ESSAYS ON RISING INCOME INEQUALITY AND QUALITY OF LIFE IN CONTEMPORARY CHINA

by

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To my parents and children

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Qiaoyuan Lin

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Abstract

The primary contribution of the thesis is to propose the idea of collaboration from self efforts and social efforts to promote well-being in the research area of income inequality. The literature merely concerns the effect of income inequality on well-being based on social efforts which reflect on the measurement of income inequality according to social comparison. The thesis argues that this unilateral examination is unable to achieve coherence and unity between theory and empirical structure with respect to individual well-being and its corresponding statistical evidence is likely biased. Hence, the thesis introduces the new two-effort framework which enables a comprehensive and fair evaluation of social efforts such as government assistance and action on the issue of inequality.

Through the application of such an idea into the analysis of China's income inequality, the thesis has the following unprejudiced conclusions. China's economy has retained strong growth over the past decades. Yet, the road to relieve the parallel outcome of rising income inequality from the robust growth is not optimistic. There is appreciable government policy on living standards in the short run but unfortunately, sustainable government intervention is scarce. This claim is drawn from three investigations of inequality by: i) examining the returns on social efforts and self efforts with respect to income inequality on living standards; ii) the influence of economic opportunity and security on individual income inequality; and iii), a case study of social efforts, government policy, particularly focusing on residential electricity pricing on household life burden.

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Acronyms

AIHC-1   Average Interruption Hours per customer

CDD   Cooling Degree Days

CHNS   Chinese Health and Nutrition Survey

CPP   Chinese Communist Party

FGLS   Feasible Generalized Least Squares

GDP   Gross domestic product

HDD   Heating Degree Days

NBS   National Bureau of Statistics

NDPC   National Development and Planning Commission

NDRC   National Development and Reform Commission

NPC   National Planning Commission

OLS   Ordinary Least Squares

POLS   Pooled Ordinary Least Squares

QR   Quantile Regression

SGCC   State Grid Corporation of China

Declaration

I hereby declare that the rest of the project is entirely my own work and that any additional sources of information have been duly cited. I confirm that any internet sources and any published or unpublished works from which I have quoted or draw references have been referenced fully in the text and in the contents list. I understand that failure to do this will result in the failure of this project due to Plagiarism. I understand I may be called for a viva and if so, must attend. I acknowledge that it is my responsibility to check whether I am required to attend and that I will be available during the viva period. A version of Chapter 5 was published by *The Journal of Chinese Economy* in April, 2014.

Signed

Dated

CHAPTER 1 Introduction

The thesis aims to argue the importance of joint efforts from the self and social sides in the research area of income inequality with respect to individual well-being. In this introductory chapter, we begin by briefly describing the initial motivation based on present affairs in China and then provide definitions for the key terms, followed by the research objectives and rationale for the methodology, data and methods and an outline of the chapters.

1.1 Brief background

As the world looks upon China as an emerging economy, no one will question the size and speed of economic expansion in China over the last three decades, on average an annual growth rate of 10 per cent (%). The positive consequences of such expansion are remarkable such as the reduction in massive poverty (over 600 million people out of poverty[1]) and the substantial improvement in the means of living conditions (from 251.246 GDP per capita (PPP $) in 1980 to 7,544.202 GDP per capita (PPP $) in 2010[2]). Nevertheless, the parallel outcome of rising inequality from the robust growth is alarming.

According to the official figure from China's National Bureau of Statistics, the Gini coefficient is 0.47 in 2012 and 0.48 in 2007. In contrast, the Gini coefficient is

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[1] According to the World Bank (2010, p.91) estimates, between 1981 and 2005 China's poverty rate fell from 85% to 15.9%, or by 620 million people. In contrast, Morrison (2012) believes the figure is 500 million.

[2] According to World Economic Outlook Database (2011, April Edition), International Monetary Fund.

0.61 in 2010 based on the estimate by Chen *et al.* (2010) in the Southwestern University of Finance and Economics. In addition to this plain index, the frequency of "mass incidents", the official euphemism for protests and riots, increased from 8,700 incidents in 1993 to over 180,000 in 2010, according to Demick (2011).[3] One may argue these incidents can hardly be attributed to the growing inequality due to a lack of scholarly empirical evidence. However, it is true that rising inequality is on the top of the central government's agenda as well as a 'hot' conversation amongst the ordinary Chinese. Particularly, the ordinary Chinese are easily able to experience government officials or their family and friends accumulating vast wealth at the expense of a politically powerless working class. These ongoing conditions direct our concern about how this rising income inequality affects the ordinary Chinese well-being.

At the same time, the achievement of social-economic development by the central government is well recognised in social media and academic research studies. In contrast, it is also possible to hear another adverse claim frequently. The claim is of an increasing concern for the inappropriate social efforts of government policies being principally responsible for the rise in income inequality that further aggravated the process of improving living standards in China. This opposing voice of praise and criticism of the government's actions can be well described by an ancient Chinese idiom of "raised up by Xiao He,[4] cast down also by Xiao He". Hence, such dilemma

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[3] See also Tanner (2011).

[4] Xiao He (died 193 BC) was a Chinese statesman who lived during the early Han Dynasty. In the beginning of the Han Dynasty, Xiao He recommended Han Xin become a general, later he helped Empress LüZhi to have him killed. Later, this phrase was used as a metaphor to describe a situation in the success or failure of an endeavour deriving from the same person or thing.

attracts our attention towards re-evaluating the social influence by the government for the rising income inequality in China.

In contrast to the overwhelming discussion of government functions in China's economy, there seems to be far less inclination to mention of the role of individuals in the same market. An economy is not fundamentally shaped by policy or government, but by the hard work of individuals. That is, the ordinary Chinese put in their own efforts to pursue the self-interest of survival and wealth accumulation, leading to benefits for their well-being and society. The ethos of hard work and relentless efforts captured in the slogan "labour is glorious" and the folk tale "Yu Gong Moving Away Mountains"[5] is an important part of Chinese culture. Therefore, it is important to foster an appreciation of the role that individuals can play in the economy and affect their economic well-being that benefits social-economic development. This importance also attracts our attention towards addressing the self efforts by individuals. In this way, it could provide comparative objective judgment for government actions.

1.2 Definitions of key terms

Economic inequality is a topic of perennial concern discussed by economists, philosophers and policymakers. The term "inequality" is derived from some idea of equality (Cowell, 2011). The fact is that equality is a "highly contested" concept (Gosepath, 2011), as well as intricate. One of the biggest issues in the controversy is the sub-conceptions of distributive equality that have come to be widely associated with the demand for economic (i.e. income) equality. This firestorm mainly lies in the

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[5] This folk tale is a well-known fable from Chinese mythology about the virtues of perseverance and willpower (Giddens and Giddens, 2005).

simple but difficult core question of "equality of what" (i.e. equal economic recourse and so on).[6] The diversity of understanding from various different people has resulted in "equality" having no unified meaning or even that it is devoid of meaning (Gosepath, 2011).

For this reason, a normative doctrine of egalitarianism is viewed as a fundamental idea. This study does not stress egalitarianism from either a communism or socialism idealism, but from the modern egalitarian perspective. In general, the focus of the modern egalitarian efforts is to realize that equality is on the possibility of a good life, i.e. on equality of life prospects and life circumstances (Gosepath, 2011).

A good life is generally regarded as *quality of life* or *well-being* in the literature, and both have attracted momentous attention worldwide in the past decade. Its scope is very broad in the international literature and is generally evaluated on a wider range of indicators than just income. However, what does quality of life mean in the Chinese culture? There has been a long historical influence of western culture on Chinese culture which could be traced back to around two thousand years ago. Regarding contemporary history, particularly since 1978, such an effect has been prominent in many aspects, including the concept of quality of life.

The concept of quality of life was started by Galbraith and Crook (1958) in their work entitled *The Affluent Society* and was then introduced into China in the 1980s. This phrase has appeared more in social media, scholarly research and government

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[6] Under this context, many theories of equality deal exclusively with what should be equalized (opportunity? Economic resource and so on), or what the parameter or "currency" of equality should be (Gosepath, 2011).

reports than in the broad masses over the last three decades. Their measured dimensions are close to the meaning in western countries. For instance, in the first China Urban Quality of Life Index Report (2011), jointly released by the Chinese Academy of Social Sciences and the Capital University of Economics and Business, since 2011, the term quality of life refers to that used by the World Bank,[7] covering twelve domains to evaluate the quality of life in urban areas. They are income, consumption, dwelling, transportation, education, social welfare, medical and health, life expectancy, leisure, employment and social security.

From the perspective of the broad masses, the phrase a *good life* is more frequently used in daily life with a particular focus on high income and influential social position. The reasons are the following five aspects: 1) people have enjoyed the virtues of capitalism with the remarkable development in living standards since the economic reform; 2) the overemphasis on the high rate of economic growth that leads to individuals being exclusively concerned with money; 3) the influential social position such as a high position as a governor official indicates money, power and privilege; 4) one typical striking conversation between ordinary Chinese is highly associated with money, which is reflected in discussing investment opportunities; 5) the pursuit of materialistic hedonism and a belief in money worship have become a normal social phenomenon (Hong, 2001; Jianhua, 2005; Al-Khatib *et al*., 2007). Hence, it is not difficult to understand why many ordinary Chinese consider material affluence (or the objective side of quality of life) as crucial for one's good life. In this sense, the

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[7] See Beyond Economic Growth (2004).

perception of a good life from the social perceptive is close to the meaning of the standards of living. In this respect, the standards of living are considered the main indicator for the quality of life for contemporary Chinese in this research.

Income inequality is often described as the gap between rich and poor, but more generally it refers to differences in income between different parts of the population (Cribb *et al.*, 2013). The present study uses the term income inequality regarding its general meaning. Self-interest is regarded as: "my self-interest is what is in the interest of myself, and not others" (Crisp, 2013, para.3). With this reference, self-interest means a person not only concerned about his own income status but others, in the present research. In contrast, social influence is the generic term to be considered beyond the individual's control, which can affect one's thoughts, actions and feelings through other people, government policies, environments, social norms and so on. Similar terms in the literature include social efforts, social interaction, social impact and social preference.

1.3 Research objectives and rationale for the methodology

An understanding of the cause and consequence of income inequality is still rather necessary because of its complexity, despite the abundant literature. In mainstream economics, the explanation from functional income distribution mainly goes with land, capital and labour, and from personal income distribution it is close to human capital such as skill-based development, knowledge, and social and personality attributes. Both perspectives actually seek to provide a field of play to bringing the human nature of self-interest into effect. This belief is the fundamental basis for western economics.

In other words, the political and economic philosophical idea is that individuals are capable of enhancing their well-being through their own self-interest according to the supply of equal economic opportunity by a government and a market. This idea suggests that self efforts and social efforts are the two essential elements for personal income distribution or inequality.

Yet, the measurements of income inequality are not consistent with such an idea; rather, they exclusively focus on measuring social influence based on a single index (i.e. the Gini coefficient or Theil index). This exclusion reflects that the index is calculated based on social comparison. In other words, the index is the result of the comparison of an individual's income with the average income of the population or of a group. Accordingly, the index is used to examine the effect of social-economic development on income inequality, or vice versa. This unilateral measure is inconsistent between theory and empirical practice because of a lack of taking the individual's efforts into account. Hence, this inconsistency is the primary motivation for this research project.

Why has this been so? It may be partly that modern economics starts with an individual's self-interest (Edgeworth, 1881) but ends up with the interest of the corresponding action in relation to the social rather than individual life (Marshall, 1890); and partly that there used to be a dearth of rich statistical information on individual living. However, this convention has been challenged along with the significant development of statistics in longitudinal data over the past several decades. In other words, the concentration has turned into observing the same individuals and

households through their life time.

For these reasons, the first study begins by constructing a novel index of income inequality caused by individuals' efforts based on the Theil's statistics, namely, the individual index. This index is computed by self-comparison instead of social comparison. Such an index can extract detailed knowledge about income inequality relative to the individual's efforts in the theory. Besides, it enables economists and policymakers to observe self-interest explicitly and to connect to ethics issues easily and focus on appropriate target groups. Furthermore, this extra index allows us to examine the joint effects of the two elements on a person's well-being further. This examination enlightens the belief that the distribution of a person's life is driven by social efforts as well as self efforts. Such a belief can represent different aspects of "a good life" compared with previous studies on an individual or household level in the inequality context.

Moreover, the link between income inequality and good life closely correlates to the hackneyed debate on the inequality and growth. Despite numerous studies, the link is still not well understood since there are no conclusive empirical results on the relationship. Previous investigation also solely concentrates on the unilateral social influence estimations which may provide biased results. The present study intends to present a model that explains the bilateral effects of social efforts and self-development on the living standards in one chapter.

In addition, since the political and economic philosophical idea also highlights the importance of economic opportunity to lighten the pressure of excessive income

inequality, the thesis further asks the following questions. Can concomitant economic opportunity in the emerging market offset income inequality given all these years of social efforts on developing the market economy in China? Does any economic insecurity emerge from the rapid economic growth? If so, how does it affect the inequality? Along with these questions, there are also limited studies in the literature, particularly on the concept of income mobility (Fields and Zhang, 2007; Chen and Zhang, 2009; Nichols, 2010). These reasons therefore inspire the second essay to address these interests empirically.

Thus far, the distinct contribution of the first two essays is firstly to introduce the notion of self-development into income inequality research and put emphasis on the collaboration of self efforts and social efforts to promote well-being in the research area of income inequality.

The final essay is about a specific policy analysis and intends to evaluate what social influence and efforts from government action can help to lighten the income gap. The basic consideration for such a design is that there is a need for a prior condition of opportunity or choice for releasing economic preferences and there is a lack of such luxuries in some circumstances. For example, the nature of a state-owned monopoly of a residential electricity sector in some developing countries leads to households having no choice of supplier. Additionally, to rely on households (especially low-income) to save energy is unrealistic. Hence, the help from government to smooth out the gap and lighten the burden on some individuals becomes vital. Particularly given the complexity and difficulty in China, there is a heavy responsibility and a long course to

go towards diminishing the rising gap because of its complexity and difficulty in China. Thus, this issue has not only appeared in the general plan by the state council, but also become an objective across various sectors, including education, health care, the tax system and the energy sector. Therefore, Chapter Five is designed for this purpose.

1.4 Data and coverage

The present research contains two sets of secondary data to analyze the above issues. The first two essays apply longitudinal data from the Chinese Health and Nutrition Survey (CHNS) with 14,667 adults, based on the nine selected provinces (Shandong, Jiangsu, Henan, Hubei, Hunan, Guangxi, Guizhou, Heilongjiang and Liaoning[8]); and eight waves (1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009). This dataset is one of the most widely used for the study of income inequality. Its collection is an ongoing international collaborative project between the Carolina Population Center at the University of North Carolina at Chapel Hill, the National Institute of Nutrition and Food Safety, and the Chinese Centre for Disease Control and Prevention. According to the CHNS, the survey applies a multistage, random cluster process to draw on a sample of thousands of households and individuals. The sample of households/adults was randomly drawn from nine provinces, including three coastal provinces, Liaoning, Shandong, and Jiangsu, and six inland provinces, Heilongjiang, Henan, Hubei, Hunan, Guangxi and Guizhou. These provinces vary by geographic location and economic development and can be considered as regionally representative. Four neighbourhoods in each city, one county-town neighbourhood, and three villages in each county were

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[8] Heilongjiang and Liaoning are not represented in all waves.

then randomly selected.

The last essay uses average household panel data taken from multiple resources between 1998 and 2011. The data cover the majority of provinces, except Inner Mongolia and Tibet because many data from these two provinces are not available. In terms of data analysis and methods, the project adopts various appropriate statistical techniques and models.

1.5 Outline of the chapters

The above discussions guide us to seek alternative ways of understanding the rising income inequality. The following part of this thesis consists of four chapters that deal with the issues and questions raised above. Chapter 2 provides the general context and theoretical background. Chapters 3 and 4 focus on presenting the main argument of this thesis and Chapter 5 is a case study for a policy analysis, followed by the final Chapter 6, the conclusions.

Chapter 2 is designed to discuss the practical context in China generally and seeks to answer the questions concerning what rising income inequality is, why inequality has increased and whether we should care about it; followed by a review of relevant historical economics related to self-interest and government intervention; then providing a discussion on the theoretical background of income inequality. The review focus is mainly on the inevitable interaction between self-interest and social influence in inequality with respect to individual well-being as well as the importance of economic opportunity. Hence, two claims are expected to be that the traditional index for income inequality is incomplete, which may lead to biased results when examining

the link between inequality and living standards and evaluating government actions. Secondly, sufficient and equal opportunity provided by a society may be the top priority but being able to perceive opportunity by individuals is also another essential issue.

Chapter 3 follows the theoretical guidance and intends to substantiate the first claim. By doing so, a new index is introduced to measure income inequality for presenting self efforts, namely, the individual index. Meanwhile, the traditional inequality index is for measuring social-economic development, namely, the social index. The second objective is to use the generalised moment of method analysis to examine the joint effects of the two measures on living conditions. Through the comparison of income inequality based on self efforts and social efforts, this essay expects to explore any lesson that can shed light on a better way to solve or understand this acknowledged problem in the debate.

Chapter 4 is designed to substantiate the second claim by examining the relationship between income inequalities, mobility and volatility, applying quantile regression with the same set of longitudinal data from the previous chapter. In the literature, income mobility presents economic opportunities and volatility indicates for income security. In the present study, self-interest is presented by individual income difference and is taken from Chapter 3. This essay expects to explore and evaluate whether social efforts in the sense of proving economic opportunities and income security can function efficiently on self-interest through this examination.

Chapter 5 aims to evaluate the implications of the new residential pricing system

in China by examining price and income elasticity of demand by different household types. We use pre-reform annual panel data for 29 provinces over a fourteen-year period, from 1998 to 2011, applying feasible generalized least squares models. The expectation of the finding is that the new system may not benefit low-income and rural households due to much public criticism. If this is the case, the promise of lightening the life burden though social efforts is unlikely to be carried out.

Chapter 6 intends to tie together, integrate and synthesize the various issues raised in all the previous discussion chapters, provide answers to the thesis research interests, identify the theoretical and policy implications of the study in respect of the overall study area, highlight the study limitations and provide direction and areas for future research.

CHAPTER 2 Context and Theoretical Background

2.1 Introduction

The term "economics" comes from Greek, originally meaning the art of household management (Harper, 2013). Economics in this original sense was more focused on the skills to manage a community, family business or home, including training servants, furnishing a house, and procuring food and so on. For nearly 150 years, Anglophone distribution theory deviated from the initial aspiration to aggregate levels and followed the Ricardian emphasis on functional distribution, the income shares of labour, land, and capital (Goldfarb and Leonard, 2005). Beginning in the 1960s, and consolidated by a research outpouring in the early 1970s, mainstream economics moves from the functional back to families and individual distribution (commonly named, personal, individual or size distribution in the literature) (Goldfarb and Leonard, 2005). In other words, the functional role of the three broad classes of workers, landlords and capitalists is less favourable than the role of well-being across individuals in modern economics. The fundamental need for such changes is the desired consideration of social reference into economics since the functional distribution is no longer sufficient to explain personal distribution as Goldfarb and Leonard (2005) summarize. Additionally, the functional role relentlessly treats human beings as an input factor of economic production. Nevertheless, the role of well-being changes the philosophical idea of people for production to that of production for people and draws attention to poverty (Brady, 1951), income dispersion (Brady, 1951), the determinants of personal

income (Friedman, 1953) and the development of human capital (Goldfarb and Leonard, 2005). Briefly, in contemporary economics, functional distribution remains with the original meaning and refers to the share of the national income accruing to the primary factors of production, land, labour and capital. The extended functional distribution disaggregates the functional distribution by sector and modes of production. The personal distribution looks at the share of national income accruing to each segment of the population (for example, quintile and decile).

The shifts from functional distribution to personal distribution also show the progressive demand of a rigorous understanding of human economic behaviour in a society. Many economic theories have been developed based on the exclusive fundamental theoretical basis of human nature of self-interest since Adam Smith (1775, 1776). The role of self-interest has been serving as fundamental to our understanding of how market economies function in mainstream economics. It is true that self-interest is the essential motivator in economic activity. It is possibly also true that there is no alternative to self-interest as the core to economic development since it has succeeded in many circumstances. However, this unique centre is narrow as a growing body of criticism and evidence from some economists themselves, and sociologists and anthropologists, supporting the view that people are social beings (homo socialism) concerned with the well-being of others as well as their own well-being. That would explain that government intervention always plays an important role in an economy.

In the area of income inequality, there is always a debate on the preference of either self-interest or social-interest based on the demand of government actions.

However, the ultimate solution generally relies on social influence rather than self-interest since the former is believed to be the main driving force of income distribution. Such belief reflects on social efforts on redistributing wealth from the rich to the poor and using productivity increases and human capital investment as instruments to reduce the level of inequality and poverty. However, there is a preference for whichever of the interests is unable to deal effectively with the complicated issue of inequality because the ultimate purpose for investigating inequality is to promote the well-being of individuals (Gosepath, 2011). One's well-being depends not only on self efforts but also on social efforts.

The following chapter does not intend to argue the importance of the fundamental belief of self-interest, but rather its incompleteness to address personal income distribution. Meanwhile, the chapter also argues the importance of the collaboration between self efforts and social efforts in the area of income inequality.

The structure of the chapter is as follows. Section 2.2 looks at income inequality in China descriptively; Section 2.3 and Section 2.4 are mainly a literature review of the relevant history of thought on economics, the role of social comparison in inequality, the importance of economic opportunity and an appropriate concept of mobility for looking at opportunity in China. The conclusion of this chapter is in Section 2.5.

2.2 Income inequality in China

2.2.1 The rising income inequality

The high level of income inequality has strikingly attracted nationwide attention in the

past decade, besides the fast growing economy of China. It is universally accepted that the gap between the poor and the rich has been warned about by scholarly attestation and public perception. The rising income inequality not only constrains further economic development to deal with poverty, but also affects political and social stability nationally, regionally and locally.

A popular measure of income inequality is the Gini coefficient which was developed by the Italian statistician and sociologist Corrado Gini in 1912. A Gini coefficient of zero expresses perfect equality, where all incomes across individuals are the same. Meanwhile, a Gini coefficient of one (100 on the percentile scale) expresses maximal inequality among values, for example, where only one person has all the income. According to the United Nations, the Gini coefficient of 0.2 represents an absolute equality; 0.2-0.3 means relative equality; 0.3-0.4 is relatively reasonable; 0.4-0.5 refers to a big gap; and 0.6 indicates a sharp difference. In international practice, 0.4 is seen as the warning level.

On average, the official Gini index is below 0.30 at national level in the 1980s, followed by 0.34 in the 1990s. In recent years, the Gini coefficient has been increasing gradually to 0.45 in 2004 (see Figure 2.1), and then hitting a peak of 0.491 in 2008, dropping to 0.490 in 2009, 0.480 in 2010 and 0.477 in 2011, according to Ma Jiantang, director of the National Bureau of Statistics (NBS). Some studies argue that the official Gini coefficients for income inequality are underestimated. Chen *et al*. (2010) list some studies that have more than 0.40 Gini coefficients for the year of 1995, and their study reveals the Gini coefficient at 0.61 in 2010, a much worse wealth scenario than

officially claimed.

In fact, China is not the only country in developing Asia to experience rising inequality. The latest report by the Asian Development Bank (ADB, 2012) shows that the Gini coefficient increased in more than one-third of Asian countries with comparative data in the past two decades, including India and Indonesia. However, China's Gini coefficient has escalated the most and at the fastest rate.

Figure 2.1: Income Disparity in China
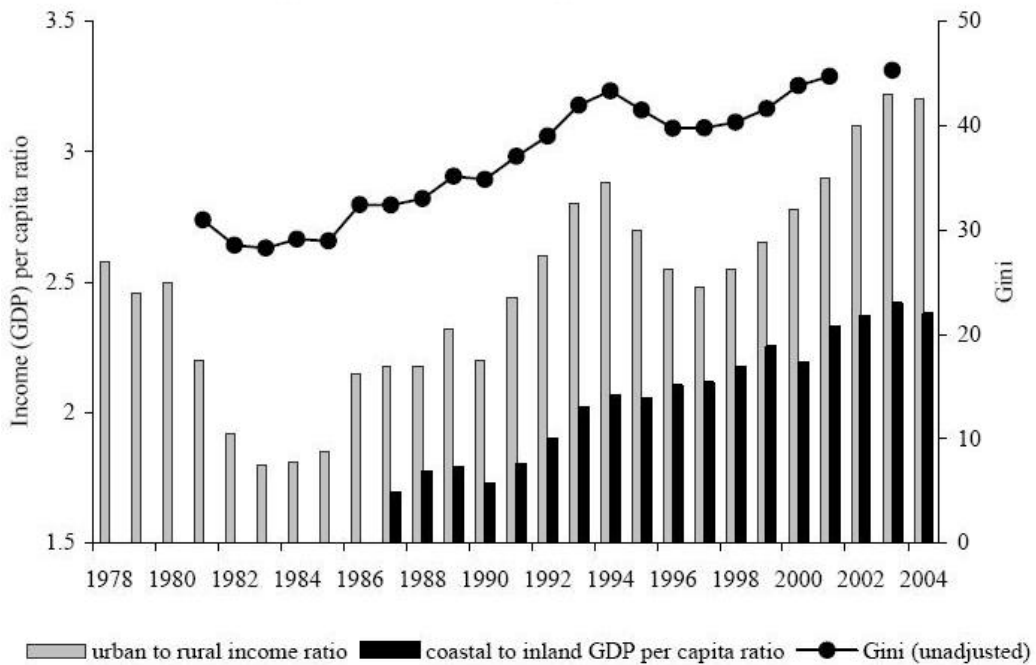
Source: Huang and Luo (2008)

One distinct income inequality is between urban and rural areas in China. Economic reform has truly made some people exceptionally rich and created an affluent urban middle class. Yet many millions, particularly in the countryside, have been left behind (Figure 2.1). The gap also noticeably reflects on all provinces, especially the disparity in the inland and coastal regions. The coastal-inland development gap and the rural-urban divide are the two principal components of

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overall inequality in China. Both urban to rural household per capita income ratio and coastal to inland GDP per capita ratio increased by almost 50% from 2.3 times and 1.7 times in the late 1980s to 3.2 times and 2.4 times, respectively, in 2004 (Huang and Luo, 2008). Several years subsequently, the growing tendency continues, that is, 3.5 times between urban and rural areas and 2.7 times in coastal-inland provinces in 2010, according to the official claim (NSB, 2011).

Residential electricity consumption is also used as supplementary information to present the issue of income inequality in China in considering the following five aspects. Firstly, the shortcomings and the quality of statistics for macro data from the NBS lead to either overestimated or underestimated results (briefly, Chen *et al*., 2010; Benjamin *et al*., 2005; Fang *et al*., 2002; Khan and Riskin, 2001; Rawski, 2001). Secondly, electricity data are recorded as a physical quantity, which may avoid as few measurement errors as possible. Thirdly, there is a highly correlated relationship between electricity usage and income growth. Fourthly, there is also unbalanced proportional spending on electricity in household consumption expenditure. Finally, the importance of energy services is a fundamental determinant of the quality of life as well as the economic vitality of both industrialized and developing nations.

Table 2.1: Proportional Residential Energy Consumption Per Capita

| Year | HCE Real Per Capita Yuan | REC Per Capita kgce | Percentage of popular residential energy | | | | |
			Coal %	Electricity %	LPG %	NG %	Gas %
1980	204.29	112	94.57	3.96	0.61	0.24	0.62
1981	209.19	101	94.27	4.16	0.74	0.23	0.60
1982	213.65	102	94.32	4.10	0.72	0.22	0.63
1983	216.74	107	94.15	4.29	0.84	0.11	0.61
1984	221.20	113	93.52	4.66	0.79	0.41	0.62
1985	240.82	127	92.29	5.84	1.06	0.37	0.45
1986	256.19	127	91.34	6.37	1.29	0.55	0.45
1987	274.94	132	90.64	6.96	1.25	0.62	0.53
1988	322.35	141	89.25	7.81	1.28	1.16	0.50
1989	356.56	139	87.39	9.03	1.53	1.27	0.77
1990	363.44	139	85.33	10.94	1.55	1.37	0.81
1991	374.30	139	83.30	12.29	2.00	1.38	1.04
1992	395.74	134	78.98	15.35	2.49	1.65	1.52
1993	455.53	133	76.49	17.59	2.96	1.38	1.59
1994	572.81	129	70.84	21.30	3.96	1.63	2.27
1995	682.41	131	68.87	22.91	5.15	1.45	1.61
1996	738.61	121	59.37	28.25	8.04	1.80	2.54
1997	760.77	119	54.72	31.58	8.39	1.79	3.51
1998	756.10	119	51.76	33.10	9.32	1.99	3.82
1999	739.77	122	49.95	34.91	9.24	2.21	3.69
2000	739.71	124	47.53	36.62	9.19	2.73	3.94
2001	745.82	127	45.25	39.08	8.75	3.34	3.58
2002	743.13	134	43.08	40.44	9.45	3.47	3.55
2003	749.57	153	41.23	42.30	9.65	3.48	3.34
2004	779.82	176	39.26	43.24	10.37	4.02	3.11
2005	801.54	194	36.53	47.06	9.22	4.28	2.93
2006	821.79	212	33.24	49.61	9.13	4.98	3.05
2007	860.02	234	28.48	53.21	9.09	6.20	3.01
2008	910.03	241	25.98	56.11	7.89	7.12	2.91
2009	908.31	254	24.54	58.42	7.59	6.99	2.47
2010	951.30	258	22.66	57.30	6.92	8.37	4.74

Source: China Statistics Year Book 2011, and China Energy Statistics, 2011 (Table 1-6).

Notes: HCE stands for household consumption expenditure and is adjusted by base year 1978. REC is annual average residential energy consumption. LPG is liquefied petroleum gas. NG is natural gas. The percentages are calculated according to GB/T 2589-2008 of coal equivalent conversion coefficient: 0.9000kgce/kg (coal), 0.4040kgce/kW.h (electricity), 1.7143kgce/kg (LPG), 1.3300kgce/cu.m (Natural Gas), and 0.5714kgce/cu.m (Gas).

As noted in Table 2.1, by 2010 electricity usage dominates residential energy consumption among five types of household common energy: coal, electricity, liquefied petroleum gas, natural gas and gas. Particularly in the past decade, the percentage of electricity usage gradually rises to more than 50% of the annual average residential energy consumption per capita. Coal used to be a large proportion but it has declined over the period of time, and such decline is opposite to household consumption expenditure. Conversely, electricity closely responds to the increased tendency of household consumption expenditure, and the correlation is 0.97 between the two.

Figure 2.2: Residential Electricity Consumption across Coastal and Inland provinces, 1998-2011
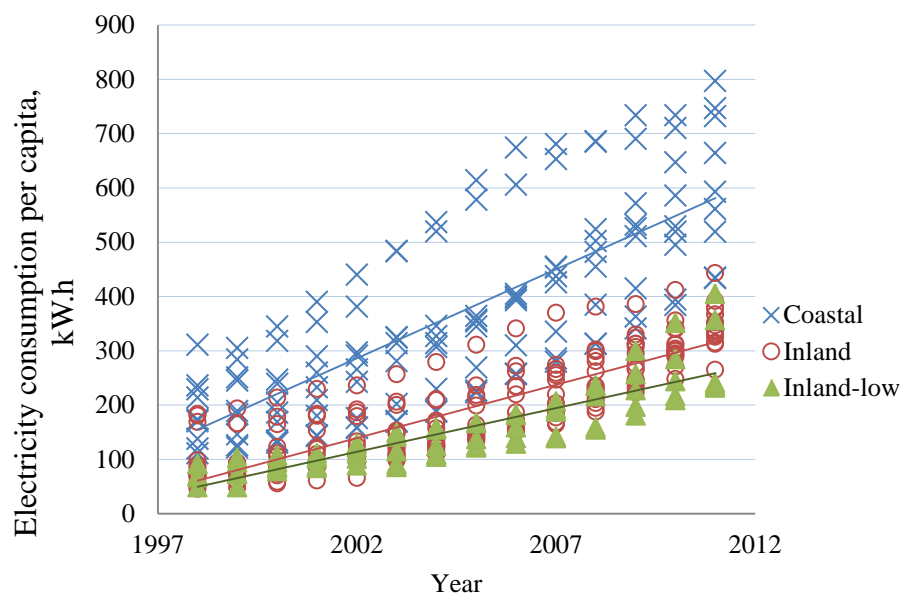
Source: Author's calculation.
Notes: Coastal region includes provinces of Shanghai, Beijing, Zhejiang, Guangdong, Jiangsu, Tianjin, Shandong, Fujian and Hebei and inland-low indicates the five lowest income provinces of Gansu, Shanxi, Guizhou, Xinjiang and Qinghai. Inland region is the remaining 15 provinces. Each of which of three lines is OLS fitted line.

