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among Foreign-Born Workers

in U.S. Metropolitan Areas

A dissertation submitted in partial satisfaction

of the requirements for the degree

Doctor of Philosophy in Geography

by

Chuncui Fan

2014

ABSTRACT OF THE DISSERTATION

A Spatial Analysis of Wage Inequality

among Foreign-Born Workers

in U.S. Metropolitan Areas

by

Chuncui Fan

Doctor of Philosophy in Geography

University of California, Los Angeles, 2010

Professor C. Cindy Fan, Co-Chair

Professor David L. Rigby, Co-Chair

This dissertation extends and connects prior research on wage inequality and immigration to the U.S.. Focusing on evidences derived from cross-metropolitan comparisons, it finds unique temporal trends and spatial patterns of wage inequality among immigrant workers, identifies wage differentials among immigrant groups by individual characteristics, and evaluates the roles of different labor market conditions in determining changes in immigrant wage inequality and their spatial variations. These findings point to the fact that race and ethnicity and geography are two key factors in understanding immigrant wage inequality. While race and ethnicity play an increasingly important role in determining wage disparities among immigrant workers, wage inequality of immigrant workers also depends on their settlement patterns and labor

market conditions in their destinations. Wage inequality among immigrants in the U.S. is a function of different types of metropolitan areas, which serve as urban contexts to accommodate racial and ethnic concentration of immigrant workers and their divergent historical economic incorporation.

Using the Integrated Public Use Microdata Sample (IPUMS) data of the Decennial Census for the years 1980, 1990, 2000 and pooled 5-year ACS data in 2009, my empirical analysis shows that immigrants had wider wage gap and higher rates of inequality growth during the past three decades than the native-born workers in the U.S.. There was great heterogeneity in urban wage inequality among immigrant workers. But all metropolitan areas experienced a rapid growth in wage inequality since 1980. A decomposition of wage inequality of the overall labor force in the U.S. by nativity shows that immigrant wage inequality and their local income shares both had an impact on the contribution of immigrant wage inequality to wage inequality of the overall labor force.

An examination of immigrant wage differentials between educational and racial and ethnic groups finds rapid growths in three-decade wage gaps between college graduates and high-school dropouts and that between White and Hispanic foreign-born workers. Among different sources of growth in immigrant wage inequality, the contribution of residual wage inequality declined moderately while the contribution of race and ethnicity continued to grow rapidly during the past three decades.

Finally, focusing on labor market level attributes, panel regression models suggest that city population size, R&D spending, structural shifts from manufacturing to services employment, de-unionization in the labor force all contributed significantly to changes in

overall and residual wage inequality among both male and female immigrant workers in U.S. metropolitan areas. To certain extent, geography also explained inter-metropolitan variations in overall wage inequality and in residual wage inequality among immigrant workers. For both genders, wage inequalities among immigrant workers tended to be lower in former immigrant gateway metros than in low-immigrant metros. Major-continuous gateway cities were more likely to have significantly higher levels of residual wage inequality among male immigrant workers than low-immigrant metropolitan areas.

The dissertation of Chuncui Fan is approved.

William A. V. Clark

Paul Ong

David L. Rigby, Committee Co-Chair

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2014

To my family Ji, Zhixin, Li, and Caroline

for their unconditional support.

And to my teachers and friends

for their lasting inspiration and tremendous encouragement.

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Chapter 1

Introduction

1.1 Background Information and Statement of the Problem

Wage inequality varies markedly over time and across space. Long a topic of considerable interest among academic researchers, the relatively recent rapid growth of wage inequality has become a focus of government policy and in media/public discussion around the globe. In the U.S., there has been a sharp increase in wage inequality among employed workers since the late-1970s. Studies of long-term trends in overall wage inequality in the U.S. show that while wages grew for both low- and high-wage earners, the overall wage gap between the 90th and 10th percentiles of the U.S. wage distribution increased rapidly over the past four decades (Autor, Katz, and Kearney 2008; Bound and Johnson 1992; Card and DiNardo 2002; Juhn, Murphy, and Pierce 1993; Katz and Murphy 1992; Murphy and Welch 1992; Lemieux 2006). Compared to a somewhat more equal wage distribution before the 1970s, earnings growth has polarized significantly since the 1980s. This temporal contrast is sharp between the 90th and 10th percentiles because earnings growth has been much faster in the upper percentiles of the wage distribution than in the lower percentiles. In 1973, the 90/10 wage ratio, the log weekly earnings ratio of workers at the 90th percentile of the wage distribution to those at the 10th percentile was 1.2. By 2005, the 90/10 ratio registered 1.67(Autor, Katz, and Kearney 2008).

In fact, changes in overall U.S. wage inequality are more complicated than simple pronouncements about growth in the 1980s and the wide gap between the 90th and the 10th percentiles suggest. Several features are highlighted in previous work. First, the rapid growth of wage inequality in the 1980s slowed down in the 1990s. The "fanning out" of the wage distribution of the overall labor force in the 1980s reflected the sharp growth of wage inequality in both the upper and lower tails. However, while inequality in the upper half of the wage distribution, summarized by the 90/50 percentile wage gap, has increased since the 1980s, wage inequality in the lower half, summarized by the 50/10 percentile log hourly wage gap, has remained more or less constant for female workers and it has declined for male workers (Lemieux 2008; Card and DiNardo 2002; Autor, Katz, and Kearney 2008). A narrowing of divergence in the bottom half of the wage distribution through the 1990s accounts for the deceleration of overall wage inequality growth thereafter (Autor, Katz, and Kearney 2008).

Further decomposition of overall wage inequality reveals that between-group and within-group wage differentials by education and experience contribute differently to temporal changes in overall inequality. Educational and occupational wage differentials widened in the 1980s, increasing between-group inequality, and these differentials have continued to increase, though at a less rapid rate, in subsequent years (Katz and Murphy 1992; Bound and Johnson 1992; Autor, Lawrence, and Alan 1998; Autor, Katz, and Kearney 2008). Since the late-1970s,

within-group wage inequality, generally defined as wage gaps conditioned on measures of education, age (used as a proxy of work experience) and gender, has increased steadily throughout the U.S.. The rise in within-group inequality accounted for one-quarter to one-half of the overall increase in U.S. wage inequality over the last 30 years (Machin 2008; Leonardi 2004).

In contrast to the profuse literature on wage inequality over time at the national level, much less work has been conducted on the sub-national geography of U.S. wage inequality. A small body of work that has examined regional wage inequality patterns suggests a more complicated reality that lies beneath the aggregate national story. According to the Census Tabulation, U.S. national inequality levels, measured by the Gini coefficient, have increased since1967, reaching a peak in 2009 (Census Bureau, 2010). Yet there is significant variation in inequality levels across states (Bernard and Jensen 1998; McCall 2001; Morrill 2000; Partridge and Rickman 2006; Fan and Casetti 1994). Wage gaps are most prominent in states such as New York, Connecticut and Texas, where shares of both high-income and low-income jobs exceed the national average. On the other end of the scale, Alaska, Utah, Wyoming, Idaho and Hawaii have the smallest Gini coefficients for inequality. Income disparities in U.S. regions have grown at an uneven rate since the 1960s (Bernstein, McNichol, and Nicholas 2008; Lynch 2003). However, studies on more detailed geographies of income inequality, such as wage distribution patterns in

metropolitan areas are lacking. Likewise, detailed explanations of regional disparities are rarely the focus of much attention.

A supply and demand framework is traditionally used to explain changes in U.S. wage inequality over time (Acemoglu 2002; Autor, Katz, and Kearney 2008; Katz and Murphy 1992; Bound and Johnson 1992; Juhn, Murphy, and Pierce 1993). As proposed by Katz and Autor (Katz and Autor 1999) in their supply-demand-institution (SDI) explanation, the wages of an individual are composed of two parts: the competitive wage given by the interaction of demand and supply and a deviation from the competitive level caused by institutional factors such as unions and minimum wage legislation.

Changes in wage inequality can be decomposed into different sources of growth: between- and residual/within-group wage inequality (Levy and Murnane 1992). Both between- and within-group wage inequalities can be attributed to changes in the demand for skills, which lead to increasing returns to observed and unobserved characteristics of workers. While observed human capital variables, such as education, work experience, and gender, all contribute to a widening overall wage gap, residual wage inequality also increased steadily throughout the past three decades (Chinhui Juhn, Murphy, and Brooks Pierce, 1993, Acemoglu 2002, Katz and Autor 1999). The latter is generally believed to account for most of the growth in overall wage inequality (Chinhui Juhn, Murphy, and Brooks Pierce, 1993, JMP; Machin, 2008). The growth in residual/within-group wage disparities is largely attributed to

increasing returns to unobserved skills and the growing unobserved heterogeneity among workers (Bound and Johnson 1992; Juhn, Murphy, and Pierce 1993; Katz and Murphy 1992; Lemieux 2006).

In terms of labor market level factors on the demand side, traditional explanations of wage inequality emphasize declines in the real value of the minimum wage and declining rates of unionization. More recently, three major factors have been widely acknowledged as responsible for the changing patterns of wage polarization among the U.S. labor force (Lemieux 2006; Machin 2008; Card and DiNardo 2002) . These include technological change, globalization and international trade, and immigration. Both technological change and trade are important sources of demand shifts. Skill biased technological change (SBTC) and the consequent rising demand for skills are constantly identified as the key driving forces of both between-group and within-group wage inequality (Katz and Murphy 1992; Levy and Murnane 1992; Berman, Bound, and Griliches 1994; Autor, Lawrence, and Alan 1998; Autor, Katz, and Krueger 1998).   International trade especially with developing economies, is increasingly regarded as a key factor in driving down the wages of workers for whom cheaper substitutes can be found within emerging economies (Feenstra and Hanson 2001; Kemeny and Rigby 2012).

The role of immigration in debates around wage inequality is often set up as a non-trade version of globalization, as a process that shifts relative labor supply. This is because immigration alters the skill distribution of the total labor force and may

lead to competition for jobs with native workers with comparable skills. Evidence on the contribution of immigration to overall inequality growth is mixed. Based on a national-level analysis, many scholars have pointed out that an influx of immigrant workers, especially those low-skilled, accounts for a significant share of the increase in overall wage inequality (Borjas, Freeman, and Katz 1997; Borjas, Grogger, and Hanson 2008). In contrast, researches using an alternative cross-city approach report that the impact of immigration-driven supply shifts on native wages was so small that it hardly affected the overall wage dispersion (Card 2009; Johannsson and Weiler 2005).

Given the wide variation between native- and foreign-born workers in their socio-economic characteristics, previous studies on wage inequality and immigration in the U.S. are more focused on the gap in income and wage progression between immigrant and native workers. However, very few studies pay attention to the considerable racial and educational wage disparities that lie within foreign-born groups (Card 2009). As Ong and Valenzuela argue (Ong and Abel Valenzuela 1996), "generalizing about all immigration" regardless of its highly distinctive human and social capital characteristics, is "an exercise in misleading polemics" in the analysis of wages. First, immigrant workers face widely different employment opportunities based on their skills, such as education and pre- and post-immigration work experience. In fact, the dispersion of observed and unobserved skills among immigrants is even higher than that of the natives, emphasizing concentration at the

high and low ends (Borjas and Friedberg 2009; Rienzo 2009). Meanwhile, race and ethnicity also play an important role in differentiating wages among immigrant groups (Clark 2003). Socioeconomic attributes underlying racial wage differentials include place of origin, year of entry into the U.S. labor market, and proficiency in English (Chiswick 1978; Friedberg 2000; Borjas and Friedberg 2009). Between 1980 and 1990, national hourly wage trends increased for foreign- born White and Black males, while big declines were shared by foreign-born Asian and Hispanic males (Ellis 2001). Since then, Asian immigrants on average have successfully caught up, leaving Latino immigrants behind with the highest poverty rate among all immigrant groups (Ellis, Wright, and Townley 2013).

In addition to individual characteristics such as skill and race, geography is the other important dimension to understand wage disparities among immigrant workers (Clark 2001; Clark 2003). The labor market outcome of immigrants is strongly dependent on local economic conditions and cultural and social environment. First, by showing large differences between the 1980-90 wages trends and poverty rates for different foreign- and native- born groups across five immigrant regions, Clark (2001) and Ellis (2001) inject significant new meaning into Portes and Rumbaut's (Portes and Shafer 2007) concept of "contexts of reception" mattering for immigrants to the U.S.. Local economic, social, and institutional structures adjust differently to immigrant supply shocks and vary in their capacities to support immigrant incorporation. Due to technological innovation and trade, industries and firms generate different demands

for skills across regional labor markets and over time. Second, immigrant skills are not distributed uniformly throughout U.S. labor markets(Hall et al. 2011; Valenzuela Jr. and Ong 2001). Immigrants of different racial and ethnical origins are historically concentrated in selected traditional gateway cities such as New York, Chicago, San Francisco, and Los Angeles, where they find employment opportunities through ethnic social networks (Portes and Shafer 2007; Wilson and Portes 1980). Since the dominance of different immigrant groups in ethnic niches varies across metropolitan areas and changes over time, even the same racial or ethnic group have been found to have different labor market outcomes across U.S. regions (Clark 2003, 1998; Portes and Shafer 2007). The 1990s and 2000s witnessed the spatial diffusion of new immigrants (mostly from Mexico and Asia) to new destinations, such as pre-emerging emerging, and re-emerging immigrant gateway cities, as attracted by the vibrant economies in these areas (Singer 2004; Hall et al. 2011; Bohn 2009)[1]. In light of the increased diversification of immigrant settlement patterns in the U.S., Clark (2004) warns about an elevation of income disparities among immigrant workers by geography and by ethnic origin.

These findings justify the need for a thorough study on wage inequality among immigrant workers and its contribution to wage inequality of the overall labor force in the U.S.. Unfortunately, there have not been sufficient efforts to examine the

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[1] See Appendix for a detailed classification of eight types of immigrant gateway cities and examples of metros of each type.

long-term trends over the past three decades. Even fewer analyses have been conducted on the uneven geography of wage inequality, especially for foreign-born workers. Whether immigrant workers share similar features as the overall labor force in the U.S. in the spatial patterns and temporal trends of wage inequality and how much immigrant wage inequality accounts for the overall wage inequality remain largely unknown. Neither do we know much about the levels of between-group and within-group wage inequalities and their contributions to the increase in total immigrant wage inequality over time. While a handful of researches have explored factors that differentiate wages between selected immigrant groups (Joassart-Marcelli 2009; Borjas and Katz 2005; Valenzuela Jr. and Ong 2001; Clark 2003), there has not been a systematic understanding of the determinants of wage inequality among immigrant workers. In particular, we need a good temporal-spatial model to identify the key driving forces that shape variations and changes in immigrant wage inequality over time and across labor markets in the U.S..

1.2 Research Significance

In this research project, I extend current research on wage inequality and immigration to the U.S. in three ways. First, this project expects to make contributions to the few existing studies on the wage distribution of immigrant workers in the U.S.. There is no doubt that immigrants have become a special labor group that contributes significantly to the U.S. economy. Between 1990 and 2005, the overall employed population increased by 22 million with nearly half of that growth (10.1 million)

accounted for by the foreign born workforce (Clark 2008). Since the 1990s, a growing literature has examined the impact of immigration on overall wage inequality or native wages in the U.S. (Lerman 1999; Reed 2001; Card 2009). Other work concentrates on the wage growth of immigrants, with most attention given to changes in mean wages and to convergence with native wages. Much less weight has been placed on wage disparities among immigrant workers. One of the commonly accepted findings is the declining quality of immigrants who arrived after 1980 (Borjas 1998; Bernt, James, and Zafar 2002; Duleep and Regets 1997). More recently, while the large inflow of unskilled workers continued, the immigrant population was found to have more diverse educational backgrounds and skills (Hall et al. 2011; Borjas and Friedberg 2009). The upward occupational mobility of the high-skilled workers lead to bifurcation of economic returns to different groups of immigrant workers(Clark 2003). Meanwhile, immigrants of different races and ethnicities follow divergent assimilation paths and therefore yield different labor market outcomes (Alonso-Villar, Río, and Gradín 2010; Frey and Farley 1996; Portes and Zhou, 1993; Portes and Rumbaut 2001). However, we know little about how wage gaps are displayed across different groups. Neither are we aware of how different sources of overall inequality growth, such as education, race and ethnicity, and residual wage inequality, contribute to changes in wage inequality among immigrant workers. These arguments bolster claims on the importance of investigating the temporal trends and spatial variations of the wage structure among immigrant workers.

Second, I provide a comparative analysis of wage inequality among immigrant workers both at the national and the metropolitan levels. Previous reports on single indicators of overall inequality mask significant regional variations in both inequality levels and long-term trends. By measuring and comparing wage inequality in different forms, I establish the basic trends of immigrant earnings inequality and discuss the representativeness of each measure. Pushing beyond indicators of overall wage inequality trends, I evaluate wage inequality among different immigrant subgroups. A more comprehensive understanding of wage distribution patterns includes examination of upper- and lower-tail wage inequality, and decomposing between- and within-group inequality defined by observed differences in gender, education and race. Moreover, I examine wage inequality patterns in detailed regional settings—the metropolitan areas. The integration of wage inequality with geography is a subject that has only been studied by a few in the research field of U.S. wage inequality.

Thirdly, the design of this study takes into consideration the uneven geography of wage inequality among immigrant workers while examining its changes over time. Pooling time-series cross-sectional labor market level data in 1980, 1990, 2000, and 2009 (5-year pooled) across metropolitan areas, I use a two-level mixed-effects model to account for the spatial and temporal variability in immigrant wage inequality. In this model, labor market level indicators of different time periods, such as demographic compositions of immigrants, technology and trade, and institutional context, are treated as first-level observations nested within the same metro area. The second-level parameters are geographic attributes of a metropolitan area such as being

in certain U.S. Census region or of a particular type of immigrant gateway. The two-level mixed-effects growth model estimates the effects of local labor market conditions and time on changes in immigrant wage inequality within metropolitan areas as well as the inter-metropolitan differences in growth of immigrant wage inequality.

1.3 Research Questions and Hypotheses

The primary objective of this study is to explore the detailed temporal trends and spatial patterns of foreign-born wage inequalities across U.S. metropolitan areas, and to explain the factors that contribute to the variations in immigrant wage inequality over time and space. The main hypothesis is that a wide wage gap lie among immigrants and has kept increasing over time. At the metropolitan area level, wage inequality among immigrant workers is even more complicated to map. The temporal changes and spatial variations in immigrant wage structure reflects an uneven spatial distribution of races and ethnicities and skills of immigrant workers. In addition, immigrant wage structures are affected by their diverse settlement patterns in local labor markets as their "contexts of reception". The spatially-dependent demographic compositions of immigrants combine with local economic and institutional conditions to shape the wage inequality among immigrant workers across U.S. metropolitan areas over the past three decades. Three sets of major research questions will be examined in this dissertation.

1. *What is the temporal trend of wage inequality for immigrants in the U.S.?*
    How does immigrant wage inequality vary across metropolitan areas and
    how does the spatial variation change over the past three decades? What
    about the temporal-spatial patterns of wage inequality among native
    workers in the U.S.? And how much does immigrant inequality account for
    wage inequality of the overall labor force?

Two temporal trends characterized labor market outcomes of immigrants to the U.S. since the 1970s. One trend identifies the decline of immigrant quality and in turn, the concentration of immigrants in the lower tail of the wage distribution. The other trend focuses on the increased skill diversification among immigrants arriving since the late 1990s. First, I am interested in finding out how skill disparity among immigrant workers is reproduced in the U.S.. It remains unknown whether wage dispersion is even wider among immigrant workers than the native labor force in the U.S.. The diversification of new immigrant skills in the 1990s may lead to a contraction of lower tail inequality (the 50/10 percentile) and the fanning out of upper-tail inequality (the 90/50 percentile), a phenomenon happened to the overall wage inequality in the U.S.. Second, I examine how levels of immigrant wage inequality vary across different types of metropolitan areas. By mapping metropolitan level immigrant wage inequalities and their changes in different years, I explore whether certain patterns can be observed regarding their geographic distributions. For robustness purposes, I also introduce different measures of

inequality for comparative analysis. Finally, I decompose the Theil-T Index to measure the contribution of immigrant wage inequality to overall US wage inequality over time and across space.

2. What are the temporal trends of between- and within-group wage inequality for immigrants? What about the spatial variations in between- and within-group (residual) immigrant wage inequality and their growth rates across metropolitan areas? How much do changes in education, race and ethnicity and residual wage inequalities account for the rise in overall immigrant wage inequalities over time and across space?

To answer these questions, I use a simple OLS regression model to measure wage differentials among immigrant workers by education, race and ethnicity and other individual factors. The analysis emphasizes the temporal trends of between-group wage inequality by education and race and ethnicity in the past three decades. It also reveals the trends of residual inequality among immigrant workers controlling the observable individual factors that differentiate individual wages. For both between- and within- group wage inequalities, I complement the temporal analysis with a spatial perspective by comparing their variations across the metropolitan areas. Finally, an OLS-regression-based decomposition approach allows me to compare how different factor sources, such as education, race and residual wage inequalities contribute to explain the rise in overall immigrant wage inequality at both the national and metropolitan levels in the past three decades. This helps to

identify which factors were the main sources of growth for wage inequality among immigrants and how their impacts changed over time and across space.

3. *How have the labor-market level factors shaped variations in overall wage inequality and residual wage inequality among immigrant workers over time and across space? Whether factors that have widely acknowledge as significant determinants of overall wage inequality are as influential in explaining wage inequalities among immigrant workers? How does wage inequality among immigrant workers vary by geographical location and immigrant gateway types?*

On discovering the impacts of individual characteristics on immigrant wage differentials, I examine how labor market level factors determine the wage distribution patterns of immigrant workers in the U.S.. I build a two-level mixed-effects model, in which labor market conditions of different metropolitans at each time-period are level-1 predictors and time-invariant geographic attributes of the metropolitan areas are level-2 covariates. On the one hand, parameters at the within-metropolitan level (level-1) inform about how local labor market conditions, such as trade and technology, industrial structural shifts, and local institutions, determine the wage inequality of immigrant workers. On the other hand, the level-2 setting of the model allows me to examine inter-metro variation in wage inequality among immigrant workers. It also seeks to find whether being in a certain region or of

a certain type of immigrant gateway type[2] increases the local level of immigrant wage inequality.

1.4 Summary of Chapters

Five chapters follow this introduction. Chapter 2 reviews previous literature on the rise in wage inequality and immigration in the U.S., focusing on major trends of the overall wage inequality and the widely acknowledged or debated explanations for these trends from 1980 to 2008. A summary of empirical findings on the wage outcomes and settlement patterns of immigrant workers in the U.S. show how wage distribution of immigrants is shaped by race and ethnicity and geography. Chapter 3 first describes the data sources and how they are used in this research project. It then addresses the first research question, examining and comparing the general wage inequality trends of immigrant workers to those of the native labor force by time and space employing a variety of different measures. By decomposing wage inequality for the overall U.S. labor force by nativity, I evaluate how much it was accounted for by the foreign-born wage inequality across the U.S. metropolitan areas over time. Chapter 4 turns to the second research question, examining the trends of between- and

_____

[2] I adopt Singer's concept of immigrant gateways, and categorize the top 100 largest metropolitan areas in the U.S. in 2009 into different immigrant gateway types based on the immigrant population size and their recent and historical settlement patterns. More elaboration of the concept and my methodology is discussed in Chapter 2 and Chapter 3.

within- group inequality for immigrants and estimating their contributions to the rise in overall immigrant wage inequality in the past three decades. Chapter 5 tackles the third question, providing explanations of the labor market level factors that shape the spatial structures of the immigrant wage inequality over time. In this chapter, I identify key forces that drive changes in overall and residual wage inequality over time and explain how geography plays a role in differentiating the wage inequality among immigrant workers across metropolitan areas. Chapter 6 concludes with the research findings, limitations, and policy implications.

