EMPIRICAL INVESTIGATIONS INTO GROWTH, INEQUALITY, REAL ESTATE TAXES AND LOCAL FOOD

A DISSERTATION SUBMITTED TO THE GRADUATE DIVISION OF THE UNIVERSITY OF HAWAI'I AT MĀNOA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

ECONOMICS

May 2017

By
Yiwen Yang

Dissertation Committee:

Theresa Greaney, Chairperson
PingSun Leung
Peter Fuleky
Jeffrey Traczynski
David Yang

Acknowledgements

Finishing the Ph. D. program in economics is certainly a wonderful milestone in my life. I would like to take this opportunity to thank those who greatly supported me along the way.

First of all, I would like to express my immense gratitude to my dissertation advisor, Professor Theresa Greaney for her expertise and intellectual advice and support throughout this research. Her integral view on research and professionalism for providing high-scholastic work has deeply impressed me. I have learnt not only economic knowledge but also the way of conducting the research. Without her guidance and persistent help this dissertation would not have been possible.

Secondly, I would like to express my great gratitude to Professor PingSun Leung. Not only for his encouragement and support throughout this research, but also for his generously providing me the funding so that I can complete my dissertation successfully.

I am very fortunate to have Professor Peter Fuleky, Jeffrey Traczynski, and David Yang in my doctoral committee. Their invaluable comments and guidance helped improve the contents of this dissertation. I sincerely thank them all from the bottom of my heart.

Many other great people have also given me wonderful support along my journey to create this dissertation. I would like to express my great thanks to my peers who always support me in many ways. Many thanks also go to the Hung family for generously providing me the funding.

Lastly, and the most importantly, I would like to thank my family for their love, understanding and support during the past five years.

Contents

List of Tables

List of Figures

Chapter 1

Introduction

This thesis tackles three seemingly disparate topics but all relate to quality of life issues and public policy. The first issue relates to the interrelationship between economic growth and income inequality. For example, some governments pursue pro-growth policies to promote higher economic growth. At the same time, in countries like China, Japan, South Korea, and the U.S., citizens express discontent regarding increasing income inequality. Inequality has even become a major issue in the 2016 U.S. presidential election. Multiple presidential candidates have included income inequality on their political platforms, addressing constituents' demands for a policy package that achieves inclusive growth. The second issue is evident in Southern Asian countries such as Hong Kong, Singapore, and Taiwan, where real estate prices increased substantially in recent years. The younger generation, in particular, has demanded a special policy to curb unaffordable housing prices. Lastly, surveys reveal that many people would like to buy locally-grown food to support the local economy. Governments have also endeavored to increase production of local food. However, it is unclear whether or not increased food localization is economically viable.

These three public issues cover topics including economic growth and income distribution of a nation, the effectiveness of speculation-suppressing tax policies in housing markets, and consumers' attitudes toward local food relative to non-local counterparts. They are all closely integrated with citizens' quality of life. This dissertation aims to explore these three topics by adopting an appropriate empirical methodology for each topic, with methodologies that include macroeconomic and microeconomic techniques. In investigating the link between inequality and economic growth, most past studies have pursued empirical analysis using cross-sectional or pooled country-level data, which tends to ignore heterogeneity across countries. These studies also tended to focus on only a unilateral relationship; that is, from growth to inequality or from inequality to growth. We contribute to this literature by: 1) conducting time-series analysis of individual countries to allow for country heterogeneity, and 2) by examining the bilateral relationship between growth and inequality. To address the effectiveness of price-curbing tax policy in Taiwan, we construct a two-tier regression discontinuity model to provide robust estimates. As a result, we are able to isolate the effect of the tax from the effect of other nontax factors, and also differentiate the impacts on the short-run target real estate market between different tax rates imposed. Lastly, to explore the conflicting outcomes among local food studies, we use a meta-synthetic approach with a "5W1H" conceptual scaffold searching for attribute candidates which might explain the range of results in the existing studies. The W's represent Who, What, When, Where, and Why, respectively, and the H stands for How. Below are the summaries of each chapter.

In Chapter 2, we build an inequality-growth-redistribution nexus, and apply the Engle-Granger two-step ECM approach to estimate the long-run and short-run relationships between inequality and growth for four economies: China, Japan, South Korea, and the United States. Our estimation results support the S-shaped curve hypothesis relating GDP per capita to inequality with different starting points for the four economies. For the reverse relationship, we find a positive causal relationship for China, Japan, and the United States, indicating that increased income inequality spurred economic growth. In addition, we find mixed results on the effect of trade openness on inequality and growth. Trade openness reduced inequality in the United States and Japan, worsened it in China and had no significant effect in South Korea. In the inequality-GDP per capita relationship, exports provided an impetus to economic growth for Japan. As for redistribution, although fiscal redistributive measures reduced inequality in Japan, they played no major role in the other three countries. With regard to the inequality-GDP per capita relationship, all countries except for China show a negative effect of fiscal redistribution on GDP per capita.

To limit excessive speculation on real estate and curb rising residential property prices in Taiwan, the government imposed a special ad valorem tax (Specifically Selected Goods and Services Tax; SSGST) on short-term transactions of real estate within the territory of Taiwan starting in June 2011. In Chapter 3, we construct a two-tier regression discontinuity model to examine the impacts of this speculation-curbing tax on the real estate market in Taiwan. We find that the special ad valorem tax was effective in curbing increasing residential property prices. However, the difference of tax rates imposed among the targeted and taxed housing transactions was not statistically significant.

Over the past two decades, there has been a growing interest in estimating the price differential between locally-produced food and their non-local counterparts. Previous empirical studies reveal conflicting results both in terms of the existence of price premiums and their magnitude. Chapter 4 aims to identify possible key determinants of these diverse findings. We conduct a standard meta-analysis of the empirical evidence on price premiums or discounts of local food, based on a sample of 49 estimates obtained from 26 studies. Our findings show that U.S. consumers tend to pay a higher premium for local food than do European consumers. The variations in the estimated price premiums or discounts of local food can also be explained by differences in the estimation methods and data used in these studies. Studies using actual market prices generate a lower price premium of locally-produced food than those using a willingness-to-pay value. This may imply that consumers tend to overstate their value for locally-produced food in a hypothetical willingness-to-pay situation. Among the types of local food, consumers' attitudes toward meat are significantly different from those toward milk and eggs. Furthermore, our results reflect that consumers are increasingly interested in local food over time.

Chapter 2

Economic Growth and Income Inequality in the Asia-Pacific Region: A Comparative Study of China, Japan, South Korea, and the United States

*This chapter is co-authored with Professor Theresa Greaney.

2.1 Introduction

Inequality has risen to the forefront of public debate in recent years as talk of the one percent versus the ninety-nine percent has grown. Concerns over rising inequality motivated the Occupy Wall Street movement and continue to motivate a backlash in many industrialized countries towards international trade. The 2016 presidential campaign in the U.S. involves lengthy political rhetoric over which candidate's policies will better serve those at the bottom of the income distribution. In Asia, China's rapid increase in inequality has become a key political issue that government leaders must address. Even in countries with relatively low levels of inequality, such as Japan and South Korea, negative public sentiment over increases in inequality has pushed the topic to the forefront. Economists and policy makers worry that a persistently unbalanced sharing of the growth dividend will sour public support for pro-growth policies and lead to political instability. Others worry that increased inequality itself might undermine economic growth.

To address these concerns, economists are renewing their efforts to understand the relationship between economic development, growth and inequality. Many studies have tackled this topic, but the results are varied and sometimes conflicting. Theoretically there are structural and political pathways by which economic growth might affect income inequality, and vice versa. Most past studies have pursued empirical analysis using cross-sectional or pooled country-level data, which tends to ignore heterogeneity across countries. These studies also tended to focus on only a unilateral relationship; that is, from growth to inequality or from inequality to growth. We propose contributing to this literature by: 1) conducting time-series analysis of individual countries to allow for country heterogeneity, and 2) by examining the bilateral relationship between growth and inequality. Based on the inequality-growth-redistribution nexus, we first build a baseline Error-Correction Model (ECM) with common determinants suitable for all countries and then construct an ECM for each country that includes country-specific determinants to examine the long-run equilibrium relationship between income inequality and economic growth. We also analyze the short-run impulse responses of the variables. Our inquiry targets four Asia-Pacific region economies—China, Japan, South Korea and the United States.

Our analysis finds support for the S-shaped curve hypothesis relating GDP per capita to inequality with different starting points for our four economies. For the reverse relationship, we find that increased inequality increases per capita GDP in the U.S., Japan and China, but decreases it in South Korea. In addition, our results show mixed effects of trade openness on inequality and growth. Trade openness reduced inequality in the U.S. and Japan, worsened it in China and had no significant effect in South Korea. In the inequality-GDP per capita relationship, exports provided an impetus to economic growth for Japan. As for redistribution, although fiscal redistributive measures reduce inequality in Japan, they play no major roles in the other three countries. Finally, all countries except for China show a negative effect of fiscal redistribution on GDP per capita.

The rest of this paper is organized as follows. Section 2 surveys the related literature on the effect of economic growth on inequality and the effect of inequality on economic growth. Section 3 discusses the analytical concept and transmission channels. Section 4 introduces the dynamic causality analysis, including empirical modeling and data employed. Section 5 presents and compares the empirical results for China, Japan, South Korea and United States, and the last section concludes.

2.2 Literature Review

Over the past 20 years, many studies have investigated the unidirectional or bidirectional relationship between income inequality and economic growth. For each causal relationship, however, theoretical predictions are controversial and empirical findings are mixed. This section provides a brief overview of existing literature regarding the link between inequality and economic growth.

2.2.1 The Effect of Economic Growth on Inequality

A large portion of the literature on the effect of economic growth on inequality focuses on the noteworthy "Kuznets' (1955) inverted U curve", which states that inequality increases early in the industrialization process and then decreases with further development. In addition, some studies hypothesized a specific factor driving growth, e.g., globalization, while investigating the effect of economic growth on inequality. After scrutinizing recent literature, we found that the effect of economic growth on inequality varies; it could be positive (e.g., Rubin and Segal (2015); Wahiba and El Weriemmi (2014); Lundberg and Squire (2003)), negative (e.g., Majumdar and Partridge (2009); Nissim (2007)) or mixed (e.g., Huang et al. (2015); Chambers (2010)) due to different specifications of models, different datasets, and different estimation methods. We highlight the main points as follows.

First of all, long-term effects may differ from short-term effects. By adopting the semi-parametric method, Chambers (2010) found that economic growth increases income inequality for all countries over the short-run and medium-run. As for the long-term effect, economic growth reduces inequality in developing countries but has the opposite effect in developed countries.

Secondly, the impact of economic growth on income inequality is inconsistent as different determinants are included in the model. For example, by taking trade openness and human capital as determinants of inequality, Wahiba and El Weriemmi (2014) showed that in Tunisia, economic growth is positively associated with inequality. Furthermore, trade openness aggravated and human capital alleviated the degree of inequality. On the contrary, taking growth volatility and human capital as determinants of inequality, Binatli (2012) found that growth has a negative impact on income inequality. At the same time, he verified that higher volatility in growth might harm income inequality all the time, but the magnitude of the effect of volatility in growth decreases over time.

In addition, worker mobility and the sensitivity of different income groups (i.e., high-income versus low-income) to economic growth have been included as determinants of inequality, which has produced diverse empirical results. Nissim (2007) demonstrated that as economic growth occurs, workers mobilize to the jobs associated with higher incomes, which helps to reduce income inequality. In other words, the impact of economic growth through worker mobility on income inequality is negative. Rubin and Segal (2015) found that in the U.S., during the post-war period (1953-2008), the high-income group was more sensitive than the low-income group to wealth income and to performance-based compensation schemes (e.g. bonuses, stock and option grants). Furthermore, the high-income group received more wealth income and performance-based compensation as the economy grew. Based on the empirical results, they concluded that economic growth increases income inequality. It can be seen from the above that there is no clear answer to the effect of economic growth on income inequality.

2.2.2 The Effect of Inequality on Economic Growth

Theoretically, some economists assert that the impact of income inequality on economic growth is positive. In this view, larger inequality motivates low-income people to work harder to earn more income and further increases economic growth. On the contrary, higher inequality might reduce the opportunities for low-income people to access education and thereby hinder economic growth. In this case, the impact of inequality on the economic growth is negative. (Boushey and Price (2014))

The conflicting hypotheses provide the impetus for empirical studies. However, the empirical studies also show conflicting results; some find a positive relationship (e.g., Li and Zou (1998); Forbes (2000)), while others find a negative relationship (e.g.,Cingano (2014); Wahiba and El Weriemmi (2014)).[1] Additionally, some studies produce mixed evidence (e.g., Fawaz et al. (2014); Halter et al. (2014); Binatli (2012); Voitchovsky (2005); Barro (2000)), while others find no relationship (e.g., Neves et al. (2012a)). This controversy could be due to different econometric methodologies, different datasets and sample coverages, different

[1] There are other studies that also find a negative impact of inequality on economic growth, such as Knowles (2005); Lundberg and Squire (2003); Castelló and Doménech (2002); Chang and Ram (2000).

specifications of models, and\or different countries.

Although there are no consistent estimations empirically, the existing literature still provides important lessons. Firstly, the differentiation of long-term from short-term effects may play an important role in estimating the impact of inequality on economic growth. For example, Forbes (2000) showed that the impact of inequality on short-term economic growth is positive. Halter et al. (2014), however, found that in the long-run, greater inequality causes slower growth.

Secondly, some studies emphasize the importance of the level of development of a country. Shin (2012) points out that theoretically, in the early stage of development, the impact of inequality on economic growth is negative; however, it is positive in the mature stage of development. Binatli (2012) supports this theoretical result by providing empirical evidence. She separated her data into two periods, 1970-1985 and 1985-2012, and concluded that the effect of inequality on economic growth is negative in the early period and positive in the latter. Fawaz et al. (2014) also found that the impact of inequality on economic growth is positive in high-income developing countries and negative in low-income developing countries.

Thirdly, the types of datasets adopted may drive different empirical results. According to Cingano (2014) and Neves et al. (2012a), inequality has negative impacts on economic growth in cross-sectional datasets and positive influences in panel datasets. Fourthly, the specifications of models vary across the studies, particularly in terms of the usage of other explanatory variables. Generally speaking, human capital, trade openness and investment tend to increase growth, while the fertility rate decreases per capita growth, but these additional determinants are not consistently used across studies. The studies provide evidence that the link between inequality and economic growth is complex. To date, there is no consistent answer to the causal relationship.

So far, most of the studies have tried to identify the determinants of economic growth or income inequality independently. However, Lundberg and Squire (2003) emphasized that economic growth and income inequality might share common determinants. Therefore, they evaluate the relationship between growth and inequality simultaneously. According to their study, favorable exchange rates and trade improve economic growth but worsen income inequality, while improved civil liberties improve equality but hurt growth.

Most studies that estimated bi-directional causality between economic growth and income inequality used cross-sectional data or panel data. To our knowledge, among existing literature, only Kang (2015) and Bahmani-Oskooee et al. (2008) examined bi-directional causality between economic growth and income inequality by using time-series analysis. However, Kang (2015) and Bahmani-Oskooee et al. (2008) included fiscal redistribution and trade openness, respectively, in their estimations but ignored the effect of other possible determinants. To fill this gap in the literature, our study employs time-series analysis in order to capture the heterogeneity of individual countries and to examine the bi-directional causality between economic growth and income inequality while including other explanatory variables.

2.3 Analytical Concept and Transmission Channels

2.3.1 The Basic Scaffold

The well-known Kuznets' "Inverted U Curve" tells us that increased income inequality is inevitable in the early stages of development, but the trend will be reversed with further development. In investigating the evolution of economic development and income inequality, Kuznets' (1955) pioneering paper points out the involvement of various factors such as social change, market restructuring and government policies in determining the relationship between them. Based on this perception, we build an inequality-growth-redistribution triangular nexus with a core indicating their common connection with the level of economic

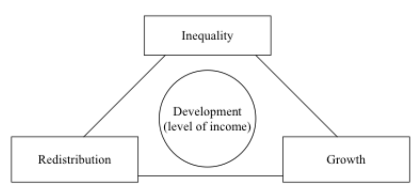

Figure 2.1: Inequality-Growth-Redistribution Triangular Nexus Based on the Developement

development, as shown in Figure 2.1. With different development situations, inequality may have positive or negative effects on economic growth, and vice versa.(See details in Section 3.2) In addition, high inequality of a country may provide a strong impetus for the government to redistribute income among different social classes. By using tax and transfer mechanisms, the government may change the income distribution of a society, and further, through inequality, extend the impact on economic growth. Furthermore, redistribution is detrimental to economic growth as higher taxes and transfers hurt incentives to work and invest. But redistribution may accelerate economic growth, provided that it involves reduction of tax loopholes or increases of productive government spendings. (Ostry et al. (2014); Muinelo-Gallo and Roca-Sagalés (2011), Muinelo-Gallo and Roca-Sagalés (2013)) In other words, under different conditions of development, the interactive relationships between these variables could be varied and complicated.

The literature has tried to examine the causal explanations of growth and inequality, either independently or simultaneously. Much of the early research into the causal relationship assumed a monotonic relationship. However, Shin (2012) and Tribble (1999) demonstrate that the relationship between the economic growth and the Gini coefficient must be non-linear. In sum, there are two concerns underlying the research on income inequality and economic growth. The first is the issue of bi-directional causality, and the second concern involves non-linear relationships.

2.3.2 The Channels through which Economic Growth and Inequality Interact

2.3.2.1 The Channels through which Economic Growth Affects Inequaltiy

The channels through which economic growth affects income inequality involve various complex factors in association with the evolution of economic growth. We classify these channels into two categories. One is based on the types of responses to growth and the other is concerned with the characteristics or sources of economic growth. Briefly speaking, the former indicates the institutional or structural changes caused by economic growth, which directly lead to inequality. The latter comprises various economic or social/demographic factors characterized by or synchronized with the growth process, which indirectly contribute to inequality. According to the theoretical predictions, the signs of the effects of growth on inequality are mixed.

Current theories in the first category reveal at least three channels that can explain how growth affects the distribution of income. First, as described by the Kuznets curve, throughout the development process, income inequality first increases and then decreases due to the population shift from the agriculture to the manufacturing sector. The structural turning point is associated with the changes in intra-sectoral and inter-sectoral income inequality. Tribble (1999) further captures the structural transition from manufacturing to service during the economic development process. He regards the relationship depicting the shift from manufacturing to service as an extension of the Kuznets' inverted-U curve. These two distinct transitions graphically combine and form a S-curve.

Secondly, capital income is concentrated at the upper-end of the income distribution and it tends to be more sensitive than labor income to economic growth. Therefore, growth benefits higher income groups disproportionately through large capital income gains. In addition, the top income groups receive a large portion of their labor income in the form of equity compensation, which further widens the income inequality.

Thirdly, economic growth has some beneficial effects for the poor such as new employment opportunities. Slower growth puts strong downward pressure on wages and employment of poor people. Workers are forced to accept wage cuts and work in the informal sector. While the duality between regular and non-regular labor can keep unemployment low, non-regular laborers typically earn less, which contributes to larger inequality. Therefore, stronger economic growth can lower inequality by allowing more low-wage workers to shift from the informal to the formal employment sector.

In addition, Zhuang et al. (2014) point out that globalization, technological change and market structuring are three key drivers of economic growth.[2] One possible model to explain the link between globalization and income inequality is the Stolper-Samuelson theorem. The theory predicts that for developing countries with abundant unskilled labor, trade openness should increase the demand for and wages of unskilled labor relative to the wages for skilled labor and returns to capital, thereby decreasing income inequality. This result should be reversed for developed countries with abundant skilled labor. Concerning the effects of globalization through foreign direct investment (FDI), the basic theory suggests a similar effect to that of trade in the Stolper-Samuelson model. However, as Heshmati and Lee (2010) indicate, there are several other trade/FDI theories proposed recently to explain the effect of globalization on income distribution. The mechanisms they mention differ from country to country and the results of predictions are mixed.[3]

Secondly, technology changes can affect the distribution of income among different factors of production. The introduction of new technology, which usually accelerates growth, may benefit relatively richer segments of the population, and worsen income inequality. If the technological change benefits skilled labor more than unskilled labor, the skill premium will go up, which might increase inequality. If the technology is capital-biased, it also could increase the income inequality because capital incomes usually accrue to the rich more than to the poor.

Finally, the market structures associated with economic growth, either for products or for factors, can also have significant distributional consequences. In general, transition from a command to a market economy can increase efficiency and benefit more the factors with relative scarcity, thus changing the income distribution. Labor unionization can change the bargaining power of labor in relation to capital owners and, accordingly, the income shares between labor and capital. Furthermore, a fairer and more competitive market can ensure that the benefits of growth accrue to more market participants instead of a small number of

[2] See also Çelik and Basdas (2010), Krongkaew and Kakwani (2003), Dahlby and Ferede (2013), and Chang and Ram (2000).

[3] See also Dreher and Gaston (2008), Ines Sim David (2011), and Çelik and Basdas (2010).

business people and entrepreneurs.

In sum, these three key drivers of growth– globalization, technological change, and market restructuring– all impact income inequality through changing the relative shares of income between skilled and unskilled labor, and between labor and capital. However, the effects of these three drivers are closely interwined and not easy to isolate empirically. (Zhuang et al. (2014))

2.3.2.2 The Channels through which Inequality Affects Economic Growth

The channels through which income inequality affects economic growth are discussed throughout the literature on economic growth. Inequality affects economic growth through mechanisms that can be beneficial or detrimental. Moreover, some of these effects tend to be realized quickly while others are incurred slowly over time. These channels can be grouped into two divergent approaches. One is based on purely economic mechanisms and the other is associated with political processes. These various mechanisms indicate that the impact of inequality on growth is rather complex and ambiguous. Generally speaking, according to Halter et al. (2014), the purely economic mechanisms usually manifest the growth-enhancing (or positive) effects of inequality while the political processes are the negative channels through which inequality hinders growth. However, there is still debate regarding these channels and their combined effects.