Figure 2.3: Residential Electricity Consumption across Urban and Rural Provinces, 1996-2010
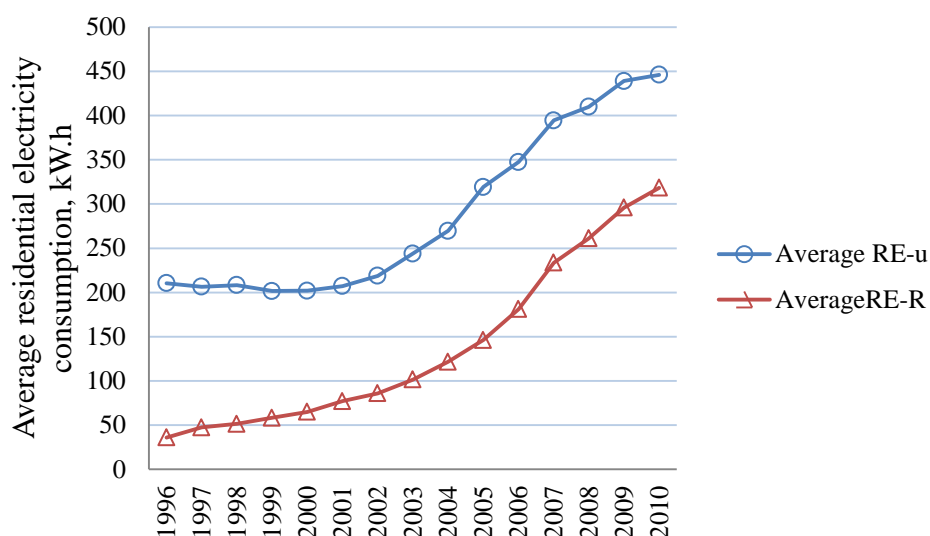
Source: Author's calculation.
Notes: RE-u is the average residential electricity consumption in urban area while RE-r is the average residential electricity consumption in rural area.

Regarding coastal-inland and urban-rural inequality, residential electricity usage displays clear positive changes and significant differences in coastal-inland regions from 1998 to 2011 and in urban-rural areas between 1996 and 2010 (see Figure 2.2 and Figure 2.3). These statistics suggest that residential electricity consumption ought to be reasonable and indicate household income inequality in China well.

In contrast to aggregate data, we also use household survey data since research finds a different picture of income inequality according to the two types of data. That is, per capita household income is substantially higher and more unequally distributed than suggested by the NBS estimates in Khan and Riskin's study (1998).

In this section, the subsample of non-negative and zero income CHNS data of wave 1989, 1997 and 2009 are used to analyze the changes in an individual's income.

There are 7994, 7844 and 5792 adults (18 years of age or older) in year 1989, 1997 and 2009, respectively. In the CHNS dataset, personal income in different survey years is adjusted to rural/urban Consumer Price Index at the provincial level.

Table 2.2: Income Inequality Changes Between 1989, 1997 and 2009

	Individual income (Yuan)			Gini Coefficient			Theil index		
Year	1989	1997	2009	1989	1997	2009	1989	1997	2009
Total	3622	5639	17615	0.450	0.463	0.493	0.402	0.410	0.454
Decomposition by area									
Urban	4000	6575	21586	0.412	0.434	0.412	0.317	0.353	0.305
Rural	3332	5158	15920	0.492	0.471	0.521	0.443	0.421	0.514
Between				0.328	0.325	0.348	0.222	0.243	0.251
Decomposition by region									
Coastal	3725	6941	19363	0.421	0.440	0.456	0.335	0.358	0.378
Inland	3560	5205	16742	0.476	0.451	0.505	0.419	0.366	0.493
Between				0.451	0.447	0.472	0.360	0.354	0.394

Source: Author's calculation.
Note: Gini coefficient is the extended Gini coefficient (Yitzhaki and Lerman, 1991); Between-group index is estimated using the Elbers and alii method (2005); Theil index is based on Theil statistics and its parameter is 0.5. Data source: The CHNS individual data.

Individual income increases manifestly from 3,622 Yuan in 1989 to 17,615 Yuan in 2009. The inequality also interlinks with such growth. The Gini coefficient increases from 0.450 in 1989 to 0.493 in 2009, while the Theil index increases from 0.402 in 1989 to 0.454 in 2009. Within rich coastal and urban areas, adult income inequality has an increased tendency in coastal region but not many changes in urban

areas over this period. Within poor inland and rural areas, the income inequality clearly increases in both places. Furthermore, inequality decreases between rich and poor areas.

Overall, the index of income inequality is larger than some previous studies in Table 2.2. There are several reasons that lead us to believe this index is acceptable. First, the Gini coefficient is generally low, based on macro national official data (Kanbur and Zhang, 2005). Second, different data may lead to different results. For example, studies by Luo and Zhu (2008) and Huang and Luo (2008) use household data, while the present study applies adult survey data. Third, the figures in the table show that the index is greater in less developed rural areas and inland provinces than in the advanced developed places (for similar results, see other calculations by Luo and Zhu, 2008). In other words, poorer areas have larger income inequality than richer areas.

2.2.2 Why has inequality increased?

The transition from a centrally planned economy to a market-oriented economy has led to trade liberalization and productivity increase and efficiency since 1978. As a consequence, the size of the economy has expanded rapidly as well as the speed of growth being remarkable. China's share of global GDP on a PPP basis rose from 3.7% in 1990 to 15.0% in 2012 (in contrast, the US share of global GDP peaked at 24.3% in 1999 and declined to 19.0% in 2013) (see Figure 2.4). Furthermore, China's real GDP grew at an average annual rate of nearly 10% from 1979 to 2012 (see Table 2.3).

This development in widening inequality is inevitable as development does not happen everywhere at the same time. Yet, the source of growing inequality should not be justified solely because of economic growth. To some extent, the rise in inequality is inevitable because of the introduction of a market system. As the Nobel-prize-winning economist Sir Arthur Lewis noted six decades ago, "development must be inegalitarian because it does not start in every part of the economy at the same time" (Lewis, 1954, p.26).

Figure 2.4: The Size of China's Economy and US Economy in Percentage
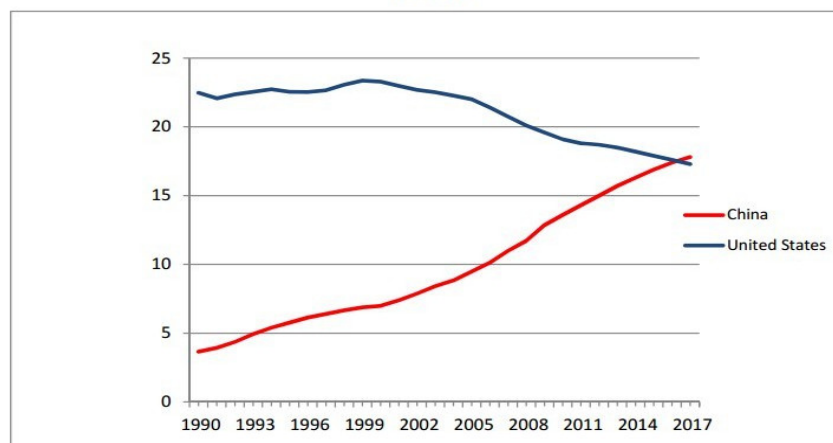
Source: Economist Intelligence Unit, 2013
Note: Based on estimates of GDP on a PPP basis and Projection between 2013 and 2017.

To some other extent, it has been exacerbated by the Chinese central government political institutions. Inequality is demonstrated as a multi-dimension phenomenon, and the central matter is often a failure in the development of the political economy (Gottschalk and Justino, 2006; Gravier-Rymaszewska *et al*., 2010). Particularly, it is three aspects of unwillingness to adjust its fundamental political institutions (Huang, 2008), government discriminatory behaviour and the inefficient implantation of policies that have worsened the inequality issue in China.

Table 2.3: China's Real GDP Growth Rate

Year	Real Growth Rate %
1979	7.6
1980	7.9
1981	5.3
1982	9.0
1983	10.9
1984	15.2
1985	13.5
1986	8.9
1987	11.6
1988	11.3
1989	4.1
1990	3.8
1991	9.2
1992	14.2
1993	13.9
1994	13.1
1995	10.9
1996	10.0
1997	9.3
1998	7.8
1999	7.6
2000	8.4
2001	8.3
2002	9.1
2003	10.0
2004	10.1
2005	11.3
2006	12.7
2007	14.2
2008	9.6
2009	9.2
2010	10.4
2011	9.2
2012	7.8
2013[*]	7.8

Source: Economist Intelligence Unit and IMF Projection for 2013 (*for July 2013)

2.2.3 Should we care about the rise in inequality?

Inequality might not be a matter of concern in itself. In economics, there is a tendency to believe that with the Pareto principle a change is considered to be good (Pareto improvement or Pareto optimality) if it makes someone better off without making anyone else worse off. Table 2.4 on income distribution shows an increased change of total income share in the richest group over the past two decades from 49.43% in 1997 to 53.74% in 2009, while there is a decrease of total income share in the poorest group from 3.04% in 1993 to 2.07% in 2009. Such changes clearly do not satisfy the common sense of the Pareto principle and indicate economic allocation is not efficient during that period of time. Whether this change is to be perceived as acceptable by members of Chinese society may depend on social norms, however.

Table 2.4: Income Distribution Between 1989 and 2009

Quintile of population	Percentage of total wave income							
	1989	1991	1993	1997	2000	2004	2006	2009
Poorest 20%	3.28	3.78	3.04	3.08	2.74	2.28	2.22	2.07
Second 20%	9.51	10.10	8.86	8.73	8.63	7.75	7.75	8.57
Third 20%	14.55	16.06	14.83	15.24	15.60	14.59	14.02	13.96
Fourth 20%	21.50	22.88	22.76	23.51	23.81	24.27	22.67	21.65
Richest 20%	50.87	47.19	58.51	49.43	49.22	51.11	53.33	53.74

Source: Author's calculation.

Perception of economic equity derives from social and cultural norms and each society will emphasize its own values as to what is equitable or not (Hofstede *et al*., 2005). Many areas in modern Chinese society have no small amount of influence from western culture, but ancient Chinese culture has spent thousands of years largely developing on its own. It is conceivable that Chinese society has its own view about economic equity. For example, the western public may be concerned about the high

level of economic inequality with regard to perfection of legal systems (i.e. the Occupy Wall Street[9] in the United States of America and the talk of tax avoidance in advanced economies in 2013). In contrast, the Chinese public may pay more attention to the inequity in relation to political corruption, particularly illegitimate private gains and unequal opportunities. This public attitude reflects on common daily life conversations among ordinary Chinese, and they can easily have heard of government officials or their family and friends accumulating vast wealth at the expense of a politically powerless working class, and can have experienced discrimination of economic opportunity. According to the report from the Pew Research Center by Wike *et al.* (2012), there are growing concerns about the high level of inequality and corruption.

Despite the different concerns between the two societies, they share common ground in that individuals are motivated by fairness. In other words, people dislike unequal distributions or outcomes (Fehr and Schmidt, 1999). Yet, they are not only concerned about their own fair return, but also the intention of their fellow citizens (Bikhchandani *et al.*, 1998; Fong, 2001). For example, if some members get rich unfairly, individuals are likely to react more negatively than when they "deserve" it. If, for instance, a political leader favours one ethnic group above others, people from the other ethnic groups probably do not have a positive attitude towards this inequality and behave accordingly. One typical example in China, inequality is generally perceived to be caused by corruption and discrimination and members of a society might be less motivated to cooperate with others or might behave improperly to gain a higher return. This improper or unhealthy behaviour in turn affects the health of an economy. More seriously, separation can lead to social tensions as the "haves" and "have-nots" are

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[9] Occupy Wall Street (OWS) is the name given to a protest movement that began on September 17, 2011, in Zuccotti Park, located in New York City's Wall Street financial district (see Gabbatt, 2011).

divided, with the opportunity to bridge that gap becoming limited. Such tensions could eventually lead to political instability as was the case in Egypt and in Syria when driven by a young population seeking economic opportunity and a better way of life (Roudi, 2011).

Nevertheless, regardless of the variation in public attitudes and similarity towards such issues, an increased high-level of income inequality has a large impact on further aggregate economic development as well as individual's economic behaviour and motivation in any economies. Human motivation is fundamentally important for economic behaviour, and it is relevant to consider its impact on economic performance. A solution to relieve the high level of income inequality can be influenced by those self-interest and social-influence concerns. Given the general picture of the rising income inequality and contemporary political-social-economic circumstances in China, the next section turns to discuss the historical development of economics in terms of self-interest and social-influence.

2.3 Historical review of economics

2.3.1 Appreciation of self-interest

Adam Smith's *The Wealth of Nations* in 1776 is usually considered as marking the beginning of classical economics. This great distinction, of course, attributes to Smith's trenchant insight of the causes of the national wealth which is not the metal of wealth, but rather the stream of goods and services that it creates. Simultaneously, more profoundly is his understanding of economics closely connected with human nature which is superior to that of his contemporaries (Coase, 1976) and led him to have been the accomplished father of modern economics.

In Books I and II of *The Wealth of Nations*, Adam Smith lays out how the

economy works. People seek material comfort and are naturally sociable, having a predisposition to "truck, barter, and exchange". From this derives market exchange, the division of labour, specialization, high productivity, accumulation and investment, higher productivity, comfort, and material wealth. This process, driven by human nature, Smith says, starts in the countryside with the expansion of productivity in making the necessities of life; moves to the towns with the subsequent expansion of productivity in making the conveniences of life; and then shows itself at last with the development of long-distance international trade in luxuries. That, at least, is the "natural" history of the economy.

His view on the nature of man in particular draws attention to the self-interest that is certainly a powerful motive in human behaviour when a condition of competition exists, but it is by no means the only motive (Coase, 1976) since he also asserts *The Theory of Moral Sentiments* (Smith, 1759). These two arguments do not contradict each other. In fact, the latter serves the former, and the former also requires such essential condition to economic prosperity. Smith believed that the ability to think long-term would curb most businesses from abusing customers. In other words, Smith expected people to practice thrift, hard work and enlightened self-interest, and thought the practice of enlightened self-interest was natural for the majority of people. Hence, based on the two arguments, Smith argues for the use of the market and the limitation of government action in economics' affairs, briefly free market, to provide high degrees of competition and no coercion which will permit individuals to get their interests out through their economic actions. Thus, this argument inspirits an essential theoretical basis of developing the subsequent neoclassical and present economics.

Similarly, John Stuart Mill's belief, in his book *Utilitarianism* (published in 1863), is that in a society where everyone is equal, each person eventually learns that

cooperation, at least in the long-run, will bring more pleasure to the individual than complete self-interest (since self-interest favours the interest of the individual over other equally as deserving people). If people forget their place in society, sanctions provide the reinforcement needed to help them remember. Consistently, a century later, Edgeworth's (1881) view that self-interest is a matter of preferences and explicitly states self-interest with great precision with "the first principle of Economics [being] that every agent is actuated only by self-interest" (p.16, cited in Vriend, 1996, p.265). In other words, this statement is clear enough to deliver a message that this is the first principle, the starting-point, of economics.

Even though Smith's brief goes thus, Shear and Healy (2011) categorize the understanding of self-interest into groups. For some, self-interest is treated as positive. It motivates hard work and innovation and balances supply and demand. Acting on our self-interest allows the economy to be the proverbial tide that lifts all boats. In agreements, we need to do as much as possible to allow people to follow their "natural" inclinations, which include deregulating the economy and creating new free markets and lower taxes. For others, this self-interest can quickly morph into untrammelled greed and cause many negative issues, including an imbalanced economy, market failure, social and environmental degradation and political corruption. In this respect, the economy needs to be carefully monitored and regulated; taxes should be raised to redistribute wealth, and policies should be legislated to protect people and the environment. People and political parties disagree about economic policy, but across the whole political spectrum, the pursuit of individual self-interest is presumed to be what motivates people in the economy itself. For the rest, the self-interest may be never understood and appreciated by this group.

2.3.2 Limitations of self-interest

Neoclassical economics may belong to the first group and remains only self-interest as the central feature to derive key economic issues with the combination of competition and disaggregates the functional distribution by sector and modes of production through supply and demand in a market. However, there are many criticisms about this exclusive fundamental and many demonstrations that human beings are not only driven by self-interest.

In a narrow sense, warnings have been issued in that the application of the calculus of self-interest may face decreasing marginal returns (Hirshleifer, 1985; Frey, 2001). A book on giving and altruism, appearing under the auspices of the International Economic Association, even describes itself as an "obituary of homo oeconomicus" (Kolm, 2000, p. 32). Studies of important activities such as charitable giving (Andreoni, 2002), voting (Mueller, 2003), and taxpaying (Andreoni *et al*., 1998) have similar conclusions. Thus, for example, it has been stated that a "purely economic analysis of the evasion gamble implies that most individuals would evade if they are 'rational', because it is unlikely that cheaters will be caught and penalised" (Alm *et al*., 1992, p.22). Furthermore, the self-interest model has been clearly rejected in a great number of laboratory experiments (see Ledyard, 1995 and Davis, 1993 for surveys). In the income inequality context, shortly, Fong (2001), Alesina and Ageletos (2005), and Boarini and le Clainche (2009) demonstrate that actions to handle income inequality cannot be explained by relying on the strict self-interest axiom.

In a broad sense, Davidson (1989) and Davidson and Davidson (1996) criticise the current conventional wisdom of neoclassical economics having ruled out the intellectual history of economic thoughts and propose how to make civic values (ethics) work with self-interest to create a more civilized economic society. Lazear (2000) and

Myerson (1999) provide two different perspectives on the broadening of economic theory. These authors differ substantially in their emphases but agree that the broadening is well underway. Frey (2001) criticises the shortcoming of the unique view of self-interest as the core of human behaviour from a moral perspective. Manski (2000) discusses the inherency of social interaction in economics, summarizing the five dimensions of constraint, expectations, preference, equilibrium and more general processes involved in social interactions. Baddeley (2010) also demonstrates that the study of economic behaviour is merely simplistically a dichotomous categorization of such behaviour as either rational or irrational, and narrow and stark from a social psychological and neuro-scientific perspective. The socioeconomics is a comparatively explicit consideration of social influence to economic decision making, which seeks to broaden its scope in economic analysis in the past decades (Manski, 2000; Zanella, 2004).

The reasons for these criticisms and challenges of mainstream economics in the present day are that, in statistical language, the focus of traditional economics (rational or irrational) may well explain the means of agents' economic behaviours, but the distribution of responses about their means was not tied to the theories (McFadden, 2001). Secondly, it may be about the perception of self-interest of economics that derives from economists and others. In these respects, economics has increasingly widened its domain today (for example, social economics and behavioural economics). At the same time, the rapidly increasing availability of microeconomic data and booming empirical techniques lead economists to pay more attention to the variations in human behaviour across individuals.

2.3.3 The role of government intervention

The classical view of income distribution is mainly concerned with functional factors for the growth of the wealth of a nation which comparatively advocates government intervention. These factors, in turn, guide politicians to make economic policy to affect the whole economic performance of a country. The most influential of classical economists such as Adam Smith and David Ricardo among others, in short, believed that the distribution of income is between the main factors of production, land, labour and capital. David Ricardo (1817) further classified the aggregate source of income into rent, profit and wage. One difference between Smith and Ricardo is that the former's influences are on the grounds of his prosaic observations about how the economic system operates (Samuelson, 1992) in terms of the general causes and the nature of the wealth of a nation, but rather statements. In contrast, Ricardo critically reviews Adam Smith's work and specifically translates it into pure economic considerations, namely, economic principles which comparatively attract academic attention. In short, Adam Smith provides more discussions in a broad sense than Ricardo, while Ricardo further develops Smith's work in a narrow focus (Samuelson, 1992).

The common ground is the same from these two great economists. Smith and Ricardo both argued to limit the power and size of government since the invisible hand is capable of illuminating self-interest. Subsequently, John Maynard Keynes (1936), on the other hand, advocates government intervention, particularly in fiscal and monetary policies in war time and post-war. Paul Krugman (2008) was one of the most prominent advocates of the 2008–2009 Keynesian resurgence and called for greater use of stimulatory fiscal policy to reduce unemployment and boost to fix the economic downturn since 2008. These views are not contradictory. The former concentrates on

the long run which believes that the economy is self-regulating and the latter two are for the short run which explains the need for government intervention to achieve economic stability (Minsky, 2008). More importantly, the historical background is totally different economically and politically. In these respects, policy influence on an economy is unavoidable and necessary in economic shocks, as argued by some but not all economists.

For these economists who support government intervention (especially Keynesian), their notion is linked to Adam Smith and David Ricardo's belief of self-interest and competition. This invisible hand in the market would strongly lead to proper pricing playing a large role and more efficiently guide the market place in their economic policy recommendations. However, Smith did not condemn government intervention completely. In fact, he suggested regulation creates a playing field upon which the market can operate the most efficiently. For example, the *Wealth of Nations* devotes regulation into the banking system. This group of these economists expects that policy could modify individuals' economic behaviour (at least some) and lead to satisfying economic results.

For these economists who advocate a free market, their fundamental theoretical basis is no doubt rooted in Adam Smith's beliefs that a free market is more effective than government intervention. Economists such as Milton Friedman (1962) from the Chicago School and others from the Public Choice School, argue that market failure does not necessarily imply that government should attempt to solve market failures because the costs of government failure might be worse than those of the market failure it attempts to fix. Beyond philosophical objections, a further issue is the practical difficulty that any single decision-maker may face in trying to understand (and perhaps predict) the numerous interactions that occur between producers and

consumers in any market. Mitchell (2005) uses standard theories to discuss the costs and benefits of government spending and provides its evidence, and also points out that scholars have found a clear negative relationship between government spending and economic performance with a list of recent academic research.

Nothing is new; modern economics began with the fight for market freedom by Adam Smith, and present-day economics still keeps the battle of market freedom. Over the period of time, these controversies surely have yielded many insights on the structure of economies. However, the debates of whether smaller government size or bigger government size will keep carrying. Furthermore, almost every economist would agree that there are circumstances in which lower levels of government spending would enhance economic growth and other circumstances in which higher levels of government spending would be desirable (Mitchell, 2005). In this sense, exclusion of government intervention is impossible and there is always a role for government in regulating the market to achieve a more optimal distribution of resources. Nevertheless, one belief that has never changed between these macroeconomists is that government policies have powerful impacts on self-interests either positively or negatively. In other words, the underlying message is that self-interest is not impervious so that policy and any other social influence always play a role in any economy.

One may argue that government policy and social interrelatedness are understood as instruments of self-interest, and only affect the appeal of self-interest. This view certainly is not egregious, and it has long been the dominant view in psychology and in much of Western thought. Thomas Hobbes (1588–1679),[10] the seventeenth century philosopher, long believed that human beings always acted from

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[10] See his book *Leviathan* (1651).

self-interest. Additionally, this very core of economic values has made significant contributions.

Yet, the exclusive emphasis of self-interest in mainstream economics is incomplete, given more rigorous consideration in the present-day study. Likewise, possibly market failure is an important consideration for government intervention, but it is also insufficient to justify policy and government action. In this sense, we argue that any economic judgment and planning lies on two fundamentals of self-interest and social influence (for example, policy, social norms and environment), including the field of income inequality.

2.4 Theoretical background of income inequality

2.4.1 Preference for self-interest and social-influence

High levels of income inequality are one of the areas that emphasizes social influence over self-interest. Its philosophical consideration regards social influence as the main driving focus to handle such issue, which reflects on the debate over inequality as the matter of what government can or should do about it. The common actions taken by government for the reduction of income inequality are redistribution by taxes, regulations or targeting assets, sales and price with releasing constraints and accessing economic opportunities. As in the Chinese saying, "the more you work, the more mistakes you make", it is not surprising that the central problem of the high level of income inequality is often attributed to a failure in the development of political economy.

Preferences for government actions are generally viewed to be influenced by values and beliefs about distributive justice, including both self-preference and social-preference in the literature (Cruces *et al*., 2012; Alesina and Giuliano, 2009;

Alesina and Angeletos, 2005; Edlund, 1999). The former preference emphasizes individual efforts to determine income and so that all have a right to enjoy the fruits of their efforts, it will choose low redistribution, low taxes and fewer policies in a target area. In equilibrium, efforts will be high, the role of luck is limited, market outcomes will be quite fair, and social beliefs will be self-fulfilled. In this way of thinking, if individuals put forth different levels of efforts, they will wind up in very different economic places so that the return on such efforts are high, and inequality is a natural (if sometimes unfortunate) outcome. In such a society, social competition and fairness are generally high. Eventually, government assistance is out of favour. Contrariwise, the latter believes that luck, birth, connections and/or corruption determine wealth and poverty is caused by circumstances beyond individual control so that people may prefer more government action regarding the poor, distorting allocations and making these beliefs self-sustaining. In this mind-set, inequality is seen as improper. In a society with such circumstances, social competition and fairness are low and influence from government actions is relatively high. In short, beliefs about the causes of income inequality determine government actions.

Perceivably, these beliefs are developed based on external and internal factors (Alesina and Giuliano, 2009). The external factors are the influence from other people and society, including surrounding information and circumstances that one is in. In contrast, the internal factor refers to one's self efforts, research, attitude and experience concerning a particular interest. These factors suggest that people do not immediately (if ever) associate with what seems best particularly with regards to imperfect information for their self-interest or social-interest. In this respect, neither self-preference nor social-preference constantly secures and guarantees optimization of the best for oneself and/or society. The expectation of one or other preferences for the

reduction of high levels of income inequality is not effective and substantial to meet the ultimate purpose of well-being. Thus, the overemphasis of the role of government on inequality may lead to inappropriate policies and actions that worsen inequality further as well as discourage motivation for individuals to lift up their well-being by self efforts.

2.4.2 The role of social comparison

One may argue that a decision made in the pursuit of self-interest also promotes social interest when the decision that was originally made to benefit oneself, as a result benefits society as a whole. However, what appear to be an individual's own efforts in response to his self-interest require the help, participation or cooperation of others. People come to know themselves by evaluating their own attitudes, abilities and beliefs in comparison with others. This evaluation process is called social comparison in social psychological study and that was initially proposed by Leon Festinger in 1954. Its concept concentrates on comparisons between the self and others and is a fundamental psychological mechanism influencing people's judgments, experiences, and behaviour. Social comparison is believed to be natural existence in human behaviour (Baumeister and Bushman, 2012). That is, people all compare themselves to others.

The benefits of these comparisons engage individuals to gain accurate self-evaluation, self-esteem and self-enhancement since these enable people to evaluate their own opinions and abilities by comparing themselves to others to reduce uncertainty in these domains, and learn how to define the self (Goethals and Darley, 1977; Wills, 1981; Tesser and Campbell, 1982; Kruglanski and Mayseless, 1990; Suls *et al*., 2002; Buunk *et al*., 2013). Conversely, the costs of the comparisons reflect

destructive emotion and behaviours, including envy, guilt, regret, and defensiveness, and to lie, blame others, and to have unmet cravings with frequent comparison (White *et al.*, 2006). Similarly, Luttmer (2005) also demonstrates that individuals' self-reported happiness is negatively affected by the earnings of others in their area.

The topics of happiness and life satisfaction have attracted unprecedented attention in contemporary well-being study as well as public interest. The two factors for well-being are highly associated with psychological status such as moods, emotions and self-evaluations. Social comparison is the channel that can deliver such desire. In other words, the subject of well-being is a cross-disciplinary study. The arguments for cross-disciplinary research have been applied recently in the research area of poverty, inequality and well-being. Hulme and Toye (2006) believe that the study of well-being and inequality and poverty is a particularly appropriate subject for cross-discipline research, and conclude that cross-discipline working should be promoted and that both interdisciplinary and multidisciplinary approaches can benefit research on poverty and well-being.

Income and well-being are highly related (Alderson, 2013; Alesina *et al.* 2004; Knell, 1999). It is worth mentioning that the ultimate goal of income equality is to promote individual well-being. This pursuance is difficult to achieve without addressing the component of social comparison since it is common that people judge their well-being such as happiness and life satisfaction partially by looking at others' income levels. As studies demonstrate, the close relationship between income and well-being is attributable to the social comparisons that income engenders (Alderson, 2013; Hagerty, 2000).

Furthermore, the notion of social comparison has been long indirectly embraced in the scope of income inequality study in relation to the consumption theories of

absolute income and relative income. The absolute income only reflects the total amount of earnings one has received in a given period. Keynes (1936) creates a theory of consumption based on people's absolute income. According to Keynes, consumers would spend a smaller percentage of their income as their absolute income grew larger, simultaneously increasing their savings rate. In contrast, the relative income takes into consideration others in a society and measures one's income in relation to other members of society, weighing it against the standards of the day. Duesenberry (1949) challenges Keynes's argument in the light of social and psychological dimensions and introduces the relative income hypothesis, which demonstrates that people make decisions based not on absolute income but on relative income. Duesenberry argues that consumers view their own position in relation to others, and behave accordingly.

However, Duesenberry's theory was not appealing and replaced by Modigliani and Brumberg's (1954) lifecycle theory of consumption and Friedman's (1957) permanent income hypothesis in the 1950s. Subsequent theories mainly focus on self-interest and emphasize utility maximization without regard for social concerns (Palley, 2008). Over the last decade, there has been a revival of interest in Duesenberry's ideas on relative income and consumption (Palley, 2008). This research has been primarily sociological and microeconomic in focus.

2.4.3 Economic opportunity at micro level

Opportunity is regarded as the key for the pursuance of self-interest to lift up standards of living in the literature. The emphasis on the importance of opportunity has a long historical development in institutional economics. The development has experienced the shift from the functional distribution to the personal distribution and the question of why individuals get what they do to what they should get.

Income inequality starts from the context of the functional distribution and is hinted to be inevitable in an economy and not problematic under the condition of economic prosperity by the most influential economists such as Adam Smith and David Ricardo since the 18th century. However, it did not pass without prominent criticism, which began in the early 20th century (Goldfarb and Leonard, 2005), including economists Edwin Cannan (1905), and Hugh Dalton (1920). They all called for the requirement of personal income distributions since income inequality was believed to be a question of persons rather than categories. Later on, along with further theory development (for example, human capital theory), state activity and data collection, among other things (Goldfarb and Leonard, 2005), the functional distribution concept can shed any light on poverty issues as it had virtually nothing to say about the distribution of income by the individual, family or household at its lower end. Hence, the blossoming of research into personal income distribution took place in the 1970s.

This change also shifts the question of the determinists of income distribution to why individuals get what they do. In the supply-demand models, the size distribution is based on the notion that an individuals' income is determined by the sale of a variety of personal attributes. The vector of attributes includes race, gender, social status, geographic location, and aptitude; the demand for these attributes is generated by the production profile of the economy. The price associated with each attribute is thus determined by the interaction of supply and demand forces. In the one-sided supply models, personal income is defined as the market value of sales of services from human and non-human capital, assuming rates are given; changes in the size distribution of income are due to inheritance, modified by thrift, ability, industry, luck and fraud and also marriage. Pryor (1973) demonstrates that no more than 50% of

household income changes can be explained by systematic forces. In effect, according to these models, the poor are poor because they are born of poor parents, marry other poor folks, and/or are unlucky. In terms of Human capital theory, this explains that individuals could affect their income levels based on individual capital (Mincer, 1958; Becker, 1975; Checchi, 2006; Galor, 2011); therefore, their locations in the income distribution are determined by the investment choices they made with respect to schooling, training and so forth (Goldfarb and Leonard, 2005).

Furthermore, the question of "*what should they get*" is always the interest behind in general distribution study (Goldfarb and Leonard, 2005). Political philosophy has shifted sharply away from utilitarianism as a theory of justice or as a measure of social welfare over the past forty years (Roemer, 2006). The shift may be marked most easily by the publication of Rawls's (1971) magnum opus. Rawls proposed to adopt the availability of "primary goods" to its worst-off member to measure the welfare of a society since it does no harm to interpret this as income, or consumption, of its worst off member.

Rawls's proposal was challenged from two different directions in brief order. Firstly, Sen (1981) argued that Rawls was inappropriate to be concerned with the *goods* people received: better, he stated, to be concerned with how well people could function with those goods. Thus, shortly, Sen's proposal was that social welfare should be measured by the capacity to function off its worst-off members. The second challenge was from Dworkin (1981) who argued that Rawls had slighted the issue of personal responsibility. The goods a person receives (think of these being income, for short) are a consequence in part of personal choices for which, ethically, it is appropriate to hold the individual responsible. Inequalities which result from such well-informed choices are not morally unacceptable. Dworkin advocated 'equality of

resources', in his own words, which is a doctrine in which individuals are compensated for the paucity of resources assigned by the natural lottery (including, importantly, the resources supplied by the individual's family), but not for the consequences of choices that flow from the individual's well-considered, adult preferences. Precisely to define the criterion of distributions of income and wealth satisfactorily is a tricky business, about which much has been written in the last 25 years, as Roemer (1998) stated (for a partial summary, see Roemer, 1998). In 1989, Richard Arneson and G.A. Cohen responded to Dworkin's proposal and proposed that although Rawls' criticism was cogent, his remedy was not quite right. Arneson suggested that the right approach was to equalize opportunities for welfare with the respect of human nature of self-interest. Roemer (2006) empirically demonstrates Arneson's proposal and claims economic opportunity is the key to inequality. If there is no opportunity, self-interest is not able to bring an effect on prices, sales and assets.

According to the review above, an understanding of income inequality is related to differences of personal attributes or individual capital that lead to differences in price, sales and assets from the micro perspective. From the macro perspective, opportunity is established as an efficient channel to deal with income inequality, which suggests political economy ought to provide sufficiently and distribute equally.