Chapter 2

Literature Review

2.1 Introduction

There is profuse literature on wage inequality in the U.S. and immigration and its impacts on the U.S economy.. Previous studies have shed light on the temporal growth trend of wage inequality among overall labor force in the U.S.. Wage gaps keep widening between different demographic groups of workers by individual characteristics such as education and ethnicity (Katz and Autor 1999; Freeman and Katz 1995; Bound and Johnson 1992). Yet residual wage inequality has increased even more rapidly, and is general considered to have accounted for at least one quarter to one half of the growth in wage inequality (Juhn, Murphy, and Pierce 1993 , Katz and Autor 1999; Acemoglu 2002; Lemieux 2006). Concurrently, a growing number of immigrant workers started to enter the U.S. labor market, characterized by relatively lower quality of skills than the native-born workers (Jasso, Rosenzweig, and Smith 1998; Borjas and Katz 2005; Borjas 1995; Bohn 2010). Since then, immigrant wage trends and their economic assimilation in their places of destinations have been widely studied. In contrast, only a handful of literature has paid special attention to wage disparity among immigrant workers and changes in immigrant wage structures across different regional labor markets (Zhou 2001; Ellis 2001; Ellis, Wright, and Townley 2013; Clark,2001).

This chapter reviews theories and empirical studies on wage inequality and immigration in the U.S., all of which combine to build a conceptual framework for understanding and analyzing the evolution of wage inequality among immigrant workers and its spatial distribution pattern in the U.S.. Section 2.2 discusses the temporal trends and spatial patterns of wage inequality among the overall labor force in the U.S. respectively. Spatial variations in wage inequality are examined at the metropolitan area level. Section 2.3 reviews factors that are widely acknowledged to have induced the rise in wage inequality in the U.S.. It also discusses how these factors, especially when examined in a local labor market context, differentiate wage inequality across metropolitan areas in the U.S.. Based on a handful of studies, Section 2.4 attempts to understand the impacts of immigration on wage inequality and the foreign-born earning trends in the U.S. . It shows how wage differentials vary by individual characteristics. In addition, it refers to the uneven spatial distribution of racial and ethnic immigrants to explain how wage structures among foreign-born workers vary across metropolitan areas. Section 2.5 concludes and calls for a thorough investigation on wage inequality among immigrant workers, its impacts on overall wage inequality in the U.S., and factors that determines temporal changes and spatial variations in wage inequality among immigrant workers.

2.2 Temporal Trends and Spatial Variations of Overall Wage Inequality in the U.S. between 1980 and 2009

2.2.1 Temporal Trends of Overall Wage Inequality in the U.S.

There is broad consensus on the continuing rise in aggregate wage inequality in the United States since the 1980s, reversing trends that reduced income inequality in the early post-World War II decades (Gottschalk 1997; Katz and Murphy 1992; Levy and Murnane 1992; Lemieux 2008; Autor, Katz, and Kearney 2008). Over the past thirt years, the U.S. labor force, especially male workers, have experienced an increase in wage inequality, characterized by a "hollowing out" of middle-class jobs and growing employment of both high-wage and low-wage workers(Levy and Murnane 1992; Autor, Levy, and Murnane 2003).

In contrast to the more equal wage distribution before the 1980s, three features are worth notifying regarding the changes in wage inequality trends in the post- 1970s era. The first, and perhaps the most studied, is the temporal trend of continued increases in overall wage inequality.   For the U.S. as a whole wage inequality rose rapidly in the 1980s, continued to rise but at a more moderate rate in the 1990s, and remains at fairly high levels today(Lerman 1999). A related phenomenon is the "fanning out" of the overall distribution of inequality—the sharp growth in wage gaps concentrated at both upper and lower tails in the 1980s, that has resulted in a widening wage gap between the rich and poor, as represented by the ratio of the 90th percentile to the 10th percentile of the U.S. wage distribution (Ong and Zonta 2001; Katz and Murphy 1992). Since the 1990s, the increase in wage inequality have been more

concentrated at the top end of the wage distribution (such as the first quartile), underlying a slowdown in the increase of wage inequality in aggregate.

The second and third features are related in the sense that they report the temporal trend in inequality by decomposing it into between- and within-group components. As for the between-group inequality, educational wage differential rose significantly in the 1980s. However, the increase in between-group wage inequality mainly defined by education-related skills has decelerated subsequently. Meanwhile, within-group inequality defined by skills started rising as early as the 1970s, and has maintained the same trend in the following four decades.

2.2.2 Spatial Variations in Overall Wage Inequality across U.S. Metropolitan Areas

There is still one feature of overall wage inequality that deserves a close examination, which is the spatial pattern of wage inequality. Geographic studies have shown an emerging interest in examining the sub-national geography of wage inequality. However, only a few set the geography at the metropolitan area scale (Chakravorty 1996; Madden 2000; Fallah, Partridge, and Olfert 2010; Cloutier 1997).

Existing literature indicate great spatial disparities in the levels and changes of wage inequality at the state level (Bernard and Jensen 1998; McCall 2000; Morrill 2000; Partridge, Partridge, and Rickman 1998; Partridge, Rickman, and Levernier 1996; Fan and Casetti 1994). As early as in the 1960s, income inequality in "mostly wealthy states in the Northeast and on the Pacific Coast" started rising (Partridge,

Rickman, and Levernier 1996, p. 20). By the 1970s, 25 states had increased income inequality even before the national rise in wage inequality (Partridge, Rickman, and Levernier 1996, p. 20). The next two decades witnessed continued increases in income inequality among most states and significant state-level variation in inequality growth (Lynch 2003; Bernstein, McNichol, and Nicholas 2008). Though studies on wage inequality at more detailed regional levels, such as metropolitan and county scales, remain far more limited, they all agree upon the spatial variation in levels and changes of wage inequality (Chakravorty 1996; Levernier, Partridge, and Rickman 1998; Galbraith and Hale 2006; Madden 2000). All these findings inform us of how poorly the national story represents what is happening to wage inequality at the sub-national level, because it masks great spatial variability.

It is important to point out that the literature on subnational inequality uses a few different measures. Several of these articles use Gini coefficients for family income reported for each state in the decennial Census (Levernier, Rickman, and Partridge 1995; Morrill 2000; Partridge, Partridge, and Rickman 1998; Partridge, Rickman, and Levernier 1996) Fan and Casetti (Fan and Casetti 1994) compare per capita income levels for each state reported by the Census Bureau, comparing inter-state income inequality. Other ways of measuring inequality are the Theil-T Index and the P90/P10 ratio. The decomposable nature of the Theil-T index allows one to further examine the sources of changes in wage inequality.

2.3   Understanding Overall Wage Inequality in the U.S.

Different dimensions of wage inequality trends lead to various explanations. A good number of studies have tried to model the temporal wage inequality pattern by including factors such as skill-biased technological change (SBTC), international trade and globalization, shifts in industrial composition,, institutional factors, and demographic compositional changes, especially that induced by immigration (Levy and Murnane 1992; Freeman and Katz 1995; Katz and Murphy 1992; Bound and Johnson 1992; Card and DiNardo 2002; Lemieux 2006; Autor, Katz, and Kearney 2008).   From Section 2.3.1 to Section 2.3.4, I review previous findings on the associations between wage inequality in the U.S. and some major causal factors.

2.3.1 Conceptual Framework for Assessing Changes in Wage Inequality

To understand how changes occur to wage inequality, we follow a traditional supply-demand analysis of skills. In the simple setting of a distribution accounting scheme proposed by Juhn, Murphy, and Pierce (Juhn, Murphy, and Pierce 1993), there are three possible reasons why wage inequality may increase over time. First, the "price" or return to observed skills may increase due to a shift in demand for skill. Second, the changing distribution in observed skills over time may lead to an increase in wage gap. The final factor is changes in the distribution of wage residuals (Katz and Autor 1999). Likewise, the residual term can be further decomposed into three terms: the effects of the changing distribution of unobserved worker characteristics, the change in "price" or return to unobserved skills due to demand shocks, and

measurement error(Lemieux 2006). By taking institutional factors into consideration, Katz and Autor further develop a supply-demand-institutions (SDI) framework (Katz and Autor 1999; Freeman and Katz 1995; Bound and Johnson 1992). Autor, Katz, and Kearney (Autor, Katz, and Kearney 2008) summarize the reasons for polarization of earnings growth as "changing demand for job tasks and their link to computerization", "mechanical effects of labor force composition" on skill supply, and (episodic) institutional factors such as falling real minimum wages in the 1980s, insisting that the first is the primary explanation. The rest of section 2.3 reviews the dominant explanations for wage inequality focusing on the supply of and demand for skills. The impacts of immigration on wage inequality will be discussed in 2.4.1.

2.3.2 Skill Biased Technical Change (SBTC)

The Skill Biased Technical Change (SBTC) hypothesis is the prevailing theory to explain rises in both between-group and within-group earnings inequality over time. It posits that recent changes in technology have been biased towards more highly skilled and educated workers, increasing the productivity of and demand for these highly skilled workers alone, and in turn leading to the rise in wage inequality. SBTC can lead to a rise in the return to both observed and unobserved skills(Juhn, Murphy, and Pierce 1993). Autor and other scholars (Autor, Levy, and Murnane 2003; Autor, Katz, and Kearney 2008) argue that a changing demand for skills or job tasks induced by SBTC was the main reason that skilled workers were still able to command a wage premium despite a sharp upward supply shock of educated workers during 1980s.

However, the SBTC hypothesis has been strongly challenged by Card and DiNardo (Card and DiNardo 2002),   who find a more stable wage gap existed in the 1990s than in the 1980s despite continuing advances in computer technology. They argue that SBTC fails to explain the clos(Card and DiNardo 2002)ing of the gender wage gap and the stability of the racial wage gap in the 1990s (Card and DiNardo 2002). Card and DiNardo consider the rise of inequality in the 1980s as a result of the declining real value of the minimum wage and deunionization. Using the May CPS, Lemieux (Lemieux 2006) reaches a similar conclusion that the rise of residual inequality in the 1980s was an episodic event due to the declining value of the minimum wage. Therefore, they argue that the "SBTC hypothesis" should not be referred to as a "unicasual explanation" of observed shifts in wage inequality and skill demand (Card and DiNardo 2002).

Responding to the controversies raised by Card and DiNardo (2002), Autor (Autor, Katz, and Kearney 2008) proposed a more nuanced version of SBTC, claiming that technological changes favor skilled and unskilled workers in non-routine jobs at the expense of skilled and unskilled workers in routine jobs (Goos and Manning 2007; Autor, Katz, and Kearney 2008; Antonczyk, DeLeire, and Fitzenberger 2010). SBTC induces a greater supply for highly-skilled workers and the increase in their wages without affecting the demand and wages for non-routine manual workers, thereby shaping a polarized wage structure at two ends and a "hollowing out" in the middle (Autor, Katz, and Kearney 2008). In this sense, both highly-skilled and low-skilled workers can find employment opportunities in certain

occupations and industries. It is obvious that the SBTC hypothesis is also skill-specific and industry-specific.

2.3.3 International Trade

Trade competition, especially with less developed economies, are also sources of growth in wage inequality. Empirically, many people expect a correlation between international trade and wage inequality because wage gap between the rich and the poor has risen concurrently as imports have grown. Theoretically, traditional Heckscher-Ohlin and Stolper–Samuelson theorems suggest that the U.S. would tend to export skill-intensive products and services and import labor-intensive ones, thereby lowering the wages of the unskilled and accelerating wage gaps between skilled and unskilled workers. Earlier studies have found little evidence that globalization and trade plays a key role in driving wage inequality (Lawrence and Slaughter 1993; Freeman 1995; Richardson 1995) However, there have been new development on the methodology in examining the causal effects of international trade on wage inequality(Rigby and Breau 2008). First, studies suggest that early attempts to link trade and inequality should have been analyzing changes in the structure of production within industries, rather than examining reallocation of resources between "low tech" and "high tech" sectors (Feenstra and Hanson, 2001; Helpman et al., 2010). Second, since the early 1990s, the rising volume of trade with less-developed counties demands scholars to separate the influence of trade with less-developed countries from the impacts of overall trade (Bernard et al., 2006; Autor et al., 2011). Adopting these suggested methodological changes, Kemeny and Rigby

(2012) show the rise in low-wage imports in the U.S. is associated with an increase in less-routine work across U.S. manufacturing.

2.3.4 Industrial Compositional Shifts

Traditional "manufacturing offshoring" is known to lead to competition on import-sensitive low-technology industries, thereby generating wage effects at the bottom end of the distribution, driving sharp wage gaps between the blue and white collar workers (Kroll 2005). From the 1990s on, industrial demand has been shifting towards non-routine skills that are either cognitive or manual, yielding an uneven geographic distribution of low- and high-skilled immigrants (like their native-born counterparts) and the special tasks that they perform. Acemoglu and Autor (2010) find a polarization of employment and earnings in high skill and low skill occupations relative to moderately-skilled occupations, which are largely cognitive routine job tasks that can be substituted by capital and technology (Acemoglu and Autor 2010). These findings are reflected the changing proportion of manufacturing employment, especially durable goods manufacturing employment, to service employment. Madden (2000) explains how changes in industrial composition in a regional labor market affect local wage structure. The loss of many manufacturing jobs, especially those in the durable goods manufacturing industries, means a decline in union power, which has an effect in reducing earning inequality. Meanwhile, service industry continue to see a "hollowing out" of of middle-wage jobs, as replaced by more and more high- and low-end employment opportunities. In metropolitan areas where high-technology industries agglomerate, there has been a rapid increase in demand for specialized

labor in metropolitan areas (Kroll 2005). As a result, residual wage inequality is rising at the top half of the distribution among white collar workers (McCall 2000).

2.3.5 Institutional Factors

Arguing against the SBTC hypothesis, revisionists have offered some non-market reasons responsible for increased wage inequality in the U.S. since the early 1980s. Their explanations center on the declining real value of the minimum wage and decline of unionization rate (Breau 2007; Lemieux 2008; Card and DiNardo 2002). First, researchers argue that the labor market returns of unskilled workers deteriorated because nominal wage gains did not keep up with inflation, causing a de facto drop in the real value of the minimum wage (Card and DiNardo 2002). As a result, there was a sharp rise in wage inequality in the 1990s(Card and DiNardo 2002). Other studies argue that most of the increase are explained by changes in the top half of the wage distribution, and that minimum wage has a relatively small impact overall(Autor, Katz, and Kearney 2008). A recent study finds , the effect of minimum wage on the measured wage distribution can even be overestimated due to measurement errors and spillovers (Autor, , and Smith 2014).

Second, deunionzation has a significant impact on the growth in wage inequality. An evaluation of the effect of decline in union membership on trends in wage inequality in the U.S. in the last two decades shows that shifting unionization accounts for a substantial part (15-20%) of the rise in male wage inequality, but has little impact on the rise in female wage inequality(Card et al. 2003; Card 2001). In

sectors that have never been highly unionized, wage inequality is also found to increase rapidly (Steelman and Weinberg 2004).

2.3. 6 Spatial Variations in Wage Inequality and Urban Labor Market

Most of the studies mentioned above attribute changes in wage inequality to the combined effects of supply and demand shifts in skills at the national level and nonmarket events such as the falling real minimum wage in the 1980s, while largely ignoring regional labor market disparities (Machin 2008; Lemieux 2008; Katz and Autor 1999; Leonardi 2004).

Spatial variation in wage inequality reflects inequality in skill distribution and redistribution, and inequality in returns to skills across U.S metropolitan areas (Glaeser, Resseger, and Tobio 2009). Based on a supply-and-demand framework, urban theories find wage inequality in a metropolitan labor market to be closely associated with local skills, population size, and technology (Florida and Mellander 2013). Metropolitan areas vary in industrial concentration and disproportionately attract low and high skills (Glaeser, Resseger, and Tobio 2009). In a few metropolitan areas, often those with a large population size, the accumulation of high skills drives "skill-biased" technological changes and fosters agglomeration economies, which keeps augmenting productivity and yielding increasing returns to high skills (Glaeser and Resseger 2009; Berry and Glaeser 2005; Rigby and Essletzbichler 2002; Baum-Snow and Pavan 2010; Korpi 2008). However, much of the spatial variation in wage inequality remains unexplained. Glaeser and his co-authors (Glaeser, Resseger, and Tobio 2009) argue that historical pattern of skill distribution, in particular the

distributions of low skills and immigrants since the 1970s, play a more important role in determining wage inequality today. They find a strong association between immigration, particularly from Latin American countries, and the concentration of low-skills in selected metros (Glaeser, Resseger, and Tobio 2009).

2.4. The Impacts of Immigrants of Wage Inequality on the Overall Labor Force and Immigrant Wage Trends

2.4.1 Impacts of Immigration on Wage Inequality

The impact of immigration on overall wage inequality has been a highly controversial topic for decades as the linkage between immigration and overall wage inequality is important. While researchers using national and cross-city approaches debate the impact of immigration on native wages, they focus less on its impacts on overall wage inequality, and rarely discuss the wage gap within immigrant workers (Borjas, Freeman, and Katz 1997; Borjas 2003; Card 1989; Altonji and Card 1989; Card 2001). A scenario study on changes in the skill composition and wage structure of the population shows that new immigration contributed 18% to 24% to national growth in males' earnings inequality in the U.S. between 1979 and 1997 (Reed 2001). Meanwhile, it also accounts for a substantial portion of the variation in inequality across U.S. Census regions. Recently, scholars suggest that the impact of new immigrants on the rise in overall wage inequality since 1980s is rather moderate (4%-6%) at the national level (Card 2009) . Yet there is no comparison on the impact

of immigration on a city-by-city basis. When comparing wage variances within the foreign-born to those within the native and the total population in the U.S., Card (Card 2009) finds that wage inequality has become the greatest for foreign-born workers. Clark (Clark 2003) also warns about the increasing income polarization among immigrant households and their uneven growth rates by geography and by ethnic origin since 1980. Both findings emphasize a need to understand wage inequality among immigrants themselves and its spatial variation across metropolitan areas.

2.4.2 Immigrant Wage Trends

Relatively few studies have examined immigrant wage inequality directly. However, there is some literature focusing on wage trends of immigrants as a whole, or more specifically in a subgroup (Borjas and Katz 2005; Borjas and Friedberg 2009; Bohon 2005). In nature, immigrant workers are more economically disadvantaged compared to the natives in many ways. Economic assimilation theories indicate a low entry wage for immigrant workers compared to natives, but immigrants expect their earnings to progress and reach income parity with natives and earlier immigrants as their length of stay in the U.S. increases (Borjas 1998). However, during 1960-1990, a downward trend in the relative entry earnings of successive immigrant cohorts (to the natives) was observed along with a decline in average educational attainment of new immigrants (Bohn 2010; Duleep and Regets 1997). According to Borjas (Borjas 1995), the wage convergence of

immigrant cohorts that arrived in the 1970s have progressed at such a slow rate(10 percentage points during 1970-1990) that it is unlikely they will ever   catch up with native wages . Borjas even suggests that it will be hard for Asian and Mexican immigrants arriving after the 1970s to reach parity with their ethnically similar native counterparts (Borjas 1995). It was not until the late 1990s that the continuous decline in the relative earnings of new arrivals was reversed. Upon   arrival, immigrants cohorts from 1995 to 2000 earned as much in 2000, relative to natives, as the 1975-1979 entrants did two decades earlier (Borjas and Friedberg 2009). The increase in the entry wage level of immigrants, as claimed by Borjas and Friedberg, is associated with the average educational levels of the new arrivals in the late 1990s(Borjas and Friedberg 2009).

The job prospects for immigrant workers from different places of origins vary greatly. Immigrants from developed countries, such as European countries and Canada, are more likely to be fully economically integrated into the U.S. labor market than their counterparts from less development countries. Standing out as a separate racial and ethnical group, Hispanic workers, in particular Mexicans, earn less than other immigrant subgroups on average and their wage convergence is much weaker compared to other immigrant groups (Borjas and Katz 2005).

Interestingly, recent data showed a relative improvement in immigrant earnings (to natives) at the bottom end of the skill distribution in the 1990s, despite the continued increase in the volume of Mexico-origin immigration inflows to the

U.S. (Borjas and Friedberg 2009). An accompanying phenomenon is the increase in wage growth for highly-skilled immigrants.

2.4.3 Segmented Assimilation Paths among Immigrant Workers and Immigrant Wage Differentials

The seminal work by Portes and Zhou (1993) on segmented assimilation among immigrant workers and their divergent labor market outcomes has triggered considerable academic interest in understanding the adaptation processes of immigrants. The theory emphasizes that there is more than one way to become economically incorporated in the U.S. (Zhou 1997). Immigrant groups with relatively better physical, cultural, and social capital were able to the process of upward mobility, while those lacking such resources are at risk of experiencing downward assimilation (Portes and Zhou 1993). There is still a third group of immigrants and their second generation follow "selective acculturation" (Portes and Rumbaut 2001). Their economic integration is accompanies by a deliberate preservation of the immigrant community's culture and values (Portes and Zhou 1993; Zhou 1997). As a result, immigrants vary in their wage outcomes by educational attainment, gender, race and ethnicity (including origin-country), and length of stay in the U.S. (Borjas and Friedberg 2009; Bohn 2010; Hoover and Yaya 2010; Portes and Rumbaut 2001). The dynamic wage structure of immigrant workers also changes along with rapid changes in the supply of and demand for immigrant labor skills.

One factor that explains wage differentials among immigrant workers is the wide dispersion in their observed skills. Wage inequality is expected to occur among different cohorts of immigrant workers. According to assimilation theory, immigrant

wages progress as their length of stay in the U.S. increases. At a given year of observation, new immigrants entering the U.S. labor market would earn a lower wage on average compared to those who arrived earlier. New immigrants to the U.S. appear different than immigrants who arrived before the 1970s in quality[3]. On one hand, the main sending countries of immigration switched from Europe to Latin America and Asia. On the other hand, the average educational attainment of new immigrants has declined strikingly since the 1970s (Borjas 1995). Using Census and CPS data in the late 1990s, a few studies report a noticeable increase in the number of highly-skilled immigrant workers, along with the continuous rise in inflows of low-skilled immigrant workers from Mexico (Jasso, Rosenzweig, and Smith 1998; Borjas and Katz 2005; Borjas 1995; Bohn 2010). In addition, Borjas and Friedberg (Borjas and Friedberg 2009) found that immigrants arrived after mid-1990s displayed a more diversified skill structure and experienced improvements of relative earnings concentrated at both ends of skill spectrum. This can be seen as a reflection of skill adjustment of the current immigrant labor force to an increase in demands for skills that are biased by technological development.

Meanwhile, earnings vary by gender. Focusing on the 2006 ACS data, Hoover and Yaya (Hoover and Yaya 2010) find that the wage gap for 10-year immigrants was smaller than that for newly arrived immigrants by gender.

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[3] More accurately speaking, the labor force composition of immigrants changed drastically after the Immigration and Nationality Act established in 1965.

On the top of that, both male and female inequality varied by place of origin, and more importantly, race and ethnicity. Race and ethnicity is another important feature that defines the heterogeneous labor market performances among immigrant workers. Engaging immigrants in the debate on racial and ethnic disparities in earnings, I rely on broad intellectual discussions on the economic assimilation and spatial concentration of racial and ethnic immigrants. Race and ethnicity has a large impact on the development of unobservable attributes among immigrant workers in their destinations, such as social network and language acquisition, and thus is a key factor that explain wage gaps among immigrant groups (Bohon 2005; Joassart-Marcelli 2009).

