ABSTRACT

Title of Dissertation: ESSAYS ON THE WTO ACCESSION, HOUSEHOLD INCOME AND MULTIDIMENSIONAL POVERTY: EVIDENCE FROM CHINA

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In the course of integrating into the global market, especially since China's WTO accession, China has achieved remarkable GDP growth and has become the second largest economy in the world. These economic achievements have substantially increased Chinese incomes and have generated more government revenue for social progress. However, China's economic progress, in itself, is neither sufficient for achieving desirable development outcomes nor a guarantee for expanding peoples' capabilities. In fact, a narrow emphasis on GDP growth proves to be unsustainable, and may eventually harm the life quality of Chinese citizens. Without the right set of policies, a deepening trade-openness policy in China may enlarge social disparities and some people may further be deprived of basic public services and opportunities.

To address these concerns, this dissertation, a set of three essays in Chapters 2-4, examines the impact of China's WTO accession on income distribution, compares China's income and multidimensional poverty reduction and investigates the factors, including the WTO accession, that predict multidimensional poverty.

By exploiting the exogenous variation in exposure to tariff changes across provinces and over time, Chapter 2 (Essay 1) estimates the causal effects of trade shocks and finds that China's WTO accession has led to an increase in average household income, but its impacts are not evenly distributed. Households in urban areas have benefited more significantly than those in rural areas. Households with members working in the private sector have benefited more significantly than those in the public sector. However, the WTO accession has contributed to reducing income inequality between higher and lower income groups.

Chapter 3 (Essay 2) explains and applies the Alkire and Foster Method (AF Method), examines multidimensional poverty in China and compares it with income poverty. It finds that China's multidimensional poverty has declined dramatically during the period from 1989-2011. Reduction rates and patterns, however, vary by dimensions: multidimensional poverty reduction exhibits unbalanced regional progress as well as varies by province and between rural and urban areas. In comparison with income poverty, multidimensional poverty reduction does not always coincide with economic growth. Moreover, if one applies a single measure ─ either that of income or multidimensional poverty ─ a certain proportion of those who are poor remain unrecognized.

By applying a logistic regression model, Chapter 4 (Essay 3) examines factors that predict multidimensional poverty and finds that the major factors predicting multidimensional poverty in China include household size, education level of the household head, health insurance coverage, geographic location, and the openness of the local economy. In order to alleviate multidimensional poverty, efforts should be targeted to (i) expand education opportunities for the household heads with low levels of education,

(ii) develop appropriate geographic policies to narrow regional gaps and (iii) make macroeconomic policies work for the poor.

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Dedication

To My Family

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Abbreviations

ADB	Asian Development Bank
AF	Alkire and Foster
BTA	Bilateral Trade Agreement
CGE	Computable General Equilibrium
CHNS	China Health and Nutrition Survey
DID	Difference-in-Difference
FGT	Foster-Greer-Thorbecke
FTA	Free Trade Agreement
FYP	Five-Year Plan
GDP	Gross Domestic Product
HO	Heckscher-Ohlin
HR	The Headcount Ratio
IESY	Chinese Industry Economy Statistics Yearbook
IPRC	International Poverty Reduction Center
ISIC	International Standard Industrial Classification
ITC	International Trade Center
IV	Instrumental Variable
MDG	Millennium Development Goal
MFN	Most Favorite Nation
MPHR	Multidimensional Poverty Headcount Ratio
MPI	Multidimensional Poverty Index
NBS	National Bureau of Statistics
OPHI	Oxford Poverty and Human Development Initiative
SDG	Sustainable Development Goal

SOE	State Owned Enterprise
TVE	Township and Village Enterprise
UN	United Nations
UNCTAD	United Nations Conference on Trade Development
UNDP	United Nations Development Programme
UNSD	United Nations Statistical Division
WB	World Bank
WITS	World Integrated Trade Solution
WTO	World Trade Organization

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Chapter 1. Introduction

1.1 Research Background and Motivation

Trade openness, if well designed, can be an important development strategy not only because it brings economic growth but also because it enables people to improve their living standards and thus promotes human development. Through expanding markets, employment opportunities and technology exposure, trade openness spurs economic integration and growth. Cross-country studies conclude that relatively open economies grow faster than those with heavy trade restrictions and barriers (Dollar, 1992; Sachs and Warner, 1995; Edwards, 1998; Berg and Krueger, 2003; Alcalá and Ciccone, 2004; Josheski and Lazarov, 2012). Moreover, by reallocating resources, protecting property rights, enlarging economic freedom, increasing cultural interchange, and spreading good governance ideas, trade openness has a potential to advance democracy and freedom in the political arena. In turn, with more (and the appropriate kind of) democracy and freedom, economic development will be made more likely, hunger and poverty will be alleviated, and therefore, human development will be promoted. The outcome is likely to be a virtuous circle among trade, poverty reduction and democratization (Crocker, 2013).

However, the "catch" is that institutions and policies must be "well designed" (Rodrik, 2009). In fact, the effect of trade openness, especially on the poor, has often been the subject of heated debates. Many free trade proponents claim such trade has positive effect on poverty reduction, but opponents argue that external opening ─ by itself ─ does not alleviate poverty or may even lead to greater poverty, a situation coined by Rodrik as

the "Globalization Paradox" (International Forum on Globalization, 2001; Rodrik, 2011).[1] As trade openness often seriously worsens income inequality, its benefits fail to be delivered to the poor.

The polarized views from trade proponents and opponents draw attention from researchers in different disciplines. Philosophers tackle the gap from a normative perspective, striving to provide an evaluative framework to assess the process and effects of (free) trade. Economists develop theoretical trade models to illustrate and explain the distributional effects of trade openness, and yet they often come up with conflicting empirical findings. Policy makers debate the effects, if any, of various polices ─ alone or in tandem ─ to mitigate adverse effects and often argue that trade openness, in spite of some negative externalities, is ─ on balance ─ beneficial. In sum, studying poverty, inequality and trade openness requires a holistic or comprehensive approach in order to bring together and critically assess the methods and research results of different disciplines.

Examining poverty, inequality and trade openness is particularly important for developing countries, including China, where trade openness is typically in its early stage. China's rapid and impressive economic growth rate, especially after joining the WTO in 2001, has served as an important instrument for improving lives of many people. In the course of integrating into the global market, China has achieved remarkable GDP growth (about 9% on average per year, although it has slowed down since 2013), and has become the second largest economy in the world. These economic achievements have generated resources for increasing individual incomes and have provided more revenue for the

[1] Rodrik argues that globalization can be disruptive. It succeeds only when social, legal and political policies and institutions ensure that the benefits of globalization are broadly shared.

government to be used for social progress. In the last two decades, China has lifted more than 500 million people out of income poverty and hunger, expanded primary education, and provided healthcare for women and children. China's notable progress towards economic growth and the Millennium Development Goals (MDGs)[2] has been hailed by the United Nations (UN)[3] and some influential scholars, even those ─ such as Drèze and Sen ─ critical of China's democratic deficits.[4]

Nevertheless, economic progress is neither sufficient for achieving desirable development outcomes nor a guarantee for expanding peoples' capability. As China's coastal cities experienced unprecedented per capita income growth, inland and rural regions have fallen far behind. China's income inequality, which ranks among the highest in the world, has posed a threat to social stability and remains a top political concern. Along with rising income inequality, disparities in human development indicators have risen sharply. While China's fiscal capacity has been strengthened significantly in the last two decades, public spending on social services is much lower than on infrastructure investment and public administration. China has paid a heavy price for abandoning its universal health care and education. China partially realized this error by launching a medical reform since

[2] World leaders gathered in New York in 2000 to adopt the United Nations Millennium Declaration, which set out a series of eight targets, known as the Millennium Development Goals (MDGs) to reduce extreme poverty, expand primary education, fight against HIV/AIDS, malaria and tuberculosis, and so forth, with a deadline of 2015. More information can be found at http://www.undp.org/content/undp/en/home/mdgoverview/mdg_goals.html. Furthermore, the UN has just adopted new targets, the Sustainable Development Goals (SDGs), as global goals for 2030. See https://sustainabledevelopment.un.org/?menu=1300.

[3] *Reports on China's Implementation of the MDGs (2000-2015),* released by the UN in 2015, discussed in detail on China's progress towards the MDGs.

[4] In *An Uncertain Glory: India and Its Contradictions* (Drèze and Sen, 2013), by drawing a comparison between India and one of its neighbors, Drèze and Sen lauded China's impressive economic progress, and expansion of education and health care, but criticized India's poor performance in human development.

2009, and now 95% of Chinese people have been covered. Nevertheless, disparities in educational resources and quality remain between urban and rural areas and across regions.

More alarmingly, a narrow emphasis on GDP growth proves to be unsustainable, and eventually is harmful for the quality of life of China's population. The integration into global market allows China to explore its comparative advantages in low-cost labors and to develop energy-intensive manufacturing industries to speed up its economic growth. Yet, China remains largely blind to water and air pollution and its overexploitation of natural resources. As a result, not only is China's current population deprived of breathing clean air and drinking safe water, but the future generation has been deprived of the opportunity to live in a livable environment. Although sustainable development has been trumpeted as a national strategy, implementing the means to reduce resource degradation, improve quality of air and water, and protect fragile ecological systems remain a daunting task.

Without the right set of policies, China's vulnerable groups are likely to continue to be negatively affected by deepening trade liberalization, social disparities may get larger and people likely will become further deprived of basic public services and opportunities. Among China's pressing challenges are identifying the poor, who are not only short of income, but also exposed to multiple disadvantages, and enabling them to cope with trade openness.

1.2 Research Questions and Structure

Given these challenges, this dissertation, entitled "Essays on the WTO Accession, Household Income and Multidimensional Poverty: Evidence from China," addresses the impact of China's WTO accession on income distribution and poverty reduction challenges and also provides a preliminary investigation of the effect of the WTO accession on the

multidimensional poor. Specifically, I offer three essays (Chapters 2, 3 and 4 respectively) to explain and answer the following research questions:

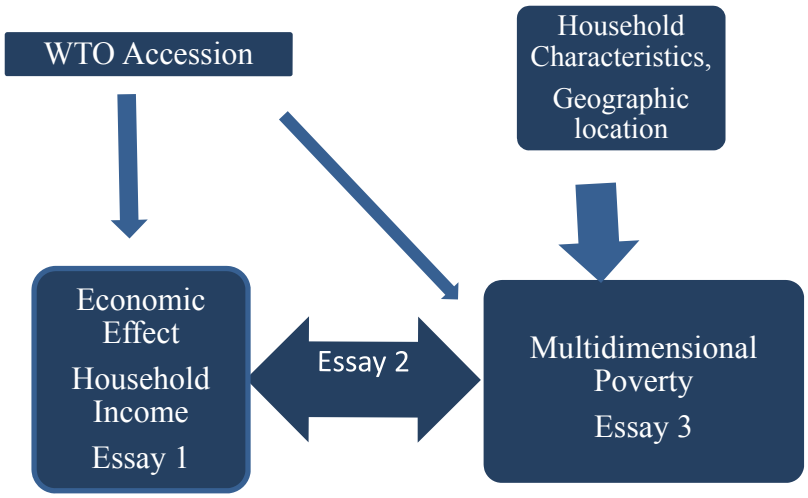
1. Have economic gains from China's WTO accession been distributed equally or have the poor suffered disproportionately?

2. How should we define and measure poverty? How does a metric of multidimensional poverty relate to the metric of income poverty in China?

3. What predicts multidimensional poverty and its alleviation in China?

4. What policy interventions, complementary to trade liberalization, should be designed to offset adverse impacts, if any, on the poor?

Chart 1.1: Structure of the Dissertation



Essay 1 (Chapter 2) starts with a discussion on international trade theories; it then empirically examines income distribution in relation to China's WTO accession. However,

recent research trends suggest that monetary indicators are not sufficient for measuring well-being. Hence, in Essay 2 (Chapter 3), I ask "How should we define and measure poverty?" and "How is a metric of multidimensional poverty different from and related to a metric of income poverty in China?" In order to answer these questions, Essay 2 constructs a multidimensional poverty measure by applying the Alkire-Foster Method[5] (AF Method), which looks at multiple deprivations that the poor may have experienced at the same time. It then calculates the multidimensional poor headcount ratio, and compares and relates the patterns of China's income poverty and multidimensional poverty. Given that the results show that income and multidimensional poverty target different groups, I have reason to explore factors that predict China's multidimensional poverty and how the WTO accession affects the multidimensional poor. Thus, Essay 3 (Chapter 4) studies factors that predict multidimensional poverty and provides a preliminary investigation of the impact of the WTO accession on the multidimensional poor in China. In the remaining pages of this introductory chapter, I provide a fuller overview of each of these three essays.

1.3 Essay 1: China's WTO Accession and Income Distribution

How have economic results ─ whether gains or losses ─ from the WTO accession been distributed? Has the distribution been equal or unequal with respect to relevant groups? For example, have the income poor suffered disproportionately? The empirical findings on this question in the existing studies are mixed. The theoretical foundation of these studies is the Heckscher-Ohlin-Samuelson (HOS) model. The HOS model predicts that, international trade would lead to a rise in returns of the abundant factors. As unskilled labor

[5] Sabina Alkire and James Foster developed the AF multidimensional poverty measure at Oxford Poverty and Human Development Initiative (OPHI), Oxford Department of International Development, University of Oxford.

(the poor) is usually an abundant factor in developing countries, the model predicts that unskilled labor gains from opening markets. Based on the HOS model, researchers claim that trade liberalization is crucial to increasing people's income and alleviating income poverty in developing countries.

However, the HOS model rests on a set of assumptions that are not always met in the real world. Without satisfying these assumptions, findings may deviate from the theoretical prediction. For example, one of the assumptions of the HOS model is the geographical and occupational free mobility of labor. This assumption is rarely met in the real world, especially in developing countries where sectoral or spatial restrictions tie people ─ particularly, unskilled workers ─ to certain occupational sectors or residency locations. As a result, it is possible that removing tariff barriers would hurt, instead of benefiting, those who are at the bottom of the skill ladder when these individuals are restricted in their efforts to relocate in response to trade shocks. Hence, opening up to the global market tends to be a double-edged sword, for both winners and losers are generated (Milanovic, 2003).

China offers an appealing case to study the subject not only because it is a major example of a developing country that successfully liberalized trade policies, but also because it is a decisive factor in the world's poverty reduction. Since joining the WTO in 2001, one of the milestones in China's increasing trade openness, China has achieved tremendous economic gains from integrating into the global market and trading with other countries. However, have the poor shared these benefits equally across provinces and equally with the non-poor? Or, do households in richer provinces benefit more while leaving the poor in underdeveloped provinces worse off or further behind or both? Do the

relatively rich in poorer provinces benefit proportionately more than their poorer fellow citizens in the same provinces? How has the entry into the WTO affected the poor within rural and urban areas?

Essay 1 answers the above questions by empirically examining income distribution in relation to China's WTO accession. By exploiting the exogenous variation in exposure to tariff changes across provinces and over time, it estimates the effect of trade shocks and finds that the WTO accession has led to an increase in average household income, but the impacts are not evenly distributed: households in urban areas have benefited more significantly than those in rural areas; and households with members working in the private sector have benefited more than those with members who work in the public sector. The WTO accession, however, has contributed to reducing income inequality between higher and lower income groups.

China's process of deepening trade liberalization remains ongoing, and the government is in dire need of additional polices to redistribute economic gains more fairly to the poor. One may wonder if redistribution of income is sufficient to help the poor? Going beyond income, poor people are often simultaneously lacking education, health, clean water and much more. Is income level highly correlated with higher education, health, fresh air, and safe water? Is it possible that a household can be income rich but multi-dimensionally poor? Essay 2 attempts to answer these questions.

1.4 Essay 2: Multidimensional Poverty in China

Poverty has long been understood as the lack of sufficient income or consumption for meeting a basic living standard. Although income serves as a convenient tool for

researchers and policy makers to differentiate between the poor and non-poor, one of its drawbacks is that it excludes other features of living that have intrinsic and instrumental value in determining people's well-being. Non-monetary attributes, such as health and public services, are critical to people's welfare. Poverty consists not only in low incomes but also in low levels of health and education, lack of clean water, poor access to sanitation, and limited opportunities and freedoms. One could be income rich but poor in health and freedom; one could be income poor but have high levels of well-being because of guaranteed access to a social safety net. In this case, if the focus is exclusively on income, the breadth and depth of deprivations in these other dimensions remain unexplained and unthematized.

Going beyond income and narrowly economic indicators, Alkire and Foster (2007, 2011, 2015) developed the AF method which provides a general framework for identifying the multidimensional poor by attending to the breadth and depth of multiple deprivations experienced by the poor. The AF method considers multiple deprivations that an individual suffers at the same time, calculates the sum of deprivations of each person and then identifies him/her as multi-dimensionally poor based on two multidimensional poverty cutoffs: a cut-off within each dimension and a cut-off of the number of dimensions (indicators) exhibiting deprivation. In employing the AF Method, the first global Multidimensional Poverty Index (MPI) includes three dimensions ─ health, education and living standards ─ measured by 10 indicators, selected on the basis of international consensus and data availability. The MPI, to be discussed in more detail in Essay 2, was published by the United Nations Development Programme (UNDP) in its *2010 Human Development Report*.

In Essay 2, I examine multidimensional poverty in the context of China. Although China made tremendous progress in income poverty reduction, this achievement comes at a heavy human ─ environmental and social ─ cost. For example, industrial pollution has become so severe that it has caused not only environmental degradation, but also health problems; clean water and fresh air have become a luxury, even for rich people. Hence, the poor may get some economic benefits from economic growth, but they are negatively affected by a degraded environment and poor health. Measuring poverty has become more complicated than before. The AF Method provides a useful tool to identify those who suffer from multiple deprivations, such as deficient health and education.

Perhaps surprisingly, Essay 2 finds that China's multidimensional poverty in fact has declined dramatically during the period from 1989 to 2011. Reduction rates and patterns, however, vary significantly by dimension. Asset ownership has improved greatly, while slower progress is evident with respect to people's nutrition and education. In addition, multidimensional poverty reduction exhibits an unbalanced regional result and varies by province and between rural and urban areas. Compared with income poverty, multidimensional poverty reduction does not always coincide with economic growth, and a certain proportion of the population is left out if only the single measure of income poverty is applied.

1.5 Essay 3: What Predicts Multidimensional Poverty in China

In addition to the profiles of the multidimensional poor, which describe overall patterns and deprivations, this study is interested in understanding what factors may predict multidimensional poverty and how macro policies, such as trade openness, affect the multidimensional poor. From a policy perspective, tackling the root of poverty, knowing

why some people are poor while others are not, and predicting the impact of policy shocks on the poor, are all essential for formulating interventions appropriately and promptly.

Studies that construct the multidimensional poverty index by applying the AF Method and considering trade liberalization's impact on poor have enhanced the understanding of multidimensional poverty reduction and the relationship between trade openness and poverty. However, mainly due to data and methodology constraints, very few studies rigorously investigate the causes of multidimensional poverty. Moreover, there is scant use of broader poverty measures that capture the multidimensional nature of poverty in estimating the impact of trade openness. The vast majority of studies have focused on the impacts of trade policy with respect to income and consumption and so forth, without taking into account basic capabilities such as education, educational opportunities, and health, which ─ arguably ─ are aspects of poverty.

By assessing the factors or characteristics that predict or explain multidimensional poverty, and by estimating the possible impact of trade policies on the multidimensional poor, who are deprived in multiple dimensions in the context of China, Essay 3 thus provides a more comprehensive picture of poverty and its reduction. Based on the MPI constructed in Essay 2 and the provincial trade openness measure constructed in Essay 1, Essay 3 conducts a logistics regression analysis by using the ongoing longitudinal household survey data from the *China Health and Nutrition Survey* (CHNS).[6] It finds that

[6] The Carolina Population Center requires acknowledgment in writing when using the CHNS data. I thank the National Institute of Nutrition and Food Safety, China Center for Disease Control and Prevention, Carolina Population Center (5 R24 HD050924), the University of North Carolina at Chapel Hill, the NIH (R01-HD30880, DK056350, R24 HD050924, and R01-HD38700) for access to these studies. I am grateful to the Fogarty International Center, NIH for financial support for access to the CHNS data collection and analysis files from 1989 to 2011 and later surveys, and to the China-Japan Friendship Hospital, Ministry of Health for support for CHNS 2009 (See http://www.cpc.unc.edu/projects/china).

the major predicting factors of multidimensional poverty and its alleviation in China have to do with household size, education level of household head, health insurance coverage, rural and urban location, and geographic location. In addition, trade policy plays a significant role in lifting the multidimensional poor out of poverty.[7]

The rest of the dissertation is organized as follows. Chapters II, III and IV are the three essays that comprise this dissertation. Chapter V concludes and discusses areas for further research.

[7] Trade policy does play a role in lifting the poor out of *both* income and multidimensional poverty in China ─ Essay 1 and Essay 3 examined the effect of trade openness on income and multidimensional poverty respectively.

Chapter 2: Essay 1 ─ The WTO Accession and Household Income: Evidence from China

2.1 Introduction

Since opening its market in 1978, China has taken significant steps towards trade liberalization. During the process of economic reform and after 15 years of prolonged negotiation, one of the milestones was China's entry into the World Trade Organization (WTO) in 2001. As a consequence of integrating into the world trade system and the global market, China has become the largest exporter of goods as well as the second largest world economy and has maintained an average annual growth rate of about 9% in the last two decades.

However, how much have Chinese households benefited from the WTO accession? How does the entry into the WTO affect the rural and urban areas, the poor and the rich, or people working in different occupations? No consensus on these questions can be found in trade theory. Empirically, there is little extensive analysis of the effects of the WTO on household income in China. This shortcoming is mainly due to the lack of available data that contains sufficiently detailed information for such an investigation.

Using a large longitudinal household dataset, the *China Health and Nutrition Survey* (CHNS), along with tariff data from *World Integrated Trade Solution* (WITS) and industrial structural data from the *Chinese Industry Economy Statistical Yearbook 2011* (IESY), this study seeks to fill the gap by providing empirical evidence on the WTO effect on household income in China.

By exploiting the variations in exposure to the WTO accession across provinces and over time, this chapter estimates the causal effect of the WTO accession on household income and its distributions. Results make pretty clear that entry into the WTO has led to an increase in average household income as well as the reduction of income inequality between the high and low income group. The positive impact of the WTO accession, however, is more significant in urban areas compared with the rural areas.

The current chapter adds to the existing literature on trade openness in three ways. First, it adds to the recent spate of studies that explore the relationship between trade openness and regional income inequality within a developing country (see Topalova (2007, 2010) on India; McCaig (2011) on Vietnam; Castilho, Menendez and Sztulman (2012) on Brazil). To my knowledge, it is the first paper that applies Topalova's (2007) identification strategy to examine trade openness in China.

Second, the chapter provides additional insight into the impact of trade shocks on household income in China. Chen and Ravallion (2003), and Hertel, Zhai and Wang (2004) estimate the welfare impact of China's accession to the WTO at the household and regional levels based on the Computable General Equilibrium (CGE) model. However, the assessments are ex ante instead of ex post and rely on cross-sectional data. This research differs from them by estimating ex-post impacts of trade liberalization in China.

Third, the analysis includes income effects of China's WTO accession in both urban and rural areas and therefore provides a more complete picture than previous studies, which typically investigated either urban poverty or rural poverty considered separately (see Anderson, Huang and Ianchovichina (2004); Han, Liu and Zhang (2012)).

The structure of the rest of this chapter is as follows: the next section reviews related literature on trade openness and income distribution, Section 2.3 describes China's WTO accession and its impacts across provinces, Section 2.4 discusses the data and methodology used to examine the effect of WTO accession on income growth and distribution, Section 2.5 reports empirical findings, and Section 2.6 provides conclusions.

2.2 Literature Review

2.2.1 Distributional Effects of Trade Openness: Theoretical Arguments

The conventional theoretical framework that predicts the distributional effects of trade liberalization can be traced back to the Heckscher-Ohlin (HO) model and the Stolper-Samuelson model. One of the important conclusions of the framework, known as the Stolper-Samuelson Theorem, is that when a country opens its market, aggregate national welfare will increase and, more importantly, the real income of a country's abundant factor should rise (Suranovic, 2010). Since developing countries are abundant in unskilled labor, usually the poor, they tend to export unskilled labor's intensive products. As the price of unskilled labor's intensive goods goes up, the real return of the relative abundant factor will increase, hence, reducing poverty and inequality within countries.[8]

Davis and Mishra (2004) challenged these arguments by declaring "Stolper-Samuelson dead" and "it is worse than wrong ─ it is dangerous" because it often fails to provide a reliable answer when applied. Though a country is labor abundant in the global market, if its labor-intensive products are in import sectors, the price of these goods will

[8] For detailed explanation of Stolper-Samuelson Theorem, refer to Chapter 5.6 of Steve Suranovic (2010).

go down. As a result, the wages of unskilled labor will decrease, hurting those at the very bottom of the ladder, which contradicts the prediction of Stopler-Samuelson.

Furthermore, Topalova (2007) suggested that the Stopler-Samuelson Theorem can be reversed if one or more of the restrictive assumptions are not met. She argued that under the assumption of restricted labor mobility across sectors, the short-run response of factor returns depends crucially on the industries in which the workers are employed and returns to labor are not equal across sectors. The same argument applies to restricted geographic mobility of labor. She concluded that poverty effects of trade openness are dependent on the extent to which factors can relocate in response to trade shocks. Hence, unskilled workers will be better off in a mobile labor market.

Similar to the arguments of Topalova (2007), the Specific Factor Model assumes capital and land are attached to specific industries and cannot move freely, while labor is mobile across industries and immobile among regions. Any reduction in the protection of a particular sector predicts a fall in price of the previously protected products. Thus, factors that are specific to previous protection sectors tend to be hurt, while factors that are specific to exporting sectors benefit. Since labor can move from one sector to another, the effect of trade on them is ambiguous ─ workers either gain or lose depending on which sector they are in.

To summarize, the extent to which trade contributes to alleviating poverty and reducing inequality depends on several factors: (i) the sectors with which labor is affiliated ─ import or export sectors; (ii) labor mobility, that is, can labor move freely across sectors and regions; (iii) whether the poor have the capabilities to participate in the gains from an opening market. In other words, the welfare impacts of trade liberalization will differ

among social groups and regions with different characteristics and in different policy settings.

2.2.2 Empirical Evidence and Approaches

Whether one employs a theoretical modeling approach or an econometric analysis approach, a number of recent studies provide *empirical* evidence for these diverse distributional effects of trade liberalization.

Based on a Computable General Equilibrium (CGE) model, Chen and Ravallion (2003) estimate the welfare impacts at the household level of China's accession to the WTO. The first round direct price effects are simulated as a result of trade reform. Under the assumptions that households take prices as given and are free to choose preferred combinations of commodities and clear markets, the predicted aggregate impacts of trade reform are negligible. However, differences across sectors and regions emerge. Researchers find a decline in real income of rural households. The richest provinces tend to gain the most in both urban and rural areas; more than 90% of farmers in the northeast provinces suffered an income loss. By applying the CGE model and taking the regional disparity into account, Hertel, Zhai and Wang (2004) found that China's WTO accession would increase welfare as a whole, whereas the agricultural sector and less-developed rural areas would get hurt.

CGE modeling techniques have advantages in capturing price changes of both commodities and factors induced by trade reform to explain how trade liberalization affects poverty. However, the assessments based on CGE models are ex ante instead of ex post and rely on cross-sectional data. In addition, some assumptions of the CGE models are too strong to hold in China. For example, the assumption of a perfect and fully employed labor

market is too strong, considering the tight labor management in China through the household registration system.[9]

Two recent papers, which take inflexible and segmented labor markets into account, explore regional income inequality and poverty impacts of trade liberalization. Topalova (2007) examined poverty and inequality impacts of trade liberalization in India. Given the nature of India's trade liberalization ─ sudden, comprehensive and externally imposed as part of reforms in response to an economic crisis in 1991, she found a causally positive link between trade liberalization and poverty in rural districts but no statistically significant relationship in urban India. Castilho, Menendez and Sztulman (2012) obtained similar results in Brazil: from 1987 to 2005, Brazilian states that were more exposed to tariff cuts were associated with smaller reductions in household poverty.

McCaig (2011) investigated the regional poverty impact of trade reform in Vietnam and found a causal impact of the 2001 U.S. – Vietnam Bilateral Trade Agreement (BTA) on poverty reduction. Provinces in Vietnam that were exposed to tariff cuts had experienced greater decreases in poverty between 2002 and 2004 than had provinces not or less exposed to tariff reductions. He further searched labor market channels through which the trade agreement affected poverty reduction. He found three changes in the labor market: (i) wages of rural workers in agriculture, forestry and fishing sectors increased; (ii) those sectors that experienced greater tariff cuts showed faster reallocation of labor than did those sectors ─ such as manufacturing, agriculture, forestry and fishing ─ with smaller tariff cuts; (iii) provinces with higher levels of trade liberalization generated more job

[9] Although China's labor market is much less rigid now than before, as evidenced by the huge amount of migrant workers (estimated at 0.12 billion in year 2012), these workers are far from moving across sectors and regions freely — the opportunity cost for migrant workers to move from rural to urban is huge.

opportunities than did provinces with lower levels of trade liberalization. Through the labor market transmission mechanism, then, the BTA tariff cuts correlated with greater drops in poverty among Vietnam provinces.

A few studies have explored the ex post effect of trade reform on income inequality in China. Wei and Wu (2002) studied the relationship between globalization and income inequality using data from *Urban Statistical Yearbook* and *Fifty Years of the Cities in New China* over the period 1988-1993 in 100 or so Chinese cities. By correcting for possible endogeneity of trade openness, they found free trade reduced urban-rural income inequality. A greater increase in cities' trade-to-GDP ratio tends to lead to a greater decline in urban-rural income inequality. They claimed that the income benefits of trade openness in China trickled to the rural area through stimulating the growth of the rural area's Township and Village Enterprises (TVEs).

Using *Chinese Urban Household Survey Data* for the period between 1988 and 2008, Han, Liu and Zhang (2012) recently examined the impact of trade openness on wage inequality in urban China. By using a Difference-in-difference (DID) approach, they found that regions more exposed to trade openness experienced a more pronounced wage inequality in contrast to those less exposed. Their analysis further suggests that high exposure to the global market also contributes to within-region inequality by raising the skill premium in urban areas.

Although the recent studies tried to establish a causal linkage among trade openness, on the one hand, and poverty and inequality, on the other hand, the findings are mixed and far from conclusive. This lack of a clear picture is what motivates the current study. Going beyond the wage and skill metrics, I consider a broader welfare indicator – household

income. An analysis of household income captures the effect of trade openness not only on wages, but also on other sources of income.[10] More importantly, Chapter 2 constructs a provincial trade exposure measure that is more precise than the measure of the Han, Liu and Zhang (2012) analysis, where dummy variables are used to capture the process of trade liberalization. In addition, the current chapter extends previous studies to include both urban and rural areas, where the poor are concentrated, and explores the differential effects of trade policy between urban and rural areas.

2.3 Background and Data Description

2.3.1 Data Sources

The data used in the chapter are drawn from various sources. The primary dataset is the *China Health and Nutrition Survey* (CHNS), a longitudinal survey conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention.[11] Though the CHNS aims to investigate the health and nutritional status of China's population, it also contains detailed information on household income, along with socioeconomic variables, such as age, ethnicity, education, health insurance and types of work units.

The CHNS is an ongoing international collaborative project with nine waves in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011 covering nine provinces:

[10] Other sources of income in China, especially in coastal regions and rural areas, can be significant. Such sources include not only market activities such as selling home-made products, working temporarily in a factory, but also non-market activities such as subsidies, remittance, rents, and so forth. All these income sources reflect the indirect benefits of trade openness.

[11] More detailed description of the dataset can be found at http://www.cpc.unc.edu/projects/china.

Liaoning, Shandong, Jiangsu, Heilongjiang, Henan, Hubei, Hunan, Guangxi and Guizhou. These provinces vary in geography, population and economic development, which can represent differences in Coastal, Central and Inland regions. The Central region, including Henan, Hubei and Hunan provinces, is situated next to and has benefited from the rapid developing and booming Coastal provinces of Liaoning, Shandong, and Jiangsu. Using a multistage, random cluster scheme, the CHNS data drew samples from both urban and rural areas.[12]

Due to both data restrictions and the estimation technique used, I restrict my analysis to the 2000-2011 survey periods. On the one hand, I exclude surveys conducted in 1989, 1991, 1993, and 1997 to make the data more comparable. In 1989, the CHNS data only contained information about these adults whose age was between 20 and 45. For the CHNS 1997, Liaoning did not participate and Heilongjiang was added for the first time to replace Liaoning province. In the 2000 CHNS, Liaoning returned to the survey and Heilongjiang was also included. On the other hand, the exclusion of the pre-2000 data helps to achieve better exogenous variation designed to avoid the endogenous bias in the regression model.