However, the understanding of the determinants of income inequality from micro perspective may be fairly superficial. Variations in individual capital certainly affect income return but the insight is the variation of the sensitivity to opportunity.

Opportunity is regarded as originating as perception in microeconomics. In other words, the perception of opportunity depends on the agent's discovery (Alvarez and Barney, 2007) and creation (Venkataraman *et al*., 2012). There have been many debates on the issue of opportunity identification in the economics of entrepreneurship

(see Shane and Venkataraman, 2000; Ardichvili *et al*., 2003; Klein, 2008; Vaghely and Julien, 2010; and Hayton *et al*., 2011). Likewise, such issue also appears across individual and household levels; for instance, opportunity is identified or recognized by some individuals but not others as result of income difference. This difference is likely due to the heterogeneity in individuals' sensitivity to opportunities (Ardichvili *et al*., 2003). Additionally, the heterogeneity is highly associated with variations in individuals' genetic makeup, family background, work experience, education, and/or in the amount and type of information they possess about a particular opportunity. Becker (1976) notices that differences across individuals generate different incomes over time and inequality is produced by differences in the demand and supply functions facing different people. However, source of knowledge about opportunity tells the insight into the different incomes, or inequality is the sensitivity to opportunity, according to the differences across individuals.

There are diverse views about the perception of the existence of opportunities among the public. For some, what they are concerned about is whether specific people with specific resources can exploit it. This belief is reasonable. Opportunities are neither real nor false in the abstract. They are simply hypothetical or potential. If one fails to extract "an opportunity", it does not necessarily imply that the opportunity did not exist. It may merely imply that one in particular was ill-suited to exploit it. However, if such cases are not small scale, social efforts need to participate more in giving information and helping individuals to identify opportunity.

Finally, action in pursuit of the perceived opportunity is motivated from two aspects of self-referential observation and/or social comparison. Perceptions may turn out to be right or wrong so that opportunity needs to be evaluated by individuals through themselves and comparisons with others. A combination of the two sources

can choose the most advantageous options, which can result in improving income status. Hence, there is a need to look into these two factors simultaneously when income inequality is observed at micro level.

Shortly, the literature sheds light on opportunity being the best path to face the problem of income inequality, and it particularly emphasizes what government should supply and how much opportunity people have. Our discussion of income inequality with respect to the sensitivity of opportunity provides more insight of the problems at micro level. At the same time, we emphasize the interaction between individual and social efforts.

2.4.4 Theoretical change of income inequality in China

Since the establishment of the People's Republic in 1949 by the Chinese Communist Party, the view of income inequality has changed alone with its economic development from a centrally planned economy to a market-orientated economy, especially the economic turning year of 1978. Clearly, the former economic system is grounded in socialism (Marxist regime) while the latter system is associated with capitalism (democratic regime).

Socialism and capitalism differ in the way that socialism theoretically advocates economic equality of income and wealth across individuals for its own sake – as an end or as partly constitutive of some end. In other words, socialism stands by horizontal equality. To achieve this goal, socialism urges the desirability of eliminating some of the inequalities associated with the institutions of a capitalist market economy (Arneson, 2013). By doing so, it generally has to enforcedly equalise output across individuals economically and politically in a society. In this sense, there ought to be no inequality in a socialistic society. This horizontal equality ideally provides a good

picture in a society. However, this ideology is not favoured by economic development. Past experiences (i.e. People Commune[11]) have shown that socialism has been excluded because of its impractical ideas. One fundamental defect is that socialism is implicitly unwelcome to inherent human nature such as in the differences among individuals and their corresponding unequal assets. Certainly, individuals have immeasurable intrinsic worth and should be treated with the same respect, regardless of their race, religion, gender or socioeconomic condition, but that does not imply that one should strive towards eliminating differences between individuals in terms of their tastes, abilities and interests (Rohac, 2011).

Conversely, the pivotal brief of modern mainstream economic theories (or capitalism) is that these differences among individuals determine economic outcomes and lead to economic prosperity. People have different innate abilities, different human capital and different wealth. These differences mean that individuals earn different incomes in a market economy because the amount of one's labour contribution varies. However, socialism is not in favour of this belief and consequently, economic development is inefficient, in spite of the fact that it can control inequality well. Hence, the slogan of abandoning the practice of having everyone "eat from the same big pot" is the herald for economic reform and opening-up. Deng (1983) put forward the principle of "distribution according to work" (p.101) and The Sixteenth Congress (2004) clearly emphasized guarding against an excessive disparity in income while opposing equalitarianism.

This reform has brought an unprecedented increase in economic freedom for hundreds of millions of people. As a result, China's economic growth has been

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[11] The People Commune is from 1958 to 1983 in China. It is commonly known as The Big Rice Bowl which is a Chinese term used to refer to egalitarian distribution. In the commune, everything was equally shared regardless of the work done (see Meisner, 1999; Zhou, 1959)

remarkable since 1978. During this transition economy, however, some contemporary Chinese people believed that their lives became worse compared with the pre-transition economy.[12] The main reasons are likely to be that: 1) an increase in inequality is expected due to the size of the expanding economy; 2) competition in the labour market increases because "eat from the same big pot" has broken down; 3) these people may not realize that there is a great hidden inequality in a pre-transition economy.[13] Such inequality was caused by the uncontrolled socialistic political power (Henderson *et al.*, 2005).

Tt is really easy to understand how traditional socialism works and why it cannot work in China, as well as its worldwide collapse in the 1990s. Government takes everything from these who have and give it to those who have not. In return, such extreme artificial equality destroys the human nature of self-interest which is the foundation for economic development.

Over the years, although China officially has kept its emphasis on the development of socialist modernization, it has become capitalist (Coase and Wang, 2014; Huang, 2008). The most distinctive feature is that capitalism in China operates under the one-party system, while capitalism in the West is under democratic regimes. The market in the former is regarded as the greatest economic transformation by scholars (Coase and Wang, 2014) and the markets in the latter are still the most advanced and leading economies in the world. However, large incomes and wealth inequality have arisen in both economies.

This partially explains why Marxism is on the rise again in the West, especially in the USA and Europe (Gregory, 2012). A form of modern socialism has also emerged in the 21st Century alongside the economic contradictions (e.g., a fevered topic of

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[12] This reflects on commemorative events of Chairman Mao (see Wang, 2013).
[13] See Henderson *et al.* (2005).

inequality) and recessions (e.g., the Global Financial crisis 2008) that inherently exist in capitalism (Piketty, 2014; The Economist, 2013; Wolff, 2013; Jeffries, 2012; McMillan, 2011). The form is featured by a focus on taking money from the rich[14] (Piketty, 2014), on developing the welfare state (Gregory, 2012) and on expending large coordinated banks (McMillan, 2011). These features are expected to reduce the disparity.

Compared to China, the emphasis of socialism is more on paper rather than on the ground. According to Huang (2008), the economic theory is not 'socialism with Chinese characteristics', but the opposite: capitalism with Chinese characteristics. This capitalism with Chinese characteristics is considered the key issue, resulting in a weak financial sector, income disparity, rising illiteracy, productivity slowdown, and reduced personal income growth in the 1990s and beyond. The reason is that such capitalism emerges with two enormous characteristics: a more entrepreneurial and market-driven version of capitalism in the 1980s and a state-led urban capitalism since then according to Huang (2008).

China also creates and introduces to construct a socialist harmonious society.[15] This construction serves as the ultimate goal for the ruling Communist Party of China along with a *Xiaokang* society, which aims for a "basically well-off" middle-class oriented society (The Sixteenth Congress, 2004) and bringing about

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[14] Piketty (2014) finds that, over the long run, the return on capital is higher than the growth rate of the overall economy. In other words, accumulated and inherited wealth becomes a larger fraction of the economic pie over time. Therefore, he prescribes a progressive global tax on capital (an annual levy that could start at 0.1% and hits a maximum of perhaps 10% on the greatest fortunes). He also suggests a punitive 80% tax rate on incomes above $500,000 or so.

[15] The phrase Socialist Harmonious Society is a socio-economic vision that is said to be the result of Chinese leader Hu Jintao's signature ideology of the Scientific Development Concept (The Sixteenth Congress, 2004). In addition, the phrase can relate back to the time of Confucius when music could bring about harmony by maintaining balance in the society (Li, 2006).

harmony by maintaining balance in society (Li, 2006). Under the umbrella of this new development strategy, China continuously focuses on economic growth but with a direction of sustainable and equitable growth (Li, 2013) and the improvement of the welfare system (Ringen and Ngok, 2013). A new plan for income inequality reform was also issued in 2013 (State Council, 2013, No.6).

In practice, however, the "harmonious society" paradigm has come under criticism as corruption and income inequality have actually worsened over the past decade. The pursuit of "harmonious society" is also often used by the government to justify the suppression of dissent, and information control in China. For example, "harmonized" has become a byword for "censored" in Chinese online jargon. This phenomenon indicates that some ordinary Chinese people do not regard the prospects for the construction of a harmonious society favourably. The society is highly imbalanced (i.e. huge social injustice and inequality) and lacks fairness and equality which are elementary issues for providing equal economic opportunity.

2.4.5 Economic opportunity in China

As previously discussed, under the western philosophical ideas of "equality of opportunity" and "equality of outcome", a branch of scholars argue that equal economic opportunity is superior in diminishing inequality [16] (Gosepath, 2011; Roemer, 1998, 2006). The underlying messages of the ideas are that: i) the consequence of rising inequality by economic growth does not necessarily have negative implications and equal opportunity would achieve a distributive efficiency without constraining economic growth; ii) equivalent economic opportunity across three classes of the community and within the community in a society is an effective

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[16] This ideology lies in one of the most prominent conceptions of distributive equality, equality of opportunity.

approach to be "better off", since it enables every individual to live a life of economic opportunity and allows them to improve their standards of living through their own efforts. In other words, this does not discriminate against citizens or hinder opportunities for them to prosper and/or there is no state of economic affairs in which the government promotes equal prosperity for all citizens.

The definition of equal opportunity is clear, but it is not easy to measure. It also seems to be inappropriate to observe the relationship between the equality of economic opportunity and income inequality in China directly. It is generally accepted that the increase in Chinese income levels is the outcome of the combination of trade liberty and the improvement and expansion of productivity. Higher trade liberty likely indicates more degrees of equality of opportunities. In contrast, the higher the productivity suggests there are more job opportunities in a society, but this does not necessarily mean more equal opportunities. The year 1978 is always viewed as a turning point in Chinese market liberalisation. More than three decades of development and it is still comparatively an imperfect and uneven market. Such economic circumstances make it much more difficult for some individuals either to take advantage of newly emerging opportunities, or to smooth a variety of shocks to their incomes that now are part and parcel of living in a market economy (Benjamin *et al.*, 2001).

Furthermore, under the same definition of equal opportunity, it is clear that the condition of economic opportunity in the case of China is worse than in the advanced economies, typical example labour and household restriction by Hukou policy as well as regional discrimination (urban with rural, and inland with coastal) and so on. Yet, compared to China itself, the situation in China now has substantial improvement in equal opportunity compared with decades before, which reflects trade liberalisation.

Bearing in mind that equality is highly associated with political systems, it is clear that the central government of China is likely to be unwilling fundamentally to change its political institutions which will primarily affect further degrees of openness in the market and equal opportunities. An alternative is needed to handle income inequality. The literature suggests that the concept of mobility (briefly, Friedman, 1962; Atkinson *et al*., 1978; Markandya, 1984; Jarvis and Jenkins, 1996; Björklund and Jäntti, 2009) could discover economic opportunity, openness and its functionality in inequality. This suggestion motivates Chapter 4 for the investigation of income mobility.

2.5 Conclusion

This chapter begins by descriptively looking at the rising income inequality in China with macro, micro and energy data, discussing its causes, and the motivations for paying attention in the case of China. The chapter then turns to review the appreciation of self-interest along with historical thoughts of economics, followed by discussing the encompassment of social influence (i.e. government action and social interaction) in economic behaviour, further to extending the underlying co-actions of self-interest and social-interest to the issue of income inequality, the role of social comparison and the importance of opportunity in the income inequality literature.

What we learn from the literature discussions can be summarized in the following points. First, the human nature of self-interest is the unique key theoretical fundamental in modern economics. However, this importance has become rather controversial from a theory perspective in contemporary economics since people's action may be derived from an external source other than perception of economic self-interest. The external source includes environment, culture, religion, social norms and policies and so on. This could explain the reason why social influence such as government action always plays an inevitable role in economic development. Second,

income inequality is one of typical areas that greatly rely on government actions by redistribution or releasing constraints and accessing economic opportunities. The literature does not miss the fact that the role of government depends on the preferential concerns of self-interest or social interest. For the belief of self-interest, the latent assumption is that an individual's wealth is gained by his internal factor such as efforts. Meanwhile, for the belief of social-interest, the individual's wealth is received through his external factor such as luck and unequal opportunity. Nevertheless, the literature rarely stresses the point that one's preference is affected by social influence, and well-being embraces income comparison with other members of a society from the theoretical perspective. Third, the literature clarifies that opportunity is the crux of the matter in the problem of income inequality but rarely concerns the source of opportunity knowledge at micro level. Hence, the claim we repeatedly hear is that the variations of individual capital engender income inequality from the microeconomic perspective. However, the discussion in the present study discovers that the insight of the issue is the sensitivity of opportunity according to individual capital. Such sensitivity or identification needs not only individuals' efforts to discover, but also the help of social efforts. Finally, the literature suggests that economic opportunity is an efficient path to look at inequality, and mobility can be a good indicator for equal opportunity. In respect to the three lessons, the following three empirical chapters will examine the issues directly or indirectly in the case of China.

CHAPTER 3 New Ways of Looking at Income Inequality Related to Living Standards

3.1 Introduction

The previous chapter theoretically discussed the combination of self-interest and social influence to address income inequality which would be effective and sustainable for the promotion of well-being. This chapter embraces such an idea into an empirical analysis of the returns on social efforts and individual efforts related to income inequality in living standards.

This chapter begins with a review of the measurements of income inequality in the literature and the most popular measurements are classed by three categories: Gini coefficient, Generalized Entropy and the Atkinson measure (Cowell, 2000, 2011). These measures, especially the first two, focus on a concept of measuring paired income distance, 1) between each income and reference income (i.e. population mean) and, 2) between individuals income pairs at a point in time or across time (or space) (Jenkins and van Kerm, 2008; Cowell, 2011). This concept embeds a belief that social comparison is a drive of individuals' well-being from a social psychological perspective, and the corresponding index (traditional index) is generally used to examine the effect of income inequality on well-being and judge the efficiency of government policies and actions as a whole. We argue that this judgement is insufficient since i), an individual's well-being depends on self efforts as well as social efforts and ii), relevant income differences among people are a result of the two efforts derived from self-interests and social influence.

This study aims first to provide two-sided information on income inequality with

the Theil statistics to examine their effects on living standards in the case of China. This examination applies individual survey data from the China Nutrition Health Survey (CNHS) between 1989 and 2009, using a statistical model of the system generalised moment of method technique. The main finding is that the returns on social efforts and self efforts related to income inequality in living standards do not function properly, which reflects on a positive coefficient of social inequality in the short run and a U-shaped individual inequality in the long run. This implies that income inequality caused by social efforts such as the excessive focus on economic growth leads to an improvement in the means of living standards. However, income difference from individual efforts suggests that individual income inequality does not widen in low income class but high income, and convergence does not occur. Hence, the return on social efforts is not substantial.

Whereas many theoretical models investigate the effect of income inequality, the cross country empirical evidence that uses income inequality measures is not conclusive in this matter; different specifications and different econometric techniques reveal different results. This study proposes the idea of the importance of the combination of self efforts and social efforts to living standards and explores how insightful this idea is. By so doing, the study firstly looks at income inequality through the concept of social efforts and self efforts. Furthermore, given the importance of the time horizon effect, there are very few studies that have considered the short run and long run relationship in one unified framework. Hence, the study incorporates different time interval effect into the models. In all respects, our results are intended to contribute extra new understanding about inequality and well-being.

This chapter is organised as follows. Section 3.2 is a review of the traditional

measurements of income inequality, followed by our measures of income inequality index at micro level. Section 3.3 discusses the related relationship between inequality and income growth in the literature. Section 3.4 concerns statistical models for qualifying the proposed claim and examines the two income indices, followed by the results in Section 3.5. The final Section 3.6 is a discussion and conclusion.

3.2 Measures of income inequality

3.2.1 Traditional measure

There is a vast literature on the methods of measuring income inequality. These methods focus on the simplest context of the evaluation of income status of agents. However, the underlying two notions of these approaches and their corresponding applications seem to be insufficient for the quality of life at micro level.

First, most assessments of inequality follow the philosophical consideration that the social-economic process and development are a drive of individuals' well-being since traditional framework assumes that every agent makes the same efforts and acts rationally for their living. Apparently, this closely links to the fundamental assumption of the economics approach, to law and everything else in that people are rational. Second, another relevant underlying belief for the traditional framework is the focus on social comparison as a way of self-enhancement and self-evaluation. This reflects on most theories of equality dealing exclusively with distributive equality among different people through the purpose of making assessments of inequality being to promote the well-being of individuals (Gosepath, 2011).

Under these guidelines, scholars have designed a great number of analytical tools to summarize inequality in terms of a single number (index) and compare corresponding

sub-distributions among different groups. The index is generally obtained by calculating the distances between two income statuses. Most previous studies follow this routine to provide descriptive information, for example, Chen *et al.* (2010), Hills (2010) and Wu and Li (2013). However, this conventional framework has two shortcomings to measure income inequality when the ultimate goal is to improve the quality of life at micro level.

The first shortcoming relates to measuring the distance between each income and the population average income. This distance-measure is certainly needed to provide a snapshot of the whole inequality, and it is rational to evaluate descriptively economic process and policies by adopting the mean income of population as a reference, since economic prosperity or growth raise the means of standards of living.

The weaknesses of the distance-measure are two. i) Aggregate information is not comparatively important for individual decision-making since individuals generally react optimally to their own income process but ignore economy-wide information, as Pischke (1995) demonstrates. Pischke (1995) also states that individuals make little efforts to gather information on the behaviour of the economy, but rather watch their own prospective fortunes. Similarly, Piketty (1995) concludes that agents are naturally exposed to a different piece of information depending on their position. Additionally, Wu and Li (2013) find that aggregate economic development has no significant effect for individual well-being in China. ii) Policymakers always look at a specific target group to establish an approach to handle income inequality issues. In this sense, many non-target individuals will not have a reaction to these changes. Even for those targeted people, their desired and basic income level is still superior for their actions.

With reference to these reasons, the message for the context of inequality is that

agents (particularly in individuals and households) mainly respond to their own income status (or distribution) to adjust their efforts rather than population average income and the whole disparity of inequality is little incorporated. Thus, the traditional index for inequality only counts the effect of economic process as likely to be insufficient, and there is a need to provide extra information about individual income inequality.

The second shortcoming is the concept of measuring distance between individuals' income pairs, which embraces a cross theory of social comparison in social psychological study. Whether social-interest is or not of central importance for understanding economic behaviour, it is certain that social comparison plays a part in individuals' well-being. This social comparison surely has many benefits such as helping individuals' decision-making process. That is, individuals generally evaluate their own opinions and abilities by comparing themselves to others and to reduce uncertainty and gain related efficient information, and then make a choice to yield higher expected payoffs or expected utility. In this sense, individuals' choices are affected by social influence. Yet, social influence should be not the whole; otherwise, individuals' well-being is difficult to achieve. As the saying goes, "comparisons are odious". Academically, Abou-Zeid and Moshe (2011) clarify that there are negative effects of social comparison on well-being behaviour. White *et al*. (2006) demonstrate that frequent social comparisons have a dark side. Conversely, individual well-being is mainly affected by social-comparisons (Wu and Li, 2013). This controversy cannot deny the fact that to some degree, one's self-interest and efforts after the decision is made play another pivotal role. Hence, one's well-being is developed based on both self-interest and social influence and could be extended to efforts and choices in the literature.

The efforts and the choices are viewed differently from Roemer's work (1998, 2003, and 2006) in our study. Roemer considers efforts and choices are equivalent, and belong to internal factors within the individual's control. In contrast, policy and natural environment are as an external factor for one's outcome while he seminally clarifies these ethical related issues empirically. The reasons are three aspects as below.

Essentially, we view one's well-being as depending upon two factors: efforts and choices. Effort is parallel to the definition by Roemer (2003); that is, the actions under the control of agents which, if expended in greater amounts, ought to increase the degree to which the individual acquires the interested objective. In the income inequality area, it refers to agents reacting to their income status, working more or less for a desired income level and the harder they work the more opportunities they seem to identify. In contrast, choice is defined to be beyond the control of agents (Roemer, 2003). It is true that the agent is the ultimate man to make a choice among two or more economic opportunities, or the power to change his behaviour in Roemer's language (2003). Roemer (2006) also believes to some extent that choice is influenced by circumstances and so he excludes that aspect of choice that is attributable to circumstance.

However, we view that the choice is equivalent to opportunity which is largely influenced by the social-economic circumstances. Firstly, the sources of these options and opportunities are from other groups of people, social-economic development, economic process and/or natural environment. Secondly, generally rational decisions involve a social-economic comparison process where agents evaluate their own presumptions, judgments and perceptions by comparing themselves to others to prevent perceptual illusions and draw a dependable conclusion from a social psychology perspective. Thirdly,

other reasons for individual choice in the economic decision theory are preferences. This aspect is also influenced by external factors to some degree. Plus, they could be either rational or irrational and are generally treated as a shadow notion in economics. Arguably, we consider preferences within the scope of circumstance. For these reasons, choice is distinct from effort and belongs to circumstances.

To sum up, the above discussion leads us to conclude that every agent's well-being process is based on self-interest and social comparison through making efforts and choices that result in a meaningful life for an objective and subjective perspective. This suggests that diminishing inequality requires two channels at micro level. That is, efficiency policy and a good environment provide more choices and opportunities to individuals in general as well as individuals' own efforts and capabilities (as Sen's suggestion, 1981). These choices and opportunities need to be assessed fairly and equally for all residents regardless of their gender, age, location and so on. An inequality index should take both elements into account; otherwise, it is incomplete. Such incompleteness will, in turn, affect policymakers to frame an effective programme. Furthermore, explicitly to show individuals' efforts allows economists and policymakers to connect to ethics issue and focus on appropriate target groups easily.

There are very few studies on index of income inequality at an individual level to look at variations from each of the two channels. Many scholars have developed decomposable formulas based on the Theil's statistics, as the well-known work by Shorrocks (1980 and 1984) and Kolenikov and Shorrocks (2004), but this work is still under the traditional notion. Therefore, we propose the following measure of individual income inequality which explicitly captures the effect of self-development and

social-economic development. This idea represents a different aspect of "a good life" into the measures of income inequality at individual or household levels. That is, one's good life depends on help from others, but most importantly it depends on one's motivation and efforts.

3.2.2 New measure

The argument of this study will be applied to the Generalized Entropy class of inequality index to exhibit how the proposed framework will manage to produce desirable results. Accordingly, two types of indices will be calculated by the prominent members of the Theil index: one index for measuring inequality from social efforts and another for capturing self efforts. The reason for using the method from Theil (1967) is that it is relatively more sensitive than other indices for both tails, top and bottom, and what makes its application popular is its decomposability into groups.[17]

The basic form of Theil index (Theil, 1967), T, is E.q 3.1 below:

$$T = \frac{1}{N} \sum_{i}^{N} \frac{y_i}{\mu_Y} \ln \frac{y_i}{\mu_Y} \ , \qquad (3.1)$$

where T is the single total index for the whole income inequality; N is the total number of individuals; y_i refers to the income of individual i; μ_Y is the average income of all individuals and also the reference income level for perfect equality. Theil (1967) describes that this method is to consider the issue of how strong a signal population shares provide

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[17] Although the Gini coefficient is the best known measure, it has its disadvantages which are not superior for the purpose of this study. For example, The Gini coefficient is sensitive to middle income classes than to the extremes, and it does not contain information about personal incomes (Deltas, 2003). As a result of this criticism, additionally to or in competition with the Gini coefficient *entropy measures* are frequently used (e.g. Theil indices) (Cowell, 2000).

in describing the observed distribution of well-being. If the distribution of well-being is unequal relative to population weights, this is entropy in the system. It looks like the Shannon entropy (or disorder) but was invented to consider the event values themselves, particularly the income y_i of agent i in a population of N agents, rather than their probability of occurrence. In other words, entropy in the Theil index has the meaning of deviations from perfect equality in the Theil's T statistics for income distributions.

The formula emphasizes several points: 1) the summation sign reinforces the idea that each person will make a contribution to the Theil index; 2) $\frac{y_i}{\mu_Y}$ is the proportion of the individual's income to average income μ_Y; 3) the natural logarithm of $\frac{y_i}{\mu_Y}$ determines whether the individual contribution will be positive ($log\frac{y_i}{\mu_Y}> 1$), negative ($log\frac{y_i}{\mu_Y}< 1$), or zero ($log\frac{y_i}{\mu_Y} = 0$).

The suggestions of the formula is that if there is no distance between y_i and μ_Y, and then the Theil index is zero, perfect equality occurs. The index could be either negative or positive, but surely the higher the absolute index, the higher the income inequality. A negative index indicates that many individuals' incomes are below the mean and the number of poor people is not small, while a positive index suggests that many individuals' incomes are greater than the mean and the amount of the wealth may be large. Additionally, individuals in the middle of the distribution contribute little to Theil's T Statistic because their incomes are equal to the average. In this respect, two ways could diminish inequality. One is to reduce the income of the rich by more tax and/or a restriction of their economic opportunities; the second is to increase income of the poor by less tax and/or provide more opportunities. The denominator is also considered as a

reference value for equality. Many applications use this equation to produce an income index for a descriptive evaluation of social welfare and social-economic development.

In recalling the arguments: 1) the measure of individual income inequality by looking at a single aspect of social influence is incomplete especially at micro level, and overall individuals' income differences need to look at the two dimensions of individuals' efforts and social-economic development; 2) efforts should measure one's own income status which is relative to his average income; and opportunities refer to the result of social-economic comparison and circumstance effects which are embedded in the traditional framework.

Under these arguments, two Theil indices are produced, namely, self effort index (*IT*) and social effort index (*ST*). The only difference between *IT* and *ST* is the reference income at denominator. The former is calculated based on the population average income and the latter is computed according to the average income of the *i*th individual across waves. *ST* is a deviation from a given benchmark for the distribution of income based on social economic development, while *IT* interprets a deviation from a given benchmark for the distribution of income based on self-development through efforts. Social income inequality equations in panel framework are E.q 3.2 and E.q 3.3:

$$ST_W = \frac{1}{n} \sum_{i \in w}^{n} \frac{y_{iw}}{\mu_{y_w}} ln \frac{y_{iw}}{\mu_{y_w}}, \qquad (3.2)$$

where ST_W is the Theil index of social development at wave w. n is the total number of individuals in each wave. y_{iw} is the income of the *i*th individual at a specific wave, w. μ_{y_w} is the mean income for the population at a particular wave. In this setting, *ST* measures the short run of income inequality effect. Perfect equality suggests that there is no

disparity between an individual's income level and a society income standard. In Equation 3.3, IT is the Theil index of self-development for the ith individual across all waves. k denotes the number of waves that individuals beings observe. $\mu_{y_{iw}}$ is the average income of the ith individual across all waves. IT indicates the long run of income inequality effect. Perfect equality of self-development indicates that there is no difference across years.

$$IT = \frac{1}{k} \sum_{i \in n}^{k} \frac{y_{iw}}{\mu_{y_{iw}}} ln \frac{y_{iw}}{\mu_{y_{iw}}}, \qquad (3.3)$$

The distinction of the proposed measurements is able to describe how a theoretical individual's well-being is translated into numerical information in an income differences context. In other words, it allows maintaining consistency between theoretical guidance and practical measurements. The next section will examine the two indices through their effects on an individual's living standards.

3.3 Income inequality and living standards

Prior to presenting an econometric framework for investigating the effects of the two indices, the related relationship between income inequality and income growth in the literature is discussed. In general, the focus of the modern egalitarian effort to realize equality is on the possibility of a good life, i.e. on equality of life prospects and life circumstances (Gosepath, 2011). In developing countries, a good life commonly depends on the quality of living standards, which is highly associated with economic growth: the wealthier the economy, the better off the individuals and the higher the living standards. It is true that China has significantly achieved a boom in its economy. Consequently, it has lifted up the means of living standards and reduced massive poverty. In other words, the

improvement in living standards is a result of economic growth. It is also true that abundant

studies demonstrate that the living standards are not sufficient to explain the quality of life.

Yet, income is the perception of quality of life to contemporary Chinese. Therefore, to

understand the relationship between income inequality and living conditions is close to the

literature of income inequality and income growth.

The relationship between growth and income inequality has been inconclusive. In the

inequality-economic growth literature, a famous postulate on income inequality and growth

was put forward in 1955 by Kuznets. Since then it has attracted abundant research in this

area. However, the existing theory is *ambiguous* about this effect, as Fields summarizes:

> While there are numerous theories in which economic inequality has a
> positive effect on the growth, there also are numerous others in which the
> effect is negative…The results are conclusively inconclusive.

(Fields, 2007, p.579)

Apart from positive and negative relationships (Barro, 2000), reverse and no

relationship (Barro, 2000[18]) also exist in the literature. For example, Clarke (1995) and

Deininger and Squire (1996) find evidence that inequality is harmful for growth, while

Forbes (2000) finds that inequality has a positive effect on growth. Although Banerjee and

Duflo (2003) find an inverted U relationship, the authors provide theoretical and empirical

reasons to believe the existence of a U-shaped relationship between changes in inequality

and changes in the growth rate that depends on model parameters. Gallup (2012), Huang *et

al*. (2012), Calì (2008), and Banerjee and Piketty (2005) reveal a U-shaped pattern. In 2011,

there is evidence that income inequality is a more important significant signal for an end

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[18] Barro (2000) finds no relationship between inequality and growth in the whole of the data. However, he breaks up his sample into poor and rich countries and finds a negative relationship between inequality and growth in the sample of poor countries and a positive relationship in the sample of rich countries.

to long periods of growth than other macroeconomic factors, according to IMF analysis (Berg and Ostry, 2011a, 2011b).

In the case of China, studies on the inequality-growth nexus also appear with mixed results. For instance, Deininger and Squire (1996) do not find a systematic link between growth and changes in aggregate inequality, but a strong positive relationship between growth and poverty reduction. Similarly, Wan *et al*. (2007) indicate that this relationship is nonlinear and is negative irrespective of time horizons. Many conclude a negative relationship (i.e. Ravallion, 1998; Benjamin *et al*., 2006; Ravallion and Chen, 2007). Conversely, Gravier-Rymaszewska *et al*. (2013) find a positive association. Yang and Zhou (1999), Xue (1997) and Tsui (1996) conclude a U-shaped curve.

Apart from these direct examinations of the link, there are also some indirect investigations. Kuijs and Wang (2005), Jones *et al*. (2003), Wan *et al*. (2007), Zhu and Wan (2012) and Kamal *et al*. (2012) have focused on examining the causes of income growth in an inequality context with macro economic factors such as capital, endowment, labour, institutional and policy factors, market accessibility, trade and globalization, education inequality, human capital gaps, spatial divisions and urbanization. However, aggregate analysis has its shortcomings such as Ravallion (1998) and Deaton (2003) pointing out that the aggregate-level results may confound the true direct effects of inequality with those that are an artefact of aggregation. In this respect, some micro studies look at factors of household or individual characteristics such as age, income type, education, marital status and others (Zhu *et al*., 2008; Sicular *et al*., 2007; Yao, 1999). In short, despite the vast studies, these theories indicate that the overall impact of inequality on growth cannot be set *a priori*; Forbes (2000) and Wan *et al*. (2007) all support this view.

In the literature, the time horizon also plays an important role to determine the findings. A typical example is the different results in magnitudes as well as in signs generated between cross-section and panel data. The representative study by Forbes (2000) demonstrates that in the long run, the relationship is negative, while it is positive in the short or medium run. Despite its importance of time interval, few studies consider incorporating different periods into one unified framework, as Wang *et al*. (2007) point out; thus, the authors conduct a regression analysis for such purpose.[19]

The distinction between the present study and previous research has two aspects. The first is the fundamental belief that is embraced in the current study. The present study believes that both social and individual make efforts to reduce inequality and improve living standards so that we explore the return on social efforts and individual efforts in the inequality context. To the best of our knowledge, there is no study that looks at inequality from this angle. Secondly, we take not only the variance among individuals into account but also across communities (there are only international, national, providence, city to household levels in previous studies). Thirdly, we also incorporate different time horizons in one unified dynamic model framework but in addition to short run and long run income inequality indices first. In this way, the present study provides new estimates of inequality.

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[19] The conventional approach to discovering the long run versus short run relationship is by averaging relevant variables over different time horizons, and then estimating a regression model. For example, Forbes (2000) uses data averaged over a five-year interval in a growth regression and claims that this is a medium or short-run relationship, which is found to be positive. Subsequently, she also reports results using ten-year averages, which indicate an insignificant relationship. Meanwhile, Barro (2000) relies on averages over a ten-year interval to estimate long-run relationships.