The enclave hypothesis identifies ethnic enclaves as a "mobility machine" that attracts new immigrant workers from the same ethnicity of earlier immigrants to cluster and settle down in a residential location and work in limited types of occupations and industries (Portes and Shafer 2007). Residential concentration provides immigrant workers better accessibility to jobs (Bailey and Waldinger 1991; Portes and Jensen 1989). However, race and ethnicity, through ethnic enclaves, have also been found to work as an economic mobility trap for immigrant workers as they are stuck in selected types of low- wage ethnic occupations and work in a relatively segregated employment environment (Borjas 1985). Based on the 2007 ACS data, Alonso-Villar, Río, and Gradín suggested that low-skilled Latino and Asian workers were more segregated, as opposed to Blacks and Native Americans, and therefore

were more likely to concentrate in low-wage sectors (Alonso-Villar, Río, and Gradín 2010; Frey and Farley 1996).

2.4.4 Distribution of Immigrant Skills across Metropolitan Labor Markets

There has been much discussion about how immigrant skill distribution and their settlement patterns vary across U.S. metropolitans and have changed in the past three decades. Since the 1970s, the majority of new immigrants come from less developed Latin America and a few Asian countries. These less skilled and less educated immigrants are heavily concentrated in a handful of gateway metropolitan areas, such as Los Angeles, New York, Chicago, Huston, and Miami (Frey and Liaw 1998). Immigrants find niche employment in a few industrial sectors dominated by workers of their own ethnic origins in different metropolitan areas (Logan, Alba, and McNulty 1994; Wang 2004; Wilson 2003; Wright and Ellis 2000). Today, the enduring role of race and ethnicity continues to limit the geographic and socio-economic mobility of immigrant workers and shape urban inequality and poverty in large gateway cities (Wright and Ellis 2000; Ellis and Goodwin-White 2006; Waldinger 1995; Cooke 1999). Yet in the late 1990s, both new and secondary immigrants, including those of Hispanic origin, became more dispersed, moving to non-traditional immigrant gateways, where cultural constraints are less pronounced and housing costs are lower (Singer 2004; Liaw and Frey 2007; Frey and Liaw 2005). The new destination choices of these pioneers and local industrial restructuring create a process of "cumulative causation" that channels subsequent cohorts of immigrants

to these metropolitan areas(Massey 2008). The distribution and redistribution of immigrants across the U.S. metropolitan areas have produced 8 types of immigrant gateways, namely former, post-WWII, major-continuous, minor-continuous, re-emerging, pre-emerging, emerging and low-immigrant gateways (Hall et al. 2011; Singer 2004). These gateways vary in immigrant skill composition. In some metropolitan areas such as San Jose, Seattle, and Raleigh, the share of high-skilled immigrant workers already exceeds that of the low-skilled, while in other areas such as Bakersfield, El Paso, Tucson, and Houston, the immigrant workforce remain predominantly low-skilled (Hall et al. 2011).

2.5 Conclusion

This chapter reviewed previous literature on the historical trends and spatial patterns of wage inequality of immigrant workers. It then summarized the impacts of immigrants on overall wage inequality in the U.S. and other widely acknowledged causal factors of overall wage inequality in the U.S., which may also influence wage inequality among immigrant workers. Finally, it discussed recent studies on the earning trends of immigrant workers, highlighting the role of race and ethnicity and geography in explaining wage differentials among immigrant workers over time and across space.

Reviewing shifts in wage trends of immigrant workers, their divergent economic assimilation patterns and spatial distribution of skills, I argue that race and

ethnicity and geography are two key factors in understanding levels and changes of inequality among the foreign-born workers. First, physical locations act as "contexts of reception" to accommodate the economic assimilation of immigrant workers. Local labor market attributes, such as demographic composition, economic and industrial development, and social and cultural environment combine to generate an uneven geography of demand for skills (Clark 2003; Wright and Ellis 2000). Second, ethnic persistence of immigrant workers, in particular different forms of ethnic enclaves and ethnic niche occupations, have shaped immigrant settlement and assimilation pattern in a local labor market, further differentiating skill profiles of immigrant workers across metropolitan U.S.. Chakravorty (Chakravorty 1996) finds that racial and ethnic diversity has a strong effect on wage inequality across metropolitan areas in the U.S.. Immigrant workers belonging to certain categories of races and classes, have better access to restricted resources and are more likely to exploit networks and hoard opportunities in a local labor market (Massey 2012). Comparing labor market outcomes of foreign-born workers in different metropolitan areas, Ellis (2001) argued that the line of segmentation between foreign- and native-born workers have cemented for over decades and makes it harder for immigrants to translate their skills into wages in traditional immigrant gateways (than in other gateway cities). The enduring role of geography and neighborhood effects perpetuates social and occupational segregations and shapes divergent immigrant wage structures across metropolitan labor markets (Sampson 2012; Morrill 2000; Glaeser, Resseger, and Tobio 2009). Therefore, the spatial configuration of inequality is embedded within the urban racial and ethnic fabric of

cities. Over time, these factors should become manifest in the uneven geography of the wage inequality among immigrant workers.

These findings about foreign-born wage inequality invoke two questions that are rarely answered so far: What are the temporal trends and spatial patterns of wage inequality among immigrant workers since 1980? How much does foreign-born wage inequality account for the wage inequality of overall labor force in the U.S.? Beginning with descriptive analysis of wage inequality in Chapters 3, I try to unwrap the details in these questions.

Chapter 3

Temporal Trends and Spatial Patterns of

Wage Inequality among Immigrant Workers

3.1 Introduction

New waves of immigration have greatly changed America's demographics in the mid of 20th century. Over the same time, wage inequality in the United States has increased markedly. Immigration is often regarded as a driving force of wage inequality among the overall labor force in the U.S.. The impacts of immigration on native wages and the rising income gap between high- and low-skilled workers in the U.S. have been widely debated at both the national and regional levels (Borjas, Freeman, and Katz 1997; Card 2009; Johannsson and Weiler 2005). However, we know little about the evolution of the wage structure among immigrant workers in the U.S. and we know even less about the uneven geography of immigrant wage inequality across metropolitan areas over time.

Wage progression among immigrants is never uniform. Early studies show that even in ethnic industries, wide disparities lie in socio-economic characteristics between ethnic employers and their employees(Sanders and Nee 1987). Recent immigrants arrived after the late 1990s have demonstrated diverse educational backgrounds and skills and are found to have a higher relative wage compared to that of the native-born than earlier immigrant cohorts arrived in the 1980s(Borjas and

Friedberg 2009). Meanwhile, there has been an accelerating concentration of low skills due to the large population inflow from Latino countries. These facts lead to a widening wage gap within immigrant workers. Using IPUMS Decennial Census in 1980, 1990, 2000, and pooled 5-year ACS data in 2009, I conduct a systematic study of wage inequality among immigrant workers in the 100 largest metropolitan areas (in 2009) over the past three decades. I expect to find a rise in immigrant wage inequality and an even wider wage gap among foreign-born workers than the native-born.

At the metropolitan level, racial and ethnic immigrants continue to be concentrated in a handful of gateway cities. Overtime, both low- and high-skilled foreign-born workers become more dispersed to new destinations in response to new demands for skills generated by technological changes and shifts in industrial structures in these metropolitan labor markets (Cadena and Kovak, 2013). As a result, we find an uneven geography of the wage inequality among immigrant workers. To understand the spatial patterns of immigrant wage inequality and why a particular geography is displayed, I articulate a framework of immigrant historical settlement patterns on local wage structure. Adopting a typology of metropolitan areas as immigrant "gateways" and a classification system of immigrant skills in metropolitan areas developed by Singer and other scholars (Hall et al. 2011; Singer 2004), I look into the association between immigrant wage inequality and their skill profiles and historical settlement patterns in different metropolitan areas. The distribution and

redistribution of immigrants across the U.S. metropolitan areas have produced 8 types of immigrant gateways, namely former, post-WWII, major-continuous, minor-continuous, re-emerging, pre-emerging, emerging and low-immigrant gateways (Hall et al. 2011; Singer 2004). These gateways vary in immigrant skill composition. In some metropolitan areas such as San Jose, Seattle, and Raleigh, the share of high-skilled immigrant workers already exceeds that of the low-skilled, while in other areas such as Bakersfield, El Paso, Tucson, and Houston, the immigrant workforce remain predominantly low-skilled (Hall et al. 2011).

Finally, I use a decomposition of wage inequality among the overall labor force in the U.S. by nativity to answer the question raised at the beginning paragraph on the contributions of immigrant inequality to the rising overall wage inequality.

In the following section, I briefly introduce the data and methods used in this chapter. The analytics are divided into four sections: the temporal trend of immigrant wage inequality, spatial distribution of immigrant wage inequality across metropolitan areas; the three-decade growth in immigrant wage inequality; and the contribution of immigrant inequality to wage inequality among total labor force in the U.S.. All analyses are conducted at both national and metropolitan levels. In addition, gender gaps are recognized throughout the analyses. Finally, I conclude the chapter with discussions on policy implications of my findings.

3.2 Data and Methods

Raw data are extracted from the IPUMS Decennial in 1980, 1990, 2000, and the five-year pooled IPUMS ACS data in 2009. The universe of the core sample in this research is restricted to full-time full-year (who work at least 35 hours per week and at least 40 weeks per year in the last year) non-self-employed civilian workers, aged between 16 and 65 and making a non-zero or non-missing wage-and-salary income. Immigrant workers are those workers whose places of birth are not within the USA (or its territories overseas) and who do not have U.S. citizenship at birth.

I construct 100 largest "metropolitan areas" based on the 2009 IPUMS ACS. All the immigration metros are medium to large cities with a total population of at least 500,000. Based on county group and PUMA level data available in IPUMS for all the years, this study constructs its own metropolitan-area data in order to fix the problem of incomplete coverage of metropolitan area in the IPUMS data[4]. Spatial correspondence tools from the Missouri Data Center are used to link PUMAs to newly constructed metropolitan areas. The definitions of all metropolitan areas follow those from the IPUMS. Based on Singer and her co-authors' (Singer 2004, 2008; Hall et al. 2011) topology of immigrant gateway types of different metropolitan areas in

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[4] The 1980-2000 Census and ACS IPUMS data suffer the problem of Incompletely Identified Metropolitan Areas. Individuals living in metropolitan areas within PUMAs that crosses metropolitan boundaries have their geography coded as unidentified. I assign values of metropolitan area to these population using the algorithm from (Hall et al. 2011)A comparison of the metropolitan-level immigrant population size in the new database and in IPUMS is available upon request.

the U.S. and the definition of their skill profiles, I develop a new database on immigrant gateway types and skill profiles of the largest 100 metropolitan areas in this study.[5] My analyses also rely on a summary of the size of the foreign-born workers in the top 100 metropolitan areas in 2009 and their three-decade growth rates, derived from the IPUMS data.

To capture spatial and temporal patterns of immigrant wage inequality, I use different inequality measures, including the percentile wage ratios and Theil-T Index. As for wage gaps between fixed percentiles on the wage distribution, the most commonly used indicator is the wage ratio between the 90th and 10th percentiles (P90/P10). I also observe the P90/P50 and P50/P10 wage ratios because relative earnings between two percentiles are easy to interpret. However, this ratio ignores information on different sections of the wage spectrum, for example, the median value of the wage distribution. The Theil-T index is a more comprehensive entropy measure of inequality and is generated from all observations rather than a few selected points of the entire wage distribution. The value of the Theil-T index ranges from 0 to 1, with 0 indicating complete equality and 1 indicating complete inequality. Its value is sensitive to inequalities at the top-end of the wage distribution. In addition, measures of wage inequality using IPUMS data have to confront the question of top-coding and

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[5] The classification of eight types of immigrant gateways is based on the size and growth rate of immigrant population over the twentieth century, as well as the total population size in a metropolitan area. Three groups of immigrant skill profile represent the ratio of high to low immigrant skills in a metropolitan area, with 75% and below as low, 75% -150% as balanced, and 150% and above as high.

changes in top-coding practices over time. I address the incomparability problems of

wages in a series of procedures, adjusting top-code values in 1980 and truncating the

top 2 percentile of the wage distribution at the national and metropolitan area levels in

the observed census year[6]. The Theil-T index can be expressed in the following form:

$$T = \sum_{i=1}^{N} \frac{y_i}{N\bar{y}} \ln\left(\frac{y_i}{\bar{y}}\right) \tag{1}$$

where N is the total population, y_i is the wage income of subgroup i, and $\bar{y}$ is the

arithmetic mean income across group.

Decomposition of wage inequality is a useful tool for identifying the

components of aggregated wage inequality for a population comprising subgroups

with many heterogeneous characteristics. A unique property of the Theil-T index is

that it can be decomposed into the sum of a term summarizing within-group

inequality (first term in Equation 2) and a term summarizing between-group

inequality(second term in Equation 2) as :

$$T = \sum_{j}\left(\frac{Y_j}{Y}\right)T_j + \sum_{j}\left(\frac{Y_j}{Y}\right)\ln\left(\frac{Y_j/Y}{N_j/N}\right) \tag{2}$$

where Y is the total income of the population, Y_j is the total income of group j, T_j

is the wage inequality within group j. In the within-group inequality term,

$Y_j/Y = (N_j/N)*(\bar{y}_j/\bar{y})$ is the share of the income of all individuals in group j. The

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[6] Detailed practices are more complex and are available upon request.

between-group inequality can be interpreted as the product of population share of group *j* in the total population and the ratio of mean wage of group *j* over that of the total population. The entropy decomposition of Theil-T Index is widely used in many social science analyses.

3.3 Findings

3.3.1 Temporal Trend of Wage Inequality among Immigrant Workers

Figure 1 suggests that the temporal trend of wage inequality for foreign-born full-time full-year (FTFY) workers is similar to that of the native workers at the national level. Wage inequality experienced sharp growth in the past three decades for both male and female, and foreign-born and native-born workers. Still, gender and nativity differences are obvious. For male workers, inequality among the foreign-born started at a higher value (immigrant wage at the 90th percentile was 4.48 times of that at the 10th percentile) than that among the native-born workers (the same ratio was 3.80). As the inequalities among both foreign- and native-born workers increased, the wide nativity gap remains. The nativity gap is different for female workers. The P90/P10 wage ratios for both foreign-born and native-born female started around 3.40 in 1980, with the former value exceeding 25% of the latter (5.67 v.s. 4.54) after three decades. The rapid growth of wage inequality among both genders and nativities is largely attributable to the high concentration of inequality at the top end of wage distribution since the 1980s. And this phenomenon is most pronounced among male

immigrant workers, with high concentration of immigrant skills at both tails of its

distribution. The P90/P50 and P50/P10 curves (Line colors vary by different types of

percentile ratios, and symbols vary by nativity.) for male immigrant workers in

Figure 1 provide evidence of wage polarization, featuring a persistent expansion of

wage disparity in the upper half and a contraction of wage divergence in the lower

half.

Figures 3.1 Percentile Ratios of Native and Foreign-born Wage Distribution for Male
(A) and Female (B) Workers at the National Level

A
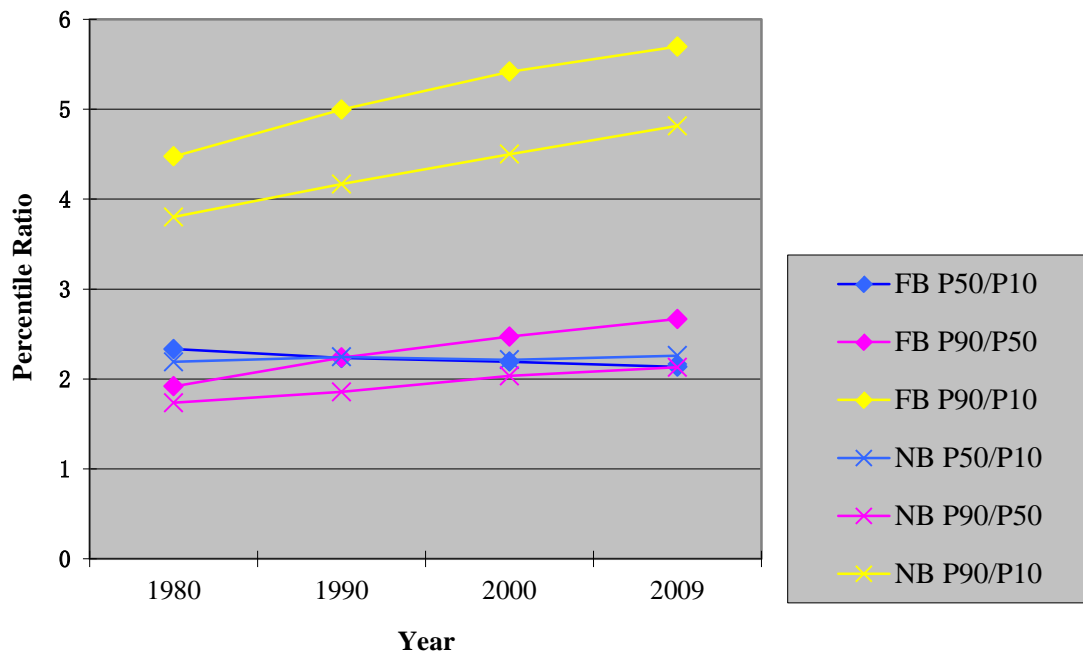
B
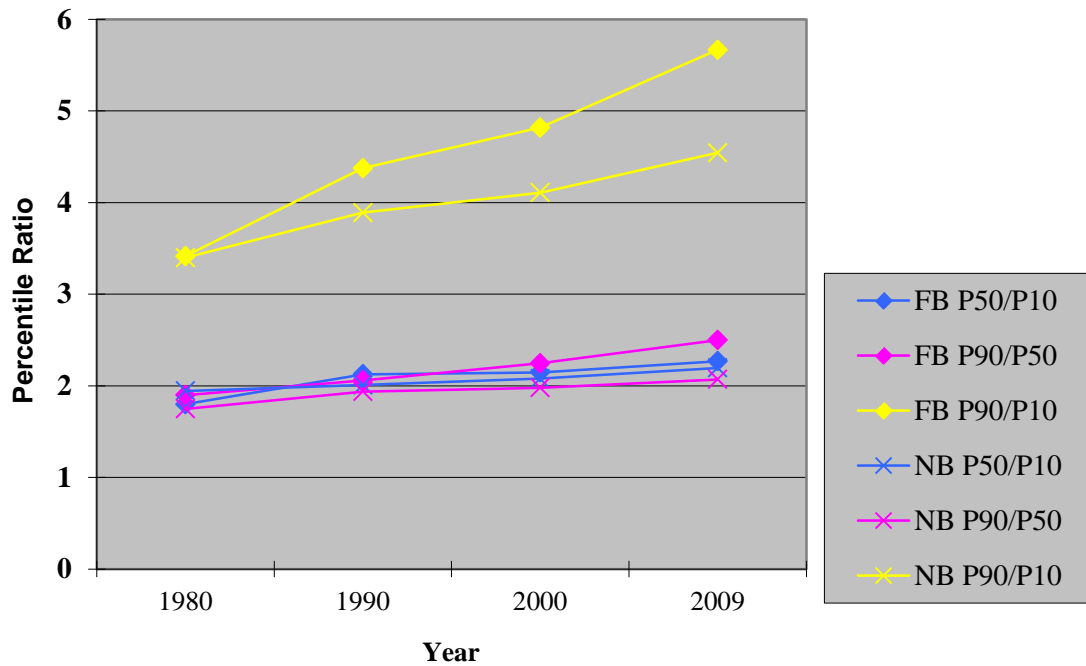
Figure 2 reports very similar gender and nativity gaps in wage inequality in the form of Theil-T values. Between 1980 and 2009, wage inequalities of both foreign-born male and female workers started at a higher level compared to their native-born counterparts and kept increasing at a much higher rate. Overall, levels of inequality remained highest among the foreign-born male workers throughout the past three decades while the highest three-decade growth rate occurred among foreign-born female workers (66.66 %).

Figure 3.2 Wage Inequality Trends in Theil-T Indices among FTFY Native and Foreign-born Workers by Gender at the National Level (With the top 2 percentile wages truncated in each Census year)
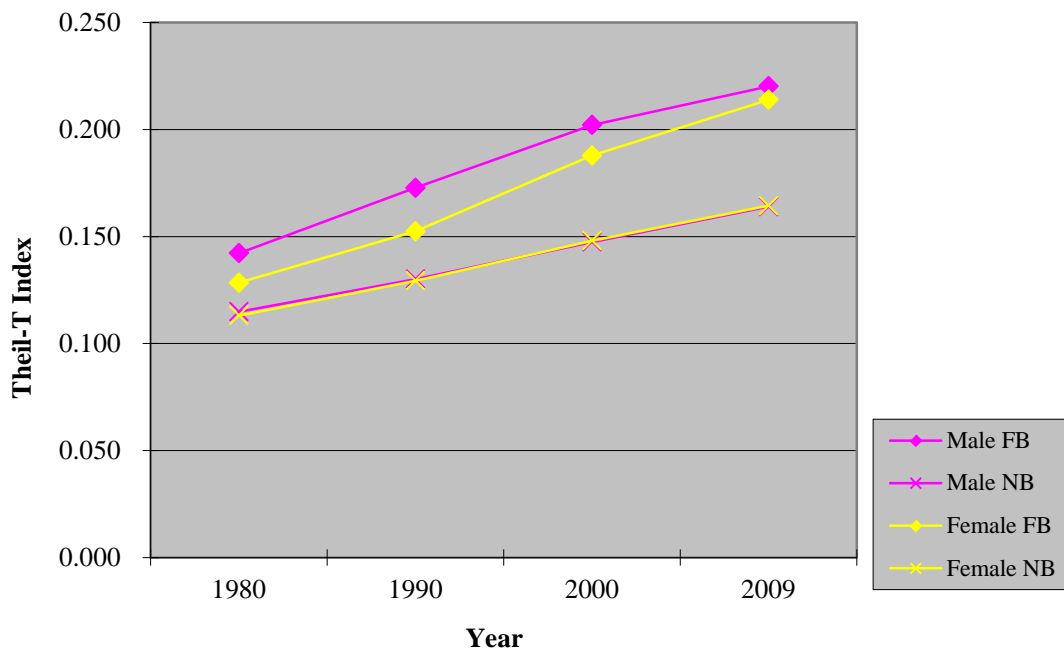
3.3. 2 Spatial Distribution of Wage Inequality among Immigrant Workers

This section seeks to assess whether the temporal trend of average immigrant wage inequality at the national level holds at the metropolitan level. In addition, I examine the spatial patterns of immigrant wage inequality in three aspects: variances in immigrant wage inequality across metropolitan areas, the geographic concentration of high inequality across different regions in the U.S., and how the foreign-born inequality level in a city is correlated with the local skill profile of immigrant workers and their settlement pattern. I generalize these findings by nativity differences and gender differences.

Table 1 summarizes the temporal trend of wage inequality among FTFY immigrant workers across the largest 100 metropolitan areas in means and variances

of Theil-T values. On average, the levels of wage inequality among immigrant workers of both genders remain higher than those among the native workers throughout all years. While the wage gap among the foreign-born male workers registered the highest Theil-T value as 15.827 in 2009, it rose most rapidly among the foreign-born female workers (by 71.60 in the past three decades). These findings are consistent with the patterns observed in national data.