The CHNS collects information on individuals of each household, such as an individual's age, gender, education, and ethnicity. Identifying who is the household head makes it possible to use the social-economic characteristics of the household heads as explanatory variables in regressions. To examine the WTO's effect on earned income, I further restrict the sample to household heads between the ages of 18 and 60 in order to

[12] More specifically, in the first stage, the CHNS randomly selected 2 cities and 4 counties from each province; in the second stage, the CHNS randomly chose12 urban or suburban neighborhoods in 2 cities, and 12 villages or townships in 4 counties.

exclude the households that are very likely under government subsidies and supports or other social programs. This leaves a total of 14,712 households throughout the survey period.

The tariff data comes from the World Bank's *World Integrated Trade Solution* (WITS),[13] which consists of data on international trade, tariffs, non-tariff measures from various sources, such as the United Nations Conference on Trade and Development (UNCTAD), the International Trade Center (ITC), the United Nations Statistical Division (UNSD) and the World Trade Organization (WTO).

The WITS contains China's annual tariff information starting as early as 1992, and its tariff data is organized in product categories from the most aggregate level to the most detailed product level. I match the two or three digit levels tariff data of the International Standard Industrial Classification (ISIC), Revision 3, to the sectors in the CHNS, including agriculture, forest, pastoral, fishing, and mining. And I aggregated the three-digit tariff level into a two-digit tariff level by referring to the commodity categories in order to construct the matching sectors, which include manufacturing, construction, electricity, water and gas supplies, and transportation and communication.

Tariff data from the WITS are at the national level. To construct tariff measures at the provincial level, I resorted to the provincial employment data from the *Chinese Industry Economy Statistical Yearbook 2001* (IESY). IESY 2001 reports the total number of employment by sectors for each province. The sector breakdown mirrors the tariff breakdown from WITS, except that IESY 2001 aggregates agriculture, forest, pastoral and

[13] Data is available at http://wits.worldbank.org/wits/

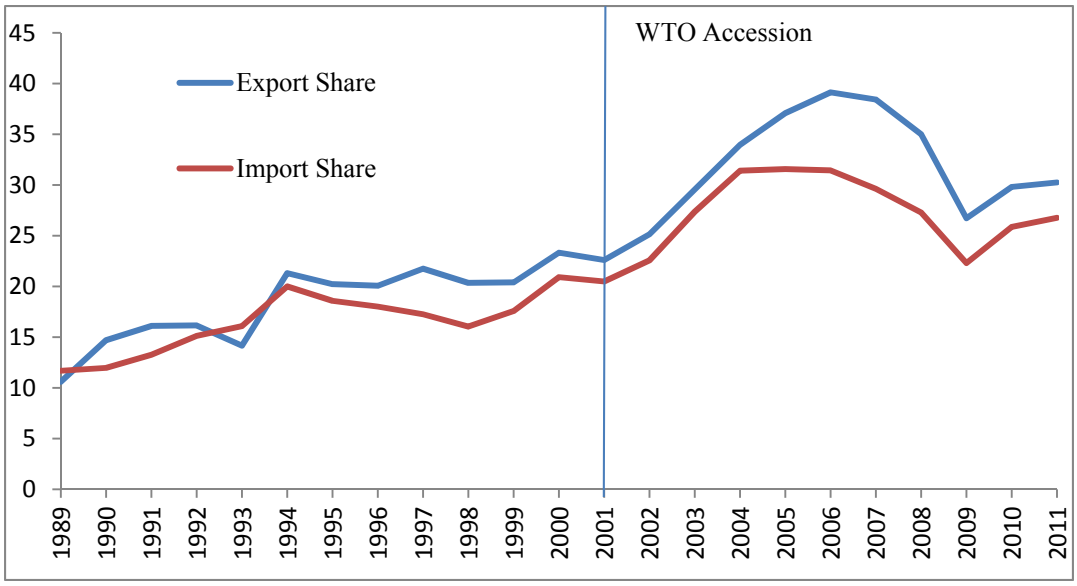
fishing into one sector. However, IESY 2001 reports the gross output value by sectors for each province. So, I calculate the weights of gross output value in agriculture, forest, pastoral and fishing and then apply the weights to the aggregate employment to get the sector specific numbers for employment.

The CHNS, the WITS, and IESY 2001 datasets are merged together using province and year as keys. So this chapter ends up with a panel dataset that has two levels of variations ─ one at the household level and the other at the province level.

2.3.2 The WTO Accession and Tariffs

The milestone of China's trade openness is its entry into the WTO. After 15 years of negotiation, China was accepted officially into the WTO in December 2001. Following China's entry, its "opening up" has steadily deepened. Figure 2.1 shows the longitudinal evolution of export and import as a percent of GDP from 1989 to 2011. Both import and export as a share of GDP were stable until 2000. However, following the WTO accession, they sharply increased from around 20% in 2001 to more than 40% for exports and 30% for imports in 2006. The decrease after 2007 reflects the effect of the world financial and economic crisis, a turn down that is still lingering. As a result, the WTO accession lifted China's share in global exports; with an annual growth rate for exports of over 20%, by the end of 2008, China's share of global exports reached 19%.

Figure 2.1: China's Import, and Export, Percent of GDP (1989-2011)



Source: *IMF World Economic Outlook; percentages are calculated by the author.*

Although the WTO accession is an event at the national level, the impact of the WTO accession is not uniform in China. Chinese provinces are heterogeneous in terms of the degree of exposure to international trade and foreign investment (Frankle and Romer (1999), Wei and Wu (2003),[14] and Han, Liu and Zhang (2012)). As a proxy measure, I used the straight distance to the nearest seaport[15] as the determinant of trade openness, classifying provinces into two groups: high-exposure regions and low-exposure regions. I include the five provinces of Liaoning, Jiangsu, Shandong, Guangxi and Guizhou, which represent the two ends of the exposure spectrum. Among these provinces, Liaoning,

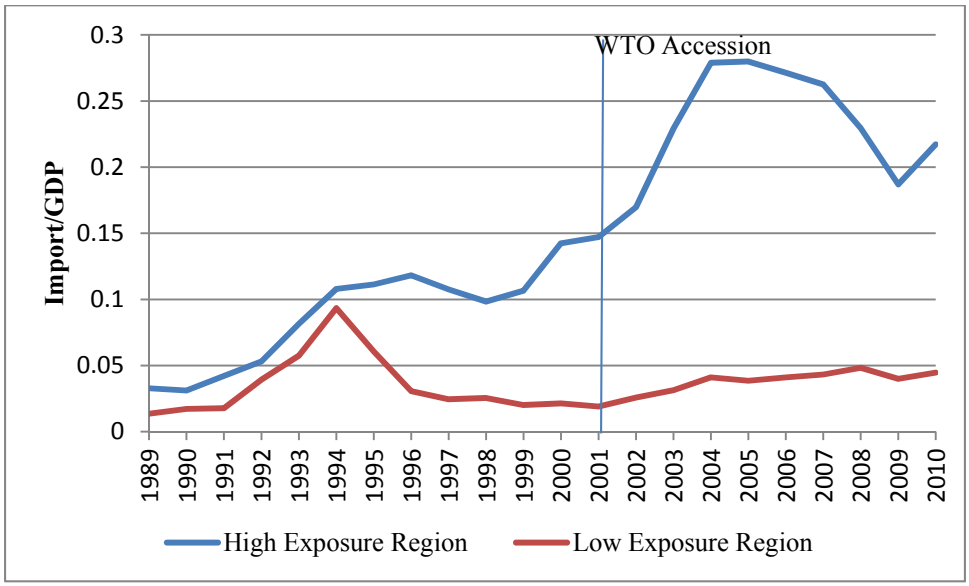
[14] Frankle and Romer (1999), Wei and Wu (2003) use the minimum distance to the nearest seaport as an instrument variable to study the impact of trade openness. They argue that the geographical distance to the seaport is exogenous to economic growth and labor market outcomes, and yet such distance is an important determinant of trade openness.

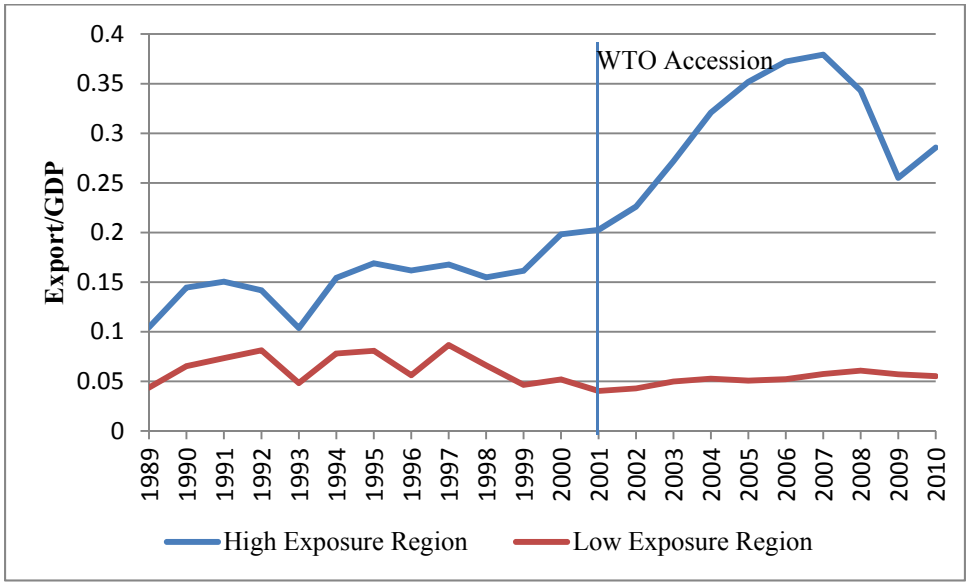
[15] In terms of handling capacity, China's major seaports include Shanghai, Ningbo-Zhoushan (Zhejiang province), Tianjin, Guangzhou (Guangdong province), Qingdao (Shandong province), Hongkong, Qinhuangdao (Hebei province), Dalian (Liaoning province), Shenzhen (Guangdong province) and Rizhao (Shandong province).

Jiangsu, and Shandong are in the high-exposure group, and each has a high degree of international trade participation.

Figure 2.2 provides evidence of the different impacts of the WTO accession on high- and low-exposure regions. One of the most important patterns in Figure 2.2 is that the WTO accession has had only very limited impact on low-exposure regions.

Figure 2.2: Regional Trend of Import and Export (1989-2010)





Source: *China Statistical Yearbook and Provincial Statistical Yearbook (1989-2010)*

The significant increases of imports and exports since the WTO accession are associated with the continuing and substantial tariff reductions. To fulfill the obligations of membership, China committed itself to undertake concrete steps to continue opening and liberalizing its regime. As shown in Table 2.1, the overall tariff rate was decreased from 15.6% in 2000 to 10% in 2008. In terms of agricultural products, the average tariff level went down from 21.3% in 2000 to 15.1% in 2008; and for industrial goods, the average tariff level went down from 14.7% in 2000 to 9.2% in 2008. By 2011, China's average tariff level dropped to 9.8 %, lower than the WTO requirement for developing countries.[16]

Table 2.1: China's Promise on Tariff Reduction

Year	Overall Tariff Level	Average Tariff of Industrial Products	Average Tariff of Agricultural Products
2000	15.6%	14.7%	21.3%
2001	14%	13.0%	19.9%
2002	12.7%	11.7%	18.5%
2003	11.5%	10.6%	17.4%
2004	10.6%	9.8%	15.8%
2005	10.1%	9.3%	15.5%
2006	10.1%	9.3%	15.5%
2007	10.1%	9.3%	15.5%
2008	10.0%	9.2%	15.1%

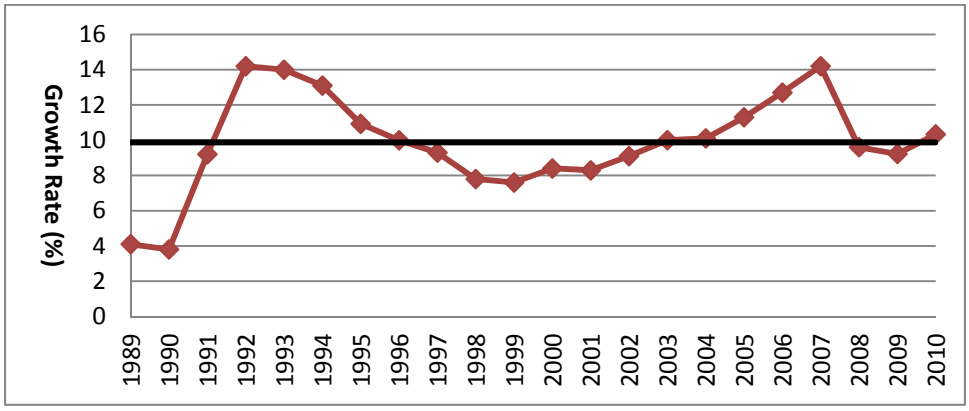
Source*: China People's Daily Official Website*, available at http://www.people.com.cn/GB/jinji/31/179/20020114/647339.html

The substantial tariff reduction and dramatic growth in trade correlate with significant economic growth. On average, the GDP growth rate was about 10% over the past twenty years. During the peak year of 2007, the GDP growth registered more than 13%

[16] See Chinese President Hu Jintao's Speech at G-20 Summit in Cannes, available at http://news.xinhuanet.com/english2010/china/2011-11/04/c_131228470.htm.

(Figure 2.3).[17] China overtook Japan in 2011 to become the world's second largest economy.

Figure 2.3: China Annual GDP Growth Rate (1989-2011)



Source: *IMF World Economic Outlook*

In addition to lowering its tariff rates, China has removed nontariff barriers and other restrictions gradually to adhere to its WTO commitments on market opening. These nontariff barriers and restrictions, such as price control measures, quotas, licenses, tendering requirements, and so on, used to play an important role in China's trade protection. Lardy (2002), Ianchovichina and Martin (2004) estimate that the quantity of tariff lines that are subject to import quotas and licenses fell from 1,247 to 261, and the import coverage of nontariff barriers fell from 32.5% in 1996 to 21.6% in 2001. The protective effect of these nontariff barriers declined dramatically during the period of China's WTO accession.

One recent study (Imbruno, 2016) finds that, over the period of 2000-2006, China's tariff reductions have been coupled with its eliminations of traditional nontariff barriers, such as quotas and licenses, but the relationship has been weaker in relation the more

[17] The exceptional GDP growth in Year 1992 is due to Deng Xiaoping's Southern Tour effect.

extreme nontariff barriers, such as antidumping and other technical barriers to trade. Besides the complexity in the interactions between tariff and non-tariff barriers as well as the non-transparency in implementation and the data scarcity of nontariff barriers also hinder an empirical examination of the effect of non-tariff barriers. Therefore, the analysis of this chapter focuses on tariff changes rather than all trade policy measures. With better data, future work may be able to assess the relative impacts of the reduction of the various trade barriers.

2.4 Trade Exposure Measures and Empirical Methodology

2.4.1 Exogenous Feature of China's WTO Entry

One of the challenges in using regression analyses to examine the impacts of an intervention ─ in this study, China's WTO accession ─ is the endogeneity problem, that is, variables of household income and the WTO accession are interdependent. This interdependence is especially true at the macro level, where the intervention occurs. One could argue that the WTO accession is conditional on the performance of the economy; and, therefore, the economic growth after the WTO accession period is driven by existing factors besides or in addition to the WTO. At the industry level, one might think that inefficient industries are more likely to lobby the government to avoid greater tariff cuts on them, resulting in a conditionality of the WTO accession on performance in certain sectors.

However, China's WTO accession can be argued as largely an exogenous shock. First, after the Tiananmen Square Protest in 1989, which damaged the reputation of the

Chinese government, the international community imposed a series of sanctions on China. These sanctions, both economic and diplomatic, included the World Bank (WB) and Asian Development Bank (ADB) suspended lending to China, high-level officials' postponed visits to China and the US and European countries halted development aid and export credits. Under global pressure, China stood at a turning point ─ either to consider external pressure as a threat and close the door, or utilize the opportunity to integrate into the global market to break economic sanctions resulting from its political policies. To achieve a more favorable international environment to stimulate its economic growth and a non-discriminatory and permanent Most Favorite Nation (MFN) status in the global market, Chinese leaders had little choice but to commit to trade liberalization.

Second, China's tariff cuts were externally imposed by the WTO instead of resulting from the lobbying power of its industries. The WTO imposed the schedule and categories of tariff cuts, and China enacted them before the WTO accepted China. As a member of the WTO, China enjoys the same benefits as other members. Meanwhile, China has to fulfill the commitments and obligations that the WTO requires. Local governments and industries are neither able to join the membership negotiations nor do they have the power to affect the WTO's decision. Therefore, the major tariff cuts associated with WTO entry resulted from external pressure rather than internal lobbying.

Additionally, some recent studies have examined the exogenous factors that help explain China's WTO accession. Bas and Strauss-Kahn (2015) do not find any significant relationship between China's tariff reduction and initial industry performance characteristics during the period between 2000 and 2006. Imbruno (2016) further checks whether there is a correlation between trade policy variables including tariffs, quotas and

licenses, and the initial, disaggregated endogenous characteristics and does not find any significant relationship, implying that domestic interest groups did not exert an substantial influence on China's entry to the WTO.

2.4.2 Provincial Trade Exposure Measure and Baseline Estimation

In examining the trade policy's impact on income, the literature typically uses tariff changes as a proxy on policy changes. The chapter follows this fashion. As shown by Figure 2.1 and Table 2.1 in Section 2.3.2, the over-time association between the WTO induced tariff rates and imports and exports shares provides solid evidence that the tariff change is the primary driver of the exports and imports in China.

As discussed in Section 2.3.1, the tariff changes are at the national level. If we have not long enough time series data, we would not be able to reliably estimate the impact of tariff changes on income distribution. Topalova (2007) innovatively designed a provincial tariff measure by using tariff changes and sector employments.

Following Topalova (2007), I constructed a measure, $TradeLib_{pt}$, to measure changes of trade policy at the provincial level p over time t. $TradeLib_{pt}$ is a combination of the longitudinal national tariff data with the initial provincial sector employment composition. Specifically, it is the effective tariff level of province p at time t as a result of weighting the national tariff at time t by the initial share of employment across economic sector in province p. The idea is intuitive — although the tariff reduction after accessing into the WTO was uniform across provinces in China, provinces with varied industry compositions would effectively benefit from such reduction differently. $TradeLib_{pt}$ is constructed as follows:

$$TradeLib_{pt} = \sum_j E_{jp,2000} * Tariff_{jt}$$

where subscript p is the province index, j is the industry index, and t is the time; E_{ip} is the share of the employed workers in industry j of province p at the initial time period of year 2000; $Tariff_{jt}$ denotes the tariff level in industry j for year t.

By using the employment share in each province on the year prior to WTO accession, the provincial tariff measure, $TradeLib_{pt}$ is pre-determined in regards to the post-WTO industrial or employment changes that could be partly caused by trade liberalization. As a result, $TradeLib_{pt}$ is an exogenous measure of trade openness.

My baseline regression model takes the following form:

$$ln(Income_{ipt}) = \alpha + \beta_1 TradeLib_{pt} + \beta_2 X_{ipt} + \delta_p + \gamma_t + \varepsilon_{ipt} \qquad (1)$$

The dependent variable is the natural log of per capita income of household i in province p at survey year t, inflated to 2011 Chinese Yuan. In the CHNS, household income, from various sources including farming, fishing, business, wages, and so forth, are defined as the sum of all income, which equals revenue minus expenditures.

X_{ipt} is a vector of household characteristics including gender, age, age squared, formal education that the household's head completed and land ownership. δ_p captures provincial fixed effects, and, γ_t captures year fixed effects, accounting for unobserved time invariant provincial specific heterogeneity and the national policy shocks respectively. ε_{irt} is the error term.

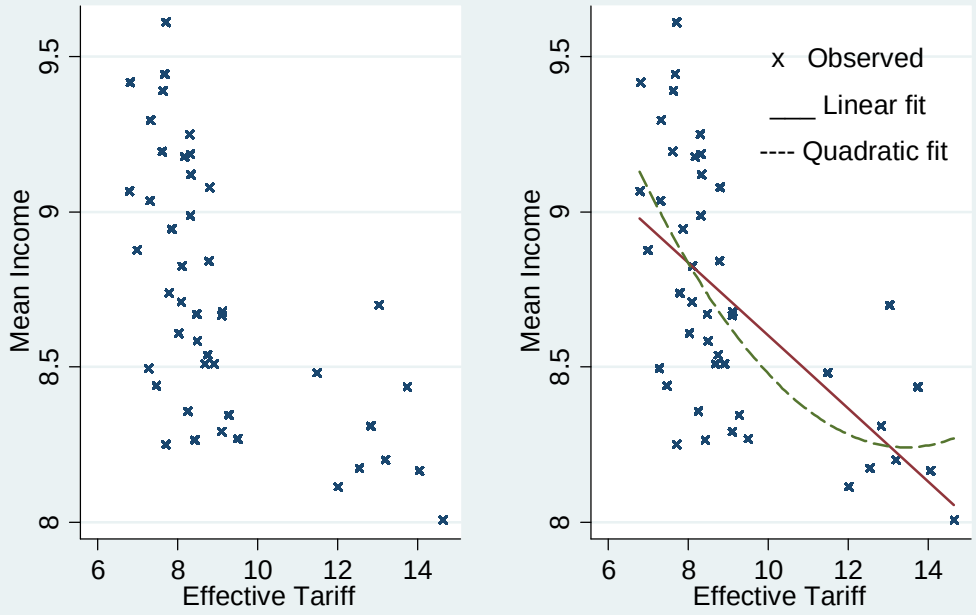
In the baseline estimation, β_1 is the key coefficient that identifies the effect of the WTO accession on household per capita income. α captures the average household per capita income at the initial time period.

The baseline regression model includes both the provincial tariff measure, $TradeLib_{pt}$, and its square term, $TradeLib2_{pt}$. I use $TradeLib2_{pt}$ to capture the nonlinear relationship between tariff and income, as shown in Figure 2.4 below. The first chart of Figure 2.4 is a simple scatter plot of the mean household income of each province and the effective tariff rate of each province, presenting a clear picture of the non-linearity. The second chart of Figure 2.4 adds the linear and quadratic fitted lines into the scatter plot, showing that the quadratic line provides a much better fit than the linear line.

I modify the baseline regression model of Equation (1) into Equation (1') by adding the term of $TradeLib2_{pt}$. I report estimation results on Equation (1') thereafter.

$$ln(Income_{ipt}) = \alpha + \beta_1 TradeLib_{pt} + \beta_2 TradeLib2_{pt} + \beta_3 X_{ipt} + \delta_p + \gamma_t + \varepsilon_{ipt} \quad (1')$$

Figure 2.4: Provincial Effective Tariff and Mean Household Income



Using data from Year 2000 to 2011

2.4.3 Non-Scaled Provincial Trade Exposure Measure and Instrumental Variable Estimation

Although using $TradeLib_{pt}$ as a measure of trade exposure is intuitive and Topalova (2007, 2010), Kis-Katos and Sparrow (2011) and Gaddis and Pieters (2012) in their research have applied it, $TradeLib_{pt}$ is constructed under the assumption that prices in non-tradable sectors are unaffected by prices in tradable sectors; that is, tariff rates are all zero in non-tradable sectors for all years. Therefore, tariffs of education, health as well as other service sectors are all assigned to zero in the calculation of $TradeLib_{pt}$. Consequently, I name $TradeLib_{pt}$ the scaled provincial trade exposure measure since its magnitude is scaled by the weight of non-tradable sectors.

However, in fact a price change in the tradable sector as a result of openness often leads to non-tradable sector's price change. This means that the effective or relative tariff of non-tradable sector should change over time, instead of being assigned zero. If this is the case, $TradeLib_{pt}$ would not measure the true effective tariff, that is, it commits a measurement error, which will lead to a biased estimation of the tariff effect in equation (1).

To deal with this error and the problem that data is unavailable to measure directly the relative price or tariff changes in non-tradable sectors, I construct a non-scaled tariff measure to correct the bias. The non-scaled tariff measure, $TrTradeLib_{pt}$, is defined as follows:

$$TrTradeLib_{pt} = \frac{\sum_j Worker_{j,p,2000} * Tariff_{jt}}{\sum_j Worker_{p,2000}}$$

where j indicates tradable industries. $TrTradeLib_{pt}$ excludes workers in non-tradable sectors and weighs annual tariff by rescaling the employment shares of tradable sectors to sum to one. It cannot be used directly in equation (1) to replace $TradeLib_{pt}$ as it ignores the size of non-trade sectors in provincial initial industrial composition. For example, $TrTradeLib_{pt}$ may be the same for two provinces, despite that one province might have only 5% tradable industries while the other province might have 95% tradable industries.

A nice feature of $TrTradeLib_{pt}$, however, is that it forms a good instrument for the scaled measure to make the measurement error correction. First, the non-scaled tariff measure is constructed to be highly correlated with the scaled tariff measure. Second, the

non-scaled tariff measure is not influenced by changes in the non-tradable sector; thus the non-scaled tariff measure is uncorrelated with the measurement error term of the scaled tariff measure.[18]

The first stage relationship can be expressed as follows:

$$TradeLib_{pt} = \mathrm{a} + b_1\, TrTradeLib_{pt} + c_p + d_t + u_{pt} \qquad (2)$$

where $TradeLib_{pt}$ and $TrTradeLib_{pt}$ are scaled and non-scaled provincial tariffs, respectively; c_p , provincial fixed effects, and d_t, year fixed effects, are defined the same as in equation (1).

Plugging equation (2) into equation (1), I get the reduced form of the instrumental variable (IV) regression model of equation (3): [19]

$$\ln(Income_{ipt}) = p + rTrTradeLib_{pt} + \beta_2 X_{ipt} + z_p + t_t + x_{ipt} \quad (3)$$

where $p = \alpha + \mathrm{a}$; $r = \beta_1(1+b)$; $z_p = \delta_p + \beta_1 c_p$; $t_t = \gamma_t + \beta_1 d_t$;

and $x_{ipt} = \varepsilon_{ipt} + \beta_1 u_{pt}$

I derive the two stages estimator of β_1 from the reduced form estimator of r and the first stage estimator of b.

[18] Consider the following equation: $\mathrm{TradeLib_{pt}} = \mathrm{trueTradeLib_{pt}} + \mathrm{measurement\ error}$, where $\mathrm{trueTradeLib_{pt}}$ is the "true" measure of effective tariff, which is unobservable. Plugging this into equation (1), we have $\ln(\mathrm{Income_{ipt}}) = \alpha + \beta_1 \mathrm{tureTradeLib_{pt}} + \beta_2 \mathrm{X_{ipt}} + \delta_p + \gamma_t + (\varepsilon_{ipt} + \beta_1 \mathrm{measurement\ error})$. Since$\mathrm{TrTradeLib_{pt}}$ is correlated with $\mathrm{TradeLib_{pt}}$and therefore $true\mathrm{TradeLib_{pt}}$, but uncorrelated with $\varepsilon_{ipt} + \mathrm{measurement\ error}$, that is, $\mathrm{TrTradeLib_{pt,}}$ is a legitimate instrument.

[19] Note that, for the simplicity of illustration but without losing generality, I have omitted the covariates, $\mathrm{X_{ipt}}$, in Equation (2). For the same reason, I have used Equation (1) instead of Equation (1'); otherwise, the reduced form equation would be excessively long, complicated, hard to interpret with respect to the coefficients and less intuitive.

Appendix 2.A reports detailed summary statistics on the scaled and non-scaled provincial tariffs as well as other variables used in the regression analysis. As Appendix 2.A indicates, the average level of scaled provincial tariff dropped from 13.02% to 7.99% (standard deviations being 0.93 and 0.68, respectively), and non-scaled provincial tariff decreased from 17.13% to 10.5% (standard deviations being 0.39 and 0.4, respectively) for surveyed provinces from 2000 to 2011.

2.5 Income Effects of the WTO Accession in China

In this section, I discuss the empirical results based on models in Section 2.4. Two major types of estimations have been performed: one type includes the estimations based on the baseline regression model of Equation (1'), and the other type includes the estimations based on the two stages least squares regression model of Equation (3).

I have conducted a Hausman specification[20] test to decide whether a fixed effect model or a random effect model is the correct model specification. Table 2 in Appendix B reports the results, which indicate that the preferred model should be the fixed effect model, with a p-value equaling to 0. Therefore, all estimations based on the fixed effect models include provincial fixed dummies to account for provincial specific time-invariant heterogeneity, and year fixed dummies to control the effect of national macroeconomic shocks other than the WTO accession.

[20] Hausman (1978) specification test is a statistical hypothesis test in evaluating the consistency of one estimator when compared to another less efficient estimator that is already known to be consistent. In the case of fixed- vs. random-effects panel regression models, the random-effects model is known to be consistent; and the fixed-effects model is consistent and more efficient under the null hypothesis but inconsistent under the alternative hypothesis. So, if the Hausman test result rejects the null hypothesis, the random-effects model should be used; otherwise, the fixed-effects model should be used.

2.5.1 The WTO Accession Effects on Household Income

Table 2.2 below presents the main estimation results. Column (2) reports the estimation results of the baseline model of Equation (1'). It yields a point estimate of -0.414 on the term of effective tariff with an associated standard error of 0.188. This suggests a statistically significant and negative relationship between provincial tariff changes and household income, indicating that provinces more exposed to trade openness (that is, a drop in provincial tariffs) experienced more increases of household income.

The coefficient of -0.414 indicates that one percentage point drop in provincial tariff leads to an approximately 41.4% increase in household income. Had the tariff reduction's effect been linear, this would have translated into substantial income gains. In China, during the survey years from 2000 to 2011, the average annual scaled provincial tariff dropped by 5.04 percentage points, suggesting an increase in household income of 208.7% (5.04*41.4%).

This notable estimated effect, however, is dampened by the second order effect estimate. The coefficient, 0.01 (with a standard error of 0.004), of the squared effective tariff rate indicates that the tariff reduction's effect is not linear; rather, it changes along with the level of tariff. Actually, there was a turning point of tariff rate 41.4 (0.414/0.01), where an increase of tariff rate will increase household income, but that turning point is out of reach of our data. To sum up, the effect of the tariff cut is not linear, and the estimated accumulated effect on household income is around 183% from 2000-2011.

The estimates on household characteristics variables are as expected. *Age* is a proxy of experience. Income, such as wage, increases as a person becomes more experienced. At

some point, income stops rising and begins to fall as a person gets older and less healthy. So, the coefficient on *age* is expected to be positive and on *age2* to be negative, just as what is shown in Table 2.2 ─ I find that households earn 8.4% higher income as the household heads get one year older, barring the reduced rate of 0.1%.

Similarly, the model estimates for female, education, land ownership, insurance holder and household size are all in line with the estimates in the literature. On land ownership, the estimate indicates a moderate but statistically significant effect on household income. This finding makes sense in the case of China, because the profitability of farming has been very moderate in recent years and many rural households only use spare or vacation time to farm in order to earn a bit of extra income.

I use the dummy variable of insurance as a catch-all proxy for certain systematic differences among households. For example, in China, the social security system is weak which yields a strong incentive to earn money regardless of the potential risk of certain occupations. If this is the case, one can think that the tariff reduction effect may be confounded by the incentive for more money. The *insurance* dummy then helps to capture the high risk occupations and therefore the incentive effect. In looking at the monopoly sector effect, for example, a work unit that offers insurance is likely in a monopoly sector that also offers other better fringe benefits that boost the household income. In this case, the insurance dummy helps control the monopoly effect. The statistically significant estimate of 0.107 indicates that households with insurance do earn more that those without insurance.

The IV estimates in Column (4) are mostly comparable with the baseline estimates. The estimated coefficient on the effective tariff is slightly larger in magnitude, suggesting a larger impact of tariff changes on household income. One explanation is that the baseline model underestimates the WTO accession effect because it fails to capture the effective changes of the tariff (through relative price) in non-tradable sectors, since the non-tradable sectors, such as education, finance, insurance, and social media, are highly regulated in China. The limited transmission of relative price effect may explain the comparable results between baseline and IV estimates.[21]

2.5.2 Urban-Rural Income Gap

Income inequality between urban and rural areas has remained a social concern in China in recent years. One common perception is that the WTO accession has provided more opportunities for households in the Coastal region and urban areas, leaving many in the rural and inland areas behind. To test if households in urban and rural areas have benefited differently from the WTO accession, I added interaction terms of effective tariff and urban dummy, *TradeLib*urban* and *TradeLib2*urban* into the baseline and IV models.

Column (3) of Table 2.2 reports the estimation results of the baseline model. The coefficient of *TradeLib* and *TradeLib2* are not significant at the 5% significant level, although they are significant at the 10% level. The impact of tariff cuts on urban household income is greater than that of rural household income, indicated by a point estimate of -0.186 on the effective tariff and urban interaction term, i.e., a tariff cut from 1% to 0 induced by the WTO accession has increased the urban household income by 54%.