Among the theoretical economic channels, one of the most popular arguments for growth-enhancing inequality is based on the standard hypothesis that individual savings rates rise with the level of income. As more income becomes concentrated at the top, the aggregate savings rate tends to increase, which leads to higher investment rates. A rise in inequality hence tends to positively affect economic growth through capital accumulation.

Secondly, some types of investments, especially those in innovative activities, may require a large minimum amount of money. Innovators often depend on high-income investors to provide the initial capital. An economy with more unequal distribution of income may find it easier to fund innovative projects, which lead to a faster rate of economic growth.

Thirdly, with more concentrated distribution of income and wealth, there might be a positive demand-side effect. The demand for more innovative or novel products will increase as opposed to demand for goods satisfying basic needs. This will induce the investments required to develop novel or better product varieties.

However, in a model of credit market imperfection, individuals and families with low incomes often cannot make productivity-enhancing investments in education and training for themselves. The banking sector constraints that limit the ability of the non-rich to borrow give rise to so-called capital market imperfection. Redistribution of assets and incomes from rich to poor tends to raise the productivity of investment and boost the rate of economic growth.

In addition to economic mechanisms, political processes also cause negative effects on economic growth. For example, income inequality might motivate the poor to engage in crime, riots, and other disruptive activities, which may threaten political stability and undermine the security of property rights. These social unrest phenomena are not friendly for investment. Lower economic growth will thus go along with worsening inequality.

Furthermore, Yusuf et al. (2005) point out that in a system of majority voting, the pressure to redistribute income from the rich to the poor is greater when the ratio of the average income to the medium income in the society is larger. Measures to redistribute income through higher taxes can give rise to economic disincentives to work, save and investment and hence lower economic growth.

However, if inequality creates more pressure on the government to finance public education, which largely benefits the lower income people, economic growth will increase through higher human capital accumulation. In other words, the impact of redistribution on growth depends on what form the government's spending takes and what taxes are used to finance it.

2.4 The Dynamic Causality Analysis

2.4.1 Empirical Modeling

Considering the inherent deficiency of ignoring distinctive country-specific features by cross-sectional analysis, we choose to employ country-level time-series analysis. By this method, as Bahmani-Oskooee et al. (2008) indicate, we can allow country heterogeneity in analyzing the relationship between economic growth and inequality.[4] Thus, for exploring the dynamic relationship between output level and income inequality, we use an error-correction model (ECM). Following Engle and Granger's two-step approach, we first test for a cointegrating relationship between output level and inequality. In addition, we also take into account other factors. By using augmented Dickey-Fuller statistics, each time-series variable is examined in isolation for its non-stationarity, i.e., integration of order 1 or $I(1)$.[5] Then, after estimating the cointegrating regression, the regression residuals were retrieved and tested for stationarity, i.e., integration of order 0 or $I(0)$. If the residual term is stationary, then the time-series variables are cointegrated and the long-run relationship among variables can be established.

As with most previous literature on this topic, we use GDP per capita to measure average income level and the Gini coefficient to measure income inequality. The link between average income level and income inequality is discussed bilaterally. In addition to regressing the GDP per capita on the Gini coefficient, we also estimate a cointegrating regression of the Gini coefficient on the GDP per capita.[6] In our time-series study, we model income inequality in the long run as a function of the average income level and other determinants as follows:

[4]See also Kang (2015) and Huang et al. (2015).

[5]The test results for unit roots are available upon request.

[6]This is consistent with the assumption that all variables in the cointegrating regression are jointly endogenous employed by the Engle-Granger two-step approach.(Best (2008))

$$
\begin{aligned}
Gini_t = \alpha_0 + \alpha_1\,(\ln\ GDP\ per\ capita_t) + \alpha_2\,(\ln\ GDP\ per\ capita_t)^2 \\
+ \alpha_3\,(\ln\ GDP\ per\ capita_t)^3 + \sum_{i=1}^{n} \phi_i X_{i,t} + \epsilon_t
\end{aligned}
\tag{2.1}
$$

where $Gini_t$ is the measurement of income inequality, ln $GDP\,per\,capita_t$ is the real per capita gross domestic product expressed in nautral logarithm form, (ln $GDP\ per\ capita_t)^2$ and (ln $GDP\ per\ capita_t)^3$ are its square and cubic forms, respectively, X_{it} indicates all other explanatory variables, and ϵ_t is the regression residual. Similarly, we adopt the following formulation to estimate the effect of income inequality and other determinants on output level in the long run:

$$
ln\,GDP\ per\ capita\ _t = \beta_0 + \beta_1 Gini_t + \sum_{i=1}^{n} \mu_i Z_{i,t} + u_t \tag{2.2}
$$

where Z_{it} are all explanatory variables but $Gini_t$ for determining the effect on $ln\,GDP\,per$ $capita_t$, and u_t is the regression residual.[7]

The determinants we employ in equations (1) or (2), other than *Gini* and *ln GDP per capita* which are the major concern of our study, are suggested by economic theory and previous studies. In the growth-inequality relationship, we look into the effects of trade openness and government redistributive policies. As for the inequality-growth relationship, based on both macroeconomic theory and the endogenous growth model, we put emphasis on factors such as exports, private investment and government expenditures, which may stimulate the level of output, and human and physical capitals, which can affect the economic growth rate.[8]

[7]There are few studies, such as Shin (2012), which model the inequality-economic growth relationship in non-linear(square) form. After running the equations for each country, we decided to drop out the square term in the formulation due to its statistical insignificance.

[8]We considered including the aged population share as a determinant of explaining the inequality-economic growth relationship, but it did not conform to the necessary condition of being I(1). As for

In order to compare the relationships between growth and inequality among countries, we first build a baseline model which comprises the common determinants and covers data with similar time periods. By this way, we can investigate and differentiate the effects on growth or inequality under the same model projection for each individual country. After running various combinations of potential explanatory variables, only one variable, $Trade$, fits the requirements of cointegrating regression and is selected for X_{it}. As for Z_{it}, there are four variables, $Labor\,force$, $Export$, $Govt.\,con.$, and $Investment$, included in the regression.

Secondly, we selectively apply different variables for different countries in estimating the cointegrating regressions. In this way, we allow for country heterogeneity by only including determinants that produce statistically significant coefficients in equations (1) and (2) for each individual country. Thus, for both the U.S and China[9], we include $Trade$; for Japan, we use $Redistribution$, $Redistribution * Gini_{mkt}$, and $Trade$; and for South Korea, we employ no additional variables in X_{it}. Similarly, for Z_{it}, we include $Labor force$, $Govt\,con.$, and $Redistribution$ in the U.S. case; we use $Labor force$, $Export$, $Govt\,con.$, $Investment$, $Fertility\ \ rate$, and $Redistribution$ in Japan's case; we employ $Primary$, $Govt\,con.$, $Fertility\,rate$, and $Redistribution$ in South Korea's case; and we add $Investment$ and $Labor\,force$ in China's case. These added variables are defined in Table 2.1. After the estimation of equations (1) and (2), if ϵ_t and u_t are tested as stationary then all time-series variables are cointegrated, and the estimated coefficients of each variable reflect their long-run effects.

According to the Engle-Granger two-step error correction model, equations (1) and (2) portray the long-run relationship among output level, income inequality and their determinants. In the second step, we try to capture the short-run effect of each variable on inequality and output level, respectively. By regressing the changes in Gini on lagged changes in its determinants as well as the equilibrium residual represented by ϵ_{t-1}, we can derive the short-

the economic growth-inequality relationship, foreign direct investment (FDI) was considered as one of the explanatory variables, but was dropped due to data insufficiency.

[9]For China, due to the insufficient and discontinuous time-series data, only post-1978 data have been used in the regression.

Table 2.1: Definitions of Variables

Variables	Definition	Source
GDP per capita	GDP per capita (constant 2005 US$)	WDI
Gini_net	Gini index of inequality in equivalized household disposable (post-tax and post-transfer) income	SWIID
Gini_mkt	Gini index of inequality in equivalized household (pre-tax and pre-transfer) income	SWIID
Redistribution	The difference between Gini_mkt and Gini_net	SWIID
Export	Exports of goods and services (% of GDP)	WDI
Trade	Export plus import (% of GDP)	WDI
Gov. con.	General government final consumption expenditure (% of GDP)	WDI
Investment	Gross fixed capital formation (% of GDP)	WDI
Fertility rate	Fertility rate, total (births per woman)	WDI
Labor force	Population ages 15-64 (% of total)	WDI
Primary	School enrollment, primary (% of gross)	WDI

term effects of explanatory variables in the prior period on Gini in the current period.[10] In addition, we also can capture the rate at which Gini adjusts to the equilibrium state after a shock, which is called the adjustment speed of error correction. A similar equation is used to capture the short-term effects of each variable on GDP per capita. The respective error correction models to equations (1) and (2) are shown as follows:

$$\begin{aligned} \Delta Gini_t = \theta_0 + \theta_1 \left(\Delta \ln GDP\, per\, capita_{t-1}\right) + \theta_2 \left(\Delta \ln GDP\, per\, capita_{t-1}\right)^2 \\ + \theta_3 \left(\Delta \ln GDP\, per\, capita_{t-1}\right)^3 + \sum_{i=1}^{n} \delta_i \Delta X_{i,t-1} + \theta_4 \epsilon_{t-1} + \nu_t \end{aligned} \tag{2.3}$$

$$\Delta \ln\, GDP\, per\, capita_t = \gamma_0 + \gamma_1 \Delta Gini_{t-1} + \sum_{i=1}^{n} \lambda_i \Delta Z_{i,t-1} + \gamma_2 u_{t-1} + \pi_t \tag{2.4}$$

where Δ indicates the change of variables, ν_t and π_t are the residuals. Among the coefficients, θ_4 and γ_2 are the adjustment rates of speed and are expected to be negative and significant. In addition, the Durbin-Watson test is used to check if the serial correlation problem exists

[10] Due to the limited sample size, we chose a maximum lag length of two for the variables. However, in the study the variables with second order of lag are less efficient than that with first order of lag by using AIC test. Thus, the lag length set at one is selected for variables in equations (3) and (4).

and the Prais-Winsten correction is applied if necessary.

In the study, we employ this time-series analysis for each country in order to better understand how economies experience different dynamics between growth and income inequality in their unique development context. Also, by incorporating long and short term effects into the model, we formulate the relationship between output level and inequality in equilibrium and the link between growth and inequality in a dynamic sense. The usual Ordinary Least Squares (OLS) estimation applies to all equations.[11]

2.4.2 Data Employed

The dataset this analysis used is mainly from the Standardized World Income Inequality Database 5.0 (SWIID) and World Development Indicators (WDI). For the measurement of income inequality, the Gini coefficient is generated from the mean of 100 imputations in SWIID. There are two kinds of Gini coefficients adopted in this analysis. One is the Gini_net coefficient, which stands for the Gini index of inequality in equivalized (square root scale) household disposable income post-taxes and transfers; the other one is the Gini_market coefficient, which is the Gini index of inequality in equivalized (square root scale) household income pre-taxes and transfers. For the measurement of economic development, the real GDP per capita is extracted from the WDI. All of the other explanatory variables come from the WDI. The variables used in the regression are listed and explained in Table 2.1.

The targeted yearly time series dataset for each country covers the period from 1960 to 2014, but SWIID does not have complete country time series. For the U.S., the sample coverage is from 1960 to 2012; for Japan, from 1960 to 2010; for South Korea, from 1963 to 2013; and for China, the sample covers the years 1964, 1966, 1968, 1970, 1972, 1974, and 1975, and then annually from 1978 to 2013. In addition, in South Korea's time-series dataset, primary school enrollment rate only covers the period from 1971 to 2014.

[11] In this study, for simplicity, we treat each equation between growth and inequality independently, similar to other studies such as Binatli (2012). For details about the estimation problems, see Lundberg and Squire (2003).

2.5 The Empirical Results

2.5.1 Comparative Evidence on the Effect of Economic Growth on Inequality

2.5.1.1 The Results for the Baseline Models

For the convenience of comparison, the estimated results of the baseline models for all four countries are summarized in Table 2.2. In the long run relationship regression, all variables are cointegrated for each individual country. Among the common determinants, the three GDP per capita terms are all statistically significant in the cointegrating equation for each country case. However, the signs of the coefficients are negative, positive, and negative for the U.S. and China; and positive, negative, and positive for Japan and South Korea. This indicates that the relationships between GDP per capita and income inequality for each individual country all conform to the S-shape curve hypothesis. However, the slopes at the starting portion of the curve differ across countries over the similar sample period. In addition, the coefficients on trade openness are statistically significant for the U.S. and China. This implies that globalization has impacted income inequality, but for the U.S., the link is negative, and for China, it is positive. Trade openness, however, has no significant effect on income inequality for Japan and South Korea.

As for the short run effect estimated in the ECM regression, the adjustment speed coefficients are all negative and statistically significant for each of the four countries. In terms of the change of the explanatory variables, they all have insignificant effects on the changes of income inequality in the cases of the U.S., South Korea, and China. However, for Japan, the coefficients on the growth of GDP per capita in all three forms have significant effects on the changes of income inequality and the signs are negative, positive, and negative in order.

Table 2.2: The Effect of Economic Growth on Inequality: Baseline Model

The Effect of Economic Growth on Inequality: Baseline Model				
	USA_CR	**JPN_CR**	**KOR_CR**	**CHN_CR**
Dependent Variable: Gini	Coefficients	Coefficients	Coefficients	Coefficients
ln GDP per capita	-69.510***	25.226***	3.504**	-2.635***
	(13.567)	(6.987)	(1.382)	(0.367)
$(ln\ GDP\ per\ capita)^2$	6.622***	-2.648***	-0.390**	0.397***
	(1.329)	(0.717)	(0.161)	(0.059)
$(ln\ GDP\ per\ capita)^3$	-0.210***	0.093***	0.014**	-0.019***
	(0.043)	(0.025)	(0.006)	(0.003)
Trade	-0.002***	-0.0002	0.0001	0.001**
	(0.001)	(0.0004)	(0.0003)	(0.0005)
Constant	242.995***	-79.719***	-10.090**	5.933***
	(46.139)	(22.644)	(3.916)	(0.753)
N	53	51	51	43
r2	0.917	0.681	0.616	0.973
r2_a	0.911	0.653	0.583	0.970
rmse	0.008	0.014	0.014	0.016
Res. ADF test	I(0)	I(0)	I(0)	I(0)
	USA_ECM	**JPN_ECM**	**KOR_ECM**	**CHN_ECM**
Dependent Variable: D. Gini	Coefficients	Coefficients	Coefficients	Coefficients
$D.ln\ GDP\ per\ capita_{t-1}$	2.044	-23.369*	4.176	-2.750
	(29.205)	(12.95)	(2.902)	(2.497)
$D.(ln\ GDP\ per\ capita)^2_{t-1}$	-0.236	2.378*	-0.470	0.417
	(2.861)	(1.344)	(0.342)	(0.381)
$D.(ln\ GDP\ per\ capita)^3_{t-1}$	0.009	-0.081*	0.018	-0.021
	(0.093)	(0.046)	(0.013)	(0.019)
$D.Trade_{t-1}$	-0.0002	-0.0004	-0.0001	-0.0002
	(0.0004)	(0.001)	(0.0002)	(0.0003)
$Error\ correction_{t-1}$	-0.328***	-0.381***	-0.551***	-0.343**
	(0.111)	(0.102)	(0.120)	(0.145)
Constant	0.001	0.001	-0.004	0.004
	(0.001)	(0.002)	(0.003)	(0.007)
N	51	49	50	36
r2	0.214	0.290	0.467	0.185
r2_a	0.127	0.207	0.406	0.045
rmse	0.004	0.009	0.009	0.009
Res. ADF test	I(0)	I(0)	I(0)	I(0)
DW	2.22	2.00	2.06	1.64

1. *, **, *** indicate 10, 5, 1 percent level of significant respectively.
2.Numbers in parentheses are the standard error.
3.The sample period for the U.S. is 1960-2012; for Japan is 1960-2010; for South Korea is 1963-2013; and for China is 1964-2013.

2.5.1.2 Results for Country-Specific Models[12]

In Table 2.3, we summarize the estimation results for the country-specific models best applied to each individual country. For the U.S., the three GDP per capita coefficients are all significant at the 1% level in the cointegrating regression. The first term is negative,

[12]For the results of country-specific models, we run different regressions in various combination of variables and selectively apply the most suitable one to each specific country. All required tests necessary to the Engle-Granger two-step model, including cointegration and adjustment responses, have been undertaken and ensured.

Table 2.3: The Effect of Economic Growth on Inequality: Country-Specific Model

The Effect of Economic Growth on Inequality: Country-Specific Model

	USA_CR	**JPN_CR**	**KOR_CR**	**CHN_CR**
Dependent Variable: Gini	Coefficients	Coefficients	Coefficients	Coefficients
ln GDP per capita	-69.510***	11.755*	4.020**	-3.151***
	(13.567)	(6.297)	(0.773)	(0.766)
$(ln\ GDP\ per\ capita)^2$	6.622***	-1.228*	-0.450***	0.474***
	(1.329)	(0.653)	(0.090)	(0.116)
$(ln\ GDP\ per\ capita)^3$	-0.210***	0.043*	0.017***	-0.023***
	(0.043)	(0.023)	(0.003)	(0.006)
Trade	-0.002***	-0.001***	-	0.001*
	(0.001)	(0.0003)		(0.0005)
Redistribution	-	-2.360***	-	-
		(0.230)		
$Redis * Gini\_mkt$	-	5.056***	-	-
		(0.575)		
Constant	242.995***	-37.112*	-11.553***	7.063***
	(46.139)	(20.222)	(2.194)	(1.671)
N	53	51	51	36
r2	0.917	0.889	0.615	0.973
r2_a	0.911	0.873	0.59	0.970
rmse	0.008	0.008	0.014	0.017
Res. ADF test	I(0)	I(0)	I(0)	I(0)
	USA_ECM	**JPN_ECM**	**KOR_ECM**	**CHN_ECM**
Dependent Variable: D. Gini	Coefficients	Coefficients	Coefficients	Coefficients
$D.ln\ GDP\ per\ capita_{t-1}$	2.044	-16.975	3.709	-2.933
	(29.205)	(15.885)	(2.755)	(2.499)
$D.ln\ GDP\ per\ capita^2_{t-1}$	-0.236	1.716	-0.416	0.444
	(2.861)	(1.647)	(0.325)	(0.381)
$D.ln\ GDP\ per\ capita^3_{t-1}$	0.009	-0.058	0.016	-0.022
	(0.093)	(0.057)	(0.013)	(0.019)
$D.Trade_{t-1}$	-0.0002	-0.0002	-	-0.0002
	(0.0004)	(0.001)		(0.0003)
$D.Redistribution_{t-1}$	-	1.729***	-	-
		(0.319)		
$D.Redis * Gini\_mkt_{t-1}$	-	-3.733***	-	-
		(0.793)		
$Error\ Correction_{t-1}$	-0.328*	-0.565**	-0.549***	-0.342**
	(0.111)	(0.222)	(0.116)	(0.145)
Constant	0.001	0.003	-0.004	0.006
	(0.001)	(0.003)	(0.003)	(0.008)
N	51	49	50	35
r2	0.214	0.508	0.470	0.186
r2_a	0.127	0.424	0.423	0.045
rmse	0.004	0.009	0.009	0.010
Res. ADF test	I(0)	I(0)	I(0)	I(0)
DW	2.22	1.944	2.06	1.66

1. *, **, *** indicate 10, 5, 1 percent level of significant respectively.
2. Numbers in parentheses are the standard error.
3. The sample period for the U.S. is 1960-2012; for Japan is 1960-2010; for South Korea is 1963-2013; for China is 1978-2013.

the second term is positive and the third term is negative which is consistent with the S-curve hypothesis. However, it starts with the back portion of inverted U-shaped Kuznets curve. There are two turning points associated with specific structural shift in the economic development process. In addition, the coefficient of trade openness is negative and significant.

This result implies that greater trade openness tends to lower inequality in the long run. As for the short-run effect estimated in the ECM regresssion, the growth in GDP per capita has a negative effect on inequality in the second term and positive effects for both the first and third terms. However, the coefficient values are all statistically insignificant and smaller than their long-run counterparts. This indicates that the change of GDP per capita has no significant effect on the change of income inequality. Also the changes in trade openness have no significant effects on the Gini during the dynamic process.

For Japan, in addition to the real GDP per capita terms, we include three other explanatory variables after trying various combinations. Among them, $Redistribution * Gini\_mkt$ is an interaction term to capture if the effect of government redistributive measures on income inequality might depend on the level of income inequality before the government intervention. In the long-run equilibrium, the three GDP per capita terms are all statistically significant and the signs of the coefficients are positive, negative, and positive, respectively. This result is consistent with the Kuznets' inverted-U curve hypothesis and it also conforms to the S-curve hypothesis. For other factors, *Redistribution* has a negative effect on income inequality as expected. On the other hand, the interaction term of $Redis * Gini\_mkt$ has a positive effect, which indicates that the redistributive effect of government taxes and transfers depends on the level of income inequality prior to government interventions. The negative effect of government policy on income inequality was noticeably offset by the original status of income distribution. In addition, trade openness helps to reduce income inequality for Japan. For the short-run results, only the changes of redistributive measures have significant effects on the change of income inequality.

The specification of the cointegrating regression for South Korea is different from those used in the two cases above. We only employ the three terms of GDP per capita as explanatory determinants in the model. The long-run effects of the three GDP per capita terms on income inequality are all statistically significant at the 5% level. The sign of the first term is positive, second term is negative, and third term is positive. This is similar to the results we obtained in Japan's case and consistent with the S-shaped curve hypothesis starting from the front portion of the Kuznets' inverse U-shaped curve. For the short-run responses, we find that changes in the explanatory variables have no significant effects on changes in the Gini in a dynamic sense. Although insignificant, the signs of the changes in the three GDP per capita terms are the same as in the long-run regression.