Table 3.1 Means and Relative Standard Deviation of Native- and Foreign-born Wage Inequalities across Metro Areas

	1980	1990	2000	2009	% of change 80-09
NB Female Theil-T					
Mean	0.105	0.116	0.134	0.148	41.541
R.S.D.	8.873	7.746	7.875	8.687	30.861
FB Female Theil-T					
Mean	0.116	0.134	0.164	0.193	71.599
R.S.D.	21.915	17.102	15.357	15.176	53.16
NB Male Theil-T					
Mean	0.111	0.123	0.139	0.153	38.531
R.S.D.	14.167	11.831	11.382	11.398	38.363
FB Male Theil-T					
Mean	0.126	0.152	0.181	0.2	64.308
R.S.D.	22.946	20.258	14.966	15.827	64.948

Meanwhile, the high relative standard deviations of foreign-born male and female wage inequalities in Table 1 indicate that the spatial variances in wage inequality were higher among the foreign-born workers than those among the natives throughout all years. A comparison between top and bottom series of maps in Figures 3A gives us a better idea about the spatial patterns of wage inequality by nativity for male workers. Figure 3A documents the changing distribution of the Theil-T index among FTFY male foreign-born and native workers across U.S. metro areas in 1980, 1990, 2000, and 2009. First, I find wider spatial variation in wage inequality among immigrant workers throughout three decades. Using identical interval scale for inequality levels across metropolitan areas, the immigrant inequality maps show a variety of different colors whereas the native-born data are more or less colored in green, indicating a more even distribution of native-born wage inequality. Even more interesting is the fact that within each state, there are significant differences across cities in immigrant inequality. For example, California has relatively high wage inequality cities such as San Francisco, San Jose and Ventura, surrounded by areas with very low wage inequality among immigrant workers such as Modesto, Stockton, Fresno and Bakersfield.

Second, high wage inequalities among immigrant workers kept being more concentrated in the South metropolitan areas over the past three decades. In 2009, a few metropolitan areas that had the highest Theil-T values (for males) among all were Birmingham (.310), Raleigh (.280), Charlotte (.262), Austin (.252), Atlanta (.248) and

Denver (.248). In contrast, the highest wage inequalities for the native-born gradually shifted from the South to large metropolitan areas along the East and West coasts. Wage inequality levels among native-born male workers remain equally low across the country, as no metros reported a Theil-T value higher than .200 in 2009.

Third, a close look at the spatial pattern of immigrant wage inequality highlights its association with local immigrant skills and their historical settlement patterns in metro-level labor markets to a certain extent. Unlike the continuous spatial concentration of high native wage inequalities in large cities that are often top gateways for immigrants such as Houston, Los Angeles, New York and San Francisco, high immigrant inequality are more likely to occur in cities with two types of characteristics. First, these metropolitan areas have experienced a sudden or continuous rapid growth in the share of foreign-born population since 1980. In addition, they demonstrate a balanced or slightly high immigrant skill profile as revealed in the 2009 IPUMS ACS, indicating a more heterogeneous distribution of immigrant skills in these labor markets. In 2009, some examples of high immigrant inequality metros were major-continuous gateways such as New York, pre-emerging gateways such as Raleigh-Durham, Charlotte-Gastonia-Rock Hill, emerging gateways such as Atlanta and Austin and re-emerging gateways such as Denver-Boulder. Although their gateway types vary, most of these pre-emerging, emerging and re-emerging metros experienced a sudden rapid growth rate in their immigrant population share in the 1990s and their three-decade growth rates are 2.5-8 times as

much as the average population growth rate in top 100 U.S. metros. Even in those low immigrant gateways with a high inequality level, the three-decade rise in population size more than doubled the average population growth rate (165.17%).

A comparison between the top series of maps in Tables 3A and 3B shows that gender gap exists in the spatial patterns of high wage inequality among immigrant workers. First, in terms of the spatial variation in wage inequality level, there is little difference between female and male immigrants, as the range of inequality levels in Theil-T Index for female workers are .22 and .23 for male. In addition, there is a strong concentration in high wage inequality among both male and female workers in South metros, with high female inequality in the Pacific West region as well. Finally, high wage inequality among female immigrant workers, as well as that among male workers, was to some extent associated with large size of immigrant workers and/or dramatic growth in immigration in a metropolitan area. Metros with highest inequality levels among foreign-born female workers were mostly re-emerging, minor-continuous, and post-WWII gateways such as Houston, Ventura, Bakersfield, Austin, Dallas, Knoxville, Charlotte, Fresno, Los Angeles and Denver, which witnessed fast immigration growth in the second half or at the end of the 20th century. Even in Knoxville, TN, the only low immigration metros with high wage inequality, the three-decade foreign-born population growth rate (340.21%) was much higher than the average rate of 165.17% in all U.S. metros. However, little association is found between female wage inequality and local immigrant skill profile in a labor

market, while high wage inequality among male workers are more likely to occur in

destinations with a balanced or slightly high immigrant skill profile. The difference

could be attributed to the high participation rate of male workers in the labor force.

Immigrant skill structure mainly reflects the skill distribution of male workers, and

therefore plays an important role in differentiating wages between high and

low-skilled immigrant male workers.

Figure 3.3A and 3.3B Distribution of Wage Inequality across Metropolitan Areas for
FTFY Foreign-Born and Native-Born Workers by Gender in 1980, 1990, 2000, and
2009

A. Male Foreign-born (top maps) v.s. Native-Born (bottom maps)

Legend:
Theil Index Range

B. Female Foreign-born (top maps) v.s. Native-Born (bottom maps)

Legend:
Theil Index Range

.0627 - .0900   .0901 - .1200   .1201 - .1500   .1501 - .1800   .1801 - .2100   .2101 - .2400   .2401 - .2700
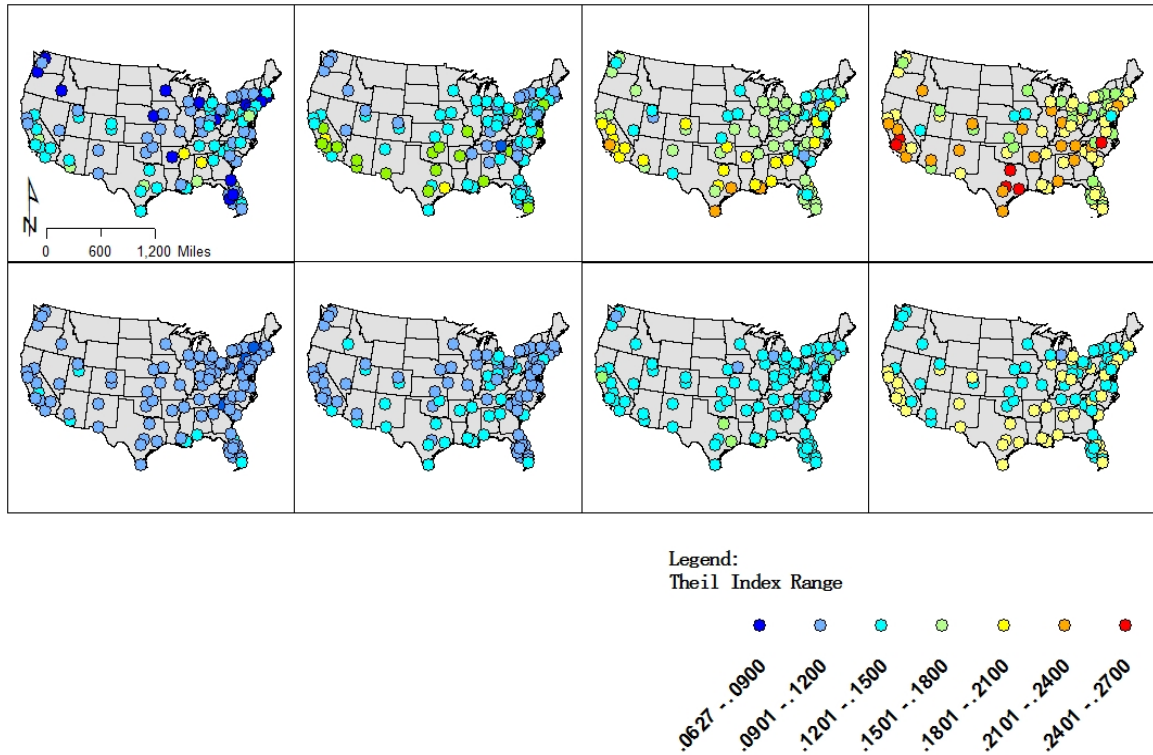
3.3.3 Growth Patterns of Wage Inequality

To better analyze the spatial pattern of changes in wage inequality among immigrant workers across the U.S. metropolitan areas, Figure 4 compares four maps of the percentages of growth in Theil-T values by gender and nativity during the past three decades. Some unique features lie in the spatial pattern of growth in wage inequality among the foreign-born workers of both genders. First, the means and variances of the three-decade growth in inequality for both male and female immigrant workers are much higher than those of their native-born counterparts. Second, from a geographical perspective (Figure 3.4), high growth rates for male immigrant inequalities are concentrated in the East North Central, Southeast and Pacific Coast metros. While the growth pattern of wage inequality among female

foreign-born workers are more spread out across the whole nation. In particular, wage gap among male immigrant workers has surged tremendously in the Northeast metropolitan areas since 1980. Third, top growth rates occurred in balanced or high skill profiled metros which have been experiencing accelerated immigration growth in the past three decades. These metropolitan areas include re-emerging gateways, such as Portland (334%) and Seattle (290%), and low-immigrant gateways, such as Birmingham (303%), Boise City (852%), Louisville (307%) and Charleston (177%), Indianapolis (388%). The same situation applies to growth in female inequality. In addition, pre-emerging gateways such as Columbus (308%), Lakeland-Winterhaven (448%) and Sarasota (479%) witnessed a rapid growth in female wage inequality in the past three decades. Finally, an interesting feature of metros with negative or smallest positive growth rates for male foreign-born inequality is that they are mostly minor-continuous (Bakersfield, El Paso, Fresno, McAllen Modesto, San Antonio), pre-emerging (Las Vegas, Fort Myers-Cape Coral) located along the Southern border.

Figure 3.4 Changes in Theil-T Index for FTFY NB and FB Workers by Gender between 1980 and 2009
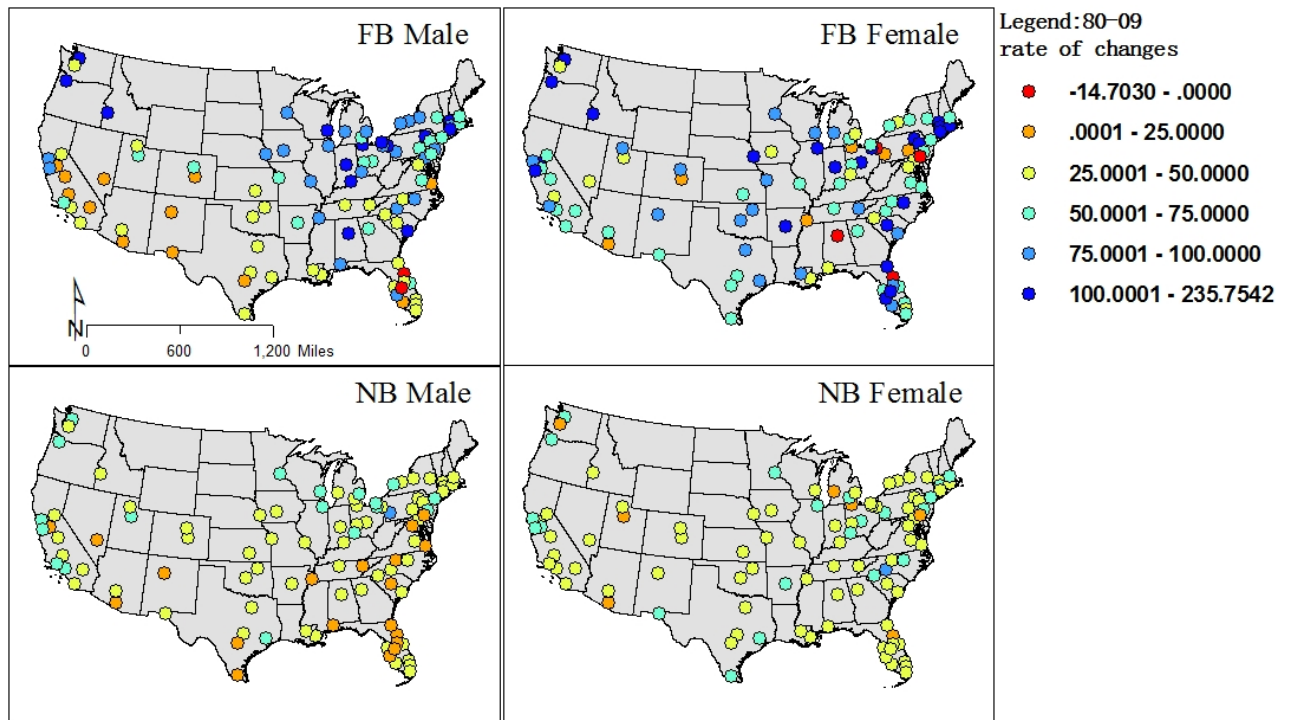
Figure 3.5 Average Wage Inequality Growth Trends for Male and Female
Foreign-born Workers by Different Types of Metros, 1980 to 2009

A: Male
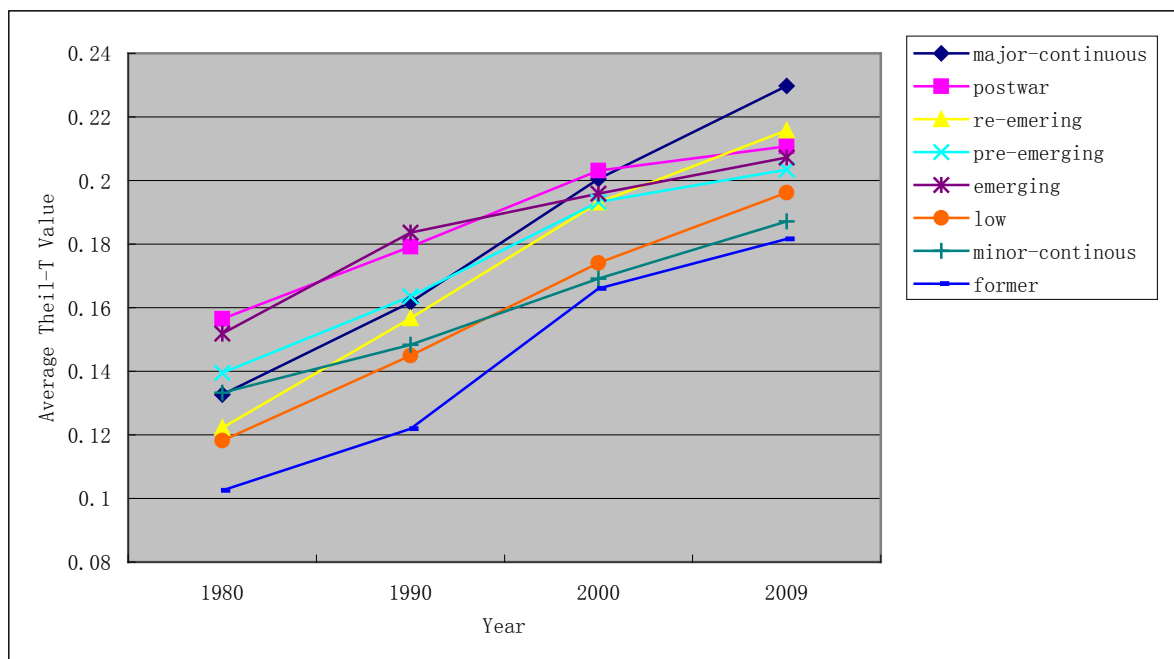
B: Female
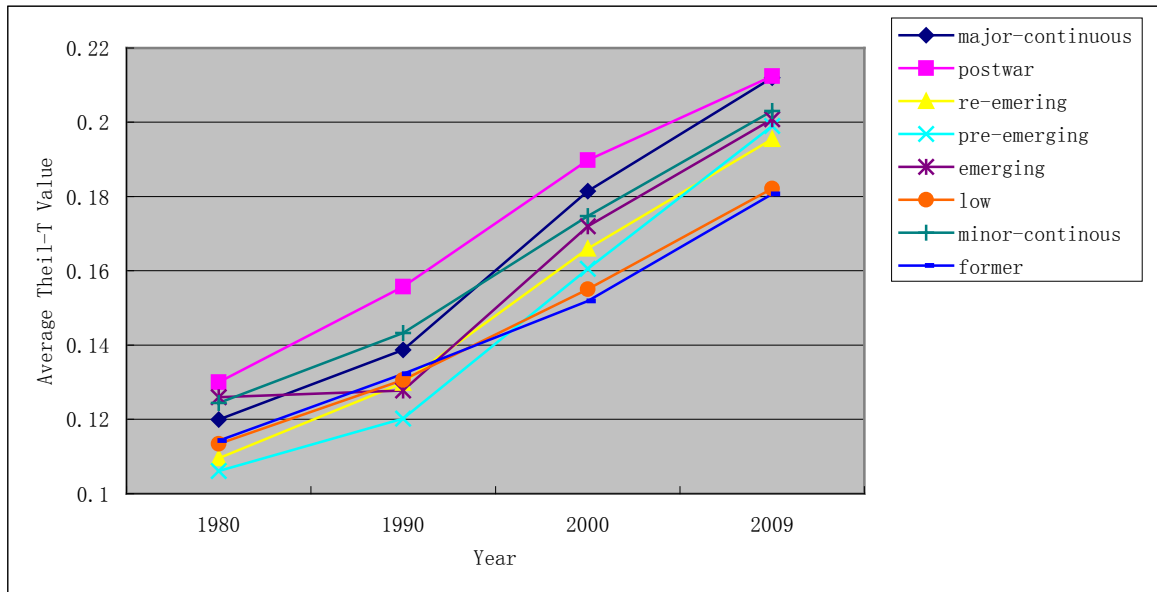
Comparing changes in average foreign-born wage inequality levels across different types of immigrant gateway cities, Figure 3.5 demonstrates an upward trend in all eight types of immigrant gateways for both genders. According to Singer (2004), major-continuous and post-WWII gateways have a large number of earlier and more recent immigrants with diversified skills. Therefore, average wage gaps among both male and female immigrants kept being high. In 2000s, there was a decline in wage inequality growth rates for both genders in post-WWII gateways. In comparison, immigrant workers in the new immigrant destinations (pre-emerging, emerging and re-emerging immigrant gateways) had a smaller wage gap than those in traditional large immigrant gateway cities. However, their three-decade growth rates increased most rapidly. In particular, male immigrant wage inequality in re-emerging gateways (80.22%) and female immigrant wage inequality in pre-emerging gateways(91.12%) topped all types of immigrant gateways for their three-decade growth rates respectively. Similarly, the three-decade growth rates of average male and female

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immigrant wage inequalities in low-immigrant gateways were also high (74.81% for male and 70.41% for female). However, the average level of wage inequality for immigrants remained low over the past three decades. In former gateways with low levels of contemporary immigration and high levels of education among immigrants, their wage inequality continued to be the lowest among all types of gateway metros, especially since the 1990s. The only gender difference in wage inequality trends happened in minor-continuous gateway cities. While the average levels of female immigrant wage inequalities in minor-continuous gateway cities were relatively high compared to those in the other gateway cities, wage inequality levels among male immigrant workers in minor-continuous gateways started low and increased slowly over the past three decades (39.96%).

Three reasons explain the distribution of high and low growth rates of wage inequality in U.S. metropolitan areas. First, the strong association between immigrant skills and high levels of wage inequality in major-continuous and post-WWII gateway metros supports previous findings that agglomeration of high skills would lead to skill-biased technological change, thereby generating greater disparity in wages (Glaeser, Resseger, and Tobio 2009). Second, minor-continuous immigrant gateways that had negative or smallest positive growth rates among immigrant workers are long-term destinations for low-skilled immigrants, mostly from Mexico. These metros often have a strong ethnic concentration of foreign-born workers in low-skill jobs. My findings show that male immigrants were more influenced by a negative selectivity of

skills than female immigrant workers. Finally, new immigrant destinations such as emerging, re-emerging, and pre-emerging immigrant gateways and even low-immigrant gateways provided fewer ethnic resources and community networks for immigrant workers. On one hand, immigrant workers in new immigrant gateway metros faced a bigger challenge of job searching than those in traditional immigrant gateways; on the other hand, as what was described as "new gateway advantages'', immigrants were less occupationally segregated from native-born workers (Ellis, 2001; Ellis, Wright, and Townley 2013). Therefore, changes in wage structures among foreign-born workers were more significant in new immigrant destinations in the past three decades.

In contrast, wage inequalities of their native-born counterparts (both male and female workers) were more evened out across the country. The fastest growth in native-born wage inequality occurred in metros that are long time magnets of both immigration and internal migration in the U.S., such as Chicago, San Jose, Houston and San Francisco. These results argue in line with earlier findings at the state level that larger regions with a relatively low start-point in 1980 have became far more unequal in the late 2000s while inequality level in many less equal regions in the 1980s have changed little (Morrill 2000).

In conclusion, the growth patterns of immigrant wage inequality points to an association between shifts in immigrant wage gap and immigrant skill distribution and their historical settlement pattern in a metropolitan area. However, these

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associations are not sufficient to explain the spatial variation in wage inequality across different types of U.S. metropolitan areas. As I will examine in Chapter 5, other spatial attributes such as local economic conditions and industrial demands also count.

3.3.4 Linking Immigrant Wage Inequality to the Overall Wage Inequality

Previous sections compare the temporal trends of foreign-born and native-born wage inequality at the national level and their spatial distributional patterns in the largest 100 U.S. metropolitan areas. Decomposing different sources of overall wage inequality by nativity, this section explores the linkage between total wage inequality and wage inequality within immigrant workers. Deriving from Equation 2, Table 2 shows the decomposition results of overall wage inequality at the national level.

Table 2 Columns 3 and 4 correspond to the temporal trends of native- and foreign-born wage inequality shown in Figure 2 above. Column 5 indicates a slight increase in percentage of contribution to overall wage inequality by nativity variation. Throughout the past three decades, the contribution of between-group inequality was significantly smaller ($< 2\%$) than those of within-group inequalities. It is interesting to notice that nativity difference among female wages was much more significant in 1980 than in 2009. The situation is reversed for male workers as the nativity variation kept increasing since 1980 and peaked in 2009. Columns 6 and 7 report the contributions of foreign-born and native-born wages to overall wage inequality, namely the Theil-T Index among immigrant and native-born workers (T_i) weighted

by their income share ($\frac{Y_i}{Y}$). While wage gap among the native-born remained the major source of overall wage inequality, the contribution of immigrant wage inequality to overall inequality continued to increase over the past three decades. In 1980, the weighted native wage gap accounted for more than 90% of the total wage inequality for male and female workers separately and them as a whole. By 2009, its contribution to the total wage inequality declined to around 80% for both genders. In contrast, the percentage of contribution from immigrant wage inequality more than doubled in three decades (from around 7% in 1980 to more than 15% in 2009). In 2009, wage inequality among male immigrant workers accounted for as much as 19.20% of the total male inequality. By definition, the effect of immigrant wages on total wage inequality can be generalized as a product of its income share and level of wage inequality. Column 3 and 8 indicate that the rapid growth rates of immigrant wage inequality and immigrant income share both overtook that of the overall wage inequality (Column 1). Consequently, the foreign-born wage contribution to the overall wage inequality continued to rise throughout the past three decades. Finally, columns 8 and 9 reveal a high correlation between the income share and population share of immigrant workers at the national level. In essence, the sharp increase in income share of immigrants reflects the large immigration influx since 1980.

