and inaccessible territory makes it difficult to deliver fresh water to all agricultural sites. On average only 50% of cultivated land has an irrigation system. Absence of irrigation means lower productivity and with notorious natural disasters such as drought production can suffer severely. As half of the cultivated land is irrigated it leaves wide margin for improvements. The productivity can be easily heightened. As irrigation normally can not be done by individual household the role of central or local authorities is crucial. Certainly public investments in the irrigation projects are more efficient than direct subsidies. They promise greater productivity growth.

Variables for fertilise use and machinery use are positive. It means that there is still a space for productivity increase through application of fertilizer and machinery investment. However none of the coefficients in our analysis is significant.

The increase in cultivated area per household is positively associated with agricultural growth except for fixed-effect model with insignificant coefficient. Other estimations prove that the cultivated land per household has a great impact on agricultural growth. Certainly land consolidation allows scale operations that in consequence enhance production efficiency and allows for more productive usage of machinery. In recent year we have noticed a permanent decrease in the cultivated land per household ratio. This tendency might be the driving force behind lagged agricultural development in China. Moreover we can conclude that regions with a higher ratio of cultivated land per household are able to achieve higher growth rates. The labour distribution analysed above contributes to the general cultivated land ratio. More labour in industry and services reduce the burden of excessive labour in agriculture facilitates land consolidation.

The share of Industry and Services in total GDP has ambivalent influence over agriculture development. None of the estimation models has a significant variable coefficient.

In China the contribution of industry to GDP differs significantly across provinces. In the regions with dominant contribution of agriculture the supporting role of the manufacturing and services sector are less sound than in the regions with comprehensive industrial base. This argument is supported by the findings of Li, Z., Liu, X., (2009).

The insignificant coefficient of secondary school enrollment variable supports the weak relationship between education and economic growth in the agriculture. Possible explanation is that students with a higher education are more willing to migrate or undertake more profitable employment in the non-agricultural sectors. This argument is supported by the findings of (Cai and Ma, 1991; Hu, 2002; Zhao, 2002), where authors conclude that migrants in eastern-coastal provinces tend to have higher education (high school or above) than their counterparts in the middle of western provinces, who are illiterate or have only primary education.

It is difficult to draw any conclusion from province-specific dummy variables. Neither coast dummy alone nor interacted coast and second period dummy turned out to be significant at any level. However based on the findings from GDP(-1) and knowing that coastal provinces are on a higher GDP level, with higher growth rate we can say that being a coastal province means developing on a higher level. The engine of growth are initial conditions marking the pattern of development trajectory. Interestingly, period between 1995 and 2005 was more prosperous for agriculture than period from 1986 to 1994. The growth was more marked and pronounced throughout that period, making coastal provinces even more prosperous, assuming the importance of initial conditions. Mostly coastal provinces benefited from the new phase of reformation and decentralised fiscal structure. Second period has seen sharper divergence in the growth trajectories. The geographical constrains played negative role in the development of western provinces, at least when compared to the coastal provinces developing with a higher growth rate. It means that coastal provinces are less isolated and can enjoy greater market openness through more comprehensive infrastructure, export possibilities and greater accessibility of technology. All these factors can contribute to the improved farmer's technical efficiency and to overall productivity. There is a strong empirical evidence that rural isolation of inland regions affects in a negative way economic growth.

Conclusion

For the last 30 year China has seen tremendous change that took place on different levels. First of all, unprecedented total growth rate averaging 9% for that period made China the fastest developing country in the world. The structure of economy has changed dramatically from predominantly agrarian economy to an industrialised and urbanised centre. However in the course of reformation the common phenomenon took place, namely uneven development. China's growth trajectory is dualistic. On the one hand highly developed and industrialised coastal regions are pulling country ahead in terms of GDP and income level. On the other hand middle-western provinces are lagging behind in terms of productivity, GDP, urbanisation and income level. Another dimension of the inequality is unbalanced growth between rural-urban areas with widening income gap. When it comes to our research hypothesis - rural-rural inequality we observed that coastal provinces perform better in terms of agricultural growth mainly due to better initial conditions. The institutional reforms have even exacerbated divergence between provinces under our analysis. The advantage of comprehensive industry supporting agriculture production, access to market and higher incomes makes eastern provinces better-off against inland areas. My paper tried to assess the convergence or divergence between agricultural areas in China. I found out that the synergies are hard to accomplish. My founding suggests that it is due to the policy bias, mostly underinvestment in the remote western-rural regions. The incomplete and incomprehensive

infrastructure and lack of a job opportunities hinders catching-up process. Furthermore, weak institutional structure and poor policy planning led to a misallocation of funds devoted to support agriculture and thus hampered economic growth. Uncoordinated actions, weak central authorities and inefficient monitoring devices led to a massive waste of governmental funds. Even more alarming is the fact that funds collected for subsidies were extracted from prospering enterprises or well-off farms and in result hindered their growth. Subsidies are necessary for agriculture technological development, but only if they are really spent on investment not on current consumption. To spark-off agricultural development it is more efficient to carry out public investments in irrigation or roads and railways. My findings strongly suggest positive impact of factors such as irrigation system or infrastructure on economic growth in agriculture. At the end creation of non-agricultural employment is the only way to free the excessive agricultural labour. As my analysis suggest rural industry in form of TVEs was a efficient platforms for labour absorption.

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