Due to the data insufficiency and discontinuity problem, we decide to employ post-1978 data for China to better fit the econometric estimations requirements. After trials of inclusion of the different explanatory variables in various combinations, we chose to include trade openness, in addition to the three GDP per capita terms, as determinants of inequality in the regression. For the long-run coefficients, we find that the signs of the coefficients of the three terms associated with GDP per capita are negative, positive, and negative, respectively. This implies that China's time series variables follow the S-curve hypothesis starting from the back portion of the inverted U-curve. For China, the trade variable is a significant and positive determinant of inequality, which differs from the result for the U.S. As for short-run dynamic effects, all determinants, except the error correction term, in change form have no significant effect on income inequality.

2.5.2 Comparative Evidence on the Effect of Inequality on Economic Growth

2.5.2.1 The Results for the Baseline Models

The estimated results of the baseline models for each individual country are presented in Table 2.4. For the long run equilibrium relationship, all countries but South Korea conform with the conditions required to use cointegrating regression. After running various combinations of explanatory variables, no cointegrating relationship can be found in the regression. Hence, we take the first difference of all variables to run the regression for South Korea.

In the long run equilibrium, higher income inequality increased economic growth for

Table 2.4: The Effect of Inequality on Economic Growth: Baseline Model

The Effect of Inequality on Economic Growth: Baseline Model

	USA_CR	**JPN_CR**	**CHN_CR**	**KOR_FD**
Dependent Variable: ln GDP per capita	Coefficients	Coefficients	Coefficients	Coefficients
Gini	5.286***	2.823**	2.434***	-0.143
	(0.570)	(1.052)	(0.614)	(0.306)
Labor force	0.097***	0.192***	0.106***	0.041***
	(0.008)	(0.014)	(0.012)	(0.011)
Export	0.011	0.040***	-0.002	-0.002*
	(0.011)	(0.011)	(0.007)	(0.001)
Govt con.	0.032*	0.169***	0.007	-0.028***
	(0.016)	(0.020)	(0.021)	(0.004)
Investment	0.007	0.011	0.029***	0.006***
	(0.012)	(0.012)	(0.007)	(0.002)
Constant	1.429*	-6.995***	-2.519***	0.046***
	(0.729)	(1.105)	(0.570)	(0.001)
N	53	51	43	50
r2	0.966	0.941	0.986	0.664
r2_a	0.963	0.934	0.984	0.626
rmse	0.062	0.122	0.133	0.022
Res. ADF test	I(0)	I(0)	I(0)	I(0)
DW				1.90

	USA_ECM	**JPN_ECM**	**CHN_ECM**
Dependent Variable: D. ln GDP per capita	Coefficients	Coefficients	Coefficients
$D.Gini_{t-1}$	-0.439	-0.047	0.264
	(0.747)	(0.382)	(0.362)
$D.Labor\,force_{t-1}$	0.008	0.053***	-0.019
	(0.019)	(0.011)	(0.026)
$D.Export_{t-1}$	-0.013***	-0.007**	0.002
	(0.004)	(0.003)	(0.001)
$D.Govt\,con._{t-1}$	-0.006	-0.013	0.010**
	(0.009)	(0.012)	(0.005)
$D.Investment_{t-1}$	0.002	0.001	0.002
	(0.005)	(0.004)	(0.002)
$Error\,correction_{t-1}$	-0.109*	-0.132***	-0.119*
	(0.061)	(0.037)	(0.070)
Constant	0.022***	0.034***	0.063***
	(0.004)	(0.004)	(0.022)
N	52	50	36
r2	0.240	0.583	0.254
r2_a	0.138	0.524	0.100
rmse	0.018	0.024	0.021
Res. ADF test	I(0)	I(0)	I(0)
DW	1.96	1.95	1.51

1. *, **, *** indicate 10, 5, 1 percent level of significant respectively.
2.Numbers in parentheses are the standard error.
3.KOR_FD indicates that the first-differences of the variables are taken as we run the long run regression for South Korea.
4.The sample period for the U.S. is 1960-2012; for Japan is 1960-2010; for South Korea is 1963-2013; and for China is 1964-2013.

the U.S., Japan and China. The *Labor force* variable shows positive effects on the GDP per capita for all four countries. For the *Export* variable, the estimated coefficients are statistically significant only in two countries, with a positive effect for Japan and negative for South Korea. Government expenditures are found to have significant and positive growth effects in the U.S. and Japan but a negative effect in South Korea. Finally, the *Investment* variable produces positive coefficients for all four countries as expected, but the coefficients for the U.S. and Japan are not statistically significant.

In the short run, the dynamic adjustment coefficients of ECM models are all negative and statistically significant. We find that none of the lagged changes of *Gini* have a statistic significant effect on changes in the GDP per capita. In the U.S. and Japan, the lagged change of *Export* has a significant and negative effect on the change of GDP per capita. Growth in the *Labor force* positively impacts GDP per capita growth in Japan, while growth in government expenditure has a positive impact in China. Finally, the short run effects of investment growth are all positive but insignificant for the U.S., Japan, and China.

2.5.2.2 Results for Country-Specific Models[13]

We summarize the estimated results of the country-specific models for each country in Table 2.5. The explanatory variables we employ to explain the U.S. real GDP per capita are *Gini*, *Laborforce*, *Govt consumption*, and *Redistribution*. The Gini has a positive effect on GDP per capita at the 1% significance level. This suggests that income inequality has been beneficial to economic development from the experience of the U.S. In addition, the labor force variable and government expenditure have positive effects on per capita output, as expected. However, fiscal redistribution policies reduce per capita output. With respect to the short-run responses, we estimate a negative effect of the change in *Gini* on GDP per capita growth but it is not statistically significant. Among other determinants, no lagged changes of explanatory variables have significant measured effects on economic growth.

For Japan, *Gini*, *Labor force*, *Export*, *Govt con.*, *Investment*, *Fertility*, and *Redistri−bution* are included as potential determinants of the GDP per capita. Similar to the U.S. results, we find a positive long-run relationship between income inequality and GDP per capita for Japan. In other words, the economy achieved a higher income level, but at a cost of increased inequality. The effects of the other variables on real GDP per capita are all found to be statistically significant. Among them, labor force, export ratio, government

[13]Please refer to footnote 12.

Table 2.5: The Effect of Inequality on Economic Growth: Country-Specific Model

The Effect of Inequality on Economic Growth: Country-Specific Model

	USA_CR	**JPN_CR**	**KOR_CR**	**CHN_CR**
Dependent Variable: ln GDP per capita	Coefficients	Coefficients	Coefficients	Coefficients
Gini	5.473***	4.093***	-22.755***	3.094***
	(0.383)	(1.178)	(3.568)	(0.866)
Labor force	0.115***	0.169***	-	0.103***
	(0.006)	(0.017)		(0.014)
Export	-	0.039***	-	-
		(0.011)		
Govt con.	0.022**	0.168***	0.124***	-
	(0.01)	(0.022)	(0.024)	
Investment	-	0.023*	-	0.018*
		(0.013)		(0.009)
Primary	-	-	0.066**	-
			(0.026)	
Fertility	-	-0.290*	-0.331***	-
		(0.158)	(0.062)	
Redistrbution	-2.933**	-2.070**	-16.694**	-
	(1.151)	(0.852)	(7.241)	
Constant	0.958**	-5.366***	9.260***	-2.113***
	(0.404)	(1.382)	(2.351)	(0.700)
N	53	51	42	36
r2	0.970	0.950	0.95	0.980
r2_a	0.967	0.942	0.943	0.978
rmse	0.058	0.114	0.179	0.133
Res. ADF test	I(0)	I(0)	I(0)	I(0)
	USA_ECM	**JPN_ECM**	**KOR_ECM**	**CHN_ECM**
Dependent Variable: D. ln GDP per capita	Coefficients	Coefficients	Coefficients	Coefficients
$D.Gini_{t-1}$	-0.570	-0.309	0.064	0.133
	(0.856)	(0.436)	(0.877)	(0.338)
$D.Labor\ force_{t-1}$	0.002	0.055***	-	-0.010
	(0.023)	(0.012)		(0.018)
$D.Export_{t-1}$	-	-0.006*	-	-
		(0.003)		
$D.Govt\ con._{t-1}$	-0.002	-0.011	0.004	-
	(0.007)	(0.012)	(0.009)	
$D.Investment_{t-1}$	-	-0.002	-	0.003
		(0.004)		(0.002)
$D.Primary_{t-1}$	-	-	0.004	-
			(0.007)	
$D.Fertility_{t-1}$	-	0.049	-0.100**	-
		(0.033)	(0.039)	
$D.Redistribution_{t-1}$	0.207	0.003	2.649**	-
	(0.653)	(0.290)	(1.035)	
$Error\ correction_{t-1}$	-0.160**	-0.144***	-0.093**	-0.087*
	(0.077)	(0.044)	(0.045)	(0.051)
Constant	0.021***	0.034***	0.051***	0.086***
	(0.005)	(0.004)	(0.007)	(0.011)
N	52	50	40	35
r2	0.106	0.560	0.446	0.229
r2_a	0.009	0.474	0.345	0.126
rmse	0.020	0.025	0.030	0.020
Res. ADF test	I(0)	I(0)	I(0)	I(0)
DW	1.90	1.93	1.881	1.66

1. *, **, *** indicate 10, 5, 1 percent level of significant respectively.
2. Numbers in parentheses are the standard error.
3. The sample period for the U.S. is 1960-2012; for Japan is 1960-2010; for South Korea is 1971-2013; for China is 1978-2013.

expenditures, and investment have positive effects on real per capita output. However, the fertility rate and fiscal redistributive policies have negative effects. As for the dynamic responses to the changes of the determinants, the results obtained indicate that changes in income inequality affect output growth negatively but with an insignificant coefficient. Labor force changes have a positive and significant effect on economic growth while export ratio changes have a negative and significant effect. The other variables did not produce significant coefficients.

We include income inequality, primary school enrollment rate, government expenditure, fertility rate, and fiscal redistribution in the regression for South Korea. As a long-run equilibrium relationship, there is an indication that the $Gini$ coefficient has a negative and significant effect on real GDP per capita. This implies that increased income inequality has hindered economic development in South Korea. In the long-run the primary school enrollment rate and government expenditures are both found to be beneficial for increasing real GDP per capita. This confirms our expectations based on the basic GDP model. On the other hand, fertility rate and redistribution have negative effects on per capita output, which is similar to the results found in Japan's case. As for the short-run responses, the change of income inequality has a positive but insignificant effect on output growth. Among other determinants, only the changes of fertility rate and redistribution are statistically significant determinants of output growth in the short-run dynamics.

We use only post-1978 data to run the regression for China as mentioned previously. We chose $Gini$, $Investment$, and $Labor force$ as significant determinants of GDP per capita in the regression for China. For the long-run equilibrium relationship, we find that income inequality is beneficial to economic output. In addition, real investment and labor force are both statistically significant and positive in relation to GDP per capita. From the results estimated by the ECM equation, changes in income inequality have a positive but insignificant effect on GDP per capita growth. Also, the effects of other determinants on GDP per capita growth are all statistically insignificant.

2.5.3 Brief Analytical Comparisons and Discussions

2.5.3.1 Analytical Comparisons

Using beta weights,[14] we can compare the contribution of each variable to growth and inequality within each country or across countries. We find that the GDP per capita is the most important determinant of income inequality for all four countries. In the income inequality-growth relationship, the labor force is the most important variable, followed by the Gini coefficient, for the U.S. and China. The government expenditure accounts for the largest variance in the regression for Japan. In contrast, for South Korea, the Gini coefficient plays the most important role.

According to the S-curve hypothesis, the sectoral shift of population in the economic development process plays a major role in explaining changes in income inequality. There are two critical turning points inherent in the process. The former one involves the structural transition from agriculture to manufacturing (i.e., industrialization) and the later one captures the structural transition from manufacturing to services (i.e. deindustrialization). Both share a similar logic in explaining changes in income inequality prior to or after the turning points. In each structural transition, we find that the level of intrasectoral income inequality in the modern sector exceeds the corresponding level in the traditional sector. At the same time, the growth of GDP per capita in the modern sector exceeds the growth level in the traditional sector. This implies an increase in intersectoral income inequality during the development process. Both of these changes in intrasectoral and intersectoral inequality cause the aggregate income inequality to accelerate. Only after the surplus labor in the traditional sector is totally absorbed by the modern sector will the aggregate income inequality reverse course and begin to decline.

Our study provides further evidence supporting the S-shaped curve hypothesis linking income inequality and economic development for our four countries. However, the countries

[14] We cannot do the variance decomposition analysis due to the use of Engle-Granger two-step approach in our study. Hence, to assess the variable importance in the regression, we employ the beta weights.

vary in their positions along the S-curve over the study period. Japan and South Korea started on the upward-sloping portion, while the U.S. and China started on the downward-sloping portion.

Generally speaking, among the four countries in our study and the starting point of 1960, the U.S. is the most advanced economy, followed by Japan, and then South Korea, and then China. The S-curve relationship between output level and inequality for each individual country is projected and showed in Figure 2.2. It is noted that the U.S. reached the highest level of GDP per capita, followed closely by Japan and South Korea, while China was far behind during the study period. However, China experienced the largest and most rapid increase in inequality. By comparison, Japan maintained the lowest inequality while achieving strong income growth over the study period.

The shape of the curve in the relationship between output level and inequality depends on two factors for each individual country: (1) the length of the sample period selected, and (2) the structural transition undergone during the time period. In this study, the data period covered for the U.S. is 1960-2012. As implied by Figure 2.3, the structural transition from agriculture to manufacturing for the U.S. happened far earlier than our figure shows using data from 1947 onward. If we had included data spanning the U.S. industrialization period, we expect we would have found evidence of Kuznets' inverted U-shaped curve, as found in Tribble (1999), and we could connect this with the deindustrialization period U-shape found in our study to support the full S-curve hypothesis. The S-curve hypothesis captures both industrialization and deindustrialization structural transitions during the economic development process, as an extension of the Kuznets' inverse U-curve.

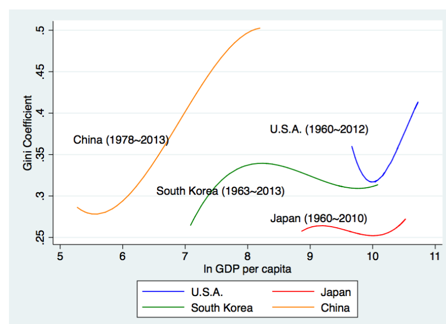

Figure 2.2: The Projected Relationship between Output Level and Inequality

Over the same time period (1960-2013), Japan and South Korea experienced a similar

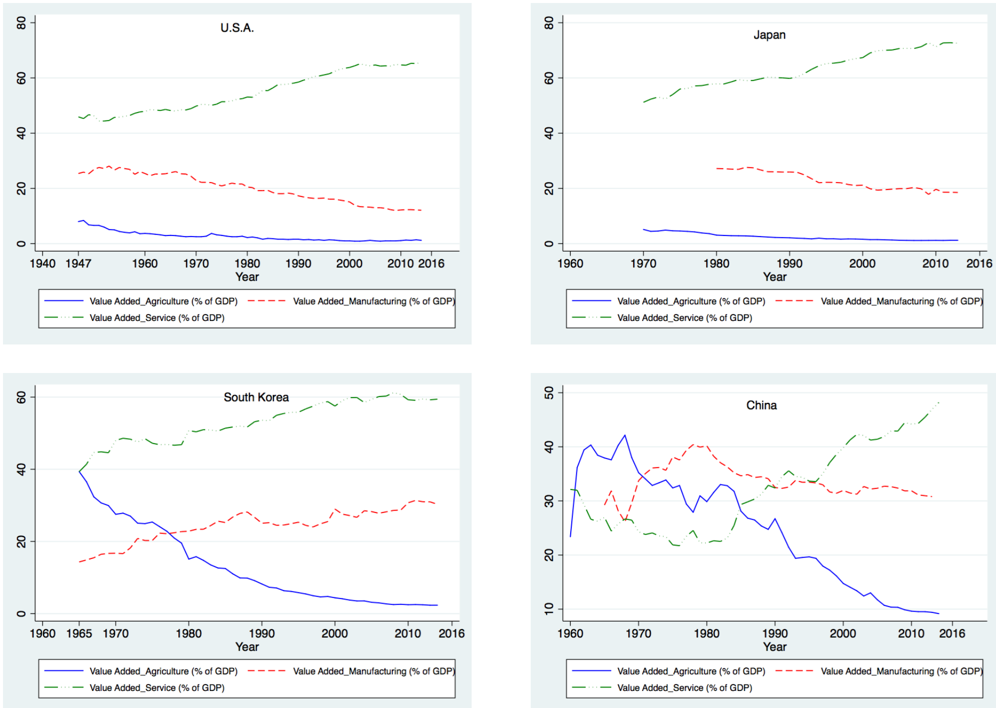

Figure 2.3: Value Added for Different Sectors among Countries

shape of S-curve during economic development (see Figure 2.2). However, Japan's structural transition pattern is more consistent with the U.S. As clearly shown in Figure 2.3, Japan underwent industrialization earlier than South Korea. In addition, the ratio of value-added of manufacturing to total GDP for Japan is higher than that of agriculture over the whole sample period. For South Korea, the ratio of value-added of manufacturing to total GDP exceeds that of agriculture only from the late 1970s. These reasonably explain the differences in the level and slope of the S-curve between Japan and South Korea, while they both started on the upward-sloping portion.[15]

As for China, in addition to the structural transitions between industries, the country also went through enormous institutional transitions from a command economy to a market system after 1978. Jain-Chandra et al. (2016) point out that differences between rural and urban areas are the most important determinant of income inequality in China. According to

[15]As shown in the estimation results of baseline models, Japan is the only country that indicates the short run effects of GDP per capita on the income inequality in a dynamic sense.

Jian et al. (1996), income inequality started to decline in China since 1978 due to the spread of light industries into rural areas and rapid growth in coastal regions. As a unique transition economy, China adopted market-oriented reforms which substantially improved rural and/or agricultural productivity and hence reduced income inequality from 1978. So the full S-curve, which is closely associated with the stages of structural/sectoral transitions, may be less applicable to China's case. Therefore, to account for the development in association with China's endeavor of being a market economy, we see only the back portion of the "downward" S-curve in explaining the GDP per capita-inequality relationship in China.

In terms of trade openness, we found a negative effect on income inequality for the U.S. in both the baseline and country-specific models. A negative relationship is also found in Japan, but only in the country-specific model. China, on the contrary, shows a positive relationship between trade openness and income inequality, while South Korea produced no significant effects. These results suggest a negative relationship between trade liberalization and income inequality for developed countries such as the U.S., and Japan, whereas a positive relationship for a developing country, e.g., China. Our findings are consistent with the evidence provided in Çelik and Basdas (2010) and Kiyota (2012) based on the analysis of imperfect market competition and distinction between the global and local factor abundances.[16]

With regard to the inequality-GDP per capita relationship, it shows a positive causal relationship for three out of four countries, indicating that increased income inequality spurs economic growth. This implication applies to both the baseline and country-specific models for the U.S., Japan, and China. In South Korea's case, there is a negative relationship captured by both the baseline and country-specific models, but the coefficient is statistically significant only in the latter model. This implies that South Korea might have experienced an inclusive growth phenomenon.

[16] The transmission mechanisms in explaining the effect of globalization on income distribution may differ from country to country or from country group to country group. For example, according to Kiyota(2012), China may be defined as a country with labor abundance in a global sense and capital abundance in a local sense. For a developing country under this classification, trade openness could increase its income inequality, which is also the result of China found in our study.

Among the other determinants of the inequality-GDP per capita regression, the estimation signs of the coefficients are all as expected in both baseline and country-specific models with the exception of the coefficients on exports and government expenditures for South Korea. In terms of exports, however, only Japan shows a significant positive effect on the economy in the long run. This indicates that exports provided an impetus to economic growth for Japan.

All four countries adopted some redistributive measures to reduce income inequality. In testing for the effects of the fiscal policies, Japan is the only country where the government redistribution policies had a significant effect in lowering income inequality. This can be explained by confirming that Japan had larger variations in fiscal redistribution policies, including direct taxes on individuals and social welfare expenditures, than did the other three countries.[17] However, in the Gini-GDP per capita relationship of country-specific models, all countries except China showed a negative effect of fiscal redistribution. These results imply that fiscal measures failed to reduce income inequality, and at the same time lessened economic growth for the U.S., and South Korea. However, for Japan, fiscal redistributive policies may have also hampered economic growth, but, at least, they successfully reduced income inequality.

2.5.3.2 Discussions

Some observers and politicians argue that economic growth exacerbates inequality, and that more attention should be paid to curbing inequality. Others argue for more pro-growth policies while asserting that economic growth reduces inequality. However, the reality of the relationship between economic growth and inequality is much more complicated than these simple assertions. The various bidirectional relationships between economic growth

[17]Calculating the data from IMF (2016), we found that the standard deviations of the ratios of direct taxes (on income, profits and capital gains of individuals) to total revenues are 0.024, 0.028, 0.025, and 0.009 for the U.S., Japan, South Korea, and China. Those of the ratios of redistributive expenditures (i.e., social security benefits and social assistance benefits) to total expenditures are 0.022, 0.038, and 0.007 for the U.S., Japan, and South Korea, respectively. (Data are not available for China.) Among them, Japan seemed to have the largest variations in both direct taxes and transfers over the data periods.

and income inequality found in our study can be classified into four possible scenarios, illustrated in Table 2.6. Case I indicates that if the signs of the bidirectional relationship are both negative, it implies that economic growth lessens inequality, and lower inequality further increases economic growth. This is called a “Virtuous cycle” with high growth and low inequality throughout time. However, this virtuous cycle cannot be sustained if the sign of either relationship is changed from negative to positive. Cases II and III show cases of interchanging equilibrium outcomes when the bidirectional relationship involves one positive and one negative effect. Finally, when both causal effects are positive we have the classic “Trade-off” problem shown in Case IV. We can achieve higher growth only at the expense of higher inequality. Where to put higher priority between growth and equality poses a great challenge to policy-makers in this case.