Table 3.2 Theil-T Decomposition of overall wage inequality by nativity for both Genders at the National Level

	Total Theil-T	FB Theil-T	NB Theil- T	Btw-group % of Contribution	FB % of Contribution	NB % of Contribution	Income Share of FB%	Population Share of FB%
Total								
1980	0.140	0.157	0.139	0.126	6.734	93.140	6.019	6.476
1990	0.147	0.172	0.144	0.309	9.591	90.100	8.147	8.996
2000	0.163	0.200	0.157	0.607	14.228	85.165	11.594	13.069
2009	0.179	0.219	0.171	0.777	17.464	81.759	14.278	16.189
Male								
1980	0.117	0.142	0.115	0.213	7.132	92.655	5.852	6.391
1990	0.134	0.173	0.130	0.685	10.537	88.778	8.201	9.430
2000	0.156	0.202	0.147	1.346	15.677	82.977	12.112	14.333
2009	0.176	0.220	0.164	1.729	19.119	79.152	15.241	18.179
Female								
1980	0.114	0.128	0.113	1.725	7.267	92.716	6.459	6.614
1990	0.131	0.152	0.129	0.064	9.338	90.598	8.044	8.401
2000	0.153	0.188	0.148	0.167	13.201	86.633	10.719	11.430
2009	0.171	0.214	0.164	0.209	15.981	83.810	12.779	13.688

I then explore the impacts of immigration on overall wage inequality in top 100 metropolitan areas in the U.S.. First, I examine the spatial variation in contribution of weighted immigrant wage inequality to overall wage inequality. Table 3 summarizes the average level of foreign-born contribution to overall wage inequalities and its variance across metropolitan areas. On average, contribution of immigrant wage inequality across metropolitan U.S. increased rapidly, by 7.2 percentage points for

females and 9.6 percentage points for males over the past three decades. The contributions of male immigrant workers started slightly high at 5.852% in 1980, but exceeded that of the female immigrants by 2.5 percentage points after three decades in 2009.

Table 3.3 Means and R.S.D. of Foreign-born Contribution to Overall Wage Inequalities by Gender across Metro Areas

	1980	1990	2000	2009	% of change 80-09
FB Female % contribution					
Mean	5.784	7.023	10.376	12.992	155.032
R.S.D.	87.926	98.959	87.703	77.916	75.244
FB Male % contribution					
Mean	5.852	7.986	12.386	15.488	246.614
R.S.D.	93.737	94.906	75.851	65.546	79.511

Second, Figures 5 and 6 demonstrate the geography of contribution of weighted immigrant wage inequality to overall wage inequality in each metropolitan area by gender in 1980, 1990, 2000 and 2009. Foreign-born wage inequality accounts for .63% to 55.32% of local wage inequality among male workers and 1.07% to 54.86% of local wage inequality among female workers. Over time, high proportion of contribution from immigrant wages spread from South immigrant gateways to most metropolitan areas across the U.S.. However, a group of metropolitan areas including Miami (54.84% in 2009), San Jose (54.26% in 2009), Los Angeles (39.73% in 2009),

San Francisco (37.02% in 2009), New York (35.22% in 2009), McAllen (32.72% in 2009), Stockton (31.37% in 2009), San Diego (29.81% in 2009), Riverside (29.29% in 2009) and El Paso (29.02% in 2009) remained "sticky places" of the highest foreign-born contribution to total wage inequality throughout the past three decades. A close look at the historical settlement patterns of these metropolitan areas indicates that all of them are long-term immigrant magnets and continue to receive large size of immigrants.

Since the effects of immigrants on overall wage inequality can be decomposed into the wage effect (immigrant wage inequality) and income share effect (which is highly correlated with size of immigrant population), I compare the spatial patterns of foreign-born contribution with those of immigrant income share. For both genders, Figures 5 and 6 show a strong positive correlation between immigrant contribution and their income share in most metropolitan areas. The p-values of the correlation coefficients are statistically significant at the .001 level across all years for both male and female immigrant workers.

Figure 3.6 Spatial Patterns of Contribution of Male Immigrant Wage Inequality and
Their Income Share in 1980, 1990, 2000, and 2009
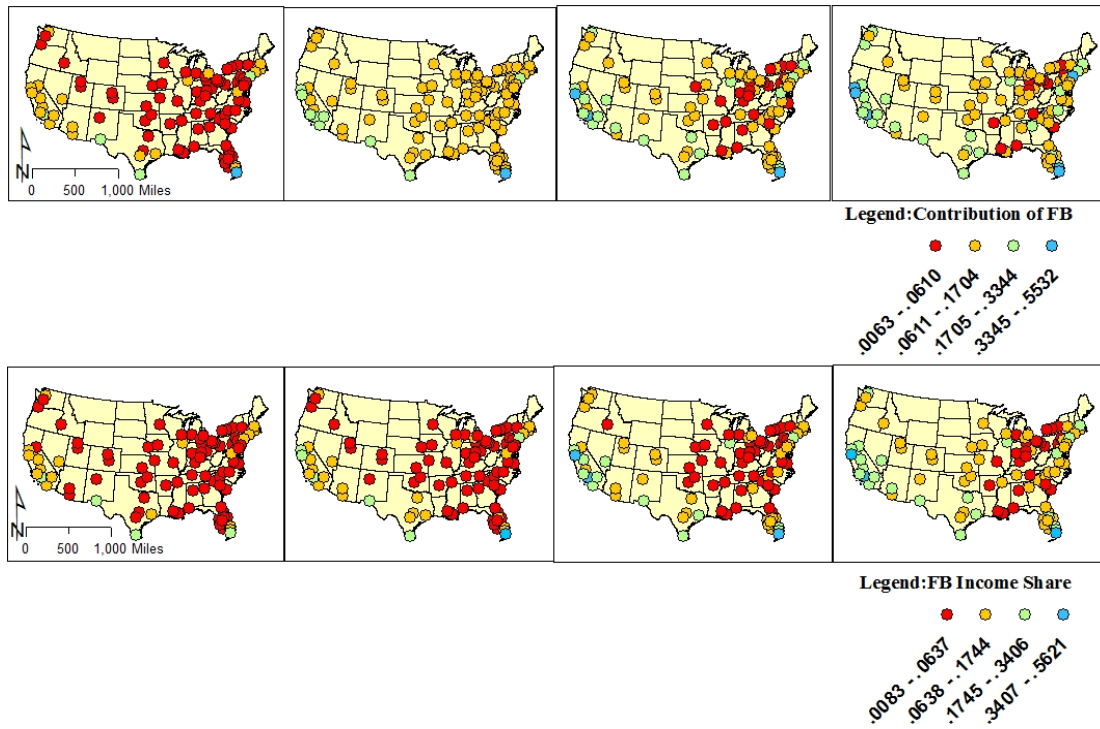
Figure 3.7 Spatial Patterns of Contribution of Female Immigrant Wage Inequality and
Their Income Share in 1980, 1990, 2000, and 2009
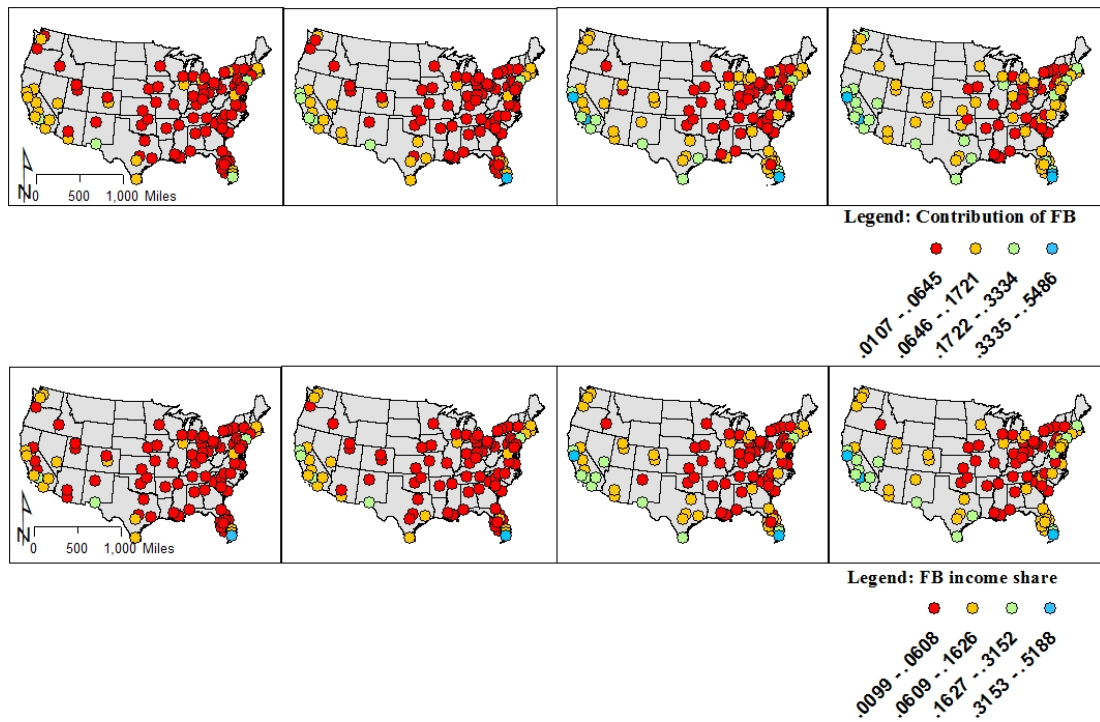
Meanwhile, comparing growth pattern of foreign-born contribution and that of the immigrant income share across metropolitan U.S., Figure 7 indicates that the highest growth rates in foreign-born contribution and in foreign-born income share were both concentrated in the Southeast. Take male for example, rapid growth in foreign-born contribution occurred in metropolitan areas include Birmingham (13.38%), Louisville (9.29%), Atlanta (7.85%), Memphis (9.06%), Raleigh (7.55%), Nashville (7.37%), Greensboro (6.62%) and Charlotte (6.22%), all of which experienced a rise of over 5% in immigrant income share over the past three decades. This spatial pattern differs from the growth pattern in immigrant wage inequality as its high growth rates were more scattered across North East Central, Southeast and Pacific Coast metros (See Figure 3.4). Therefore, the decomposition of overall wage inequality indicates that high foreign-born contribution to overall wage inequality has a strong association with the foreign-born population size, as also indicated by the statistically significant p-value of correlation coefficients between them. The situation holds for both female and male foreign-born workers.

Figure 3.8 Three-decade Changes in Foreign-born Contribution to Overall Wage Inequality and Changes in Foreign-born Income Share
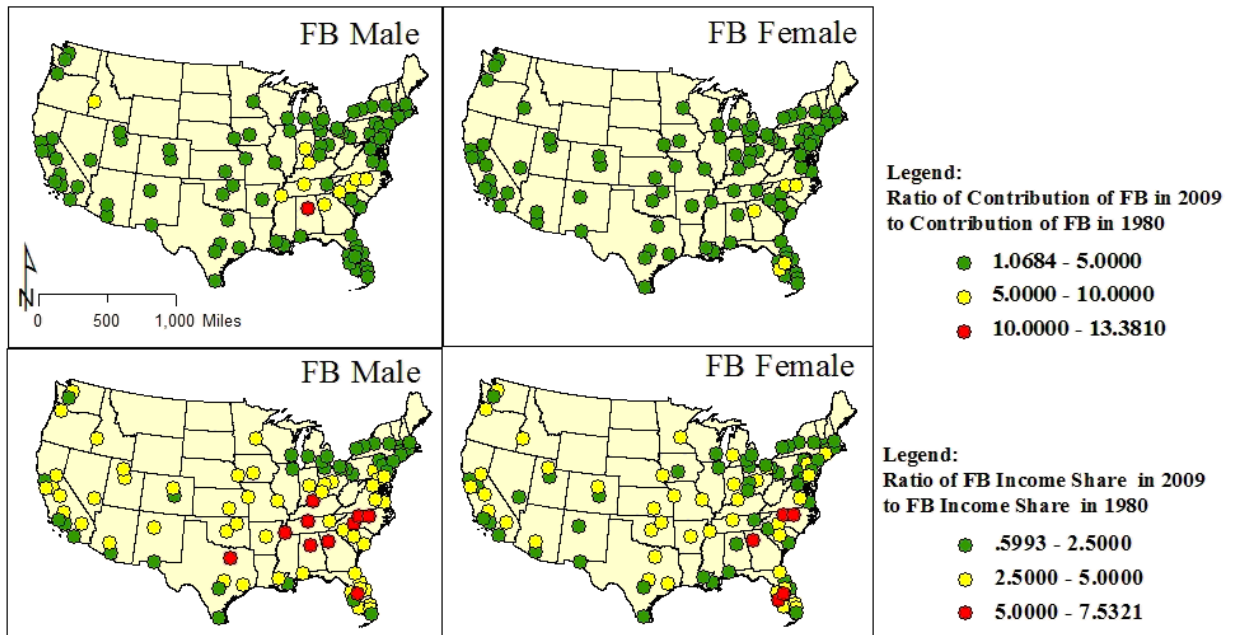
Figure 3.9 Average Foreign-born Contributions to Overall Wage Inequality by Different Types of Metros by Gender, 1980-2009
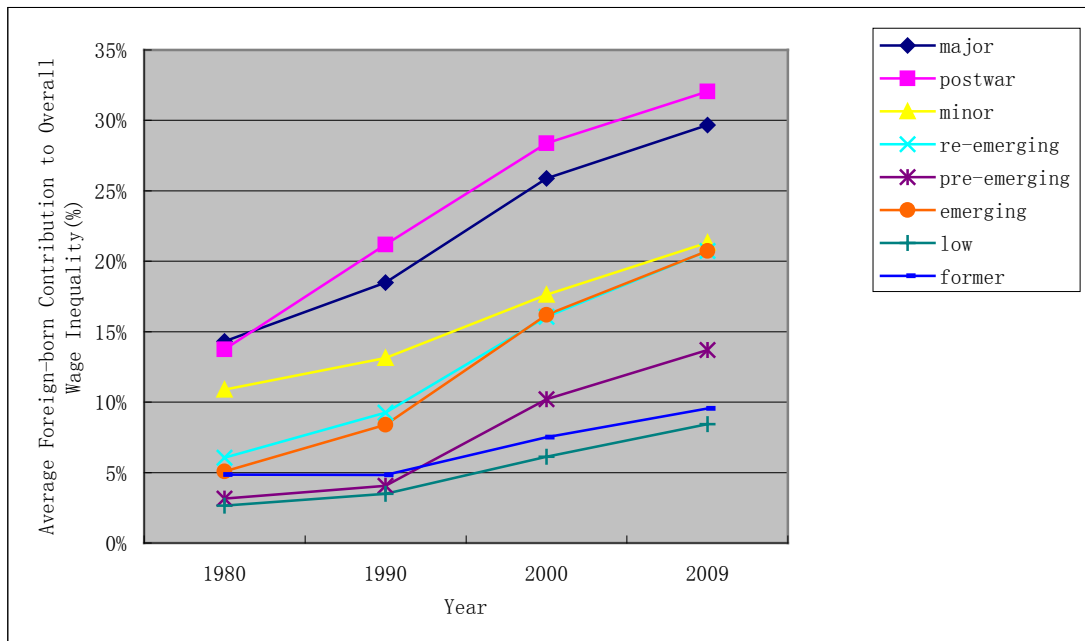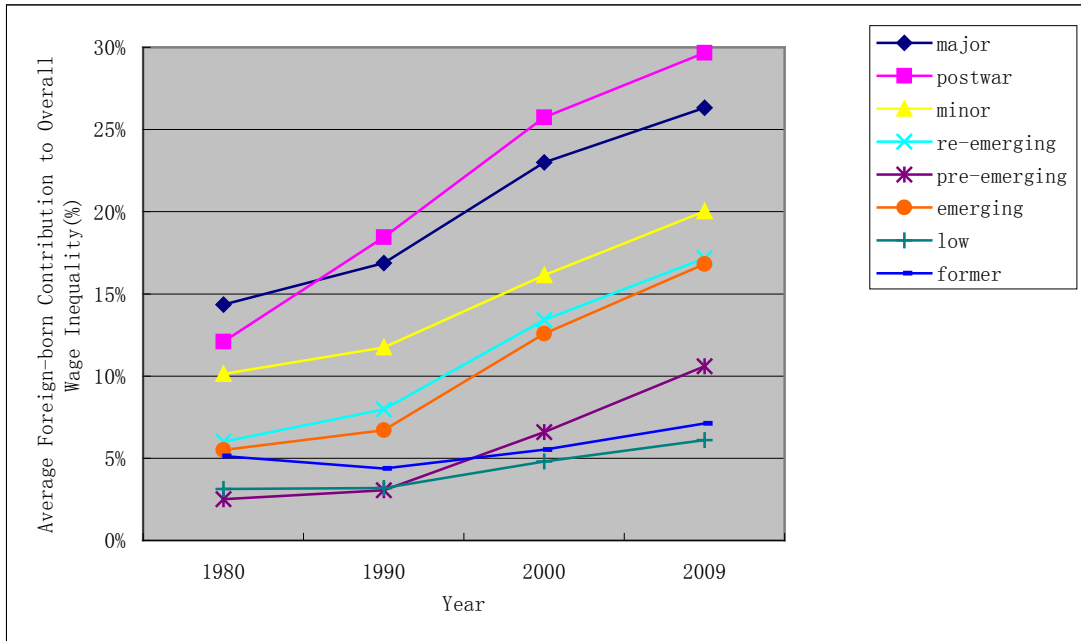
A: Male

B: Female

Comparing changes in average foreign-born contributions to overall wage inequality across different types of immigrant gateway cities, Figure 3.9 shows an upward trend in all eight types of immigrant gateways for both genders. As indicated in Figures 3.7 and 3.8, traditional immigrant destinations such as major-continuous, post-WWII and minor-continuous immigrant gateways had the highest shares of immigrant populations, and therefore ranked top in foreign-born contributions to overall wage inequalities. As for immigrant workers in the new immigrant destinations (pre-emerging, emerging and re-emerging immigrant gateways), their contributions to overall wage inequality were between 5% and 20% on average, a range much lower than those in traditional large immigrant gateway cities. Yet their three-decade growth rates were almost two times higher than the growth rates in other metropolitan areas. For example, the contribution of male immigrant wage inequality

to overall wage inequality grew by 400% in emerging gateways and 366% in pre-emerging gateways during the last three decades, which were the highest among all gateway types. In contrast, low- and former- gateway metros accommodated the smallest numbers of contemporary immigrants. Therefore, on average, foreign-born contributions to overall wage inequality remained low for both male and female immigrant workers in these areas.

In conclusion, the effect of between-nativity difference on overall inequality was relatively small at both the national and metropolitan levels. Instead, much of the wage inequality happened within native and non-native wage groups. Although the major source of within-group wage inequality came from the native subgroup, the foreign-born contribution to overall wage inequality keeps increasing. While levels of foreign-born contribution remained highest in major- and minor-continuous immigrant gateways, the largest three-decade growth rates occurred in a few Southeast metropolitans which experienced a concurrent rapid rise in immigrant income share. Therefore, spatial variations in the levels of foreign-born contribution to overall wage inequality and their three-decade growth are associated with local demographic changes of immigrants and their historical settlement patterns in metropolitan areas.

3.4 Summary and Policy Implications

In corresponding to my first hypothesis of this dissertation, Chapter 3 identifies some unique temporal-spatial patterns of wage inequality among the foreign-born workers. First, at both national and metropolitan levels, different measures indicate that the overall and average levels of wage inequality were higher among immigrants than the native-born workers in all observed years, which   in both tails of the skill distribution. Second, while both started at relatively low levels, the foreign-born wage inequalities grew at a much faster rate that those of the native-born at both the national and metro levels. In contrast, the native-born inequalities increased much less significantly and more evenly over time. Third, throughout the past three decades, metropolitan-level spatial variations in wage inequality were much wider among immigrants than the native-born workers. In 2009, while the highest levels of native-born wage inequalities remained concentrated in large metropolitan cities, the highest foreign-born wage inequalities occurred in both major-continuous and new immigrant gateway metros. Meanwhile, A few cities with a balanced or slightly high immigrant skill profile and a sharp increase in immigrant population size during the rest half of the 20th century topped the list of high wage inequality growth among immigrants.   Therefore, I argue that the spatial distributions of foreign-born wage inequalities and their growth rates reflect the different skill profiles of immigrant workers and their historical settlement patterns of immigrants across metropolitan areas. Finally, I show that immigrant wage inequality accounted for more than 17% of the overall wage inequality in the U.S. in 2009. However, there is wide spatial variation in its contribution to the overall wage inequality across different metro

areas. The effect of immigration is the largest in traditional large immigrant gateway metros along the Northeast and Pacific West coasts. Yet Southeast metros became top growth regions of immigrant contribution, as a combined result of high increases in immigrant wage inequality and income share. Although the contributions of weighted immigrant wage inequality to overall wage inequality vary spatially, immigrant wage inequality continues to be a significant component of the overall wage inequality at both national and metropolitan levels since 1980. At the metropolitan area level, high levels of foreign-born contribution tend to be concentrated in large immigrant gateways. These phenomena are more attributable to the sharp increase in income share of immigrant workers than the rise in inequality within the immigrant group. In contrast, wage gaps among U.S. natives were smaller in size and grew at a much slower rate since the 1980s, suggesting that the impacts of immigration on overall wage inequality are highly concentrated among immigrants themselves.

A strong implication of my findings is that wage inequality among immigrant workers, like other social and economic processes and labor market outcomes, are geographically contingent and spatially grounded at the metropolitan level. On one hand, relatively low wage inequality among immigrant workers in a metropolitan area may not always be a positive signal for local economy. In many minor-continuous immigrant gateways along the South border, low inequality among immigrant workers is associated with a relatively evenly distributed low-skilled structure among immigrant workers. Although immigrant workers continue to favor these destinations,

the mobility of immigrant workers to these metros has a negative selection effect on their skill profile. In these low-skilled low-inequality minor-continuous gateways, immigrant workers are often trapped in traditional occupations or sectors where the earlier arrived cohorts belonging to the same racial and ethnic groups fit in, thereby reinforcing the existing wage structure of immigrant workers. Therefore, the low wage inequality among immigrants should not be taken for granted.

On the other hand, in large metropolitan areas which are also traditional immigrant gateways, the foreign-born inequalities remain a larger component of the high overall wage inequality due to the rapidly increasing immigrant population share. However, the native-born inequalities declined, indicating that a more significant effect of immigration on wage disparity happened among immigrant workers than on the overall or the native-born inequalities. As the influx of immigrant workers continues to be strong in these metros, how to reduce the wage disparities within the immigrant group has become key to the reduction of the overall wage inequality. The found linkage between locational demographic attributes and immigrant wage inequality informs us that much attention should be paid to the local immigrant demographic and skill compositions and their job match with local employment structure in order to reduce the rise in immigrant wage inequalities.

Finally, high wage inequality among immigrant workers can happen in low-immigrant gateways such as Birmingham, Boise City and Louisville. In these areas where immigrant skill profiles are balanced or slightly-high and population size

surged significantly in recent years, how to absorb immigrant supply shock in the interest of local economic structure remains a challenge for local economic development planners.

In conclusion, by emphasizing the association between overall wage inequality trends of immigrant workers and the spatial distribution of foreign-born skills and immigrant historical settlement patterns, the exploratory findings in this chapter provides a framework for the following two chapters to explain the temporal changes and spatial variations in wage inequality among immigrant workers.

Chapter 4

Between-Group and Within-Group Wage Inequalities among

Immigrants and Their Contributions to

Changes in Overall Immigrant Wage Inequality

In Chapter 3, I reported higher levels of overall wage inequality among immigrant workers than those among native-born workers across U.S. metropolitan areas. In this chapter, I push the analysis of U.S. wage inequality a little further, exploring between-group wage differentials by education and race and within-group wage inequality by controlling education, race and a few other individual characteristics of immigrant workers. In this chapter, I use within-group wage inequality and residual wage inequality as interchangable terms.