3.4 Statistical analysis procedure

3.4.1 The model

We notice that China's income inequality has attracted much attention in studies since it is at warning level. However, what the literature does not know is the question of whether it is essential to observe individual efforts with respect to income inequality on living conditions. This study pioneers filling this gap. If so, is there any significant difference between the two income inequalities from difference efforts? Additionally, how do the uncertain changes affect the living condition when the index changes?

In this mind-set, this study estimates living standards as a function of inequalities, initial income, human capital and age. This specification is inspired from the parsimonious model of inequality and growth (see Forbes, 2000 and Perotti, 1996). It is possible to contain more additional variables. However, this study concentrates on this fairly simplified specification for three reasons. First, the primary interest of this study is typically one of initiating an examination of the contribution of individual efforts with respect to inequality on living standards. The second is data constraint, but more independent variables do not necessarily ameliorate omitted variable bias by the inclusion of additional control variables (Clarke, 2005). At the same time, Banerjee and Duflo (2003)[20] demonstrate a consistent result that does not regard the number of control variables, but rather the estimation methods. To summarize, the proposed model central to this study is as Equation 3.4.

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[20] Banerjee and Duflo (2003) present two sets of control variables from the specification by Perotti (1996) and by Barro (2000) with the same estimation techniques. The former adopts 4 control variables and the latter applies 13.

$$Y_{iw} = \beta_1 + \beta_2 Y_{i,w-s} + \boldsymbol{\beta_3 ST_{j,w-s}} + \boldsymbol{\beta_4 IT_i} + \boldsymbol{\beta_5 IT_i^2} + \beta_6 C_{iw} + \alpha_i + \delta_t + u_{iw} ,$$

$$(3.4)$$

where i and j denotes individual $\{1,2, ... , N\}$ and group $\{1,2, ... , K\}$ while w and s is wave period $\{1989,1991, ... , W\}$ and lagged period $\{0, 1,2, ... , s\}$ in Eq.3.4. α_i and δ_t are the unobserved individual and time effects, respectively, while u_{iw} is the well-behaved disturbance term in the sense of independent, zero mean and constant variance. Y_{iw} is individual disposable real income as the indicator of the living conditions for the individual i during period w. Meanwhile, Y_{iw-s} indicates the dependence of living standards on the accumulation of previous income level. The highlighted variables are the primary regressors of interest. $\boldsymbol{ST_{j,w-s}}$ stands for social Theil index or social income inequality for group j during the period $w–s$. If s=1, indicating initial inequality is associated with sequence income growth in the short or medium term. Meanwhile, individual Theil index (*IT*) or individual income difference is a proxy for individual efforts of individual i during all period w and its square term, indicating that the linear relationship between individual efforts in relation to inequality and living standards may not hold in the long run. In addition, C is a vector for variables of age and education attainment.

3.4.2 Data

The present study applies the longitudinal data taken from the China Health and Nutrition Survey (CHNS). The data provide information on individual behaviour both across time and across individuals. This type of data not only reduce measurement error and omitted variable bias, but also increase precision in estimation, is more effective for dealing with heterogeneity and multicollinearity (Cameron and Trivedi, 2005; Baltagi, 2005).

It is worth noting that the provinces in the data are unlikely to be randomly sampled

from all provinces (see Figure 3.1) and the data may embody a broad spectrum of inequality in China but the results are properly under the general heading of China. These provinces vary by geographical location and economic development. The variation across provinces can be considered as regional and income-level representative because these chosen areas cover poor (Guizhou and Guangxi in the Southwest) and rich provinces (Jiangsu in the east). However, the CHNS include neither the most developed places such as Beijing, Shanghai and Guangzhou, nor the least developed regions such as Yunnan, Xinjiang and Xizang. Apart from this weakness for the chosen provinces, some selected cities and counties share a similar situation since the survey contains all capital cities and capital counties in a selected province.

Figure 3.1: Survey Regions

Source: CHNS (2012). The green (or highlighted) colour denotes the survey provinces.

The analysis mainly uses the sub-sample of the CHNS individual data which still maintains nine provinces and eight waves but particularly limits to positive income observations. The reason is that the full data do not contain observations of multiple phenomena obtained over multiple time periods for a few of the same individuals. These observations are unable to detect changes in individuals' income over time, which is not in line with the interests of this study. Therefore, the present study adopts its sub-sample of 59711 repeated observations with total 14667 adults, and its percentage is 88.26% of total the CHNS individual data. The sub-sample also excludes negative and zero values of income because these values have a small number of observations and they have some difficulties for estimations and calculation. This exclusion is common in income inequality studies. Variables in the selected sample are real individual disposable income, provinces, urban and rural, education, gender and age. Table 3.1 and Table 3.2 show clear information about the number and the percentage of different income values of data in the CHNS and the number of observations in each wave and province in the selected sample.

Table 3.1: Number of Sub-samples based on Income Observations

Income types	Number	Percentage
Total sample	67653	100%
Positive	65913	97.43%
Zero	214	0.32%
Negative	1526	2.26%
Panel positive	59711	88.26%
Single	6202	9.17%

Source: Author's calculation.

Table 3.2: Number of Observations in Each Wave and Province in Sub-sample

Wave	Guangxi	Guizhou	Heilongjiang	Henan	Hubei	Hunan	Jiangxu	Liaoning	Shandong	Wave total
1989	1182	1112	NA	946	1009	925	1025	913	882	7994
1991	1214	1224	NA	1149	1109	943	1067	965	985	8656
1993	1194	1158	NA	1028	1043	897	1045	834	917	8116
1997	1193	1088	780	1039	1004	836	1054	NA	850	7844
2000	1138	1057	863	890	945	745	1110	790	821	8359
2004	809	804	683	590	747	580	899	782	699	6593
2006	759	779	712	525	706	622	863	752	639	6357
2009	709	679	649	555	685	515	740	641	619	5792
Province total	8198	7901	3687	6722	7248	6063	7803	5677	6412	59711

Source: Author's calculation.

Table 3.3: Description of Variables

Type	Variable		Description	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
Numerical	Y		Real individual disposable income for indicating living standards, RMB per capita	1.3	2090.1	4315.6	7364.2	8830.4	623931.6
	ST	Tci	Social Theil index across six levels of city of county	0.252	0.341	0.399	0.409	0.442	0.650
		Tp	Social Theil index across eight levels of province	0.214	0.330	0.379	0.402	0.475	0.631
		Tn	Social Theil index across fourteen levels of neighbourhood	0.066	0.338	0.407	0.404	0.465	0.699
		Tc	Social Theil index across two hundred and thirteen levels of community	0.000	0.185	0.286	0.325	0.411	1.499
	IT		Thiel index for income inequality relative to individual efforts on living	0.000	0.086	0.195	0.237	0.336	1.565
	Age		Age is measured in years	2.21	32.23	42.29	43.41	53.85	100.83
Categorical	Urban		Urban and Rural						
	Gender		Male and female						
	Provinces		Guangxi, Guizhou, Heilongjiang, Henan, Hubei, Hunan, Jiangxu, Liaoning and Shandong						
	Coastal		Jiangxu						
	Inland		Guangxi and Guizhou						
	Education		Education degree: None degree, Primary school, Secondary school, High school, Technical school, University and college, Master'sand above, and other						
	Wave		Survey waves: 1989, 1991, 1993, 1997, 2000, 2004, 2006 and 2009						

Source: Author's calculation.

Notes: ST denotes a set of Theil indexes based on different geographical division for income inequality relative to social efforts on social-economic development.

Table 3.3 displays all interest variables and their basic statistical information. The main interested variables are income, a sect of social Theil inequality indices and one individual Theil inequality index. The social Theil index has four types which are based on different geographical divisions across provinces in China. The size of the divisions from largest to smallest is city of county, province, neighbourhood and community. Social inequality at city of county and province levels is similar, from acceptable income inequality level of under 0.30 to high level of above 0.60. Social inequality at neighbourhood level has greater range than the previous two from low 0.066 to high 0.699. The mean of these three levels of indices are close together: about 0.40. In contrast, the level of income inequality is smaller than these with more aggregate levels with the average value of 0.33 in social inequality at community level (tc) and 0.24 in individual Theil index (IT). This statistical information shows that income inequality gradually declines from aggregate level to individual level and individual index is expected to be smaller than social index since the effort made by many people's earnings is progressive and stable compared to themselves.

IT and Tc have the same issue of zero value at minimum indices and greater than one at maximum indices. These maximum values indicate measurement errors in the sample due to Theil index being between zero and one. Additionally, this sample is for adults and the variable of age appears as 2 years, suggesting recording mistakes. These measurement errors are excluded in the data analysis.

The minimum value of income, 1.30 RMB, is extremely low while the maximum value of income, 623,932 RMB, is immensely large. This may suggest some extreme outliers on both tails in the sample. At micro level, extreme values are common in income

inequality analysis. There are two approaches of discriminate outliers of trimming and winsorising (Chernobai and Rachev, 2006). The difference between the two is that the former throws extreme values completely and comparatively, the latter pays more attention to the heavy tails of the distribution. Winsorising is a technique that replaces extreme data with less extreme value and puts more weight on the edges of the distribution. Many relevant papers only adopt a trimmed dataset. In the present study, both techniques are employed. That is, first to trim the data based on income with a proportion of 0.001%, followed by winsorising. The fraction of winsorising for income outliers is only 0.005 in the present study. This data manipulation leads us to use a robust M-estimator for the parameters as reference information for the other panel models.

3.4.3 Estimation and testing endogeneity

There are a variety of different techniques that can be used to estimate the equation (Eq. 3.4). To evaluate which technique is the most appropriate, it is necessary to consider two factors: the nature of the data and the potential endogeneity. To simplify the following discussion, we rewrite Equation 3.4 in vector form:

$$Y_{iw} = \gamma Y_{i,w-1} + X1'_{iw} B_1 + X2'_i B_2 + e_{iw}, \qquad (3.5)$$

where the component error is $e_{iw} = \alpha_i + \delta_t + u_{iw}$. B_1 and B_2 are vectors of coefficients associated with time variant and time invariant variables, respectively. The common standard method for such elimination is fixed effects (FE or within estimator) through transforming the data into deviation from individual means and ignoring individual effects. For the purpose of estimating Equation 3.4, the individuals in the CHNS data are based on geographical regions and cities, and these places are not randomly selected so that the

intercepts are more clearly "fixed". In this respect, the RE framework is intuitively inappropriate, which suggests that the null will be rejected in the Hausman test. Unfortunately, FE has two important defects: i) all time-constant variables are removed from the transformation; ii) FE is not fully efficient since it merely takes within-unit changes into account but ignores between-unit variation. The first issue is more serious because we also interested in the unknown parameters of *X2*. To overcome this disadvantage of fixed effects, the least squares dummy variable (LSDV) estimator is comparatively appropriate. The two methods for time fixed effects estimation are the LSDV and within time estimator, identical in the sense that they give the same estimates, but they differ computationally.

A problem with all the mentioned estimators above, however, is the endogeneity issue of correlation between regressors and error in observed data. In particular, the lagged income obviously indicates that these mentioned estimators are no longer consistent for the parameter of interest. To simplify the following discussion, we rewrite Equation 3.5 in vector form as E.q 3.6 (the level equation):

$$Y_{iw} = \gamma Y_{i,w-1} + \boldsymbol{X}'_{\boldsymbol{iw}} B_1 + \boldsymbol{D}'_{\boldsymbol{i}} B_2 + \alpha_i + \delta_t + u_{iw} , \qquad (3.6)$$

where B_1 and B_2 are vectors of coefficients associated with time variant and time invariant variables, respectively. To address the issue of omitted variable bias and to account for endogeneity in the scope of dynamic panel models, the possible methods are introduced by Anderson and Hsiao (1982) and by Arellano and Bond (1991). Both methods eliminate α_i based on the first difference model initially and then differ from the

utility of information to generate instruments for endogenous variables in E.q 3.6[21] (the differenced equation). Unfortunately, Equation 3.7 clearly shows that time invariant variables are removed by the first difference transformation:

$$Y_{iw} - Y_{i,w-1} = \gamma(Y_{i,w-1} - Y_{i,w-2}) + (X'_{iw} - X'_{i,w-1})B_1 + (D'_i - D'_i)B_2 + (\delta_t - \delta_{t-1})$$

$$+ (u_{iw} - u_{i,w-1}), \tag{3.7}$$

To overcome the shortcoming of the first differenced GMM estimator (Arellano and

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[21]The former constructs an instrument for the lagged dependent variable from the second and third lags of Y (likewise for the other endogenous X variables if any the issue). It is also possible to include $Y_{i,w-3}$ as a second instrument. However, the example of instrument matrix of Z_i^{AH} for the lagged dependent variable shows that the higher the lagged order, the more information would be lost in the Anderson–Hsiao approach. In contrast, the latter uses all possible lagged values of each of the variables as instruments without losing any information based on a generalised moment of method (GMM) context. The example of instrument matrix of Z_i^{AB} clearly displays the Arellano-Bond estimator prevents loss of degree of freedom for the estimation.[21]

$$Z_i^{AH} = \begin{Bmatrix} \cdot & \cdot \\ y_{i,1} & \cdot \\ y_{i,2} & y_{i,1} \\ \vdots & \vdots \\ y_{i,T-2} & y_{i,T-3} \end{Bmatrix}$$

$$Z_i^{AB} = \begin{Bmatrix} 0 & 0 & \cdots & 0 \\ y_{i,1} & 0 & \cdots & 0 \\ 0 & y_{i,2} & \cdots & 0 \\ 0 & 0 & \ddots & \vdots \\ 0 & 0 & \cdots & y_{i,T-s} \end{Bmatrix}$$

In this way, the Arellano-Bond estimator is comparatively efficient and it corrects not only for the bias introduced by the lagged endogenous variable, but also permits a certain degree of endogeneity in the other repressors if there are any. More specifically, in the first differenced transformation (E.q 3.8), for period 3, Arellano and Bond use $Y_{i,1}(Y_{i,3-2})$ as an instrument for $(Y_{i,2} - Y_{i,1})$; for period 4, they use $Y_{i,1}$ and $Y_{i,2}$ as instruments for $(Y_{i,3} - Y_{i,2})$, etc., and follow the same procedure to create instruments for each differenced variable. In short, the available instruments for the lagged dependent variable are $Y_{i,w-2}, Y_{i,w-3}, \dots, Y_{i,1}$ and for the other independent endogenous variable are $X_{i,w-2}, X_{i,w-3}, \dots, X_{i,1}$.

Bond, 1991), Arellano and Bover (1995) and Blundell and Bond (1998) propose an alternative method. That is, in addition to differentiating the model and using lagged levels of $Y_{i,w-s}$ as instruments of $\Delta Y_{i,w-s}$ for E.q 3.7, they work with the level model (E.q 3.6) and use the difference $\Delta Y_{i,w-s}$ as instruments of $Y_{i,w-s}$. The estimators obtained in this way are labelled the system GMM estimators or the extended GMM (see Alonso-Borrego and Sánchez-Mangas, 2001). In this way, system GMM is comparatively efficient and the coefficients of the time-invariant variable and highly persistent variable can be identified in the level model.

The critical assumption must be satisfied for this system GMM estimator to be consistent and efficient. That is, the error terms cannot be serially correlated: $E(u_{iw}, u_{i,w-s})$=0 for all $s \geq 1$. The common tests for this assumption are a test for second order serial correlation and Sargan's test for overidentifying restrictions. The validity of the instruments used for the first differenced equations depends principally on the absence of serial correlation in the disturbances u_{iw}. In that case, the first differenced residuals are expected to show negative first order serial correlation but should not display any second order serial correlation. The overall validity of the moment conditions is tested through the Sargan test[22] with the null hypothesis of valid of exogenous instruments but this test requires that the error terms are independently and identically distributed.

The advantage of the system GMM is not only able to avoid dynamic panel bias caused by the clear endogenous lag of Y, but also to identify more easily other potential

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[22] The test has been demonstrated to be weakened by large T (Roodman, 2009). In the present study, T is only eight so that the disadvantage of the Sargan test should not be an issue. See Roodman (2009).

endogenous variables than the standard IV approach[23] if *a priori* is difficult to establish. The potential endogenous variable of *ST* faces the difficulty of obtaining external instruments (Forbes, 2000). Apart from *ST*, *IT* may also be potentially correlated with the errors. The reason is that both are derived from the dependent variable of *Y* which is generally subject to random measurement error. This problem reflects on spurious and extreme outliers in income which may cause endogeneity. Hence, trim data are commonly used to exclude these outliers and eliminate measurement error in income inequality analysis (for example, Figini, 1999; Cowell and Litchfield, 1999; Benjamin *et al*., 2005; van Kerm, 2007; and Nichols, 2010). Additionally, *IT* measures income inequality for an individual throughout consecutive waves, while *ST* measures income inequality at aggregate level. In this way, endogeneity should be reduced to some extent, although it may still be a potential issue. A Hausman specification test can evaluate whether the two explanatory variables are exogenous within the system GMM. In this way, we can prevent finding external instruments for testing endogeneity from the two.

3.4.4 Sensitively analysis

Since the proposal of return on social efforts and individual efforts related to income inequality on living standards is rather new, and also since sample selection and the limitation of the data may influence the coefficient estimates, this section thoroughly tests the robustness of the estimations across different size and groups of sub-samples.

One potential problem with the whole estimation is whether the chosen data fulfil the requirements of the GMM estimator about fix effects. First, the chosen CHNS data are

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[23] The standard instrumental variables approach needs instruments from outside the system, which involves more uncertainty. It has been suggested that many applications of the IV regressions suffer from weak instruments (Stock *et al*., 2002).

partially random in the sense that participants are randomly selected but the randomness of their cities and provinces is suspect. Although the Hausman test is expected to reject the null and detect fix effects rather than random effects, it is worthwhile re-examining carefully. Second, the major advantage of GMM is to utilize instruments within the system rather than external instrument variables which reduce uncertainty. However, the number of lagged instruments is sensitive (Bowsher, 2002). Despite the Sargan-Harsan test being commonly used to provide a statistical examination of the validity of instruments, it suffers from either a limited or a large amount of lagged instruments as well as when there are measurement errors in the dependent variable (Dahlberg *et al.*, 2008). The T dimension of the imbalance data is considered between three and eight so that observations with T=3 may face weak instruments because their instruments are limited to the last level of lags. These second lagged values are regarded as weak instruments which may affect and influence the coefficient estimates. With these considerations, sensitivity analysis carries on across three random sizes of the data and variety of groups within the data.

A t-test is applied to test the equality of *ST* and *IT* parameters whenever possible: $H_0: \beta_{st} - \beta_{it} = 0$, and $H_1: \beta_{st} - \beta_{it} \neq 0$. The equality would imply that there are sufficient opportunities in the circumstance to meet the demand of individuals. However, since self-interest is believed to be the very core of human motivation and social influence serves as instrument in conventional wisdom, the null hypothesis may be rejected:

$$t_{b_{st}-b_{it}} = \frac{b_{st}-b_{it}}{Se(b_{st}-b_{it})} \; , \qquad (3.8)$$

The t-statistic is built using information about the covariance matrix of the estimators and the formula is as E.q 3.8. If t-statistic is greater than critical values, then the null is rejected. Therefore, there is empirical evidence that social income inequality has a higher incidence on living conditions in China than individual income inequality.

3.5 Results

Recalling the claim that this present study aims to make, the individual's well-being with respect to living standards is associated with two factors of social efforts and self efforts related to income inequality. The empirical analysis provides evidence to substantiate this claim in the aspects of i), the significance of income inequality indices and ii), the significant differences between the two indices, according to the system GMM estimator and t test. Details are as follows.

Table 3.4 and Table 3.5 report estimates of the basic interested Equation 3.6 using the robust M estimator, pooled OLS, fixed effects, random effects and the system GMM technique (Blundell and Bond, 1998). Living standards are explained by the past values of income (2 lags), current and initial social income inequality, individual income inequality and its square term, age and education. To decide which technique is utilized, it is necessary to test the validity of the assumptions underlying each method. First, it seems estimates do not have any extreme difference between robust M estimator and the standard panel methods, except that the initial social inequality is significant in the M estimator. Second, a poolability test suggests pooled OLS is not appropriate and a Hausman specification test comparing the fixed effects estimates with random effects rejects the assumption of random effects. As discussed previously, however, these methods are inconsistent due to the presence of the lagged income terms. The system GMM corrects

this problem.

Table 3.4: Model Comparison Between Standard Panel Models

	M	PO	LSDV	RE
	Coef.	Coef.	Coef.	Coef.
	(S.E)	(S.E)	(S.E)	(S.E)
(intercept)	4.379***	4.658***		5.157***
	（0.088）	（0.095）		（0.099）
Y_1	0.288***	0.274***	0.274***	0.218***
	（0.088）	（0.008）	（0.008）	（0.008）
Y_2	0.146***	0.143***	0.145***	0.128***
	（0.088）	（0.008）	（0.008）	（0.008）
tc	-0.562***	-0.032***	-0.646***	-0.642***
	(0.046)	(0.050)	（0.050）	（0.050）
tc_1	0.072***	0.059	0.059	0.077
	（0.048）	（0.052）	（0.052）	（0.052）
it	-0.997***	-1.099***	-1.145***	-1.272***
	（0.124）	（0.134）	（0.134）	（0.148）
it^2	1.208***	1.223***	1.264***	1.399***
	（0.162）	（0.175）	（0.175）	（0.195）
age	0.008***	0.006***	0.006***	0.008***
	（0.001）	（0.001）	（0.001）	（0.001）
education	0.035***	0.0352***	0.0354***	0.039***
	（0.002）	（0.002）	（0.002）	（0.002）
R^2		0.20	0.21	0.34
F-statistics		478	482	1020

Source: Author's estimation.
Notes: Poolability test between PO and LSDV is 736 with p-value $< 2.2e-16$; Hausman test between LSDV and RE is 479 with p-value $< 2.2e-16$. ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

In Table 3.5, four sets of estimates are generated by the system GMM technique. SGMM-1 eliminates for the correlation between the lagged dependent variables and the error term, while the rest of SGMM controls for the lagged dependent terms and the index of social income inequality. The insignificant Sargan test suggests that the lagged dependent terms are not only endogenous variables, but also other endogenous variables likely exist in column 1. The significant Sargan tests in columns 2, 3 and 4 confirm the need for control of the correlation between the social index and the error and show that the

models have valid instrumentation. In addition, several other tests for the requirements underlying the system GMM are satisfied. AR(2) tests for second order serial correlation are satisfied since the test statistics are negative and not significant, while all Wald tests of joint significance reject the null hypothesis.

As mentioned, GMM is sensitive to the number of lagged instruments and there is no formal test to examine this. Roodman (2009, 2007) suggests the need for reporting how to obtain the "optimal" number of instruments. In this case, the number of possible instruments for the lagged income comes from the second lagged values to the end of the period. The number of instruments for the social income inequality index is based on the first lagged value and the last available lag. We have estimated many other regressions by increasing or decreasing the number of instruments as well as using a special user written command 'collapse' for decreasing instruments, but any other limits worsen the diagnostics. In this respect, this chosen number of instruments in Table 3.5 is, say, "optimal".

Although there is still a possibility that endogeneity between individual inequality and the dependent variable of disposable income undermines the requirement of *E(IT, u)=0*, according to all the above evidence, we may conclude that the system GMM with the control of endogeneity from the lagged dependent variables and social inequality is consistent. For some reasons, the interested coefficients in column 4 are not consistent with other results from the system GMM and the standard panel regressions because of the changes of coefficients' sign. Hence, we may conclude that the system GMM in columns 2 and 3 is comparatively efficient, and the following discussion focuses on these estimates.

The positive significant coefficients of age and education in the system GMM agree

with the majority of the literature. More importantly, the significant positive coefficient of initial social inequality is also in line with the representative study by Forbes (2000)[24] and the domestic study by Gravier-Rymaszewska *et al.* (2013)[25] at province level and Su (2001)[26] at national level in the income-growth nexus literature. This result indicates the initial social inequality at community level is associated with the sequence of the improvement in living standards and implies that the return on social efforts on the focus of economic development in the means of living standards is valuable in the short run.

Regarding the coefficients of the individual inequality that show a U-shaped pattern which is against the Kuznets curve, this U-shaped relationship agrees with recent studies by Gallup (2012),[27] Huang *et al.* (2012),[28] Calì (2008),[29] Banerjee and Piketty (2005)[30] and the domestic studies by Yang and Zhou (1999),[31] Xue (1997)[32] and Tsui (1996).[33] The findings indicate that i), income disparity shrinks in low income individuals and expands in high income individuals and ii), living standards are associated with the

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[24] The study mainly focuses on an international study of 45 countries. The coefficient on the initial traditional inequality index is 0.0013 with the standard GMM method.

[25] The study measures inequality by Theil statistics and the data from NBSC between 1989 and 2006, using the system GMM method for estimation. The coefficient on the initial traditional inequality index is 0.821.

[26] The paper finds the parameter of Gini coefficient is 0.064 for China with fixed effect model.

[27] The paper calculates its own aggregate data from each nation's household surveys, including 87 countries and different time periods.

[28] The study applies US data over the period 1917 to 2007 and the result is in favour of a U-shaped linkage between income inequality and economic development.

[29] The results support the idea of a U-shaped relation between rural-urban disparities in socio-economic indicators and the level of economic development in India.

[30] The authors also find the same pattern for India between 1922 and 2000.

[31] The study observes that urban-rural income inequality and consumption experienced a U-shaped change after the economic reforms were launched in the late 1970s.

[32] The paper examines urban-rural income distribution between 1978 and 1995 and the data are taken from NBSC.

[33] The author finds a U-shaped evolution of regional inequality in the post reform period using real per capita GDP from 1978 to 1989.

beginning of a poor return on individual efforts and towards the end of positive in the long run. These indications are not an issue only if convergence occurs. However, the coefficients of the lagged income terms are significant and positive, suggesting the improvement in living standards from previous periods, but convergence does not occur at individual level. The following results by the sensitivity analysis show the estimates by the system GMM are robust.

Regarding the sensitivity analysis, Gini coefficients for social income inequality and three pairs of data category have been investigated and reported in Table 3.6, using the SGMM technique with the same instruments for the basic model above. On the whole, the coefficients on the initial short run social inequality are always significant and positive, except one in the Inland regression. The U-shape of the long run individual inequality does not change. First, we re-examined Equation 3.6 with the Gini definition of inequality to look at the effect of social efforts. The coefficient estimates change slightly and the significances remain. The tests for the requirement for the SGMM are consistent with the equation for the Theil index. T-tests show significant differences between the two income inequality indices in the standard analysis models. This re-examination suggests the change in the measurement of inequality does not affect the main results. Second, when we exclude *IT*, although the coefficient estimates do not appear to have any unusual outcome, the Sargan test highly rejects the null.

In addition, social or geographical factors may have an influence so that we re-examine the basic model with three common pairs of groups such as coastal-inland region, urban-rural area and gender. In any case, the relationship between the inequalities and living standards agrees with the standard analysis in most estimates.

Table 3.5: Model Comparison Between the System GMM

	SGMM-1	SGMM-2	SGMM-3	SGMM-4
	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)	Coef. (S.E)
y_1	0.178*** （0.017）	0.172*** （0.017）	0.170*** （0.017）	0.195*** （0.020）
y_2	0.063*** （0.016）	0.054*** （0.016）	0.051** （0.016）	0.061*** （0.019）
tc	-0.669*** （0.052）	-0.059 (0.107)	-0.057 (0.106)	0.019*** （0.119）
tc_1	-0.096* （0.017）	0.272*** （0.070）	0.300*** （0.067）	0.315*** (0.075)
it	-1.398*** （0.156）	-1.759*** （0.166）	-1.783*** （0.165）	-1.83*** （0.192）
it^2	1.354*** （0.212）	1.609*** （0.217）	1.625*** （0.218）	1.728*** （0.263）
age	0.006*** （0.001）	0.006*** （0.001）	0.006*** （0.001）	0.006*** （0.001）
education	0.039*** （0.002）	0.042*** （0.002）	0.042*** （0.002）	0.041*** （0.002）
N.O.U	28768	28768	30010	30010
N	41907	41907	41907	41907
Sargan test	148 (3.9587e-10)	36 (0.99)	40 (0.91)	51 (0.72)
AR(1)	-17 (<2.22e-16)	-17 (< 2.22e-16)	-17 (< 2.22e-16)	-17 (< 2.22e-16)
AR(2)	-0.45 (0.65)	-0.03 (0.97)	-0.07 (0.95)	-0.02 (0.98)
Wald test for coefficients	2182 (<2.22e-16)	1808 (< 2.22e-16)	1797 (< 2.22e-16)	1596 (< 2.22e-16)
Wald test for time dummies	53 (2.23e-10)	46 (1.04e-08)	46 (1.04e-08)	62 (3.64e-12)

Source: Author's estimation.
Notes: SGMM-1 is without control of the correlation between social inequality index and the error. The difference between SGMM_2 and SGMM_3 is that the former uses merely one lag as instrument for endogenous variables and the latter applies all possible lags. SGMM_4 uses a two-step estimator which is the standard procedure for estimating parameters using GMM, while previous SGMM models adopt one step procedure. ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

Table 3.6: Sensitivity Analysis of Group Effect

	tc Coef.(S.E)	tc_1 Coef.(S.E)	it Coef.(S.E)	it^2 Coef.(S.E)	N.O.U	N	Sargan test	AR(2)	t test
Estimates									
Standard analysis									
Thiel index	-0.057	0.300***	-1.783***	1.625***	28768	41907	40, 0.91	-0.07	95
	（0.106）	（0.067）	（0.165）	（0.219）				(0.95)	
Gini	-0.086	0.294***	-1.781***	1.626***	28768	41907	39, 0.91	-0.07	90
	（0.099）	（0.049）	（0.160）	（0.215）				(0.91)	
Without 'it'	-0.078	0.289***			28768	41907	518 (< 2.22e-16)	0.10	
	（0.106）	（0.067）						(0.92)	
Three categories									
Coastal	0.225	0.576***	-1.912***	1.797***	7079	10053	21 (1)	-8.09	
	（0.211）	（0.145）	（0.335）	（0.449）				(6.3e-16)	
Inland	-0.041	0.121	-1.467***	1.264***	7531	10706	14 (1)	-1.11	
	（0.182）	（0.125）	（0.305）	（0.414）				(0.27)	
Urban	0.435*	0.306*	-1.517***	1.335***	8265	13223	19 (1)	-1.79	
	（0.186）	（0.120）	（0.280）	（0.450）				(0.07)	
Rural	-0.197	0.306***	-1.539***	1.431***	20503	28684	37 (0.98)	-0.58	
	（0.122）	（0.080）	（0.192）	（0.249）				(0.56)	
Male	0.016	0.284***	-1.556***	1.284***	15384	22070	33 (1)	0.44	
	（0.147）	（0.090）	（0.223）	（0.289）				(0.66)	
Female	-0.132	0.323***	-2.11***	2.089***	13384	19837	51 (0.72)	-0.34	
	（0.151）	（0.101）	（0.249）	（0.334）				(0.73)	

Source: Author's estimation.
Notes: Wald tests are all significant. ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

Table 3.7: Sensitivity Analysis of Data Size Effect

D.V.	n=2000 Coef.	n=5000 Coef.	n=10000 Coef.	Full Coef.
y_1	0.172***	0.163***	0.181***	0.170***
	（0.030）	（0.023）	（0.019）	（0.017）
y_2	0.056*	0.033	0.047***	0.051**
	（0.029）	（0.022）	（0.018）	（0.016）
tc	-0.074	-0.144	-0.132	-0.057
	(0.216)	(0.145)	（0.119）	(0.106)
tc_1	0.347**	0.377***	0.251***	0.300***
	（0.147）	（0.094）	（0.078）	（0.067）
it	-2.065***	-1.821***	-1.709***	-1.783***
	（0.369）	（0.243）	（0.193）	（0.165）
it^2	1.944***	1.607***	1.481***	1.625***
	（0.472）	（0.303）	（0.253）	（0.218）
age	0.007***	0.006***	0.007***	0.006***
	（0.002）	（0.001）	（0.023）	（0.001）
education	0.044***	0.038***	0.040***	0.042***
	（0.004）	（0.033）	（0.002）	（0.002）
Sargan test	37	58	49	40
	(0.98)	(0.49)	(0.80)	0.91
AR(1)	-9.53	-13	-15	-17
	(< 2.22e-16)	(< 2.22e-16)	(< 2.22e-16)	(< 2.22e-16)
AR(2)	-1.40	-0.06	-0.10	-0.07
	(0.16)	(0.95)	(0.92)	(0.95)
Wald test for coefficients	431	763	1304	1797
	(< 2.22e-16)	(< 2.22e-16)	(< 2.22e-16)	(< 2.22e-16)
Wald test for time dummies	15	33	35	46
	(0.01)	(3.19e-06)	(1.59e-06)	(1.04e-08)

Source: Author's estimation.
Notes: ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

We notice that the Sargan test has a perfect p-value of 1. The existing explanation for such a p-value is the low power of the test if data have large N and large T (Dahlberg *et al*., 2008; Roodman, 2008; Bowsher, 2002). Previous studies obtain a similar p-value of the Sargan test (Castelló-Climent, 2005; Azizov, 2007). It seems the large T may not be the case in our study (T=3-8), and yet such a p-value is

still present. Hence, we restrict these models with gradually decreasing lagged instruments but the corresponding results are not effective, suggesting such a p-value likely has nothing to do with the number of instruments. Alternatively, we further re-estimate the basic model with three sets of different random size from the data to observe whether the size matters. The results are reported in Table 3.7. Fortunately, when the number of individuals increases from n=2000, n=5000, n=10000 to the full data, the Sargan tests do not show any unsatisfactory results. Additionally, the coefficient estimates across different size of data are the same in terms of the significance and the sign of parameters and the value of coefficients. According to all this evidence, we are confident to conclude that the system GMM is consistent and efficient and the empirical analysis substantiates our arguments with reliable evidence.