As found in our study, for the economic growth-inequality relationship, all countries experience the S-curve in the economic development process. This clearly indicates that each individual country has the opportunity to experience both positive and negative causal links from growth to inequality throughout the development process. However, for the inequality-economic growth relationship, we found positive links for the U.S., Japan, and China, and a negative effect for South Korea. As a result, only South Korea may have benefited from the Virtuous cycle relationship with high growth and low inequality during some parts of its development over our study period. However, as suggested in previous studies, if high growth with low inequality is the main objective to pursue, various other complementary measures such as education and government redistribution are definitely needed.(See, for example, Ostry et al. (2014), OECD (2012))

2.6 Concluding Remarks

Previous literature on the relationship between income inequality and economic growth has produced mixed results. Due to unreliable and insufficient data, varied methodologies, different time periods covered and the complex mechanisms involved in the relationship, a

Table 2.6: Four Possible Scenarios of the Relationships between Growth and Inequality

Four Possible Scenarios of the Relationships between Economic Growth and Income Inequality

		From Inequality to Growth (I to G)	
		Negative	Positive
From Growth to Inequality (G to I)	Negative	**I**: High growth with low inequality (Virtuous Cycle)	**II**:High growth with low inequality and low growth with high inequality (Interchanged)
	Positive	**III**:High growth and high inequality and low growth with low inequality (Interchanged)	**IV**:High growth with high inequality vs low growth with low inequality (Trade-off)

consensus has not been reached. This paper contributes to the literature in the following major ways. Firstly, based on the inequality-growth-redistribution nexus, we are one of few researchers to apply the Engle-Granger two-step ECM approach to estimate the long-run and short-run relationships between inequality and growth. Secondly, to allow for cross-country heterogeneity, we construct (1) a baseline model with common determinants, and (2) country-specific regressions with various combinations of variables for each country. Thirdly, our estimation results demonstrate that the long-run relationship between inequality and income levels tends to be statistically significant more often than their short-run dynamic relationship. In general, the short-run dynamic relationships between economic growth and change in inequality in either direction are mostly statistically insignificant.

We find that in the long run equilibrium, all four countries (the U.S., Japan, South Korea, and China) conform to the S-shaped curve hypothesis for the GDP per capita-inequality relationship. However, the countries vary in their positions along the S-curve over the study period. In addition, we show mixed results on the effect of trade openness on income inequality. Although fiscal redistributive measures reduce inequality in Japan, they play no major roles in the other three countries. With regard to the inequality-GDP per capita relationship, we find that increased inequality benefits the economy for the U.S. Japan, and China, and hurts the economy for South Korea. All countries except for China show a negative effect of fiscal redistribution on GDP per capita. However, for Japan, fiscal redistribution may have hampered economic growth, but, it successfully reduced income inequality.

Chapter 3

Does the Tax Cooling Measure on Real Estate Really Work? An Empirical Study on Taiwan

3.1 Introduction

Real estate prices in Taiwan escalated between 2007-2014. The growth rate of real estate's prices[1] during this period was around 39% and the price-to-income ratio[2] increased from 5.76 in 2007 to 8.39 in 2014. These scenarios could lead Taiwan to a danger of real estate bubble burst. It is believed that ignoring a real estate bubble burst can have disastrous consequences (Crowe et al., 2013). For instance, a sharp decline in real estate prices may lead to real estate market disorder and further trigger a financial crisis, while in terms of income distribution, it may enlarge the gap between the rich and the poor. In order to prevent the economic catastrophe caused by a bubble burst, the Taiwanese government adopted a tax-cooling measure – a type of ad hoc transaction tax – from June 2011 in an attempt to curb real estate price increases. The main purpose of this paper is to examine empirically whether or not the tax-cooling measure is effective.

To limit excessive speculation on real estate and curb the rising prices of residential property in Taiwan, the government imposed a special ad valorem tax – Specifically Selected Goods and Services Tax (SSGST) – on short-term transactions of real estate within the territory of Taiwan starting in June 2011.[3] For real properties[4] that have been held for a period of no more than 2 years, the tax rate is 10%; for those that have been held for a period of no more than 1 year, the tax rate is 15%. The ultimate goal is to dampen the upswing phase and price increases of the overall real estate market through imposing a tax specifically on the short-term speculative transactions of the real estate (tax-targeted market). Lo (2013) showed the prices of the overall housing in Taiwan were still at high levels in 2012, which

[1] The prices of real estate are provided by Real Estate Information Platform, Ministry of Interior (MOI), Taiwan. The prices are market or contract prices surveyed by the government.

[2] The index of price-to-income is defined as the ratio of average market housing price to the average per capita (or household) income.

[3] This special ad valorem tax was abolished and replaced by a short run capital gains tax in 2016.

[4] The SSGST exempts "self-used" (i.e., owner-occupied) residential property and few qualified real estates from tax liability. The conditions for the self-used residential property are as follows: the owner and owner's spouse and lineal relatives of minor age, own only one unit of a building and the land associated with the unit, have completed household registration, and during the holding period neither provided it for business use nor leased it.

seems to indicate that the tax-cooling policy was not effective. However, it is expected that the special transaction tax could only initially affect the short-run speculative transactions, before gradually extending its price-taming effect to the overall real estate market. Therefore, to investigate the effectiveness of the tax-cooling measure, the focus should be on its initial impact first and the short-run transactions should be the targeted market of the study and isolated from the overall market.

The contribution of this paper is to construct a two-tier regression discontinuity (RD) model to examine the impacts of this speculation-curbing tax on the real estate market in Taiwan. The two-tier model demonstrates not only the influence of imposing a tax on the targeted market, but also the influence of imposing different tax rates within the targeted market. According to the eligibility rules of tax implementation, the holding period of houses in transaction is an appropriate rating variable. The cutoff point is at the 730^{th} day, which indicates that the transaction observations on the left side of the cutoff point are treated with taxation while those on the other side are not. In the first tier, I run a regression discontinuity equation at the cutoff point of the 730^{th} day to examine the impact of speculative transaction tax on the prices of short-term targeted housing transactions. After that, I perform the second tier equation of RD within the targeted observations, which delineates the cutoff point at the 365^{th} day. The tax-suppressing effect on housing prices is tested to determine if the difference of tax rates imposed actually matters. The result shows that the special ad valorem tax was effective in curbing increasing real estate prices. However, the difference of tax rates imposed among the short-run targeted housing transactions was not statistically significant.

The remainder of the paper is organized as follows. Section 2 surveys the related literature. Section 3 articulates the tax-price mechanism. Section 4 introduces the databases and data sources used. Section 5 describes basic summary statistics. Section 6 lays out the empirical models with regression discontinuity. Section 7 presents the estimation results. Finally, Section 8 offers further discussions and concluding remarks.

3.2 Literature Review

Among the extensive literature on real estate prices, some studies focus on the identification of the bubble. A bubble may exist if the market price of real estate is much higher than its fundamental value.[5] Ahuja et al. (2010) found that in terms of the entire housing market, housing market prices in China were not significantly higher than their fundamental value in 2009. Hui et al. (2011) also tested whether a housing price bubble existed in the Hong Kong housing market. By comparing market prices to the fundamental value of houses, they concluded that there were two bubbles, one before 2003 and another after 2008. They went on to suggest that the government can curb speculative activities by introducing a capital gains tax on short-term transactions.

In fact, there are several ways for a government to regulate the real estate market. Crowe et al. (2013) pointed out that monetary policy, fiscal tools, and macroprudential regulation are all potential policy options to stabilize the real estate market. The effectiveness of a policy is uncertain and varies across policy options. Theoretically, both Crowe et al. (2013) and Allen and Carletti (2010) claimed that a cyclical transaction tax may be a better tool with respect to stabilizing the real estate market. Empirically, some studies examined the effectiveness of the specific policy. IMF (2010) studied the trends in real estate prices and found the transaction tax performs well in terms of stabilizing the real market. In the case of rebound economies, imposing a transaction tax could dampen real estate prices and limit speculative activities. Hong Kong and China, for instance, imposed higher stamp duties to stabilize their housing market, though the policy seemed to work only temporarily. In the case of bust economies, the reduction of the transaction tax could stimulate the real estate market; the suspension of stamp duty in the U.K. is an example. Aregger et al. (2013) adopted various approaches to estimate the impact of a transaction tax and capital gains tax on residential housing price in Switzerland from 1985 to 2009. The result from

[5] Generally speaking, the fundamental value of real estate is composed of the present value of cash flow received over time and the terminal value of the real estate by the end of the holding period.

the univariate analysis showed that cantons with increasing transaction tax experience lower price growth than cantons with decreasing or identical transaction tax, although it is not robust. Overall, unlike the results from IMF (2010), they found no sufficient evidence to support that transaction taxes can dampen Swiss housing prices, and concluded that a transaction tax may not be an appropriate tool to contain the housing price. Slemrod et al. (2015) investigate the behavioral response to residential housing transfer taxes in Washington D.C., specifically, whether or not a change in the notched tax rate causes a lock-in effect. By employing difference-in-differences, they did not find enough evidence of a lock-in effect.

Until now, only Lo (2013) estimated the effect of the SSGST on the real estate market in Taiwan. By using the vector error correction model, he found that the SSGST has a significant effect on discouraging the speculative activities but showed no impact on stabilizing real estate prices during the period from the second quarter in 1996 to the end of 2012. While Lo (2013) used a macro time series, this study uses a micro panel dataset composed of housing characteristics, registration and tax imposition. Therefore, I am able to apply a hedonic decomposition of housing price in detail and to measure the importance of the various characteristics.

In summary, the existing literature indicates that there is no consistent consensus on the effectiveness of using transaction taxes to stabilize the real estate market. It is necessary to consider, however, that the empirical methods employed may not well capture the effect of the transaction tax. As Slemrod (1998) notes, the method used to isolate the impact of tax changes separate from nontax factors is critical for accurately estimating the effect of tax changes. This paper contributes to this end by using a two-tier regression discontinuity model to provide relatively precise estimates. As a result, I am able to isolate the effect of the tax from the effect of other nontax factors, and also differentiate the impacts on the targeted real estate market between different tax rates imposed.

3.3 Brief Articulation about the Tax-Price Mechanism

3.3.1 Household Renting-Buying Decision-Making Model

In theory, households will be indifferent between renting and owning a house, if the rent paid equals the user cost of owning. This is not typical, however, due to the tax treatment of owner-occupied housing by the government. For example, the imputed rents are seldom taxed, even if the transaction and property taxes could be regarded as indirect ways of taxation. In a tax system where imputed rents are not taxed directly, hypothetically the rent would be equal to the user cost of owning the house as shown in Figure 3.1.[6] The user cost is formulated as the product of house price and the various cost items (as percentages of house price) associated with owning a house, including mortgage interest rates, property tax rates, maintenance, depreciation, risk premiums on residential property, and expected capital gains, respectively. If real estate taxes increase, including the transaction tax, the wedge between renting and the user cost of owning would increase, reducing house prices for households. This may explain why some countries/areas (e.g. Hong Kong, China, and Singapore) adopted special transaction taxes in response to housing price bubbles.

3.3.2 Theoretical Model of Real Estate Price Bubbles

There are various theories in the literature attempting to explain real estate price bubbles. Allen and Carletti (2010) constructed a model, which focuses on the role of speculators in real estate investment as illustrated in Figure 3.2.[7] From their theoretical framework, real estate prices are fundamentally driven by the expected flow of housing services in normal times. In bubble times, it becomes worthwhile for speculators to enter the market if the expected profits exceed the opportunity costs of the investment. In this case, the purchase price of

[6] See Crowe et al. (2013), p.309 for an identity equation of mathematical form.

[7] Allen and Carletti (2010) construct a two-period model to explain the role of speculators in real estate investment.

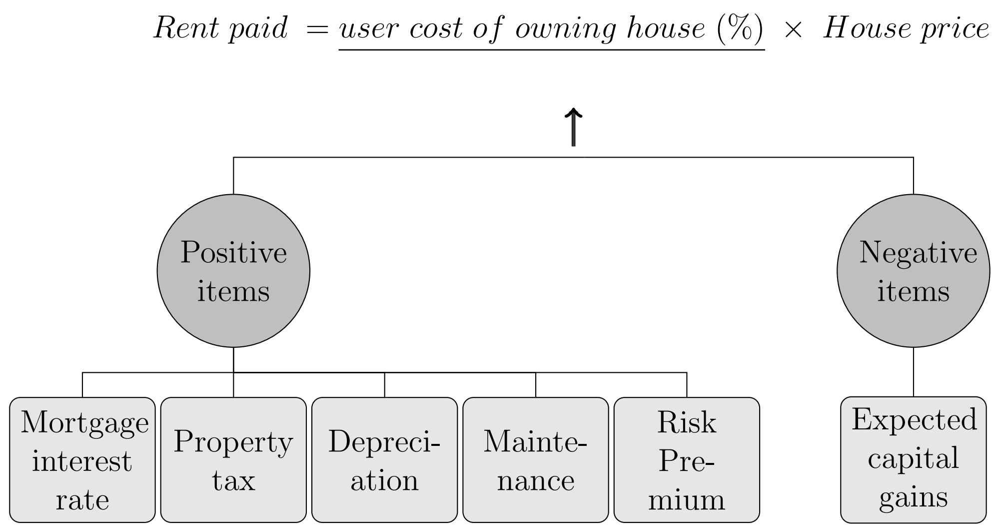

Figure 3.1: A Wedge between the User Cost of Owning A House and Renting

housing will be greater than its fundamental value since the supply of real estate is relatively fixed in the short run. To prevent real estate bubbles, the macroprudential tools involving real estate taxes are typically implemented. The real estate transaction tax constitutes one of the major cost components of speculators' investments. Therefore, increasing the real estate transaction tax mitigates speculation and related activities, thereby restraining housing prices.

3.4 Databases and Data Sources

3.4.1 Databases

The data used comes from two sources provided by the Ministry of Interior (MOI) and the Ministry of Finance (MOF) of Taiwan. The MOI began requiring registration of real estate transactions in January 2012. Hence, there are no MOI data on transactions of real estate prior to 2012. This dataset provides information on real estate transactions, including selling prices, selling date and the housing characteristics (i.e., house square footage, location, age of housing, number of rooms, number of bathrooms, number of parking spaces, number of living

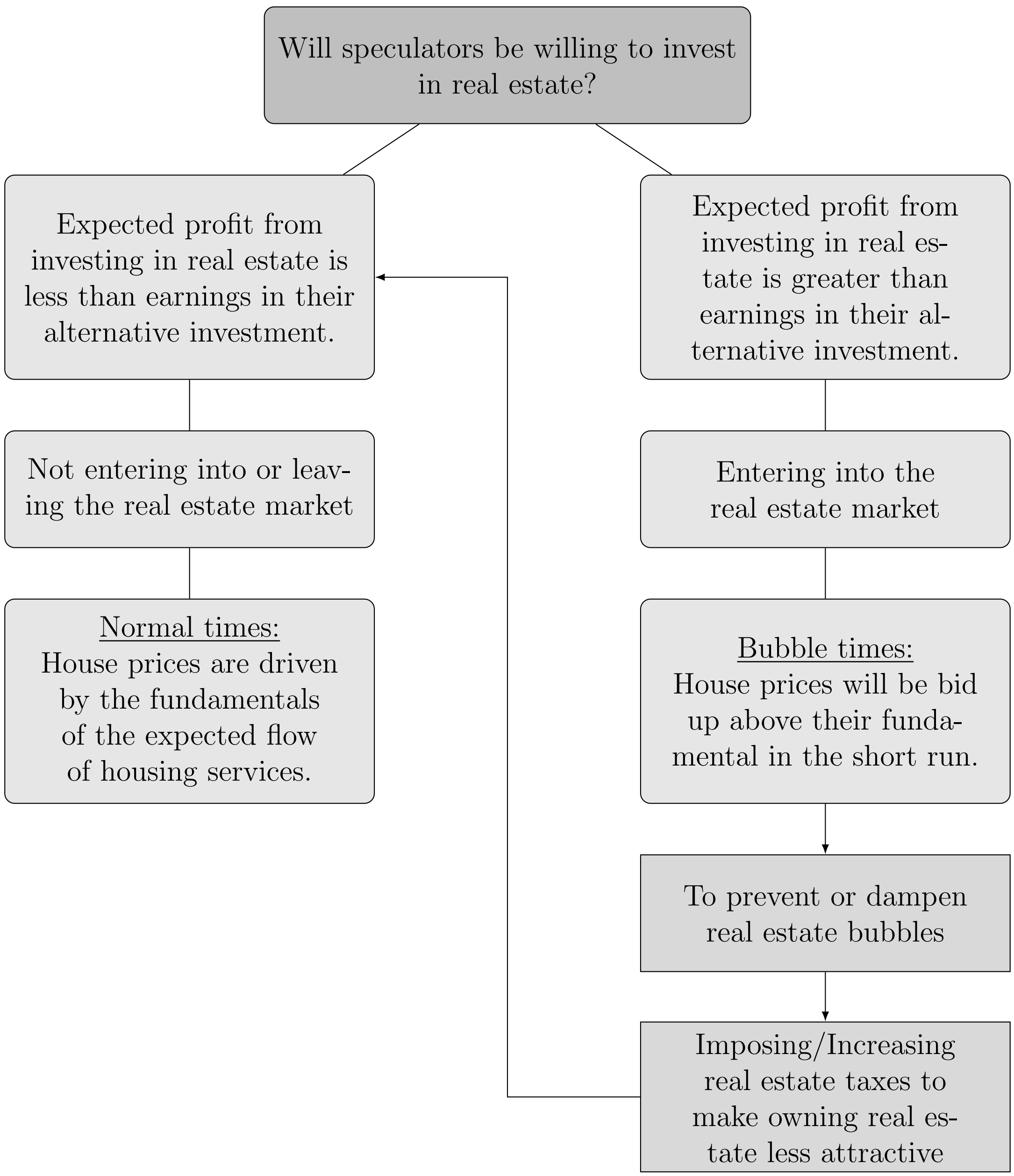

Figure 3.2: The Speculator's Role in Real Estate Investment

and dining rooms, type of building, building materials, etc.). However, due to 6-months of propagation from January to June 2012, only July 2012 to October 2014 is covered in the study. The number of observations is around 720,000. Data on the SSGST comes from the MOF, this dataset provides information on real estate transactions that are actually taxed. It includes tax rates (10% or 15%) imposed, prices of houses sold, and tax revenues collected. Since the SSGST starts from July 2011, the dataset covers the period from July 2011 to October 2014. The number of observations is around 15,000. Both datasets include land-only transactions and land with house transactions. Since the major concern is housing prices, this study focuses on the latter. Excluding land-only transactions, the numbers of observations in the MOI and in the MOF are around 508,000 and 8,000, respectively.

3.4.2 Data

The primary data used is from the MOI, which provides various detailed housing characteristics for individual transaction. The data of property registration is merged with taxation data by matching the registered identification number of houses sold to each other. The final dataset covers July 2012 to October 2014.[8] To conduct this analysis, I calculate the holding period for each housing transaction before sale. In this merged panel data set, if the properties were sold more than twice, then the previous selling date is identifiable and the time of holding can be easily computed. For those that only transferred once but were taxed, the "SSGST Tax Dataset" is then used to search for the previous selling dates. The contents of data sources are organized as Figure 3.3. Housing transactions collected are classified into two groups. The first group includes transactions of houses held for more than two years, which are not targeted by the SSGST. The second group comprises transactions of houses held for less than two years. These transactions are deemed as speculative and will be taxed by the SSGST. Since the SSGST exempts "self-used" residential houses (limited

[8] I thank the MOI and the MOF for merging the two datasets for me by cyber coding. The most accurate way to link the two data sets is to match the identification numbers of sales and buyers. However, due to legal restrictions, the identification number is not provided.

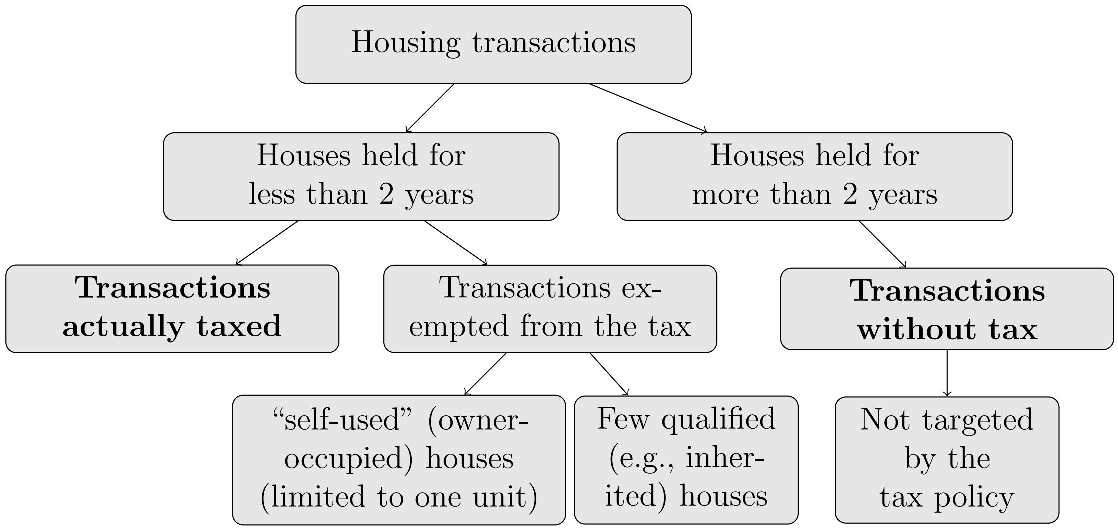

Figure 3.3: Data Breakdown

to one unit) and few other qualified (e.g., inherited) real properties from tax liability, not all housing transactions within two years are taxed. The data on the housing transactions actually taxed and housing transactions without tax, as shown in Figure 3.3, are the focus of this study.