Previous studies, as mentioned in Chapter 2, pointed out that educational wage differentials for the overall labor force in the U.S. widened in the 1980s, and it has continued to increase, though at a less rapid rate, in subsequent years (Katz and Murphy 1992; Bound and Johnson 1992; Autor, Lawrence, and Alan 1998; Autor, Katz, and Kearney 2008). Almost at the same time, within-group wage inequality of the U.S. labor force, generally defined as wage gaps conditioned on measures of education, age and gender, has also increased steadily throughout the U.S. (Machin 2008; Leonardi 2004).In particular, within-group inequality was found to account for one-quarter to one-half of the overall increase in U.S. wage inequality over the last 30

years (Machin 2008; Leonardi 2004). However, little is known about the between-and within-group wage inequality among immigrant worker.

In this chapter, I examine the trend of wage differentials of immigrant workers by education and race and ethnicity in the past three decades. The other focus of this chapter is on residual wage inequality or that part of the variance in wages that cannot be explained by demographic characteristics. Both between-group wage differentials (in the forms of wage gap between foreign-born college graduates and high-school graduates and that between foreign-born White and Hispanic workers) and residual wage inequality among foreign-born workers in the United States as a whole and within different metropolitan areas are examined. Furthermore, I evaluate the contributions of observable individual characteristics and residual inequality and determine which factors were the main sources of growth of overall wage inequality among immigrant workers over the past three decades.

Chapter 4 is organized in the following way. Section 4.1 describes temporal trends of wage inequality between different educational and racial and ethnic groups of immigrant workers since 1980. Levels of between-group wage inequalities are estimated in two different measures: the unadjusted educational and racial and ethnic wage gaps among immigrant workers in mean log values, and the adjusted educational and racial and ethnic wage gaps predicted in an OLS models controlling for different individual characteristics of immigrant workers. An investigation on the metro-level variation in different wage gaps informs how race and ethnicity and skill

concentration of immigrant workers interact with geography in accounting for the heterogeneity of immigrant wages. Section 4.2 examines the trend of residual wage inequality among immigrant workers over time and across space. To further examine the variability of residual wage inequality across different groups of immigrants, I compare within-group wage variances by different educational and racial and ethnic categories. In Section 4.3, a regression-based approach is used to decompose the shares of different factor sources, such as education, race and ethnicity, and residual wage inequality in overall immigrant wage inequality in different years. This approach also sheds light on how changes in education, race and ethnicity and residual wage inequality account for the rise in overall immigrant wage inequality over time and across space. Similar to the previous chapters, gender gaps are addressed throughout Chapter 4. Section 4.4 summarizes the main findings.

4.1 Temporal Trends and Spatial Patterns of Wage Gaps between Immigrant Groups

Education has long been regarded as the single most important factor that contributes to wage inequality (Katz and Murphy 1992; Bound and Johnson 1992; Autor, Lawrence, and Alan 1998; Autor, Katz, and Kearney 2008). Education-based wage differentials for the overall labor force in the U.S. rose rapidly since the late-1970s. As pointed out in Chapter 3, race and ethnicity are also a key factor that shaping the structure of wages in the U.S.. Therefore, I draw special attention to the

unadjusted and adjusted trends of educational and racial and ethnic wage gaps among

immigrant workers to see how their levels evolved in the past three decades.

Table 4.1 provides an overview of changes in the shares of the U.S. immigrant

population by educational attainment and race and ethnicity over time. For both men

and women, the highest growth rates in labor force shares were among college

graduates. However, the shares of high-school graduates continued to be the largest

overall (around 30%). Meanwhile, the rise of the foreign-born population in the

United States since the 1970s was primarily due to the large influx of immigration

from Latin America and Asia. Between 1980 and 2009, the shares of non-Hispanic

Asian and Hispanics increased by 7.64 and 19.48 percentage points for male workers

and 10.90 and 11.18 percentage points for females. In contrast, the percentages of

non-Hispanic Whites declined by more than 25 percentage points for both genders

since 1980. The compositional changes in full-time full-year immigrant workers in the

U.S. indicate a continued heavy concentration in the low-end of the skill distribution,

as well as a rise in the shares of relatively high skilled workers. This bifurcation in

immigrant educational backgrounds is the likely cause of a rise in wage disparity

among immigrant workers.

Table 4.1 Percentage distributions of FTFY workers by Education and by Race and Ethnicity (%)

	Male	Female

		1980	1990	2000	2009	Three-Decade Change	1980	1990	2000	2009	Three-Decade Change
Educational Categories	High-school dropout	38.72	31.74	31.46	29.55	-9.17	32.92	23.74	20.88	17.91	-15.01
	High-school graduate	24.04	24.3	29.31	30.38	6.34	32.01	28.28	31.28	29.31	-2.7
	Some College	15.61	20.36	14.38	13.76	-1.85	18.23	25.04	19.15	19.13	0.9
	Bachelor's degree	8.96	12.9	13.58	14.89	5.93	8.9	15.58	18.5	21.3	12.4
	Postgraduate education	12.67	10.7	11.26	11.42	-1.25	7.94	7.36	10.2	12.35	4.41
Race and Ethnicity	Hispanic	34.43	42.73	48.55	53.91	19.48	28.46	33.53	36.64	39.64	11.18
	Non-Hispanic White	44.31	27.58	20.39	15.87	-28.44	44.09	29.03	22.11	18.99	-25.1
	Non-Hispanic Black	5.38	7.06	7.13	7.24	1.86	7.78	9.54	10.63	11.18	3.4
	Non-Hispanic Asian	14.31	22	23.02	21.95	7.64	18.14	27.24	29.55	29.04	10.9
	Others	1.56	0.63	0.91	1.03	-0.53	1.53	0.66	1.07	1.15	-0.38

4.1.1   Unadjusted and Adjusted Wage Gaps at the National Level

There are a variety of measures to calculate between-group wage gaps. The simplest method is to compare the unadjusted mean log wage within each educational or racial and ethnic category. Controlling for other observable individual

characteristics, Parks (Parks 2011) estimated the predicted mean racial wage gap in a simple regression model. Using March and May/ORG CPS, Autor (Autor, Katz, and Kearney 2008) and Lemiux (Lemieux 2006) also measured wage gaps by creating the mean log wage for different educational and experience groups averaging out wage differentials within each experience cell. However, in the study of wage inequality among immigrant workers, the construction of pre-immigration and post-immigration experiences would require too many assumptions, and therefore causes analytical biases. Therefore, I choose to create an adjusted wage gap through running a simple OLS regression with a group of individual level controls, including both total estimated experience (age-education-6) and years of stay in the U.S. as a proxy of the U.S. experience of an immigrant.

Both the unadjusted and adjusted trends demonstrate a widening wage gap between immigrants who have an educational background of bachelor's degree or above and those who with below college education. In Table 4.2, while the unadjusted mean log wage of high-school graduates and high-school graduates both declined by 3% between 1980 and 2009, the wage of college graduates remained constant over the same period.   Consequently, the mean log earnings gap between college graduates and high-school graduates more than doubled for both genders at the national level. As demonstrated in Figure 4.1, the wage gap between college graduates and high-school graduates kept increasing across all gender and racial and ethnic groups during the past three decades. The only exception was the decline in the wage gap

between college graduates and high school graduates among both male and female Hispanic immigrants in the 2000s. However, after controlling for other individual characteristics, the adjusted predicted educational wage gap continued to widen across both genders and all racial and ethnic groups throughout the three decades in Figure 4.2. For all three racial and ethnic groups, the increase in the wage gap was more significant among male than female immigrant workers. The temporal trends of both unadjusted and adjusted wage inequalities indicate that educational differences contributed positively to the rising overall wage inequality among immigrant workers. The three-decade growth in immigrant educational wage differentials was a combined effect of compositional changes in shares of bachelor's degree holders and the increasing returns to skills.

Table 4.2 Unadjusted FTFY Wage Trends by Gender and Education, 1980-2009

	Male				Female			
	1980	1990	2000	2009	1980	1990	2000	2009
High-school drop-out	10.11	9.92	9.86	9.81	9.72	9.66	9.63	9.57
High-school graduate (HS)	10.32	10.16	10.09	10.01	9.92	9.91	9.9	9.83
Some College	10.42	10.34	10.34	10.26	10.06	10.14	10.16	10.1
Bachelor's degree(CG)	10.59	10.59	10.63	10.58	10.21	10.37	10.45	10.41
Post-graduate education	10.71	10.77	10.82	10.87	10.38	10.55	10.61	10.68
CG/HS Gap	0.27	0.43	0.54	0.57	0.29	0.46	0.55	0.58

Figure 4.1 Unadjusted Educational Wage Inequalities for FTFY Immigrant Workers by Gender, 1980-2009
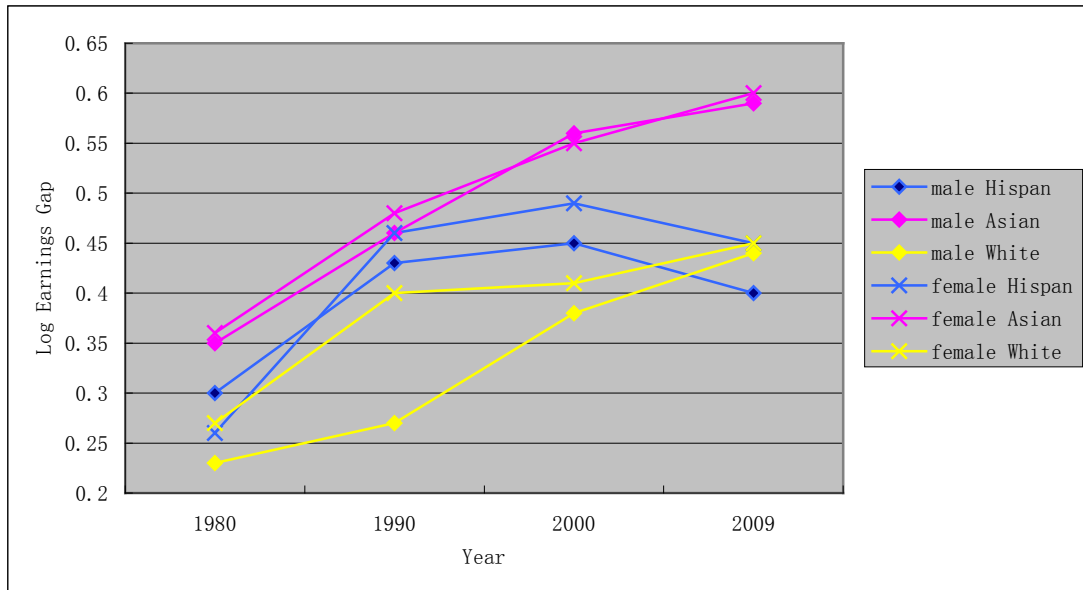
Figure 4.2 Adjusted FTFY Real Log Annual Wage Gaps by Gender and Race and Ethnicity, 1980-2009
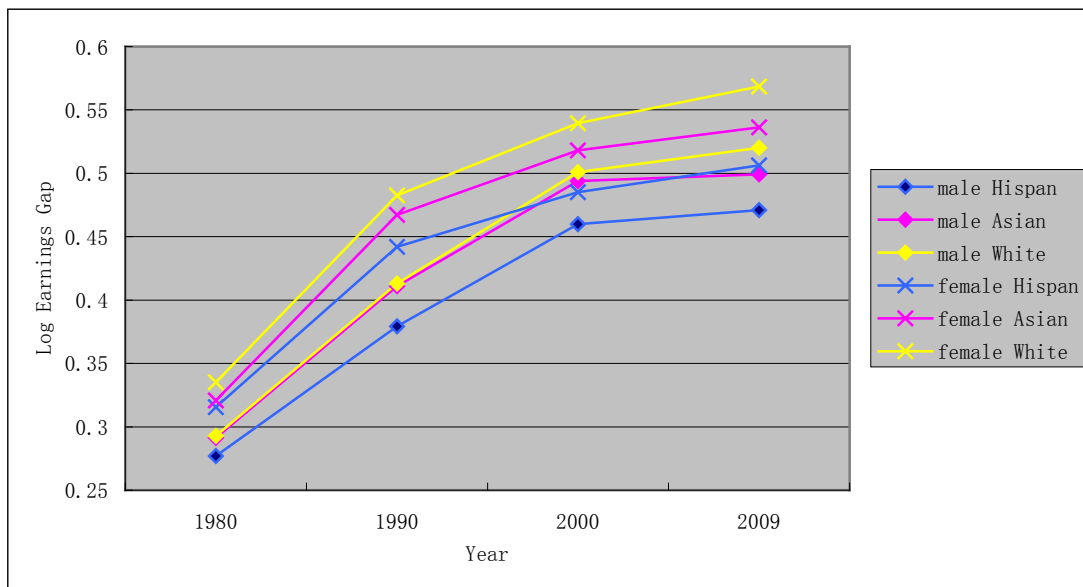
Figure 4.3 and Figure 4.4 show the unadjusted and adjusted trends of the log White-Hispanic wage gap and the log White- Asian wage gap respectively between 1980 and 2009. The wage gap between White and Hispanic immigrant workers has continually widened over the past three decades. Over the same time, the wage gap between White and Asian immigrants has almost disappeared. In fact, the wages of Asian female immigrants exceeded those of White female immigrants in mean predicted log earnings during each observed year, controlling for effects of other individual characteristics. The contrast between the trends of White/Asian and White/Hispanic wage gaps indicate that while both shares of Hispanic and Asian immigrants increased considerably during the past three decades, their wage structures shifted in opposite directions. This is due to the fact that the skill distributions of the two racial groups varied greatly. Existing literature indicates a concentration of skills in both high and low-ends among more recent immigrants. While skill concentrations in both tails are found among recent Asian immigrant workers, newly-arrived Hispanic immigrants are predominantly low-skilled workers. Therefore, unlike the contribution of educational wage inequality, the total effect of race and ethnicity on the total immigrant inequality turned out to be more complicated.

Figure 4.3 Unadjusted FTFY Racial Wage Gaps by Gender and Race, 1980-2009
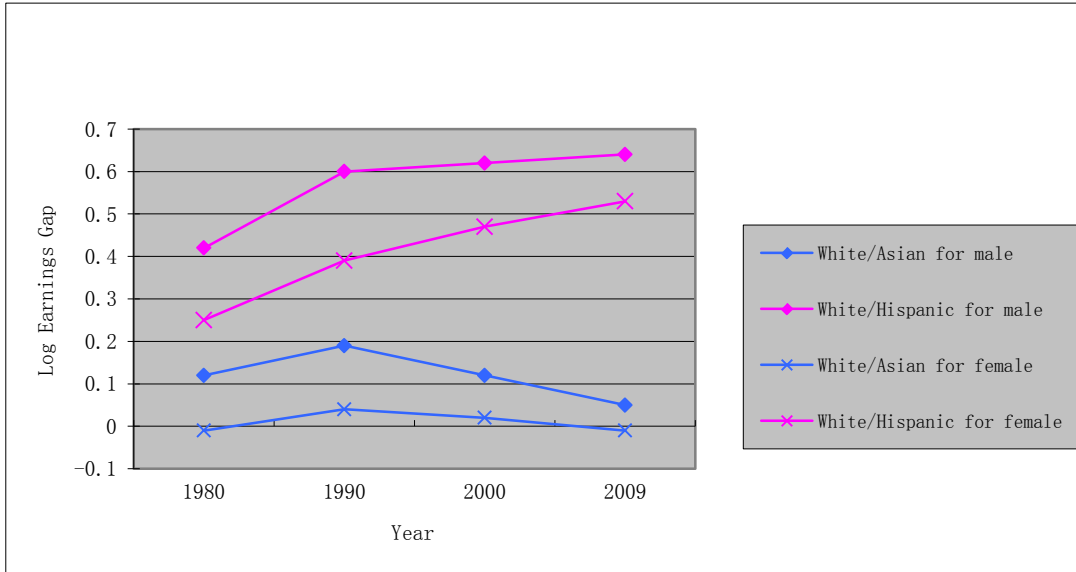
Figure 4.4 Adjusted FTFY Racial Log Wage Gaps by Gender and Race, 1980-2009
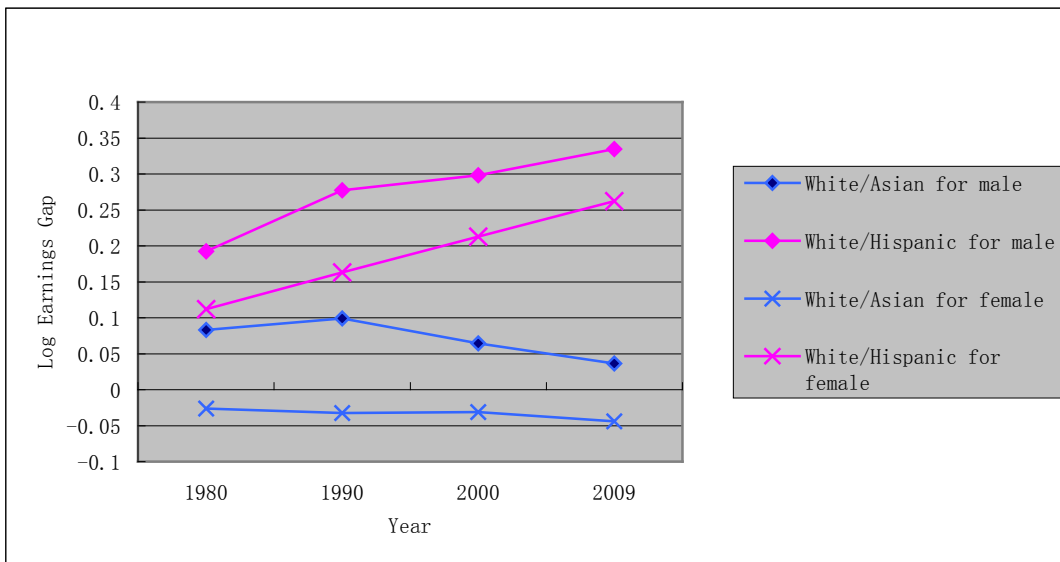
4.1.2   Between-Group Wage Differentials at the Metropolitan Level, 1980-2009

I now shift attention to examine the spatial variation in between-group wage inequality trends and how geographical patterns of educational and racial and ethnic

wage differentials have changed over time. Since the adjusted wage inequality between college graduates and high-school graduates (CG/HS) follow a uniform pattern across gender and race and ethnicity at the national level (as seen in Figure 4.2), I create metro-level maps of educational wage gaps by gender. Figure 4.5 shows that the educational wage gap for immigrants of both genders increased in most metropolitan areas in the U.S.. By 2009, in 84 of the top 100 metropolitan areas, earnings among foreign-born college graduates were at least 1.5 times that of foreign-born high-school graduates. Figure 4.5 also indicates a convergence in the level of educational wage gap, as evidenced by the decline in the standard deviation in the wage gap between male college graduates and male high-school graduates from .42 in 1980 to .21 in 2009 and an increase in average educational wage gap from 0.279 in 1980 to 0.509 in 2009. Geographically speaking, relatively high levels of the immigrant educational wage gap gradually occurred in some West and Southwest metros where immigrant skill compositions are mostly high or balanced. These labor markets include San Jose, CA, Austin, TX, Boise City, ID , Tulsa, OK, and Denver, CO, which either experienced an increasing demand for skills due to local economic structural changes or /and had disproportionately large inflows of skilled immigrant workers since wages are more unequally distributed among more-educated workers.

Figure 4.5 CG/HS Wage Gap for Male and Female Immigrant Workers

Male 1980　　　Male 1990　　　Male 2000　　　Male 2009

Female 1980　　　Female 1990　　　Female 2000　　　Female 2009

Legend
● .620 - 1.000
● 1.001 - 1.500
● 1.501 - 2.000
● 2.001 - 2.500
● 2.501 - 4.797
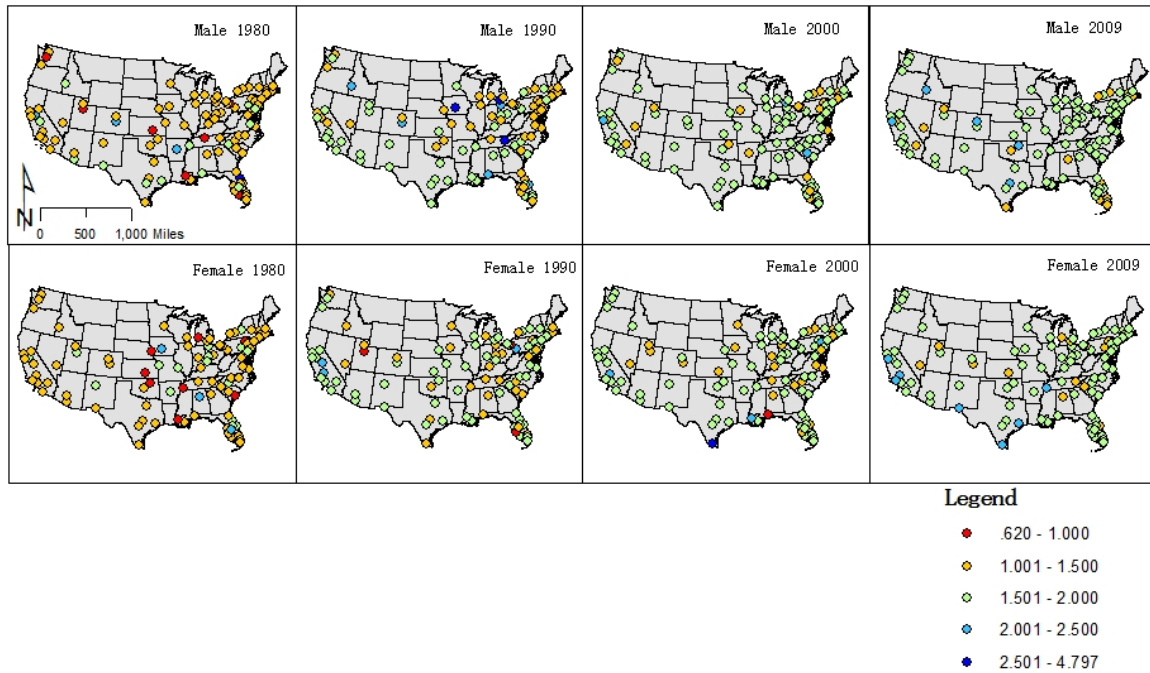
Because of the divergence in relative earnings between Hispanic and Asian immigrants (to their White counterparts), I created two separate sets of maps of racial and ethnic wage gaps by gender. In accordance with the national level findings, a comparison between Figures 4.6 and 4.7 shows that the temporal trends of White/Asian and White/Hispanic wage gaps vary greatly at the metro level. On one hand, the mean value of the adjusted wage gap between White and Asian immigrants converged to around 1 during the past three decades, indicating a narrowing in the White/Asian gap. Figure 4.6 demonstrates an increase in the number of dots (in orange and green) representing moderate inequality values and a decline in the number of dots (in red and navy) representing extreme values in 2009. On the other hand, the increasing White/Hispanic wage ratio suggests a widening gap between the two population groups across metropolitan areas. In 1980, there were still 19 metros with a higher predicted wage among Hispanics than the Whites for men and 32 metros

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for women. By 2009, White immigrant workers had exceeded the Hispanics in predicted log wage across almost all metros for both genders.