[21] See Appendix C: Table 2 for the first-stage estimation results.

However, the estimates of the IV model (Column (5) of Table 2.2) show a larger urban and rural gap, compared with that of the baseline model. Specifically, the IV model yields a smaller estimate on tariff, indicating a smaller impact of tariff reduction on rural income, although the impact decreases at a slower rate. The estimate on rural area remained only marginally significant (i.e., at 10% significant level), but the estimate on urban is now significant. With a point estimate of -0.346, the estimated impact of tariff reduction on urban is much higher, albeit with a quicker diminishing rate. In general, the study finds that the WTO accession tends to have caused a larger income disparity between urban and rural areas.

Table 2.2: Regression Models ─ Baseline and IV regressions

Dependent variable: natural log of household per capita income

	Scaled tariff fixed effect Column (2)	Scaled tariff fixed effect-Urban Column (3)	IV fixed effect Column (4)	IV fixed effect-Urban Column (5)
TradeLib	-0.414	-0.369	-0.415	-0.344
	[0.188]**	[0.192]*	[0.197]**	[0.201]*
TradeLib2	0.010	0.008	0.011	0.007
	[0.004]**	[0.005]*	[0.004]**	[0.005]
TradeLib*urban		-0.186		-0.346
		[0.126]		[0.164]**
TradeLib2*urban		0.009		0.016
		[0.006]		[0.008]**
Age	0.084	0.084	0.084	0.084
	[0.016]***	[0.016]***	[0.015]***	[0.015]***
Age2	-0.001	-0.001	-0.001	-0.001
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Female	-0.098	-0.099	-0.098	-0.089
	[0.065]	[0.065]	[0.054]*	[0.054]*
Land	0.013	0.013	0.013	0.013
	[0.002]***	[0.002]***	[0.001]***	[0.001]***
Insurance	0.107	0.107	0.106	0.108
	[0.026]***	[0.026]***	[0.027]***	[0.027]***
Household size	-0.173	-0.173	-0.173	-0.173
	[0.012]***	[0.012]***	[0.011]***	[0.011]***
Primary school	0.036	0.036	0.036	0.035
	[0.050]	[0.050]	[0.045]	[0.045]
Middle school	0.064	0.064	0.064	0.064
	[0.056]	[0.056]	[0.049]	[0.049]

High school	0.103	0.102	0.103	0.101
	[0.070]	[0.070]	[0.064]	[0.064]
Technical school	0.132	0.130	0.132	0.128
	[0.079]*	[0.079]*	[0.085]	[0.086]
College degree	0.189	0.189	0.189	0.188
	[0.083]**	[0.083]**	[0.093]**	[0.093]**
Master's degree	0.553	0.554	0.553	0.552
	[0.245]**	[0.247]**	[0.340]	[0.340]
Province dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Constant	10.364	10.409	10.342	10.454
	[1.831]***	[1.834]***	[1.959]***	[1.960]***
R^2	0.222	0.222	0.222	0.222
No. of Obs.	13,090	13,090	13,090	13,090

Notes: Robust standard errors are reported in the parentheses. ***Significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

The difference between baseline and IV estimates may be due to the measurement error in the baseline model. Because the service sectors in urban areas are more developed in China, the measurement error problem is more severe in urban areas. As a result, the baseline model underestimates the effect of trade policy in urban areas; meanwhile, the measurement error problem is somewhat subdued when the study pooled the rural and urban data together, leading to the similar estimation results in Section 2.5.1.

2.5.3 The WTO Effects across Income Groups

Having established that the reduction in provincial tariff rate leads to an increase in household income, the study turns to examine if the effect differs between the rich and the poor. By interacting the tariff measure with income groups, the section estimates possible differential effects of the tariff cut on income groups, with results shown in Table 2.3 below.

The estimates of tariff measure suggest that a decline in provincial tariff protection leads to a significant increase in household income, but in different magnitudes among different income groups. Column (2) reports the effects of the tariff cut on the bottom 10% income groups. The statistically significant estimate of -0.59 on *TradeLib*group* indicates

that the bottom 10% income households enjoyed larger benefits from WTO accession relative to the rest of income groups; however, the larger benefits are more significant at the lower tariff level, as indicated by the statistically significant estimate of 0.03 on *TradeLib2*group*. At the tariff level of 19.67 (0.59/0.03), the poor benefit the same as the other income groups. These estimates suggest that the poor do not benefit as much at a higher tariff level as at a lower tariff level.

Results in Column (3) show a similar pattern ─ the bottom 25% income group benefits more from the WTO accession than the rest of the households. Only when the tariff level rises to 51.5% (0.309/0.006), does the bottom 25% households enjoy the same benefits as other income groups. Findings of Columns (2) and (3) suggest that the WTO accession had a significant effect on decreasing the income gap, at least for households at the bottom of the income distribution. In addition, the lower the tariff level, the smaller the income gap is.

I also investigated the other end of the income spectrum, with results reported in Column (4) and Column (5) of Table 2.3. The results show that the highest 10% income group benefited less than the rest of income groups, which suggests that the WTO accession had an effect in reducing the income gap across the income distribution in China, at least at the current tariff level.

Table 2.3: Regression Model with Income Groups Interactions

Dependent variable: natural log of household per capita income

	Lowest 10% Income Groups Column (2)	Lowest 25% Income Groups Column (3)	Highest 25% Income Groups Column (4)	Highest 10% Income Groups Column (5)
TradeLib	-0.350	-0.309	-0.374	-0.355
	[0.158]**	[0.153]**	[0.167]**	[0.179]**

TradeLib2	0.008	0.006	0.011	0.011
	[0.004]**	[0.004]*	[0.004]***	[0.004]***
TradeLib*group	-0.590	-0.393	0.145	0.166
	[0.188]***	[0.121]***	[0.021]***	[0.023]***
TradeLib2*group	0.03	0.020	-0.008	-0.009
	[0.009]***	[0.006]***	[0.001]***	[0.001]***
Age	0.083	0.053	0.043	0.066
	[0.012]***	[0.012]***	[0.013]***	[0.014]***
Age2	-0.001	-0.000	-0.000	-0.001
	[0.000]***	[0.000]***	[0.000]***	[0.000]***
Female	-0.026	-0.102	-0.059	-0.100
	[0.043]	[0.041]**	[0.046]	[0.049]**
Land	0.009	0.008	0.008	0.010
	[0.001]***	[0.001]***	[0.001]***	[0.001]***
Insurance	0.088	0.071	0.060	0.064
	[0.021]***	[0.020]***	[0.023]***	[0.024]***
Household size	-0.140	-0.097	-0.096	-0.125
	[0.008]***	[0.008]***	[0.009]***	[0.010]***
Lowest 10% income groups	0.877 [0.942]			
Lowest 25% income groups		0.413 [0.606]		
Highest 25% income groups			0.470 [0.098]***	
Highest 10% income groups				0.488 [0.103]***
Education dummy	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Constant	10.050	10.557	10.111	9.604
	[1.567]***	[1.501]***	[1.662]***	[1.779]***
R^2	0.488	0.553	0.459	0.359
No. of Obs.	13,090	13,090	13,090	13,090

Notes: standard errors are reported in the parentheses. ***Significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

These results seem counterintuitive to what people perceived in China, that is, income inequality between the poor and the rich has grown in recent decades, which is coincident with the WTO accession (Global Policy Forum, 2006). However, the perceived relationship between inequality and the WTO accession is an association that is not sufficient to conclude if it is entry into the WTO that exacerbates income inequality, or if other factors tie these two, or if this association is just spurious. Nevertheless, our results of decreasing in income disparities only indicate that the income of the poor grows faster, so that the income ratio of the rich to the poor gets smaller. It is possible that the absolute

difference in income that is caused by the WTO accession between the rich and the poor has still increased.

There are two possible reasons for the estimated reduction of the income gap between the rich and the poor in China. First, the demand for unskilled labor has been rising and continues to be high in China while the skilled labor, especially the college graduates can hardly find jobs in recent years. Second, labor is much more mobile in China now, with hundreds of millions of immigrant workers moving from rural areas to urban areas. This is partly due to the work opportunities created by the WTO accession. The back-to-home remittances increase the poor households' income.

2.5.4 The WTO Effects across Types of Firms and across Occupations

China's WTO accession affects people in various types of firms and occupations differently, and the CHNS allows us to conduct such analysis, given it collected information on the types of firms that household heads worked in and the occupations of household heads. The CHNS includes family contract farming, private enterprise, state-owned enterprise, large collective enterprises, small collective enterprises, foreign enterprises, government, and state or service institutes.

I grouped the types of firms that share similar features. The family contract farming, private enterprises and foreign enterprises are grouped together because they are all private in nature; in addition, the number of observations on foreign enterprises is too small for a separate investigation. State-owned enterprises, large collective enterprises and small collective enterprises are grouped together since they are all administrated by government or government-linked entities. Government and state or service institutes are grouped

together for the reason that they are both funded by fiscal allocation in China. This leaves us with three categories: private enterprises, state or collectively-owned enterprises (SOE) and public units.

The tariff and types of firm interaction terms are used to capture the different effects of the WTO accession, with results shown in Table 2.4. I first re-run the IV fixed-effects regression of Column (4) of Table 2.2; the difference is that now the regression is applied to the reduced data sample. As shown in column (2) of Table 2.4, albeit the estimates on *TradeLib* and *TradeLib2* are a bit smaller, they are similar in the direction and significance, indicating our regression model is robust to sampling changes.

Column (3) of Table 2.4 reports the estimated effects of the WTO accession on households in different types of firms, with public units as the reference group. Considering a certain proportion of people changed jobs over the survey period, I include types of firm dummies (SOE and Private enterprise) to capture the income differences due to changing jobs. The estimated coefficient on private enterprise is significantly higher, while the estimated coefficient on SOE is not statistically significant. It suggests that people earn more when they change jobs from SOE or public unit into private enterprise. The finding is consistent with the perceived reality in China ─ people would not leave their SOE or public unit jobs that are associated with higher social status and better benefits unless they are offered more rewarding jobs in the private sector.

The coefficient estimates on *TradeLib* and *TradeLib2* in Column (3) are not statistically significant. The point estimate of -0.125 on effective tariff rate is negative, suggesting that the WTO accession may increase the income of people working in public

units. A point estimate of zero on the squared effective tariff rate term indicates no nonlinear relationship between income from working in public units and tariff rates. These estimates are not unexpected because public units rely on fiscal allocation instead of the free market. Fiscal budgeting correlates weakly with the concurrent market since it is based on the long-term projection. In addition, China's fiscal allocation is highly centralized which can lead to insensitivity to tariff reduction effect in the short run.

China's SOEs resembles the public unit in many ways ─ being soft budgeted, taking part of government functionalities, and not being sensitive to market signals. Findings indicate that the tariff reduction effect on the income of SOE workers is not much different from that of the public unit ─ the coefficient estimates on SOE are not statistically significant.

Findings on the private sector are interesting, where the estimated tariff reduction effect is statistically significant with the expected signs. That is, the impact on private sector is greater than on other sectors, indicated by a point estimate of -0.587 on the *TradeLib*private* term; so, a drop of tariff rate from 1% to zero induced by the WTO accession would increase the household income in the private sector by 58.7%. This rate of increase is smaller at the higher tariff level, as represented by the point estimate of 0.03 on the *TradeLib2*private* term. In fact, at the point where the tariff rate had been higher than 19.57% (0.587/0.03), a tariff reduction would have hurt the private sector more than other sectors.

Table 2.4: Regression Results with Type of Firms and Occupation Interactions[22]

Dependent variable: natural log of household per capita income

	All firms Column (2)	By type of firms Column (3)	All Occupations Column (4)	By occupation Column (5)
TradeLib	-0.345	-0.125	-0.345	-0.270
	[0.208]*	[0.251]	[0.208]*	[0.227]
TradeLib2	0.008	0.001	0.008	0.005
	[0.005]*	[0.008]	[0.005]*	[0.007]
TradeLib*soe		0.063		
		[0.242]		
TradeLib2*soe		-0.003		
		[0.011]		
TradeLib*private		-0.587		
		[0.254]**		
TradeLib2*private		0.030		
		[0.012]**		
SOE		-0.348		
		[1.218]		
Private enterprise		2.658		
		[1.246]**		
TradeLib*agr				-0.001
				[0.158]
TradeLib2*agr				0.000
				[0.007]
TradeLib*skilled				-0.272
				[0.274]
TradeLib2*skilled				0.013
				[0.013]
TradeLib*unskilled				-0.076
				[0.234]
TradeLib2*unskilled				0.005
				[0.011]
Agriculture				-0.394
				[0.790]
Skilled worker				1.403
				[1.347]
Unskilled worker				0.260
				[1.159]
Controls	Yes	Yes	Yes	Yes
Province dummy	Yes	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes
Constant	10.523	9.180	10.561	10.207
	[2.062]***	[2.228]***	[2.054]***	[2.087]***
R^2	0.222	0.223	0.223	0.222
No. of Obs.	10,460[23]	10,460	10,552	10,552

Notes: Robust standard errors are reported in the parentheses. ***Significant at the 1% level; **significant at the 5% level; *significant at the 10% level.

[22] I omitted the control variable in order to condense the table.

[23] Due to missing information on types of firms, the number of observations was reduced.

The occupations in the CHNS include the following categories: 1) farmer, fisherman and hunter; 2) skilled workers such as foreman, craftsman and group leader; 3) non-skilled workers such as ordinary laborer and logger; 4) senior professionals such as doctor, professor, lawyer and engineer; 5) junior professionals such as midwife, teacher and editor; 6) administrators such as government official, village leader and administrative cadre; 7) office staff such as secretary and office helper; and 8) other occupations such as driver, soldier and policeman, housekeeper, athlete and actor.

I grouped the occupations from 4) to 8) into one category because they belong mostly to service-type of work that link indirectly to tariff reduction. This leaves us with four occupation categories: farming/fishing/hunting workers; skilled workers, non-skilled workers and service workers.[24]

Column (4) of Table 2.4 reports estimates on different occupations, with Column (3) simply a duplication of Column (1) on a slightly different sampling. Most estimates on occupations are insignificant. It is partly due to the data limitation: the occupation categories are too broad to avoid the type II error. The other possibility is that impacts of trade liberalization are indeed relatively homogenous across occupations ─ although trade liberalization affects people in different sectors or different types of firms differently, it yields a similar benefit or loss among people with different occupations in a certain sector.

Despite the statistical insignificance, the estimates reinforce some of the earlier findings. For example, the point estimate on *TradeLib*agr* is much smaller compared to

[24] The CHNS does not provide a strict definition on skilled and unskilled workers, but from the examples it gave, I assume they should be mostly production and manufacturing workers.

the estimate on *TradeLib*skilled*. Under the reasonable assumption that skilled workers mostly live in urban areas in China, the enlarging income gap between urban and rural areas may be partly due to the different occupational distribution.[25]

2.6 Conclusion and Policy Implications

Through exploiting the variations in exposure to the WTO accession across provinces and over time, this study estimates the causal effect of the WTO accession on household income and its distributions. In particular, I measure whether the impact is different in rural and urban areas; whether the bottom income groups derive relatively larger or smaller benefits than the top income groups; and whether households among different types of firms and occupations benefit differently.

Results suggest that provinces more exposed to tariff reduction experienced a larger increase in household income than less exposed provinces. Households with a more experienced head, higher education, land ownership and health insurance tend to get more benefits from trade openness. Opening markets has had different impacts on households in urban and rural areas ─ urban households have benefited more from than their rural counterparts. Consequently, the WTO accession tends to widen the income disparities between urban and rural areas.

Moreover, tariff cuts have a significant impact on households among different income groups. The bottom 10% and 25% income groups benefited more than the rest of income groups; while the top 25% and 10% income groups benefited less than the rest of income groups from opening the market. The WTO accession is likely to contribute to

[25] When using the skilled workers as the reference group, the estimate on it is statistically significant.

narrowing the income gap between the top and the bottom income groups. As expected, the impact of trade liberalization on households in the private sector is greater than those in other sectors, such as the public sector. No significant effect of tariff reduction has been found among households with various occupations.

This empirical study is useful to guide policy design that can help to direct the potential economic benefits of trade openness to the people that are most in need. Exploring if the entry into the WTO widens the income gap is directly relevant to China's ongoing endeavor of further opening up[26] its market and integration into the global economy. China aims to create 20 free-trade areas covering 29 countries, among which 12 Free Trade Agreements (FTAs) have been implemented and 8 FTAs are under negotiation. Lessons from the WTO accession will contribute to compensating potential disadvantaged groups affected by FTAs.

Targeted policies should endeavor to aid poor people in rural areas to reduce urban-rural income disparities. On the one hand, it should relax the *hukou* registration system that prevents rural labors from migrating into cities. Being restricted in rural areas, rural people, especially the poor, hardly enjoy the employment opportunities brought by trade openness. On the other hand, both central and local government should invest more in rural education. Lower education levels of rural households, especially rural poor people, underpin the

[26] Before China's economic reform in 1978 and the WTO accession in 2001, China closed its door and adopted a self-sufficiency policy. Although the "opening up" brings many new challenges to China ─ for example, the widening income gap between urban and rural areas – the opening brings more opportunities to China than did a closed-door policy. If China had kept its door, it could not have improved its overall economic performance and many person's livelihoods, developed its legal system, strengthened regulations in financial and other sectors, stimulated way of thinking, and in particular, increased assistance to the poor. Considering the WTO entry as a milestone and a starting point of its economic reform, China continues to move forward on its path of "opening up."

backward rural economy and the large urban-rural income gap. Specifically, governments have the responsibility to create more education opportunities for rural residents by waiving the tuition, fees, and providing fellowships for poor students. Upgrading the human capital has been proven an effective way to lift the poor out of poverty.

Appendix 2.A: Summary Statistics

Variable	Observations	Mean	Std.Dev	Min	Max
	Year 2000				
Household per capita income	3183	5764.817	5748.470	0	85486.35
Log household per capita income	3169	8.288	0.961	2.286	11.356
Age	3236	44.280	8.590	20.380	59.990
Female	3236	0.105	0.307	0	1
Years of schooling	3194	7.860	4.006	0	18
Education	3194	1.897	1.206	0	6
Household size	3183	3.770	1.214	1	11
Land ownership	3236	3.395	9.416	0	305
Health insurance	3178	0.236	0.425	0	1
Scaled provincial tariff	3236	13.017	0.933	11.482	14.645
Non-scaled provincial tariff	3236	17.128	0.391	16.546	17.998
State/Collectively-owned enterprises	2821	0.689	0.463	0	1
Private enterprises	2821	0.029	0.169	0	1
Public units	2821	0.267	0.442	0	1
Urban	3188	0.275	0.447	0	1
	Year 2004				
Household per capita income	2985	7537.085	8027.997	0	83725.06
Log household per capita income	2939	8.490	1.060	0.535	11.335
Age	3027	46.1	8.29	18.92	59.98
Female	3027	0.109	0.312	0	1
Years of schooling	2772	8.342	3.800	0	16
Education	2772	2.037	1.187	0	5
Household size	2985	3.507	1.218	1	10
Land ownership	3027	3.589	8.647	0	150
Health insurance	2745	0.291	0.455	0	1
Scaled provincial tariff	3027	8.383	0.662	7.274	9.501
Non-scaled provincial tariff	3027	11.019	0.331	10.482	11.652
State/Collectively-owned enterprises	2147	0.126	0.332	0	1

Private enterprises	2147	0.607	0.488	0	1
Public units	2147	0.140	0.347	0	1
Urban	2985	0.273	0.446	0	1
	Year 2006				
Household per capita income	2887	9190.196	13167.780	0	252189.9
Log household per capita income	2849	8.613	1.120	0.759	12.438
Age	2962	47.07	7.96	18.48	59.99
Female	2962	0.103	0.304	0	1
Years of schooling	2659	8.359	4.234	0	18
Education	2659	2.085	1.308	0	6
Household size	2887	3.542	1.285	1	10
Land ownership	2962	3.294	7.411	0	90
Health insurance	2636	0.529	0.499	0	1
Scaled provincial tariff	2962	8.150	0.682	6.989	9.275
Non-scaled provincial tariff	2962	10.705	0.386	10.071	11.421
State/Collectively-owned enterprises	2068	0.114	0.318	0	1
Private enterprises	2068	0.689	0.463	0	1
Public units	2068	0.153	0.360	0	1
Urban	2887	0.279	0.449	0	1
	Year 2009				
Household per capita income	2824	13111.04	17609.54	0	312123.1
Log household per capita income	2781	9.023	1.054	3.021	12.651
Age	2976	47.91	7.87	19.31	59.99
Female	2876	0.117	0.321	0	1
Years of schooling	2630	8.478	3.967	0	18
Education	2630	2.091	1.238	0	6
Household size	2824	3.430	1.290	1	11
Land ownership	2876	3.583	11.429	0	210
Health insurance	2617	0.923	0.266	0	1
Scaled provincial tariff	2876	7.980	0.686	6.797	9.104
Non-scaled provincial tariff	2876	10.482	0.406	9.795	11.248
State/Collectively-owned enterprises	2058	0.105	0.307	0	1

Private enterprises	2058	0.699	0.459	0	1
Public units	2058	0.160	0.367	0	1
Urban	2827	0.299	0.458	0	1
	Year 2011				
Household per capita income	2559	15387.7	19089.47	0	343328
Log household per capita income	2532	9.184	1.094	2.899	12.746
Age	2611	48.57	7.58	21.2	59.97
Female	2611	0.115	0.319	0	1
Years of schooling	2326	8.843	4.035	0	18
Education	2326	2.217	1.308	0	6
Household size	2559	3.388	1.301	1	11
Land ownership	2611	3.401	10.221	0	200
Health insurance	2307	0.961	0.193	0	1
Scaled provincial tariff	2611	7.994	0.682	6.816	9.121
Non-scaled provincial tariff	2611	10.501	0.400	9.823	11.266
State/Collectively-owned enterprises	1862	0.106	0.308	0	1
Private enterprises	1862	0.669	0.471	0	1
Public units	1862	0.169	0.375	0	1
Urban	2562	0.303	0.460	0	1

Appendix 2.B

Table 1: Hausman Test

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
wtariff	-.0970026	-.1294389	.0324363	.0031469

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 106.24
Prob>chi2 = 0.0000

Table 2: First Stage: Relationships between Scaled and Non-scaled Provincial Tariff

	TradeLib (1)	TradeLib2 (2)
TrTradeLib	0.6559*** (0.0102)	
TrTradeLib2		0.9879*** (0.0121)
R square	0.9970	0.9889
No. of observations	14712	14712

Note: All regressions include year and provincial fixed effects.
Standard errors are reported in the parentheses.
***Significant at the 1% level; **significant at the 5% level; * significant at the 10% level.

Table 2 presents the estimation results of equation (2). Column (1) shows the point estimation of the coefficient b equal to 0.66, indicating that the scaled and non-scaled measure are highly correlated; the associated standard error of the point estimate is very small, with a less than a 1% significant level.

Appendix 2.C: Literature Review

Table 1. Cross-Country Studies

Authors/Year	Title of Study	Methodology	Trade & Welfare Measure	Country	Principal Findings
Dollar and Kraay (2001)	Trade, Growth, and Poverty	Cross-country regression	Trade: measured by the trade-to-GDP ratio	156 countries	Globalizers grow faster than non-globalizers, and the increase in growth rates leads to proportionate increases in incomes of the poor. Trade liberalization is associated with higher growth rates and poverty reduction in poor countries.
Guzman (2008)	Trade Openness and well-being: Do Complementary Conditions Matter	Cross-country regression	Trade: tariff rates, NTB's, trade-restraining subsidies Well-being: income, infant mortality, life expectancy rates	156 countries	Unilateral trade liberalization is not associated with higher levels of well-being; Gains in multilateral trade openness do not alone guarantee the achievement of higher levels of well-being
Milanovic and Squire (2004)	Does Tariff Liberalization Increase Wage Inequality?	Cross-country regression	Trade: average tariff rates instead of trade volume Wage inequality: (1) occupational wages; (2) industry wages	156 countries	A reduction in the average tariff rate is weakly associated with higher inter-occupational wage inequality in poor countries and strongly associated with greater inter-industry wage inequality.
Slaughter (2001)	Trade Liberalization and Per Capita Income Covergence: A Difference-in-Difference Analysis	Cross-country difference-in-difference approach	Trade: dummy variable Welfare: per capita income dispersion	47 countries	No systematic linkage between trade liberalization and per capita income convergence has been found.

Table 2. Single Country Case Studies

Authors/Year	Title of Study	Methodology	Trade and Welfare Measure	Country	Principal Findings
Castilho, Menendez and Sztulman (2012)	Trade Liberalization, Inequality and Poverty in Brazilian States	Panel regression	Trade: weighted average of national industry-level tariffs and trade flow-based indicators Poverty: the headcount index Poverty gap inequality: the Gini and Theil indices	Brazil	Brazilian states that were more exposed to tariff cuts experienced smaller reductions in household poverty and inequality
Chen and Ravallion (2003)	Household Welfare Impacts of China's Accession to the World Trade Organization	Computable General Equilibrium (CGE) Model	Data: 1999 rural and urban household surveys Welfare indicator: income per person Trade openness: tariff changes	China	The predicted aggregate impacts of trade reform is negligible. However, implications across sectors and regions emerge. A decline in real income of rural household has been found. The richest provinces tend to gain the most in both urban and rural areas; more than 90% of farmers in northeast provinces suffer an income loss.
Diao, Fan and Zhang (2002)	How China's WTO Accession Affects Rural Economy in the Less-Developed Regions	Computable General Equilibrium (CGE) Model	Data: 1996-1998 regional level data Trade: tariff reduction and removal of protection Welfare: income	China	China's WTO accession would increase the welfare as a whole, whereas agricultural sector and less-developed rural areas would get hurt.
Hertel, Zhai and Wang (2004)	Implications of WTO Accession for Poverty in China	Computable General Equilibrium (CGE) Model	Trade: tariff reduction Poverty: wages/consumption	China	The biggest gains of the WTO accession will go to urban households, while the smallest gains will go to rural households. The WTO accession tends to widen income disparities in China.

Wei and Wu (2002)	Globalization and Inequality: Evidence from Within China	Cross-section and panel regression (2SLS)	Trade: trade-to-GDP ratio Inequality: urban-rural income ratio IV: the minimum distance from the city to either Hong Kong or Shanghai	China	Overall, trade openness tends to reduce income inequality. Specifically, it leads to a reduction in urban-rural income inequality, within-urban inequality and within rural inequality.
Han, Liu and Zhang (2012)	Globalization and Wage Inequality: Evidence from Urban China	Difference-in-Difference approach	Trade openness: regional dummy Wage inequality: quantile regression of real labor earnings	China	Globalization was significantly associated with rising wage inequality in urban China.
Topalova (2007)	Trade Liberalization, Poverty and Inequality: Evidence from Indian Districts	Panel regression	Trade exposure: average industry-level tariffs weighted by the workers employed in that industry in 1991 as a share of all registered workers Poverty: head count ratio and poverty gap	India	Rural poverty was negatively correlated with trade openness. Urban poverty and rural and urban inequality were unaffected by tariff reductions.
McCaig (2009)	Exporting Out of Poverty: Provincial Poverty in Vietnam and U.S. Market Access	Panel regression	Trade: tariff reduction Poverty: headcount ratio	Vietnam	Provinces more exposed to tariff cuts experienced greater reduction in poverty across Vietnam provinces.

Chapter 3: Essay 2 — Multidimensional Poverty in China: Estimates and Policy Implications

"We have tended to judge development by the expansion of substantive human freedoms – not just by economic growth (for example, of the gross national product), or technical progress, or social modernization. This is not to deny, in any way, that advances in the latter fields can be very important, depending on circumstances, as 'instruments' for the enhancement of human freedom. But they have to be appraised precisely in that light – in terms of their actual effectiveness in enriching the lives and liberties of people – rather than taking them to be valuable in themselves"

-- Drèze and Sen (2002)

3.1 Introduction

Poverty has long been understood as the lack of sufficient income or consumption to meet a basic living standard. The underlying assumption of the definition is that money, as a "universally convertible asset", can be "translated into satisfying all other needs" (Scott, 2002: 488). However, poverty may arise not only from ─ or be conceived as ─ inadequate income but also in relation to low levels of health and education, lack of clean water, poor access to sanitation and public services, limited opportunities and freedoms.

Amartya Sen (1999) proposed the capability approach as a conceptual framework of well-being and discussed poverty from the perspective of capability. He argued that individuals should obtain a certain level of capabilities or substantive freedoms ─ ones that they have reason to value ─ to function well in a society. Capabilities are *various* combinations of functionings (beings and doings) that the person can achieve, and therefore poverty is a multidimensional concept. Today, it is widely acknowledged that poverty is

the deprivation not ─ or, not only ─ of income but (also) many other dimensions.[27] One could be income rich but be poor in health and freedom; one could be income poor but have high levels of well-being because of guaranteed access to a social safety net.

Inspired by and committed to Sen's conceptual framework, and aided by improved data availability, Alkire and Foster (2007, 2011, 2015) put multidimensional poverty analysis forward methodologically and normatively. They developed the "Alkire and Foster (2007, 2011) Method"[28] (hereafter "AF Method") to identify the multidimensional poor and to measure the breadth and depth of multiple deprivations experienced by the poor. The United Nations (UN) adopted the AF Method and its construction of the global Multidimensional Poverty Index (MPI), which was first published by the United Nation Development Programme in its *2010 Human Development Report*. The global MPI has three dimensions ─ health, education and living standards ─ measured by 10 indicators, selected on the basis of international consensus and data availability.

[27] From the World Bank: http://www.worldbank.org/en/topic/poverty/overview#1

[28] Besides the AF Method, other existing multidimensional poverty methodologies include the dashboard approach, the composite indices approach, Venn diagrams, the dominance approach, statistical approaches, fuzzy sets and the axiomatic approach. How these methodologies differ from each other in terms of essential characteristics, is summarized in the following table. More discussion and critical evaluation can be found at Alkire, Foster, Seth, Santos, Roche and Ballon (2015), Chapter 3.

Method	Able to capture joint distribution of deprivations: require micro data	Identification of the poor	Provide a single cardinal index to assess poverty
Dashboards	No	No	No
Composite Indices	No	No	Yes
Venn Diagrams	Yes	May	No
Dominance Approach	Yes	Yes	No
Statistical Approaches	Yes	May	May
Fuzzy Sets	Yes	Yes	Yes
Axiomatic Approaches	Yes	Yes	Yes
AF Method	Yes	Yes	Yes

Source: *Alkire, Foster, Seth, Santos, Roche and Ballon, 2015: 122*

China, as we have seen, represents an appealing example to study poverty issues. On the one hand, China has made a remarkable advance, with more than 30 years of fast economic growth as it transforms itself from an egalitarian but inefficient system under a planned economy into an unequal but efficient system under a market economy, lifting hundreds of millions people out of income poverty.

On the other hand, there has been a dark side to this impressive economic growth ─ environmental degradation as well as long-term and unfairly distributed social and health costs and benefits. For example, the transition to a market economy has shifted the responsibilities of health care, education, and housing from the government to each individual or family. Under the planned economy, although the level of income was low, people enjoyed almost free education, medical care and paid a very low rent for housing. However, these welfare benefits either disappeared or decreased significantly during the transition process, which increased inequality dramatically and intensified the imbalance of social development. Moreover, this massive transition process has been bound up with rent-seeking opportunities that hatch corruption, a factor that restricts and undermines people's capabilities and functionings.[29] Furthermore, pollution ─ which makes clean water and fresh air a luxury, even for rich people ─ has become a main downside of China's export-oriented economic growth.

Although China maintains its progress on income poverty reduction, new challenges are emerging in providing clean water, housing, education, and so on. The

[29] See, for example, Fu Hualing, "Wielding the Sword: President Xi's New Anti-corruption Campaign," in Susan Rose-Ackerman and Paul Lagunes, eds. *Greed, Corruption, and the Modern State: Essays in Political Economy* (Cheltenham, UK and Northampton, MA: Edward Elgar, 2015). In addition to describing, explaining and evaluating Chinese corruption, Fu trenchantly shows how current Chinese anti-corruption efforts have concentrated power in the Chinese Communist Party and the presidency.

traditional anti-poverty strategy, which focused solely on economic growth, became less effective in eradicating multidimensional poverty in China. To assist in addressing these new development challenges, this chapter aims not only to examine multidimensional poverty in China by applying the AF Method, but also to compare how the multidimensional poverty measure is different from and complements the income poverty measure.

This chapter finds that China's multidimensional poverty has declined dramatically during the period from 1989-2011, but the reduction rates and patterns vary by dimensions; multidimensional poverty reduction also exhibits regional and provincial differences, as well as imbalances between rural and urban areas. Compared to income poverty, multidimensional poverty reduction does not always coincide with economic growth. Hence, if only income or multidimensional poverty measure is applied, the proportion of those who are "really" poor but not considered poor, is unacceptably high.