3.5 Descriptive Statistics

3.5.1 Summary Statistics

Housing prices in Taiwan increased substantially from 2007 to 2014. As shown in Figure 3.4, the national average total price per house was NT$7,118 thousand in the 3rd quarter of 2007, but climbed to NT$9,621 thousand in the 4th quarter of 2014. During the same period, the national average unit price rose from NT$164 thousand to NT$242 thousand. Due to varied degrees of regional economic development, houses located at different cities or areas have experienced dissimilar price trends. Compared to the southern half of Taiwan, the northern half, particularly around the Capital city of Taipei, always led the way when housing prices started moving upwards. From Figure 3.5, the average total price per house in Taipei was NT$14,837 thousand in the 3rd quarter of 2007. In the 4th quarter of 2014, it

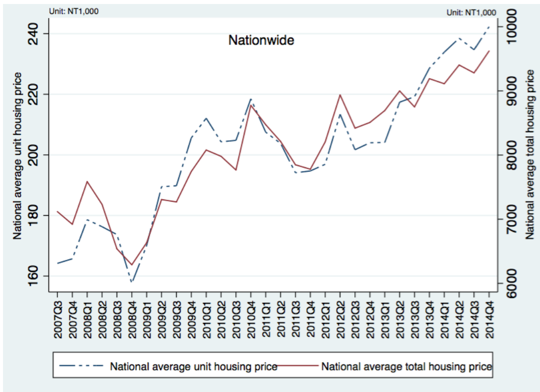

Figure 3.4: Average Housing Price Trend of Taiwan from 2007Q3 to 2014Q4

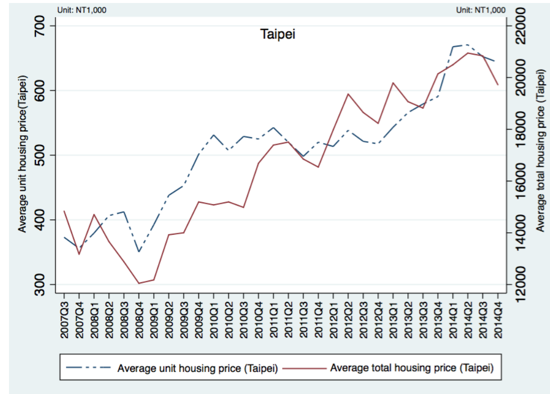

Figure 3.5: Average Housing Price Trend of Taipei from 2007Q3 to 2014Q4

rose to NT$19,723 thousand, more than twice the national average. Figure 3.4 demonstrates that the average housing price in Taiwan continued increasing, despite the implementation of SSGST in the 3rd quarter of 2011.

The MOI dataset provides some characteristics of all houses that were sold during the period analyzed. These characteristics are summarized for each house sold in Table 3.1. The housing characteristics for all houses include location (collapsed into municipalities and urban cities), age of houses, house square footage, number of buildings,[9] number of parking spaces, number of rooms, number of living and dining rooms, number of bathrooms, building type, quality rank, story height, managed by housing security commission, use of house, and house exterior. The types of buildings include apartments, independent houses, shops, commercial buildings, residential housings, mansion buildings, suites, factory offices, and farm houses. The quality of houses is classified into 5 rankings,[10] with the first tier comprising those of highest ranking. Houses are also classified as residential, commercial, industrial, agricultural, residential and commercial mixed, residential and industrial mixed, industrial and commercial mixed, public-shared parts, and public housing. Finally, house exteriors include wood, steel, mixed concrete, reinforced concrete, stone, brick, prestressed

[9]Each individual transaction usually matches with a single building identify number registered in the MOI dataset. Some transactions may include two or more building identify numbers in a deal.

[10]The quality rank is represented by the economic prosperity of the administrative jurisdiction of a city in which the house is located.

Table 3.1: Summary Statistics and Hedonic Regression Results

	Obs	Mean	Std. Dev.	Tax Dummy
House price (in log form)	508394	15.660	0.952	
Tax Dummy				-0.218***
Location:				
Municipality (Special city with population over 1.25 million)	508394	0.777	0.416	0.631***
Urban cities	508394	0.913	0.282	0.384***
Age of house (in years)	508394	14.046	13.145	-0.014***
House square footage (square meter)	508394	255.193	4562.717	4.043e-06***
Number of buildings	508394	1.025	0.267	0.319***
Number of parking spaces	508394	0.441	0.834	0.219***
Number of rooms	508394	2.956	1.845	0.053***
Number of living and dining rooms	508394	1.630	0.830	0.134***
Number of bathrooms	508394	2.032	1.640	0.053***
Building type:				
Apartments (less than 5 stories)	508394	0.124	0.329	1.118***
Independent houses	508394	0.255	0.436	1.465***
Shops	508394	0.019	0.137	1.995***
Commercial buildings	508394	0.010	0.101	1.541***
Residential buildings (more than 11 stories with elevators)	508394	0.371	0.483	1.050***
Mansion buildings (less than 10 stores with elevators)	508394	0.138	0.345	1.001***
Suites	508394	0.049	0.215	0.372***
Factories	508394	0.003	0.052	2.877***
Factory offices	508394	0.004	0.062	2.249***
Farm houses	508394	0.006	0.075	1.768***
Quality rank:				
Rank 1	508394	0.167	0.373	0.192***
Rank 2	508394	0.154	0.361	0.192***
Rank 3	508394	0.089	0.285	0.155***
Rank 4	508394	0.079	0.269	0.147***
Rank 5	508394	0.063	0.242	0.199***
Story height	508394	9.628	6.890	0.018***
Organizations of house safety and management	508394	0.561	0.496	0.069***
Use of House:				
Residential use	508394	0.646	0.478	-0.051***
Commercial use	508394	0.036	0.186	0.122***
Industrial use	508394	0.007	0.082	0.267***
Agricultural use	508394	0.006	0.078	0.370***
Residential and commercial mixed use	508394	0.046	0.210	0.071***
Residential and industrial mixed use	508394	0.001	0.028	0.351***
Industrial and commercial mixed use	508394	0.001	0.027	0.231***
Public-shared parts	508394	0.354	0.478	-0.056***
Public housing	508394	0.011	0.103	-0.211***
Exterior:				
Building by woods	508394	0.001	0.033	-0.115***
Building by steels	508394	0.002	0.039	0.528***
Building by mixed concrete	508394	0.000	0.007	0.097
Building by reinforced concrete	508394	0.851	0.356	-0.163***
Building by stones	508394	0.000	0.006	-1.693***
Building by bricks	508394	0.004	0.061	-0.171***
Building by prestressed concrete	508394	0.000	0.010	-0.222**
Building by bricks structure	508394	0.065	0.246	-0.179***
Building by precast reinforced concrete	508394	0.000	0.005	0.400**
Building by steel concrete	508394	0.001	0.036	0.097***
Building by steel reinforced concrete	508394	0.014	0.116	0.198***
Building by mixed reinforced concrete and bricks structure	508394	0.018	0.131	-0.161***
Other covariates:				
Local interest rate differences between 2011Q2 and 2011Q3	466625	0.111	0.078	1.724***
Volume percentage change in pre- and post- taxes for houses holding between 2 and 3 years	508383	0.114	0.024	-1.860***
Volume percentage change in pre- and post-taxes for houses holding less than 2 years	508383	-0.734	0.086	-4.356***
Volume percentage change in pre- and post-taxes for land holding less than 2 years	507834	-0.099	0.730	-0.495***
Short term transactions (in lag form)	508393	1458.199	756.140	0.0001***
constant				9.522***
N				446170
r2_a				0.521

*, **, *** indicate 10, 5, 1 percent level of significant respectively.

concrete, brick structure, precast reinforced concrete, steel concrete, steel reinforced concrete, and mixed reinforced concrete and brick structure.

3.5.2 Hedonic Decomposition of the Housing Prices

By using the merged panel dataset, I run a pooled regression equation to search for a hedonic decomposition of the log of the sale price of houses in order to reveal the importance of the various housing characteristics. Other than housing characteristics, there are many other major local (dis)amenities such as school quality, crime rate, labor market, etc., which also have a close relationship with the value of houses. However, it is well known that the difficulties of these local unobserved (dis)amenities are a major problem in identifying the hedonic function. Thus, I make use of this additional information obtained to examine short run responses in housing value due to the important exogenous changes in local (dis)amenities or other factors. In order to further examine the effects of changes involved with government micro- or macro-prudential policies on the housing prices, I include five special variables: 1) local interest rate differences between the 2nd quarter of 2011 and 3rd quarter of 2011,[11] 2) volume percentage change in pre- and post- taxes for houses holding between 2 and 3 years, 3) volume percentage change in pre- and post- taxes for houses holding less than 2 years, 4) volume percentage change in pre- and post- taxes for land holding less than 2 years and 5) short term transactions of previous year, in the hedonic regression. The estimation results are presented in column 4 of Table 3.1. These covariates are almost all suitably regressed (except the variable called "building by mixed concrete") and these control variables are also included in my subsequent RD regression analysis. Interestingly, the pooled regression result shows that the structural change from short run (less than 2 years) to long run transactions and the tax dummy both have negative significant effects upon curbing the sale prices in the housing market.

[11] The Central Bank of Taiwan adopted few so called "Credit-Controlled Measures" from the second quarter of 2011. The loan interest rate and the limit on loan-value ratio were set differently among local districts depending on their real estate market situations.

3.6 Empirical Model with Regression Discontinuity

3.6.1 Internal Validity of Regression Discontinuity

3.6.1.1 Density Test of the Rating Variable

As mentioned above, the holding period of houses before they are sold is chosen as a rating variable for this analysis. In addition, according to the eligibility rule of the SSGST tax implementation, the cutoff points are set at the 730^{th} day (24th month) and the 365^{th} day (12th month), respectively. The density test of the rating variable is conducted to determine whether or not the cutoff point can be manipulated. If the cutoff point can be manipulated, then the RD design fails. A valid RD design requires that there is no discontinuity observed above or below the cutoff points. The tax rate changes according to the holding periods. The tax rates are 15%, 10%, and none for the holding period of houses of less than 1 year, between 1 and 2 years, and more than 2 years, respectively. A visual inspection can be used on the graph of the density of the rating variable.[12] From Figure 3.6, it appears that the numbers of observations around both cutoff points are rather smooth in the curve. In other words, there should be no discontinuity observed in the number of observations just above or below the cutoff points for both holding periods of 12 months and 24 months. The possible explanations for the lack of manipulation problems incurred around cutoff points are as follows: 1) The real estate tax was the first of its kind and therefore it was difficult to predict its actual burden in practice; 2) There are many real estate transactions exempted from this tax. Such rules and regulations are determined by the tax authority and are unknown in certainity in advance; 3) The exact sales date used for determinating the holding period is the contract signing date, the date both sellers and buyers agree upon the deeds, rather than the date registered in the government agency by the law, which is relatively easy to manipulate. Consequently, this RD design passes the density test of the

[12] As usually suggested, I have run the McCrary test. By using default settings for the bin size and bandwidth and assuming rating variable continuous, the results are rather confounding. For the cutoff point at 730^{th} day, the log difference in height is zero at significant level, but for the cutoff point at 365^{th} day, it is a bit vague.

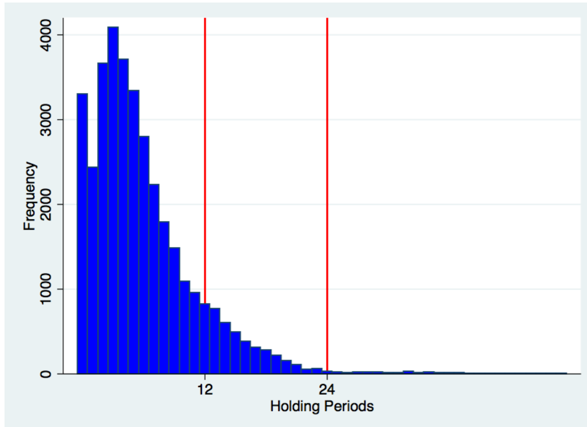

Figure 3.6: Density Test of the Rating Variable-House Holding Periods

rating variable. It is a valid RD design.

3.6.1.2 Probability of Receiving Treatment

In this section, the probability of receiving treatment as a function of the rating variable is conducted to determine whether or not this RD design is sharp. The valid sharp RD design requires that, taking holding periods as the rating variable, if a house holding period is less than 12 months, the tax rate imposed on all observations is 15%. On the other hand, if a house holding period is between 12 and 24 months, the tax rate imposed on all observations is 10%. From Figure 3.7, where holding periods are less than 12 months, 98.8% of observations receive the eligible treatment, a tax rate of 15%. On the other side of the cutoff point of holding periods between 12 and 24 month, 99.3% of observations receive the eligible treatment, a tax rate of 10%. Since there are high probabilities of receiving treatments on both sides of the cutoff point – the 12th month – the design is clearly sharp in nature.[13] This similar test is also applied to examine the probability of observations which will not receive any tax treatment, if the holding period is more than 24 months. From Figure 3.7, on the left side of the cutoff point – the 24th month, 100% of observations receive the eligible treatment, either a tax rate of 10% or 15%. On the right side of holding periods

[13]After careful examinations, the "no shows" and "crossovers" happened mostly due to the administrative negligences or errors incurred in the registration of contract timing.

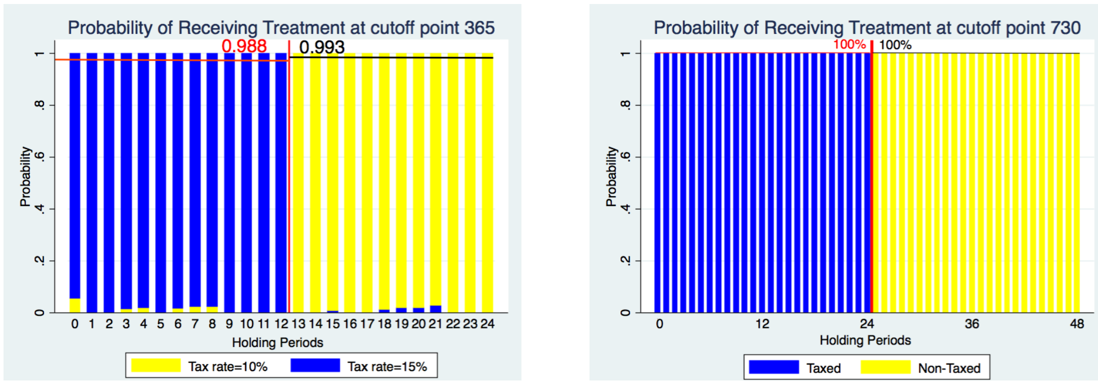

Figure 3.7: Probability of Receiving Eligible Treatment

more than 24 months, 100% of observations are exempted from taxation. As a result, the sharp type RD could be obviously visually judged and supported.

3.6.1.3 Examination of Non-outcome Variables

The examination of non-outcome variables is conducted to determine the potential covariates used in the RD model. The criterion for judging and testing is that the discontinuity does not happen graphically while I plot the non-outcome variables against the rating variable at the cutoff point. No discontinuity around the cutoff point indicates that these potential covariates could not be impacted by the treatment. As shown in Figure 3.8 and 3.9, all the potential covariates are smooth at the cutoff points, the 730^{th} day and the 365^{th} day. For the cutoff point at the 730^{th} day, the non-outcome variables include building by mixed concrete, building by stones, building by precast reinforced concrete, building by steel concrete, residential and industrial mixed use, industrial and commercial mixed use, house square footage, and number of bathrooms. For the cutoff point at the 365^{th} day, the non-outcome variables include building by mixed concrete, building by stones, building by bricks, building by precast reinforced concrete, building by steel concrete, industrial and commercial mixed use, and house square footage. These control variables are employed in my subsequent RD regression analysis, but, for simplicity, I do not report these coefficients in the table below.

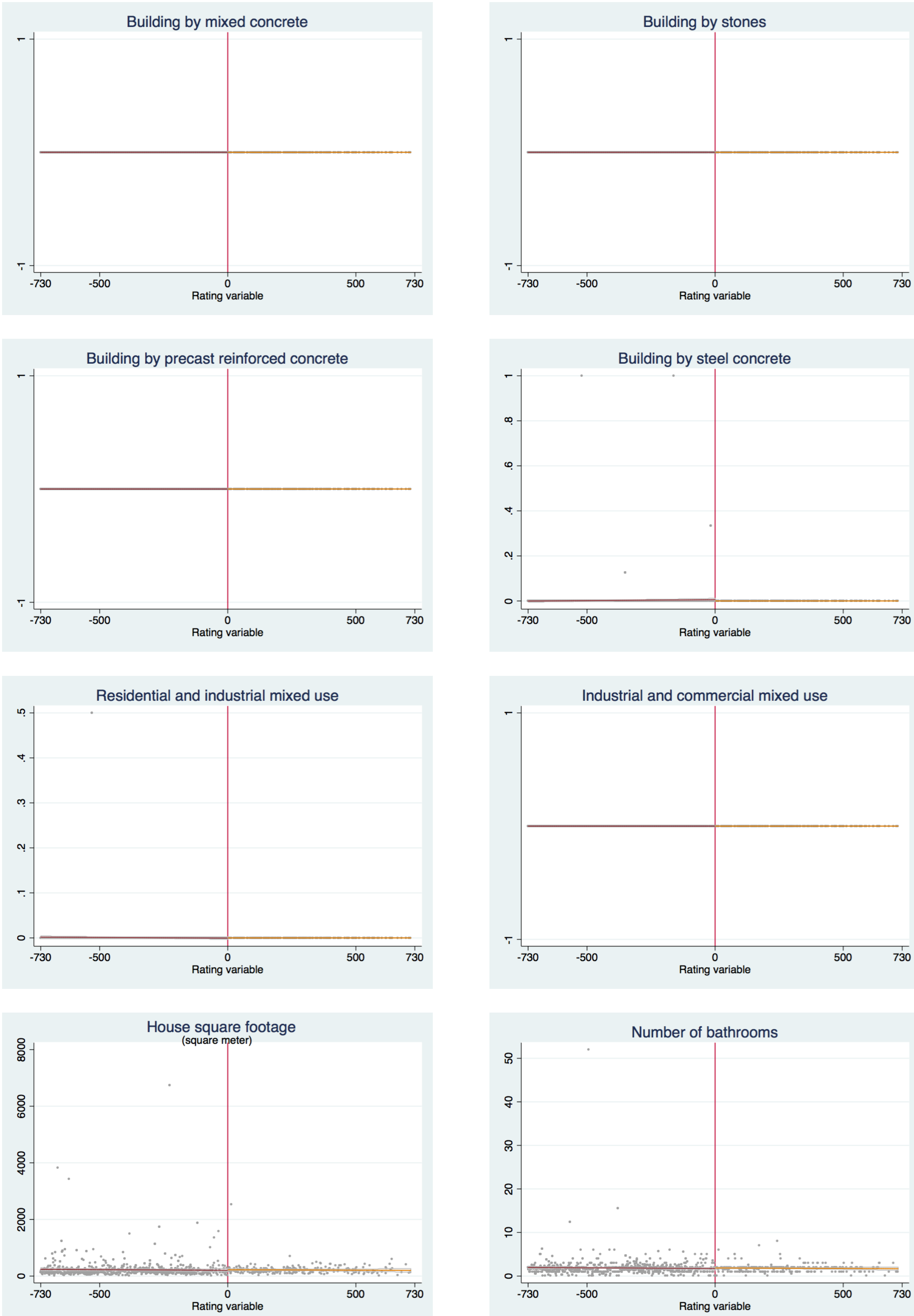

Figure 3.8: Examination of Non-outcome Variables at Cutoff 730^{th} Day

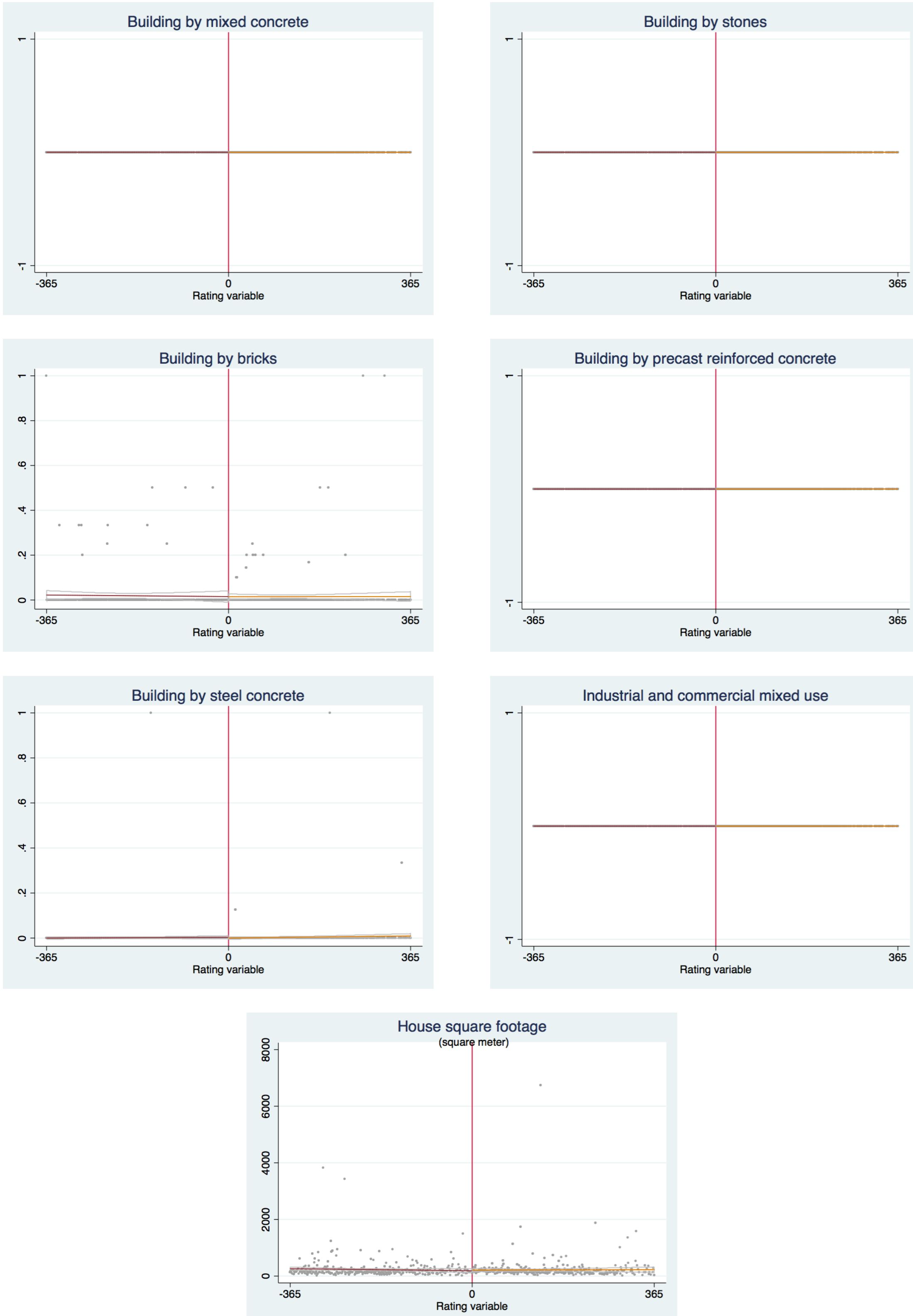

Figure 3.9: Examination of Non-outcome Variables at Cutoff 365^{th} Day

Figure 3.10: Multiple Cutoff Points

3.6.2 Sharp Regression Discontinuity Model

3.6.2.1 The Two Cutoff Points Description

According to the SSGST, for real properties that have been held for a period of less than 2 years, a 10% of tax rate will be imposed; for those that have been held for a period of no more than 1 year, the tax rate will be raised to 15%. This makes a sharp distinction at the 730^{th} day of holding in choosing to impose the speculative transaction tax or not. Furthermore, the 365^{th} day point provides us with the chance to separate the possible treatment effects from different tax rates. Since the probabilities of wrong treatment are slim at holding periods of the 365^{th} and the 730^{th} day, a sharp RD model can be build to identify the effects of the SSGST on the housing prices. Based on simple linear estimation, Figure 3.10 shows that at the cutoff point of the 365^{th} day, the housing price increases as the holding period increases and the tax rate decreases. On the other hand, at the cutoff point of the 730^{th} day, the housing price with taxation (either 10% or 15%) decreases compared with housing price without any taxation.[14]

[14] The housing prices are defined as the prices paid by the buyers in the housing market. I also tried to run simple linear estimation on housing prices obtained by the sellers after tax. The results of the relationship among housing prices, holding periods and tax changes are very similar to the one shown in Figure 3.10.