3.6 Discussion and conclusion

This study aims to examine the effects of income inequality on living standards in China, applying the CHNS individual data from 1989 to 2009. Differently, we looked at income inequality through the concepts of social efforts and self efforts. The main empirical techniques include the Theil (1967) statistics for the measures of two income inequality indices and the system GMM (Blundell and Bond, 1998) for the procedures of parameter estimates. The findings have three aspects. The coefficient is positive on social income inequality (the traditional income inequality index), while the parameters of individual income inequality (new measure of index) show a U-shaped pattern on living standards. Additionally, the coefficient of initial income is

positive.

These results reveal several important messages. In the short run, social efforts on economic development (represented by income inequality at community level) to improve living standards are consequential. However, this short run effect may not help achieve a long run sustainable improvement. Individual efforts (represented by income inequality at individual level) on enhanced living standards by augmenting income shows a completely different picture. That is, it is a non-monotonic trend along the process of improvement of living standards by individuals, but it is against the Kuznets curve of a U-shaped pattern. The Kuznets curve is a systematic evolution of income distribution along a country's development path from wide income inequality to narrow. In contrast with the aggregate level, the present study shows that income difference starts to diminish with individuals making efforts to raise living standards and then remains similar when settling down in life for a while and widens as the return on the efforts becomes earlier than the beginning of the process. Briefly, it indicates that the improvement in living standards is limited in low income individuals but not in high income individuals. Although the improvement occurs across all individuals, the living standard for low income people does not converge towards a high income one since the initial income level has a positive sign of coefficient.

This study starts from the argument that the traditional evaluation of the effect of income inequality on individual well-being is insufficient since the conventional measure of income inequality is based on the concept of social comparison from the

social psychological perspective. In addition, this unilateral evaluation is inconsistent with the goal of the reduction of income inequality for individuals' well-being. Essentially, the well-being depends not only on social efforts such as government assistance but also self efforts. By doing so, self efforts is measured by an index which is calculated through income difference within a person over years, so called individual income inequality, indicating one's balance of earning progress, followed by the present study investigating the joint effects of the new index and the traditional index to qualify the returns on social efforts and self efforts in living standards.

The underlying consideration for looking at both sides, social and individual, of the information is also about the impressive improvement of living standards over the decades in China which may not be attributed entirely to the government economic institutions and policies, but also the efforts and desire of improving their living conditions by the population. Taking both sides' information into account allows us to make an unprejudiced judgment of government assistance and actions. Previous studies have failed to take individual income inequality into account when determining the effect of income inequality on the living standards and therefore, yield biased results.

This study firstly measures inequality through social efforts and individual efforts, going beyond economic factors. Generally, economic study focuses on the functional distribution (i.e. land, capital or labour) and the size of income distribution (or distribution of income among persons). Yet, it is not sufficient when policymakers and economists explicitly set the goal of promoting the well-being of individuals

through economic opportunities, especially in the research area of inequality. Without addressing any part, it is an incomplete account for the well-being of individuals and more importantly, the process made by traditional ideology may lead to some degree of negative meaning about the life of individuals.

This study introduces different time horizons, short run and long run, in one unified framework. It has the benefit of looking at inequality from multiple dimensions. In this way, an unbiased judgment can be made. For example, the short run effect by initial social index implies the effective government action and policy but this is not correct when restricting to the long run effect by individual index. The issue with such a setting is the need for a set of longitudinal data with large N and reasonable length of T. The social inequality index and individual inequality index may not measure social inequality and individual inequality properly with a small N and short T, respectively. The present study may face such an issue that arises from the short T, especially some T=3 (minimum time length), but many individuals are repeatedly observed over more than three waves and the time span is long. Certainly, we desire to improve such measurement when more data are available.

The results are robust and contribute additional evidence of the need for sustainable government assistance and action in China. Besides, the study works out how these social efforts and self efforts insights are. A limitation of this study is that of the data having the major drawback of representing the whole population in China since individuals are subjected to geographical selection. Further work is needed to develop this proposed idea of the joint collaborative of returns on social efforts and

individual efforts to evaluate government intervention and promote well-being.

More urgently, due to the improvement in living standards in low income individuals being rather limited and more importantly, not converging to the high income group, these may imply insufficient economic opportunity and a lack of equal opportunity across income levels, particularly for the bottom income distribution. Hence, the next chapter is designed to link the analysis to economic opportunity in China.

CHAPTER 4 Mobility, Volatility and Individual Income Inequality

4.1 Introduction

The findings from the previous chapter imply that there may be a lack of economic opportunity among the poor. This chapter therefore further investigates opportunity through the concept of income mobility, regarded as an effective measurement for relieving the pressure of income inequality and for the well-being of the individual in the literature. Senik (2005) shows that perceived mobility is central to the link between other people's income and individual satisfaction as it determines individual opportunities and risks.

Over recent years, it has become increasingly popular to study income mobility and income inequality. However, this research area is still in its early development, while limited studies incorporate income volatility in China, as concluded by Fields and Zhang (2007) and Chen and Zhang (2009) from their survey of previous domestic studies. Nichols (2010) points out that much existing evidence of the link is "vitiated" since there is a lack of volatility of income measurement taken into account at the same time; the author, hence, conducts such analysis.

This present study further investigates how the uncertainty of income inequality can be explained by mobility and volatility in China. This research introduces the idea of individual income inequality (see Chapter 3 for detailed discussion) in this investigation. The measure considers an individual's income inequality over a period of time rather than other people's, group or population income levels at a point in time. In this way, the study attempts to observe the question of how one's unequal income development can be affected by economic opportunity and security.

The China Health and Nutrition Survey individual data are used for this

investigation with the quantile regression. The quantile regression estimates show that the parameter of absolute mobility is positive and significant across all observed quantiles (i.e. it is 0.130 at the 50 percentile); and conversely, the coefficient of volatility is negative across many observed quantiles (i.e. it is -0.063 at the 50 percentile) from 1989 to 2009. Furthermore, the lower the income level, the lower the income security is. This result reflects on the coefficients of volatility. All these findings indicate that income mobility can offset income inequality, but economic security such as insurance, the welfare system, property rights and health care and so on is the most crucial and essential area to tackle income inequality in China.

The following chapter is organised into five parts. Section 4.2 focuses on the literature review of international and domestic studies, followed by the measurements of inequality and mobility in Section 4.3. Sections 4.4 and 4.5 present the estimation process, results and discussion. Section 4.6 is the conclusion.

4.2 Literature review

4.2.1 Theory development

The term "mobility" is within the contexts of social mobility in sociology and anthropology, the study of social movement and changes (see Miller, 1956). Income mobility is one branch of social mobility with the particular economic focus on the transition of income status. Miller brought the term of income mobility into the introduction of the concept of mobility in 1955.

Initially, the emergence of income mobility in economics stands alone with the large shift from the functional income distribution to the size of income distribution in the 1960s-1970s (Goldfarb and Leonard, 2005). At the same time, economists and politicians are not content with "static" measures of income inequality since the limitation of "static inequality" is not satisfactory with a broad welfare theoretic

conception of economic justice. As a concept advanced by Friedman (1962), he brings attention to combining this importance of mobility with an understanding of inequality and clearly states that given that the same income inequality between two societies and higher income mobility in one than the other, the one is regarded as equality comparatively and its corresponding economy is more efficient and has more equal opportunity than the other. What is not clear in Friedman's statement is the relationship between mobility and inequality. The well-known statement by Friedman states:

> Consider two societies that have the same distribution of annual income. In one there is great mobility and change so that the position of particular families in the income hierarchy varies widely from year to year. In the other, there is great rigidity so that each family stays in the same position year after year. Clearly, in any meaningful sense, the second would be the more unequal society. The one kind of inequality is a sign of dynamic change, social mobility, equality of opportunity; the other of a status society.

> (Friedman, 1962, p.171)

Subsequently, many scholars make an effort to examine the effects of mobility on inequality. Paukert (1973) states that there is a clear long-term trend towards income equality in his survey of relevant literature, and the statement comes to light mainly by Soltow's two studies (1965 and 1968) since they trace a long historical period. Soltow (1965) uses annual income with eight Norwegian cities in ten-year intervals between 1840 and 1960. The majority of Gini coefficients decreases during the period of time. Another study by Soltow (1968) traces the longest period in Great Britain that begins with 1436 and ends with 1962 and finds that there is no indication of increases in inequality. In contrast to shorter periods, there are some variances (Kravis, 1962) and supports (Kohen *et al.*, 1975). For example, there are some contradictory findings in other developing countries of Puerto Rico, Argentina and Mexico (Weisskoff, 1970).

Hart (1976) summarizes that the dynamic analysis of income distributions reveals important changes in income distribution, which are hidden by the usual

comparisons of the inequality of incomes at two or more points in time. For example, it reveals the movement of people between different income brackets over time. It also shows how the average income of the poorer-paid changes relatively to that of the better-paid, how the average length of stay in an income bracket changes, and how the time path of a person's income changes through his life cycle (Hart, 1976). Similarly, Shorrocks (1978a, 1978b) also observes previous studies and discovers that variations in income depend on the interval between observations, and on the length of the accounting period chosen for incomes. That is, the aggregate of incomes over time tends to improve the relative position of those temporarily found at the bottom of the distribution, and the situation of those at the top tends to deteriorate. In short, these studies above are mainly concerned about the effect of the long run (time interval) measure of mobility (or time trend) on the short run (one year) measure of income inequality.

In recent decades, income inequality and income mobility receive abundant attention concerning the traditional question of whether the large rise in income inequality that has occurred over the years has been accompanied by a decline in mobility. This underlying assumption for such a question is that an increase in mobility can offset income inequality. Beenstock (2004) points out that income inequality and mobility are closely interwoven concepts even to the point of confusion. It is quite right that this assumption does not necessarily mean a negative relationship between the two. The notion for such interest is that for mobility to offset the increase in inequality, the rate of mobility has to accelerate. In other words, in providing that high level of income inequality and significant income mobility in an economy, the inequality is tolerable since income mobility is regarded as an equalizer of longer-term incomes (Krugman, 1992; Jarvis and Jenkins, 1998; Fields, 2010).

Evidence to support such traditional hypotheses does not occur consistently and rather indicates the converse results of a positive relationship. Prieto-Rodríguez *et al.* (2010) find a positive relationship between income inequality and mobility in European Union regions. Lukiyanova and Oshchepkov (2012) conclude that the inequality-reducing effect is almost exactly offset by changes in the relative positions of individuals, and the overall reduction in cross-sectional inequality is merely modest in Russia. De Figueiredo and Ziegelmann (2010) suggest that Brazil has low income mobility, indicating that its social framework is relatively rigid. In other words, the income class in which an individual is inserted will determine his/her future social position. Beenstock (2004) discovers that there is high income mobility between 1983 and 1995 in Israel, and horizontal measures of income overstate its inequality. Parker and Gardner (2002) find general support for the claim that world mobility increased between 1972 and 1992, counterpointing the increased inequality over this period. Quadrini (1999) finds that during periods of growth, society opts for less taxation and less redistribution, and growing economies are characterized by higher income inequality and by greater mobility of agents within income classes over time**.**

In contrast, there is no empirical case that accelerated rates of mobility offset the increases in inequality that have been convincingly documented by extensive research (Mishel *et al.*, 2008). For example, Aaronson and Mazumder (2008) report the mobility between the earnings of fathers and sons that has doubled from around 0.3 to around 0.6 since 1980 in the USA. However, Lee and Solon (2009) state that the estimates of mobility are widely divergent and discover no such acceleration in the USA. Gangl *et al.* (2007) conclude that high US inequality is not offset by greater mobility in the period of 1980s-1990s since an eight-year interval mobility of income does not alter the inequality. Aaberge *et al.* (2000) find no evidence of a positive

relationship between inequality and mobility in the comparative study between Scandinavian countries and the USA. Hassler *et al*. (2007) demonstrate that the correlation across countries can be either positive or negative.

From the review thus far, several aspects are clear. First, the concept of income mobility is derived from the length of accounting income period, describing changes in the income of an individual or a set of individuals in the overall income distribution of a defined group. Second, mobility represents the dynamics of income change, while inequality generally means for a static income status. There is a need to look at both components to understand income disparity. Third, the core theme for the investigation of the link between income inequality and income mobility is the question of whether inequality can be offset by significant mobility. If so, the inequality in a society is not necessarily a big issue to be concerned with. Finally, the theory is ambiguous on the relationship between mobility and inequality because the results are conclusively inconclusive, as Fields (2001, 2007) also points out.

In contrast, the theory is elusive on the link between the two since the inequality-offset question is intuitively easily mistaken on the effect of mobility. Originally, Friedman's (1962) statement[34] does not indicate that the larger the income mobility, the smaller the income inequality and yet, the statement somehow is simply interpreted as such in the literature, which is not quite precise. In addition, high level inequality is considered a bad thing, and mobility is regarded as a good thing for enhancing equality and efficiency in an economy (Friedman, 1962; Atkinson *et al*., 1978; Aaberge *et al*. 2000). Such an inverse position of the two is facilely thought a negative relationship.

However, one thing is certain in that growth of mobility is desirable. Thus, high

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[34] See Friedman (1962, p.171).

mobility implies that individuals can improve their living condition by their own efforts. Conversely, if it is not, then it indicates that economic opportunity is restrained or/and productivity reduces. Apart from such a general indication, income mobility is far more capable than that because of the multidimensionality of this concept (Fields, 2001, 2007).

A significant positive correlation between inequality and mobility also suggests that redistribution is not otherwise essential. Lorente Prieto *et al*. (2008) point out that the social demand for redistribution has two main determinants in the literature: social mobility and beliefs regarding whether income differences are due to effort or luck. Piketty (1995) finds that stronger beliefs that income differences are a result of luck, together with lower social mobility, increases the level of support for income redistribution. Ravallion and Lokshin (2000), Corneo and Gruner (2002) and Fong (2001) confirm these results: greater mobility reduces the popular desire for redistribution, and a firm belief that individual efforts is the principal cause of income dispersion similarly produces a greater aversion to redistributive policies.

Income mobility is also a notion that helps attenuate the unequal distribution of initial endowments. As Björklund and Jäntti describe:

> Consider two hypothetical types of societies. The first is characterized by strong associations in income among parents and children as well as among siblings. In such a society, knowing a person's family background makes it easy to predict her income during adult life. The second society reveals the opposite pattern so that the correlation between family members' income is weak or close to zero. In the former society, a person's income is to a large extent predetermined by factors that she has not chosen herself. Arguably, there is less equality of opportunity in the first society.
>
> (Björklund and Jäntti, 2009, pp.491-492)

With agreement, origin independence seems to capture intuitions about "equality of opportunity" which can be roughly defined as the extent to which personal

characteristics (such as talent) rather than parental background determine monetary rewards (cf. Loury, 1981; Benabou, 1996; Benabou and Ok, 1999).

4.2.2 Volatility

Given that mobility measures the dynamic of the income component, such movement likely comes with fluctuation. This fluctuation (or variability) is regarded as income volatility and often suggests income insecurity (or instability). Jenkins (2010) explains that high income mobility may be problematic because it increases the longitudinal instability of income flows and increases income risk so that observing income security is desired at the same time. Jarvis and Jenkins (1996) and Nichols (2008) view mobility that may also be a synonym for income fluctuations and hence, economic insecurity. Jarvis and Jenkins clearly state:

> On the one hand mobility is an indicator of how open society is and the degree of equality of opportunity, and hence a Good Thing. To some, greater inequality may be more tolerable if accompanied by significant mobility. On the other hand, mobility may also be a synonym for income fluctuations and hence economic insecurity, a Bad Thing. Whether income flux is more concentrated amongst the poorest or the richest is likely to influence the overall social verdict.
>
> (Jarvis and Jenkins, 1996, p.1)

Thus, as Fields and Ok (1999a, 1999b) point out, by using measures of income movement, one can examine how unstable the incomes of individuals have been throughout a given time period and address questions related to economic insecurity. Apart from these reasons, economies have become more unstable along with more dynamic economies. These phenomena are in line with globalization and deregulation, and technological changes have increased the amount of creative destruction and thus, the competitive pressures and risks faced by disaggregate levels such as workers and firms over the years (Dynan *et al*., 2007). This is even particularly relevant if an

economy is under consideration of a lack of functioning credit market that could insure individuals against economic shocks and help them smooth their consumption patterns (Fields *et al.*, 2007).

Nevertheless, there is very little work that has been done in this respect (Nichols, 2010), even though numerous authors (i.e. Gosselin, 2004; Moffitt and Gottschalk, 1995; Hacker, 2006; Gosselin and Zimmerman, 2007; Dynan *et al.*, 2007; Dahl *et al.*, 2008; Shin and Solon, 2008; Nichols and Zimmerman, 2008; Whalley and Yue, 2009) have debated the degree to which income volatility has increased over time and what this means for individuals and household income security (see also Gosselin's, 2008 book for further discussion). At the same time, these studies suggest that there is no universally preferred model of income dynamics or income dispersion on which to base a measure of volatility. Furthermore, this literature has been inconclusive in the reach area of income volatility, starting with the seminal work of Gottschalk and Moffitt (1994). Many studies have found that individual earnings and household income have become more volatile during the past few decades. These findings suggest that the higher the volatility, the higher the income inequality. In contrast, there are some notable exceptions which find no increase or decline in the volatility of earnings and total household income (such as CBO, 2008 and Dahl *et al.*, 2011).

4.2.3 Previous studies of China

Fields and Zhang (2007) conclude from previous domestic studies that research on income mobility in China is still in its early development. Chen and Zhang (2009) also recognise that the impact of volatility on inequality has received limited attention in the literature based on their survey. The existing domestic studies in income mobility mainly focus on the measurement which can be divided into two groups: one focuses on descriptive analysis, and another applies regression examination based on

conditional or unconditional regression analysis to measure mobility.

Nee (1996) shows that rapid and extensive rural household income mobility is due to economic reform in China in the 1980s. In a recent decade, Wang (2005) measured China's household income mobility in the 1990s using the CHNS data, which was for the first time implemented by a Chinese economist in this field. Khor and Pencavel (2006) declare that the degree of income mobility in urban China during the first half of the 1990s is much higher than in the USA and other advanced economies. Yin *et al*. (2006) find that income mobility between 1998 and 2002 is lower than from 1991 to 1995 after measuring the data from 1995 to 2002 in China. Ding and Wang (2007) examine household income mobility and find high levels of mobility which is due to an exchange process accompanied by high growth as well as historical macroeconomic policies. The measure of income mobility by Shi *et al*. (2010) is based on the combination of rank mobility and quantity mobility, and income inequality and income mobility. One of the findings is the poorest households were more mobile compared to the rich. That is, a large percentage (73%) of the households in the lowest quintile in 1989 was able to move up to a higher quintile by 2006. Chen and Cowell (2013) show high mobility as well as income inequality. Among these studies, several papers also apply regression analysis for the changes of income with or without conditional restriction (Khor and Pencavel, 2006; Zhang *et al*., 2007).

The main finding of these studies is consistent with international literature. That is, the long run inequality is lower than short run inequality in China which means that income mobility offsets income differences. Yet, this statement is not particularly insightful to clarify the fact that the high levels of income inequality are ethically wrong. Certainly, this conclusion emphasizes the desire of mobility in Chinese society because the engine of mobility is economic opportunity. However, there is the need for

ensuring income security to prevent excessive mobility.

Nichols (2010) claims the first study to address this issue in China and finds that income mobility in China is higher than in the USA, but volatility in the USA is lower than in China and the suggestion is to provide substantial insurance mechanisms and develop a welfare system by policymakers. Whalley and Yue (2009) and Zhao (2008) focus on the income volatility and income inequality in rural or urban areas since the study believes that previous inequality researchers do not consider volatility simultaneously.

Another relevant study is that of Zhang and Eriksson (2010). They aim to measure the degree of inequality of opportunity associated with the distribution of income with the regression framework by Roemer (1998). The results indicate substantial degrees of inequality of opportunity which reflect on parental connections remaining an important transmission mechanism for the intergenerational persistence of economic advantage and disadvantage. Additionally, the increase in income inequality during the period largely mirrors the increase in inequality of opportunity. Similar studies briefly include Breen and Jonsson (2005) and Gong *et al*. (2012).

Recalling the proposed argument of this thesis: an individual's well-being depends on self efforts and social efforts and relevant income differences among people are a result of the two efforts derived from self-interest and social influence. Previous studies have followed traditional measures of income inequality to explore the link of inequality and mobility. The traditional inequality index focuses on cohort measurement such geographical divisions (for example, national and regional) and social characteristic divisions (for example, age and ethics). This present study advances the research area on income inequality and mobility by investigating how the overall income mobility can affect the balance of individual life time earnings. In this

way, we will provide more insights into the effect of economic opportunity and security on inequality.

4.3 Measures of mobility and volatility

4.3.1 The notions

One issue in the mobility literature is that it does not provide a unified discourse of analysis since the notion of income mobility is not well-defined and different studies concentrate on different aspects of this multi-faceted concept (Fields and Ok, 1996a, 1996b). Basically, mobility studies analyse how specific individuals move through the income distribution in terms of symmetric income movement, positional movement, directional income movement, time dependence, or some other measures (Fields *et al.*, 2007) (see Table 4.1). Different mobility notions adopt corresponding measures. This diversity of mobility notions and measures recall the variety of inequality indices. Hence, Fields and Ok (1999a, 1999b, p.561) suggest "a crucial preliminary step of any sort of mobility analysis is the clarification of the particular facet of the notion of 'income mobility' that one is seeking".

Table 4.1: Common Measurement of Income Mobility Index

Mobility notion and index	Formula
Mobility toward equality	
Shorrocks' equalization index	$1-\left[I\left(\sum_{t=1}^{T}y^{t}\right)\Big/\sum_{t=1}^{T}w^{t}I\left(y^{t}\right)\right]$
Fields' equalization index	$1-\left[I\left(\sum_{t=1}^{T}y^{t}\right)\Big/I\left(y^{1}\right)\right]$
Mobility as time dependence	
Pearson's correlation coefficient	$cov\left(Y_{j}^{f},Y_{j}^{i}\right)\Big/\left[\sqrt{var\left(Y_{j}^{f}\right)}\sqrt{var\left(Y_{j}^{i}\right)}\right]$
Pearson's chi square test	$\sum_{c}\sum_{r}\dfrac{\left(n_{c,r}-m_{c,r}\right)^{2}}{m_{c,r}}$
Mobility as positional movement	
Mean absolute quantile change	$\dfrac{1}{n}\sum_{j=1}^{n}\left|P_{j}^{f}-P_{j}^{i}\right|$
Mobility ratio	$1-Trace\left(\mathbf{M}\right)$
Mobility as symmetric income movement	
Average absolute income change	$\dfrac{1}{n}\sum_{j=1}^{n}\left|Y_{j}^{f}-Y_{j}^{i}\right|$
Relative absolute income change	$\sum_{j=1}^{n}\left|Y_{j}^{f}-Y_{j}^{i}\right|\Big/\sum_{j=1}^{n}Y_{j}^{i}$
Mobility as directional income movement	
Average income change	$\dfrac{1}{n}\sum_{j=1}^{n}\left(Y_{j}^{f}-Y_{j}^{i}\right)$
Average logarithmic income change	$\dfrac{1}{n}\sum_{j=1}^{n}\left[\ln\left(Y_{j}^{f}\right)-\ln\left(Y_{j}^{i}\right)\right]$

a. The variables are defined as follows:
$Y_{j}^{f,i}$: income of individual j in period f (final) or period i (initial)
$P_{j}^{f,i}$: income position (for example, quantile) of individual j in period f (final) or period i (initial)
$\mathbf{M}$: transition matrix
$n_{c,r}$: number of observations in column c, row r, of a quantile mobility matrix
$m_{c,r}$: number of expected observations in any cell of a quantile mobility matrix under the hypothesis on time independence (that is, the inverse of the squared number of quantiles times the total number of observations)
$\mathbf{y}^{t}$: population vector of individual incomes for period t
n : number of individuals in the population
w^{t} : factor weights (the ratio of average income in period t to the sum of average incomes over time)

Source: Fields *et al*. (2007)

Primarily, the present study focuses on the understanding of whether a high degree of the inequality is accompanied by economic opportunity and income security and whether redistribution is desired in China. In accordance, the absolute mobility index captures the overall income transmission[35] and is reasonable to indicate

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[35] Absolute income mobility simply measures the actual change in an individual's real

economic opportunity and economic security. The reason is that the more opportunity there is in a society, the more income transmission. It is worth noting that the degree of mobility is not only the consequence of more opportunity, but also other factors such as productivity increases in China. In this sense, the high mobility cannot attribute to equal opportunity entirely in the case of China. It is more appropriate and logical to view economic opportunity conceptually as one of the elements of economic mobility in short and median term measurements.

4.3.2 Methods

In the present study, the framework of economic opportunity follows the concept of distance based on the absolute difference in log-incomes and belongs to a class of absolute mobility measures (Fields and Ok, 1999a, 1999b) (Eq. 4.1). The Fields and Ok (1999a, 1999b) approach is a commonly used measure for the overall income mobility.

$$MA(Y_{it}, Y_{i,t+s}) = \frac{1}{n} \sum_{i \in N}^{n} \left| \ln(y_{i,t+s}) - \ln(y_{it}) \right| \; , \tag{4.1}$$

where *MA* is the total movement (mobility) of income, *n* is the number of individuals in the economy, and Y_t and Y_{t+s} are the initial and final incomes of individuals, respectively. This index is the aggregate of the change in each individual's income. Here, the income mobility is regarded as an absolute mobility, as any variation of an individual's income is taken into account in the index.

Firstly, the equation suggests that if $Y_t = Y_{t+s}$, and then $MA = 0$, this indicates that the incomes of all individuals stay the same through time and concludes no income movement in the society. When $Y_t \neq Y_{t+s}$, and then $MA > 0$, this means that income movement occurs. In general, we expect that the final incomes are greater than

income.

the initial one. If this is the case, the higher the absolute mobility there is maybe: 1) the higher the means of the standards of living and 2) the higher the possibility to move from a poor to a rich state. Additionally, it maintains that the level of mobility associated in which a certain transformation would not be altered if the same dollar amount is added to everybody's income in both the initial and final distributions of this transformation. In other words, absolute changes allow one to talk about income mobility in terms of total dollars, as Fields and Ok (1996a, 1999b) summarize. Secondly, the implicit assumption of this method is that a dollar gain or loss is the same regardless of the income level of the person experiencing it (Fields and Ok, 1999a, 1999b). This assumption is relevant to economic opportunity.

As we discussed, the fluctuation of income mobility is regarded as volatility, which is an indicator for income insecurity if the mobility fluctuates rapidly and suggest high income volatility. Conversely, if the income almost never changes, it has low volatility, which indicates the social welfare system needs to provide monetary assistance to people with an inadequate or no income. Standard deviation is the typical and simplified statistic used to measure volatility. There are three other popular approaches to estimating earnings volatility (Venn, 2011): time-series methods, cross-sectional methods and categorical methods, all of which are used for longitudinal data to calculate individuals' income volatility. The present study is designed to look at the variability of mobility. By doing so, the volatility of mobility is measured as the cumulative standard deviation of relative mobility across individuals. By "relative mobility", we mean the individuals' share of the total income mobility and refer to it as the speed of change in an individual's income from *t* to *t+s*. The formula is Eq. 4.2,

$$MR(Y_{it}, Y_{i,t+s}) = \frac{1}{n} \sum_{i \in N}^{n} \frac{\ln(y_{i,t+s}) - \ln(y_{it})}{\ln(y_{it})} \quad , \qquad (4.2)$$

where MR is the relative mobility, and Equation 4.2 suggests that if $y_{i,t+s} = y_{it}$, then $MR = 0$, and there is no income growth in the final period; if $y_{i,t+s} < y_{it}$, then $MR < 0$, and negative speed of income movement; if $y_{i,t+s} > y_{it}$, then $MR > 0$, and positive speed of income movement. The speed of the income movement is one of the factors that affect economic well-being in terms of security so that its standard deviation is used to measure income volatility (V) which is the measure of fluctuations of a process, where MR_i is the ith individual contribution of the relative movement.

$$V = \sqrt{var(MR_i - MR)} \qquad (4.3)$$

The individual inequality index, IT, is calculated according to the Theil's statistics in equation 4.4 which is for the ith individual at an observed period of waves. $\mu_{y_{iW}}$ is the average income of the ith individual over particular waves; k is the number of waves appeared for an individual. *IT=0* suggests perfect equality while *IT=1* indicates perfect inequality across years (see detailed discussion in Chapter 3).

$$IT = \frac{1}{k} \sum_{i \in n}^{k} \frac{y_{iw}}{\mu_{y_{iw}}} ln \frac{y_{iw}}{\mu_{y_{iw}}}, \qquad (4.4)$$

Regarding alternative methods in the literature, there is a plentiful number of measurements of income mobility, including Shorrocks (1978a and 1978b), King (1983), Chakravarty *et al*. (1985), Cowell (1985), Dardanoni (1993) and Fields and Ok (1996, 1999). Fields and Ok (1999b) also show that their method of mobility index is superior in terms of measuring income flux. There are also various alternative methods to estimate volatility and changes therein are discussed by Nichols and Zimmerman (2008) and include both parametric and nonparametric methods (i.e. Gottschalk and Moffitt, 1994; Dahl *et al*., 2011; Dynan *et al*., 2007; Shin and Solon, 2008). However, the simplest methods also tend to produce fairly reliable results in large data, according

to Nichols (2010). At the same time, this essay is the first to explore the different effects of mobility and volatility between the two inequalities rather than dwelling on measurement methods.

4.4 Variable description and estimation method

4.4.1 Mobility and volatility

The data are taken from the CHNS from 1989 to 2009. Figure 4.1 shows a clear income movement during the period and some negative and zero values. These negative and zero values are exclusive.[36]

Figure 4.1: Income Movement Across Waves
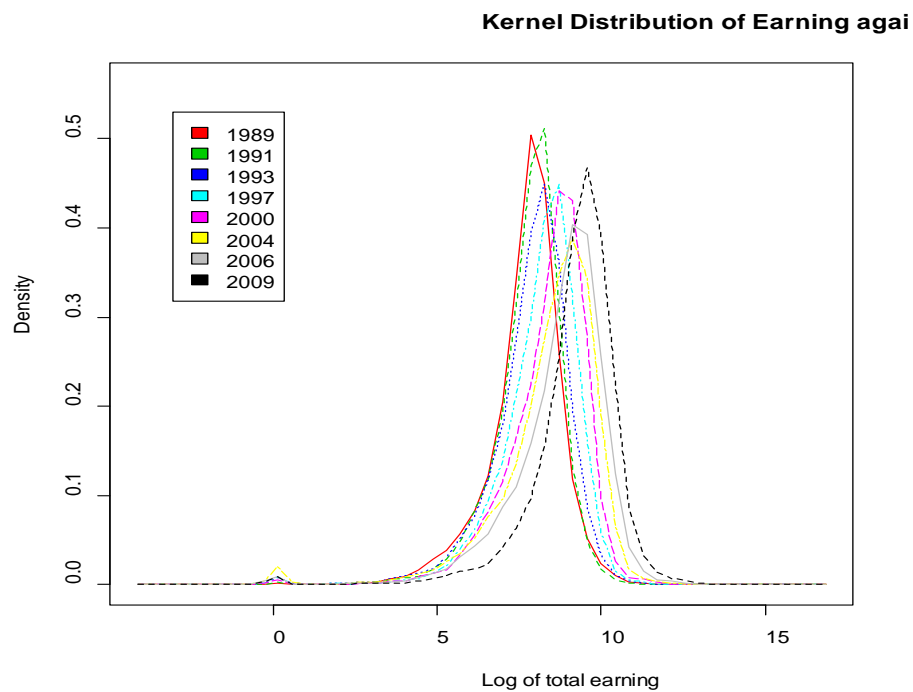
Source: Author's calculations.

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[36] More detailed discussion is in Chapter 3.