The analysis adds to the literature by applying the AF Method to empirically estimate multidimensional poverty in China. A number of studies recently analyzes multidimensional poverty estimation in African countries, Bhutan, Pakistan and China (Batana, 2008; Santos and Ura, 2008; Naveed and Islam, 2010; Yu, 2011). This present chapter differs from existing studies in that it is not restricted to estimate China's multidimensional poverty; it also focuses on how the multidimensional poverty measure is different from and yet complements the monetary poverty measure.

The rest of Chapter 2 is structured as follows: the next section reviews the claims and arguments of these two major approaches to evaluating poverty, and explains why it is important to study multidimensional poverty in China; section 3.3 describes the

methodology for estimating multidimensional poverty; sections 3.4 and 3.5 construct China's MPI and report the associated empirical findings; and section 3.6 discusses policy implications and conclusions.

3.2 A Review on the Two Major Approaches to Evaluating Poverty

3.2.1 The Monetary Approach: Income Poverty

A mainstream analysis of poverty relies on the monetary approach to measure people's well-being. The rationale behind it is that with a certain level of income or consumption, people can satisfy their basic needs and function in society.[30] The international (income) poverty line, commonly used by researchers, provides a threshold to identify the poor in all countries after accounting for the differences in currency units, purchasing power and inflation rates. A person is considered to be poor if his or her income level falls short of the threshold. One merit of income measure is that it makes cross-country comparisons possible. In addition, the data of income or consumption is easily obtained and calculated ─ almost all household survey datasets record households' income or/and expenditure, thus making it the popular and dominant poverty analysis in the last several decades. Finally, it is undeniable that income is often a means to many opportunities and higher levels of well-being.

Although income serves a convenient ─ and data accessible ─ tool for researchers and policy makers to differentiate between the poor and non-poor, one of its drawbacks is that it excludes other features of living that have instrumental value in achieving people's

[30] Although this conventional approach employs the rhetoric of the end of enabling people to meet basic needs and function in society, little effort is made to show that income in fact results in the alleged end. Moreover, the means (income) tends to become the end in itself.

well-being and intrinsic value in conceiving that well-being. A person's well-being is not highly correlated with income in all circumstances. People may income rich but deprived in education, or income poor but rich in health. Consider two persons who are equally income poor based on the international poverty line. One is disabled with a high school diploma; the other is healthy with a Master's degree. Obviously, the second person has a greater opportunity to get out of poverty and achieve well-being than the first one. In this context, the breadth and depth of deprivations in non-income dimensions remain unexplained and unthematized.

Under the monetary approach, anti-poverty policy is pretty straight forward: just increase people's income and, thereby their lives will be improved. However, if history can offer any guidance, the success of such an anti-poverty policy has tended to be short-lived and even has had perverse effects.[31] Why? Because it overlooks other important aspects of and means to well-being: health, education, political rights, social inclusion and so forth. As Crocker, following Sen, has argued, income is important but as a means rather than as an end in itself (Crocker, 2013). To increase income can only serve as one means of defining and improving people's welfare rather than being the only definition of or means to the end. In fact, if increasing income is treated as the end rather than one means, the pursuit of this end usually undermines its attainment. The ultimate goal of development ─ for which income is at best one means ─ is to enhance people's capabilities and enable people to live a life they have reason to value.

[31] The failure of Latin American countries in the 70s and 80s, and the Dutch disease of the African countries, is an example. The heavy investment in education and health care in advanced countries, such as the U.S, offers evidence as well because it shows how important these factors are in long-term reduction of poverty and sustained growth.

3.2.2 The Capability Approach: Multidimensional Poverty and Well-being

The concept of multidimensional poverty is constructed on the theoretical framework of the capability approach, which Sen pioneered (1984, 1993, 1999), Nussbaum (2000) and Crocker (2008) and many others significantly advanced in development ethics, and Alkire and Foster (2007, 2011, 2015), among others, operationalized. The Capability Approach (CA) centers on people's capabilities, underscores human development and aims to widen people's choices and realize their freedoms.

The CA focuses on a person's freedom to achieve valuable functionings. Sen explains a functioning as an achievement of a person: what she or he manages to do or be (Sen, 1999). Functionings can vary from basic states of being healthy, being educated, and so forth, to more complex achievements, such as being empowered, participating in political decision, and enjoying freedom of speech. Sen refers to "the substantive freedoms" to achieve such functioning combinations as capabilities (Sen, 1999: 75). Poverty, in the framework of capability, is conceived as deprivation of basic capabilities, being unable to "satisfy certain crucially important functions up to certain minimally adequate levels" (Sen, 1993: 41).

In addition to the interpretative and evaluative concepts of functioning and capability (well-being achievement and well-being freedom, respectively), Sen argues for

an empirical and normative notions of agency.[32] Crocker (2008: 219-220) systematized and developed Sen's idea when he characterized someone as an agent to "the extent that they are able to scrutinize critically their options, themselves decide (rather than have the decision made by someone else or an external or internal force), act to realize their purposes, and have an impact on the world." Crocker ramified Sen's distinction between well-being and agency,[33] and emphasized the *process* aspect of human well-being, that is, the social arrangements for enabling people to exercise their agency freedom and make decisions about opportunities and outcomes.[34] Following Sen and Crocker, "agency freedom" refers

[32] The term "agent" used in the CA is different from that employed in economic literature. Sen explains in *Development as Freedom* (1999) that he uses the term "agent" in the sense of "someone who acts and brings about change, and whose achievements can be judged in terms of her own values and objectives, whether or not we assess them in terms of some external criteria as well" (Sen, 1999: 12). Here, Sen's usage contrasts with the economic notion of agent and principal, for in economic theory principals are the commanding doers and agents are their more or less passive instruments. Individuals need not be seen as "passive recipients of the benefits of cunning development programs", but as agents who, with adequate opportunities, "can effectively shape their own destiny" (Sen, 1999: 11).

[33] Crocker (2008) offers the following table coupled with a detailed explanation about the distinction between well-being and agency. The table shows that both well-being and agency have two dimensions: achievements and freedom. Well-being concerns a person's own achievements (functionings) and substantive freedom for functionings (capabilities), while the notion of agency marks what a person can do or achieve – whether or not the outcome is personally advantageous to the agent – through exercising his or her freedom as an agent.

	Well-Being	Agency
Achievements	Well-Being Achievements (Functionings)	Agency Achievements
Freedom	Well-Being Freedoms (Capabilities)	Agency Freedoms

Agency freedom stresses social arrangements and decision-making process, which enable people and groups to decide on their own, act on their own or with others and shape their own destinies. For more discussion on agency and capability, see Crocker (2008) Chapter 5 and Crocker and Robeyns (2010). How does well-being freedom (capability) differ from agency freedom? The latter, for Crocker, is a sort of "super" capability on the basis of which an agent decides to assess, weigh and prioritize her well-being freedoms and other values.

[34] For instance, if one person lives in a "nanny state," in which the state and its experts run the show, and the second person lives in an "agency state," in which one's agency can be exercised and his or her values can be brought about, both of them might be on the same level of well-being freedoms (capabilities) and well-being achievements (functionings), but are not have the same degree of agency freedom (Crocker, 2008).

to an individual's or community's ability to make decisions, act, and make a difference in the world.[35]

Unable to exercise their agency freedom, persons may live as "well-fed, well-clothed, and well-entertained vassals" (Drèze and Sen 2002: 288). The "agency-oriented capability approach," which Crocker (2008) developed and defended, views poverty not only as a capability failure, but also as the failure of persons to determine and be responsible for their own lives (Crocker, 2013). A slave with a benevolent master may have ample well-being, but he is drastically limited as an agent, for against his will he can be bought, sold, separated from his family, and humiliated. Moreover, even if the master has granted the house slave or field foreman some domains for agency freedom, the master always can unilaterally and arbitrarily abolish this freedom.

The capability approach provides an alternative conceptual framework for inter alia welfare economics and poverty analysis. The emphasis on the presence or absence of functioning, capability and agency broaden the well-being and poverty evaluation from monetary to include as well non-monetary dimensions. Monetary resources are valuable, but only a means to expand people's freedom to live lives they have reason to value. They are a necessary but not a sufficient space for evaluating people's achievements and freedoms to achieve. Capabilities and agency provide an alternative evaluative space to judge whether people are better off or not.

[35] The current study does not thematize individual and collective agency, even though it is an essential part of Sen's and Crocker's versions of the Capability Approach. In future research I will explore this topic in some detail.

Moving from ideal or normative theory to some empirical applications of Sen's capability approach, Alkire and Foster (2007, 2011, 2015) developed the AF Method to identify the multidimensional poor by reflecting the breadth and depth of multiple deprivations experienced by the poor. The AF Method relates to Sen's capability approach as it identifies the multidimensional poor and broadens the information base to include a focus on people's capabilities and functionings that they have reason to value. Besides the normative appropriateness of targeting the multidimensional poor, the AF Method has an advantageous flexibility that allows users to determine the unit of analysis, dimensions and indicators, weights and cut-offs in specific contexts and for particular purposes. Thus, it provides another tool ─ beyond monetary poverty measures ─ for policy makers to evaluate the outcomes and monitor the progress of policies and programs.

Although many would not disagree that poverty is a complicated and multidimensional phenomenon, not everyone agrees with the AF Method. Since the global MPI, one implementation of the AF Method, was published in 2010, it has aroused heated debates and encountered challenges.[36] Ravallion states one fundamental objection: "…it is not credible to contend that any single index could capture all that matters in all settings" (Ravallion 2011:16). Another critique centers on the measurement of multidimensional poverty. By rejecting a single multidimensional index, Ravallion recommends a "dashboard approach," that is, applying a standard poverty measure to selected dimensions

[36] After the UN published the global MPI in 2010, a hot debate emerged. Two rounds of debates between Martin Ravallion, Director of the Development Research Group, World Bank (WB), and Sabina Alkire and James Foster, Director of the Oxford Poverty and Human Development Initiative (OPHI) and Professor of Economics and International Affairs at the George Washington University, creators of the global MPI, initially occurred both on World Bank's blog and Duncan Green's blog, and then were featured in the *Journal of Economic Inequality* (Alkire and Foster, 2011b; Ravallion, 2011; Lustig, 2011). Other researchers, such as Maria Emma Santos, Sir Tony Atkinson, Francois Bourguinon, and Nicole Rippin, contributed to the discussion and shared their views. The debate is still ongoing.

to obtain a dashboard of multiple but separated indices, in order to "focus our efforts and resources on developing the best possible distinct measures of the various dimensions of poverty" (Ravallion 2011: 17). One example of this dashboard approach is Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) that the United Nations (UN) has constructed. This approach collects multiple dimensions of poverty, including both income and non-income indicators, but without aggregating them to a single index. Proponents contend that what we need is not a single MPI, but a dashboard of several credible indices.

I argue that both the AF Method and MPIs[37] are unique and important additions for poverty measurement and policy evaluation. First, they complement and do not replace traditional monetary poverty measures, such as ones that use metrics of income or consumption, but rather provide additional information and insights for poverty reduction and policy-making. The AF Method goes beyond the monetary poverty measure by examining multiple non-monetary dimensions ─ such as education and health ─ that are intrinsically (as well as instrumentally) valuable for people's well-being.

Second, the dashboard of multiple poverty indices does have the advantage of selecting and using various (but not all) sources of the dataset to identify the proportion of the population deprived in each particular dimension. However, it always risks overlooking or neglecting a key feature of the AF Method, namely, the joint occurrence or coincidence of deprivations, which gives the proportion of the households who experienced

[37] MPIs, adaptations of the AF Method, have two broad categories: global MPI and regional or national MPIs. See detailed discussion at http://hdr.undp.org/sites/default/files/mpi_trainingmaterial_mcc_mk_clean_june_2015.pdf

deprivations in multiple dimensions *simultaneously*. For example, the dashboard approach shows that in both China and India,[38] 33.33% of children do not finish the elementary school, 33.33% of people are malnourished and 33.33% of people are excluded from the decision-making. However, it would be useful to know how these deprivations overlap and affect each other. The AF Method provides us the tool to recognize if people experience all deprivations simultaneously or all, most, or some people experience different combinations of deprivations at different times. Of course, the dashboard approach could assemble various free standing indices, and investigate their coincidence or lack thereof. What the AF Method provides is a protocol that requires attention to such relationships, and such a requirement protects against unintentional (or intentional) omissions.

Nevertheless, Pogge and Wisor are still concerned with the AF multidimensional measure and the fact that the selection of weights and dimensions has not been "justified through a public, deliberative process" (Pogge and Wisor, 2014). I agree that the specific design of multidimensional poverty measure should be made through deliberative participation involving the public, in particular, the poor. Sen emphasizes the importance of "the connection between public reasoning and the choice and weighting of capabilities in social assessment" (Sen, 2009: 242). There is no reason why Alkire and Foster cannot

[38] China

	Education	Health	Empowerment
1	1	0	0
2	0	1	0
3	0	0	1

India

	Education	Health	Empowerment
1	0	0	0
2	1	1	1
3	0	0	0

emphasize public deliberation. Moreover, much of Alkire's earlier work makes ample room for such public accounting.[39] Although Pogge and Wisor fail to provide a theory of and polices for public deliberation, it must be conceded that much work remains to be done on this topic in democratic theory, policy, and institutions.[40]

As a new tool to measure multidimensional poverty, the AF Method does have limitations. First, it is deeply constrained by data availability. Dimensions and indicators selected and employed are more related to functionings (such as being nourished) and resources (such as access to clean water), which are available in most surveys, rather than capabilities or opportunities and agency for which little or no data currently exist. The global MPI identifies the multidimensional poor in three dimensions including health, education and standard of living, while largely missing other dimensions, such as the ability to appear in public without shame, empowerment, which emphasizes people's freedom from humiliation, agency or ability to decide their own destinies and that of their groups, and the freedom to shape their values and those of their communities. The gap between the ideal dimensions and practical selection of indicators highlights the importance of conducting empirical surveys and finding ways to collect data that contains information specifically related to capabilities and agency.[41]

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[39] See Alkire (2003, 2009). She emphasized the role of public deliberation and debate in making decisions.

[40] For promising steps in this directions, see Crocker (2008, 2014); and Sen (2009, 2015). In my future work I plan to consider ways in which a participatory and deliberative process can and should contribute to the design and measure of multidimensional poverty. In spite of the difficulties of engaging people with various languages, religions and cultures in a deliberative process, I intend to research ways in which it is possible and valuable to develop a public and deliberative process in which local, national and global citizens participate into creating and implementing multidimensional poverty measurement.

[41] The Oxford Poverty and Human Development Initiative (OPHI) has been working to design survey modules to include indicators of quality of work, empowerment, physical safety, ability "to appear in public" without shame and psychological well-being, and to collect data in collaborations with Chad, China, Sri Lanka, Nigeria and the Philippines. The first national representative dataset on multidimensional poverty has been collected in Chile.

Second and more specifically, how to measure agency and freedom opens up avenues to be improved and strengthened by further research. It is not easy, though important, to observe the process by which the agent, other agents, or the force of structures and circumstances make decisions or cause them to be made. Consider a bundle of capability sets; it gives a person more than one option with respect to possible functionings to realize or achieve, for example, with access to rice and a bicycle, a person's capability sets could be [being hungry, riding a bike] or [being well-nourished, being stationary]. We usually can only observe outcomes, while we are often blind to the process of choices making in others (and often in ourselves). An individual may achieve the functioning of bike riding but being hungry (and the latter may be a means to the former in a competitive race), which gives us a snapshot of his state of living, though he has the capability to be nourished and not riding a bike.

Third, building on my response to the last objection, the process of constructing MPI could and should be strengthened by some specific features of deliberative participation.[42] People, in particular those whose lives would be affected by the measure and its evaluation, should be engaged as active agents in designing the multidimensional poverty measure. Not only face-to-face deliberation, but also online discussion is encouraged to exchange information and ideas. Local governments and experts, should value dissent and concerns from the vulnerable groups, and forge an equal deliberation on

[42] Crocker (Crocker, 2008:309) cited John Rawls's (1999) influential definition of deliberative democracy: "The definitive idea for deliberative democracy is the idea of deliberation itself. When citizens deliberate, they exchange views and debate their supporting reasons concerning public political questions. They suppose that their political opinions are not simply a fixed outcome of their existing private or nonpolitical interests. It is at this point that public reason is crucial, for it characterizes such citizens' reasoning concerning constitutional essentials and matters of basic justice." But Crocker (2008:310) criticizes Rawls for restricting deliberation to "constitutional essentials and matters of basic justice." One application of a deliberative process would be to the construction of a MPI.

poverty dimensions selection, rather than dominating and controlling the process. Through deliberative participation and overcoming conflicts, people, as agents of their own development, make their contributions to final decisions about dimensions and indicators that would be included in the multidimensional poverty measure. The basic argument for this participatory-deliberative approach is that those stricken by poverty have a perspective that may supplement and correct partiality and bias that often limits the perspective of academic researchers and policy makers.

How should we understand the relation of the AF multidimensional poverty measure to standard income approaches to poverty analysis and policy? Are these rival approaches or complementary ones? If complementary approaches, what are the contributions (and limitations) of each, and why might we benefit by employing both approaches. Any multidimensional poverty measure is different from an income poverty measure in that the two approaches are developed based on different conceptions of poverty. As two important empirical measures on poverty, the two have their own strengths and limitations, and yet they can and should complement each other. The income measure's conceptual foundation is money, a "universally convertible asset" that is often not "translated into satisfying all other needs" (Scott, 2002: 488). The merits of income measure are at least two folds: 1) data on income are widely available and easily accessible, from individual level all the way to country level; 2) income measure is easy to calculate and simple to understand. However, one critical drawback of income measure is it may mislead policy-making by exclusively focusing on the poor's income and thus failing to tackle other causes on aspects of poverty, for example, a person's lack of opportunity to convert income into well-being. The AF multidimensional poverty measure, based on the

Capability Approach, measures deprivations on various dimensions that people experience simultaneously. Lack of income is not poverty itself but the lack of a means to move out of poverty, defined as freedoms and functionings that people have good reason to value. To only measure the means is to neglect the end that the means can and should serve.

Yet, as noted above, the AF measure, at least in its current form, gives us a fuller view of poverty (as unfreedom) and its normative contrast (well-being and agency). The emphasis on the presence or absence of functioning, capability and agency broaden the well-being and poverty evaluation from the monetary to include as well non-monetary dimensions that people have reason to value. Moreover, the AF Method is more flexible than income poverty because it permits users to determine the unit of analysis, dimensions and indicators, weights and cut-offs in specific contexts and for particular purposes. Yet it also cautions researchers and policy makers not to minimize or neglect non-monetary end of poverty alleviation and not to absolutize money as the be-all and end-all of life.

Therefore, the AF multidimensional poverty measure and the income poverty measure should complement not compete with each other. Not only are they not necessarily at odds but each measures a morally urgent aspect of human deprivation. Both resources (and the income that may buy them) and what humans can do with them (human development) are important. Healthy and enlightened (educated) functioning and the freedoms to achieve functionings are both components of human well-being (one end of development) as well as among means of human development. The AF measure enables us to conceive, measure, and target morally urgent ends of human and national development, which income measures ignore.

3.2.3 Why Study Multidimensional Poverty in China

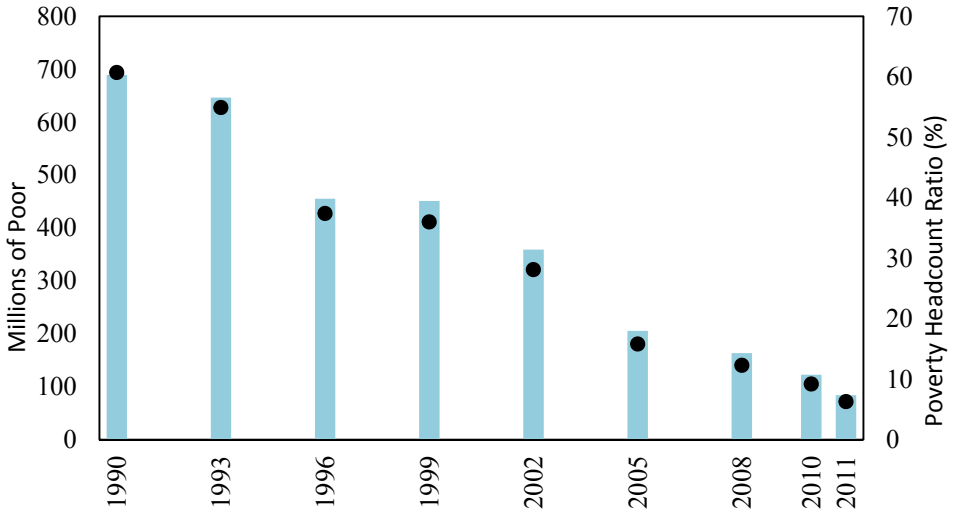
Besides all the intriguing theoretical arguments on measuring poverty in a multidimensional framework, a key benefit of investigating multidimensional poverty in China lies on the uniqueness of China's development process. One fundamental change that drove the magnificent economic achievement in China has been the transition from a planned economy, an egalitarian but inefficient economy, to a market one, unequal but more or less efficient. It involved a series of socioeconomic reforms that affected every aspect of people's lives, both physically and ideologically (Guo, 2003; Islam, 2009).

At one time a clear case of global poverty, China, since opening its market in 1978, has made spectacular progress in economic growth, which has led to a tremendous decline in income poverty. Measured in terms of the $1.25 international poverty line, the number of poor has dramatically dropped from 689.4 million in 1990 to 84.1 million in 2011. The $1.25 poverty rate has fallen from 60.2% to 6.3%, approximately 54% of poor having been lifted out of income poverty during this period (see Figure 3.1).[43] As a result, China achieved the first of the Millennium Development Goals (MDGs), namely, that of halving the 1990 incidence of extreme income poverty well ahead of the 2015 target year.

[43] Statistics are available at the World Bank: Poverty and Equity Databank and http://siteresources.worldbank.org/INTPOVCALNET/Resources/Global_Poverty_Update_2012_02-29-12.pdf

Figure 3.1: Income Poverty Trend in China, 1990-2011

(By International Standards of $1.25/day)



Source: *Poverty and Equity Databank and PovcalNet, the World Bank*

Yet, the rapid economic growth, did not come without cost. First, the health care system has been undermined during the transition process. Poverty as illness or health deprivation has become serious in both urban and rural areas, and steep health costs have been one of the leading causes of poverty. Due to the broken "Iron Bowl" policy in 1990s, more than one hundred million state-employed workers lost jobs and related benefits, including health care. With the decline of government-provided health care, and the lack of a market-oriented health safety net, many people have to pay health care costs out of pocket. In addition, due to uneven allocation of health resources that are usually concentrated in cities, people in remote areas find it particularly hard to access medical services. Lacking medical coverage or only enjoying a limited health benefit, poor people cannot afford to see a doctor. When their diseases get worse, they have no choice but to suffer or wait to die. Lack of health care and freedom for good health are among the main components of multidimensional poverty and one of the main barriers for the poor to escape income and other dimensions of poverty.

Second, lack of education is another challenge for Chinese poverty eradication and a challenge that the multidimensional poverty is well suited to understand and measure. Although the Chinese government provides nine-year compulsory education and investment in education has increased, funding is distributed unevenly and the focus is on "inputs" and not their conversion into enhanced well-being (and agency). Rural areas usually get significantly less investment in primary education than cities. Families have to pay school fees, and these fees increase every year. Unable to afford tuition, children drop out of school. Currently there are 5 million school-age children who cannot complete their primary education, most of whom are located in poor areas (UNDP *Human Development Report*, 2011).

With respect to higher education, the government abolished the tax-funded education system in the1980s and adopted a shared-cost system. Schools, colleges and universities charge tuition to help cover their costs, and this policy imposes a big burden on poor families. Without adequate scholarships and student loans available, children from low-income households are prevented from continuing their studies and gaining opportunities to change their lives. This also increases the social cost to lift the poor out of poverty.

Lack of education, along with other issues, such as health care and housing, gets compounded by the *Hukou* (Household Registration) policy. Started in the late 1950s, this policy aims to restrict labor mobility. As China's export-oriented economy demands cheap labor, hundreds of millions people left their hometowns and entered into labor-intensive factories in coastal cities. Unfortunately, these migrant workers are not permitted to register

as urban residents because of *Hukou* policy. As a result, they fail to qualify for the benefits of social safety nets, and their children cannot enjoy local public education.

Third, pollution has become the main negative externality of China's export-oriented economic growth, which makes clean water and fresh air a luxury, even for the income-rich people. China's economic development has emphasized the expansion of manufacturing sectors ─ low-paid labor, intensive energy use and high pollution. Lacking adequate environmental and regulations has worsened the pollution. Until 2013, groundwater had been polluted in 90% of Chinese cities, two-thirds of which suffered from "severely polluted" water.[44]

Finally, China's massive transformation from a centrally-planned economy towards a market-oriented one, has been replete with rent-seeking opportunities that occasion and incite corruption, a factor that undermines many people's capabilities and functionings (and unfairly expands the freedom and power of those engaged in corrupt acts and networks). Although corruption is not the focus of this analysis and not measured in the CHNS data, it can predict the hurdles that people, especially the poor, face when they try ─ in a context rife with corruption ─ to access better health care, education, water supplies and participate in political and social life.

Undoubtedly, measuring poverty in China has become more complicated than before. The income poverty measure, as shown in Figure 3.1, not only fails to provide a complete picture of citizens (means to) well-being, but can even provide a biased one

[44] See *The New York Times, Concerns Grow About 'Severely Polluted' Water in China's Cities*, February 20, 2013

because it does not involve consultation with disadvantaged and vulnerable people who are vulnerable to other deprivations. Therefore, it is necessary to examine Chinese poverty measured beyond income. The AF Method serves as a useful tool to identify those who are deprived in multiple dimensions, such as in education and health.

3.3 Methodology

Sen (1976) described two distinct problems that should be addressed in the measurement of poverty. The first is to identify the poor among the population; and the second is to construct a poverty index based on the identification in the first step. The AF Method follows Sen (1976), for it involves both 1) identification, and 2) aggregation. The identification involves a "dual-cutoff" approach, which is based on traditional counting approaches.[45] The first set of cutoffs is set for each selected indicator. Specifically, a household is considered to be deprived with respect to selected indicators if its achievements are below the cutoffs. The second cutoff is used to determine if a household is multi-dimensionally poor. A household's deprivations in each indicator are weighted and added up to achieve an overall deprivation score, that is, a certain number of indicators below the first cut-off. If the deprivation score ─ the certain number of indicators below the first cut-off ─ exceeds the second cutoff, the household is identified as multi-dimensionally poor.

The aggregation step of the AF Method builds upon and extends the Foster-Greer-Thorbecke (FGT)[46] (Foster, Greer, and Thorbecke, 1984) class of uni-dimensional poverty

[45] As Atkinson (2003) explained, one counts "the number of dimensions in which people suffer deprivation,"…and "the number of dimensions in which they fall below the threshold."
[46] Based upon the normalized income gap, or poverty gap, the Foster-Greer-Thorbecke (FGT) family of indices has been widely used by international organizations and researchers (Alkire, Foster, Seth, Santos, Roche and Ballon, 2015)

measures. It generates both Multidimensional Poverty Headcount Ratio (MPHR), the percentage of multidimensional poor within a population; and Adjusted Multidimensional Poverty Headcount Ratio (AMPHR), which reflects not only the incidence of multidimensional poverty, but also the share of deprivations that the multidimensional poor experienced.

3.3.1 Identification of the Multidimensional Poor

Consider there are *N* households and each household has *J* (J≥2) dimensions.[47] The observed achievements h_{ij} of household *i* (*i* = 1, 2, 3….N) in dimension *j* (j=1, 2, 3…J) is an element in the data matrix H. We can express H as:

$$H = [H_{.1}, H_{.2}, \dots, H_{.J}] = \begin{bmatrix} h_{11} & h_{12} & \dots & h_{1J} \\ h_{21} & h_{22} & \dots & h_{2J} \\ \vdots & \vdots & \ddots & \vdots \\ h_{N1} & h_{N2} & \dots & h_{NJ} \end{bmatrix} = \begin{bmatrix} H_{1.} \\ H_{2.} \\ \vdots \\ H_{N.} \end{bmatrix} \quad (1)$$

Where $H_{.j}$ is a vector that contains the achievements of all the households on dimension *j*, with $H_{.j} = (h_{1j}, h_{2j}, \dots, h_{Nj})'$; where $H_{i.}$ is a vector that contains the achievements of household *i* on all the dimensions, with $H_{i.} = (h_{i1}, h_{i2}, \dots, h_{iJ})$.

Analogous to the income poverty measure, which uses the poverty line as a cut-off, the multidimensional poverty approach includes multiple dimensions and therefore multiple cutoffs. Let $z = (z_1, z_2, \dots, z_J)$ be a row vector of the deprivation cut-offs, with element z_j the cut-off on dimension j.

[47] For simplicity of illustration, I assume each dimension only involves one indicator here. Of course, there are more than one indicator in each dimension, and, hence, this plurality requires assessment on each indicator and aggregation from indicators into each dimension.

The first round of identification is accomplished by the use of z. If the level of achievement of household i is below the threshold z_j in a given dimension j, the household i is considered as deprived in dimension j, and denoted as:

$$g_{ij} = \begin{cases} 0 & if\ h_{ij} \geq z_j \\ 1 & if\ h_{ij} < z_j \end{cases} \qquad (2)$$

The deprivation matrix, denoted as G, is in the following form:

$$G = [G_{.1}, G_{.2}, \dots, G_{.J}] = \begin{bmatrix} g_{11} & g_{12} & \cdots & g_{1J} \\ g_{21} & g_{22} & \cdots & g_{2J} \\ \vdots & \vdots & \ddots & \vdots \\ g_{N1} & g_{N2} & \cdots & g_{NJ} \end{bmatrix} = \begin{bmatrix} G_{1.} \\ G_{2.} \\ \vdots \\ G_{N.} \end{bmatrix} \qquad (3)$$

Where $G_{.j}$ is a vector that indicates the deprivation status of all households on dimension j, with $G_{.j} = (G_{1j}, G_{2j}, \dots, G_{Nj})'$. Similarly, $G_{i.}$ is a vector that indicates the deprivation status of household i on all dimensions, with $G_{i.} = (G_{i1}, G_{i2}, \dots, G_{iJ})$.

The deprivation matrix G indicates who are deprived in which dimensions; however, it is not a measure on poverty since it only presents information in a defined manner. In order to construct a measure on multidimensional poverty, an important decision needs to be made, that is, to determine the weights of the different dimensions. Let's use W to denote the vector of weights, then $W = (w_1, w_2, \dots, w_J)$, where w_j is the weight on $G_{.j}$.

In this chapter, I follow the global MPI (Alkire and Santos, 2010/11) and treat each dimension as equally weighted, and each indicator (some dimensions have more than one indicator) within a dimension is equally weighted as well. I normalize the weights so that $\sum_{j=1}^{J} w_j = 1$.

After defining the deprivation matrix and weight vector, I can now calculate household *i*'s deprivation score,C_i, as the following

$$C_i = G_i * \mathrm{W} = \sum_{j=1}^{J} g_{ij} * w_j \qquad (4)$$

Equation (4) takes a weighted sum of the deprivations experienced by the household *i*.

The second round of identification in multidimensional poverty involves, as I have adumbrated, a multidimensional poverty cut-off *k* which satisfies $0 \leq k \leq 1$. If household's deprivation score falls below the multidimensional poverty cut-off, the household would be declared as multi-dimensionally poor. The multidimensional poverty identification function as P (C_i, k) is defined as:

$$\mathrm{P}\ (c_i, \mathrm{k}) = \begin{cases} 0 & if\ c_i < k; \\ 1 & if\ c_i \geq k; \end{cases} \qquad (5)$$

How to determine the multidimensional poverty cut-off *k*? One option is to follow the Union Approach that Anthony Atkinson (2003) proposed. Atkinson treats a household as multi-dimensionally poor if its deprivation count is more than or equal to the minimum weight of all dimensions. This standard is a lower one, for it identifies an excessively large proportion of the population as the multidimensional poor and overestimates poverty. A second approach to identification, the Intersection Approach (Atkinson, 2003), defines the poor as those who experience deprivation in all dimensions. This standard is a higher one. In contrast to the Union Approach, the Intersection Approach is likely to underestimate poverty because it only identifies a very small proportion of the population as the poor. To avoid the extremes of both the Union Approach (the poor experience at least one dimensional deprivation) and Intersection Approach (the poor experience deprivations in

all dimensions), Alkire and Foster (2007, 2011, 2015) suggest choosing an intermediate poverty cutoff level which lies somewhere between 0 and 1. This chapter follows Alkire and Foster's global MPI and selects the poverty cut-off point as 1/3 of the weighted indicators, that is, I consider a household as multi-dimensionally poor if its deprivation score is equal to 1/3 or higher.