3.6.2.2 The Estimation Equation

A sharp RD model with a rating variable of holding days is constructed. The whole estimation is characterized by a two-tier procedure. As Figure 3.11 and 3.12 illustrate, two cutoff points are chosen. The first cutoff point is at the 730^{th} day of holding, which indicates the eligibility rule on whether a housing transaction is taxed or not. The second cutoff one is at the 365^{th} day of holding, which demonstrates the change of tax rates from 15% to 10%. In both tiers of operations, I start with simple linear regression and add higher-order polynomials until 5th degree and interactions to it. After that, I take the covariates explained above into consideration. Suppose x represents the holding days, z represents other covariates, and $f(x)$ is the polynomial function. The RD models for the cutoff point of the 730^{th} day are:

$$log\,(price)_i = \beta_0 + \alpha t_i + f(x_i) + dz_i + \epsilon_i \tag{3.1}$$

where

$$t = 1, if\ x_i \leq 730$$

$$t = 0, if\ x_i > 730;$$

For the cutoff point of the 365^{th} day, the RD models are:

$$log\,(price)_i = \beta_0 + \alpha t_i + f(x_i) + dz_i + \epsilon_i \tag{3.2}$$

where

$$t = 1, if\ x_i \leq 365$$

$$t = 0, if\ x_i > 365;$$

The key coefficient to be estimated is evidently α.

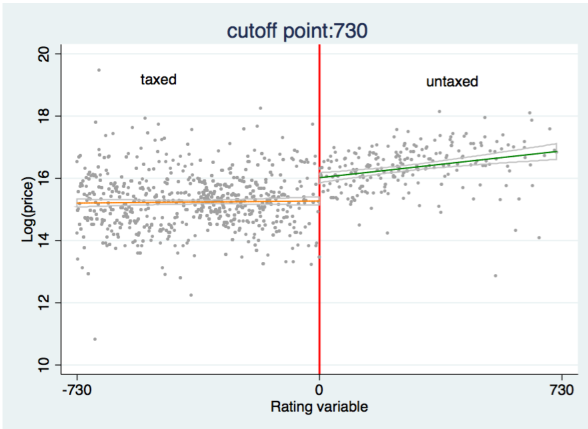

Figure 3.11: Cutoff Point at the 730^{th} Day

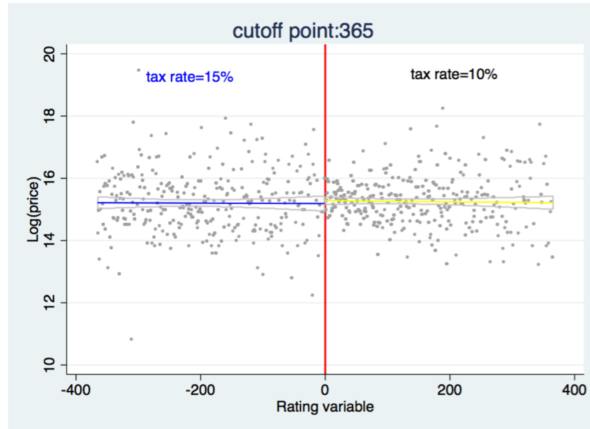

Figure 3.12: Cutoff Point at the 365^{th} Day

3.7 Estimation Results

For each cutoff point, a variety of functional forms are tested to determine which fits the data set best. I tried first through fifth order polynomials, and allowed the polynomial to differ on each side of the cutoff.

3.7.1 The First Tier: The Treatment Effect of Housing Transaction Tax

As shown in Table 3.2, from the results of the estimations at the cutoff point of the 730^{th} day, the linear form of the model is the one better fitted and chosen, in terms of AIC and BIC tests. For the model without covariates, the coefficient of t is -0.749 at 0.01 significant level; for the model with covariates, the coefficient of t is -0.727 at 0.01 significant level. Approximately speaking, the houses shortly held by sellers are sold 73-75% cheaper on average when the SSGST is taken effect than when it is not. This indicates that the transaction tax adopted by Taiwan imposed upon the short-term housing transactions does have a price-curbing effect on houses held for less than 2 years before transaction. This is precisely the purpose and reason for the speculation-restrained type of tax instrument adopted in Taiwan. From the analysis, the government policy decision appears effective.

Table 3.2: The Treatment Effect Estimated at the 730th Day

The Treatment Effect Estimated at the 730th Day	Treatment Estimate	Standard Error	R-squared	AIC	BIC
Treatment Effect					
All data point					
Full impact (no covariates)					
Model1: linear	-0.749***	0.105	0.101	5729.270	5751.314
Model2: quadratic	-0.570***	0.169	0.102	5731.200	5764.266
Model3: cubic	-0.673***	0.233	0.103	5732.936	5771.513
Model4: quadruple	-0.976***	0.303	0.104	5732.464	5776.552
Model5: quintuple	-0.932**	0.370	0.104	5732.436	5776.524
Full impact (with covariates)					
Model1: linear	-0.727***	0.097	0.228	5458.226	5496.802
Model2: quadratic	-0.550***	0.156	0.229	5459.634	5509.233
Model3: cubic	-0.628***	0.220	0.229	5463.244	5523.865
Model4: quadruple	-0.875***	0.287	0.230	5463.312	5529.443
Model5: quintuple	-0.926***	0.346	0.230	5462.802	5528.934

1. Sample size:1828.
2. *, **, *** indicate 10, 5, 1 percent level of significant respectively.

3.7.2 The Second Tier: The Treatment Effect of Housing Transaction Tax Between Differences in Tax Rates

According to Table 3.3, the simple linear form of the estimation model for the treatment effect of transaction tax between the differences in tax rates also fits best in terms of AIC and BIC tests. It indicates that although both types of houses are taxed, the change in tax rates does not affect the house prices. For the model without covariates, the coefficient of t is -0.092 but not statistically significant; for the model with covariates, the coefficient of t is -0.078 and not statistically significant either. The design of the SSGST demonstrates that the shorter the holding period before the sale, the higher the tax rate. According to the results, if the tax rate rises from 10% to 15%, the prices of houses will be 8-9% lower on average. This means that the higher the transaction tax rate is, the more the housing prices are suppressed. There are, however, no obvious distinctions between them.

Table 3.3: The Treatment Effect Estimated at the 365th Day

The Treatment Effect Estimated at the 365th Day	Treatment Estimate	Standard Error	R-squared	AIC	BIC
Treatment Effect					
All data point					
Full impact (no covariates)					
Model1: linear	-0.092	0.138	0.001	5061.082	5082.510
Model2: quadratic	-0.082	0.215	0.001	5064.880	5097.021
Model3: cubic	-0.051	0.290	0.001	5067.849	5110.704
Model4: quadruple	-0.186	0.351	0.002	5067.126	5109.981
Model5: quintuple	-0.183	0.408	0.002	5066.797	5109.653
Full impact (with covariates)					
Model1: linear	-0.078	0.130	0.099	4904.962	4942.460
Model2: quadratic	-0.079	0.201	0.099	4908.398	4956.610
Model3: cubic	-0.169	0.270	0.100	4910.583	4969.509
Model4: quadruple	-0.188	0.325	0.101	4910.072	4968.998
Model5: quintuple	-0.163	0.378	0.101	4910.052	4968.979

1. Sample size: 1567
2. *, **, *** indicate 10, 5, 1 percent level of significant respectively.

3.8 Discussions and Concluding Remarks

There have been many studies discussing the policy impacts on reducing house price bubbles expected from the imposition of transaction tax. The outcomes are varied due to data used, tax system adopted, and even special historical or cultural factors. The SSGST designed in Taiwan was intended to prevent the housing price from suddenly bursting by restricting speculative activities in housing transactions. For administrative convenience, short term transactions, which are defined as less than 2 years of holding period before sale, are identified as the speculative activities. In addition, since the official price registration system for real estate has only been established for no more than 4 years, this study could only focus upon analyzing the effects of transaction tax on the short term housing transactions in Taiwan. As more data is collected in the future, and as more complicated variables interact in housing market, the tax-curbing effect upon housing price might be worth re-examining.

The means by which the SSGST would effectively curb housing prices is to reduce short

Table 3.4: Volume Change Percentage of Housing Transactions Held for More Than 2 Years Pre- and Post-Tax Imposition among Municipalities

	Volume percentage pre-tax imposition	Volume percentage post-tax imposition	Percentage change
Taipei City	34%	71%	37%
Taichung City	41%	73%	32%
Keelung City	49%	76%	27%
Tainan City	42%	74%	32%
Kaohsiung City	43%	73%	30%
New Taipei City	40%	71%	31%
Yilan County	42%	78%	36%
Taoyuan City	37%	72%	35%
Chiayi City	39%	68%	29%
Hsinchu County	46%	81%	35%
Miaoli County	41%	72%	31%
Nantou County	39%	64%	25%
Changhua County	41%	72%	31%
Hsinchu City	44%	76%	32%
Yunlin County	42%	89%	47%
Chiayi County	49%	73%	24%
Pingtung County	45%	74%	29%
Hualien County	40%	75%	35%
Taitung County	48%	80%	32%
Kinmen County	38%	61%	23%
Penghu County	38%	65%	27%
Average	**42%**	**73%**	**31%**

Source: Calculated from Lo(2013), Table 4.3.9, pp. 124.

term (less than 2 years) speculative activities in the real estate market. As shown in Table 3.4, among all localities in Taiwan, the volume percentages of housing transactions held more than 2 years increased, in average, from 42% pre-tax imposition to 73% post-tax imposition for the period of 2009-2013. This clearly indicates that after the SSGST, the speculative motivations on housing investment were effectively restrained.

Real estate prices in Taiwan have increased substantially from 2007 to 2014. This price bubble situation also occurred simultaneously around other new developed countries/areas, especially in southern Asian countries/areas such as China, Hong Kong, and Singapore. Other than various macroprudential policies employed by these governments, all of them decided to adopt an additional transaction tax as an optional instrument. From this analysis, it is evident that the special transaction tax on short term holding houses could slow down the rising house prices. At least, such a policy is a good starting point for a government to take action.

Chapter 4

Price Premium or Price Discount for Locally Produced Food Products? A Meta-Analysis

*This chapter is co-authored with Professor PingSun Leung.

4.1 Introduction

The local food movement has gained traction in recent years, particularly in the developed world. This is reflected in the increased number of farmers' markets. In the U.S., the number of farmers' markets increased by over 120% from 3,706 in 2004 to 8,284 in 2014 (USDA, 2014). Based on a survey administered by the Food Marketing Institute in 2011, quality and supporting the local economy are the major reasons for buying locally-grown food. While there is a strong desire expressed by consumers, agribusinesses, and government leaders to increase the amount of local food produced and consumed in their localities, it is unclear whether increased food localization is economically viable. Insufficient economic information on production and consumption of local foods has hindered effective decision making activities for individual producers and public agencies. The purpose of this study is to address the consumption side of local food. Many studies have investigated if prices of locally-produced food reflect consumers' concerns about locally-produced food. However, previous studies document inconsistent empirical results. That is, some studies find that consumers would like to pay a premium if the food is locally-produced; on the other hand, some find the opposite results (Xu et al., 2015a, Tang, 2014). Hence, the main purpose of this paper is to systematically analyze the differences and causes of the mixed results among these empirical studies.

Meta-analysis is a statistical methodology used in the field where the evidence of empirical studies answering the same question is not consistent (Neves et al., 2012b). A meta-analysis enables a more accurate assessment of the factors which lead to the range of estimation across different studies (Cooper, 2009). Accordingly, to determine what factors influence the price premium/discount of locally-produced food among diverse studies, we conduct a meta-analysis of locally-produced food. We first generate a dataset of studies evaluating the price premium/discount of local food in the literature. Relevant variables such as market structure (e.g., local market share) and the normalized percentage of price premium/discount are carefully compiled. A regression model is then run with the percentage of premium/discount as a function of market structure, and other factors including estimating techniques used in studies, physical characteristics of product, and specific regional differences etc. It is worth mentioning that we only include existing studies on fresh (non-processed) local food in this meta-analysis.

To the best of our knowledge, there are no studies exploring the conflicting outcomes among local food studies in a quantitative and systematic approach. In addition, the existing studies are all single-region studies. Without employing a meta-analysis, it is difficult to determine whether regional differences affect the empirical estimation. Thus, this paper aims to fill this gap by pinning down the key determinants of the price of fresh, locally-produced food in a meta-synthetic approach. We find that the data source, which is closely associated with the methodology, is an important factor which explains the various outcomes across studies. Studies with actual market prices generate a lower price premium of locally-produced food than those with a willingness-to-pay value, implying that consumers tend to overstate their value for locally-produced food in a hypothetical willingness-to-pay situation. Furthermore, our results provide evidence that the trend in the price premium reflects possible changes in attitudes toward locally-produced food. In other words, over time, the price premium increases as consumers become more interested in locally-produced food.

The rest of this paper is organized as follows. Section 2 briefly discusses the background of studies on local food price. Section 3 introduces the methodology and database. Section 4 describes the model and estimation methods. Section 5 presents the empirical results and the last section concludes.

4.2 Background

4.2.1 The Relationship between Meta-analysis and Existing Studies

Farmers' markets are ubiquitous worldwide and affect their local welfare and economy. Locally-produced food has generated more interest in the past two decades. Numerous empirical studies investigate willingness-to-pay for different types of locally-produced food. Generally speaking, existing empirical studies fall into two categories. One group focuses on whether or not consumers are willing to pay higher prices for locally-produced food than for imported foods. The other measures the magnitudes of price premium/discount of locally-produced food. There are many different explanatory attributes used to determine the price premium/discount of local food, including physical characteristics of product (freshness, taste, organic, and nutrition) (Darby et al., 2008; Davidson et al., 2012; Loureiro and Hine, 2002) and socio-demographics (income, education, gender, age, occupation, environment-friendly, and family size) (Carpio and Isengildina-Massa, 2009; Darby et al., 2008; Gracia et al., 2011; Loureiro and Hine, 2002; Martinez, 2015; Yue and Tong, 2009).

One of the common properties across existing studies is that only local foods grown in a specific area are addressed. The advantage of this kind of study is that it mitigates the noise of regional characteristics. At the same time, however, major impacts on results due to the regional differences are neglected. A single study may only pinpoint the key determinants of local food price for a specific region, but may not be applied to other areas (Tang, 2014). Also, some critical factors, such as market structure, might be ignored in their model specifications.

The existing empirical studies on the price premium/discount of locally-produced food have provided conflicting results in terms of both signs and magnitudes. This controversy could be due to different factors such as estimation methods, types of datasets (e.g., survey data, actual price), regions/countries and specifications of the models adopted. To improve on the deficiencies in the existing studies and explore the factors causing these conflicting

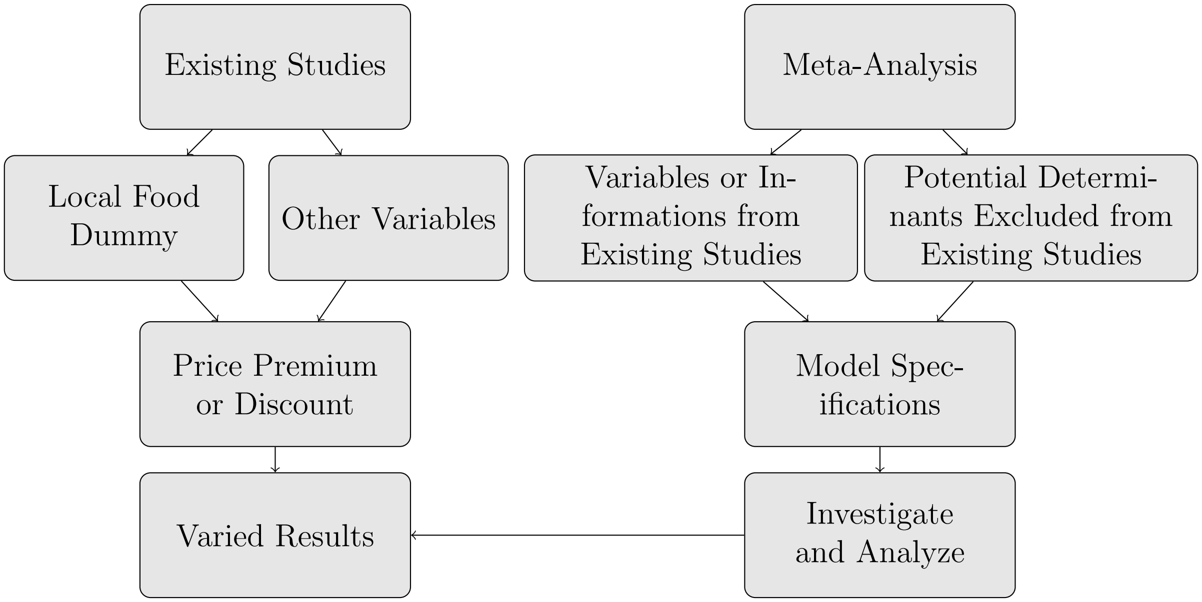

Figure 4.1: The Link between Existing Studies and Meta-Analysis

results, we conduct a meta-analysis, combining the results from all existing studies. It not only allows us to compare the differences among various studies, but also takes into account the neglected determinants in the single study. The relationship between a meta-analysis and the existing studies is shown in Figure 4.1.

4.2.2 The Candidates for Attributes in the Meta-analysis

To search for attribute candidates which might explain the range of results in the existing studies, we adopt a "5W1H" conceptual scaffold. The W's represent Who, What, When, Where, and Why, respectively, and the H stands for How as shown in Figure 4.2. We elaborate on the attributes included in the study below.

Who: Who are the participants chosen in the empirical studies?

Respondent Type It is well known that the representative sample plays a critical role in the results of research (Loureiro and Hine, 2002). Informed consumers, who are actively engaged in purchasing or have experience purchasing the item, may assess the value

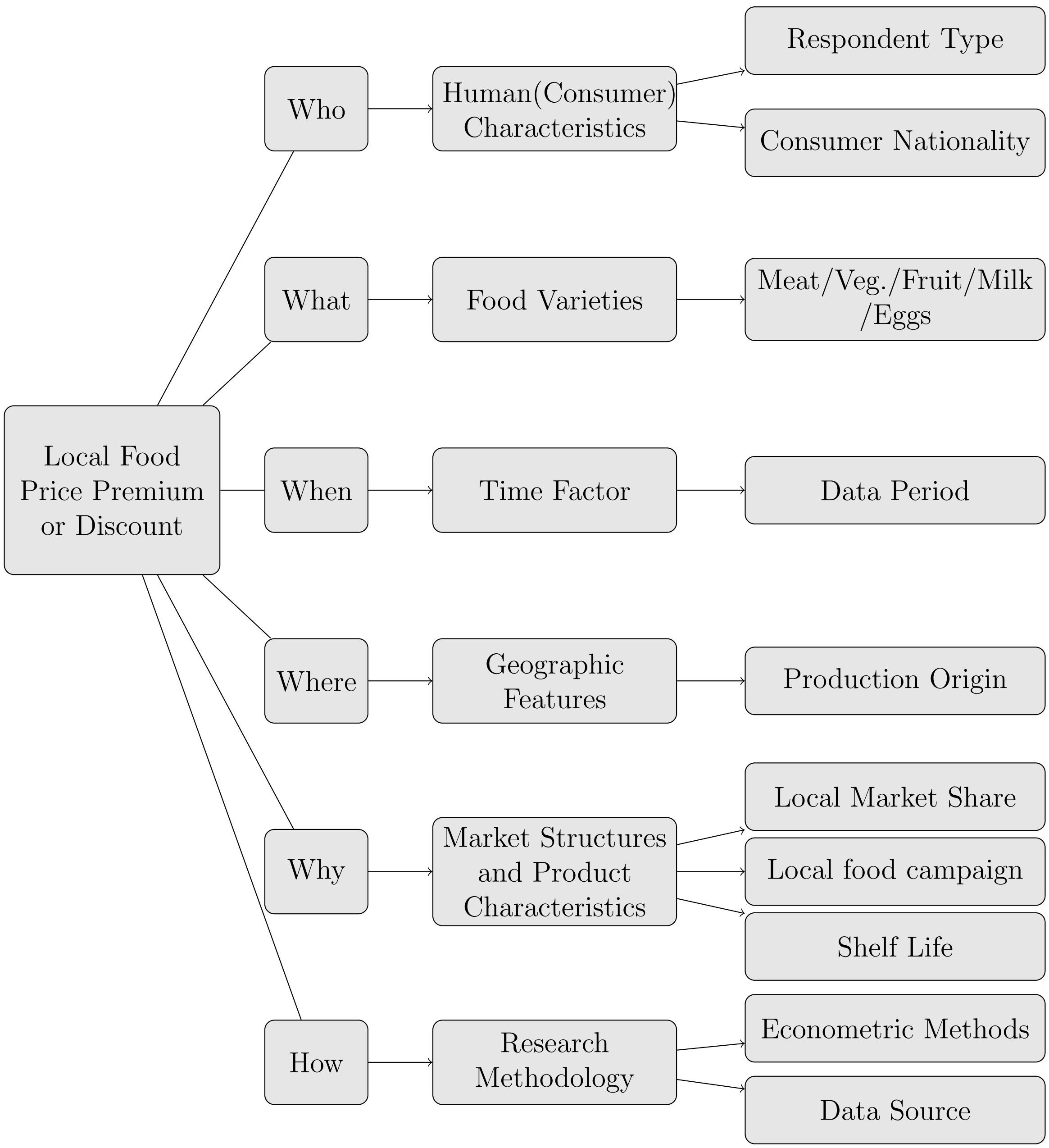

Figure 4.2: “5W1H” Conceptual Scaffold for Candidate Attributes

of locally-grown food more rationally. They are willing to pay a higher price for locally-grown food due to its quality and freshness instead of consumers' intuitive perception. Including the informed consumers allows us to identify whether or not different types of respondents influence the results.