Table 4.2: Summary of Mobility and Volatility

|	Period	Income			Mobility			Volatility		
		2009-1989	2009-2000	1997-1989	2009-1989	2009-2000	1997-1989	2009-1989	2009-2000	1997-1989
Overall	Min.	16	114	45	0.00	0.00	0.00	0.00	0.00	0.00
	10%	2608	4076	1964	0.30	0.27	0.29	0.12	0.11	0.08
	1st Qu.	4857	7401	3217	0.75	0.58	0.60	0.22	0.17	0.17
	Median	9239	12672	5137	1.51	1.12	1.14	0.44	0.31	0.31
	Mean	13186	16840	6812	1.74	1.37	1.37	0.47	0.35	0.35
	3rd Qu.	16570	21053	8106	2.50	1.93	1.90	0.69	0.50	0.50
	90%	27404	32603	13124	3.39	2.87	2.76	0.89	0.76	0.70
	Max.	161922	161922	88622	8.20	8.20	7.11	1.22	1.02	1.09
Rural	Min.	18	114	45	0.00	0.00	0.00	0.00	0.00	0.00
	10%	2284	3487	1733	0.35	0.33	0.34	0.11	0.10	0.10
	1st Qu.	4406	6444	2944	0.88	0.67	0.70	0.26	0.19	0.19
	Median	8566	11377	4956	1.73	1.29	1.28	0.50	0.35	0.35
	Mean	12132	6487	6487	1.87	1.51	1.48	0.51	0.39	0.39
	3rd Qu.	15521	19171	7910	2.66	2.11	2.06	0.74	0.56	0.54
	90%	25088	29515	12861	3.58	2.99	2.87	0.94	0.76	0.72
	Max.	161922	161922	88622	8.20	8.20	7.11	1.22	1.06	1.02
Urban	Min.	16	304	64	0.00	0.00	0.00	0.00	0.00	0.00
	10%	3378	6498	2613	0.23	0.19	0.22	0.08	0.05	0.06
	1st Qu.	5730	10274	3771	0.57	0.44	0.46	0.17	0.12	0.13
	Median	10825	15391	5601	1.40	0.84	0.87	0.34	0.23	0.23
	Mean	15217	20500	7525	1.17	1.09	1.12	0.39	0.29	0.29
	3rd Qu.	18951	24901	8523	1.95	1.47	1.48	0.56	0.40	0.40
	90%	31463	38330	13760	2.93	2.29	2.45	0.81	0.60	0.63
	Max.	147979	147979	81566	7.80	7.80	6.41	1.22	1.06	1.01

Source: Author's calculations.

Table 4.2 represents the overall basic summary of income, mobility and volatility and the differences between urban and rural areas at three periods of time: the whole sample period from 1989 to 2009 (1989-2009) and two separate periods of 1989 and 1997 (1989-1997) and 2000 and 2009 (2000-2009).Table 4.2 shows that the longer

the period of time, there is higher mobility because the mobility index is larger in the full sample period than the other two short periods. Volatility has a similar situation with mobility. In addition, the higher the income level, the higher the mobility and volatility. The minimum and the maximum of the mobility and volatility indices have significant differences across three periods and three classed of individuals ("overall", "rural" and "urban"). It is worth noting that all minimum income levels are extremely small and do not have any income movement. In other words, these individuals stay as the poor as they used to be when time passed. Such a minimum is far away from the poverty base line of 2300 RMB per year (Chinese Academy of Sciences, 2012) and it is not reasonable to observe these individuals' life time earnings when they struggle with survival. Hence, this study excludes people in poverty but future research is needed to look at this group of individuals in-depth. In terms of urban and rural areas, although the average income in urban areas is higher than in rural areas, the income movement and volatility are not as much as in rural areas. This result is similar with the measurement of mobility by Chen and Cowell (2013) and Sun *et al*. (2007).

Figure 4.2 and Figure 4.3 display clear pictures of the relationship between individual inequality and mobility and between the inequality and volatility at different quantiles. These two plots suggest quantile regression is superior because of a clear pattern of heteroscedasticity. OLS regression will, here, be misleading because it relies on the mean as a measure of centrality for the distribution. Instead of the mean, the median (which is the 50th percentile) or some other quantile could be a more appropriate reference for unknown parameters.

Figure 4.2: Plot of Inequality and Mobility by Quantile
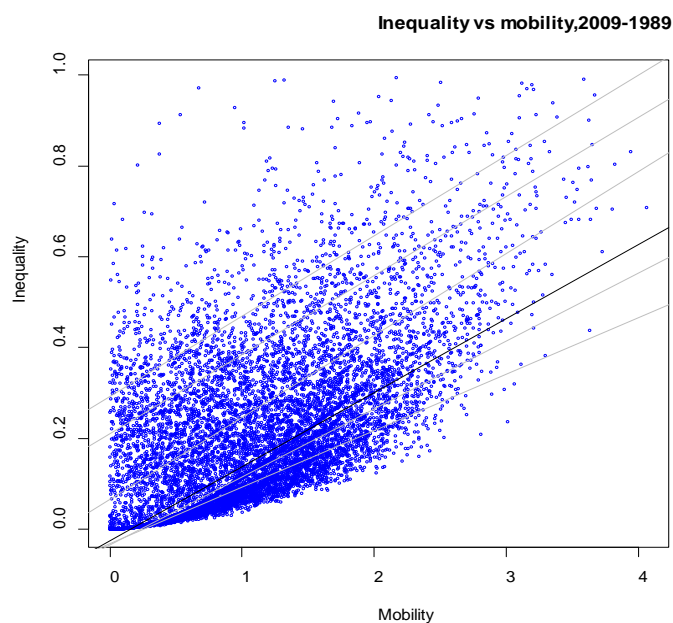
Inequality vs mobility,2009-1989

Source: Author's calculations.
Notes: The black line is the fitted line from OLS; the rest are the 5 percentile, the 10 percentile, the 25 percentile, the 75 percentile, the 90 percentile and the 95 percentile lines based on quantile regressions.

Figure 4.3: Plot of Inequality and Volatility
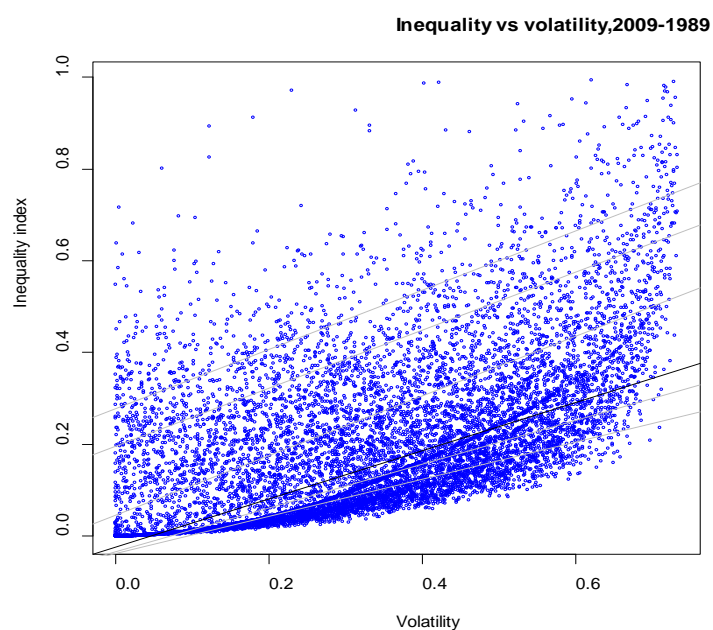
Inequality vs volatility,2009-1989

Source: Author's calculations.
Notes: The black line is the fitted line from OLS; the rest are the 5 percentile, the 10 percentile, the 25 percentile, the 75 percentile, the 90 percentile and the 95 percentile lines based on quantile regressions.

4.4.2 The quantile regression

The general model for the interested relationship with respect to individual income inequality is expressed as follows:

$$IT_i = f(MA_i, V_i), \qquad (4.5)$$

where *i* denotes individual {1,2, ... ,N}.Individual income inequality, *IT*, is the index of individual income inequality, *MA* is absolute mobility index and *V* is volatility. The unknown parameters will be estimated by quantile regression mainly based on the observation of descriptive analysis. We examine three periods of time: 1989-2009, 1989-2000 and 2000-2009.

Quantile regression is developed by Koenker and Bassett (1978) and is desired if conditional quantile functions are of interest. The general reason for such interest is that the ordinary least-squares regression models the relationship between one or more covariates *X* and the conditional mean of response variable *Y* given *X=x*. In contrast, quantile regression models the relationship between *X* and the conditional quantiles of *Y* given *X=x*. In this sense, one advantage of quantile regression is that the quantile regression estimates are more robust against outliers in the response measurements. This property is important in handling the data set due to no small amount of extreme values from the bottom and the top income distributions. In other words, the lower quantile and the upper quantile are always critical in income inequality analysis. Secondly, quantile regression has been proposed and used as a way to discover more useful predictive relationships between variables in cases where there is no relationship or only a weak relationship between the means of such variables. Thirdly, there is a significant difference between the mean of speed mobility and the median. Correspondingly, the conventional location shift model thus delivers a rather misleading impression of the speed mobility effect to inequality. Furthermore, quantile

regression is flexible in terms of allowing median regression when the quantile is 0.5. Finally, quantile regression is superior in dealing with unequal variations and handling data with heterogeneous conditional distribution. In these respects, this method is appropriate and will provide more complete and detailed information of the covariate effect. This approach follows Koenker and Bassett (1978) and Koenker and Hallock (2001).

The base linear model is:

$$IT_i = X'_i\beta_\theta + e_i \text{ with } Quant_\theta(IT_i|X_i) = X_i\beta_\theta \ , \quad\quad (4.6)$$

where IT_i is a dependent variable and X_i denotes a vector of repressors, β_θ represents the vector of parameters to be estimated, and e_i is a vector of residuals. $Quant_\theta(IT_i|X_i)$ represents the θth conditional quantile of IT_i given X_i. The θth regression quantile solves the following problem:

$$\min_\beta \{\sum_i^n \theta|IT_i - X_i\beta| + \sum_i^n (1-\theta)\,|IT_i - X_i\beta|\}, \quad\quad (4.7)$$

This is generally written as:

$$\min_\beta \sum_i^n \rho_\theta(IT_i - X_i), \quad\quad \theta \in (0,1) \quad\quad (4.8)$$

Eq. 4.8 can be solved by the linear programming technique where $\rho_\theta(e)$ is the check function defined as $\rho_\theta(e) = \theta e$ if $e \geq 0$, or $\rho_\theta(e) = (\theta - 1)e$ if $e \leq 0$. The median regression, which is a special case of the quantile regression, is obtained by setting $\theta = 0.5$. Other quantiles of the conditional distribution can be obtained via variation. To convey a sense of the relationship of selected explanatory variables across the entire conditional room price distribution, the results for the 10th, 25th, 50th, 75th and 90th quantiles are reported.

In OLS, it allows estimating how, on average, mobility and volatility affect

income inequality and whether there is any significant relationship between mobility and inequality in the equation. In QR, it can go a further step forward; that is, it enables us to answer important questions of whether mobility influences inequality differently for individuals with a low income inequality than for those with a high one. In other words, it specifies changes in quantiles of the inequality. For example, a median regression (when quantile=0.5) of inequality on mobility specifies the changes in the median inequality as a function of the predictors. However, OLS is also used as supplementary information, aiming to see any difference in the effects between mean and median. The F-test is also used for testing the difference in parameters at different quantile regression, aiming to justify the use of quantile regression.

There may be a potentially similar correlation between independent variables and the error term to Chapter 3, but the estimates do not show serious changes in the values of coefficient on endogenous variables when we control for the endogeneity between social inequality and income. Hence, the study concentrates on dealing with heteroscedasticity. For this purpose, the quantile regression is superior. Moreover, many studies on income inequality and income mobility draw conclusions merely according to descriptive analysis; Cunha *et al*. (2006) also support this view.

4.5 Results and discussion

Table 4.3 displays the estimates from OLS and quantile regression. There are three time periods in total: 1989-2009 covers all the examined waves; 2000-2009 concerns waves in the 2000s and includes four consecutive survey waves of 2000, 2004, 2006 and 2009; and the last period of 1989-1997 focuses on the nineties, including waves of 1989, 1991, 1993, 1997. The results display that the OLS estimates differ from QR estimates since the effects of mobility and volatility in OLS are very different from the estimates based on median (the 50th percentile).

Mobility is expected to have a positive and significant effect on income inequality across the three periods because it suggests income inequality can be offset by mobility. The estimates show that the coefficients of mobility between OLS and the quantile regressions agree with the expectation in Table 4.3. In addition, all coefficient estimates of mobility show an increasing positive trend from low percentile to high percentile across all three periods, suggesting that the higher the income inequality, the higher the mobility. In theory, higher mobility is expected in a longer income accounting period. Our results are also in agreement because the coefficients are larger in 2009-1989 than the other shorter periods of 2009-2000 and 1997-1989. Ding and Wang (2007) have the same demonstration with the CHNS data from 1989 to 2000. Shi *et al.* (2010) find the effect of mobility on inequality is 0.38 in the long term and 0.48 in the short term. Additionally, our results show that the mobility in the 2000s is generally lower than in the 1990s. Liu *et al.* (2013) also show the mobility in the 2000s is lower than in the 1990s, while Yin *et al.* (2006) have opposite results with the CHIP data between 1991 and 2002 (see Table 4.4). Furthermore, mobility has increasing trends from the 5th percentile to 95th percentile across all three periods. The top of the income distribution has 8 times higher income movement than the bottom over the past two decades; meanwhile, the other two short periods have 3 times. At the same time, although the mean of mobility is higher with a longer income accounting time, the mobility does not emerge in the 5th percentile and the 10th percentile.

Regarding volatility, this is expected to have a positive effect on income inequality because high income inequality is in the link with high variation of mobility. The results in Table 4.3 show that all coefficient estimates are significant and positive across the percentiles. Horizontally, the finding agrees with the expectation since all coefficient estimates of volatility have an upward trend from low percentile to high

percentile across three periods, suggesting that high income inequality is associated with high income volatility. Vertically, comparing all three periods of volatility, the mean of income volatility coefficients is greater in 2009-1989 than other two shorter periods. Nichols (2010) finds a simultaneous increase in trends between inequality and volatility with the CHNS data from 1989 to 2006.

However, this message is not so clear in percentiles. High percentiles have lower coefficients in a longer income accounting time; for example, the coefficients in the 95th percentile are 1.016 in 2009-1989, 2.285 in 2009-2000 and 3.093 in 1997-1989. Meanwhile, low percentiles have high coefficients in the longer period; for example, the coefficients in the 5th percentile are 1.012 in 2009-1989, 0.747 in 2009-2000 and 0.745 in 1997-1989.

Table 4.3: Regression Results

Period	Variable	OLS Coef(S.E)	Q5% Coef(S.E)	Q10% Coef(S.E)	Q25% Coef(S.E)	Q50% Coef(S.E)	Q75% Coef(S.E)	Q90% Coef(S.E)	Q95% Coef(S.E)
2009-1989	Intercept	0.051	7.802	7.866	8.067	8.482	9.057	9.594	9.898
		0.003	0.005	0.007	0.010	0.010	0.024	0.028	0.028
	Mobility	0.676	0.115	0.196	0.456	0.496	0.765	0.945	0.914
		0.040	0.047	0.059	0.077	0.077	0.012	0.052	0.050
	Volatility	1.038	1.012	1.017	1.034	1.050	1.124	1.072	1.016
		0.011	0.012	0.015	0.019	0.025	0.053	0.062	0.062
2009-2000	Intercept	-0.018	-0.013	-0.012	-0.011	-0.010	-0.009	-0.005	-0.002
		0.001	0.0002	0.0004	0.0003	0.0006	0.0005	0.0004	0.001
	Mobility	0.381	0.265	0.303	0.368	0.486	0.580	0.661	0.741
		0.003	0.012	0.167	0.013	0.015	0.015	0.011	0.027
	Volatility	0.990	0.747	0.836	1.045	1.435	1.720	1.988	2.285
		0.015	0.044	0.063	0.050	0.057	0.056	0.034	0.100
1997-1989	Intercept	-0.026	-0.012	-0.012	-0.013	-0.016	-0.017	-0.008	-0.004
		0.001	0.0002	0.001	0.001	0.0005	0.001	0.001	0.001
	Mobility	0.380	0.277	0.333	0.408	0.485	0.645	0.869	0.975
		0.004	0.014	0.016	0.012	0.017	0.027	0.026	0.036
	Volatility	0.926	0.745	0.926	1.162	1.137	01.186	1.702	3.093
		0.018	0.053	0.060	0.044	0.062	0.102	0.099	0.133

Source: Author's estimation.
Notes: R^2 and F-statistics in OLS is 0.90 and 850, respectively. All coefficients are highly significant at 99% significance level.

Table 4.4: Summary of Previous Studies in China

Author	Method	Data and Period	Finding
Shi *et al*. (2010)	Transition matrices; Positional movement; Regression	CHNS 1989-2006	Gini Mobility rank-based (S): 0.68(1989)-0.91(2006); Quantity mobility (β): 0.29(1989) – 0.15 (2006) Effect of mobility on inequality in 2006: Long-term income, 0.380; short-term income, 0.483. The poorest households were more mobile compared to the rich.
Ding and Wang (2008)	Movement measures	CHNS 1989-2000	Mobility in the long-term is greater than that in the short term.
Liu *et al*. (2013)	Transition matrices; Positional movement	Multiple survey resource 1995-2008	AQIR and AQMR: 0.59– 1.39 (1995-2008); 0.54– 0.57 (1995-1999)-(2000-2003); 0.39– 0.88 (1995-1999)-(2000-2008) The higher the rate of AQIR means the less the mobility. The higher the value of AQMR means the higher the mobility.
Yin *et al*. (2006)	Transition matrix; Positional movement and time independence	CHIP: 1991–1995 1998–2002	Income mobility in urban China is lower between 1998 and 2002 than that in the period from 1991 to1995.
Khor and Pencavel (2006)	Transition matrix and correlation coefficients	CHIP, 1990–1995	The level of rank income mobility of individuals in urban China in the 1990s was greater than that in the United States or other high-income

		(The Chinese Household Income Project)	countries, but the correlation coefficients between incomes in different years are lower in China than those in the United States, which suggests greater income mobility in China. China(1990-1995): 1.056 (AQMR); 0.334 (AQIR) and 0.541 (Correlation) USA (1993-1998): 0.624 (AQMR); 0.522 (AQIR) and 0.749 (Correlation)
(time-independence)			
Wang (2007)	Transition matrix; Positional movement	CHNS 1989–2000	The degree of income mobility in rural China was found to be greater than that in urban, suburb, and town, but the rural households at the bottom would stay there during the next period with a slightly higher probability than average, while those at the top would remain there with an indeed lower probability.
Sun *et al.* (2007)	Transition matrix; Positional movement	Ministry of Agriculture PR China 1986–2001	Income mobility among rural households increased initially during the study period and then maintained stability, meaning that dynamic inequality is significantly smaller than static inequality; and that compared to the urban areas, income mobility in the rural area was higher during 1991–2001.
Zhang *et al.* (2007)	Transition matrix; Positional movement	Ministry of Agriculture PR China 1987–2002	Income mobility increasingly contributed to income inequality, but the possibility of the poorest households climbing the higher income status increased, while the upward mobility of those of the middle-income has gradually become stagnant.

Source: This table is based on Shi *et al*. (2010) and updated by the author.

Table 4.5 shows the F-test for coefficient difference across quantile. F-statistics are very large and p-values are close to zero at 1% significance level. This confirms that quantile regression is appropriate and there is heterogeneity among the levels of inequality.

Table 4.5: Homogeneity Test for Parameters by Quantile

Period	Tau	F-statistics	p-value
2009-1989	All	876.98	< 2.2e-16 ***
	0.95-0.05	2001.2	< 2.2e-16 ***
	0.90-0.10	3710.5	< 2.2e-16 ***
	0.75-0.25	2270.4	< 2.2e-16 ***
2000-1989	All	2214.7	< 2.2e-16 ***
	0.95-0.05	2345.8	< 2.2e-16 ***
	0.90-0.10	11371.0	< 2.2e-16 ***
	0.75-0.25	1132.9	< 2.2e-16 ***
1997-1989	All	573.89	< 2.2e-16 ***
	0.95-0.05	1173.4	< 2.2e-16 ***
	0.90-0.10	1205.3	< 2.2e-16 ***
	0.75-0.25	1502.8	< 2.2e-16 ***

Source: author's estimation using the CHNS data.
Notes: "All" is the tau in { 0.05, 0.10, 0.25, 0.50, 0.75, 0.90, 0.95 } and *** denotes statistical significance at 1% level.

Taking all the statistical evidence of mobility and volatility into account, two keys lead to the rising income inequality in China. One is income volatility and another is unequal opportunity over the years, especially, the mobility is low in low income individuals. In fact, the mobility has increased substantially across observed percentiles over time. The empirical evidence implies that it is true that the robust growing economy has been enhancing the economic opportunity over the period of

time. This opportunity liberates more economic freedom as well as offers more jobs to individuals and allows them to pursue more self-interest, and this ultimately leads to higher living standards. The problem is the coexistent volatility from the same economy that exposes the insecurity of the individual's income position. This information demonstrates that: 1) China's economy is experiencing high absolute mobility while high volatility so that the income gap keeps widening; 2) income insecurity and unequal opportunity are the crux of the matters to resolve the contradiction of income inequality.

In fact, there has been increasing attention on economic security since the mid-1990s, followed by many policy instruments and mechanisms introduced to address the issue while maintaining robust economic growth (Zhengyi, 2004). However, our empirical evidence implicitly releases that these instruments and mechanisms are likely not efficient due to economic insecurity having been aggravated. Secondly, a new plan, entitled *The Income Inequality Reform Plan*,[37] was issued by the State Council in February 2013. The plan lists 35 points for deepening the reform of the income distribution system. Salidjanova (2013) highlights the 35-points into eight dimensions: Double Personal Income by 2020 and Raise Minimum Wage, Interest Rate Liberalization; State-Owned Enterprise Dividend Payments; Restrictions on Government Officials' Income; Tax Reforms; Land Rights; Residence Permit System; Social Safety Net. The focal point of the plan is still

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[37] State Council, "关于深化收入分配制度改革的若干意见" ("Several Opinions on Deepening the Reform of the Income Distribution System"), February 3, 2013. Available: [http://www.gov.cn/zwgk/2013-02/05/content_2327531.htm]. Accessed on 10 September 2013.

grounded heavily in the pursuit of economic growth through increasing household consumption but also a substantial amount of attention on ensuring economic security. This is in accordance with the suggestive evidence in our study. Yet, considering the history of policy implementation, relieving the exasperated high level of income inequality may not be optimistic in the short- and median- terms.

4.6 Conclusion

The present chapter was designed to explore the effects of income mobility and volatility on the uncertainty of income inequality. By doing so, this study has reviewed the concept of mobility and its related aspect of volatility, previous studies on the link between mobility and inequality, and further discussed the importance of incorporation with mobility and volatility. We should note the limited studies in this research area in the case of China, and that the CHNS data from 1989 to 2009 is used for the investigation with quantile regression.

The literature review suggests that economic opportunity is the key to income inequality and mobility is an appropriate concept to measure opportunity. The traditional postulation between mobility and inequality is a positive relation. In this way, mobility can offset inequality. In addition, simultaneously looking at the related concept of volatility is desired because the fluctuation of income movement may affect well-being. This volatility is used to present income security. The research area of these three dimensions is rather limited in China, according to Zhang (2007), Chen and Zhang (2009) and Nichols (2010).

The findings show that income mobility and volatility have a significant

positive effect on income inequality. The empirical evidence agrees with theoretical expectation that mobility offsets income inequality, and contributes additional information that China is experiencing high mobility and high volatility. In particular, income insecurity and unequal opportunity are the crucial drivers for the rising income inequality, and should be treated as vital factors. Hence, progressive policies are needed to assuage inequality pressures to assist low income individual for more opportunity and ameliorate income instability through, for example, job security, social security and the uneven labour markets, but implementation remains crucial.

The current examination was limited by the data, which has the major drawback of a lack of representation of the whole population in China since individuals are not randomly sampled from all provinces.

CHAPTER 5 Implications of Residential Electricity Pricing:

A Case Study of Social Efforts

5.1 Introduction

The previous two empirical chapters emphasize the importance of interaction between self-interest and social influence in income differences across individuals. That is, income return depends not only on self efforts, but also on sufficient and equal opportunity and help from society. However, in some circumstances such as the highlighted electricity usage among Chinese residential energy consumption in Chapter 2, even if households expend their efforts, they make little or no progress to save such energy to cope with life burdens by themselves. The reasons are that: 1) there is rare replacement for electrical appliances; 2) there are no other options for residential electricity suppliers under a monopoly; and 3) tight budget constraints already occur in low-income households. In other words, price plays the most vital role and the price of power has a perceptible effect. It is no surprise that electricity pricing has always been treated as a channel to lighten income inequality by the central government. Hence, this chapter evaluates the role of residential electricity pricing for living standards and whether the new residential electricity pricing system can achieve such a goal.

The proposal for restructuring the electricity pricing system in the household sector has sparked 'hot' debates in the Chinese society since October 2010. These debates are mainly concerned with two questions. First, was the effect of the proposed rise in retail electricity price different across residents? Second, was the proposed pricing system fair for households with different income levels? The government

believed that the proposed rise in electricity prices was necessary, and the increase was reasonable. Hence, it would not have a negative impact on residents' daily life. In contrast, many residents argued the pricing scheme did not appropriately address income inequality across regions and households and if carried out as planned, it would increase the burden on some households. After receiving a wide range of opinions and suggestions, the proposal was modified and announced by the government as 'Multistep Electricity Price' in July 2012. This study attempts to evaluate the reform in the pricing system by providing robust empirical evidence by investigating the pre-reform price and income elasticity of household demand for electricity across regions and income levels in China.

Existing literature on the issue is limited and primarily focuses on the impact of electricity demand on economic growth at aggregate country level. Such information is inappropriate for judging the effect of the current residential pricing on the demand for electricity in China. One reason is that aggregate estimates are not suitable for explaining the consumption of electricity in different groups of households. From a social and economic perspective, the electricity sector provides for the daily necessity of 1.3 billion people in China. Financial returns should not be the only consideration for electricity pricing; the households' ability to cope with the cost of living should also be considered. Even though Chinese economic growth has been impressive in the past three decades, the inequality of income distribution has also widened significantly. A second reason challenging previous results is that compared with developed countries, the supply of electricity is less reliable in developing countries, including China. This is due mainly to the problem of supply shortages, grid performance, wiring deficiencies and other technical issues. Previous studies on electricity pricing in China all assumed that supply of electricity was sufficient and

reliable, which is unrealistic, despite the improvements made in recent years. Hence, there is a need to control for supply reliability in the analysis.

Given the debates in the society and lack of appropriate studies in the literature, this paper aims to investigate the price and income elasticity of household demand for electricity by multidimensional household average income levels in China. The paper assesses residents' responsiveness to changes in electricity price and their income, while controlling for several other factors affecting demand commonly used in the literature. These are the price of residential pipeline natural gas, weather, and electricity supply reliability. The main contribution of the paper is two-fold. First, we provide robust empirical evidence for China by employing good quality panel data for 29 provinces over a fourteen-year period from 1998 to 2011 and applying feasible generalized least squares estimator. Second, we explicitly incorporate the electricity supply reliability effect into the analysis.

The results, on the whole, provide evidence of highly statistically significant residential electricity price elasticities of less than one, and income elasticities of demand larger than one. The empirical results reveal that disposable income substantially impacts on demand, and there is important heterogeneity in the responsiveness to electricity price changes according to household income levels. Poorer households are more sensitive to changes in electricity prices than richer urban households. We therefore argue that the current electricity pricing system might have underestimated the impact of changes in electricity price on some households, especially in low-income inland provinces.

Next in the paper, the residential electricity market and its pricing system are discussed, followed by a review of the literature. We then discuss theoretical considerations, data and estimation methodology. Empirical results are reported and

policy implications of the findings are discussed, followed by a conclusion.

5.2 Residential electricity pricing system in China

5.2.1 Evolution of residential electricity prices

In the 1950s, each electricity supply company in China had its own right to independent pricing. There were many different electricity pricing forms. Even the National Planning Commission (NPC) was not able to discover and control the whole situation. Some regions allowed using grain in exchange for electricity. For example, per unit residential electricity usage was measured by 1 kilogram of millet in Baotou region in 1950. In the following year, the usage of grain was replaced by currency, approximately equating to 0.22 RMB (Renminbi) per unit (kilowatt hour, kWh) (see Inner Mongolia Electric Power Company, 1998).

In 1960, the central government introduced a unified management principle for electricity prices and the state started to regulate them. The NPC and the Ministry of Water Resources and Electric Power jointly issued the national electricity price catalogue (see Centre for Industrial Energy Efficiency, 2009). This is the first time that China had an electricity price catalogue (see Centre for Industrial Energy Efficiency, 2009) for different regions. Electricity enterprises had to implement these retail prices to residents and to the industrial and commercial sectors. For instance, the residential electricity price was approximately 0.29 RMB per unit in Guangxi province in 1960,[38] while it was 0.22 RMB per unit[39] in Hubei province. The retail electricity prices were highly centralized and fairly stable in many areas until the 1990s. Most of the prices were between 0.20 RMB to 0.30 RMB per unit.

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[38] The Local Chronicles of Guangxi Province: Electricity Industry Volume, 1992, China Water Power Press.
[39] The Local Chronicles of Wuhan City from 1980 to 2000: Electricity Industry Volume, Wuhan University Press.

Table 5.1: Province Official Residential Electricity Prices and Retail Residential Prices of Pipeline Natural Gas in 2011

Province	REP	GP	Province	REP	GP
Anhui	0.558	2.114	Jiangxi	0.600	4.048
Beijing	0.481	1.830	Jilin	0.520	2.054
Chongqing	0.515	1.536	Liaoning	0.495	2.083
Fujian	0.518	3.404	Ningxia	0.449	1.280
Gansu	0.510	1.295	Qinghai	0.443	1.161
Guangdong	0.610	3.698	Shaanxi	0.498	1.786
Guangxi	0.526	4.503	Shandong	0.493	2.003
Guizhou	0.451	3.304	Shanghai	0.615	2.232
Hainan	0.598	2.321	Shanxi	0.462	1.446
Hebei	0.495	2.161	Sichuan	0.520	1.516
Heilongjiang	0.505	1.682	Tianjin	0.485	1.964
Henan	0.503	1.696	Xinjiang	0.474	1.390
Hubei	0.567	2.088	Yunnan	0.421	4.563
Hunan	0.581	2.304	Zhejiang	0.553	2.920
Jiangsu	0.523	1.964	*Average*	*0.516*	*2.288*

Source: Author's selection based on local electricity supply agents.
Notes: REP denotes residential electricity price taken from electricity supply enterprises at province level. RMB per unit (kWh). GP denotes the price of pipeline natural gas taken from the China Price Information network. RMB per cubic metre. 1 cubic metre of natural gas is approximately equivalent to 11 kWh.

Residential electricity prices underwent numerous adjustments and increases from 1997 until 2005. Subsequently, the retail prices have not changed much. Table 5.1 shows retail residential electricity prices in 2011. The highest price is 0.615 RMB per unit in Shanghai, while the lowest is in Yunnan, 0.421 RMB per unit. The average price in the country is 0.516 RMB per unit. Despite the massive investment in the electricity industry and the rapid increase in income, the level of the official residential electricity prices seems to have remained at a fairly low level. Considering pipeline natural gas as a substitute energy source, its prices at the provincial and national levels look higher than electricity prices, but 1.00 RMB per cubic metre of

natural gas is approximately equivalent to 0.091 RMB per kWh of electric power.

Compared with other countries, the average residential electricity price in China also

appears low, but as a proportion of income it is one of the highest (see Table 5.2).

Table 5.2: Comparison of International Average Residential Electricity Prices in 2011

Country	Price (cents per kWh)	Income per capita (U.S dollar)	Ratio of price and income (per 1000 kWh)
China	8.3	5,417	1.534
Germany	32.5	44,111	0.737
France	17.7	44,007	0.402
Italy	25.8	36,267	0.711
Japan	17.6	45,870	0.383
Poland	18.9	13,469	1.403
Romania	13.9	8,875	1.566
South Korea	8.9	22,424	0.397
Turkey	15.7	10,363	1.515
United Kingdom	18.4	38,811	0.474
USA	11.9	48,387	0.245

Source: Eurostat (2011), US Energy Information Administration (2011),
International Monetary Fund (2010-2011).
Notes: The prices for Japan and South Korea are for 2008.

5.2.2 Urban and rural residential electricity prices

According to the pricing policy in China, there has been no distinction between urban

and rural residential prices, but one price for all residents. In practice, however, the

price for rural residents was much higher than for those urban residents in the 1990s.

This was mainly due to arbitrary charges to rural residents. It was common for the

average price charged to rural end-users to be much higher than that to urban users.

According to Dang (2000), the actual residential electricity price was 1.50 RMB per

unit in most rural areas; in a few places it was even 5.00 RMB per unit. The average

residential price in urban areas was approximately 0.40 RMB only per unit in 1998.

To reduce the burden on farmers and rural end-users, the National Development

and Planning Commission (NDPC) and the State Grid Corporation of China (SGCC) issued two urgent telegrams to the electricity supply sector in 1998 (NDPC, document 39 and SGCC, document 02). Since then, the arbitrary charges were gradually ameliorated. At the same time, arguably, the Asian financial crisis led to electricity surplus. This crisis opened up an opportunity to address the problems. In the same year, the State Council (document 134, 1998) formulated six large-scale infrastructure projects to expand domestic demand and stimulate economic growth. Rural electricity network development and improvement was one of these projects. The project aimed to reform the management system and standardize management to develop and improve the rural distribution network and to facilitate the power supply cost reduction and alleviate end-users' burdens. The expected outcomes were ultimately to merge urban and rural distribution networks and to achieve a uniform residential electricity price for all urban and rural areas. This project was popularly called "Two Changes and One Price". According to the National Development and Reform Commission (NDRC),[40] the majority of provinces had achieved one price for urban and rural areas by 2003.