As discussed above, the dual cut-off approach is a "sequential use of deprivation and poverty cutoffs to identify the poor" (Foster and Alkire, 2011: 6). Whether a household is identified as multi-dimensionally poor depends on both the deprivation cutoffs, which identifies a household is deprived or not with respect to each dimension (indicator), and the multidimensional poverty cutoff, which considers a household as multi-dimensionally poor if its deprivation score exceeds the threshold.

3.3.2 An Aggregation of Multidimensional Poverty

So far, I have defined P (C_i, k) which is used to identify multidimensional poverty of each individual household i. However, to examine multidimensional poverty over time and across sub-groups of the population in China, it is helpful to define an aggregated measure of the multidimensional poverty.

The Headcount Ratio (HR), the percentage of people whose income falls below the poverty line within a population, is commonly used to measure *income* poverty. Analogous to income poverty HR, the Multidimensional Poverty Headcount Ratio (MPHR), is defined as the percentage of the multidimensional poor within a population. Let MP as the number of people who are multidimensional poor.

$$MP = \sum_{i=1}^{N} \mathrm{P}(\mathrm{C_i}, \mathrm{k}) \qquad (6)$$

MPHR equals

$$MPHR = MP/N = 1/N \sum_{i=1}^{N} \mathrm{P}\ (\mathrm{C_i}, \mathrm{k}) \quad (7)$$

As Alkire and Foster (2007, 2011, 2015) indicated, one problem of the MPHR lies in its violation of the "dimensional monotonicity." If a person is deprived in an additional dimension, the level of poverty should increase but the MPHR cannot reflect the change. To solve the problem, Alkire and Foster (2007, 2011) proposed poverty intensity (A) to include the share of deprivation experienced by the poor, which can be expressed as:

$$A = 1/MP \times 1/J \times \sum_{i=1}^{N} C_i \quad (8)$$

The Adjusted Multidimensional Poverty Headcount Ratio (AMPHR), which takes into account how much each dimension contributes to multidimensional poverty, is given by:

$$AMPHR = MPHR \times A = 1/N \times 1/J \times \sum_{i=1}^{N} C_i \quad (9)$$

Equation (9) indicates the AMPHR equals the weighted sum of deprivations suffered by the poor divided by total number of the population. Since AMPHR takes average deprivation share of the poor into account, it is sensitive to the incidence and the breath of multidimensional poverty.

The AMPHR can be decomposed, which is useful for breaking the whole multidimensional poverty picture into regions and groups. For example, there are three regions in China. In symbols, let H_1, H_2, H_3 be the regional data matrices of achievements, z_1, z_2, z_3 the vectors of the dimensional thresholds for the three regions, and N_1, N_2, N_3 the number of households in each region with N the total number of households in China.

$$AMPHR(H,z) = \frac{N_1}{N} AMPHR(H_1, z_1) + \frac{N_2}{N} AMPHR(H_2, z_2) + \frac{N_3}{N} AMPHR(H_3, z_3) \quad (10)$$

The multidimensional poverty rate is the sum of the weighted average of regional multidimensional poverty rates. The decomposability is convenient because it allows us to investigate regional multidimensional poverty by looking into the regional specific AMPHRs. Similarly, the decomposability also allows us to reveal the poverty level across different groups.

3.4 Data Description and Indicators

3.4.1 Data Source and Sample Description

As explained in Chapters 1 and 2, I used the data from the *China Health and Nutrition Survey* (CHNS), a longitudinal survey conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention.[48] The CHNS is an ongoing international collaborative project with waves in nine years: 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011covering nine provinces, namely, Liaoning, Shandong, Jiangsu, Heilongjiang, Henan, Hubei, Hunan, Guangxi and Guizhou.[49] The China map below shows geographic locations of nine provinces, which are highlighted in green.

[48] More detailed description of the dataset can be found at http://www.cpc.unc.edu/projects/china.
[49] In the round of 1997, Heilongjiang replaced Liaoning and in the round of 2000, Liaoning was returned.

Source: *http://www.cpc.unc.edu/projects/china/proj_desc/chinamap*

The Northeastern provinces ─ Heilongjiang and Liaoning: these two provinces were the heart of the Chinese economy under the planned-economy regime, but have lagged behind Coastal provinces in recent years. Resembling the former Soviet Union in industrial structures and with fertile land and rich natural resources, they were China's heavy industrial and agricultural base.

The Coastal provinces ─ Jiangsu and Shandong ─ located on the East coast of China. They are among the fastest growing provinces in China in the past two decades. The import and export volume of Jiangsu reached $465.79 billion in 2010[50] and ranked as the second largest local economy, just behind Guangdong and followed by Shandong.

[50] The statistics are from China Jiangsu Provincial Economic and Trade Office, available at http://webcache.googleusercontent.com/search?q=cache:yOqDpx6bwBkJ:www.china-jiangsu.org/1doc.htm+&cd=2&hl=en&ct=clnk&gl=us.

The Central provinces ─ Henan, Hubei and Hunan: these three provinces are important agricultural bases and their population densities are among the highest in China.

The Western provinces ─ Guizhou and Guangxi: these two provinces are beset by more mountains and deserts than other provinces and represent the poorest regions. Limited arable land, the lack of water as well as underdeveloped infrastructures, at least partially explain Guizhou and Guangxi's underdevelopment. It is worth noting that in these two Western provinces, nearly 40% of the population consists of ethnic minorities.

A 2011 survey included for the first time the three provinces of Beijing, Shanghai and Chongqing. To make our sample more comparable, I exclude these three provinces. Using a multistage, random cluster scheme, the CHNS data drew samples from both urban and rural areas.[51] The sample size in each survey year is provided in Table 3.1.

Table 3.1: Number of Households Included in the CHNS (1989-2011)

Survey Year	Total Number of Households	Urban	Rural
1989	2815	879	1934
1991	3511	1127	2373
1993	3321	988	2282
1997	3420	1025	2289
2000	3812	1060	2512
2004	4194	1234	2653
2006	4263	1256	2633
2009	4399	1291	2698
2011	4401	1268	2631

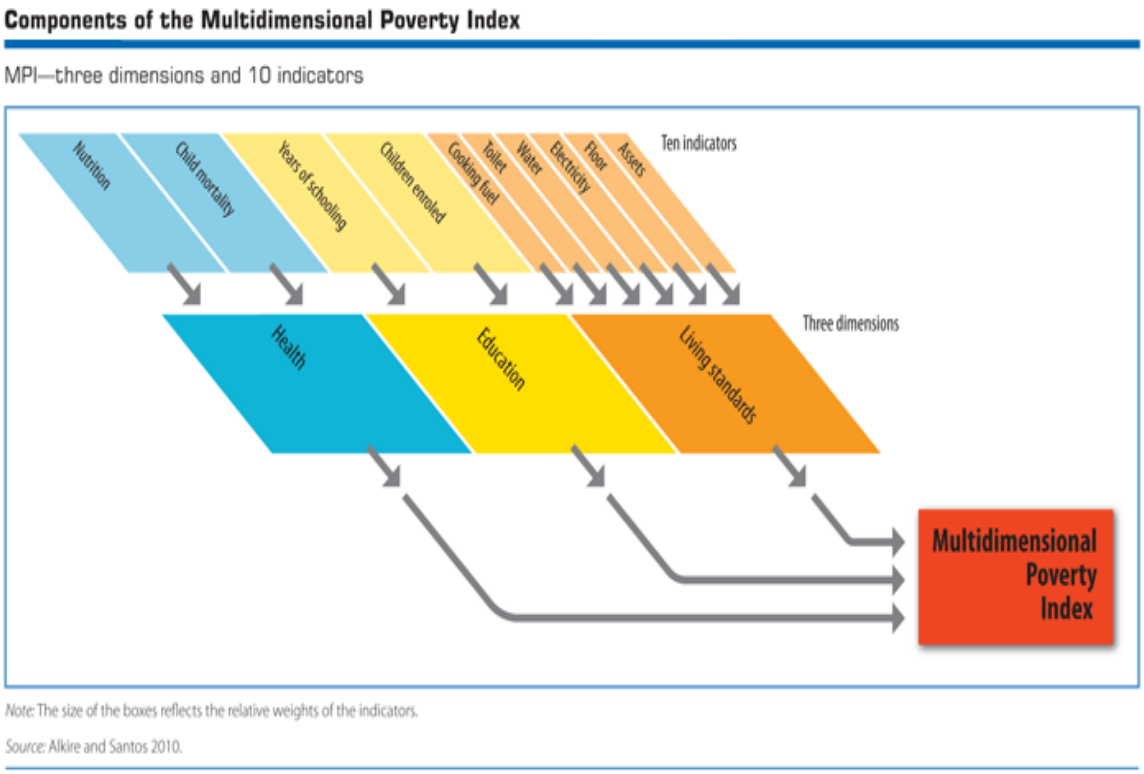
[51] Specifically, in the first stage, 2 cities and 4 counties were randomly selected from each province; in the second stage, 12 urban or suburban neighborhoods in 2 cities, and 12 villages or townships in 4 counties were randomly selected.

The main strength of the CHNS data is that it includes extensive information on non-monetary aspects of well-being, such as health, nutrition, sanitation, water source, housing, and so forth, as well as other demographic information. Hence, this data makes it possible to analyze multidimensional poverty in China. Moreover, with the long duration of the survey periods, from 1989-2011, and geographic representation of various China regions, the panel structure of the dataset enables us to track the evolution of multidimensional poverty over the survey period.

3.4.2 Dimensions and Indicators

The global MPI that the UN adopted has three general dimensions: health, education and living standards, and 10 more specific indicators ─ nutrition, child mortality, years of schooling, children enrolled, accessing to electricity, drinking water, sanitation, flooring, cooking fuel, and ownership of assets (see Table 3.2).

Table 3.2: Global Multidimensional Poverty Index (MPI)



Guided by the UN global MPI and constrained by the data availability of the CHNS, I have selected in the current study three dimensions and eight indicators (see Table 3.3) to measure China's multidimensional poverty.[52] Each of the three dimensions, namely, education, health/food security and living standards, is equally weighted at 1/3. Among eight indicators, Body Mass Index (BMI) is weighted at 1/3. Within each dimension, indicators are weighted equally. Years of schooling and school attendance are weighted at 1/6 of the aggregate, and access to electricity, clean water, improved sanitation facilities,

[52] Indicators of flooring and child mortality are not included in the analysis. Since 2004, Chinese government has reached the goal to improve household's floor. In the CHNS, only four household's floors were composed of dirt and no household was deprived with respect to flooring in 2009 and 2011. Child mortality has not been the concern in the CHNS since 2000 — the number of child deaths was less than 5, and no child died in 2011.

improved cooking fuel and household asset ownership are weighted equally at 1/15 of the total for poverty.

Table 3.3: Selected Dimensions, Indicators, and Deprivation Cutoffs

Dimension	Indicator	Household deprived if
Education	Years of Schooling	None of household adult members has completed five years of schooling
	School Attendance	Any school-aged child is not in school
Health/Food Security	Nutrition	Body Mass Index (BMI) of any household adult member is less than 18.5kg/m^2
Living Standards	Electricity	The household does not have access to electricity
	Safe Drinking Water	The household does not have access to in-house or in-yard tap water
	Sanitation	The household is using an earth open pit as a toilet
	Cooking Fuel	The household cooks using wood, straw/stick, charcoal as its main fuel
	Asset Ownership	The household does not own more than one of these: radio, TV, bike, motorbike or refrigerator, and does not own a car or tractor

The value of education lies in promoting human's well-being and agency through enhancing people's skills and knowledge. As Sen (1997: 1959) argues, education "focuses on the ability of human beings to lead lives they have reason to value and to enhance the substantive choices they have." The ideal indicators of measuring education would be related to the capability to read and write, to think imaginatively and critically. However, such information is not available in the CHNS. Limited by the availability of data, indicators of years of schooling for adult and school attendance for school-aged child are chosen in the study as a proxy ─ albeit, an inadequate one ─ for education. A household is

considered as deprived with respect to education if none of household adult members has completed primary education ─ either five years of schooling or when any school-aged child fails to attend school. Though years of schooling and school attendance are not the best measure for educational achievement, it would contribute to developing and enhancing people's capabilities through providing educational opportunities.

Health is both intrinsically valuable and instrumentally important as a means to enhance individual's other capabilities. As Sen (2002) put it, "health is among the most important conditions of human life and a critically significant constituent of human capabilities which we have reason to value."[53] The BMI, calculated as weight (*kg*) divided by height squared (*meters*), has been widely accepted to screen obesity in adults. Following WHO's criteria (see Table 3.4), an adult would be deprived in health if his/her BMI is less than 18.5kg/m^2. Being overweight and obese is treated as unhealthy, but they are obviously not caused by lack of food. For the purpose of analyzing poverty, only malnutrition (BMI≤ 18.49kg/m^2) is considered in the study.

Table 3.4: The International BMI Classification of Adult

Classification	BMI (kg/m^2)	
	Principal Cut-Off Points	Additional Cut-Off Points
Underweight Severe Malnutrition Moderate Malnutrition Mild Malnutrition	<18.50	<18.50 <16 16-16.99 17-18.49
Normal Range	18.50-24.99	18.50-24.99
Overweight	≥25.00	≥25.00
Obese	≥30.00	≥30.00

Source: *Adapted from WHO, 1995, WHO, 2000 and WHO, 2004.*

[53] Sen (2002) "Why Health Equity?" *Health Economics*, Vol. 11: 659-666

Living standards are determined by access to services or resources, such as electricity, clean water, improved sanitation or cooking fuel, and asset ownership. As UN emphasizes in its report, "Sanitation and drinking water are universally accepted as being essential for human life, dignity and human development."[54]A household is considered to be deprived if it is unable, for example, to have access to or the opportunity for electricity. Indicators of clean water, improved sanitation, cooking fuel and asset ownership are from MDG. Following the appropriate MDG, the household is deprived if it cannot access piped water and improved sanitation, such as a flushing toilet, or a latrine connected to a piped sewer system, septic tanks, flush/pour flush and so forth.[55] An MDG considers it deprived to use wood, straw/stick, charcoal and dung as the main cooking fuel source. As to asset ownership, deprivation takes place if the household does not own more than one of the following: radio, TV, bike, motorbike or refrigerator, and does not own a car or tractor. Resources and commodities of various sorts are means to valuable capabilities and agency and reliable access to or command over such resources are among the valuable capabilities.

3.5 Empirical Results

3.5.1 Multidimensional Poverty Estimates

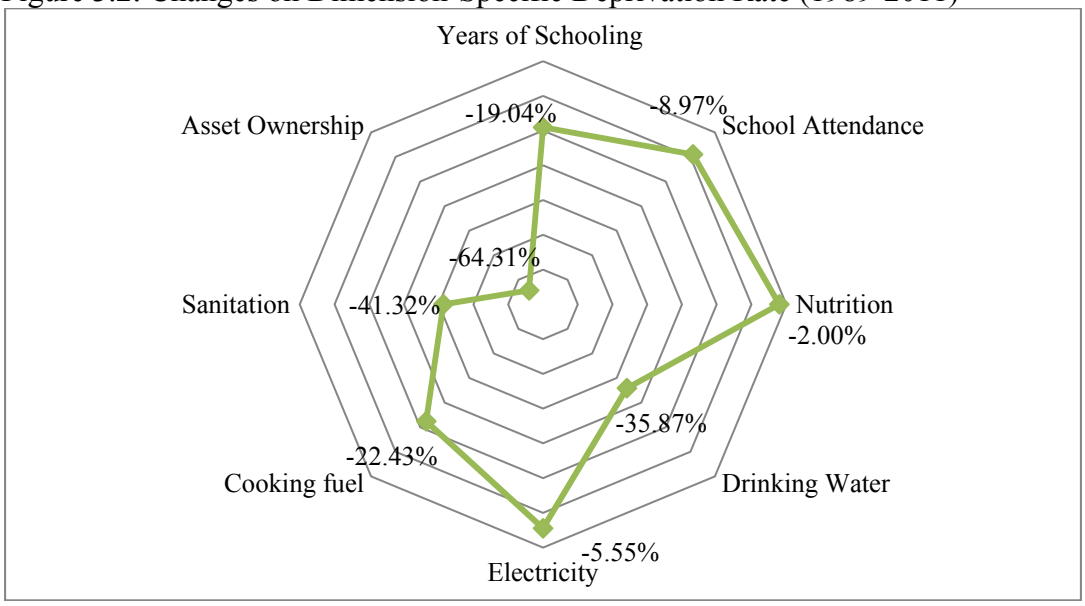
From 1989 to 2011, China has made significant achievements on selected dimensions. The spider diagram, Figure 3.2, compares changes of poverty incidence across different indicators over the survey period. The largest deprivation reduction has taken

[54] See *UN-Water Global Analysis and Assessment of Sanitation and Drinking Water (GIASS) 2012 Report: The Challenge of Extending and Sustaining Services.*

[55] WHO/UNICEF Joint Monitoring Programme (JMP) defines inadequate facilities as, flush/pour flush to elsewhere, pit latrine without slab, bucket, hanging toilet or hanging latrine. Deprivation or "unimproved sanitation" occurs when there are either no facilities or when only the "bush" or "field" is available. See http://www.wssinfo.org/definitions-methods/watsan-categories/

place in asset ownership, 64.31% of households are no longer deprived in owning TV's, telephones, bikes motorbikes, refrigerators, or cars. 41.32% more households have access to improved sanitation ─ deprivation has been reduced from 57.48% to 16.16%.[56] These improvements suggest that more resources are at their disposal for better functionings and enhanced capabilities, if, and when the complementary policies such as efficient public services and effective governance, are in place.

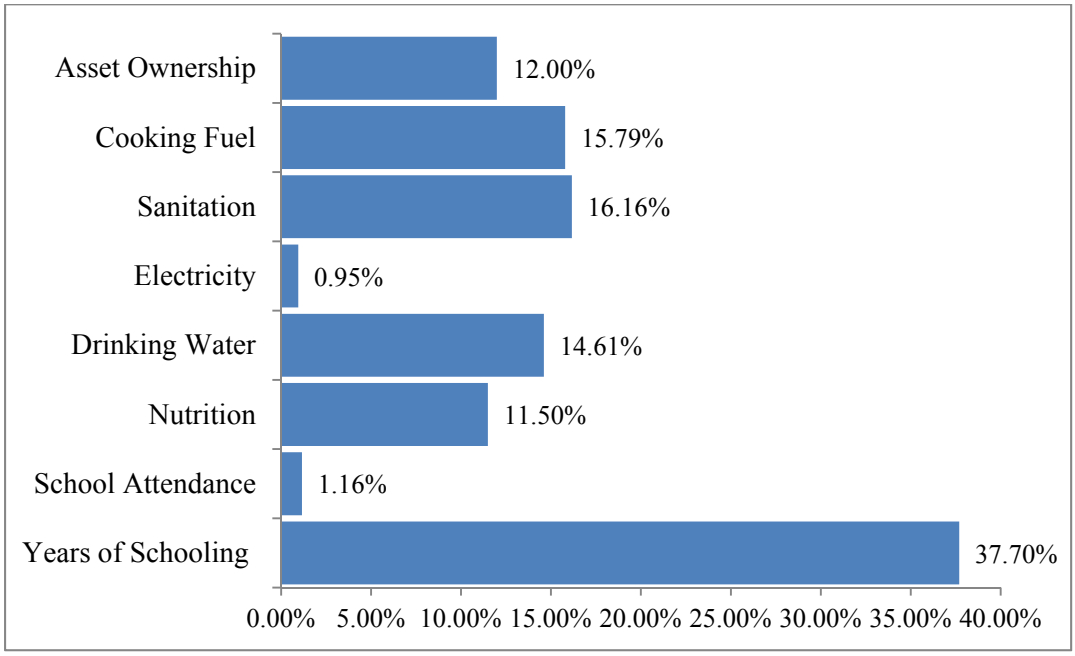
Figure 3.2: Changes on Dimension-Specific Deprivation Rate (1989-2011)



Despite overall improvement in people's living standards, the access to improved sanitation, cooking fuel and clean water was still low in 2011. As Figure 3.3 indicates, about 16.16%, 15.79% and 14.61% of households still do not have access to improved sanitation, cooking fuel and in-dwelling tap water, respectively. In addition, in 2011, school attendance and access to electricity are the least inadequate ─ only 1.16% and 0.95%, respectively, of households have deficiencies.

[56] See Appendix Table 2 for detailed statistics.

Figure 3.3: Headcount Ratio in Each Dimension in 2011



Slow progress has been made over the last twenty years in education. In 2011, 37.7% of households remained deprived of years of schooling, that is, no adult household members had finished their primary education. It is surprising that from 2004-2009, the educational deprivation has increased by 1.38%.[57] Yu (2011) indicated that the change of family members was one possible reason. Educated young family members may move out because of marriage or job change.

It is encouraging that the rate of school attendance[58] has increased greatly. But from 2004 to 2011, school attendance started to drop slowly. One possible explanation is that many children from immigrant families dropped out of school due to limited schooling opportunities for immigrant rural families, unaffordable school expenses and the pressure to earn money to support his/her family.

[57] See Appendix Table 2 for statistics.
[58] See Appendix Table 2 for statistics.

The overall nutrition deprivation rate has gone down by 2% over the survey period (see Figure 3.2). However, the trend is not linear. There was a sharp increase of deprivation during years of 1989-1991, jumping from 13.5% to 23.78% of the population (see Appendix Table 2). One reason is that in 1980s, China started to reform its healthcare system. The central and local governments cut down their funding on public health institutions and encouraged hospitals to support themselves by charging user fees. Governments did not provide full coverage for the people any longer, and many people needed to pay healthcare out of pocket since the health insurance safety net was not yet well established. With the collapse of the cooperative medical system in rural areas, and the breakdown of state-owned enterprises in urban areas, the coverage fell from around 90% of the population to less than 10% in 1990s (Liu, 1996). Thus, increasing uninsured populations in both rural and urban areas exacerbated health deprivation.

The breadth of deprivation over the years surveyed is shown in Table 3.5. It presents the percentages of households in the entire populations deprived in a weighted number of selected dimensions. For example, 0 means no deprivation in any dimension, 1 means deprivation in all dimensions, and any number between 0 and 1 means deprivation in a weighted fraction of dimensions. From 1989 to 2011, the percentage of households without any deprivations has increased from 14.67% to 50.22%, suggesting a positive trend in poverty reduction. And since 1997, no household was deprived with respect to all dimensions of multidimensional poverty.

Table 3.5: Breadth of Deprivation (%)

Weighted Number of Selected Dimensions (k)	1989	1991	1993	1997	2000	2004	2006	2009	2011
0	14.67	14.61	16.32	26.05	33.18	41.65	42.46	46.56	50.22
0.1	9.59	10.05	12.17	14.68	16.53	16.64	17.78	18.53	19.06
0.2	20.64	17.09	17.62	17.98	16.19	14.74	14.64	12.66	11.84
0.3	26.93	25.58	25.35	20.58	18.52	14.69	15.04	12.82	11.11
0.4	12.65	9.57	9.42	6.37	5.56	4.70	3.12	3.09	2.36
0.5	6.57	8.03	6.93	5.91	4.83	4.41	4.46	4.32	4.04
0.6	6.11	10.94	9.52	6.61	4.20	2.77	2.18	1.93	1.23
0.7	1.67	2.76	1.51	1.40	0.68	0.36	0.28	0.07	0.09
0.8	0.92	1.22	1.02	0.35	0.29	0.05	0.05	0.02	0.05
0.9	0.18	0.14	0.09	0.06	0.03	0.00	0.00	0.00	0.00
1	0.07	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00

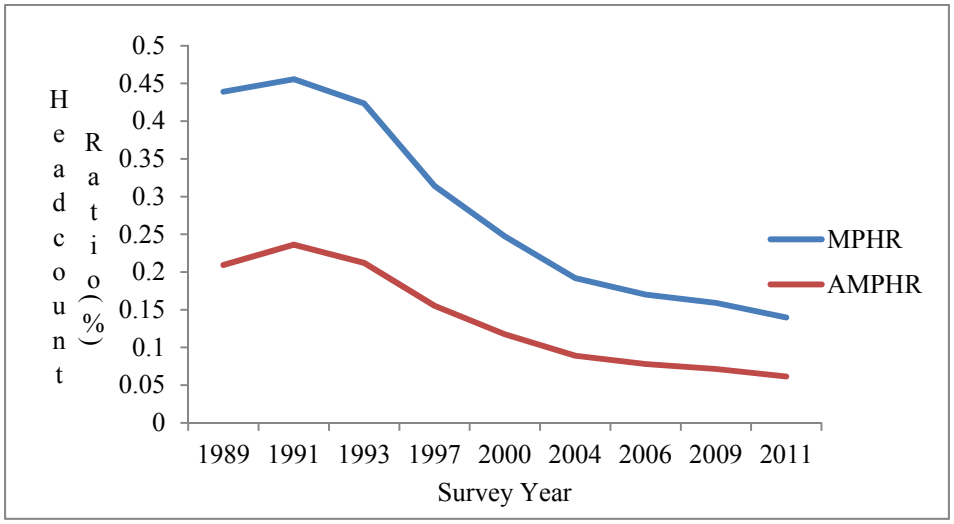
To identify a household as multidimensionally poor, a multidimensional poverty threshold k ($0<k\leq1$) should be determined as discussed in Section 3.3. Following Alkire and Foster (2011), a household is considered to be in multidimensional poverty when its deprivation score is higher or equal to a third of the weighted considered indicators. If a household experienced one third or more deprivations in the component indicators ($c_i \geq \frac{1}{3}$), it is identified as multidimensionally poor. Otherwise, it is not.

The evolution of multidimensional poverty at the national level from 1989 to 2011 is shown in Figure 3.4, containing information about the MPHR[59] (Multidimensional

[59]I define the MPHR as the percentage of the multidimensional poor within a population.

Poverty Headcount Ratio) and AMPHR[60] (Adjusted Multidimensional Poverty Headcount Ratio). Both the multidimensional poverty headcount ratio and adjusted multidimensional poverty headcount ratio declined significantly. MPHR declined from 44% of the population to 14%, a 68% decrease in multidimensional poverty; AMPHR declined from 21% of the population to 6%, a 70% decrease in multidimensional poverty. These results make clear that both multidimensional poverty's incidence and depth has been reduced.

Figure 3.4: Changes in Multidimensional Poverty (1989-2011)



3.5.2 Regional Disparities of Multidimensional Poverty

Inter-Provincial Divergence of Multidimensional Poverty

In spite of national progress in multidimensional poverty reduction, currently multidimensional poverty is not distributed evenly among provinces. There are marked regional differences in the incidence of multidimensional poverty, measured either by

[60] I calculate the AMPHR as the weighted sum of deprivations suffered by the poor divided by total number of the population.

MPHR (the Multidimensional Poverty Headcount Ratio) or AMPHR (the Adjusted Multidimensional Poverty Headcount Ratio).

Figures 3.5.1 and 3.5.2 show the MPHR and AMPHR by province for the period of 1989-2011.[61] Results indicate that multidimensional poverty shows consistent regional differences and patterns. At the beginning of the survey period, the Western region, represented by Guizhou and Guangxi, and the Central region, represented by Hubei, had much higher MPHR and AMPHR than other regions. More than 20 years later, the MPHR and AMPHR in Western regions are still much higher than in other regions, although they have decreased substantially.

The finding is not surprising not only because the Western region, and to some extent, the Central region, are known for their arid lands, inhospitable mountains and many poorly performing SOEs, but also because the Western region was subject to less favorable development policies. China's development policies were designed to prioritize the Coastal and Eastern regions first on the debatable assumption that subsequently they can and will help the rest of the country to develop.[62]

[61] I omitted Heilongjiang in these charts because its data only start in 1997.
[62] In 2000, China launched the Western Development Plan to promote the development of the Western region through improved transportation, telecommunications, energy, education, and the effort to prevent skilled labor from leaving the Western region. However, it is not clear if the policy has had a significant impact on the development of that region.

Figure 3.5.1: Provincial Multidimensional Poverty Headcount (1989-2011)

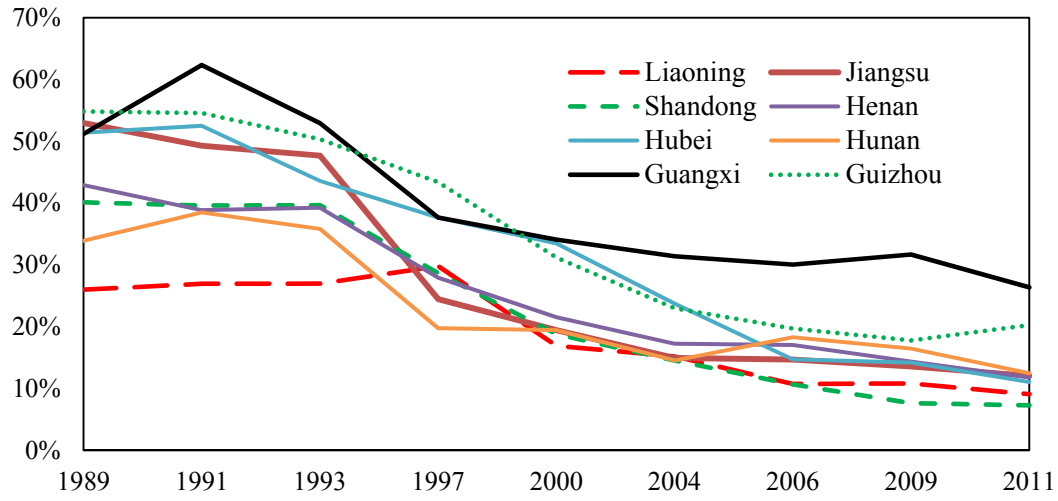
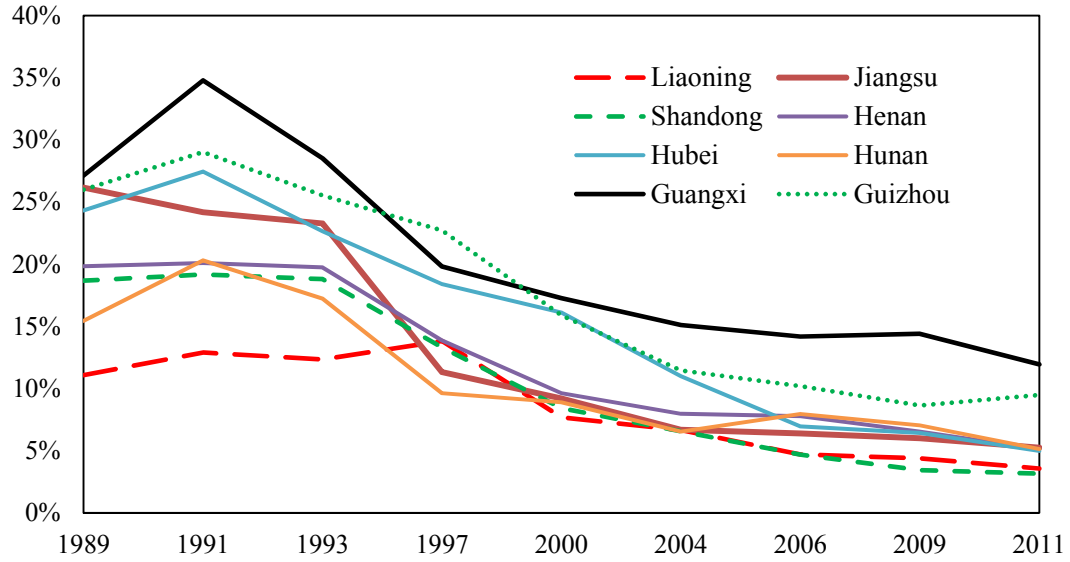


Figure 3.5.2 Provincial Adjusted Multidimensional Poverty Headcount (1989-2011)



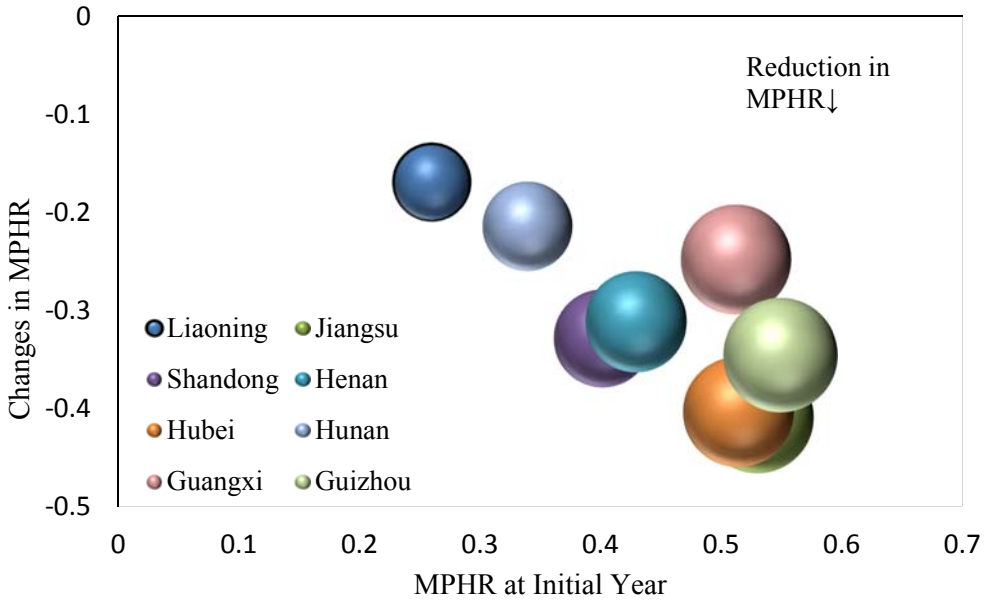
Although all provinces have experienced a decrease from 1989 to 2011 in the proportion of their multidimensional poor, the pace of multidimensional poverty reduction varies across provinces. The Coastal province, Jiangsu, made the greatest progress on multidimensional poverty reduction ─ a drop of MPHR from 52.97% to 12.08%, or about 1.9% each year. As a result, by 2011, Jiangsu is among the provinces at the extreme end of the multidimensional poverty spectrum, although it used to be one among those with the

greatest poverty. Shandong is one of the high achievers as well, although it used to be in the middle of the spectrum.