Consumer Nationality People from different countries might cultivate different concepts and evaluations of locally-grown food and produce different results accordingly. Even in a single-area study, consumers' socio-demographic characteristics, such as income, education, age and so on, have statistically significant impacts on their willingness-to-pay for locally-grown food. Moreover, there exist large differences in culture, economics, and demographic composition between countries. Hence, it is reasonable to infer that consumers from different countries might assign different values to the same locally-grown food and further lead to varied empirical results. This study takes the nationality of consumers as an attribute to explain the diverse results.

What: What kinds of foods were included in the studies? Consumers' perceptions may vary by the type of locally-grown foods and consequently produce different price premiums/discounts. Based on our compiled dataset, there are five types of locally grown foods investigated in the existing studies. They include vegetables and fruit, meat, seafood, milk, and eggs. Chen (2015) analyzed the psychological determinants of willingness-to-pay and found that attitudes have positive effects on willingness-to-pay in the case of local and organic eggs and organic tomatoes, but show no effects in the cases of beef and milk. He provided evidence that consumers value types of food differently. It is therefore appropriate to take into account the type of food in explaining the diverse empirical results.

When: What is the time period of data covered? Intuitively, the social atmosphere of supporting local food might affect people's attitudes toward evaluating locally-grown food. If an increasing number of people support locally-grown food, then there may be a higher willingness-to-pay for it. "Go for local" is a global-wide trend in recent time. The increasing prevalence of farmers' markets serve as evidence for the growing demand for local food. Accordingly, the price premiums consumers are willing to pay may differ over time. Hence, the time period of data covered could be one of the factors explaining conflicting empirical results among studies. We expect that the price premium for locally-produced food rises over time.

Where: Where is the location of production of local food? Regional differences – culture, geographies, social bonding and so forth, associated with each region – may be a contributing factor in the wide range of estimates. Furthermore, the characteristics of agricultural and food products may be closely affiliated with their location of origin.[1] Food products with specific geographic indications may assure consumers of a more genuine and higher quality food (Deselnicu et al., 2013). If a local food is also associated with specific characteristics of the region of production, consumers are expected to be willing to pay more for the local product. Hence, it is reasonable to factor in the production origin in the meta-analysis.

Why: Why are other potential factors neglected in existing studies? Some potential attributes which could explain the conflicting estimates of local food prices, might be excluded in the existing studies due to limited scope of studies. Since previous empirical studies usually focused on a specific area and food items, it would not be a surprise if they neglected to include the market structure and product characteristics in their models. These factors may be critical and would affect the price premium/discount of locally-grown food among different regions. In this meta-analysis, we add three variables, namely market share, government campaign, and product shelf life, into the modeling specification.

[1] Well-known examples of geographic indications are the wines of Bordeaux, the cheese of Parma, and so forth.

Market Share Ratio *Food Marketing Institute* launched a nationally representative *U.S. Grocery Shopper Trends Survey* in 2011. This survey highlighted the top four reasons which motivate people to buy locally-grown foods in the grocery store - "freshness," "support of local economy," "taste," and "knowing the source," respectively. Pinchot (2014) also surveyed consumers' preferences and motivations for purchasing local food by different types of buyers. Consumer groups included household consumers, institutional consumers, and wholesale and retail customers. "Freshness and quality" and "support for local farms" are the two important motivations for household and institutional consumers to buy local food. While "support for local economy" is one of the significant factors which could affect price of locally-grown food, this critical determinant has never been examined in the existing literature.[2]

By using the market share ratio of local food, we investigate how the degree of support for the local economy could affect the price premium of local food. People who are more conscientious about supporting the local economy are expected to pay a higher premium for local food. However, in spite of its close link with patriotic concerns, the market share of local food may have a mixed effect on price premiums. On one hand, the larger the market share of local food, the more the consumers would like to pay because of its larger contribution to the local economy. On the other hand, it may also cause contradictory reactions for consumers; people may think that there is no need to support the local economy because local food already has an advantage relative to its imported counterpart.

From the supply side, local producers have higher market power if their market share is larger. Producers may accordingly put pressure on the price for local food. On the other hand, a large market share indicates that local producers may be weighed down by high inventory costs. If local food cannot be exported, local producers may be forced to lower their prices. In sum, it turns out that the impact of market share on price premiums is

[2] In the international trade literature, there are other studies, which address the home bias puzzle (Lopez et al., 2006 and Hanson and Xiang, 2004). Strong consumers' preference for local food over imported food has acted as a natural barrier to food imports.

unclear.

Local Food Campaign Government policies supporting local food purchases, such as promotional advertising, might direct people's attention toward local food. Once the social atmosphere of concern for local food is formed, people may increase their interest in buying local food and subsequently increase their willingness-to-pay for local food. Therefore, this study expects that the price premium may increase if there are special local food campaigns carried out by the local government.

Shelf life Many studies have indicated that freshness has an important impact on consumers' value of local food and further affects consumers' purchasing decisions (see Low et al., 2015, Brown, 2003 and Davidson et al., 2012). Usually, consumers may take shelf life, the length of time during which a stored food remains suitable for consumption, as an indicator of freshness when making purchasing decisions. Grebitus (2013) pointed out that consumers may assign different values to different types of foods according to the shelf life. Since willingness-to-pay reflects consumers' value, different weights of shelf life across different types of foods may lead to varying price premiums. We, therefore, employ shelf life of local food to capture the degree to which the studies varied in evaluating the price premiums for locally-grown food. Its impact on price premiums is uncertain. According to Grebitus (2013), it is expected that the longer the shelf life, the higher the price premium. In some cases, however, the highly perishable foods might be the ones with a higher price premium for consumers.

How: How do the existing studies conduct their empirical experiments? It is well known that different research methodologies, including econometric approaches and data source, drive different results. We elaborate on them in detail below.

Econometric Methods In our compiled dataset, estimation methods include the hedonic method, conjoint analysis, contingent valuation, choice experiment, experimental auction, and questionnaire survey. The methods can be classified into hypothetical and non-hypothetical experiments. According to Martínez-Carrasco et al. (2015), the former does not require a monetary commitment by the participant; while the latter does. For the estimation methods included in our compiled dataset, contingent valuation is classified as a hypothetical experiment, while an experimental auction is considered non-hypothetical. Conjoint analysis and choice experiments could be either hypothetical or non-hypothetical experiments, while the hedonic method is neither. Another type of classification involves revealed versus stated preference methods. Among them, the hedonic method and experimental auction are methods eliciting revealed preferences; conjoint analysis, contingent valuation, choice experiment, and questionnaire survey are methods eliciting stated preferences. Martinez et al. (2010) stated that different methodologies may explain some part of inconsistent empirical results. Hence, we take estimation methods as one of the attributes in conducting the meta-analysis.

Data Sources: Actual Price vs. WTP Based on our compiled dataset, there are two types of data sources. The first is scanner data, which records prices that consumers actually paid; the second is survey data, which indicates the willingness-to-pay value. It is usually believed that the former is closer to consumers' true value for the locally-grown food. Park and Gómez (2010) used the actual retail price data and found that the premiums observed in their study were lower than those in the willingness-to-pay studies. This means that participants may have overstated their price premiums for local food, illustrating that data sources play a crucial role in explaining the estimated price premiums/discounts of locally-grown food. Thus, by taking the data source as an attribute in meta-analysis, we can rigorously examine whether or not consumers overvalue locally produced food when they stated their willingness-to-pay.

4.3 Methodology and Data Description

To identify the determinants of the locally-grown price premium/discount, this study adopts a standard meta-regression analysis presented below:

$$P_i = \beta_0 + \sum_{k=1}^{K} \beta_k X_{ki} + \epsilon_i, \qquad i = 1, 2, ..., N \tag{4.1}$$

where P_i stands for the price premium/discount of locally-grown food in the observation i, X_{ki} are meta-independent variables, which indicate the attributes, and ϵ_i is the residual term.

To gather the observations for our study, we searched for relevant studies from databases of EconLit, Agricola, EBSCO Business Source Primer, AgEcon Search, and Google Scholar. To identify relevant studies we used the following keywords and keyword combinations: "local food/produce prices," "factors of local food/produce price," "locally-grown food/produce," and "price of local food." To ensure we included most if not all of the relevant studies, we searched for cited papers within each study as well. The studies targeted were published before the end of the year 2015.

The included studies reported the estimation results of the price premium/discount of local food. However, they differed in scope (attributes considered and type of food) and in econometric methodology. We excluded studies with processed and/or semi-processed local produce (e.g., Onken et al., 2011, Hu et al., 2009, and Lefèvre, 2014) to mitigate the complexities inherent in locally-processed food. Since some studies provided more than one observation, amongst the 26 empirical studies, there are a total of 49 observations.[3] A summary of the included studies is shown in Table 4.1.

Among the 26 empirical studies, some provided the percentage of premium/discount of local food while some studies only computed the dollar value of price premium/discount of local food. In order to obtain a consistent metric of price premium/discount of local food,

[3]Some studies estimated the price premium/discount for several locally-grown foods separately.

Table 4.1: Summary of Locally Produced Food Valuation Studies Included in the Meta-Analysis

No.	**Authors**	**Year**	**Food Category**	**Method**	**No. of Estimates**	**Price Premium /Discount**
1	Adalja et al.	2015	Meat	Conjoint	3	20.17%; 45.33%; 58.8%
2	Boys et al.	2014	Veg and Fruit	Contingent	1	12%
3	Brown	2003	Veg and Fruit	Questionnaire	1	1.50%
4	Carpio and Isengildina-Massa	2009	Veg and Fruit; Meat	Contingent	2	27%; 23%
5	Costanigro et al.	2011	Veg and Fruit	Field (in-store) Experiment	1	19.67%
6	Darby et al.	2008	Veg and Fruit	Conjoint	2	22.27%; 39.29%
7	Davidson et al.	2012	Seafood	Conjoint	2	43.7%; 39.2%
8	de Magistris and Gracia	2014	Veg and Fruit	Real Choice	1	32.42%
9	Gracia	2014	Meat	Real Choice	1	8.92%
10	Gracia et al.	2011	Meat	Experimental Auction	2	20.45%; 11.19%
11	Gustafsson and Gustafsson	2014	Milk	Questionnaire	1	15%
12	Keahiolalo	2013	Veg and Fruit	Hedonic	1	-5.30%
13	Lim and Hu	2013	Meat	Choice	1	44.38%
14	Loke et al.	2015	Milk	Hedonic	2	17.35%; 17.35%
15	Lopez-Galan et al.	2013	Eggs	Choice	1	77.00%
16	Loureiro and Hine	2002	Veg and Fruit	Contingent	1	9.37%
17	Martinez	2015	Veg and Fruit	Hedonic	2	-37.60%; -14.27%
18	Park and Gómez	2012	Veg and Fruit; Milk	Hedonic	4	16.2%; 8.7%; 20.8%; 0%
19	Roosen et al.	2012	Milk	Choice	1	59.39%
20	Tang	2014	Veg and Fruit; Milk; Eggs	Hedonic	7	0%;0%;58.7%;0%; 70.7%; 10.5%;46.9%
21	Thilmany et al.	2008	Veg and Fruit	Contingent	1	3.50%
22	Ulupono	2011	Veg and Fruit; Milk; Eggs	Questionnaire	4	52.3%; 113.42%; 57.83%; 62.42%
23	Xu et al.	2015	Veg and Fruit	Hedonic	2	-9.52%; -11.93%
24	Xu et al.	2015	Veg and Fruit	Hedonic	2	0%; 0%
25	Loke et al.	2016	Eggs	Hedonic	2	33.76%; 39.74%
26	Yue and Tong	2009	Veg and Fruit	Choice	1	35.73%

Note: 0% price premium reflects that the local price premium was not statistically significant different from zero in the original study.

we employ the following formula to transform the price premium/discount in dollars to percentages.

$$Premium\ or\ Discount(\%) = \left(\frac{P^L - P^M}{P^M}\right) \times 100 \tag{4.2}$$

where P^L stands for the price of local food and P^M stands for the price of imported food. For studies employing an experimental approach where the price of imported food was not given, we follow the method suggested by Deselnicu et al. (2013) and Lusk et al. (2005) and use the median value of the price treatments in the design as the price of imported food to calculate the percentage premium/discount for local food. The last column in Table 4.1 reports the percentage of premium/discount of local food for each studies. The price premium/discount ranges from -37.6% and 113.42%.

Our final dataset consists of the following attributes, most of which are collected from the 26 existing empirical studies. First, respondents targeted in the existing studies are characterized as informed consumers or uninformed consumers. In our compiled dataset, consumers who take part in the actual purchasing or have experience with purchasing the product of interest are classified as informed consumers. Since the studies characterized other consumers as randomly selected, for the purposes of this analysis, we treat them as uninformed consumers. This is to make the distinction between informed and uninformed.[4] Nationalities are composed of the U.S., Spain, Germany, and Sweden. We group consumers into those from the U.S. and from Europe respectively to see if different nationalities lead to different valuations of locally-produced food.

In terms of food varieties, various kinds of food are included - vegetables, fruit, beef, lamb, seafood, milk and eggs. Due to the limited sample size, we categorize food varieties into three groups (vegetables and fruit; meat and seafood; and others) in our meta-analysis. The data periods covered in existing empirical studies are from 2000 to 2014.

[4] We acknowledge that randomly selected consumers may, however, include informed consumers and uninformed consumers.

The data for production origin, representing specific geographic indications of food products are not available. Hence, we decide to exclude the attribute of production origin from our meta-analysis. As for the research methodology, different estimation methods have been adopted in the studies, including the hedonic method, conjoint analysis, contingent valuation, choice experiment, experiment auction, and questionnaires. Due to the small sample size, we simply classify the estimation methods into two types: the hedonic method and the remaining methods. By doing so, the contribution of the hedonic method to the difference of price valuation of local food could be identified. It is noted that the data source, which is represented by WTP and actual prices, is closely associated with the estimation methods.

In addition to the useful information provided above from the 26 existing empirical studies, three variables – market share, campaign, and shelf life – for market structure and product characteristics are created. Since official data for the market share of local food is scarce to date, we need to compute the market share ratios of local food in each individual study for our meta-analysis.[5] However, due to the various definitions of local food, identifying the proper scope of the local market for calculating the market share ratios was rather difficult. To solve this problem, we contacted authors directly and requested that they provide approximate figures on local food market share in their papers. If the authors did not respond, we then contacted the USDA and other renowned experts on local food to obtain more information. In total, we collected 38 observations for computing local food market shares. Again, due to the limited sample size, we simply create a dummy variable which indicates whether or not the market share of local food is over 50%.

For information on "local government campaign," 43 observations are collected following the same method described above. We create a dummy variable indicating if there is a local government campaign during the studying period. As for the variable "shelf life," by referring to Boyer and McKinney (2013), we assign the days of shelf life across different

[5]To calculate market share of local food, the local food must be distinguished from the imported food in data. As far as we know, only the state of Hawaii has the detailed statistics on local and imported food, although it is available only up until 2008.

kinds of foods included in each individual study. In sum, this compiled dataset provides a wealth of information about local food for the meta-analysis. The descriptive statistics of all variables are shown in Table 4.2.

4.4 Model and Estimation Methods

Based on the "5W1H" conceptual framework, after excluding production origin, there are nine candidate attributes used in this meta-analysis. However, in our compiled dataset, the variable indicating the data source, which is represented by actual prices and WTP, completely coincides with the variable denoting the estimation method, which is represented by hedonic analysis and non-hedonic approaches.[6] Consequently, we exclude variables of data sources from our regression. Furthermore, as shown in Table 4.2, compared to 49 observations for other variables in the study, there are only 38 and 43 observations for market share and government campaign, respectively. Due to this incompleteness, we purposely run the estimation in two different model specifications. The basic model specification without market share and government campaign is as follows:

$$\begin{aligned} Premium_i = &\beta_0 + \beta_1(Informed\ Consumers) + \beta_2(Nationality) \\ &+ \beta_3(Veg\ and\ Fruit) + \beta_4(Meat) + \beta_5(Data\ Year) \\ &+ \beta_6(Shelf\ Life) + \beta_7(Hedonic) + \epsilon_i \end{aligned} \tag{4.3}$$

Then, the extended model specification including these two market structure variables is estimated:

$$\begin{aligned} Premium_i = &\beta_0 + \beta_1(Informed\ Consumers) + \beta_2(Nationality) \\ &+ \beta_3(Veg\ and\ Fruit) + \beta_4(Meat) + \beta_5(Data\ Year) \\ &+ \beta_6(Shelf\ Life) + \beta_7(Hedonic) \\ &+ \beta_8(Market\ Share) + \beta_9(Campaign) + \epsilon_i \end{aligned} \tag{4.4}$$

[6] The correlation matrices are available upon request.

Table 4.2: Description of Variables

Variable	**Definition**	**Mean**	**Min**	**Max**	**Obs**
Premium	Percentage price premium for local food.	0.248 (0.278)	-0.376	1.1342	49
Informed Consumers	1 if the respondants are informed consumers; 0 if uninformed consumers	0.673 (0.474)	0	1	49
Nationality	1 if the respondants are American; 0 otherwise (e.g., European)	0.816 (0.391)	0	1	49
Veg.&Fruit	1 if the product are Veg. and Fruit; 0 otherwise	0.551 (0.503)	0	1	49
Meat	1 if the product are Meat and Seafood; 0 otherwise	0.204 (0.407)	0	1	49
Other Food	1 if the product are other than veg., fruit, meat and seafood; 0 otherwise	0.245 (0.434)	0	1	49
Data Year	Year of the data collected.	10.449 (2.777)	1	15	49
Market Share	1 if the local market share is over 50%; 0 if less than 50%	0.158 (0.370)	0	1	38
Campaign	1 if there is local food campaign held by local government; 0 otherwise	0.814 (0.394)	0	1	43
Shelf Life	Days of shelf life for each product.	13.898 (19.580)	2	120	49
Hedonic	1 if methodology is Hedonic; 0 otherwise	0.449 (0.503)	0	1	49
Actual Price	1 if the data from actual paid price; 0 if WTP	0.449 (0.503)	0	1	49

1. Numbers in parentheses are the standard errors.
2. For *Data Year*, 1 to 15 represents Year 2000 to Year 2014, respectively.

In addition to the simple ordinary least squares equation (OLS), a weighted least squares approach (WLS) is also employed in consideration of sample size differences.[7] Generally speaking, WLS indicates that the estimates generated from a larger sample size will have a greater effect on the price premiums of local food than that from a smaller sample. The residuals could be correlated across studies when some premium estimates are obtained from the same study. Therefore, random effects models are also examined and estimated. However, the results of Breusch-Pagan Lagrange multiplier tests showed that the hypothesis that within-study variances equal zero cannot be rejected. This indicates that the ordinary least squares is the appropriate estimation method.

4.5 Empirical Results

Estimation results are shown in Table 4.3 where the results of OLS and WLS for both basic and extended models are reported. We find that consumer experience in buying food is not a statistically significant attribute influencing the price premium of local food in all models. Interestingly, U.S. consumers seem more inclined to pay a higher premium for local food compared to European consumers, although the coefficient of the variable is not statistically significant in the extended OLS model. The results suggest U.S. consumers are willing to pay 21.7%, 22.4%, and 47.3% more in the basic OLS, basic WLS, and extended WLS models, respectively.

The empirical results also suggest that the type of food might be an important contributing factor to the price premium of local food. Although $Veg.\&Fruit$ has a negative but statistically insignificant effect on the price premium in all four regressions, $Meat$ is an important variable except for in the extended OLS model. The coefficient on $Meat$ indicates that consumers are willing to pay a lower premium for locally-produced meat compared to milk and eggs. The magnitudes are -19.8% and -22.7% in the basic OLS and WLS models, respectively, and -28.5% in the extended WLS model. This finding is also consistent with

[7] Sample sizes in the 26 existing studies ranged from 38 to 10,469.