In addition, the spatial variations in White/Asian and White/Hispanic wage gaps declined for both genders. Between 1980 and 2009, the standard deviations of metro-level predicted wage gap between the White and Asian immigrants decreased from .16 to .13 for male workers and from .25 to .11 for females. Meanwhile, the average wage gap the White and Asian immigrants changed from 0.05 to 0.04 for male and from -0.010 to -0.009 for female workers respectively. As for the predicted wage gap between the Whites and the Hispanics, the standard deviations dropped from .22 in 1980 to .19 in 2009 for male workers and from .20 in 1980 to .17 in 2009 for females. On average, wage gap between the White and Hispanic immigrants increased from 0.12 to 0.30 and from 0.05 to 0.20 for male and female workers respectively.

Figure 4.6 White/Asian Wage Gap by Gender
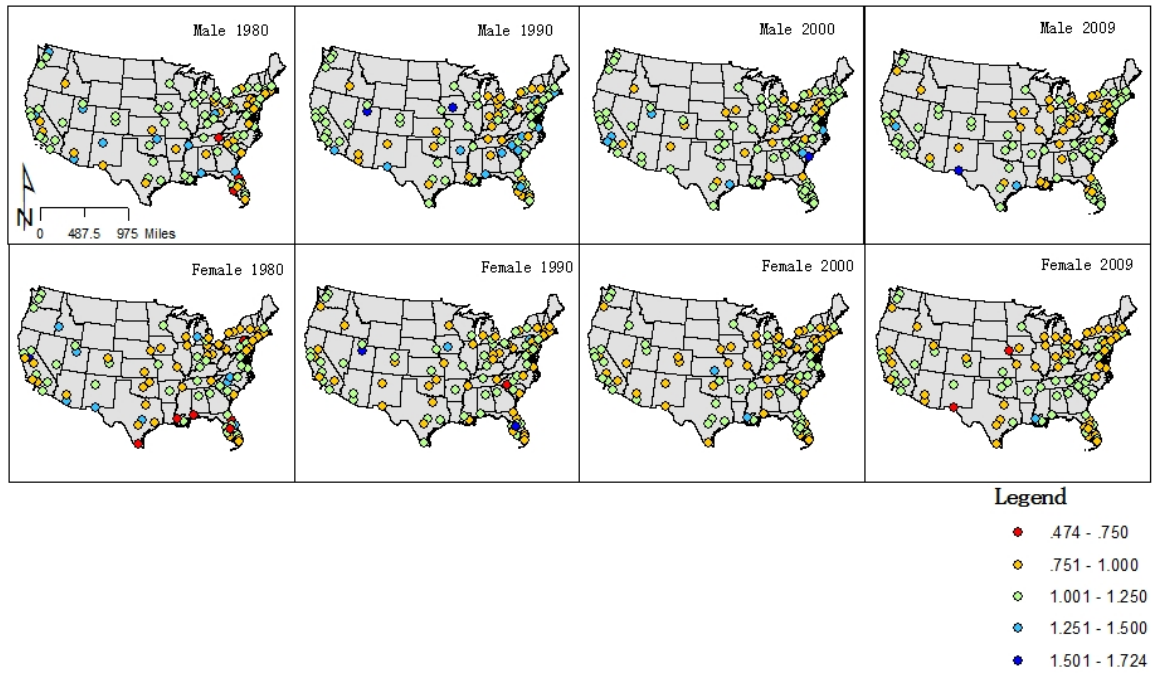
Figure 4.7 White/Hispanics Wage Gap by Gender
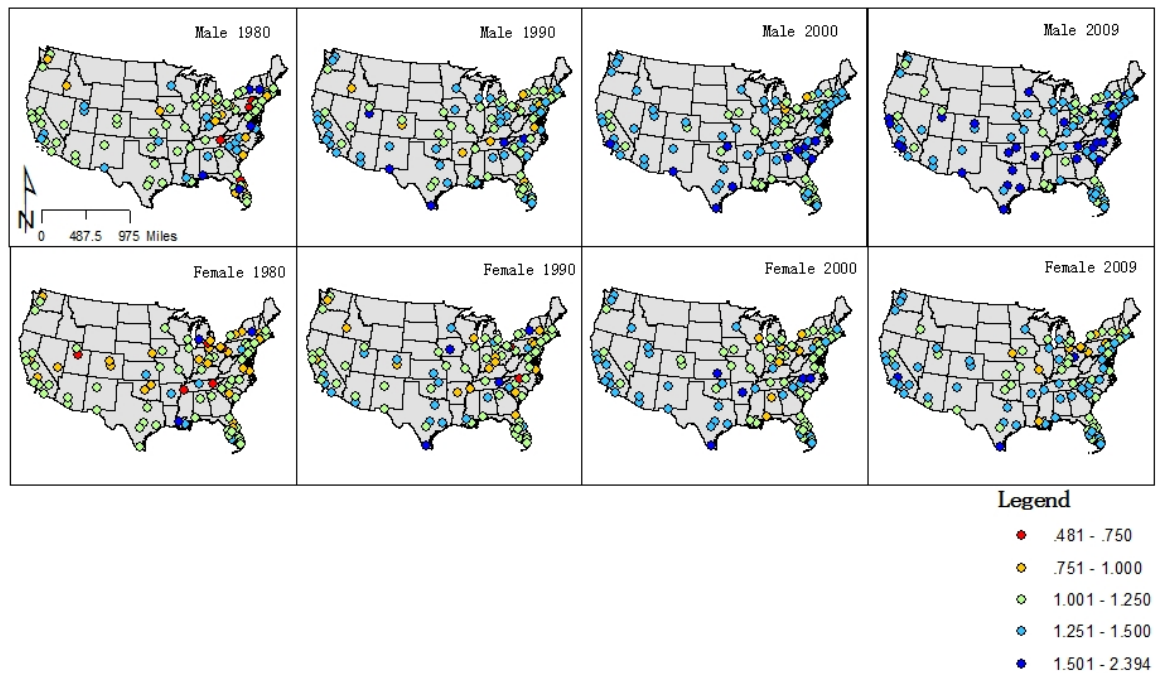
Figure 4.6 indicates an association between the distribution and growth in racial and ethnic gaps and geography, namely local immigrant skill profiles and their historical settlement patterns. Between 1980 and 2009, wage gaps between White and

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Asian immigrant workers narrowed in more than 50 metros for both genders. By 2009, the predicted wage among Asian immigrant workers exceeded their White counterparts in 37 metros for men and 53 metros for the women. The reverse of wage gap between White and Asian were more concentrated in the Mid West and Northeast regions of the U.S. in 2009. These include low-immigration metros such as Scranton, PA, Boise City, ID, Columbus, OH, Wilmington, Dayton, OH, Hartford, CT, Rochester, NY, Louisville, LA, Allentown, PA/NJ, and Des Moines, IA , and former gateways such as Pittsburgh, PA ,Detroit, MI KY/IN, Buffalo, NY, St. Louis, MO-IL, Cleveland, OH, and Milwaukee, WI. All of them have a high or at least balanced skill profile of immigrant workers. These findings indicate a gradual dispersion of Asian immigrants, especially the high-skilled workers, across the non-traditional immigrant gateways in the U.S.. Interestingly, the spatial distributions of the red dots in the upper left and lower left maps in Figure 4.8 suggest that many of these high skilled low-immigrant gateways are also metros that have experienced the highest decline in wage gap between White and Asian immigrants during the past three decades.

In comparison, I observe two different scenarios regarding the spatial distribution of White/Hispanic wage gap and its interaction with geography over time. As discussed above, Figure 4.7 unfolds a gradual rise in wage gaps between the White and Hispanic immigrant workers in more than 90% of the metropolitan areas for both genders. In 2009, a group of high White/Hispanic wage inequalities were distributed in Denver, CO, Seattle, WA, Minneapolis, MN , San Jose, CA, Raleigh, NC,

Charlotte, SC, Greensboro, NC, Atlanta, GA, Knoxville, TN. All metros were new immigrant destinations, ranging from re-emerging, pre-emerging, emerging to low-immigrant gateways. Besides, all demonstrated a high or balanced skill profile of immigrant workers in 2009. As many of these metros are becoming melting-pots that accommodate various race and ethnicity, concentrations of both high and low skills induce a rise in wage gap between White and Hispanic workers. Meanwhile, another group of high White/Hispanic inequalities were concentrated in border-region low-immigrant and minor-continuous gateways such as El Paso, TX, Fresno, CA, McAllen, TX, Ventura, CA, Tulsa, OK, Oklahoma, OK and Austin, TX. Over time, these metros continue to have a low-skilled profile of immigrant workers due to the concentration of both illegal and legal immigrants from Mexico. As a result, the high competition at the low-end of the job spectrum perpetuates a wide earnings gap between White and Hispanics. Examining the three-decade changes in White/Hispanic growth on the right side of Figure 4.8, I find that the highest growth rates occurred among high or balanced skilled low-immigrant metros such as Knoxville, TN Raleigh, NC, Scranton, PA, Youngstown, OH-PA, Wilmington, DE , and Little Rock, AR, which are also metros that had a high inequality between White and Hispanic in 2009.

Figure 4.8 Three-decade Changes in Racial and Ethnic Wage Gap

White/Asian Male

White/Hispanic Male

White/Asian Female

White/Hispanic Female

Legend
- -36.237 - -25.000
- -24.999 - .000
- .001 - 25.000
- 25.001 - 50.000
- 50.001 - 136.553

Legend
- -41.008 - -25.000
- -24.999 - .000
- .001 - 25.000
- 25.001 - 50.000
- 50.001 - 215.125
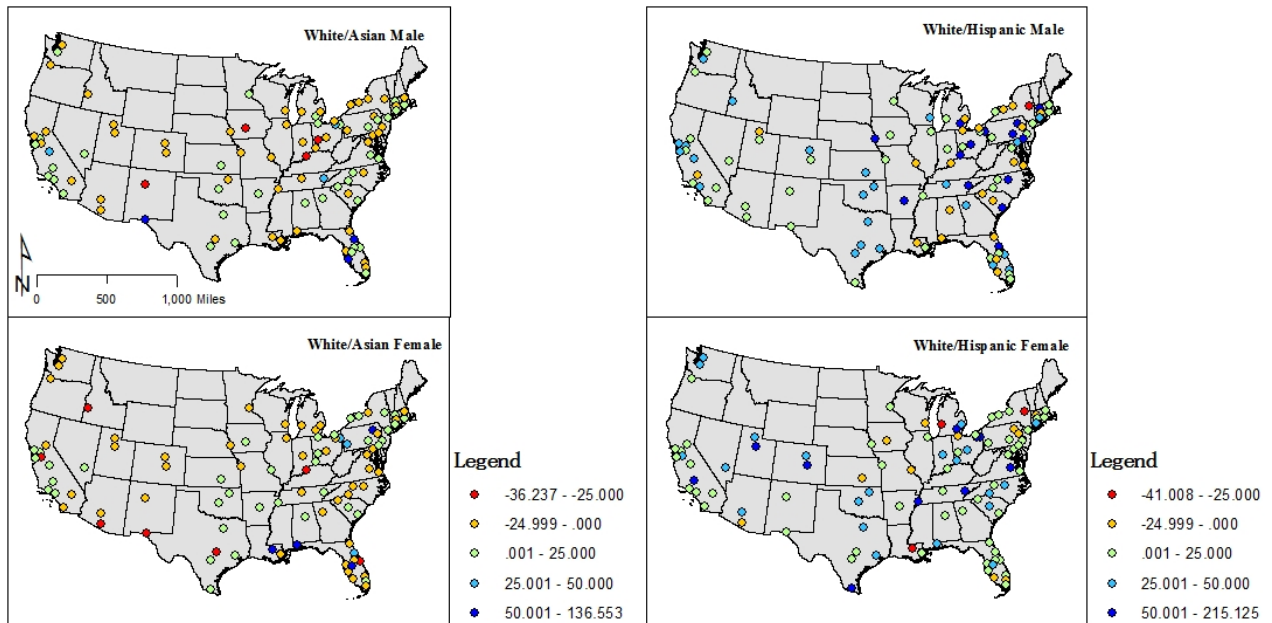
Next, a comparison across different types of immigrant gateway cities in Figures 4.9 (A, B, C, D) show interesting patterns of growth in average White/Asian and White/Hispanic wage gaps over time. For male workers, there has been a decline in wage gap between White and Asian workers in most types of gateways since the 1990s or 2000s. This is in line with the downward trend of overall wage gap between White and Asian workers observed in Figure 4.6. In former gateways, the wage gap even reversed in 2009 so that Asian workers exceeded that of the Whites. The only exception was Post-WWII gateways, where the average White/Asian wage gap continued to increase, but at a slow rate (29%), during the past three decades. Figure 4.9B also shows a narrowing wage gap or even a reversed wage gap between White and Asian female workers. In immigrant destinations where White female workers fared better than their Asian counterparts in 1980, such as pre-emerging, emerging and re-emerging gateways, the White/Asian wage gaps decreased rapidly from their 1980 levels. Meanwhile，in former and low gateways, where Asian female workers

already performed better than White female workers in their economic outcomes, the wage gaps also narrowed to certain extent in the past three decades.

The trends of wage gaps between White and Hispanic workers show little variation across different types of immigrant gateways and between genders. These upward trends in different metropolitan gateways lead to an overall widening gap between the White and Hispanic wages for both genders. While new destinations such as re-emerging, emerging and low-immigrant gateways have witnessed the fastest growths in White/Hispanic male wage gaps, the three-decade growth rates of White/Hispanic wage gaps among female workers were the highest in emerging, former and low-immigrant gateways.

Figure 4.9 Average Racial and Ethnic Wage Gaps by Different Types of Metros by Gender, 1980-2009

A. Male White/Asian Wage Gap
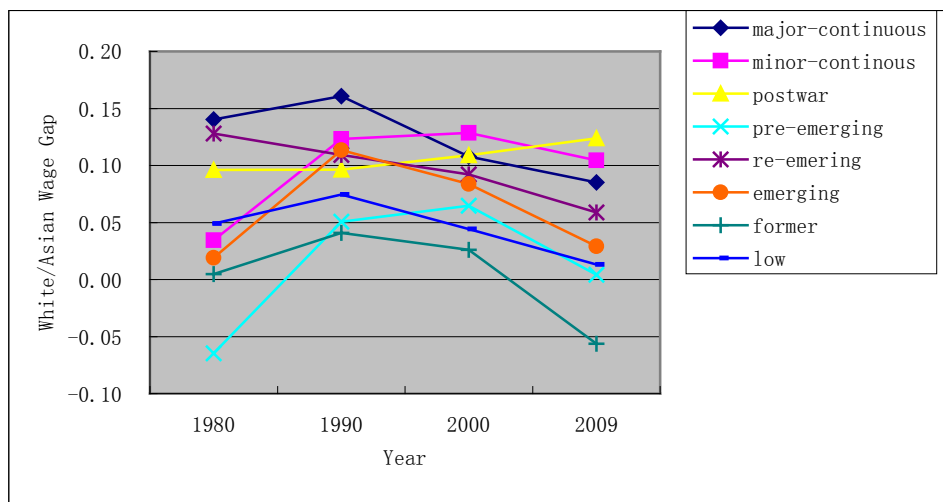
B. Female White/Asian Wage Gap
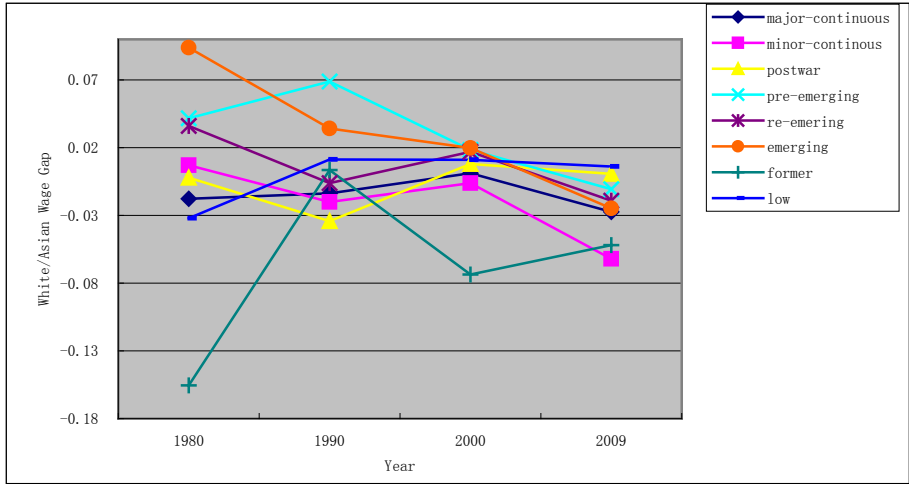
C. Male White/Hispanic Wage Gap
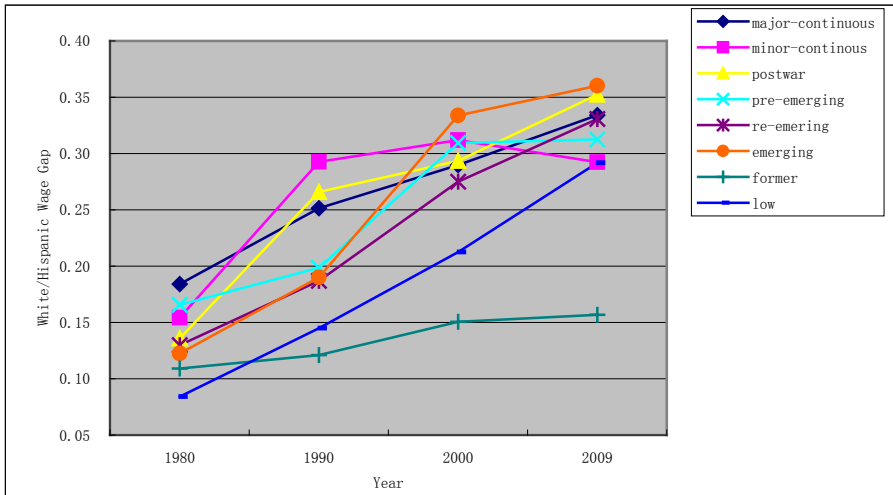
D. Female White/Hispanic Wage Gap
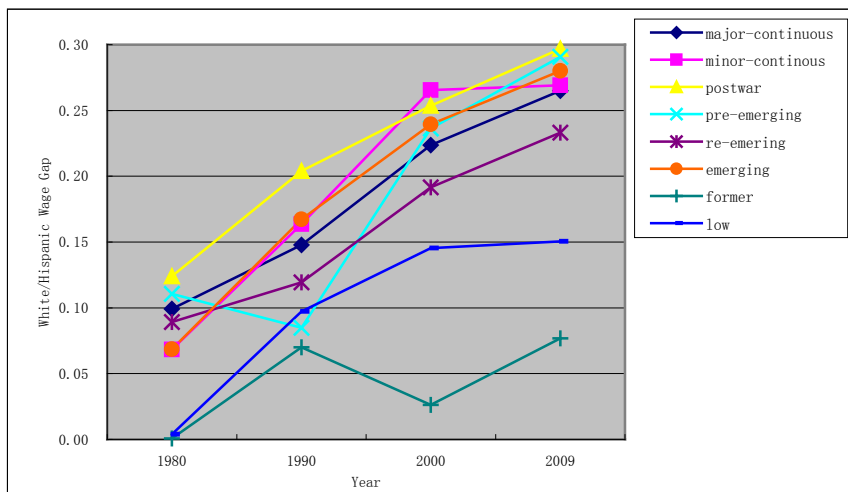
In conclusion, racial and ethnic wage gaps among immigrant workers vary and they vary by space and by metropolitan gateways. Evidence show that spatial variations in racial and ethnic wage gaps are associated with the historical settlement patterns of immigrant workers and their skill structure in different local labor markets.

4.2 Temporal Trends and Spatial Patterns of Within-Group (Residual) Wage Inequality

In this section, I examine the temporal trend of residual wage inequality among immigrant workers. Residual wage inequality captures the effects of unobserved skills, compositional differences in unobserved characteristics, as well as measurement errors. In calculating the within-group variance, I use the conventional measure of variance of residuals, also known as mean squared error (MSE), computed from the simple OLS regression (used above) to represent residual wage inequalities (Lemieux 2006; McCall 2000). After examining temporal shifts in immigrant worker residual wage inequality, I adopt a cross-sectional approach to compare growth in residual wage inequality by education and race and ethnicity. Finally, a spatial analysis of levels of residual wage inequality across metropolitan areas in the U.S. sheds light on variation in the unexplained component of immigrant wage inequality across space.

4.2.1 National Level Trend of Within-Group Wage Inequality

Figure 4.9 provides an overview of the three-decade trend of immigrant residual wage inequality by gender. The variance of immigrant wage inequality for

men is higher than that for immigrant women over the period 1980 to 2009. However, the difference between the variance of residual wage inequality across by gender has narrowed, all but disappearing by the end of the study period. For male immigrants, the residual wage variance increased from 0.254 in 1980 to 0.281 in 2009, representing a rate of growth of 11.7%. This increase was not constant over the three decades. The 1980s saw residual wage variance for immigrant men and women decline slightly. For female immigrant workers, residual wage variance increased from 0.219 in 1980 to 0.280 in 2009 at a growth rate of 27.7%.

Figure 4.10 Residual Wage Inequalities by Gender
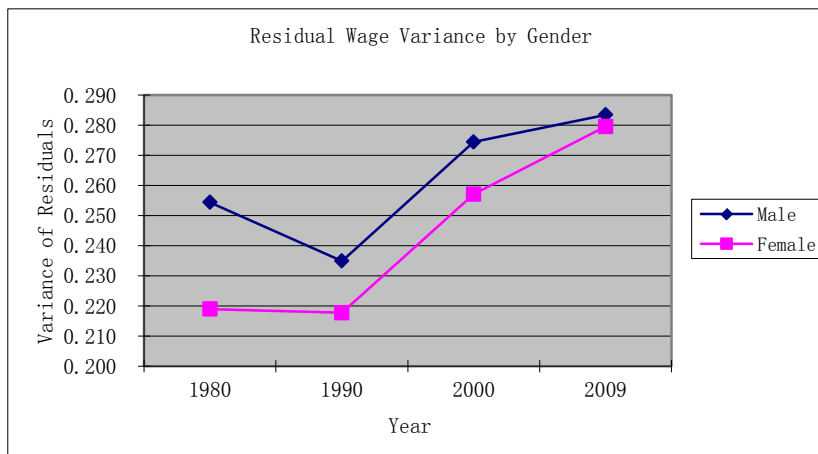
Tables 4.3 and 4.4 show the trends and growth rates of within-group inequalities for different educational and racial and ethnic groups in each observed year between 1980 and 2009. As indicated in Table 4.3, changes in within-group inequality are not uniform in their directions and sizes across different individual groups. The variance of MSEs for male immigrants increased for all levels of education greater than a high school degree between 1980 and 2009. Meanwhile, the variance of MSEs for female

immigrants increased for all levels of education greater than high-school dropouts. This suggests, perhaps, relatively common fortunes for immigrants with low-levels of education in the labor market, while for more educated immigrants a greater diversity of wage experience is increasingly the norm.