Liaoning, the Northeastern province, had the lowest MPHR and APHR in the early years, but those rates increased until 1997. Along with Heilongjiang, it used to be the heart of the Chinese economy under the planned economy regime. Undoubtedly, these two states are affected the most by the economic and social transition. National policy changes, such as the reform of State Owned Enterprises (SOE), resulted in thousands of workers losing their jobs in the Northeastern provinces.

Figure 3.6 shows that relationship between the initial level of MPHR and the cumulative change in MPHR. The bigger the ball, the more poverty reduction has been made relative to other provinces. It indicates that the higher initial poverty level is associated with larger change, indicating that the poverty reduction in China is widespread. Hubei and Jiangsu experienced the largest reduction in multidimensional poverty. Guangxi and Guizhou, the Western provinces, decreased their multidimensional poverty headcount substantially. However, given the fact that they had the highest MPHR in the initial survey year and multidimensional poverty is easing at a slower pace, they remain as the provinces with highest MPHR. As a result, the regional poverty gap has widened. For example, the gap between Guizhou and Jiangsu has risen from 1.87% to 8.2%.

Figure 3.6: Level of MPI and Speed of Multidimensional Poverty Reduction in Provinces (1989-2011)



Rural -Urban Multidimensional Poverty Disparities

Figure 3.7 presents trends of multidimensional poverty, measured by MPHR and AMPHR in rural and urban areas from 1989 to 2011.

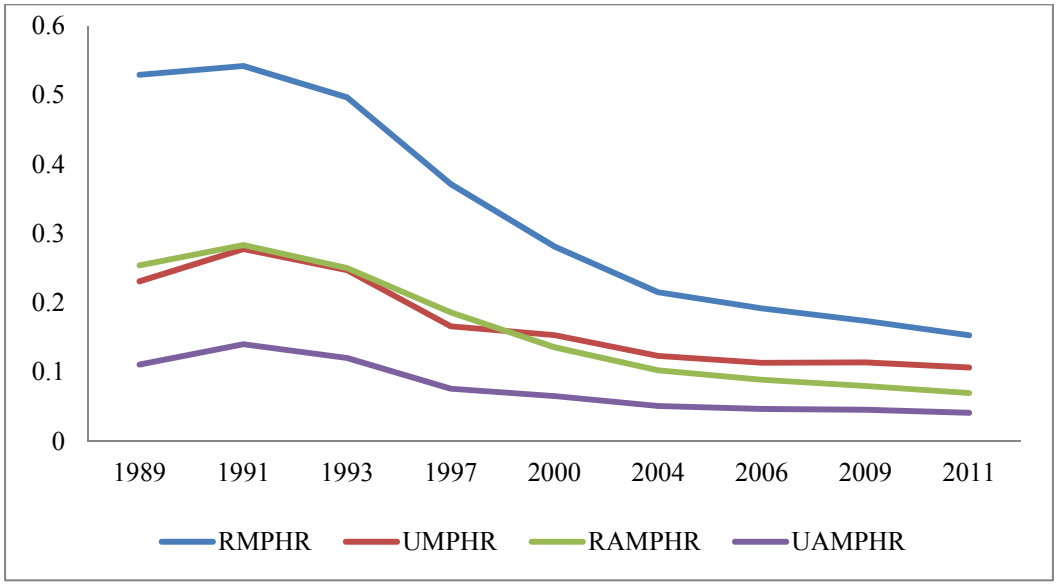
As indicated by the big gap in lines at the left side of Figure 3.7, the multidimensional poverty in rural areas was much higher than that in urban areas. Historically, poverty in China had been concentrated in rural areas due to a biased development policy, with heavy investment in urban areas and strict restrictions on urban-rural migrations. Urban areas have benefited from urban-biased policies at the expense of rural areas in terms of economic growth and public services. Therefore, it is not surprising that a gap existed between rural and urban areas.

The trend of multidimensional poverty reduction was quite different between urban and rural areas. First, albeit starting at a much lower base, urban MPHR has increased by 4.68% from 1989-1991, while rural MPHR only increased by 1.28% during the same period. Second, the urban MPHR did not reach its 1989 level until 1997, although the MPHR went down quickly in rural areas.

What drove these different trends was ─ as noted earlier ─ the dismantling in the early 1990s of the "Iron Rice Bowl." The "Iron Rice Bowl" was a metaphor for the centrally planned economy in China. Urban residents of working age were guaranteed permanent positions ("Iron Rice Bowl") in State-owned enterprises (SOEs) or collective owned enterprises. These positions included guaranteed benefits of free or subsidized housing and health care. Under the "Iron Rice Bowl" policy, urban unemployment did not exist and urban poverty was low. While the "Iron Rice Bowl" together with the associated welfare system broke down in early 1990s, urban poverty also increased as a result of a dramatic increase in the number of unemployed urban workers and inadequate social safety nets.

In recent years, multidimensional poverty reduction in rural areas has maintained its momentum, but the reduction in urban areas has been sluggish, which is not surprising given the challenges urban areas have been facing. Many factors contribute to urban multidimensional poverty. These factors include, but are not limited to, lay-offs of workers in state-owned enterprises, ineligibility for schooling or higher school fees for children of migrant families, ineligibility for urban social assistance programs for migrants, the sky-rocketing and unaffordable housing prices and severe pollution in urban areas.

Figure 3.7: Rural and Urban Multidimensional Poverty Reduction Pattern (1989-2011)



3.5.3 Comparisons with Income Poverty

In order to make comparisons available across survey years and provinces, I have adjusted household income by reference to the Consumer Price Index (CPI)[63] and the 2011 Chinese Yuan. To make income poverty and multidimensional poverty comparable, I use the incidence of income poverty as an income poverty measure. Basically, if a household's income is lower than a predetermined poverty line, then the household is considered to be income poor. The incidence of income poverty is the proportion of income poor households in a relevant population. I calculated the incidence of income poverty according to both the $1.25 and $2.00 per day international poverty line.

Figure 3.8 compares income and multidimensional poverty reduction over the survey period. In general, both income and multidimensional poverty declined dramatically

[63] The UNC Carolina Population Center constructed the CPI based on the standard consumer basket supplied by the State Statistics Bureau of China, average urban-rural price ratio using CHNS price data, and each year's CPI from the Statistical Yearbook of China. The procedure used in calculating the CPI can be found at http://www.cpc.unc.edu/projects/china/data/datasets/data/datasets/convar.

during the survey period. The incidence of income poverty, no matter which poverty line applied, either the $1.25 or $2.00 per day international poverty line, declined by 25.8% and 44.48% respectively. And the multidimensional poverty headcount has dropped by 30%.

In recent years, however, income and multidimensional poverty reductions present significantly different pictures of China. As shown in Figure 3.8, since 2006, MPHR and AMPHR barely declined while substantial progress in the reduction of income poverty continued, even though the Great Recession of 2008 greatly impacted China economically. It is worth noting that the poor's well-being in a multidimensional perspective in urban areas, has not been improving much from 2006 to 2011 (Figure 3.9), although income poverty reduction still moved ahead, albeit unevenly. This is an important point. If things look pretty good with the lens of progress in reducing income poverty but multidimensional poverty is getting worse (and the latter has been shown to reveal a significant kind of deprivation), then public policy had better be facing up to the challenge of (urban) multidimensional poverty.

Figure 3.8: Multidimensional Poverty vs. Income Poverty (1989-2011)

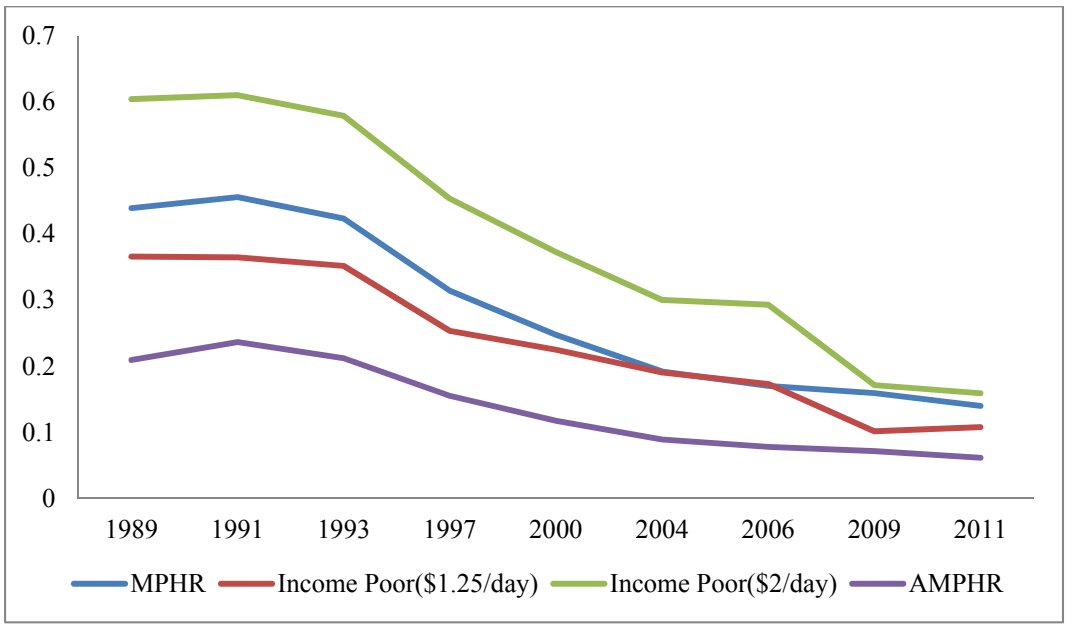
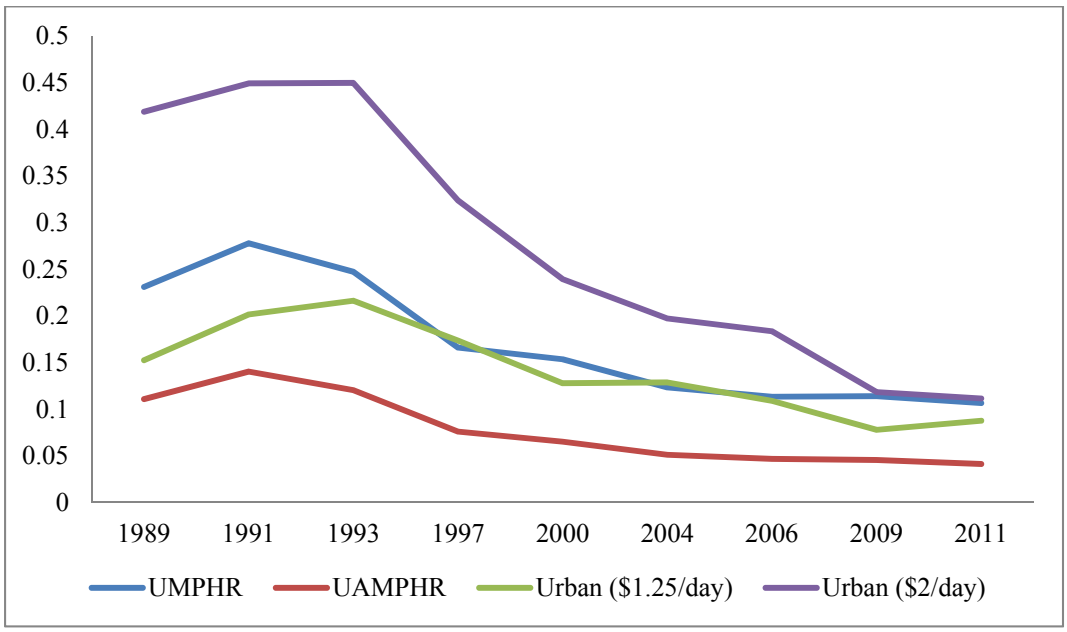


Figure 3.9: Multidimensional Poverty vs. Income Poverty in Urban Area (1989-2011)



Although national income poverty reduction has been slightly faster than multidimensional poverty reduction during the survey period, two Coastal provinces,

Jiangsu and Shandong, as shown in Figure 3.10, have reduced multidimensional poverty faster than income poverty. At the other end of the spectrum, in Guizhou, a Western province, multidimensional poverty has been reduced much more slowly during the survey period, even though Guizhou has made the greatest achievement in reducing income poverty.

It is worth noting that Jiangsu is the only province where the MPHR is higher than the $2 line in most years. Jiangsu, the richest among surveyed provinces, is ranked 2nd in 1989 and 5th in 2011 in the MPHR, indicating that multidimensional poverty reduction does not always coincide with economic growth or per capita income.

This non-coincidence is displayed in Figure 3.10. While income poverty rose in Jiangsu and Shandong in 2004-2006 and in Hunan and Guangxi in 2009-2011, the multidimensional poverty in these provinces decreased. In addition, Guizhou experienced an increase of multidimensional poverty headcount even though income poverty decreased in 2009-2011.

Figure 3.10: Provincial Multidimensional Poverty vs. Income Poverty (1989-2011)

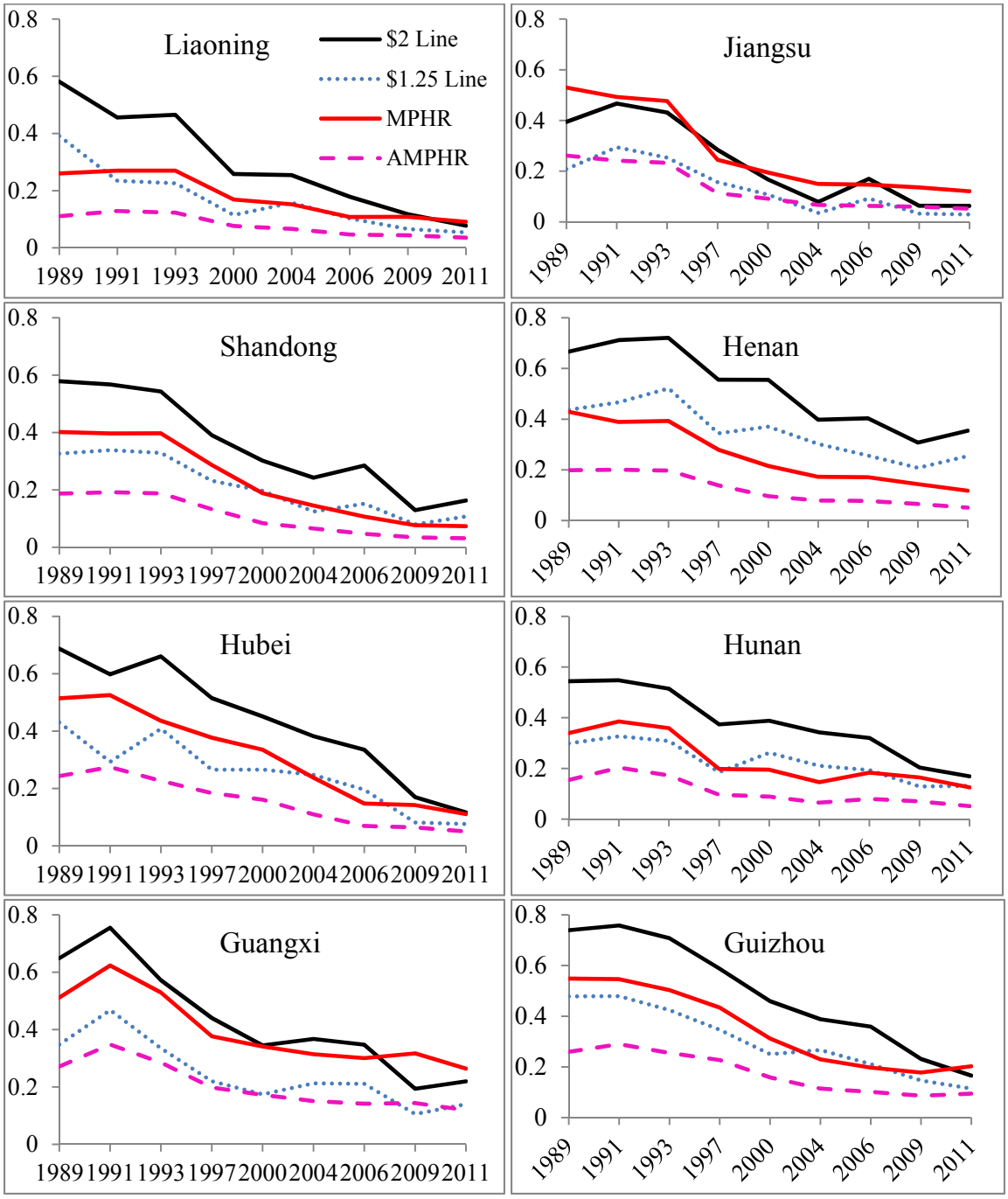
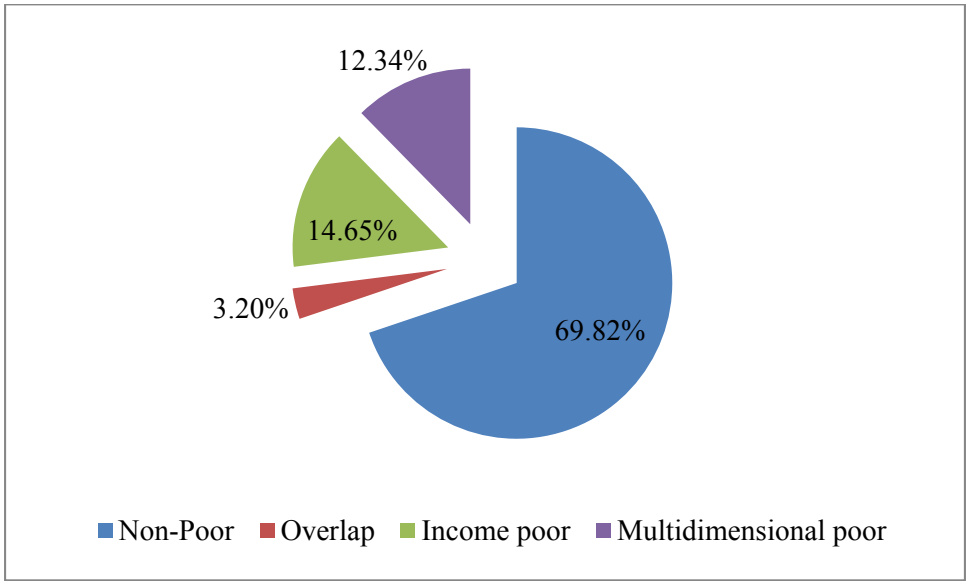


Figure 3.11 examines the overlaps and the gaps between income poverty and multidimensional poverty. It shows that in 2011 income poverty only accounts for a small

part of multidimensional poverty: we identify 3.20% of households as poor by both the $2 per day international poverty line and multidimensional poverty measure. 14.65% of income poor are not identified as multidimensional poor, and 12.34% of multidimensional poor are not income poor. If one only uses either the income poverty or the multidimensional poverty measure, a certain (and unacceptable) proportion of poor households will remain unrecognized. Figure 3.11 suggests that income poverty and multidimensional poverty measures complement each other, for the two approaches target different groups and each focuses on ethically urgent aspects of poverty.

Figure 3.11: Overlap and Gap between Multidimensional Poverty and Income Poverty, 2011



3.6 Concluding Remarks

By using the CHNS longitudinal household survey and applying the AF Method, this study provides an in-depth study of multidimensional poverty in China and compares it with China's income poverty. To calculate multidimensional poverty, I selected three

dimensions and eight indicators. I weighted each dimension equally, and within each dimension I weighted each indicator equally.

The chapter finds that China's multidimensional poverty has declined dramatically during the period from 1989-2011, but reduction rates and patterns vary by dimensions. The slowest progress has been made on improving people's nutrition and access to clean water. Until 2011, the headcount of those deprived in education ranked highest in deprivation followed by those deprived of cooking fuel and adequate sanitation. Because of these and other differences between income and multidimensional poverty measures, complementary and targeted policies in education and health are especially needed. In education, policies should be targeted to eradicate discrimination against children from migrant families and to reduce various kinds of fees. In health, what is called for is continued improvement of health safety nets, the implementation of the Amendment to the Chinese Environmental Protection Law in 2014, and the sort of cooperation on climate change and clean energy advocated in a recent U.S. - China joint announcement. These steps are in the right direction.

China's multidimensional poverty exhibits a clear and consistent regional pattern. The Western region, represented by Guangxi and Guizhou, is home to the highest proportion of the multidimensionally poor. Moreover, the gap with respect to multidimensional poverty reduction between the Western provinces and other provinces during the survey period has been widening. These findings suggest that differentiated regional policies may be an effective way to achieve multidimensional poverty reduction if not eradication.

In 2013, China proposed an international cooperation and development strategy, One Belt And One Road, where One Belt will link China's Western region with Europe through Central and Western Asia. The policy opens a new door for Western provinces and may promote their economic development through more trade, investment and cooperation with neighboring countries. Although this policy may help to reduce income poverty, so far the new development strategy focuses solely on economic growth. A step forward would be to broaden the policy by taking education, health, social safety nets into account. Then the new policy is more likely than at present to work for the multidimensional poor and thus achieve a more sustainable and balanced development in the West.

Rural households were historically deprived more seriously than their urban counterparts, partly due to the government's urban-focused policy (such as *Hukou* system). Since the 1990s, the poverty gap between urban and rural areas has been narrowing as a result of decreasing speed in the elimination on urban poverty caused by the breakdown of "Iron Rice Bowl", and the more rapid decline in the incidence of rural poor. Especially, in recent years, multidimensional poverty reduction in urban areas has been sluggish: in 2006-2009, the proportion of the urban multidimensional poor even grew slightly (by 0.06%). The sluggishness of urban multidimensional poverty reduction has been caused, as noted above, by several factors, such as problems facing immigrant families, unaffordable housing and health care in cities, as well as life threatening pollution. Although the Chinese government has become increasingly aware of these problems, it has not yet found effective measures to deal with them.

Despite the fact that both income and multidimensional poverty have been reduced dramatically from 1989 to 2011, they present different trends, especially in recent years

and in different areas. Multidimensional poverty reduction does not always coincide with economic development. This phenomenon is likely to be even more pronounced if and when China's economic development model becomes more unsustainable, the environment becomes increasingly "overloaded" and degraded.

If the above analysis and evaluation is correct, a comprehensive evaluation of poverty in China requires attention to both measures ─ income poverty and multidimensional poverty. Incomes and what they can buy are important but only means to end of human development ─ the capabilities and activities that peoples have reason to value. The multidimensional metric focuses on intrinsically important human capabilities and achievements as well on important means. If only a single poverty measure, either income or multidimensional poverty, is applied rather than if both poverty measures are used, different poor groups would be identified while leaving a certain number of poor people unrecognized. The lack of overlap implies that being income poor is not necessarily to be multidimensionally poor. Therefore, the AF measure picks up ethically urgent aspects of poverty missed by the metric of merely income poverty.

China's development policy used to focus exclusively on economic growth and measured success solely in relation to income and consumption. Income, and the goods and resources it can buy, are indeed important as a means to improve human being and doing. However, solely depending on growth in income and what income can buy, is not sufficient to eradicate complex poverty. The Chinese government, under the 12th Five-Year Plan (2011-2015) also and rightly sets targets to improve access to education and public service, expand safety nets, and enhance the development of the Western region. In this context, the approach and findings of the present study offer a tool that can improve the

measurement and justification of future anti-poverty policies and endeavors. With more comprehensive and adequate poverty measures, China can target the poor more accurately and monitor progress in complex poverty reduction more effectively.

Appendix

Table 1: Summary Statistics

Variables/SS	1989	1991	1993	1997	2000
Per Capita Income	Per capita household income inflated to 2011				
Min	-6348.41	-668.685	-1644.35	-3953.83	-860.904
Mean	3035.583	3002.84	3439.471	4241.568	5485.031
SD	2640.842	2257.57	3000.921	3391.724	5521.214
Max	63552.83	31830.49	37166.37	32831.85	80668.96
Observations	2814	3502	3309	3403	3753
Years of Schooling	The maximum years of schooling of adult household members				
Min	0	0	0	0	0
Mean	8.623046	8.685	8.854	8.824	9.205
SD	2.934193	3.261	3.246	3.453	3.544
Max	18	18	18	18	18
Observations	2751	3506	3306	3307	3553
School Attendance	Deprived if any school-age child is not attending school				
Min	0	0	0	0	0
Mean	0.101243	0.065508	0.085215	0.040936	0.04276
SD	0.301704	0.247456	0.279244	0.19817	0.202341
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812
Body Mass Index	The minimum BMI of adult household member				
Min	14.781	13.134	13.07	12.91	13.06
Mean	20.689	20.095	20.248	20.7	21.113
SD	2.286	2.29	2.27	2.49	2.664
Max	31.03	36.097	33.436	39.63	35.563
Observations	2815	3511	3321	3420	3812
Access to Clean Water	Deprived if household does not have the access to in-house or in-yard tap water				
Min	0	0	0	0	0
Mean	0.5	0.42	0.377	0.327	0.318
SD	0.50	0.49	0.485	0.469	0.466
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812

Access to Electricity	Deprived if the household does not have the access to electricity				
Min	0	0	0	0	0
Mean	0.505	0.422	0.377	0.327	0.318
SD	0.5	0.494	0.485	0.469	0.466
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812
Access to Sanitation	Deprived if the household is using an earth open pit as toilet				
Min	0	0	0	0	0
Mean	0.575	0.559	0.49	0.389	0.322
SD	0.494	0.497	0.499	0.488	0.467
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812
Access to Cooking Fuel	Deprived if the household cook using wood, straw/stick, charcoal as the main fuel				
Min	0	0	0	0	0
Mean	0.382	0.388	0.382	0.366	0.288
SD	0.486	0.487	0.486	0.482	0.453
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812
Asset Ownership	Deprived if the household does not own more than one of these: TV, bike, motorbike, refrigerator, and does not own a car or tractor				
Min	0	0	0	0	0
Mean	0.763	0.712	0.647	0.488	0.355
SD	0.425	0.453	0.478	0.5	0.479
Max	1	1	1	1	1
Observations	2815	3511	3321	3420	3812

Variables/SS	**2004**	**2006**	**2009**	**2011**
Per Capita Income				
Min	-14249.3	-8733.39	-206321	-98540.2
Mean	7503.567	8764.029	12432.77	14260.04
SD	7929.946	12017.1	16329.29	17729.79
Max	83725.06	252189.9	312123.1	395285.1
Observations	4155	4191	4329	4290
Years of Schooling				
Min	0	0	0	0
Mean	8.979	8.992	9.015	8.997

SD	3.738	4.085	3.985	4.034
Max	18	18	18	18
Observations	4194	4260	4399	4400
School Attendance				
Min	0	0	0	0
Mean	0.01073	0.012198	0.008411	0.011588
SD	0.103039	0.109782	0.091335	0.107036
Max	1	1	1	1
Observations	4194	4263	4399	4401
Body Mass Index				
Min	12.42	13.24	13.5	2.297
Mean	21.389	21.563	21.697	22.044
SD	2.866	2.873	3.0239	3.467
Max	34.928	36.787	42.59	54.575
Observations	4194	4263	4399	4401
Access to Clean Water				
Min	0	0	0	0
Mean	0.258	0.227	0.191	0.146
SD	0.437	0.419	0.393	0.353
Max	1	1	1	1
Observations	4194	4263	4399	4401
Access to Electricity				
Min	0	0	0	0
Mean	0.258	0.227	0.191	0.146
SD	0.437	0.419	0.393	0.353
Max	1	1	1	1
Observations	4194	4263	4399	4401
Access to Sanitation				
Min	0	0	0	0
Mean	0.273	0.23	0.187	0.162
SD	0.446	0.421	0.39	0.368
Max	1	1	1	1
Observations	4194	4263	4399	4401
Access to Cooking Fuel				
Min	0	0	0	0

Mean	0.257	0.219	0.163	0.158
SD	0.437	0.414	0.37	0.365
Max	1	1	1	1
Observations	4194	4263	4399	4401
Asset Ownership				
Min	0	0	0	0
Mean	0.257	0.218	0.153	0.12
SD	0.437	0.413	0.36	0.325
Max	1	1	1	1
Observations	4194	4263	4399	4401

Table 2: Headcount Ratios on Dimension-Specific Deprivation (%)

Dimension	1989	1991	1993	1997	2000	2004	2006	2009	2011	Changes
Income ($1.25/day)	36.57	36.44	35.18	25.33	22.49	19.04	17.3	10.14	10.77	-25.8
Income ($ 2/day)	60.38	60.99	57.87	45.34	37.25	30.01	29.28	17.14	15.9	-44.48
Years of Schooling	56.73	60.75	57.6	51.49	43.02	37.79	41.26	39.17	37.7	-19.03
School Attendance	10.12	6.55	8.52	4.09	4.28	1.07	1.22	0.84	1.16	-8.96
Nutrition	13.5	23.78	21.53	17.05	15.01	13.85	12.81	13.28	11.5	-2
Child Mortality	0.5	0.34	0.03	0.18	0.05	0.12	0.07	0.07	0	-0.5
Electricity	6.5	4.04	1.42	0.64	0.89	0.33	0.33	0.27	0.95	-5.55
Drinking Water	50.48	42.18	37.73	32.72	31.85	25.75	22.71	19.1	14.61	-35.87
Sanitation	57.48	55.88	49.02	38.92	32.19	27.35	22.99	18.73	16.16	-41.32
Cooking Fuel	38.22	38.79	38.18	36.61	28.8	25.68	21.89	16.32	15.79	-22.43
Asset Ownership	76.31	71.18	64.71	48.83	35.49	25.7	21.84	15.28	12	-64.31
Sample Size	2815	3511	3321	3420	3812	4194	4263	4399	4401	

Table 3: Provincial Multidimensional Poverty Headcount (1989-2011)

MPHR	1989	1991	1993	1997	2000	2004	2006	2009	2011
Liaoning	0.2601	0.2698	0.2699	N	0.1692	0.1522	0.1077	0.1084	0.0911
Heilongjiang	N	N	N	0.2983	0.2622	0.1787	0.1674	0.1543	0.1396
Jiangsu	0.5297	0.4930	0.4769	0.2448	0.1945	0.1494	0.1468	0.1356	0.1208
Shandong	0.4016	0.3964	0.3969	0.2868	0.1881	0.1454	0.1069	0.0766	0.0731
Henan	0.4293	0.3886	0.3925	0.2794	0.2155	0.1726	0.1706	0.1438	0.1178
Hubei	0.5139	0.5250	0.4360	0.3767	0.3349	0.2374	0.1473	0.1419	0.1106
Hunan	0.3393	0.3852	0.3585	0.1976	0.1946	0.1457	0.1831	0.1647	0.1250
Guangxi	0.5119	0.6234	0.5294	0.3767	0.3409	0.3141	0.3006	0.3170	0.2638
Guizhou	0.5484	0.5460	0.5034	0.4342	0.3122	0.2300	0.1972	0.1780	0.2028

Provincial Adjusted Multidimensional Poverty Headcount (1989-2011)

AMPHR	1989	1991	1993	1997	2000	2004	2006	2009	2011
Liaoning	0.1109	0.1291	0.1235	N	0.0769	0.0666	0.0471	0.0440	0.0357
Heilongjiang	N	N	N	0.1383	0.1169	0.0795	0.0704	0.0685	0.0608
Jiangsu	0.2616	0.2418	0.2328	0.1132	0.0920	0.0668	0.0639	0.0599	0.0526
Shandong	0.1869	0.1919	0.1881	0.1332	0.0842	0.0658	0.0469	0.0345	0.0317
Henan	0.1984	0.2009	0.1975	0.1387	0.0963	0.0796	0.0778	0.0653	0.0512
Hubei	0.2432	0.2745	0.2265	0.1841	0.1612	0.1099	0.0695	0.0642	0.0498
Hunan	0.1545	0.2031	0.1724	0.0963	0.0889	0.0654	0.0796	0.0704	0.0513
Guangxi	0.2713	0.3479	0.2853	0.1983	0.1727	0.1511	0.1419	0.1441	0.1195
Guizhou	0.2600	0.2903	0.2554	0.2273	0.1589	0.1146	0.1020	0.0865	0.0949

Table 4: Rural and Urban Multidimensional Poverty Reduction (1989-2011)

	RMPHR	UMPHR	RAMPHR	UAMPHR
1989	0.5293	0.23094	0.25417	0.1108
1991	0.5421	0.27773	0.28344	0.1402
1993	0.4969	0.24725	0.25023	0.1204
1997	0.3715	0.16604	0.18622	0.076
2000	0.2813	0.15343	0.13582	0.0652
2004	0.2154	0.12329	0.10262	0.0511
2006	0.1919	0.11335	0.08886	0.0467
2009	0.174	0.11391	0.07982	0.0454
2011	0.1532	0.10644	0.06967	0.0412

Chapter 4: Essay 3 — What Predicts Multidimensional Poverty in China: A Logistic Regression Analysis

4.1 Introduction

Since 1978, China has transformed itself successfully from a centrally-planned economy to a market-oriented one and has maintained spectacular economic growth. Its annual growth rate ─ until 2014 ─ exceeded 9% on average. It has become the second largest economy and has continued its growth, though at a slower pace of 7%, in 2014. This remarkable and widely celebrated economic achievement has been instrumental in pulling more than 500 million people out of income poverty ─ according to the World Bank's $1.25 poverty line.[64]

Despite its tremendous progress in income poverty reduction, with a large population of 1.36 billion, China remains home to 98.99 million people who live under the national poverty line of 2300 Yuan a year (about $1.46 per day at 2011 Purchasing Power Parity),[65] ranking second after India in the headcount of the world's income poor. In addition, the rapid economic growth has shifted China from a relatively egalitarian to an unequal country, with quite an alarming Gini coefficient[66] of 0.474 in 2012, according to China's National Bureau of Statistics (NBS). Both the rich and the poor have benefited from the economic progress, but, as shown in Chapter 2, at unequal amounts and speeds. As a consequence, the income disparities have increased, mostly over the last three decades.