5.2.3 Residential electricity pricing system reform

In recent decades, the electricity sector in China has been through several key stages of reform aimed at the creation of competitive power markets. One critical step was to dismantle the State Power Corporation in 2002 into five state-owned power groups (the Big Five) and the State Grid Corporation as the central government aimed to end the monopoly in the power generation industry. These six organizations and numerous

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[40] National Development and Reform Commission (n.d.) *Most provinces achieved one price*. Available: http://www.ndrc.gov.cn/xwfb/t20000630_27822.htm, [Accessed 01/2011].

province branch companies together manage the power supply market. The pricing is influenced by a bargaining process between the industry oligarchs and the administrative control represented by the NDPC.

Along with the reform in 2002, the State Council also launched "Electricity Pricing System Reform Scheme" (document 62, 2003) in the following year, and the price reform was a key component of the power sector reform. The ultimate aim of the scheme was to allow end-users a free choice of electricity supplier and to enjoy an equilibrium price in the electricity market.

Even though the price reform was meant to be a core issue of the whole power sector reform, there were complications and difficulties. The scheme had not in fact been fully implemented. The residential electricity pricing system remained largely unchanged up to then. However, fuel market prices increased rapidly from the early 2000s and power enterprises strongly criticized the inadequate residential pricing system. The reason for the criticism was that the residential sector had been adopting a single electricity pricing policy. The single pricing policy means that a household is charged a single electricity price regardless of the total amount of electricity usage. In addition, the enterprises insisted on increasing residential electricity prices because they were much lower than the prices in the industrial sector and the average electricity price in the country. Furthermore, residential electricity prices had been lagging behind coal and gas prices. It was therefore not possible for the electricity industry to cover its costs. Hence, electricity pricing reform for the residential sector had been on the top of the agenda from the late 2000s.

On the basis of the domestic and international situation, the NDRC announced a draft proposal for implementing a new pricing system to replace the single price system for residential customers on 9th October 2010. The draft proposal aimed at

introducing an increasing block tariff. The proposed increasing block tariff envisaged monthly electricity consumption to be divided into three categories and charges on electricity consumption to be progressively increasing based on the amount of electricity usage. The NDRC believed that the new tariff would improve the whole pricing system. It was also expected to address the problem of electricity shortage and high fuel prices. Furthermore, it was planned gradually to align the pre-reform (low) single residential electricity price to a rational and reasonable pricing system. The tariff was also expected to encourage reduction in electricity consumption and the associated pollution.

However, the benefits of the new tariff had not been convincing for many households and had attracted widespread repercussion, criticism and fear amongst residential customers who are mainly subject to income disparity.[41] Despite the public disapproval, according to the NDRC statistics, from a total of 21,794 comments, 61% showed support, while only 34.5% showed opposition. It was also argued that the draft proposal did not envisage a significant increase in electricity price and for 70% to 80% of households, the electricity bill would remain unchanged. In July 2012, the NDRC modified the draft by increasing the rate of unaffected consumers from the initial 70%-80% to 80%-90% across provinces and regions.

5.3 Literature review

In the consumer behaviour theory, a measure of a household's demand sensitivity is its responsiveness to changes in prices, holding other factors constant. Households react to changes in the electricity price by adjusting their electricity demand. As price hikes, households reduce the amount used, whereas when price falls the household

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[41] It is generally accepted that there is high level of income inequality in China. For example, a study by Song et al. (2009).

response is the opposite. This responsiveness of households to price changes is characterized by "price elasticity of demand" in the consumer behaviour theory. In the demand elasticity context, the theory not only suggests how sensitive the demand for electricity is to changes in the price of electricity, but also to changes in the price of related energy sources and to changes in income. A number of previous studies adopt this basic economic framework to conduct their analysis.

5.3.1 The gap in the domestic studies

Several early studies investigated the relationship between Chinese electricity consumption, prices and output within macroeconomic or regional frameworks. Lin (2003) discusses the variation of electricity prices across the country and concludes that the available electricity prices are not adequate to examine the relationship between electricity consumption and economic output at national level. Therefore, the study adopts time series data from 1978 to 2001 for the price of coal as a proxy for the electricity price. The estimated price elasticity is unusually low, only 0.016. A study by Lam (2004) concludes that the average electricity prices are below the average total costs and highly subsidized as the author investigated the determinants of the average electricity price for 26 provinces with cross-section data for 1998. Xu and Chen (2006) point out that one of the most serious problems with the electricity price is that it does not reflect the true relationship between supply and demand. Similarly, Zhang and Heller (2007) describe the electricity demand and supply relationship as based on planned allocation by the government, and conclude that tariffs have little relation with the real cost of supplying power or demand.

He *et al*. (2011) examine the demand price elasticity for several sectors: residential, agricultural, industrial, and commercial. The study adopts a computable general equilibrium model with cross-section data for 2007. In terms of the residential

sector, the study concludes that the price elasticity is only -0.3, which indicates that residents are not sensitive to change in electricity prices across the nation. However, one underlying assumption of the He *et al*. (2011) study is that there are no constraints to the electricity power supply, which is the unlikely case in China. Zhao *et al*. (2012) conducted an investigation on the impact of electricity policies on electricity generation efficiency with regional data and pooled regressions. The study considers average price effect measured as the ratio of revenue and quantity of electricity sold over the period 1993-2007.

There are two concerns regarding the previous studies. First, it may be true that the average electricity price is low given the massive and ongoing investment in the electricity industry. However, the existing studies are not adequate to reveal the effect of prices and the proposed alternative electricity pricing system on the demand for electricity in the household sector. The primary reason is that national-level information is not suitable for explaining consumption of electricity by different groups of households. Furthermore, from an econometric point of view, shortcomings stem from problems with data used for analysis, the specifications selected for the estimating equations, or sometimes from the variables used. Apart from these aspects, previous studies also do not focus on the consequences of varying household income levels even though it is generally accepted that there are large income disparities between regions and rural and urban areas. Therefore, the existing econometric estimates do not provide sufficient information about the pricing reform effects on households. Besides, although the generation and supply of electricity in China has significantly improved, the reliability of supply is still in doubt. According to the Electricity Power Reliability Management Centre (2011), the average interruption hours per customer (AIHC-1) was 7.01 hours per household across the nation. The

rural supply system performance is much poorer than the urban one; the AIHC-1 was 18.43 hours per rural household in 2011. With this in mind, there is thus a need to control for the reliability factor when examining price elasticity of electricity demand.

5.3.2 The international literature

Many theoretical and empirical studies on the price and income elasticity of residential electricity demand have been carried out in an international context. Early studies were conducted by Houthakker (1951) and Fisher and Kaysen (1962).[42] These studies obtained varying results depending on the variables used. Houthakker (1951) carried out a pioneering cross-sectoral study of electricity demand in the UK. He assumed the presence of stable demand function and showed the demand for electricity as being quite sensitive to both changes in price and income. Fisher and Kaysen (1962) used time series data from 1946 to 1957 for 47 states in the USA. They added extra non-economic variables such as the utilization rates of appliance stocks. In the short run, the findings of Fisher and Kaysen (1962) agree with Houthakker's (1951) study in that the demand of residential electricity mainly depends on price and income. In the long run, Fisher and Kaysen conclude that non-economic variables are the primary determinants of residential electricity demand, while electricity price has a lesser impact on demand.

However, the measurement of appliance stocks is difficult; Fisher and Kaysen (1962) pointed out that the quality of their data ranged "…from somewhat below the sublime to a bit above the ridiculous…" and that "…no results can be better than the data on which they are based" (p.27). Wills (1977) stated that lack of adequate data for these stocks have usually precluded their use in empirical work while he

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[42] See Athukrala and Wilson (2010), Filippini and Pachauri (2004), Halicioglu (2007), Holtedahl and Joutz (2004), Nakajima and Hamori (2010), Sa'ad (2009), Narayan *et al*. (2007), Narayan and Smyth (2005), and Nakajima (2010).

examined a cross-section data of 77 cities in the USA. Subsequently, Wills (1977) revealed that a high quality of measurement on the stocks is necessary; otherwise, the long run analysis is hampered. Although the appliance stock is a determinant of the demand for electricity, to obtain a high quality data is still problematic to date. Therefore, recent studies exclude appliance stock from the analysis.[43] Given data limitations, some studies use income as a proxy for appliance stock.

Recently, the interest in empirical studies of residential electricity demand has increased. This is mainly due to the tendency of global electricity sectors becoming more competitive and deregulated. Furthermore, knowledge of the determinants of residential electricity demand and its accurate forecasting are relevant for assessing proposals to revise electricity rates and for predicting the residential electricity demand. Larsen and Nesbakken (2004) and Narayan and Smyth (2005) investigated the determinants of the demand for residential electricity. Their economic model states that residential electricity demand is a function of its own price, the price of substitute sources of energy, real income, prices of household appliances as well as other variables which might influence household preferences.

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[43] See the relevant summary of previous studies by Narayan and Smyth (2005).

Table 5.3: International Studies of Residential Electricity Demand

Country	Author	Data period	Variables	Income elasticity	Own price elasticity	Estimation technique or framework
India	Filippini and Pachauri (2004)	Survey data: 1993-1994 3,000 households	REC; Electricity price; Kerosene price; LPG price; Personal income; Covered area of the welling square feet.	0.60-0.64 across all three seasons	-0.42 winter -0.29 summer	Cross-section data techniques
Turkey	Halicioglu (2007)	Time-series: 1968-2000	Per capita REC; The real income; The real residential electricity price; The urbanization rate.	Long run: 0.70	Long run: -0.52	The bounds testing procedure to cointegration
South Korea	Sa'ad (2009)	Time-series: 1973-2007	Household disposable income; The real electricity prices; Structural factors.	Long run: 1.33	Long run: -0.23	Structural time series model
USA	Nakajima and Hamori (2010)	Panel data: 48 states 1993-2008	REC; The real person income; The real price of electricity; HDD and CDD.	48 states: 0.38 (1993-2000) 0.85 (2001-2008)	Long run: -0.33 (1993-2000) -0.14 (2001-2008)	Panel cointegration test
Australia	Narayan and Smyth (2005)	Time-series: 1969-2000	Per capita REC; The real income; HDD+CDD; The real price of gas; The real electricity price.	Long run: 0.323-0.408 Short run: 0.0121-0.0415	Long run: -0.541 Short run: -0.263	The bounds testing procedure to cointegration
USA	Dergiades and Tsoulfidis (2008)	Time-series: 1965-2006	Per capita REC; The real capita income; The real average residential price of electricity; HDD+CDD; The average price of oil; The	Long run: 0.273 Short run: 0.101	Long run: -1.0652 Short run: -0.386	The ARDL bounds testing procedure to cointegration

			stock of housing.			
Sri Lanka	Athukorala and Wilson (2009)	Time-series: 1960-2007	Per capita REC; The real per capita GDP; The average real price of electricity; The average real prices of kerosene oil; The average real prices of LP gas.	Long run: 0.78 Short run: 0.32	Long run: -0.62 Short run: -0.16	Cointegration and error-models developed by
Japan	Nakajima (2010)	Panel data: 46 prefectures 1975-2000	The per household REC; The real disposable income per household; The real unit price of the residential electricity.	Long run: 0.602	Long run: -1.127	Panel unit root tests; Panel cointegration tests; Johansen-Fisher-type cointegration test
Taiwan	Holtedahl and Joutz (2004)	Time-series: 1955-1995	Per capita REC; The real electricity price; The percentage of the population living in cities; The real disposable per capita income; The real world oil price; HDD and CDD.	Long run: 1.04 Short run: 0.23	Long run: -0.16 Short run: -0.15	The general-to-specific modelling approach Engle and Granger method
G7:	Narayan, Smyth and Prasad (2007)	Panel data: 1978 -2003	Per capita REC; The real income per capita; The real price of natural gas; The real residential electricity price.	Long run: 0.3119 Short run: Insignificant	Long run: -1.4502 Short run: Insignificant	Panel OLS; Panel DOLS Panel unit root test; Panel cointegration

Table 5.3 illustrates the most recent studies that have estimated the income and price effects on residential electricity demand with various econometric techniques in different countries. On the whole, the results for income and price elasticity are consistent with the theory. Income elasticities are positive, and own-price elasticities are negative. In terms of variables used, all studies use residential electricity consumption as an indicator for electricity demand. The most popular independent variables are mainly economic factors such as electricity price, substitute energy price(s) and household income. Features of dwellings appear in several studies such as the size of dwelling, stock of appliances and the outdoor temperature, among which the outdoor temperature is the most frequently used in recent studies.

A study by Nakajima (2010) for Japan shows that own price elasticity is greater than 1; demand in Japan is price elastic. Similarly, Narayan *et al*. (2007) provide panel data results for G7 developed economies that indicate residential demand for electricity in the long run is price elastic, 1.45; and income inelastic, 0.31. Overall, existing studies demonstrate that in developed economies, electricity demand is generally price elastic in the long run as the estimates are above 1. In contrast, in developing countries such as India, Turkey, Sri Lanka, Taiwan and South Korea demand is own-price inelastic in the long run. These price elasticities of demand are from 0.15 to 0.39. In terms of income elasticity, only Taiwan and South Korea show elasticities greater than 1.

Three issues arise in the literature based on the findings of the international empirical studies. First, the conventional wisdom is that those households with higher incomes are less sensitive to energy prices than households with medium to low incomes. Accordingly, households in developed economies should react less to the changes in electricity prices than households in developing countries. However, there

is opposing evidence in the literature for the long run. The reason is likely to be developing countries tightly regulate their markets, leading to artificially low price electricity in residential sectors. Second, regarding the stock of appliances, demand for electricity is derived from the flow of services provided by the household's durable energy-using appliances. The use of these household appliances is related to the construction features of dwellings, for example, space heating and cooling, lighting, the number of people in the household as well as the outdoor temperature. However, it is likely that there is a high correlation between stock of appliances and income in developing countries since households will purchase more appliances when they have a higher income to improve the quality of living. The high correlation makes it difficult to estimate accurately the effect of each variable on the demand for residential electricity. Therefore, there is an argument that the stock of appliances should be omitted from specifications in developing countries or instrumented with appliance prices. Third, there has not been much work done on the effect of electricity supply reliability in developing countries where intermittent interruptions to supply are common place. Thus, capturing this effect in examining electricity pricing is indispensable. One of the contributions of this study is to extend the existing literature on the Chinese residential electricity issues by introducing a technical index of electricity supply reliability as a controlling factor.

5.4 Theoretical considerations, data and estimation methodology

5.4.1 The demand model

As discussed in the literature review, the majority of previous empirical studies relies on the consumer behaviour theory and develops empirical demand models for analyzing residential electricity consumption. A standard model represents residential electricity demand as a function of own price, the prices of substitute sources of

energy, income, prices of household appliances, stock of housing and temperature.[44] In setting up our model, we point to the fact that electricity utilities are typically natural monopolies in all different contexts so that the standard residential electricity demand model developed for Western economies is largely applicable to developing countries as well (see also Table 3). Even if we accepted that the market structure differs in terms of the degree of competition between developed and developing countries, the relatively higher degree of competition in the West would permit end-customers to have more choice in electricity power suppliers. This in turn should means lower prices and better services from suppliers. Yet, the majority of end-customers have less/or no choice in developing countries, but they often benefit from monopoly or oligopoly in these countries due to the strict regulation and control of utilities by government. That is the reason why electricity retail prices are often artificially low despite the high generation and distribution costs in developing countries. In this respect, the role of market players may not be particularly significant, but rather common factors in the standard model. For example, Kirschen (2003) points out that the introduction of competition in the electricity retail market has not been very successful even in California.

Many studies fall well short of the ideal empirical specification because of data constraints. Therefore, Narayan and Smyth (2005) suggest a parsimonious demand model including own price, prices of substitute energy, income, and temperature. This suggestion implicitly assumes a non-binding supply of electricity which is appropriate in developed economies. However, a sufficient and consistent supply of electricity is not the case in developing countries such as China. Therefore, we extend the general model in the panel setting as follows;

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[44] This view is also supported by Hartman and Werth (1981); Reiss and White (2002); Acton *et al*. (1976).

$$D_{it} = f(EP_{it}, GP_{it}, Y_{it}, R_{it}, W_{it}, U_{it}), \ i = 1 \dots N, \ t = 1 \dots T. \qquad (5.1)$$

where *D* denotes the residential electricity consumption per capita (kWh), *i* denotes cross-sectional unit and *t* stands for time period. *EP* represents the real retail residential electricity price (RMB per kWh). *GP* denotes the real price of natural gas (RMB per cubic metre). *Y* is the real annual household disposable income per capita (RMB) that is also used as a proxy for the household electric appliances and household characteristics. Income is calculated for three groups of households: average national income (*YA*), urban household income (*YU*) and rural household income (*YR*). *R* denotes electricity supply reliability and its corresponding indicator is the average interruption hours per customer (AIHC-1). *W* captures weather conditions and is calculated as a sum of the total number of heating degree days and cooling degree days. *U* depicts a set of unobservable factors in a panel data setting.

Equation (1) can be further modified following Beenstock *et al*. (1999) by expressing it in a relative price form. This is the most common specification in the literature (Narayan and Smyth, 2005):

$$D_{it} = f(EP_{it}/GP_{it}, Y_{it}, R_{it}, W_{it}, U_{it}), \quad i = 1 \dots N, \ t = 1 \dots T. \qquad (5.2)$$

5.4.2 Data and variables

Residential electricity demand

Residential electricity consumption (REC) has been sharply increasing in the past three decades in China. For instance, REC was 480.8 billion kWh in 1990, while total REC increased to 4,396.1 billion kWh in 2008 (*China Statistical Yearbook*, 2010), a nine times increase. The REC share of total electricity consumption was approximately 12%, which is much lower than industrial electricity consumption (80%) in 2008. Nevertheless, REC represents the second largest share of total electricity consumption and it directly affects more than a billion people's living

standards in China. We use annual REC per capita as demand indicator. Data are mainly from the *China Energy Statistical Yearbook* from 1999 to 2012. Figure 5.1 shows that the residential electricity consumption per capita increases over the period and that the spread of electricity consumption varies substantially across coastal and inland provinces. Richer provinces consistently consume more electric power than poorer provinces.

Figure 5.1: Residential Electricity Consumption Per Capita, 1998-2011
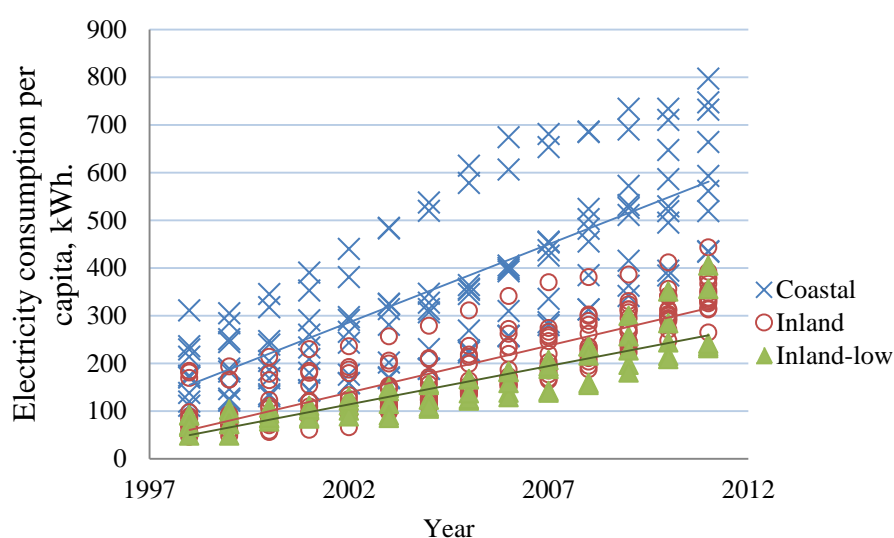
Source: Author's calculation.
Notes: straight lines are the fitted line from OLS.

Household income

Increase in income and its impact on living standards is an important driving force of electricity consumption in China. As household income increases, residents tend to buy a larger dwelling and use more electric appliances, resulting in a higher consumption of electricity for cooking, heating, lighting and entertaining. Figure 5.1 and Figure 5.2 show that the trends of electricity consumption and income increase over a period of time. The majority of previous studies show that income is a

significant determinant of demand for electricity. We employ the real household disposable income per capita as an indicator for household income. It is taken from the *Chinese Statistic Yearbook* from 1999 to 2012.

Figure 5.2: The Real Household Disposable Income Per Capita, 1998-2011
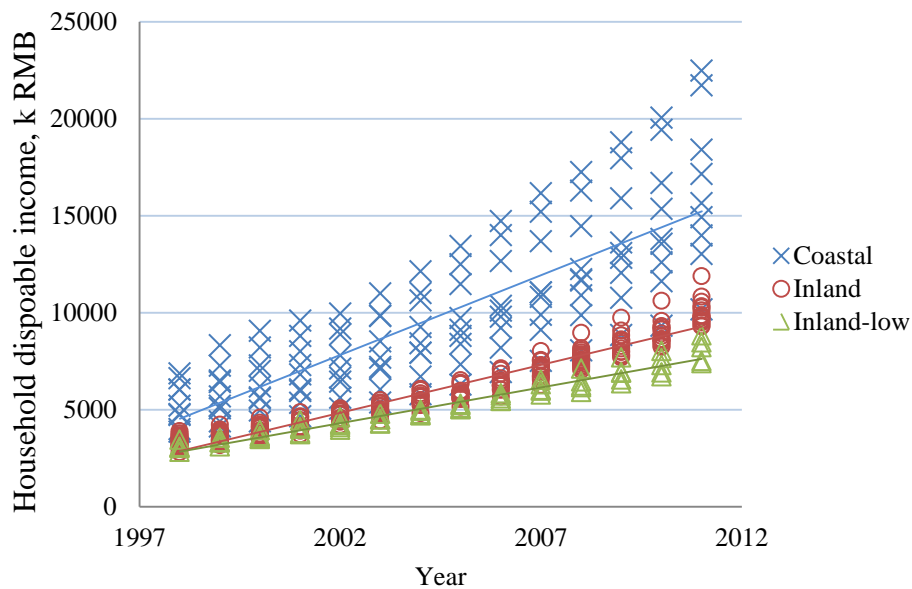
Source: Author's calculation.
Notes: straight lines are the fitted line from OLS.

Figure 5.2 displays the income differences across all 29 provinces, classified into coastal, inland and the bottom five (low-income) inland provinces. In 2011, the coastal province with the highest average income (22,491 RMB per capita) was Shanghai, in the east of China. In contrast, the lowest average income (7,396 RMB per capita) inland province was Gansu, in the northwest of China. The household incomes in both provinces have doubled over the fourteen-year period. Nevertheless, the growth in incomes has also led to the widening of income disparities. The coastal provinces (Shanghai, Beijing, Zhejiang, Guangdong, Jiangsu, Tianjin, Shandong, Fujian and Hebei) grew the most and were far ahead of others. The bottom five inland

provinces are Gansu, Shanxi, Guizhou, Xinjiang and Qinghai.

Table 5.4 provides information about the disparity in incomes between urban and rural households. It is clear that urban household income is much higher than rural. On average, urban household income is approximately 10,468 RMB per capita while rural household income is around 3,756 RMB per capita. This level of the rural household income is similar to the income of households living in urban areas with minimum income of 2,815 RMB per capita. It is likely that these households will be more sensitive to changes in electricity price than rich urban households given the single pricing policy for residential electricity.

Own-price effects

As with the household income, real electricity price is another decisive factor affecting household demand. Generally, most residential electricity prices at province level have three classes according to capacity of power cables: less than 1 Kw; between 1 Kw and 10 Kw and greater than 10 Kw. The residential electricity price series represent, in general, average prices based on the first two classes, which are more common than the third class. The source of official retail price information is taken from each electricity supply enterprise at province level.

Table 5.4: Summary of Variables

Variable	Description	Unit	Min.	Q1	Median	Mean	Q3	Max.
EC	Residential electricity consumption	kWh per capita	46	124	201	238	313	797
EP	The real residential electricity prices	RMB per thousand kWh	280	440	489	500	552	930
GP	The real price of the pipeline natural gas	RMB per cubic metre	871	1683	2167	2433	2955	7310
R	The electricity supply reliability	Minute per household	50	356	582	788	946	6492
W	The sum of heating degree day and cooling degree day	Degree	2,512	4667	5543	5910	6844	11487
YA	The real average household disposable income	Thousand RMB per capita	2815	4671	6304	7112	8582	22491
YU	The real average urban household disposable income	Thousand RMB per capita	4196	7039	9505	10468	12645	31170
YR	The real average rural household disposable income	Thousand RMB per capita	1399	2290	3141	3756	4493	13811
Coastal	Coastal provinces	Thousand RMB per capita	3868	6675	9116	9882	12439	22491
Inland	Inland provinces	Thousand RMB per capita	2815	4342	5685	6078	7698	11889
Inland-low	The bottom five low income inland provinces	Thousand RMB per capita	2826	3982	5010	5228	6353	8837

Notes:Coastal provinces (9): Beijing, Shanghai, Zhejiang, Guangdong, Jiangsu, Tianjin, Shandong, Fujian and Hebei. The bottom five Inland-low provinces (5): Xinjiang, Guizhou, Gansu, Ningxia, and Qinghai. Inland provinces (15): the rest. Q1 and Q3 stand for the first and the third quantiles, respectively.

The expected reaction of households to high electricity prices is to reduce electricity demand. Households use more electricity with a low electricity price than with a high price. Accordingly, it is expected that there is a negative relationship between electricity price and households' electricity consumption. Urban residents and high-income households, in general, may be less price-sensitive because the nominal electricity price has not changed very much over the period of analysis and the real electricity price has even decreased. In other words, urban and high-income households may be less responsive to own-price change. Meanwhile, residents in rural areas and low-income households are likely to be more sensitive to changes in electricity prices.

Figure 5.3: The Real Residential Electricity Price in Different Areas, 1998-2011
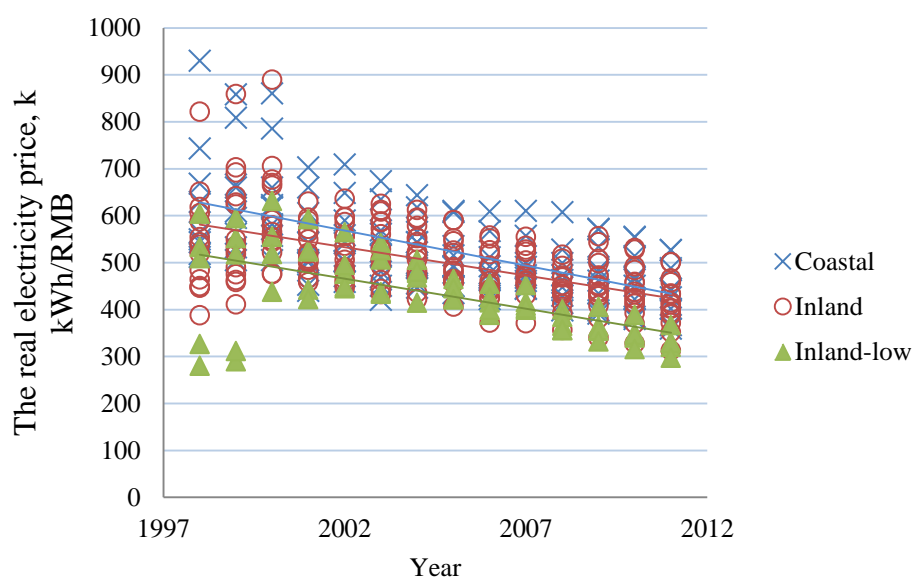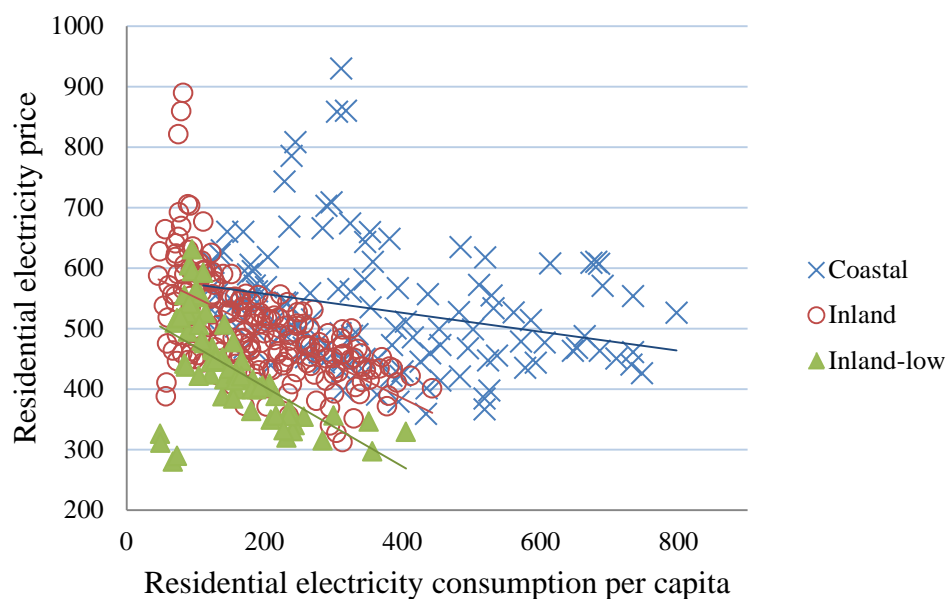

Source: Author's calculation
Notes: straight lines are the fitted line from OLS.

Figure 5.3 shows the differences of residential electricity prices across coastal, inland and low-income inland provinces. Straight lines indicate that the average residential electricity price corresponds to the order of regional income level. The

price distribution exhibits weak association with levels of income. Two high-income provinces have fairly low electricity prices (Beijing and Fujian). In contrast, some low-middle income provinces have relatively high electricity prices. Nevertheless, according to the amount of electricity consumed, the price distribution seems to be fairly reasonable across the three levels of provinces. Figure 5.4 indicates that coastal provinces use the most electric power and are charged higher prices, while it is the opposite for the low-income inland provinces.

Figure 5.4: Residential Electricity Consumption and Real Retail Price, 1998-2011

Source: Author's calculation
Notes: straight lines are the fitted line from OLS.

Cross-price effects

Generally, in the short run, an increase in the price of electricity will increase the demand for substitute forms of energy such as natural gas, providing that appropriate appliances are already available. In the long run, an increase in the price of electricity will tend to increase the stock of appliances that use other fuels. This will cause an

outward shift in the demand curve for alternative fuels, with corresponding increases in the quantity consumed. However, traditionally, the shift can be limited (Acton *et al*., 1976). The reason is that households do not have a stock of appliances that permits them to switch between types of energy, particularly in the short run. As a result, the shift is limited to the income effect until an adjustment in appliance stocks can occur.

In the case of China, although the substitute energy equivalent price is lower than the electricity price (see Table 5.4), the shift from electricity to pipeline natural gas is restricted. Particularly, the infrastructure for pipeline natural gas is limited in some urban areas and most rural areas in China. Consequently, the effect of the substitute energy will have little or no impact on these households' responsiveness to changes in electricity own-price.[12] However, this shift may be more pronounced for some urban households, especially as the Chinese government has increased efforts to boost urban infrastructure development. Therefore, the cross-price effect might be significant for the demand of electricity in some urban areas.

We use pipeline natural gas as a substitute fuel for electricity, because it has been a commonly used substitute fuel for electricity in urban areas in recent years. The natural gas price is taken from the China Price Information Network (2012) for the period 1999 to 2012. The price is mainly based on information for urban residents in every province. The price of natural gas for rural residents is not available. As a result, the estimations for the cross-price effect for rural households are likely to be much lower (and less reliable) than for urban residents. In general, the cross-price effect should be positive.

Electricity supply reliability and weather

To measure electricity supply reliability we employ the total annual average interruption hours per customer (AIHC-1) as an indicator controlling for the effect of

electricity supply. The source of this variable is the Electricity Power Reliability Management Centre which publishes a technical index annually based (only) on the 10 Kw urban power supply system; other supply systems are not covered. Due to data availability, we can only use the AIHC-1 as a proxy for all households. The expected effect of the interruption in supply is negative.

The information on weather conditions is obtained from the Weather Underground (2012).[45] For every provincial capital city we use the sum of heating degree days (HDD) and cooling degree days (CDD) as a proxy for the weather conditions at province level because information is not available for every city and county within a province. Both HDD and CDD are indexes with reference to temperature of 65^0F. The higher the HDD and CDD, the more electricity households consume. Thus, the expected effect of temperature on demand is positive.

Estimation methodology

In the discussion on the main factors affecting electricity demand, we noted that there are differences across provinces and time. The estimation strategy contains two processes. First, we identify appropriate estimation techniques for the models which include pooled ordinary least squares (POLS), robust methods, and feasible generalised least squares (FGLS) estimators with fixed effects panels. Second, based on the verified estimator(s), we examine the differences of the price and income elasticity of demand given the regional income effects and the price of substitute energy. The general fixed effects specifications are[46]:

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[45] The Weather Underground provides the most localized weather condition available, and it is committed to delivering the most reliable, accurate weather information possible. It includes almost 19,000 weather stations in the USA and over 13,000 weather stations across the rest of the world.