Table 4.3: Estimation Results

Variable	Basic_OLS	Basic_WLS	Ext_OLS	Ext_WLS
Informed	0.051	0.010	-0.085	-0.166
Consumers	(0.091)	(0.090)	(0.136)	(0.122)
Nationality	0.217**	0.224**	0.234	0.473*
	(0.099)	(0.097)	(0.277)	(0.262)
Veg&Fruit	-0.124	-0.130	-0.117	-0.122
	(0.083)	(0.081)	(0.102)	(0.098)
Meat	-0.198*	-0.227**	-0.269	-0.285*
	(0.109)	(0.104)	(0.172)	(0.159)
Data Year	0.047***	0.055***	0.063***	0.068***
	(0.014)	(0.012)	(0.020)	(0.016)
Shelf Life	0.001	0.001	0.001	0.005**
	(0.002)	(0.002)	(0.003)	(0.002)
Hedonic	-0.445***	-0.470***	-0.444***	-0.440***
	(0.100)	(0.093)	(0.112)	(0.102)
Market Share			0.014	0.073
			(0.121)	(0.118)
Campaign			0.038	0.063
			(0.140)	(0.145)
Constant	-0.161	-0.225	-0.283	-0.594*
	(0.198)	(0.189)	(0.347)	(0.316)
N	49	49	38	38
r2	0.468	0.643	0.532	0.806
r2_a	0.378	0.582	0.381	0.744
rmse	0.220	0.197	0.233	0.152

1. *,**,*** indicate 10, 5, 1 percent level of significance respectively.
2. Numbers in parentheses are the standard errors.

Chen's (2015) argument. That is, people assign different values across different types of foods.

The variable *Date Year* has a positive and statistically significant effect on price premium, although the magnitudes are rather small in all four models. This implies that, over time, consumers have gradually become more willing to pay a higher premium for local food, providing evidence that consumers are more concerned about local food nowadays. As for the estimation method, the coefficients of *Hedonic* are negative and statistically significant in all four regressions. It indicates that the hedonic approach generates a lower price premium than other methods. The estimated price premiums in hedonic models are about 45%

less than those in other models. Furthermore, the data sources of the hedonic methods are either from scanner data or from actual retail shelf prices, while data sources of other methods mostly come from willingness-to-pay valuations. Hence, it could be interpreted that the actual price paid by consumers is relatively lower than their expressed willingness-to-pay. In other words, consumers seem to overstate their willingness to pay for local food.

The coefficient of $Shelf\ Life$ in the extended WLS model is positive and statistically significant. Although the coefficients of $Market\ Share$ and $Campaign$ are all positive but not statistically significant, the positive effects of $Market\ Share$ on price premium still provide useful insights. It indicates that consumers have a strong incentive to support the local economy. The more the local food sector represents local economic activities, the more consumers are willing to pay the price premium for local food. Producers of local food with larger market shares may also have strong market power and therefore set a higher price. Unfortunately, it is difficult to differentiate these two factors from each other in the study. Finally, the positive sign of local campaign is consistent with the prediction, implying that the government may play an important role on this issue.

4.6 Concluding Remarks

Understanding the existence and extent of the price premium/discount of local foods as well as its underlying determinants can be of utmost concern to local producers, agribusinesses, and policy makers alike. Although there are a number of studies that have examined the price premiums of several locally-grown food products across different regions, the results are far from conclusive with respect to the existence of price premiums and the levels of the price differentials of locally-produced food products versus their imported counterparts. This study aims to fill this gap by addressing an important question: what are the critical determinants for the existence and level of local food price premium or discount? We attempt to address this question by conducting a standard meta-analysis based on the empirical evidence of local food price premiums derived from a sample of 49 estimates obtained from 26 studies. Our findings show that U.S. consumers tend to pay a higher premium for local food than their European counterparts. Studies using actual market prices generate a lower price premium for locally-produced food than those with a willingness-to-pay value. This may imply that consumers tend to overstate their value for locally-produced food in a hypothetical willingness to pay situation. Among the types of local food, consumers' attitudes toward meat are significantly different from those toward milk and eggs. Furthermore, our results reflect that, over time, consumers are increasingly interested in local food.

In summary, the outcomes of relevant studies should be interpreted with caution. For example, some studies suggest that governments and producers in all countries should provide consumers with more persuasive information about the attributes of local food, and investigate whether the prices charged are consistent with consumers' perceptual values. However, production and marketing decisions based on this information may seem inappropriate because consumers' willingness-to-pay values are typically overstated, as demonstrated by our study. Additionally, the patriotic concern in support of local economies may be a critical reason that households purchase local food. However, as indicated in Pinchot (2014), the pertinence of the consumer patriotic bias toward local food may need further investigations.

Not for publication:

Supplemental Appendix

Table 4.4: Correlation Matrix for the Basic Model

obs=49	**(1) Premium**	**(2) Informed Consumers**	**(3) Nationality**	**(4) Veg&Fruit**	**(5) Meat**	**(6) Data Year**	**(7) Shelf Life**	**(8) Hedonic**	**(9) Actual Price**
(1)	1.000								
(2)	-0.155	1.000							
(3)	-0.109	0.119	1.000						
(4)	-0.316	0.071	0.314	1.000					
(5)	0.123	-0.295	-0.283	-0.561	1.000				
(6)	0.291	0.304	-0.172	-0.375	0.120	1.000			
(7)	0.047	0.187	-0.155	0.131	-0.311	-0.090	1.000		
(8)	-0.424	0.629	0.428	0.237	-0.457	0.241	0.026	1.000	
(9)	-0.424	0.629	0.428	0.237	-0.457	0.241	0.026	1.000	1.000

Table 4.5: Correlation Matrix for the Extended Model

obs=38	**(1) Premium**	**(2) Informed Consumers**	**(3) Nationality**	**(4) Veg&Fruit**	**(5) Meat**	**(6) Data Year**	**(7) Shelf Life**	**(8) Hedonic**	**(9) Actual Price**	**(10) Market Share**	**(11) Campaign**
(1)	1.000										
(2)	-0.167	1.000									
(3)	-0.162	0.078	1.000								
(4)	-0.327	0.099	0.051	1.000							
(5)	0.186	-0.448	0.102	-0.536	1.000						
(6)	0.316	0.476	-0.132	-0.379	0.120	1.000					
(7)	-0.007	0.193	-0.542	0.107	-0.273	-0.072	1.000				
(8)	-0.450	0.684	0.224	0.119	-0.411	0.352	-0.008	1.000			
(9)	-0.450	0.684	0.224	0.119	-0.411	0.352	-0.008	1.000	1.000		
(10)	0.090	0.008	-0.221	0.054	0.010	0.266	-0.187	0.023	0.023	1.000	
(11)	-0.134	0.444	0.456	0.243	-0.485	0.103	-0.148	0.490	0.490	-0.130	1.000

Bibliography

Adalja, A., Hanson, J., Towe, C., and Tselepidakis, E. (2015). An examination of consumer willingness to pay for local products. *Agricultural and Resource Economics Review*, 44(3):253–274.

Ahuja, A., Cheung, L., Han, G., Porter, N., and Zhang, W. (2010). Are house prices rising too fast in china? *IMF Working Papers*, No. 10/274.

Allen, F. and Carletti, E. (2010). What should central banks do about real estate prices? *Paper presented at the conference of Columbia University's Center on Capitalism and Society on Microfoundations for Modern Macroeconomics.*

Aregger, N., Brown, M., and Rossi, E. (2013). Transaction taxes, capital gains taxes and house prices.

Bahmani-Oskooee, M., Hegerty, S. W., and Wilmeth, H. (2008). Short-run and long-run determinants of income inequality: evidence from 16 countries. *Journal of Post Keynesian Economics*, 30(3):463–484.

Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of Economic Growth*, 5(1):5–32.

Best, R. (2008). An introduction to ECM. *https://www.coursehero.com/file/13398891/Error-Correction-Model-Slidespdf/.*

Binatli, A. O. (2012). Growth and income inequality: a comparative analysis. *Economics Research International*, 2012.

Boushey, H. and Price, C. (2014). How are economic inequality and growth connected? a review of recent research. *Washington Center for Equitable Growth,, Washington, DC.*

Boyer, R. R. and McKinney, J. M. (2013). Food storage guidelines for consumers.

Boys, K. A., Willis, D. B., and Carpio, C. E. (2014). Consumer willingness to pay for organic and locally grown produce on dominica: insights into the potential for an organic island. *Environment, development and sustainability*, 16(3):595–617.

Brown, C. (2003). Consumers' preferences for locally produced food: a study in southeast missouri. *American Journal of Alternative Agriculture*, 18(4):213–224.

Carpio, C. E. and Isengildina-Massa, O. (2009). Consumer willingness to pay for locally grown products: the case of south carolina. *Agribusiness*, 25(3):412–426.

Castelló, A. and Doménech, R. (2002). Human capital inequality and economic growth: some new evidence. *The Economic Journal*, 112(478):C187–C200.

Çelik, S. and Basdas, U. (2010). How does globalization affect income inequality? a panel data analysis. *International advances in economic research*, 16(4):358–370.

Chambers, D. (2010). Does a rising tide raise all ships? the impact of growth on inequality. *Applied Economics Letters*, 17(6):581–586.

Chang, J. Y. and Ram, R. (2000). Level of development, rate of economic growth, and income inequality. *Economic Development and Cultural Change*, 48(4):787–799.

Chen, X. (2015). Consumers' willingness to pay for organic and local food: an experimental study using structural equation modeling. Master's thesis, University of Delaware.

Cingano, F. (2014). Trends in income inequality and its impact on economic growth. *OECD Social, Employment and Migration Working Papers*, No. 163.

Cooper, H. (2009). *Research synthesis and meta-analysis: a step-by-step approach*, volume 2. Sage publications.

Costanigro, M., McFadden, D. T., Kroll, S., and Nurse, G. (2011). An in-store valuation of local and organic apples: the role of social desirability. *Agribusiness*, 27(4):465–477.

Crowe, C., Dell'Ariccia, G., Igan, D., and Rabanal, P. (2013). How to deal with real estate booms: lessons from country experiences. *Journal of Financial Stability*, 9(3):300–319.

Dahlby, B. and Ferede, E. (2013). Income inequality, redistribution and economic growth. *The School of Public Policy SPP Research Papers*, 6(25):1–41.

Darby, K., Batte, M. T., Ernst, S., and Roe, B. (2008). Decomposing local: a conjoint analysis of locally produced foods. *American Journal of Agricultural Economics*, 90(2):476–486.

Davidson, K., Pan, M., Hu, W., and Poerwanto, D. (2012). Consumers'willingness to pay for aquaculture fish products vs. wild-caught seafood-a case study in hawaii. *Aquaculture Economics & Management*, 16(2):136–154.

de Magistris, T. and Gracia, A. (2014). Do consumers care about organic and distance labels? an empirical analysis in spain. *International Journal of Consumer Studies*, 38(6):660–669.

Deselnicu, O. C., Costanigro, M., Souza-Monteiro, D. M., and McFadden, D. T. (2013). A meta-analysis of geographical indication food valuation studies: what drives the premium for origin-based labels. *Journal of Agricultural and Resource Economics*, 38(2):204–19.

Dreher, A. and Gaston, N. (2008). Has globalization increased inequality? *Review of International Economics*, 16(3):516–536.

Engle, R. F. and Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica*, 55(2):251–276.

Fawaz, F., Rahnama, M., and Valcarcel, V. J. (2014). A refinement of the relationship between economic growth and income inequality. *Applied Economics*, 46(27):3351–3361.

Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *The American Economic Review*, 90(4):869–887.

Gracia, A. (2014). Consumers' preferences for a local food product: a real choice experiment. *Empirical Economics*, 47(1):111–128.

Gracia, A., de Magistris, T., and Nayga Jr, R. M. (2011). Willingness to pay for a local food label for lamb meat in spain. In *2011 International Congress, August 30-September 2, 2011, Zurich, Switzerland*, number 114607. European Association of Agricultural Economists.

Grebitus, C. (2013). Paying a premium for shelf life. *Asia Pacific Food Industry*, April/May:52–54.

Gustafsson, A. and Gustafsson, S. (2014). Consumer wtp for local and organic milk: Evidence from piteå, sweden. Master's thesis, Lulea University of Technology.

Halter, D., Oechslin, M., and Zweimüller, J. (2014). Inequality and growth: the neglected time dimension. *Journal of Economic Growth*, 19(1):81–104.

Hanson, G. H. and Xiang, C. (2004). The home-market effect and bilateral trade patterns. *The American Economic Review*, 94(4):1108–1129.

Heshmati, A. and Lee, S. (2010). The relationship between globalization, economic growth and income inequality. *Journal of Globalization Studies*, 1(2):87–117.

Hu, W., Woods, T., and Bastin, S. (2009). Consumer acceptance and willingness to pay for blueberry products with nonconventional attributes. *Journal of Agricultural and Applied Economics*, 41(1):47–60.

Huang, H. C. R., Fang, W., Miller, S. M., and Yeh, C. C. (2015). The effect of growth volatility on income inequality. *Economic Modelling*, 45:212–222.

Hui, E. C.-M., Ng, I., and Lau, O. M.-F. (2011). Speculative bubbles in mass and luxury properties: an investigation of the hong kong residential market. *Construction Management and Economics*, 29(8):781–793.

IMF (2010). *World Economic Outlook: Recovery, Risk and Rebalancing (Box 1.2 Dismal Prospects for the Real Estate Sector).* International Monetary Fund, Washington DC.

IMF (2016). Government finance statistics http://data.imf.org/?sk=a0867067-d23c-4ebc-ad23-d3b015045405&ss=1409151240976.

Ines Sim David, M. (2011). Globalization and income inequality in Brazil. *Aarhus School of*

Business, Aarhus University, Master of Science in International Business.

Jain-Chandra, S., Kinda, T., Kochhar, K., Piao, S., and Schauer, J. (2016). Sharing the growth dividend: analysis of inequality in Asia. *IMF Working Papers*, No. 16/48.

Jian, T., Sachs, J. D., and Warner, A. M. (1996). Trends in regional inequality in China. *China Economic Review*, 7(1):1–21.

Kang, J. W. (2015). Interrelation between growth and inequality. *Asian Development Bank Economics Working Paper Series*, No.447.

Keahiolalo, K. (2013). Hedonic price analysis of fresh packaged tomatoes in the honolulu market: an exploratory investigation. Master's thesis, Master's capstone paper, Department of Economics, University of Hawaii at Manoa.

Kiyota, K. (2012). Trade liberalization, economic growth, and income distribution in a multiple-cone neoclassical growth model. *Oxford Economic Papers*, 64(4):655–674.

Knowles, S. (2005). Inequality and economic growth: the empirical relationship reconsidered in the light of comparable data. *The Journal of Development Studies*, 41(1):135–159.

Krongkaew, M. and Kakwani, N. (2003). The growth–equity trade-off in modern economic development: the case of Thailand. *Journal of Asian Economics*, 14(5):735–757.

Kuznets, S. (1955). Economic growth and income inequality. *The American Economic Review*, 45(1):1–28.

Lefèvre, M. (2014). Do consumers pay more for what they value more? the case of local milk-based dairy products in senegal. *Agricultural and Resource Economics Review*, 43(1):158–177.

Li, H. and Zou, H. (1998). Income inequality is not harmful for growth: theory and evidence. *Review of Development Economics*, 2(3):318–334.

Lim, K. H. and Hu, W. (2013). How local is local? consumer preference for steaks with different food mile implications. In *2013 Annual Meeting; Feb*, pages 2–5.

Lo, D. C. (2013). The effectiveness of specifically selected goods and services tax and its impact on income distribution. *Research Paper.*

Loke, M. K., Xu, X., and Leung, P. (2015). Estimating organic, local, and other price premiums in the hawaii fluid milk market. *Journal of dairy science*, 98(4):2824–2830.

Loke, M. K., Xu, X., and Leung, P. (2016). Estimating local, organic, and other price premiums of shell eggs in hawaii. *Poultry science*, 95(5):1050–1055.

Lopez, R. A., Pagoulatos, E., and Gonzalez, M. A. (2006). Home bias and us imports of processed food products. *The North American Journal of Economics and Finance*, 17(3):363–373.

Lopez-Galan, B., Gracia, A., and Barreiro-Hurle, J. (2013). What comes first, origin or production method? an investigation into the relative importance of different attributes in the demand for eggs. *Spanish Journal of Agricultural Research*, 11(2):305–315.

Loureiro, M. L. and Hine, S. (2002). Discovering niche markets: a comparison of consumer willingness to pay for local (colorado grown), organic, and gmo-free products. *Journal of Agricultural and Applied Economics*, 34(3):477–488.

Low, S. A., Adalja, A., Beaulieu, E., Key, N., Martinez, S., Melton, A., Perez, A., Ralston, K., Stewart, H., Suttles, S., Vogel, S., and B. R Jablonski, B. (2015). *Trends in US Local and Regional Food Systems: report to Congress*. USDA.

Lundberg, M. and Squire, L. (2003). The simultaneous evolution of growth and inequality. *The Economic Journal*, 113(487):326–344.

Lusk, J. L., Jamal, M., Kurlander, L., Roucan, M., and Taulman, L. (2005). A meta-analysis of genetically modified food valuation studies. *Journal of Agricultural and Resource Economics*, 30(1):28–44.

Majumdar, S. and Partridge, M. D. (2009). Impact of economic growth on income inequality: a regional perspective. *Paper presented at the Agricultural and Applied Economics Association 2009 AAEA and ACCI Joint Annual Meeting, Milwaukee, Wisconsin.*

Martinez, S., Hand, M., Da Pra, M., Pollack, S., Ralston, K., Smith, T., Vogel, S., Clark, S., Lohr, L., Low, S., and Newman, C. (2010). Local food systems: Concepts, impacts, and issues. *USDA, Economic Research Report, ERR-97.*

Martinez, S. W. (2015). Fresh apple and tomato prices at direct marketing outlets versus competing retailers in the u.s. mid-atlantic region. *Journal of Business & Economics Research (JBER)*, 13(4):241–252.

Martínez-Carrasco, L., Brugarolas, M., Martínez-Poveda, A., and Ruiz-Martínez, J. J. (2015). Comparing hypothetical versus non-hypothetical methods for measuring willingness to pay in a food context. *Spanish Journal of Agricultural Research*, 13(4):1–12.

Muinelo-Gallo, L. and Roca-Sagalés, O. (2011). Economic growth and inequality: the role of fiscal policies. *Australian Economic Papers*, 50(2-3):74–97.

Muinelo-Gallo, L. and Roca-Sagalés, O. (2013). Joint determinants of fiscal policy, income inequality and economic growth. *Economic Modelling*, 30:814–824.

Neves, P., Silva, S., and Afonso, O. (2012a). A meta-analysis assessment of the effects of inequality on growth. *CEF.UP Working Paper*, No. 2012-04.

Neves, P., Silva, S., and Afonso, Ó. (2012b). A meta-analytic assessment of the effects of inequality on growth. Technical report, Universidade do Porto, Faculdade de Economia do Porto.

Nissim, B. D. (2007). Economic growth and its effect on income distribution. *Journal of*

Economic Studies, 34(1):42–58.

OECD (2012). Reducing income inequality while boosting economic growth: can it be done? *Economic Policy Reforms 2012: Going for Growth*, 181–202.

Onken, K. A., Bernard, J. C., and Pesek Jr, J. D. (2011). Comparing willingness to pay for organic, natural, locally grown, and state marketing program promoted foods in the mid-atlantic region. *Agricultural and Resource Economics Review*, 40(1):33–47.

Ostry, M. J. D., Berg, M. A., and Tsangarides, M. C. G. (2014). *Redistribution, inequality, and growth*. International Monetary Fund.

Park, K. and Gómez, M. I. (2010). Do price premiums exist for local products? *Journal of Food Distribution Research*, 42(1):145–152.

Pinchot, A. (2014). *The Economics of Local Food Systems: A Literature Review of the Production, Distribution, and Consumption of Local Food*. University of Minnesota.

Roosen, J., Köttl, B., and Hasselbach, J. (2012). Can local be the new organic? food choice motives and willingness to pay. In *Selected paper for presentation at the American Agricultural Economics Association Food Environment symposium*, pages 30–31.

Rubin, A. and Segal, D. (2015). The effects of economic growth on income inequality in the US. *Journal of Macroeconomics*, 45:258–273.

Shin, I. (2012). Income inequality and economic growth. *Economic Modelling*, 29(5):2049–2057.

Slemrod, J. (1998). Methodological issues in measuring and interpreting taxable income elasticities. *National Tax Journal*, pages 773–788.

Slemrod, J., Weber, C., and Shan, H. (2015). The behavioral response to housing transfer taxes: evidence from a notched change in D.C. policy.

Tang, Y. (2014). A case study of price premiums for local foods. Master's thesis, Cornell University.

Thilmany, D., Bond, C. A., and Bond, J. K. (2008). Going local: exploring consumer behavior and motivations for direct food purchases. *American Journal of Agricultural Economics*, 90(5):1303–1309.

Tribble, R. (1999). A restatement of the s-curve hypothesis. *Review of Development Economics*, 3(2):207–214.

Ulupono (2011). Local food market demand study of oahu shopper.

USDA (2014). Economic research service using usda, agricultural marmarket service, farmers' market survey.

Voitchovsky, S. (2005). Does the profile of income inequality matter for economic growth? *Journal of Economic Growth*, 10(3):273–296.

Wahiba, N. F. and El Weriemmi, M. (2014). The relationship between economic growth and income inequality. *International Journal of Economics and Financial Issues*, 4(1):135–143.

Xu, X., Keahiolalo, K., Loke, M. K., and Leung, P. (2015a). Local premium or local discount: the case of packaged fresh tomatoes in hawaii. *Journal of Agricultural and Applied Economics*, 47(3):345–358.

Xu, X., Loke, M. K., and Leung, P. (2015b). Is there a price premium for local food? the case of the fresh lettuce market in hawaii. *Agricultural and Resource Economics Review*, 44(1):110–123.

Yue, C. and Tong, C. (2009). Organic or local? investigating consumer preference for fresh produce using a choice experiment with real economic incentives. *HortScience*, 44(2):366–371.

Yusuf, A. A. et al. (2005). A survey on growth and inequality: does improved inequality data have anything to say? Technical report, Department of Economics, Padjadjaran University.

Zhuang, J., Kanbur, R., and Rhee, C. (2014). What drives Asia's rising inequality? *Inequality in Asia and the Pacific-Trends, Drivers, and Policy Implication*, 37–57.