[64] Statistics are from the World Bank, available at http://www.worldbank.org/en/country/china/overview
[65] See World Bank statistics, at http://www.worldbank.org/en/country/china/overview
[66] The Gini coefficient, a widely used indicator of income inequality, is a number between 0 and 1, where 0 corresponds with perfect equality and 1 implies absolute inequality.

Apart from rising income inequality, China is suffering from social inequalities, such as health and education. People in China used to enjoy free or close-to-free health care and education under the planned-economy regime. During the process of China's transformation into a market-oriented economy, social classes started to benefit differently from the limited health and education resources and other public services, some of which were not monetized and therefore not accessible with money itself. Chapter 3 confirmed that many multidimensional poor are not identified as income poor.

Moreover, China's economic growth, as we have shown, comes at additional heavy costs, with environmental degradation emerging as a daunting challenge in recent years. As a result of overuse and pollution, thousands of rivers have disappeared and the supplies of drinking water are diminishing. Even worse, the limited water availability is distributed unevenly. Rural areas face more serious water shortages than cities. China also has the worst air quality in the world, which seriously threatens people's health. Therefore, not only income poverty, but also disparities in health, education, access to drinking water, and so forth, threaten to derail China's economic achievement.

Many papers have explored the relationships, and in some cases the causal relationships, between China's poverty and factors such as socioeconomic background and policies, but they typically employ, as seen in Chapter 3, a uni-dimensional approach, which uses income as the measure of poverty (Huang, Zhang and Rozelle, 2007; He, Wu, Webster and Liu, 2010). These analyses direct the government to increase people's income levels, and this policy does indeed provide a basis for fighting some aspects of poverty. However, the narrow focus on increasing income without adequate complementary and fair policies on education, health, social protection and environment, would not lead China

to achieve the development goal, namely, expanding people's valued opportunities and capabilities, including that of participating in social life (Sen, 1999).

A few papers have started to study the factors that predict and reduce multidimensional poverty. Alkire, Foster, Seth, Santos, Roche and Ballon (2015) discuss the technical issues and modeling framework for studying how micro and macro variables relate to multidimensional poverty. Ballon and Apablaza's paper (2012) is the best example of this analysis in the literature. It employs a logistic regression model to estimate the probability of being multidimensional poor person. The estimate is based on a set of demographic and socioeconomic characteristics that use household survey data from West Java, a province of Indonesia located in the western part of the island of Java.

Grasping the factors that predict multidimensional poverty will deepen our understanding of both macro and micro-level multidimensional poverty and therefore, provide additional insights for policy makers to formulate appropriate interventions to alleviate multidimensional poverty. Drèze and Sen (2013), aiming to do such an analysis in *An Uncertain Glory: India and its Contradictions*, offer a critical evaluation of India's growth and development. Its analytical and statistical results indicate that the lack of attention paid to the essential needs of the people, especially the poor and women, was a key factor that hindered Indian people's well-being freedoms and achievements. The volume highlights the importance of social interventions in the field of education, nutrition, medical care, and public services, including provision of access to clean water, electricity and transportation.[67]

[67] More will be done in the future on the Drèze and Sen's comparative assessment of India and China.

To my knowledge, no study explores what predicts people's poverty in China from a multidimensional perspective. The lack of such an analysis may be due to data and methodology constraints. However, the recent innovation on poverty measurement, developed by Alkire and Foster (AF Method) (2007, 2011, 2015), provides an appropriate tool for multidimensional poverty analysis.[68] The on-going longitudinal household data, *China Health and Nutrition Survey* (CHNS), contains information on household and regional characteristics, and thus enables us to examine what relates with China's multidimensional poverty. The present chapter contributes to the literature by exploring and quantifying the predicting factors on multidimensional poverty in China at the household level. Specifically, it examines the household and regional characteristics that are associated with vulnerability of the poor and evaluates the relationship between macroeconomic policies, such as free trade policy, and multidimensional poverty reduction.

The findings indicate, as adumbrated above, that factors that predict multidimensional poverty include household size, the education level of household head, health insurance coverage, rural and urban location, geographic location and the openness of the local economy. In order to reduce ─ if not eradicate ─ multidimensional poverty, efforts should target expanding education opportunities for those households with low education levels of household heads, develop specific strategies to narrow regional gaps, making macroeconomic policies work for the poor, as well as extend the multidimensional poor's participation into anti-poverty policy making.

The rest of this chapter proceeds in four steps. Section 4.2 provides an overview of multidimensional poverty in China and identifies the challenges to multidimensional

[68] See Chapter 3 for details.

poverty eradication. Section 4.3 presents relevant data sets and the methodology used in the study. Section 4.4 reports and discusses the empirical results, and Section 4.5 concludes with policy recommendations.

4.2 Multidimensional Poverty in China

There is, as I have argued in Chapter 3 (Essay 2), mounting agreement that income poverty has limits when it comes to understanding and measuring poverty. Sen (1992, 1999, 2009) revolutionized our understanding of poverty and well-being and laid the theoretical foundation for multidimensional poverty measurement. He argues that our focus should be shifted from "the means of living" to the actual ways of being and doing and "the actual opportunities a person has" (Sen, 2009: 253). Of ultimate importance in understanding, evaluating, and reducing poverty is the norm of expanding people's freedom and capability to "lead the kinds of lives that people have reason to value" (Drèze and Sen, 2013: 43). Thus, poverty can be defined not only as the lack of money but also and more fundamentally ─ as a kind of capability deprivation.

Informed by Sen's capability framework, Alkire and Foster (2007), as we saw in Chapter 3, proposed and developed a multidimensional poverty measurement approach that supplements the income poverty measurement. Recall that the AF Method identifies the multidimensional poor by making use of two forms of poverty cutoffs (Alkire and Foster, 2007, 2011, 2015): (1) "A cutoff within each dimension to determine whether a person is deprived in that dimension," and (2) "A cutoff across dimensions that identifies the poor by counting the number of dimensions in which a person is deprived." (See Chapter 3 for the detailed methodology)

The United Nations Development Programme (UNDP) introduced the global Multidimensional Poverty Index (MPI) for the first time in the 2010 *Human Development Report* and subsequently has updated it annually. The global MPI measures the overlapping deprivations in three dimensions including education, health and standard of living. The 2014 *Human Development Report* concluded that 6% of the population in China is multi-dimensionally poor, while 19% are close to multidimensional poverty.

Table 4.1 compares income poverty and multidimensional poverty in three East Asian countries, China, Indonesia and Viet Nam. It shows that although China has the lowest income poverty headcount rate compared to the other two countries, it has a higher multidimensional poverty headcount rate than Indonesia. More importantly, it has the highest near multidimensional poverty headcount rate at 19%, 10% higher than that of both Indonesia and Viet Nam. Furthermore, the intensity of deprivations in China, that is, the average share of deprived indicators across multidimensional poor, runs higher ─ at 43.40% ─ than either Indonesia or Viet Nam, which implies that China's multidimensional poor experienced more deprivations than Indonesia and Viet Nam. In addition, disaggregation of the three dimensions of the MPI indicates that health contributes the most (44%) to overall multidimensional poverty in China, living standards comes in second at 34.6% and education contributes 21% to overall Chinese multidimensional poverty.

Table 4.1: China, Indonesia, Viet Nam's Most Recent MPI

	Income Poverty	MPI Headcount	Intensity of Deprivations	Near MPI Headcount	In Severe MPI	Contribution to overall poverty		
						Health	Education	Living Standards
China	11.80%	6%	43.40%	19%	1.30%	44.40%	21%	34.60%
Indonesia	16.20%	5.90%	41.30%	8.10%	1.10%	35.10%	24.70%	40.20%
Viet Nam	16.90%	6.40%	40.70%	8.70%	1.30%	25.70%	35.90%	38.40%

Source: *2014 Human Development Report*

To continue its efforts to fight against poverty, in 2011 the Chinese government released the *Outline for Development-Oriented Poverty Reduction for Rural China (2011-2020)* (*Outline 2011-20*), a publication that aims to help people climb out of poverty and improve their standard of living. *Outline 2011-20* includes programs that tackle poverty in a coordinated and organized way from a holistic perspective; it includes instruments such as a social safety net and an agricultural tax, targets the needs by industries, regions, and special groups, and coordinates the efforts of government departments, enterprises, and public institutes. However, in essence, *Outline 2011-20* still uses income as the metric for poverty and in order to reduce poverty channels money to existing programs.

As illustrated and concluded in Chapter 3, income poverty only represents one aspect of poverty, and targeting income poverty is not sufficient and may not always be the most effective way to improve people's well-being. The cross-country comparison of Table 4.1 reinforced that conclusion ─ China's headcount rate of multidimensional poverty is comparatively higher than income poverty, implying that income poverty reduction did not always translate into multidimensional poverty eradication.

In order to design more effective policies on poverty reduction, especially policies to achieve multidimensional poverty elimination, more needs to be known on what is

correlated with multidimensional poverty and its reduction. For example, does the education of household heads provide additional predictive power with respect to the well being or deprivation of households? If the higher education level of household heads does predict a lower household deprivation, this finding can help us to identify the most-in-need households and targeted policies to mobilize resources into those households. Such an identification and targeting approach would be more effective compared to general policies without such a target.

The present chapter explores rich data from *the China Health and Nutrition Survey* (CHNS), along with data from a number of other sources, and examines factors that predict multidimensional poverty. It not only assesses household characteristics, such as the education of household heads, but also their access to non-income resources, such as medical insurance, as well as household geographic location. In addition, it also conducts a preliminary examination of the relationship between multidimensional poverty and China's World Trade Organization (WTO) entry in 2001. Such examination extends into the multidimensional context the analysis of the trade openness and income poverty of Chapter 2. One might question whether the Chapter 4's treatment of China's entry into the WTO merely repeats Chapter 2's argument. The answer is that Chapter 2 studies the impact on income of the WTO accession while the current chapter studies the human and social impact of such accession.

4.3 Data and Methodology

4.3.1 Data Description

The data for this study, as was the case in Chapter 2 and 3, draws from various sources. As mentioned previously, the main dataset comes from the *China Health and Nutrition Survey* (CHNS), an on-going longitudinal household survey, produced by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention. These institutions issued CHNS data in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011. These data covered nine of China's thirty-four provinces and province-level administrative divisions, including Liaoning, Heilongjiang, Jiangsu, Shandong, Henan, Hubei, Hunan, Guangxi and Guizhou. These provinces and other administrative units vary substantially in natural resources, economic growth and social development. The CHNS employs a multistage, random cluster sampling procedure in selecting its participants. Approximately 4,000 households participated in the household survey in each round, and the survey included both urban and rural areas.

The main dataset I employ in this chapter builds on the dataset of Chapter 3. The multidimensional poverty measures come directly from Chapter 3, but for the analytical purpose of the present chapter, I have added further variables, such as the education of household heads, household ethnicity, and household status on medical insurance.

Trade policy data comes from the World Bank's *World Integrated Trade Solution* (WITS).[69] The WITS contains China's annual tariff information starting as early as 1992.

[69] Data is available at http://wits.worldbank.org/wits/

Tariff data from the WITS are at the national level. Following Topalova's (2007, 2010) identification strategy, I have constructed tariff measures[70] at the provincial level, by resorting to the provincial employment data from the *Chinese Industry Economy Statistical Yearbook* (IESY) 2001.[71]

The main dataset and the trade policy data are merged together using province and year as key to form the final dataset. The sample size of the final dataset is shown in Table 4.2.

Table 4.2: Sample Size in Each Survey Year (1981-2011)

Survey Year	All	Urban	Rural
1989	2815	880	1935
1991	3511	1127	2384
1993	3321	1006	2315
1997	3420	1069	2351
2000	3812	1141	2671
2004	4194	1329	2865
2006	4263	1372	2891
2009	4399	1412	2987
2011	4401	1433	2968
Total	34136	10769	23367

Table 4.3 presents summary statistics of the constructed variables. However, before discussing each of the variables in detail, it is worth noting the basis for selecting these variables. In conducting an analysis of factors that predict multidimensional poverty, one of the key challenges is how to resolve two separated but interconnected challenges ─ the endogeneity issue and the circularity issue. Specifically, health and education affect

[70] Tariff measures of this chapter are the same as those of Chapter 2 (Essay 1), which are exogenous by construction.

[71] For a detailed description of the CHNS and WITS data and the constructed measures, as well as how the data from various sources are merged, see Chapter 2 and 3 (Essays 1 and 2). Additionally, the data on tariff measures are only available from year 2001.

multidimensional well-being, and multidimensional well-being can in turn affect health and education. Meanwhile, health and education are the very indicators that have been included in the construction of multidimensional poverty measure, so they should not be included as explanatory variables in the "predicting factors" analysis; otherwise, the study is subject to circularity.

To avoid or to least mitigate these issues, the study has carefully selected a set of variables, which, on the one hand, do not include these problematic indicators in the multidimensional poverty measure; and, on the other hand, can still yield insights from a policy perspective. Some variables are predetermined,[72] such as minority status, female household head, urban and regions; some are policy-driven, such as health insurance and trade openness ─ these variables can be considered exogenous and therefore free of endogeneous bias. Other variables, including household income, household size, and educational level of the household head, could still be affected by indicators with respect to multidimensional well-being. However, the extent of the effects is arguably small and is beyond the scope of this chapter, for my focus here is to study what variables *significantly* predict multidimensional poverty and therefore provide a basis to formulate general policy recommendations (rather than provide precise causal relationship estimates). With the above explanation, I now turn to discuss each of the following variables:

Household size, defined as the number of household members, with a mean of 4.2 and a max of 16.

[72] For example, an individual's ethnic minority status is often based on his or her family "tree" history.

Log household income, defined as the log of per capita household income measured in year 2011 Yuan. In a very small proportion of the households, incomes were negative in some years because those households were in the agriculture sector, where the production expenses exceeded the production income.

Health Insurance is a dummy variable that takes the value of 1 when a household has health insurance and 0 otherwise. Overall, about 45% households are covered by health insurance; however, the over-time change of the coverage is very telling. In 1991, the first year where health insurance data were available in the survey, there was a relatively high coverage of 45%. This high coverage was a residue of the centrally- planned economic system. This government gradually reduced such coverage, and in 2000 it bottomed out at 32%. However, largely due to the rapid development of the current social safety net in China, insurance coverage started to grow quickly after 2000; in 2004 such coverage reached 40% in 2011, such coverage included almost everyone (98%).

Female household head is a dummy variable that takes the value of 1 when the household head is a female and 0 otherwise. The percent of households with female heads has risen from 13.3% in 1989 to 18.2% in 2011, quite a dramatic increase. It has been a deeply rooted social norm in China that husbands have supreme authority in the households. This dominance has been hard to change, especially in a relatively short time period. Nevertheless, the notable change that did occur was arguably due two factors ─ (i) the significant increase of women's labor market opportunities and increased financial power, and (ii) the divorce effect, which makes the female, as single parent, the head of a household.

Minority[73] is a dummy variable that takes the value of 1 when a household has no member of Han ethnicity and 0 otherwise. In China, thanks to recent Ethnic Policies, a household with minority members enjoys a number of extra economic and social benefits, which range from more education opportunities to monetary subsidies.

Household head education, defined as the years of schooling of the household head.

Since household education has been included as one of the indicators in the multidimensional poverty measure, it should not be used as one of the explanatory variables in the regression analysis; otherwise, it would be subject to both the endogenous bias and circularity problems noted above. However, the use of household head education bypasses such issues while offering an interesting perspective on household multidimensional poverty. On the one hand, the education of household heads is not necessarily correlated with the household's education and thus it is not one of the indicators in the multidimensional poverty measure; on the other hand, the household head education may, in many ways, predict household multidimensional poverty. For example, a household head usually plays an important role in determining his/her child's schooling and his/her education level would affect his/her capability in performing such a role.

Urban indicates if a household lives in an urban area or rural area.

Northeast, central, coastal and western are four regional dummies to capture households' geographic locations.

[73] There are 56 ethnic groups that are identified and confirmed by Chinese government. Except *Han* which accounts for about 92% of the population, the other 55 ethnic groups, 8% of the population, are the national minorities.

Table 4.3: Summary Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
household size	34136	4.15201	1.702532	1	16
Log household income	33317	8.361465	1.108836	-0.0126652	12.88736
Health insurance	34136	0.4487108	0.4973723	0	1
Female household head	34136	0.0571328	0.1636859	0	1
Minority	33773	0.103485	0.3045958	0	1
Household head education	34136	6.911396	4.166878	0	18
Tariff	27810	11.60482	5.962169	6.797261	29.55623
Urban	34136	0.3107863	0.4628223	0	1
Northeast	34136	0.1842337	0.3876803	0	1
Coastal	34136	0.2265643	0.4186145	0	1
Central	34136	0.3464085	0.4758322	0	1
Western	34136	0.2427935	0.4287776	0	1

4.3.2 Methodology: Logistic Regression

As Alkire, Foster, Seth, Santos, Roche, and Ballon (2015) illustrate, the appropriate multidimensional poverty measure should be a household's censored deprivation score,[74] c_i, given the analysis is at the household level. According to the AF approach, if the deprivation score of a household is equal to or greater than the multidimensional poverty cutoff (k), the household is considered multi-dimensionally poor, denoted as M. M_i is a binary variable that takes the value of 1 when the household is multi-dimensionally poor and 0 otherwise, that is,

[74] Each household is assigned a deprivation score based on its deprivation in selected indicators of multidimensional poverty measures. The deprivation score of each household ranges from 0 to 1, where 0 indicates that the household is not deprived in any indicator and 1indicates that the household is deprived with respect to *all* indicators. For households who are considered to be multidimensional non-poor, even if its deprivation score is greater than 0, I formulate the deprivation score as 0, which Alkire and Foster (2009, 2011, 2015) call the "censored" deprivation score.

$$M_i = \begin{cases} 1 & if\ and\ only\ if\ c_i \geq k \\ 0 & otherwise \end{cases} \quad (1)$$

Using M_i as the measure of multidimensional poverty, we can employ regression analysis to understand what is associated with the multidimensional poverty status of a household. However, since M_i is a binary variable, the classical linear regression model will not work.[75] This study, therefore, specifies a logistic regression model, which assumes the binary variable M_i has a Bernoulli distribution with a probability of π_i taking the value of 1, so the probability mass function is:

$$f(M_i) = \begin{cases} \pi_i & if\ \ M_i = 1 \\ 1 - \pi_i & if\ \ M_i = 0 \end{cases} \quad (2)$$

One of the important properties of the Bernoulli distribution is that the expected value of the Bernoulli random variable,M_i, equals the probability as follows:

$$E(M_i) = \pi_i \times 1 + (1 - \pi_i) \times 0 = \pi_i \quad (3)$$

To see how this property is used in the logistic regression model, I now explain the logistic function. The logistic function can take an input with any value from negative to positive infinity, whereas the output always takes values between 0 and 1 and hence is interpretable as a probability. This is important since the value of inputs can vary from negative to positive infinity but the resulting probability ranges between 0 and 1. The logistic function can be written as

$$F(X_i) = \frac{1}{1 + e^{-\left(\beta_0 + \sum_{j=1}^{J} \beta_j x_{ij}\right)}} \quad (4)$$

[75] Chapter 10 of Alkire, Foster, Seth, Santos, Roche, and Ballon (2015) provides detailed discussion on why one should use a logistic regression model, instead of a linear regression model.

Where X_i is a vector that contains all the random variables of x_{ij}. In the context of this study, (X_i) is interpreted as the probability of the dependent variable (i.e., M_i) equaling 1 rather than 0; as a result

$$F(X_i)=E(M_i)=\pi_i=\frac{1}{1+e^{-(\beta_0+\sum_{j=1}^{J}\beta_j x_{ij})}} \quad (5)$$

Now, a mathematic transformation yields

$$g(X_i)=\ln\frac{F(X_i)}{1-F(X_i)}=\ln\frac{E(M_i)}{1-E(M_i)}=\ln\frac{\pi_i}{1-\pi_i}=\beta_0+\sum_{j=1}^{J}\beta_j x_{ij} \quad (6)$$

The equation illustrates that the logit (i.e., natural logarithm of the odds) is equivalent to the linear regression expression that is typically expressed as $E(M_i)=\beta_0+\sum_{j=1}^{J}\beta_j x_{ij}$. I can therefore specify the logistic regression model as

$$M_i=\mathrm{L}\left(\beta_0+\sum_{j=1}^{J}\beta_j x_{ij}\right)+\varepsilon_i \quad (7)$$

The terms are defined as follows:

$g(X_i)$ refers to the logistic function of some linear combination of x_{ij}, the predictors;

$L(\cdot)$ refers to a function after some transformations of the logistic function of $g(X_i)$;

β_0 is a constant, denoting the intercept of the logistic regression equation;

β_j, the regression coefficient, is interpreted as marginal changes of the logit due to a one unit change in x_{ij}; a more intuitive and easier interpretable parametric is e^{β_j}, which

can be thought as the change in odd ratio of the multidimensional poverty due to a one unit change in x_{ij};

X_i is a vector of predictors, including household characteristics and socioeconomic factors; and

ε_i is the error term.

Equation (7) is expressed in a setting of cross-sectional data. The CHNS dataset used in this analysis is a panel dataset, so the actual regression equation is as following:

$$M_{it}=\mathrm{L}\left(\beta_0+\sum_{j=1}^{J}\beta_j x_{ijt}\right)+\varepsilon_{it} \qquad (8)$$

where all the variables are defined the same as before, except that a time dimension is added, as indicated by the subscript "*t*".

4.4 Results and Discussion

4.4.1 Descriptive Statistics

Table 4.4 provides a snapshot of bilateral correlations among variables. The signs of correlations in the columns are as expected. For example, household size is positively correlated with the amount of household multidimensional poverty, implying that an increase of household size is associated with a higher multidimensional poverty (Column 2); similarly, household size is positively correlated with household income poverty, although the magnitude of the correlation is smaller (Column 3). The directions of associations between the rest of the Columns 2 and 3 are the same as well, although the differences in magnitude can be large in some cases.

Female household headship is negatively correlated with poverty measures, which seems surprising, considering that households with female heads are relatively income poorer because those households are often single parent families. However, this assumption may not be held in China ─ the households with female heads in the CHNS are richer in terms of income than those with male heads; the former have an average per capita income of 7387 Yuan in contrast to the latter's 7359 Yuan. This partially explained the percentage increase of Chinese households with female heads.

Column 4 of Table 4.4 provides correlations with household per capita income. The magnitudes of correlations are not comparable with Column 2 and Column 3 due to the difference in measurement; however, the direction of the correlations contrasts, as expected, with the previous columns.

Table 4.4: Correlations Among Variables, 1989-2011

	Household Multidimensional Poverty Column (2)	Household Income Poverty 1/ Column (3)	Household Per Capita Income Column (4)
Household size	0.188	0.160	-0.261
Household health insurance	-0.181	-0.290	0.401
Female household head	-0.028	-0.017	0.009
Minority	0.056	0.065	-0.083
Education of household head	0.184	0.129	-0.180
Scaled Effective Tariff 2/	0.205	0.191	-0.314
Non-scaled Effective Tariff 2/	0.208	0.182	-0.307

Sources: the CHNS; the WITS and author's calculation.

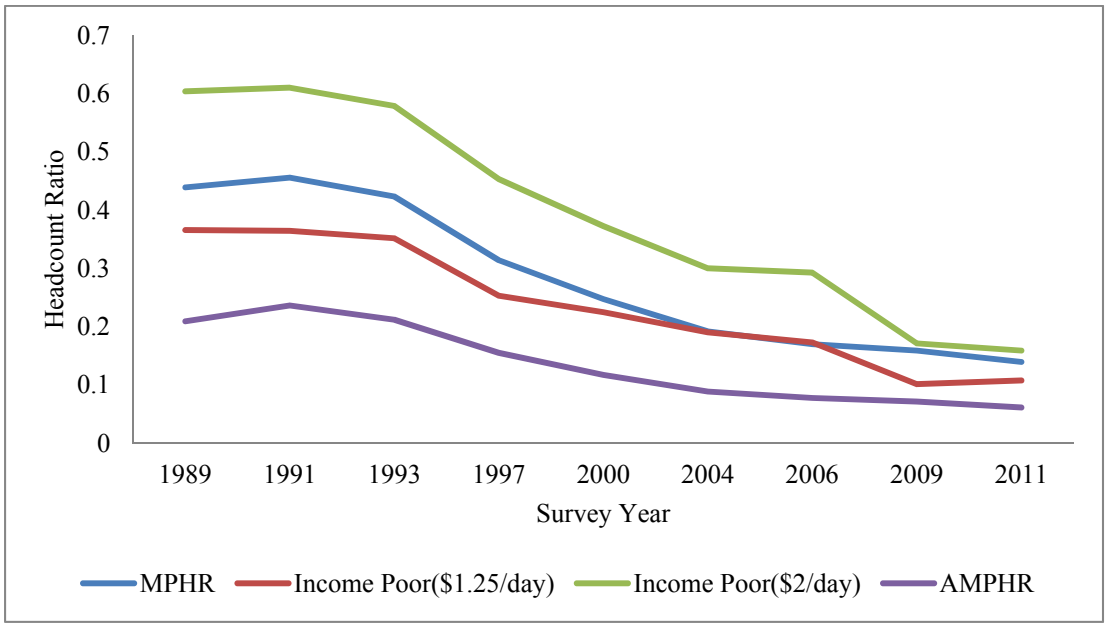
1/ Using the $1.25/day poverty line. The results are similar with $2/day poverty line.

2/ Tariff measures are at the provincial level.

Figure 4.1 below shows the evolution of income and multidimensional poverty reduction in China. It indicates that income poverty decreased much faster than

multidimensional poverty. In 1989, more than 60% households were income poor, using $2/day poverty line, and that number was reduced to less than 30% in 2011. This result is shown in green as a steep downward sloping line. However, the purple line shows that multidimensional poverty, measured by AMPHR, has been reduced at a much slower rate.[76]

Figure 4.1: Income Poverty vs. Multidimensional Poverty (1989-2011)



Although Table 4.3 and Figure 4.1 are informative, they are descriptive in nature and only provide an initial picture in examining the factors that predict multidimensional poverty in China. First, the correlations discussed are bilateral relationships, which may not exist after adjusting for other factors. For example, suppose household size and female household head both covary with poverty and they also vary with each other. It is possible that after adjusting for either household size or female headship, the other factor's

[76] See Chapter 3 (Essay 2) a more detailed discussion.

covariance with poverty becomes much smaller or disappears. Second, it is unknown if these relationships are statistically significant or not, especially after adjusting for other factors. Therefore, it makes sense to conduct a regression analysis.

4.4.2 Regression Results with Household Characteristics

As discussed in Section 4.3, I employ the logistic regression model of Equation (8) to examine factors that affect multidimensional poverty. Specifically, Equation (8) can accomplish the following with respect to this dissertation's research questions:

1. Test the hypotheses that the probability of being multi-dimensionally poor varies with a specific variable, conditional on other explanatory variables. For example, it tests the hypothesis that the odds of being multi-dimensionally poor vary with the number of years of education of the household head, conditional on other explanatory variables.
2. Estimate the odds of being multi-dimensionally poor when a variable changes by one unit of measurement, conditional on other explanatory variables. For example, how the odds of being multi-dimensionally poor change when a household has an additional person, conditional on other explanatory variables.

One of the technical questions in estimating with Equation (8) is how to deal with the error term ε_{it}, which can be decomposed into $\varepsilon_{it} = v_i + \tau_{it}$.[77] The fixed-effects model assumes v_i to be fixed and therefore can be correlated with predictors; the random-effects model, on the other hand, assumes v_i is random and cannot be correlated with predictors.

[77] This can be further decomposed into $\varepsilon_{it} = v_i + u_t + \zeta_{it}$. The study assumes that u_t, the household-invariant error term, is fixed rather than random. So it will capture the effect of those macro socioeconomic policies that are not available in the data.

For a non-experimental social study like the present one, it is hard to tell which assumption is closer to the true data generating process, so we run regressions of both models and perform a Hausman specification test[78] to decide between fixed- or random-effects.

The chapter first examines the explanatory factors at the household level and reports the results in Table 4.5. Columns 2 to 5 report the estimation results of the fixed-effects model, while columns 6 to 9 report those of the random-effects model. Apart from the coefficient of *Minority*, all other coefficients are similar in direction and significance in both the fixed-effects and the random-effects models. The Hausman specification test, with its test result reported in Table 4.5, suggests using fixed-effects model. The results indicate that conditional on other explanatory variables, the probability of being multi-dimensionally poor increases as household size increases, whereas it decreases with the presence of a female household head; education of the household head is negatively associated with multidimensional poverty, indicating that the higher education level of the household head, the less risk there is that the household will fall into multidimensional poverty; and the probability of being multi-dimensionally poor decreases as household per capita income increases, conditional on other explanatory variables.

[78] See Chapter 2 for a discussion of the Hausman specification test.

Table 4.5: Logistic Regression Model on Household Characteristics

Dependent variable: Household's censored deprivation score

	Fixed Effects				Random Effects			
	Coefficient	Std. Err.	t Ratio	Odds Ratio	Coefficient	Std. Err.	t Ratio	Odds Ratio
Household size	0.277	0.017	16.73	1.319	0.290	0.014	21.11	1.337
Female household head	-0.702	0.091	-7.73	0.495	-0.595	0.064	-9.35	0.551
Minority	-0.276	0.225	-1.23	0.759	0.202	0.086	2.35	1.224
Education of household head	-0.085	0.010	-8.30	0.919	-0.134	0.006	-21.40	0.874
Log Per Capita Income	-0.402	0.020	-19.80	0.669	-0.467	0.018	-25.83	0.627
Hausman Specification Test	Prob>chi2 = 0.0475							

Sources: the CHNS; the WITS; and author's calculation.

Specifically, each additional household member increases the odd of a household being multi-dimensionally poor by 32%,[79] after controlling for other variables. A household with a female head decreases the odds of being multi-dimensionally poor by 50%, all else being equal. Similarly, the odds of being multi-dimensionally poor decreases by 8%, with additional year of the household head's schooling, and decreases by 33% with one unit increase of the log per capita income.

Some may find it counter-intuitive that the probability of falling into multidimensional poverty decreases with the presence of a female household head. After all, the world is far from gender equality, not to mention women's inferior social and economic privileges. A recent report that three women with global clout ─ Hillary Clinton, Melinda Gates and Chelsea Clinton ─ have issued, shows that women are still far from gaining equality in leadership positions (Clinton, Gates and Clinton, 2015). The report reviewed women's progress since the 1995 UN Fourth World Conference on Women in Beijing. It was then that the first lady Hillary Clinton who declared: "Let it be that human

[79] A positive coefficient means an increase in the odds, which can be calculated by (odds ratio-1)*100; likewise, a negative coefficient means a decrease in the odds, which can be calculated by (1-odds ratio)*100.

rights are women's rights, and women's rights are human rights, once and for all." But 20 years later, women are still "very much a minority," representing fewer than 30% of the world's lawmakers and a smaller percentage hold leadership positions in corporate and political offices.