[46] See Equation 5.1 and 5.2 for the definition of each variable.

$$lnD_{it} = \beta_1 + \delta_t + \beta_2 lnEP_{it} + \beta_3 lnGP_{it} + \beta_4 lnY_{it} + \beta_5 lnR_{it} + \beta_6 lnW_{it}$$
$$+ e_{it} \,, \tag{5.3}$$

$$lnD_{it} = \beta_1 + \alpha_i + \beta_2 lnEP_{it} + \beta_3 lnGP_{it} + \beta_4 lnY_{it} + \beta_5 lnR_{it} + \beta_6 lnW_{it}$$
$$+ e_{it} \,, \tag{5.4}$$

where α_i and δ_t are the unobserved "individual" and time effects respectively, representing the joint impact of the unobserved variables on the dependent variable D_{it}. Since energy consumption and the regressors are in logarithms, the coefficients are directly interpreted as demand elasticities.

In the literature, previous studies correct for a bias associated with the endogeneity of electricity price in Equation (5.3) and Equation (5.4) (Blazquez *et al.*, 2012; Alberini and Filippini, 2011; Matsukawa, 2004). The reason is that many countries have been adopting increasing block pricing systems which are nonlinear in terms of price and quantity. As we discussed, the pre-reform pricing system was a single fixed price for each province in China; hence, we treat electricity price as exogenous in our estimation.

However, the dependent variable and the random error are suspected of heteroskedasticity since the variance of the observations is clearly not the same. If this is the case, this problem could be overcome by first using robust estimators and further applying FGLS estimator if necessary. The tests for the estimations include poolability by a standard F-test, the comparison of fixed and random effects models by the Hausman (1978) test, serial correlation test by Wooldridge (2002) and cross-sectional dependence by Pesaran (2004).

The next step is to test the null hypothesis to see if the electricity consumption behaviour is the same across regions. To achieve this objective, we apply both intercept dummy and slope dummy variables for each additional explanatory variable

in the verified equation, and then jointly test the significance of the dummy variable coefficients using the Chow test (Hill *et al.*, 2008). Furthermore, we assume that regional income affects the parameters of prices and income. Supposing that time effect is detected in the first step, then the specified model for each region is as in Equation (5.5):

$$lnD_{it} = \beta_1 + \delta_t + \beta_2 lnEP_{it} + \beta_3 lnGP_{it} + \beta_4 lnY_{it} + \beta_5 lnR_{it} + \beta_6 lnW_{it} + \beta_7 Region$$
$$+ \theta_1(lnY_{it} * Region) + \theta_2(lnEP_{it} * Region) + \theta_3(lnGP_{it} * Region)$$
$$+ \theta_4(lnR_{it} * Region) + \theta_5(lnW_{it} * Region) + e_{it}, \quad\quad (5.5)$$

where *Region* includes three levels: coastal, inland and the bottom five (low income) provinces, as "the bottom five" is the reference group. If the F-statistics for testing the joint null hypothesis of equal parameters is less than a critical value, we will reject the null in favour of the alternative that at least one $\theta_i \neq 0$.

The final step of our estimation strategy is to model the relative price based on the price of electricity substitute as in Equation (5.2). Presuming a verified fixed time effects model with an appropriate estimator, the estimating equation is defined as follows:

$$lnD_{it} = \beta_1 + \delta_t + \beta_2 lnRP_{it} + \beta_3 lnY_{it} + \beta_4 lnW_{it} + \beta_5 lnR_{it} + \beta_6 Region$$
$$+ \theta_1(lnRP_{it} * Region) + \theta_2(lnY_{it} * Region) + \theta_4(lnW_{it} * Region)$$
$$+ \theta_5(lnR_{it} * Region) + e_{it}, \quad\quad (5.6)$$

where *lnRP* is the log of the ratio of the real price of electricity to the real price of natural gas. The relative price variable is expected to be negatively related to electricity consumption, and urban areas should have a higher parameter than the one at national level.

5.5 Results

5.5.1 Model selection

The coefficients estimated with fixed effect models are reported in Table 5.5 and Table 5.6 which summarize estimation results for three groups of households: national, urban and rural. The models include pooled OLS, fixed time effects with robust standard errors, fixed individual effects with robust standard errors, and FGLS with time and individual effects.

With regard to the national level and the urban sample (Table 5.5), poolability by F-statistics indicates that all time fixed effects models are significant at 10% and often at 1% level or better, which implies that the electricity consumption functions shift over time. The time effect may be due to factors such as the rapid acceleration of Chinese economic growth that results in fast household income increasing from one year to the next. Similarly, the individual fixed effects are highly significant, which reflects the substantial differences among provinces in terms of residential electricity consumption. Therefore, the POLS models are rejected. Second, the fixed effect model is expected according to the nature of the data, and the significant Hausman tests suggest that fixed time effects are more favourable than random effects, which is consistent with our expectation. Third, Wooldridge's tests for serial correlation in fixed effects panels are only in favour of the FGLS model with time effects at national level and urban areas. Furthermore, the Pesaran tests for cross sectional dependence of the FGLS model with time effects are insignificant at 5% level. Hence, the evidence suggests that the FGLS with time fixed effects are valid models to assess residential electricity consumption for the national level and the urban samples.

Table 5.5: National and Urban Income Models

Income level	National income					Urban income				
Model	Pooled	FE *t*	FE *i*	FGLS *t*	FGLS *i*	Pooled	FE *t*	FE *i*	FGLS *t*	FGLS*i*
Variable	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)
Intercept	-8.034***					-10.288***				
	0.672					0.769				
EP	-0.231**	-0.413***	-0.077	-0.412***	-0.079	-0.111	-0.306**	-0.135	-0.300***	-0.127**
	0.071	0.094	0.101	0.004	0.047	0.078	0.101	0.106	0.010	0.047
GP	0.118***	0.107**	0.092*	0.107***	0.022	0.165***	0.148***	0.115*	0.142***	0.033
	0.033	0.034	0.046	0.002	0.031	0.036	0.036	0.048	0.008	0.031
YA	1.318***	1.474***	1.303***	1.476***	1.097					
	0.028	0.048	0.042	0.006	0.052					
YU						1.319***	1.548***	1.229***	1.550***	1.039***
						0.031	0.057	0.043	0.010	0.049
W	0.286***	0.299***	-0.0334	0.296***	0.008	0.378***	0.410***	-0.005	0.401***	0.020
	0.038	0.039	0.096	0.002	0.027	0.042	0.042	0.099	0.006	0.026
R	-0.030*	-0.022	0.010	-0.022***	0.001	-0.057***	-0.048**	0.004	-0.047***	-0.001
	0.014	0.016	0.011	0.0002	0.005	0.015	0.017	0.012	0.001	0.005
SSE	18.645	17.745	8.811	17.745	10.171	22.083	20.425	9.363	20.429	10.625
Adj.R^2	0.866	0.741	0.818	0.885	0.934	0.844	0.709	0.812	0.868	0.931
Pooltest		F=1.521	F=14.829				F=2.416	F=18.050		
		P=0.109	P<-2.2e-16				P=0.004	P<-2.2e-16		
Hausmantest		Chisq =	Chisq =				Chisq =	Chisq=		
		48.30	11.68				50.10	66.00		
		P =	P=0.039				P = 1.3e-09	P = 6.9e-13		
		3.08e-09								
Wooldridge test		Chisq =	Chisq =	Chisq=	Chisq=		Chisq =	Chisq =	Chisq=	Chisq=
		1650.3	520.45	0.056	801.4		1690	655	0.269	812.9
		P < 2.2e-16	P < 2.2e-16	P=0.814	P<2.2e-16		P < 2.2e-16	P < 2.2e-16	P=0.604	P<2.2e-16
Pesaran CD test		Z=-1.389	Z=1.220	Z=-1.930	Z=9.066		Z=-1.522	Z=4.205	Z=-1.418	Z=10.351
		P=0.165	P=0.222	P=0.054	P<2.2e-16		P=0.128	P=2.6e-05	P=0.156	P<2.2e-16

Notes: ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

Table 5.6: Rural Income Models

| Model | Pooled | FE t | FE i | FGLS t | FGLS i |
Variable	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)	Coef.(S.E)
Intercept	-0.532				
	0.621				
EP	-0.623***	-0.522***	-0.024	-0.517***	-0.033
	0.073	0.098	0.108	0.005	0.050
GP	-0.005	0.027	-0.047	0.024***	-0.068**
	0.035	0.035	0.049	0.005	0.031
YR	1.174***	1.093***	1.404***	1.097***	1.212***
	0.026	0.037	0.049	0.007	0.048
W	0.016	0.031	-0.071	0.034***	-0.004
	0.040	0.041	0.103	0.007	0.030
R	0.010	-0.006	0.024*	-0.006***	0.007
	0.015	0.017	0.012	0.001	0.005
SSE	20.57	19.106	10.09	19.108	11.14
Adj.R^2	0.854	0.725	0.804	0.876	0.928
Pool test		F= 2.280	F= 13.80		
		P=0.007	P<2.2e-16		
Hausman test		Chisq=42.86	Chisq=21.66		
		P =3.9e-08	P=6e-04		
Wooldridge's test		Chisq= 1966	Chisq= 328	Chisq=15.624	Chisq=736.6
		P<2.2e-16	P<2.2e-16	P=7.7e-05	P<2.2e-16
Pesaran CD test		Z=-1.327	Z=6.924	Z=-2.357	Z=14.518
		P=0.185	P=4.4e-12	P=0.018	P<2.2e-16

Notes: ***, ** and * denote statistical significance at 1% level, 5% level and 10% level, respectively.

In terms of rural areas (Table 5.6), poolability tests suggest the need to control for either time or individual effects so that POLS is not appropriate. However, the remaining models have the problem of serial correlation since the Wooldridge's tests are insignificant. Such issue may be caused by omitted variables of other energy prices capturing the effects of other conventional energy sources such as coal and wood in rural areas.[47] Yet, the insignificant Pesaran test shows that there is no cross sectional dependence in fixed time effects regressions with robust standard errors, which may suggest that the estimates remain unbiased but inconsistent (Sarafidis and Wansbeek, 2012; Pesaran, 2004; Cerrato and Srantis, 2002).

5.5.2 Price and income elasticities without regional effects

The coefficients of main interests of income, own-price and cross-price effects are statistically significant and are in line with the expectations of the consumer behaviour theory (see Table 5.5 and Table 5.6).

The electricity price shows a consistently negative effect on the quantity of electricity demanded when holding other factors constant. The elasticity is less than 1, suggesting that the electricity demand is price inelastic. National, urban and rural samples show different estimates for the response of households to changes in residential electricity prices, -0.412, -0.300 and -0.522, respectively. The results reveal that (poorer) rural income households are more sensitive to changes in electricity prices than (richer) urban households.

The household income variable is also consistently, significantly and positively

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[47] See Yao *et al.* (2012).

related to electricity consumption for each income group, with elasticity above 1 when holding other factors fixed. Income elasticities suggest that the higher the household income, the higher the electricity demand in China. In other words, urban households demand more electricity than average income and rural households in China as the income elasticity is 1.550 greater than 1.480 at national level and 1.093 in rural areas. The results are consistent with the expectations of the consumer behaviour theory.

The cross-price elasticities are also as expected, all positive and significant at the national level and for the urban households. Generally, the cross-price elasticity of urban households is higher than at national level. However, both elasticities are small, which suggests that there may not be a strong substitution relationship between the residential electricity and the alternative, residential natural gas during the period of analysis. Alternative specifications confirm that natural gas is a substitute source of energy for electricity at national level, and in the urban areas, the relative price variable has the expected negative sign and is significant.

Our estimates of own-price elasticity are close to the He *et al*. (2011) estimate of -0.300 for household electricity demand with cross-section data in 2007; our results differ from the Lin study (2003) which finds an average electricity price elasticity of 0.016 at national level. The latter paper uses time-series data, which does not take the province effect into account. The estimated elasticity close to zero seems unreasonable for the household sector. Considering previous international studies, our findings also agree with price inelastic estimates for the USA, Australia, Taiwan and

Sri Lanka (Table 5.3).

5.5.3 Supply reliability and weather effects

The electricity supply reliability significantly affects electricity consumption both for national and urban households, as demonstrated in Table 5.5. The findings indicate that the electricity reliability is a key factor affecting residential electricity consumption in spite of electricity supply enterprises having made efforts to improve the electricity supply reliability in China.

The weather condition is also a highly significant factor influencing residential electricity consumption at national level and in the urban areas. These findings are consistent with previous studies on residential electricity consumption (Alberini and Filippini, 2011; Dergiades and Tsoulfidis, 2008; Holtedahl and Joutz, 2004; Nakajima and Hamori, 2010; Narayan and Smyth, 2005).

5.5.4 Regional income effects

The results reported in Table 7 represent tests of the regional income level impact on the price and income elasticities. Our findings are twofold. First, there are important differences across the three categories of regions since all the Chow tests are significant at 1% level ($F_{(0.99, \ 6, \ 437)}$= 2.834). We therefore reject the null hypothesis that the electricity consumption function is uniform and conclude that there are significant differences in consumption behaviour according to regional income levels.

Table 5.7: Testing for the Equivalence of Income Levels and Regional Income Effects

	National		Urban		Rural	
Variable	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
EP	0.277***	0.015	0.261***	0.024	0.311***	0.021
GP	-0.450***	0.010	-0.441***	0.015	-0.445***	0.019
YA	1.452***	0.028				
YU			1.363***	0.039		
YR					0.955***	0.032
W	-0.451***	0.012	-0.362***	0.018	-0.614***	0.016
R	0.071***	0.005	0.056***	0.007	0.116***	0.006
Inland	-3.569***	0.463	-4.589***	0.603	-1.277***	0.366
Coastal	-5.703***	0.390	-5.610***	0.511	-11.262***	0.408
EP : Inland	-1.138***	0.030	-1.033***	0.045	-1.350***	0.038
EP: Coastal	-0.588***	0.023	-0.407***	0.034	-0.442***	0.030
GP: Inland	0.545***	0.024	0.547***	0.026	0.504***	0.025
GP: Coastal	0.722***	0.019	0.616***	0.022	0.861***	0.021
YA: Inland	-0.111***	0.025				
YA: Coastal	-0.111***	0.024				
YU: Inland			-0.104**	0.034		
YU: Coastal			-0.077*	0.032		
YR: Inland					-0.099***	0.016
YR: Coastal					0.134***	0.025
W: Inland	0.925***	0.021	0.966***	0.026	0.838***	0.017
W: Coastal	0.604***	0.021	0.536***	0.025	0.793***	0.025
R: Inland	-0.085***	0.006	-0.075***	0.008	-0.114***	0.007
R: Coastal	-0.059***	0.005	-0.043***	0.008	-0.095***	0.006
SSE	12.823		14.006		13.524	
Adj.R^2	0.917		0.909		0.912	
Wooldridge's test	chisq = 2.158, p-value = 0.142		chisq = 1.373, p-value = 0.242		chisq = 13.82, p-value =2.0e-04	
Pesaran CD test	z = -0.711, p-value = 0.477		z = -0.125, p-value = 0.900		z = -1.898, p-value = 0.058	
The Chow test	F=28.010		F=33.453		F=30.129	

Notes: Results are based on FGLS time effects estimators. The 1% critical value of the F distribution for the Chow test is $F_{(0.99,6,437)}$= 2.834. ***, ** and * denote statistical significance at 1% level, 5% level, and 10% level, respectively.

Second, regional variation affects the price and income elasticities. The estimates for each of the three regional categories are as follows.

Coastal provinces:

National: $\widehat{D}= -0.311$ EP$+0.272$ GP$+1.341$ YA$+0.153$ W$+0.012$ R-5.703 Coastal

Urban: $\widehat{D}= -0.146$ EP$+0.175$ GP$+1.286$ YU$+0.174$ W$+0.013$ R-5.610 Coastal

Rural: $\widehat{D}= -0.131$ EP$+0.416$ GP$+1.089$ YR$+0.179$ W$+0.021$ R-11.262 Coastal

Inland provinces:

National: $\widehat{D}= -0.861$ EP$+0.095$ GP$+1.341$ YA$+0.474$ W-0.014 R-3.569 Inland

Urban: $\widehat{D}= -0.772$ EP$+0.106$ GP$+1.259$ YU$+0.604$ W-0.019 R-4.489 Inland

Rural: $\widehat{D}= -1.039$ EP$+0.059$ GP$+0.856$ YR$+0.224$ W$+0.002$ R-1.277 Inland

The majority of electricity price elasticities are less than 1 and show that the lower the income level, the higher the own price elasticity of demand. Particularly, households in inland provinces are much more sensitive to changes in electricity prices than households living in coastal provinces. In addition, their income elasticities of demand are consistently higher than 1. Interestingly, the own price elasticity is slightly greater than 1 for rural households in inland provinces, which also shows low income elasticity of demand. The high price elasticities may imply that although the proportion of electricity expenditure in total household consumption is not as substantial as food expenditure, the income effects are still large.

5.5.6 Price elasticity of substitute energy

The parameters of the relative price of electricity to pipeline natural gas are reported in Table 5.8. They have the expected negative sign (except for rural households in inland provinces) and are highly significant, at the 1% level. The coefficients are

-0.037, -0.056 and 0.007 for national, urban and rural income levels for the inland

provinces and -0.244, -0.132 and -0.229, respectively, for the coastal provinces.

Therefore, we conclude that overall pipeline natural gas is indeed a substitute for

electricity in China, except in inland rural areas.

Table 5.8: Testing for the Price of a Substitute

Variable	National Coef.	S.E.	Urban Coef.	S.E.	Rural Coef.	S.E.
RP	0.390***	0.013	0.412***	0.021	0.417***	0.026
YA	1.425***	0.021				
YU			1.387***	0.045		
YR					0.800***	0.025
W	-0.455***	0.011	-0.374***	0.025	-0.572***	0.028
R	0.057***	0.003	0.058***	0.010	0.089***	0.006
Inland	-8.224***	0.197	-8.361***	0.407	-6.857***	0.358
Coastal	-4.387***	0.210	-3.274***	0.389	-5.472***	0.353
RP: Inland	-0.427***	0.014	-0.468***	0.025	-0.410***	0.027
RP: Coastal	-0.634***	0.012	-0.544***	0.021	-0.646***	0.026
YA: Inland	0.039*	0.018				
YA: Coastal	-0.126***	0.024				
YU: Inland			0.021	0.032		
YU: Coastal			-0.127**	0.041		
YR: Inland					0.086***	0.012
YR: Coastal					0.107***	0.023
W: Inland	0.909***	0.013	0.948***	0.035	0.730***	0.035
W: Coastal	0.570***	0.011	0.483***	0.025	0.487***	0.030
R: Inland	-0.093***	0.003	-0.095***	0.009	-0.121***	0.005
R: Coastal	-0.051***	0.003	-0.050***	0.010	-0.074***	0.006
SSE	14.901		15.680		17.668	
Adj.R^2	0.904		0.899		0.885	
Wooldridge's test	chisq = 0.345, p-value = 0.557		chisq = 0.882, p-value = 0.348		chisq = 1.173, p-value = 0.279	
Pesaran CD test	z = -0.656, p-value = 0.5121		z = -0.094, p-value = 0.925		z = -1.813, p-value = 0.070	

Notes: Results are based on FGLS time effects estimators. ***, ** and * denote
statistical significance at 1% level, 5% level, and 10% level, respectively.

5.6 Conclusion and policy implications

A principal motivation for this paper is to evaluate the implications of the new residential electricity pricing system in China and to understand how households respond to changes in electricity prices across Chinese provinces, differentiating between urban and rural households as well as across income groups. The issue of Chinese electricity demand at household levels has received little attention in the academic literature despite its considerable policy relevance. We apply panel data models to investigate the demand responsiveness of households to change in electricity own-price and household income when controlling for other relevant factors such as substitute energy prices, electricity supply reliability and weather conditions using annual data from 29 provinces over the period 1998-2011.

The main argument in the paper is that the perceived "low price" of domestic electricity in China may be true when referring to the economic development for the whole country. However, the "low price" is not true when different levels of average household income are considered. Our findings suggest that income is the prime driving force of residential electricity demand which mediates a variation in own price elasticity across three categories of provinces. The residential electricity price elasticity is fairly high for the urban households in inland provinces compared to the coastal urban households. The second argument is that study on residential electricity consumption should not ignore the effect of electricity supply reliability due to electricity shortages and less advanced technology in developing countries, including China; otherwise, estimates may be biased.

The results suggest that the new residential electricity pricing system in China should take into account the variation in price responsiveness, particularly for urban households in inland provinces and for rural households. These households are more than five times as sensitive to changes in electricity prices as the households living in coastal urban areas which have average to high incomes. Furthermore, the electricity pricing system should take into account the variation in elasticity across the different tiers of the price schedule. In other words, important differences in the price elasticity in different blocks of the rate structure should be considered in the new electricity pricing system. For instance, for high-income households there is considerable room for price increase, which can be used to finance the development of the supply system.

While our findings are robust, a limitation of the paper is that the conclusions are drawn from a relatively small dataset and fixed effects models. Future work should include prices of other conventional energy sources to investigate in more detail the effects in rural areas. Also, residential bill data could help to examine baseline quantities, to estimate price elasticity between the rich and the poor sectors as well as to distinguish between short run and long run effects.

CHAPTER 6 Conclusions

In the introduction, we expressed the hope that the work on this thesis could provide a new way of unbiased evaluation for the effect of income inequality on quality of life. In this final chapter, we will conclude by describing the progress made towards this goal and its application to problems in a range of domains. The thesis will also suggest some future research directions that could provide the next steps along the path to a practical and wide applicability of the proposed two-effort framework.

6.1 Introduction

This research was designed to explore the concept of income inequality through the notion of self efforts and social efforts as well as to evaluate the impact of rising income inequality on the quality of life in respect of the contemporary Chinese people's perception of it. This perception was identified as associated with living standards in the short and medium terms. The present research has reviewed the reasons and motivations for the specific case of China and pinpointed the essential and the limitation of self-interest in economics and in the subfield of income inequality. The reasons for the combination of self efforts and social efforts to reduce the gap have also been discussed.

The research has understood that the macro literature has established sufficient and equal opportunity as the efficient pathway for income inequality since it allows one to pursue self-interest. In contrast, the reasons for the inequality are attributed to differences in personality traits across individuals from the micro perspective.

However, the present study has illustrated that the underlying insight into individual income difference was the sensitivity of opportunities.

Moreover, in spite of the importance of self-interest through theoretical considerations, the structure of measuring income inequality in the literature has merely emphasized social efforts (which reflect on the calculation being based on social comparison, for example, Gini coefficient and Theil index). In other words, self efforts derived from self-interest have always been assumed as identical across individuals, and this assumption was generally without any explicit justification. In this disregard, it is biased to claim that an increasing concern for the government policies and actions was primarily responsible for the rise in income inequality that in turn aggravated the process of improving living standards. This is one of claims that has been repeatedly heard over recent years in China.

Hence, the research sought to examine three objectives to provide unbiased judgment on the effect of income inequality on well-being. First was to investigate the impact of social influence and individual efforts in relation to income inequality on living standards. Second was through the concepts of absolute mobility and volatility to examine how they affect individual efforts related to income inequality. Third was a case study of social efforts with respect to policy analysis on the effect of residential electricity pricing on life burden. In other words, social efforts are measured by three angles of traditional index of income inequality, absolute mobility and volatility index, and a specific policy analysis. Meanwhile, self efforts are observed by the balance of an individual's life time earnings.

The examination applied two different sets of secondary data. One was the adult survey from the CHNS between 1989 and 2009, while the other was average household electricity consumption data at province level from multiple resources between 1998 and 2011. The main statistical method for measuring income inequality was the Theil statistics for measuring inequality and the Field and Ok (1999) method for calculating absolute mobility and volatility. Meanwhile, econometric techniques included OLS, robust M estimator, pooled OLS, LSDV, RE, FGLS, the system GMM and quantile regression.

6.2 Summary of key findings

The main empirical findings are chapter specific and were summarized within the respective three empirical chapters: social and individual income inequality on living standards in Chapter 3; income mobility and volatility on individual income inequality in Chapter 4; and a case study of social efforts in relation to the role of residential electricity pricing in Chapter 5. These three analyses have shown solid evidence to demonstrate that the improper social efforts worsen the gap in the case of China. This section will synthesize the empirical findings to understand the research interest.

First, social efforts such as government assistance and action has had an important positive impact on living standards in the short run but is not sustainable, as detailed in Chapter 3. This conclusion is drawn from the statistical evidence on the significant positive coefficient of social inequality index and a U-shaped pattern of the coefficients of individual income inequality index and its squared term. In addition,

the significant positive coefficient of initial income suggests that convergence does not occur. These results may imply that social efforts are unable to supply sufficient or unequal economic opportunity across individuals in the long run.

Second, the implication of a lack of the opportunity in Chapter 3 was further confirmed by Chapter 4 within the context of income inequality and mobility. The conclusions were that although economic opportunity provided by social efforts offset the inequality, two problems exist simultaneously. First is that the opportunity appeared as unequal allocation across percentiles of individuals, which reflects on the significant F test for the equality of coefficients of mobility across percentiles. Second is that the development of income security was scarcity, which reflects on the effect of income volatility being negative to the inequality. Hence, the unequal economic opportunity and this income insecurity are the major issues for the raising individual income inequality.

Third, even though there are many social efforts by the central government intended to smooth over income inequality through different departments, the particular policy of the residential electricity pricing schedule would further magnify the gap since low income households could not benefit from the current pricing system from the energy sector. The results in Chapter 5 indicate that poorer households are more sensitive to changes in electricity prices than richer urban households and there is important heterogeneity in the responsiveness to electricity price changes according to household income levels.

6.3 Theoretical and methodology implications

The primary contribution of this thesis to the literature is to firstly introduce the notion of looking at social efforts and self-development simultaneously to evaluate the effect of income inequality on quality of life empirically. This is unlike the existing literature which merely addresses inequality according to a unilateral aspect of social influence which may provide biased information. The present analysis provides a novel insight in this respect.

The present research has shown that this belief can achieve coherence in the income inequality discourse between theory and empirical structure with respect to individual well-being as well as enabling a more sustainable and comprehensive understanding. Essentially, the well-being of individuals comprises two aspects of social influence and self-development. Examining both dimensions of an issue can embrace and promote the philological belief that one's good life is built on social efforts and self efforts. Furthermore, to show individuals' efforts not only allow economists and policymakers to connect to the ethics issue easily and focus on the appropriate target groups, but also implicitly account for criticisms on the limitations of self-interest. To the best of our knowledge, there have not been any previous studies paying attention on these dimensions in the context of income inequality.

The results of the empirical analysis have demonstrated the importance of taking social and self efforts into account for the evaluation of government assistance and action. With the two-sided statistical evidence, we acknowledge that the achievement by social efforts to enhance living standards is significant in China. Such

effort, however, is not sustainable in the long run and the corresponding benefit is not likely for some poorer individuals because of the shortage of equality and the appearance of rising volatility. This conclusion is not new in the literature, but our statistical evidence allows the achievement of unbiased and unprejudiced judgment.

Although the research methods used in this research were not new, they were combined in ways that had been rarely done previously. First, the notion of self development allows measures of income inequality over time because income inequality not only occurs between people, but also within one's life time of earning. Previous studies looking at inequality merely focus on social comparison at a time. Furthermore, different time horizons, the short run and long run, can be cooperated into one unified empirical framework with our consideration. This is because the traditional measure of inequality is a static calculation and our measure of inequality based on self development is a dynamic calculation.

6.4 Policy recommendations

This proposed notion has important practical implications in China. There are very different views among the government and the ordinary Chinese people, which may reflect the discontent in society. The finding from this study indicates that looking at either side likely leads to a biased analysis. Hence, it is particularly vital to policymakers for considering the information from both sides.

The findings have also linked to one particular policy programme with extended theoretical underpinnings, that is, the mission to reduce income inequality which China has been making efforts on since the 1990s. However, evidence from

many studies and this thesis seems to point to the fact that government actions have not been sustainable in the long run; the income inequality reduction policy has not been efficiently making the anticipated impact in general; and the current residential electricity pricing is likely to be unable to implement its promise of lightening the life burden in particular.

Therefore, policymakers should persist in the construction of the harmonious society and deliver its message of China's future being dependent on balancing social, economic and environmental objectives when making decisions. As soon as such a message is given, equal opportunity is likely to occur across the nation. In this way, low income individuals can climb their income ladder and converge towards the rich effectively. In addition, policymakers should provide a wide range of programmes to help ensure all residents secure a lifetime income and maintain a good quality of life, for example, by continuously improving the welfare system and developing a mature insurance market. Besides the overall plans, sectoral schemes also require attention. This study indicates that policymakers should take variations in price responsiveness into account, particularly for urban households in inland provinces and for rural households. For instance, for high-income households there is considerable room for price increases, which can be used to finance the development of the supply system.

We have to admit that the Chinese government has made significant efforts to administer substantive opportunities through trade liberalization and productivity improvement since 1978. Nevertheless, over the years, the Chinese government has fundamentally maintained the same strategy, hoping to keep up the amount of

opportunity that can relieve the pressure from the high levels of income inequality. The theoretical arguments for this justification suggest the need for political-economical institutions and some relevant policy reviews in the direction of equality which can enable equal opportunity to work for the poor and the disadvantaged groups.

In fact, China does not lack plans to accomplish rebalancing such as the new strategy of the construction of the harmonious society, the 12th Five-Year Plan (2011) and the Income Inequality Reform Plan; rather it lacks poor implementation. Historical evidence in particular has shown that policy implementation is rather inefficient under the current institutions (Chen and Zheng, 2008). Similarly, enhancing economic security has been emphasized since the mid-1990s (Zhengyi, 2004), and yet other studies and the current research implies economic insecurity has been aggravated. Recently, despite the new ideal scheme of the income inequality reform, the foreground is still not very optimistic.

6.5 Limitations

The research employed the well-known survey data, the CNHS data, but they are based on selected provinces and cities through sampling thousands of adults in China. As a direct consequence of this careful investigation, the study also encountered a number of limitations which need to be considered.

First, although the study has shown an evaluative perspective on the research interests of social efforts and self efforts through income inequality, to apply this notion into an empirical analysis requests a large set of longitudinal data with wide N

and long T. The available statistical information is likely nothing more than the CNHS.

Second, the examination was limited by the CHNS data which has the major potential drawback of representing the whole population in China and the precise ability to look at the research interest, especially observing individual income inequality. In spite of the shortcoming in the CHNS data, they are one of the most popular longitudinal data to study income inequality in the literature and cover a relatively long period of time. Furthermore, this research is limited in the short and medium terms of quality of life since the focus of living standards as the indicator of quality of life is clearly a contemporary concern for ordinary Chinese. Thus, what is less clear is the long-term indication for the quality of life which should consider not just income, but also integrate other indicators such as life expectancy and education such as the human development index.

6.6 Future research directions

The two-effort framework in the present study is a new development in the field of income inequality, and has provided comprehension to the evaluation of the effect of social efforts in relation to income inequality on living standards, although there are several limitations. These limitations can in fact suggest future research directions to improve these issues and sustain this new developed two-effort framework. Exploring the following as future research strategies can facilitate the attainment of such a goal.

First, to trace individual life time income inequality will be one of the important directions for future research and will attract more attention when more and extended longitudinal data are available. To apply longitudinal data analysis is the fashion for

empirical study because such data involve rich information on household and individual behaviours over time. The development of such a data set began in the mid-1960s in the USA (Hsiao, 2003). Since then, panel data have become increasingly accessible and yet, they are still in the early process. That may be the reason previous studies have rarely attempted to address individual income inequality. Second, this framework can be used in conducting an international study, for example, a comparative study between China and other developed and/or developing countries, especially the USA and the UK because both countries have a long advanced development of household survey data for example the Panel Study of Income Dynamics (2014) and the British Household Panel Survey (2014). Third, since this research merely considered living standards as the ordinary Chinese people perception of quality of life, the scope of the project is unlikely to go beyond the medium term. Hence, a future study should not just employ income as an indicator, but also others to explore the long-term effect. In addition, investigation on these who do not have income mobility is desired since the movement of the bottom of income distribution does not occur. Finally, in relation to the extension of achievable policy strategies and development targets with regards to income inequality, there is a need for more studies at the international, regional, urban-rural and sectoral levels to allow further analysis of diversified dimensions of the subject in China.

6.7 Conclusion

It is often reported that both self-interest and social efforts have a stake in income inequality in theoretical and policy debates. However, the high level of inequality is

always attributed to the failure of the social efforts such as government intervention without justifying the individual's self efforts. The social efforts in practice have truly offered some successful solutions to the prevailing and persistent vulnerability and deprivation of individuals in China. The credit for this success, on the other hand, goes to the government without appreciating the hard work of the ordinary Chinese. The unilateral judgment has been shown to be neither comprehensive nor sustainable in promoting the goal of well-being among individuals in the context of income inequality. This scarcity is the primary theme that this research project aimed to work and develop in the literature.

In the context of China, evidence from this research highlights the consistent claim made in many previous studies; that is, the high level of income inequality is the result of a lack of sustainable government actions such as unequal opportunity and high income volatility. More importantly, this methodology takes ordinary Chinese people's hard work and attitudes for well-being into account to evaluate the claim. This is also vital to provide two-sided statistical evidence to give the different views of the government and society in China.

Certainly, the central government is and will continually play an imperative role in economic development and social coverage. There is still, of course, a long way to go before it reaches the standards of living of the West. For the sake of one-fifth of the world's population, our hope is that it will do so.

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