Nevertheless, women's life and rights have improved since the People's Republic of China was established and in particular, after Chairman Mao proclaimed that "Chinese women hold up half of the sky." In 2013, China stood at 37 out of 142 countries on the Gender Inequality Index,[80] a relative high ranking in comparison with its overall ranking on human development, for China only ranked 91st on the Human Development Index of the UNDP *2014 Human Development Report*. The descriptive data from previous sections is consistent with China's improvement ─ since the 1950s ─ households led by females, on average, earn more than households with male heads. In addition, the "odd ratio" estimate is in line with what Alkire and Shen (2015) found, that is, female-headed households are less poor than are male-headed households.

However, the estimate on female household heads in itself does not to suggest that China is no longer a male-dominated society. On the contrary, gender inequality, especially at work and in the political arena, still exists. One possible explanation may be that the female household heads are so much more diligent and caring than their male counterparts with the result that female-headed households are less likely to be poor.[81]

[80] Gender Inequality Index measures inequality between women and men in three important dimensions of human development – reproductive health, empowerment and the labor market. Detailed information and data can be found at http://hdr.undp.org/en/content/table-4-gender-inequality-index

[81] We need more gender specific data to better capture the differential effect between female-headed and male-headed households on multidimensional poverty.

The coefficient estimates for *minority* households are different in direction, magnitude and significance in fixed- and random-effects[82] models. The random-effects model in Table 4.5 suggests being a minority household ─ in which the household head does not belong to the ethnicity of *Han* ─ is associated with an increase of multidimensional poverty. The fixed-effects model, however, identifies a negative effect on multidimensional poverty of being a minority household, although the relationship is not significant at the 5% significance level. The insignificant estimate on being a minority is likely due to the limited explanatory power of the fixed-effects model on time-invariant variables ─ one side feature of the fixed-effects model is that it is not designed to investigate time-invariant causes of multidimensional poverty, such as the ethnic minority status of a household, which rarely, if ever, changes over time.

Table 4.6 reports the regression results with an additional explanatory variable included; that is, a dummy variable that indicates that a household is being covered by health insurance. Compared to those of Table 4.5, the results of Table 4.6 are similar in direction and significance for all the variables included, but the magnitude is slightly different.

[82] The Hausman specification test suggests the superiority of the fixed-effects model since it indicates that the estimates of the random-effects model are inconsistent and biased. The results could only be suggestive, however, when some regression assumptions fail.

Table 4.6: Logistic Regression Model on Household Characteristics, Including Health Insurance

Dependent variable: Household's censored deprivation score

	Fixed Effects				Random Effects			
	Coefficient	Std. Err.	t Ratio	Odds Ratio	Coefficient	Std. Err.	t Ratio	Odds Ratio
Household size	0.266	0.017	15.75	1.304	0.279	0.014	20.01	1.324
Female household head	-0.559	0.092	-6.09	0.572	-0.504	0.064	-7.85	0.604
Minority	-0.394	0.231	-1.71	0.675	0.158	0.087	1.81	1.171
Education of household head	-0.070	0.010	-6.74	0.933	-0.127	0.006	-19.98	0.881
Log Per Capita Income	-0.306	0.021	-14.41	0.737	-0.360	0.019	-18.90	0.698
Health Insurance	-0.505	0.043	-11.70	0.603	-0.605	0.040	-15.11	0.546
Hausman Specification Test				Prob>chi2 = 0.0646				

Sources: the CHNS; the WITS; and author's calculation.

During the survey period, households experienced dramatic changes in health insurance coverage. In the late 1980s, the government significantly reduced its expenditure on public health services. As a result, the escalating costs made health care unaffordable for the poor. Moreover, the lack of basic health care for many became a key obstacle for their climbing out of poverty. The coefficient estimates on health insurance is significantly and negatively associated with a household's multidimensional poverty, highlighting the importance of basic health care. According to the random-effects model, the odds of being multi-dimensionally poor for households with medical insurance are lowered by 55%.[83]

The estimates with respect to minority members remain substantively different between the fixed- and random-effects models, although now they are both insignificant at

[83] There are several reasons to suggest that the random-effects model is appropriate when the indicator of health insurance is included. First, the result of the Hausman specification test in Table 4.6 supports the random-effects model, since it cannot reject the null hypothesis that the random-effects model yields consistent estimates at the 5% significant level (with a statistic of 6.46%). Second, the random-effects regression is based on a whole sample of households (31,182 observations), while the fixed-effects regression is only based on about two-thirds of that sample because 4025 households did not change their multidimensional poverty status over the survey period. Third, the fixed-effects model cannot investigate time-invariant characteristics.

the 5% significant level. Most minorities live in Western China, so one possible reason for the difference in estimates may be that, the estimates of the random-effects model are contaminated by the omission of regional factors that have implicitly been controlled in the fixed effects model. In the next section, I include a Western regional dummy to control the effect, with results shown in Table 4.7.

4.4.3 Regression Results with Geographic Locations

I now further examine if households' geographic locations make a difference on the odds to be multi-dimensionally poor, with results in Table 4.7. Since a household's location rarely changes over time in CHNS, the variable of households' location is time-invariant and cannot be estimated by fixed-effects model (see Table 4.7).

Table 4.7: Logistic Regression Model of Household Multidimensional Poverty, with Location Factors Included

Dependent variable: Household's censored deprivation score

	Fixed Effects				Random Effects			
	Coefficient	Std. Err.	t Ratio	Odds Ratio	Coefficient	Std. Err.	t Ratio	Odds Ratio
Household size	0.266	0.017	15.75	1.304	0.250	0.014	17.68	1.283
Female household head	-0.559	0.092	-6.09	0.572	-0.427	0.065	-6.57	0.652
Minority	-0.394	0.231	-1.71	0.675	-0.157	0.092	-1.70	0.855
Education of household head	-0.070	0.010	-6.74	0.933	-0.110	0.006	-16.97	0.896
Log Per Capita Income	-0.306	0.021	-14.41	0.737	-0.354	0.019	-18.59	0.702
Health Insurance	-0.505	0.043	-11.70	0.603	-0.569	0.040	-14.16	0.566
Northeast	…	…	…	…	-0.207	0.090	-2.30	0.813
Central	…	…	…	…	0.065	0.076	-0.85	0.937
West	…	…	…	…	0.573	0.085	6.76	1.774
Urban	…	…	…	…	-0.614	0.064	-9.65	0.541
Hausman Specification Test				Prob>chi2 = 0.1569				

Sources: the CHNS; the WITS; and author's calculation.

With the exception of estimates with respect to a household's including a non-*Han* or "minority" member, the results that Table 4.7 displays are the same in direction and

significance as the other household characteristics, which Table 4.6 contains. After controlling for regional factors, the estimates on being a minority are consistent in both the fixed- and random-effects models, confirming the contamination hypothesis on the random-effects model. However, the negative association between being a minority and being multi-dimensionally poor seems surprising ─ in the literature, minorities are more likely to live in poverty (Povich, Roberts and Mather, 2015; *The Economist*, 2015). One possible ─ although controversial ─ reason is that China's Minority Policy arguably contributes to improving the quality of life of minorities ─ they enjoy more economic and social benefits than non-minorities, ranging from monetary subsidies to education opportunities; moreover, in order to maintain social stability, such ethnic minorities as Uighurs are given more financial aid and preferential policies related to employment, language, and education.[84]

The odds of being multidimensional poor differ significantly by regions, especially when we contrast urban with rural areas. Relative to Coastal provinces, such as Jiangsu and Shandong, the odds of being multi-dimensionally poor for households in the Western region is 77% higher than Eastern or Coastal regions. It is not surprising considering the Western region is, relative to the Eastern or Coastal regions, left behind not only in economic growth, but also in education, health and social development. No significant differences in the risks of falling into multidimensional poverty have been found between Central and Coastal regions.

[84] Additional ethnic data is required to explore the specific effect of ethnicity on multidimensional poverty status in China.

The odds of being multidimensional poor in Northeast are a bit lower than in Coastal area. This is unexpected since the Coastal regions have enjoyed the highest economic growth during the survey period. However, while achieving the best economic performance, measured in terms of income, is certainly one important means to improve well-being, it is not sufficient, especially if such economic growth is unbalanced and unsustainable, not converted into a better life, and at the cost of environmental pollution.

The urban and rural disparity with respect to multidimensional poverty is as expected ─ an urban household is 56% less likely to be multi-dimensionally poor than is a rural household. After all, urban households ─ except for migrant families ─ have easier access to schools (and education in general) and medical services as well as have more employment opportunities.

4.4.4 Regression Results with Trade Policy

During the survey period, China has undertaken significant trade reforms in order to promote economic growth, improve people's standards of living, and advance human development. Chapter 2 has studied the differential effect of China's WTO entry on household income. A natural question now arises "what is the effect on China's household multidimensional poverty of the country's entry into the WTO?" To date, no theoretical framework has systematically been applied to address this question. However, conceptually, a household may or may not be able to convert its income gains of trade openness to enhance its members' capabilities ─ freedoms for better functionings in education, health, and improved living standards. So a household that is not deprived in income may still be multi-dimensionally poor.

From a broader perspective, the WTO entry certainly offered indirect benefits for Chinese people, benefits that go beyond narrowly economic gains. First, the new technology associated with trade openness may affect people's lives with respect to improved medical treatment as well as cleaner water and better sanitation, which are important means for enhancing people's well-being.

Second, trade openness often brings in democratic ideas, which may influence people's lives in a profound way. For example, the conventional wisdom argues that the best way to get people out of poverty is to give them good-paying jobs and trade openness is one of the ways to increase job opportunities. Undoubtedly, being employed is an important dimension of people's quality of life and a necessary ─ or, at least, usually helpful ─ mechanism for the increase of people's income and a fuller sense of fulfillment. However, such a policy alone will not be enough. Not only did Chapter 2 find that urban-rural income inequality has widened as a result of trade openness in China, but beyond this negative result of trade, there are some non-employment benefits associated with trade: when people live in regions where social institutions fail to ensure equal access to potential employment opportunities, trade openness still may bring transparency to government. And greater transparency prompts governments to improve social arrangements for disadvantaged people. Public officials have an incentive to appear free of corruption. Finally, the WTO entry has affected the Chinese government's ability to deliver public services, such as public health, education, and so forth.

There could be more channels where the WTO entry can affect multidimensional poverty ─ some of which were not studied in Chapter 2. However, a thorough investigation of all channels is beyond of the scope of this study. Using the same trade measure as in

Chapter 2, namely, employing Topalova's (2007) identification strategy[85] to construct provincial scaled tariff rates as the proxy of trade openness, the present chapter conducts a preliminary empirical examination on whether trade openness correlates with the reduction of the multidimensional poverty.

Table 4.8's results suggest that tariff reduction has significantly decreased the likelihood of households falling into multidimensional poverty, even after controlling for household per capita income. The odds of being multi-dimensionally poor increased by 9%, following a one unit increase in the provincial tariff rate. By referring to compared Table 4.7, it is clear that, after including the tariff rate, the association of per capita income with household multidimensional poverty largely decreases, indicating that a substantial portion of income's contribution to multidimensional poverty reduction may be through trade openness. Meanwhile, the significant estimate on tariff suggests that trade openness yields benefits on household well-being that go beyond the income channel.[86]

[85] See Chapter 2 for more details.
[86] Note that I did not use the non-scaled tariff measure as an instrumental variable to correct the potential endogeneity problem, as I did in Chapter 2, because of the technical difficulties to run an IV logit panel regression model. This issue will be addressed in future research.

Table 4.8: Logistic Regression Model of Household Multidimensional Poverty, with Tariff Measure Included

Dependent variable: Household's censored deprivation score

	Fixed Effects				Random Effects			
	Coefficient	Std. Err.	t Ratio	Odds Ratio	Coefficient	Std. Err.	t Ratio	Odds Ratio
Household size	0.201	0.028	7.07	1.222	0.180	0.021	8.37	1.197
Female household head	-0.656	0.163	-4.02	0.519	-0.382	0.967	-3.95	0.683
Minority	-0.205	0.376	-0.54	0.815	-0.344	0.129	-2.66	0.709
Education of household head	-0.046	0.016	-2.95	0.955	-0.105	0.009	-11.29	0.900
Log Per Capita Income	-0.079	0.034	-2.29	0.924	-0.160	0.028	-5.64	0.852
Health Insurance	-0.174	0.069	-2.54	0.840	-0.263	0.062	-4.24	0.769
Northeast	…	…	…	…	0.435	0.125	3.49	1.515
Central	…	…	…	…	0.278	0.122	.8.84	1.321
West	…	…	…	…	1.081	0.122	8.84	2.947
Urban	…	…	…	…	-0.506	0.091	-5.59	0.603
Effective Tariff	0.090	0.015	6.06	1.09	0.077	0.013	5.72	1.080
Hausman Specification Test				Prob>chi2 = 0.000				

Sources: the CHNS; the WITS; and author's calculation.

Results in Table 4.8 are based on data after year 2000. To check the robustness of the results, I have re-run the regressions of Table 4.8 by using data from surveys after year 1992, the first year when the effective tariff measure could have been constructed. The results are reported in Appendix Table. By comparing Table 4.8 with Appendix Table, it is clear that the results of Table 4.8 are quite robust.

4.5 Concluding Remarks and Policy Implications

Using a logistic regression model, the preset study estimates the factors that associate with multidimensional poverty in China. My analysis uses panel data from the CHNS collected in 1989, 1991, 1993, 1997, 2000, 2004, 2006, 2009 and 2011 in nine provinces. Regressions show that larger households are more likely to fall into multidimensional poverty, a result in line with the previous research that household size matters in poverty reduction. In addition, years of schooling of the household head and

household income level positively predict the reduction of a household's multidimensional poverty.

Moreover, geographic location, health insurance policy, and trade openness are robustly related to multidimensional poverty levels. Households without health insurance and those who live in rural and western areas are more likely to fall into multidimensional poverty. Trade openness plays a significant role in reducing multidimensional poverty ─ tariff reduction decreases the odds of being multi-dimensionally poor.

The Chinese government places the issue of poverty and inequality on its policy agenda and continues its efforts to fight against poverty. To achieve the goal of improving people's standards of living, which is an important means for expanding people's freedom, and ultimately promote people's capability (and agency), anti-poverty intervention programs should focus not only on economic growth, but also on help the poor access higher education, increase the opportunities of the multidimensional poor to participate in society, develop appropriate regional development policies, and so forth.

First, complementary policies are needed to make macroeconomic policies, such as trade policy, work for the poor. China's economic success in the last three decades mainly stemmed from its integration into the global economy. In particular, after China joined the WTO in 2001, China has benefited economically from its comparative advantage in low cost labor, expanding employment opportunities, and improved productivity efficiency. However, the free market by itself neither guaranteed equal income distribution nor ensured environmental sustainability and other development outcomes. The study reinforced the point that without adequate policies in place, people, especially the

multidimensional poor, are deprived of basic opportunities, such as having access to drinking water and living in a clean environment. The government can play a critical role in mitigating adverse impacts and sustaining a green environment through shifting its focus from the pace of growth to the quality of growth.

Moreover, increased education opportunities for the multidimensional poor promote not only their education levels, but also the quality of their education. The education of the multidimensional poor, in particular, the migrant child's education, remains a critical social problem. For children in villages and rural areas, the study recommends that the Chinese government should take more responsibility to ensure they are able to go to school and have sufficient teachers for each grade. Most of the children of migrant workers who move with their parents to cities are excluded from normal local schools and can only go to schools established specifically for migrant children. These migrant schools usually are illegally over-crowded, located in flimsy buildings, and equipped with poor facilities ─ bad lighting, no sports equipment, no computers, and so forth. Both the central and local governments should finance more of these migrant schools and give migrant children ─ usually the very poor ─ an adequate education. Without investing more into human capital and overcoming barriers to education, it would be difficult for the multidimensional poor to escape from poverty.

Finally, to make multidimensional poor's voices heard, expansion of their opportunities for democratic participation is needed. Due to the data limitation, the association between people's political opportunities and the multidimensional poverty status at this time, unfortunately, cannot be investigated. But, based on statistics of the latest, 12th National People's Congress, China's legislative body, the proportion of peasants

and low income workers as representatives is only 13.42%.[87] Even if the current percentage is 5.18% higher than that of the 11th National People's Congress, these people are still grossly underrepresented, for as many as 80% of the population are peasants and low-income workers. Similarly there are almost 0.2 billion migrant workers, but only 3 people represent them in the National People's Congress. Unless more peasants and low-income workers can participate in legislation, regulation and policy making, multidimensional poverty is highly unlikely to be eradicated and deprivation in opportunities and other important aspects unlikely to be improved.[88]

To sum up, poverty goes beyond income and consumption and has been acknowledged as a multidimensional phenomenon. It is no longer effective to use solutions for poverty exclusively based on income-based approaches. More comprehensive policies to eradicate multidimensional poverty, such as social, political and ethnic policies are called for. The present analysis yields additional insights in those factors that predict multidimensional poverty and those interventions that improve the chances that the Chinese people will be able to climb out of multidimensional poverty.

[87] Statistics is available at http://www.china.com.cn/guoqing/2013-02/28/content_28083685.htm
[88] See *Will China Democratize?* ed. By Andrew Nathan, Larry Diamond, and Mark Plattner (Baltimore, MD: Johns Hopkins University Press, 2013), which discusses issues such as women's meager representation in the higher levels of government and party organization, and the lack of political freedom as well as press freedom in China.

Appendix

Table: Logistic Regression Model of Household Multidimensional Poverty, with Full Sample Tariff Measure
Dependent variable: Household's censored deprivation score

	Fixed Effects				Random Effects			
	Coefficient	Std. Err.	t Ratio	Odds Ratio	Coefficient	Std. Err.	t Ratio	Odds Ratio
Household size	0.198	0.021	9.26	1.219	0.185	0.017	10.92	1.204
Female household head	-0.340	0.114	-2.98	0.712	-0.337	0.076	-4.43	0.714
Minority	-0.600	0.276	-2.17	0.549	-0.231	0.106	-2.19	0.793
Education of household head	-0.050	0.013	-4.00	0.951	-0.103	0.008	-13.71	0.902
Log Per Capita Income	-0.131	0.026	-4.96	0.877	-0.197	0.230	-8.59	0.821
Health Insurance	-0.306	0.051	-5.96	0.736	-0.340	0.047	-8.56	0.670
Northeast	…	…	…	…	0.176	0.103	1.72	1.193
Central	…	…	…	…	0.061	0.089	0.69	1.063
West	…	…	…	…	0.816	0.098	8.30	2.262
Urban	…	…	…	…	-0.663	0.074	-8.95	0.515
Effective Tariff	0.077	0.004	20.92	1.080	0.073	0.003	21.52	1.075
Hausman Specification Test				Prob>chi2 = 0.000				

Sources: the CHNS; the WITS; and author's calculation.

Chapter 5: Conclusion and Areas for Future Research

The three essays I have presented in this dissertation tackled the topics of trade liberalization, income distribution and multidimensional poverty in China. The first essay assessed the income impact of one of the most important policy changes in China, the WTO accession in 2001. The second essay moved to the theoretical discussion and the empirical measurement of multidimensional poverty and compared how the analysis income poverty and multidimensional poverty differed from and complemented each other. The third essay examined factors that predict multidimensional poverty, explored whether trade policy was or was not one such factor, and by such means provided some basis for poverty reduction policies.

Data used in the three essays came mainly from the *China Health and Nutrition Survey* (CHNS), the *World Integrated Trade Solution* (WITS), and the *Chinese Industry Economy Statistical Yearbook* (IESY), which were collated and merged to form a large panel dataset. Each essay employed well-designed measurements and/or regression models in exploring the rich dataset. The findings of Chapter 2 indicated that China's openness and growth experiences, although reaffirming that trade openness was ─ in general ─ a powerful instrument in raising people's income levels and lifting people out of income poverty, had its own shortcomings. For example, the narrow focus on the pace of growth has increased both urban-rural and regional income disparities, and favored the private sector. To a large extent, the Chinese government has recognized these challenges. Undoubtedly a recent package of polices, including monetary and fiscal stimuli, burden-relief in rural areas, as well as income redistribution, helped the income poor. However, would these be sufficient to reduce poverty more broadly conceived?

Poor people are not only exposed to monetary or economic shortages, such as lack of food, but also are deprived in many other dimensions that are intrinsically important to their quality of life. Through constructing and calculating measures of multidimensional poverty, Chapter 3 indicated that disadvantages borne by vulnerable groups in China encompassed not only geographic location and low income, but also lack of basic education, nutrition, access to clean water and adequate sanitation, and so forth. It was an assemblage of inter-related dimensions rather than merely lack of income that prevents them from living a life they have reason to value. Even worse, due to the deteriorating environment, not only the current generation, but also future generations, are exposed to such disadvantages as poor air quality and natural resource degradation.

One of the important findings of Chapter 3 is that income poor are not always the multidimensional poor ─ the proportion of those who are poor but not considered poor is high if only income or only multidimensional poverty measure is applied. This mismatch suggests that reducing the number of income poor does not necessarily imply that the same numbers of multidimensional poor have climbed out of poverty. The government was alarmed that some people were a lot worse off than previously thought (when only income poverty was taken into account). It has become clear that the blind pursuit of raising income level and rapid GDP growth rate would not achieve ─ by itself ─ the aim of broad-based economic and human development.

Findings from Chapters 2 and 3 combined suggest that socioeconomic policies in general, and the WTO accession in particular, have diverse effects on diverse people's well-being. It is hard, if not impossible, to find one policy that fits all equally. In this context, in order to pursue further anti-poverty policies and endeavors, it is worthwhile to explore

predicting factors of the multidimensional poverty in Chapter 4, for these factors give us reason to believe who are the winners and losers (and in what ways or on what dimensions) of various policies. As a result, if all good things do not go together (in the same way) for everyone, then policy makers will have to decide which groups should have priority or be targeted.

Results of Chapter 4 revealed that larger sized households were more likely to fall into multidimensional poverty. Moreover, more years of schooling of the household head and higher household income level significantly reduced a household's multidimensional poverty. Geographic location, health insurance policy, and trade openness were related to multidimensional poverty levels. All these findings are statistically significant and robust[89] to model specifications. Some of these factors, such as inadequate education and inadequate social safety nets reflect the erosion of the role of China's government in social progress. In the course of integrating into the global market, China has transformed itself from a planned system to a market-oriented economy. Although its fiscal capacity has significantly increased, government expenditure on social services ─ health insurance, education and food security ─ has shrunk.

To sum up, poverty goes beyond income and should be acknowledged as a multidimensional phenomenon. It is no longer effective to base anti-poverty solutions exclusively on income based policies. As argued in Chapter 4, broader and more comprehensive policies to eradicate poverty, such as social, political and ethnic policies are called for. Fortunately, more and more entities, including Chinese government, are

[89] Tests are claimed as robust since they consistently provide similar results even if new variables are added, the sample size changed, or assumptions are altered, and so forth.

beginning to recognize the importance of multidimensional poverty.[90] At the conclusion of 12th Five-Year Plan (FYP), the Chinese government plans to "Build a Moderately Prosperous Society in All Aspects"[91] and places the poverty reduction as one of its priorities in the next FYP. Effective implementation of multidimensional poverty reduction requires ─ but is not limited to ─ a sufficient recognition of the need for multidimensional poverty remedies and buy-ins by local Chinese communities.

Although this dissertation contributes to the needed change in outlook and policy implementation by providing a more comprehensive picture, than available earlier, on China's WTO accession and poverty, the present study does have limitations of its own, which I intend to address and hopefully overcome in future research.

Missing Dimensions

Due to data constraints, the current multidimensional poverty measure is limited to education, health and standards of living, while missing other fundamental aspects that are intrinsically and instrumentally important for people's well-being, such as various freedoms. To probe multidimensional poverty empirically and collect better data, OPHI has identified five missing dimensions ─ quality of work, empowerment, physical safety, social connectedness, and psychological well-being ─ and designed model questionnaires[92] that can be incorporated into in both national survey and international survey.

[90] China's International Poverty Reduction Center (IPRC), the National Bureau of Statistics (NBS), in partnership with the Oxford Poverty and Human Development Initiative (OPHI), are planning to undertake a national multidimensional poverty measurement study between 2015 and 2016 to better identify the multidimensional poor and monitor multidimensional poverty reduction progress, see http://www.mppn.org/participants/china/

[91] It was raised in the Report to the Eighteenth National Congress of the Communist Party of China, November 8, 2012, detailed information can be found at http://www.china.org.cn/china/18th_cpc_congress/2012-11/16/content_27137540.htm

[92] For further details, see http://www.ophi.org.uk/research/missing-dimensions/

These missing dimensions not only are highly valued by Chinese people, but also are arguably the most needed in China. It is well-known, for example, that China lacks freedom of speech, with news media tightly controlled and online portals strictly censored by the government. It would be valuable to add questions with respect to quality of life or well-being that can give a measure of both people's freedom to access information and press freedom.

A few initiatives have started to deal with these freedom deficits. As recently as 2014, the Chinese government implemented a pilot survey in the Wu Ling Mountain Region, one of the most severely deprived areas and one with the highest number of minorities. Besides education, health, and living standards indicators, natural resource indicators, such as soil quality, environmental safety and ecological fragility, are added. These natural resource indicators yield valuable information on one of the missing dimensions ─ physical safety. This information will be a basis for assessing food security and proposing policy interventions to improve the quality of life of both the current and the future generations.

Agency and Its Measurement

Crocker contends that "the best space for understanding and measuring poverty" is "not income but agency, functionings, and capability for functioning" (Crocker, 2013: 382). At present the AF treats functionings and, as we have seen, can and should be extended to freedoms or capabilities to function and to agency.[93] Through liberalizing its economy, China has experienced a process of significant social and economic change. However, this

[93] People's agency is important: an individual or group can have both well-being achievements (good nutrition) and well being freedoms (freedom to be well nourished) but lack the freedom to be in charge of their own lives.

process has been a source of both greater economic freedom and more vulnerability. Although Chinese people have developed their awareness of rights and sense of dignity, they lost the much-needed social safety net that used to be provided by the government under the planned economy regime (See Chapter 4 for more details). With respect to agency, they have had little if any opportunities to exercise their *political* agency. Although China is now making great efforts to establish an affordable, market-oriented social safety net system, most vulnerable people rarely have a say in it and when they have a say, it is limited to the local level. Individual and most group agency is highly constrained by top-down Party dominance. Even when individuals and groups have some choice, agency is always in danger of being reduced if not destroyed.

One may be concerned about China's lack of institutions that enable people to exercise their agency not only in the public sphere but also in the private sphere. Agency and some independent decision-making, is, in fact, taking place in China at the micro level ─ in the small to medium township enterprises, privately-owned firms and self-employed proprietors. Workers are more empowered then earlier; they seize more opportunities than before to access information, express themselves and make decisions. Sometimes they have gained more decision-making power within their enterprises. With the expansion of individuals' local economic (and political) agency, demand for a better system of political agency at the meso, and macro levels, such as transparent and democratic government, will follow. Or so one hopes.

As illustrated above and discussed in the theoretical framework of Chapter 3, popular agency should be an important instrument in China's multidimensional poverty reduction as well as one of the principle ends of development. China could not be said to

be fully developed or to have "realized its highest potential if it makes economic progress but does not progress in political freedoms and rights." (Crocker, 2013: 277) My future work will defend an agency-oriented version of the CA and employ it to assess Chinese governance.[94]

Much work remains to apply the ideal of agency to real world analysis and prescription. One task, as Crocker and Robeyns recognize, is "to give an account of how democracy, including public discussion, provides procedure for collective agency, procedures in which many agents can reason together to arrive at policy that is wise and action with which most can agree" (Crocker and Robeyns, 2009: 84). Empirical application and agency measurement is complicated because of data availability, practical feasibility and methodology constraints. It is certainly more difficult to observe and measure the process of making individual or collective choices than it is to analyze (certain) outcomes.

Nevertheless, as noted above, a few researchers attempt to address the challenge to put agency ─ as decisions and impactful action based on reasons the agent has reason to value ─ under empirical scrutiny. Alkire (2008) suggests categorizing and measuring individual and group agency measures into four ways: i) agency in the space of capability; ii) agency as direct control; iii) agency that advances agent's own well-being; iv) agency

[94] Recently, a number of investigations have offered arguments defending China's approaches to development and governance, among which are Justin Lin's proposal of a non-democratic China Model and Daniel A. Bell's (2015) defense of China's "political meritocracy." Lin (2012, 2015) states the recipe to economic growth and poverty reduction for developing countries is "the one that helps policy makers" to "identify the industries in which their economies may have a latent comparative advantage and remove binding constraints to facilitate private domestic and foreign firms' entry to and operation in those industries" (Lin, 2012: 353). My future research will employ an Agency-Oriented Capability, Asian-appropriate approach to analyze and evaluate to Lin's and Bell's arguments.

motivated by what the agent has reason to value but does not expand and may decrease the agent's well-being.

Such agency so conceived and differentiated cannot be captured by any single indicator. Alkire (2008) encourages a broadening of the concept and measure of agency to encompass even more features. Nevertheless, what still remains important is not "when our goals are merely realized," but when it is "we [who] decide on and intentionally realize or contribute directly or indirectly to the realization of our goals" (Crocker and Robeyns, 2009: 79). Foster (2010) and Burchardt (2005) explore freedom rankings and adaptive preferences. Much like Crocker, Silva-Leander (2011) links freedom to morality via rational choice, focuses on the intentional achievements and analyzes decision-making processes at the group or political levels. This recent work is exploring new ways to measure as well as understand human self-determination. It also challenges inquirers to do further research and empirical analysis of these normative concepts.

Other Policies That May Affect the Multidimensional Poor

Another issue of the logistic regression model of Chapter 3 concerns some "missing variables." Over the past decades, China has undertaken a variety of policy reforms at the national, regional, and local levels. Fortunately, it is unnecessary to make room for all these policies in an empirical regression model since many of these policies' effects have been captured by the year dummies (such as non-preferential central government policies), or the region dummies (such as local policies), and/or the year and local interaction dummies (such as the regional preferences in central government policies that started in different time periods).

Nevertheless, to provide a complete multidimensional poverty profile and to evaluate the effects of these policies, these dummies are too crude to pin down the effects. For example, the estimates on minorities in Chapter 4 are not stable among model specifications and are insignificant in some model specifications. Some discussions have been offered based on the idea that the mechanism of preferential minority policies and the inherent cultural and religious barriers worked in opposite directions. If measures on China's preferential policies, including health subsidy, social welfare, and interest-free loans for ethnic minorities and ethnic minority areas are available, the regression model in Chapter 4 can yield estimates on the effects of the preferential policies, as well as that of being an ethnic minority. These estimates will better inform policy-makers and challenge them to formulate and implement more effective strategies to accelerate the economic and social development of the ethnic minority.

It is also worth investigating local governments' ability to deliver public services. Compared to the central government, local governments take more responsibilities for public housing, compulsory education, social security, health care, and so forth. Because of different levels of economic growth, revenues taken in by local governments have varied. Rich provinces have strong fiscal capacity for delivering public services for their residents, while residents in poor provinces suffer from limited public service resources. Disparities in delivering public services among local governments result in people's different capabilities to have access to public services that are instrumentally valuable for people's quality of life. Evaluating how local governments' expenditure affects the multidimensional poor would provide additional valuable insight for fighting against multidimensional poverty.

Potential Endogeneity[95] *Issue in Multidimensional Poverty Analysis*

As discussed in Chapter 4, the logistic regression model of multidimensional poverty is subject to the endogeneity problem. Although this risk has been mitigated through carefully selecting the explanatory variables, some variables, including household income, household size, and educational level of the household head, may still be affected by multidimensional well-being. Future research could deal with the endogeneity issue by adopting an instrumental variable approach, if a valid instrument could be found and constructed. A valid instrumental variable would help to find the roots or the causes of multidimensional poverty, thus leading to more effective anti-poverty policies and strategies.

Final Remarks

The China case study presented in the dissertation reaffirms that trade openness is an important development strategy in advancing economic growth and increasing people's income. However, solely depending on monetary policies does not guarantee the achievement of the desirable development goal of improving people's quality of life. The study highlighted the role of government in assuring the benefits of an open economy and economic growth while mitigating their adverse impacts on the (income and multidimensional) poor. Over the past 15 years, the Chinese government has demonstrated its commitment to realizing the MDGs and SDGs and to eliminate income poverty, achieve universal primary education and improve the people's livelihood. To further improve people's quality of life, the Chinese government, cooperating with the UN and OPHI, has

[95] If explanatory variables are correlated with the error term of the model or, in another word, explanatory variables and the dependent variable are interdependent, then the endogeneity issue emerges.

started to construct a national multidimensional poverty measure. This analysis of the multidimensional poor as well as of patterns and predicting factors of multidimensional poverty help both to shed light on the reasons behind the multidimensional poverty index and to justify this approach to analyzing, explaining, and reducing human deprivation.

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