Table 4.3 Within-Group Inequality of Wages by Education and by Gender

	Male					Female				
	1980	1990	2000	2009	3-Decade Change (%)	1980	1990	2000	2009	3-Decade Change (%)
High-school drop-out	0.254	0.206	0.222	0.215	-15.429	0.200	0.177	0.199	0.194	-3.185
High-school graduate	0.250	0.217	0.236	0.242	-3.113	0.207	0.199	0.223	0.233	12.699
Some College	0.238	0.224	0.250	0.266	11.480	0.211	0.200	0.231	0.258	22.313
Bachelor's degree	0.236	0.242	0.306	0.331	39.997	0.226	0.220	0.268	0.304	34.811
Post-graduate education	0.232	0.255	0.321	0.295	27.107	0.246	0.246	0.298	0.298	21.049

A comparison between Table 4.3 and Table 4.1 suggests a positive association between the growth of residual wage inequality and changes in labor force shares for each group. In particular, groups with the highest positive growth rates in residual wage inequality also have relatively high and positive changes in population shares. For female workers, the top three educational categories (population with some college education and above) that experienced the highest growth rates in

within-group variance also had the largest growth in work-force share in the last three decades (.9% for females with some college education, 12.4% for female college graduates, and 4.41% for female post-graduates). The results for males are different in that high-school graduates whose residual wage inequality declined experienced a rising work-force share. In addition, male workers with some college education and post-graduate education both had slight decline in their work-force shares. However, male college graduates had the largest increase in within-group variance among all educational groups and a relatively large increase in work-force share of 5.93%. The increasing residual wage inequality of college graduates (and above) can possibly be attributed to a more variable wage structure induced by a large inflow of workers in these educational groups. Meanwhile, the local supply and demand structure continue to affect the prices of unobserved skills, which explains the decline in within-group variance among high-school graduates despite the considerable growth in its work-forces share. These results are similar to the findings of Lemieux (2006) on within-group variances among the total labor force in the U.S.. Lemieux argues that the composition effects of observable individual characteristics, as well as the price effects arising from shifts in supply-demand and institutional factors, plays an important role in shaping residual wage inequality.

Table 4.4 reports a more complicated pattern of changes in residual wage inequality within racial and ethnic groups. For immigrant workers of both genders, there was a small decline in residual wage inequality among Blacks and Hispanics

since 1980. The most significant increase in residual wage inequality happened to White and Asian immigrants. Table 4.1 shows that the shifts in shares of labor force in these two groups were both significant. In the past three decades, both male and female White immigrants experienced the largest decline in percentage points as much as around 30% whereas the shares of Asian immigrant workers increased rapidly for both genders (7.64% for men and 10.9% for women).

Considering the distinct historical and recent skill distribution patterns of each racial or ethnic group in the U.S., their residual wage inequalities reflect the levels and the growths in their work-force shares to a certain extent. According to Borjas and Friedberg (Borjas and Friedberg 2009), relative earnings of new immigrants to their native counterparts have increased since the 1990s, partly due to a shift in immigration policy towards high-skill workers. As indicated by Table 4.5, the recent increase in high-skills was mainly due to compositional changes among White and Asian immigrants. Therefore, the high growth rates in residual wage inequality among Asian and White workers were consistent with a continued inflow of relatively high-skilled immigrants, who showed more diversity in unobserved skills. In contrast, the rapid increase in the share of the Hispanics in the U.S. only worked to reinforce their concentration in the low-skill end (a rise of 14.45 percentage points for high-school graduates) of the total immigrant wage distribution. Therefore, wage dispersion within Hispanic immigrant workers remained relatively low.

Table 4.4 Within-Group Inequality of Wages by Race and by Gender

	Male					Female				
	1980	1990	2000	2009	3-Decade Change(%)	1980	1990	2000	2009	3-Decade Change(%)
Other Race	0.276	0.241	0.282	0.293	5.905	0.255	0.228	0.245	0.277	8.686
White	0.242	0.240	0.305	0.323	33.209	0.220	0.225	0.272	0.297	35.326
Black	0.273	0.218	0.252	0.264	-3.133	0.241	0.198	0.227	0.248	2.728
Asian	0.250	0.252	0.310	0.325	29.963	0.226	0.226	0.276	0.318	40.983
Hispanic	0.258	0.215	0.230	0.235	-8.716	0.200	0.200	0.228	0.236	17.826

Table 4.5 Skill Distribution within Racial and Ethnic Groups in 1980 and 2009

	1980					2009					Three-Decade Change				
	Other Race	White	Black	Asian	Hispanic	Other Race	White	Black	Asian	Hispanic	Other Race	White	Black	Asian	Hispanic
High-school drop-out	21.50	28.06	29.37	14.82	59.80	18.31	6.04	9.06	6.73	46.73	-3.19	-22.02	-20.31	-8.09	-13.07
High-school graduate	23.80	27.83	34.06	15.86	19.73	37.88	26.18	35.95	18.65	34.18	14.08	-1.65	1.89	2.79	14.45
Some College	22.50	17.40	18.85	16.66	11.90	16.72	17.87	24.22	15.25	10.30	-5.78	0.47	5.37	-1.41	-1.60
Bachelor's degree	13.00	11.15	7.59	18.71	3.59	16.09	24.79	18.64	30.27	6.07	3.09	13.64	11.05	11.56	2.48
Post-graduate education	19.20	15.56	10.13	33.96	4.98	11.00	25.12	12.13	29.09	2.72	-8.20	9.56	2.00	-4.87	-2.26

4.2.2 Spatial Pattern of Residual Wage Inequality across U.S. Metropolitan Areas

In accordance with the temporal trend of within-group residual wage variance at the national level, Figure 4.10 indicates that on average, residual wage inequality across metros for both genders grew steadily while their variances declined during the same period. On average, residual wage inequality among male immigrant workers started at a relatively high value (0.242) than the females (0.205). In 2009, the MSE values reached 0.260 for male immigrant workers and 0.252 for female workers. During the three-decades studied, average residual wage inequality grew by 7.01% for men and 22.92% for women. Similar to the spatial pattern of between-educational group wage inequalities in Figure 4.5, the variance of MSE across metro declined over time, at a rate of 58.67% for men and 40% for women in 2009 from the 1980 levels.

Spatially speaking, relatively high levels of residual wage inequality gradually became concentrated in metros which had both a long history of settlement of highly skilled workers and a high or balanced skill profile of immigrants in 2009 (see Figure 4.11). These labor markets include major-gateways such as New York, San Francisco, Boston, and Chicago in 2009; former immigrant gateways such as St. Louis and Detroit; re-emerging gateways such as Philadelphia, San Jose, and Seattle-Everett; post-WWII gateways such as Washington D.C.. Similar results can be found in the spatial distribution of high residual wage inequalities for female immigrant workers. Many metropolitan areas such as Detroit, Philadelphia, New York, San Jose, San

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Francisco, Denver, and Washington D.C. also have high levels of within-group

residual wage variances for female immigrant workers. As indicated in previous

literature, greater dispersion of earnings was found in local labor markets that have a

relatively large proportion of high-skilled workers. It is these labor markets that

attract skilled immigrant workers. (Katz and Murphy 1992; Glaeser, Resseger, and

Tobio 2009).

Comparing three-decade trends of average residual wage inequalities across

eight types of immigrant gateways, Figures 4.12 A and B highlighted a pattern of

growth in residual wage variances for both genders since the 1990s. In accordance

with findings in Figure 4.10, the highest average growth rates in residual wage

variances are found in major-continuous gateways(27%) and former gateways(35%)

for male foreign-born workers, and in major-continuous(37%), former(27%),

re-emerging(31%) and emerging gateways(34%) for female workers.

The above findings indicate that the spatial patterns of residual wage inequality,

as well as those of between-group wage inequality, were associated with historical

settlement patterns and immigrant skill profiles of different metropolitan areas. This is

in line with Lemieux's (Lemieux 2006) argument about residual wage inequality of

the total labor force in the U.S., which suggests that "residual wage inequality

generally moves in tandem with other 'between-group' wage differentials".

Figure 4.11 Residual Wage Variances by Metros, 1980-2009
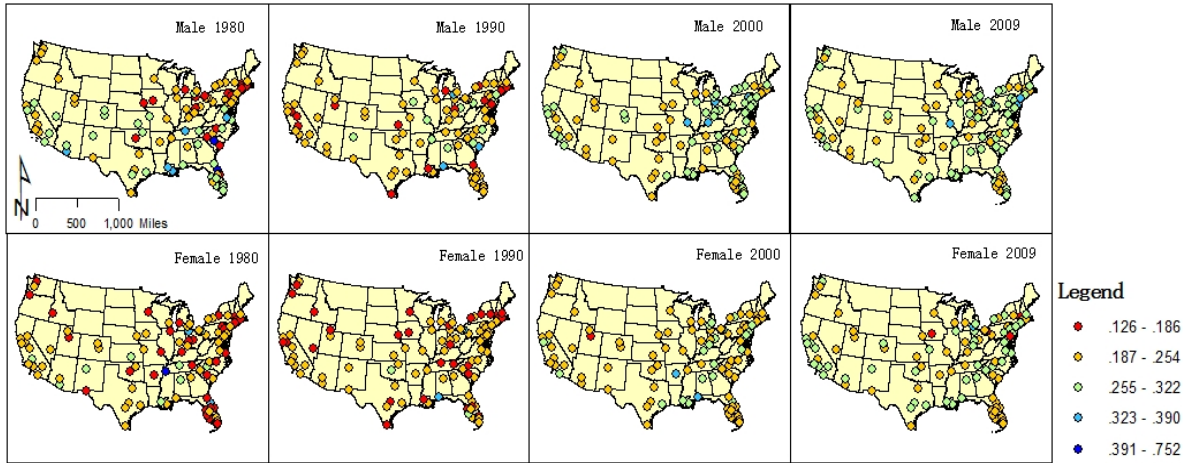
Figure 4.12 Average Residual Wage Variances by Different Types of Metros by Gender, 1980-2009

A. Male
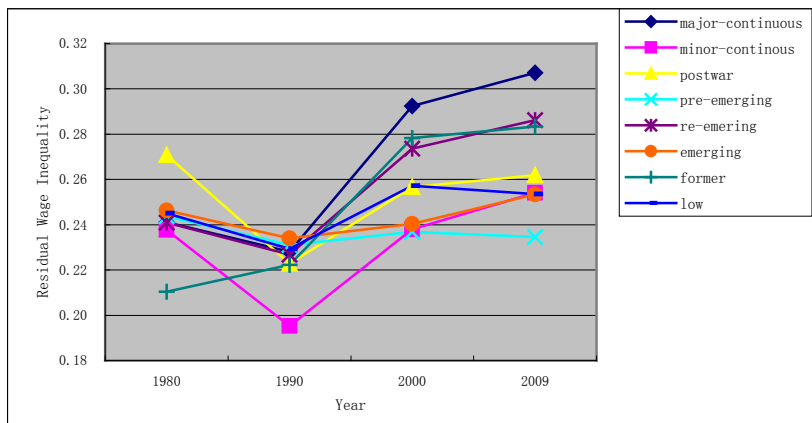
B. Female
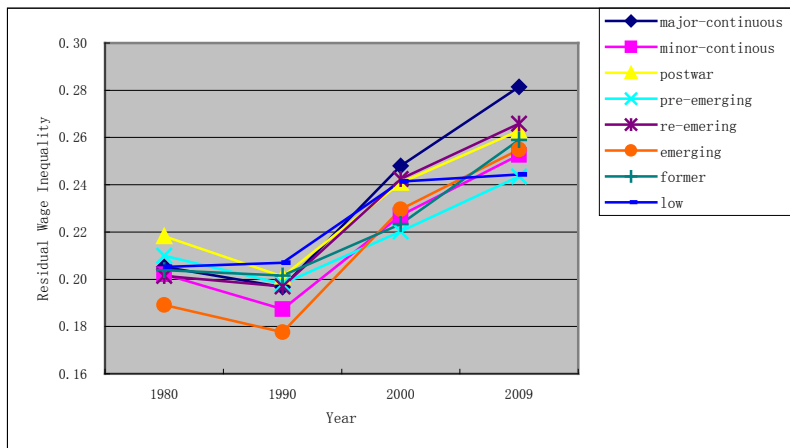
4.3 Contribution of Different Factors to Overall Immigrant Wage Inequality and to Changes in Overall Inequality

The previous sections show a rapid increase in both between-group and within-group residual wage inequality for immigrant workers between 1980 and 2009 at different geographic scales. Yet it remains unknown how much the growth of total wage inequality is attributable to different factors. A regression-based approach allows a decomposition of overall inequality by factors such as education, experience, and race and ethnicity. Yet often the contributions of these factors s are exceeded by residual inequality (Western and Bloome 2009). The "common wisdom" about wage inequality in the U.S. labor force is that a large portion, often more than half, of total inequality, is unexplained. Meanwhile, within-group inequality contributes significantly to the rise in overall wage inequality over time. The previous literature found changes in within-group inequality accounted for one-quarter to over one-half of the increase in overall wage inequality in the U.S. (DiNardo, Fortin, and Lemieux 1995; Gottschalk 1997). Derived from results of the regression-based approach, a difference analysis in income inequality (Fields 2002) helps to identify the major sources of changes in total immigrant wage inequality in the past three decades. It compares the percentage contributions of changes in different observed individual and residual inequalities to the changing wage inequality of immigrant workers. Similar to the previous sections, I report results at the national level and on a regional basis and observe the spatial pattern of contributions to overall wage inequalities by metro.

4.3.1 Shares of Different Factors in Overall Immigrant Wage Inequality

Among the different approaches of inequality decomposition, the GE Index decomposition (Theil-T Decomposition used in Chapter 3) is the simplest one. In this case, a multi-way decomposition of Theil Index should be used to handle more than one factor in decomposing the overall wage inequality. However, the GE Index decomposition suffers from several drawbacks. First, it does not allow one to disentangle the contributions of one or more characteristics while controlling for other factors. In addition, it only works well for categorical variables. Finally, the creation of a multi-group variable becomes more difficult as the number of groups increases. A possible solution is the regression-based decomposition, which uses a simple OLS regression model to decompose total wage inequality by factor-sources as below.

$$y = b_0 + \sum_{j=1}^{J} b_j x_j + u \tag{1}$$

,

where b_j is the OLS estimate of β_j, $j = 0\ldots J$, and u is the OLS residual. The equation produces a "composite variable" $Z_j = b_j x_j$ and $\widehat{\varepsilon}$. One can relate Z_j and $\widehat{\varepsilon}$ to the proportional contribution of observable factors or residual to inequality, and the contribution of the value of characteristic j and residual u can be estimated as

$$z_j = \begin{cases} b_j^2 \cdot \dfrac{\sigma^2(x_j)}{\sigma^2(y)}, & j = 1,\ldots J \\[2mm] \dfrac{\sigma^2(u)}{\sigma^2(y)}, & j = J+1 \end{cases} \tag{2},$$

in which, $\sigma^2(x_j)$, $\sigma^2(y)$ and $\sigma^2(u)$ are unbiased sample variances of x_j, y

and u respectively. In this study, I include education, race and ethnicity, total work

experience, year of stay in the U.S., citizenship, proficiency in English, and annual

work hours. The regression also measures the contribution of residual wage inequality

to overall wage inequality. The final proportionate contribution of each composite

variable that I report in the figures and tables below is $\rho_j * \sigma(x_j) / \sigma(y)$, denoted as

$s_j (\ln y)_t$, where *t* is one year among 1980, 1990, 2000, 2009 (See Tables 4.6 and 4.7

for examples.). However, we should keep in mind that the regression-based approach

is an inequality accounting rather than a causal model.

Figures 4.13 A and B show factors that accounted for more than a modest share

of overall immigrant inequality by gender, including education, race and ethnicity,

experience, duration of stay in the U.S., and the residual wage inequality. For both

male and female immigrant workers, controlling for all the covariates jointly, the

contribution of residual wage inequality started high, accounting for more than 70%

of total inequality in 1980. Since then, the proportion of unexplained wage inequality

fluctuated between 60% and 70%. This fact means that the observable characteristics

combined only account for 30% to 40% of the total inequality over the past three

decades. Education and race were the second and third most important source factors

of total immigrant wage inequality. The contribution of education to total immigrant

wage inequality grew by 10 percentage points between 1980 and 2009, while the

contribution of race to total immigrant wage inequality grew by 5 percentage points

during the same period.

Figures 4.13 A and B Contribution of Between and Within-Group Inequality to Total Wage
Gap by Gender, 1980-2009
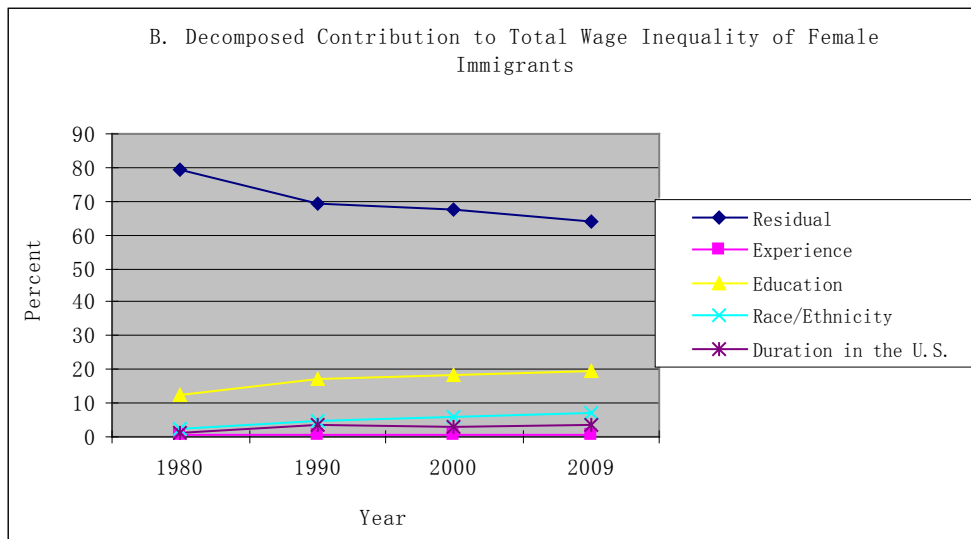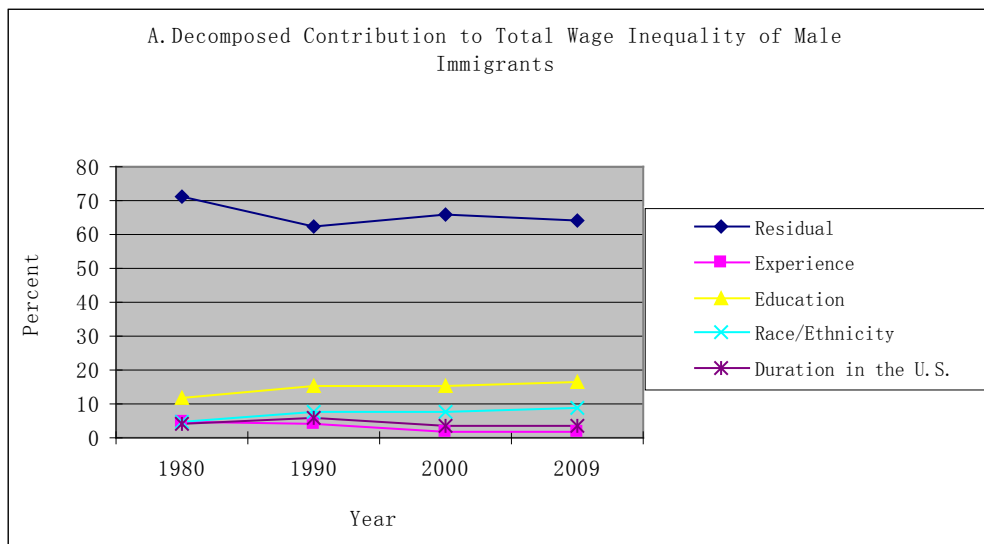
Figure 4.14 compares the contribution of education and race and ethnicity to

total wage inequality between 1980 and 2009 for male immigrants across the

largest U.S. metropolitan areas. Similar to the national-level results, the mean

percentage contribution of education and race and ethnicity to total inequality

continued to rise throughout the past three decades. On average, education and race

accounted for 10.87% and 4.50% of male inequality respectively in 1980. By 2009,

the former reached 16.43% and the latter became 8.49%. In the meantime, the

variances of both factors declined slightly, as evidenced by a convergence in

percentages of contribution across metros in the top two maps on the very right side

of Figure 4.14. In contrast, the average contribution of residual to total wage

inequality declined slightly from 67.41% in 1980 to 62.24% in 2009.   There was

an obvious convergence in percentage contributions of residual wage inequality

since its variance dropped from 12.74 in 1980 to 7.20 in 2009.

Figure 4.14 Contribution of Educational, Racial and Ethnic and Residual Inequality to
Total Wage Gap among Male Immigrants by Metros, 1980-2009 (%)
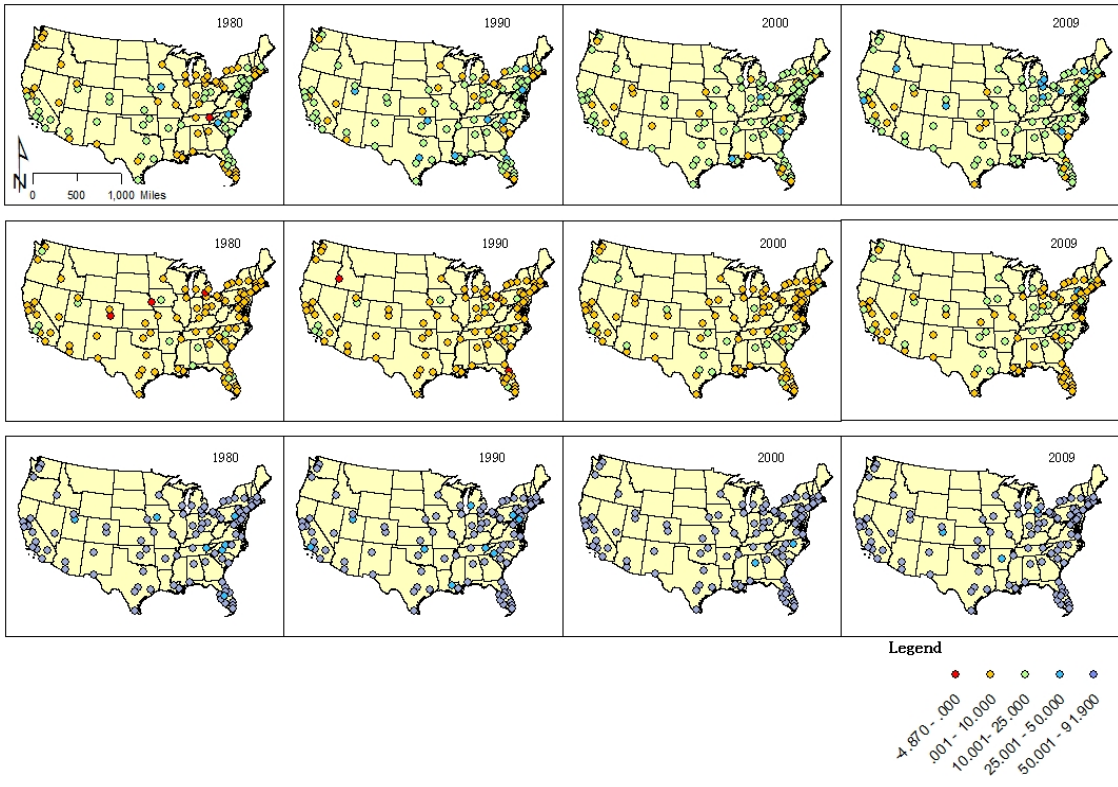
Comparing contributions of three major sources of immigrant wage inequality averaged by different immigrant gateway types, Figures 4.15 A, B, and C support findings in Figure 4.14. The average growth rate of contributions of race and ethnicity was the highest in all types of immigrant gateways during the past three decades, ranging from 31% to 284%. Education has also become increasingly important in accounting for immigrant wage inequality in most gateways. In contrast, there was an obvious decline in the average percentage of overall wage inequality that was accounted for by residual wage inequality in all types of immigrant gateways except for pre-emerging gateways. The rate of decrease ranged between 1.4 to 18.2 percent in the past three decades.

Figure 4.15 Average Contribution of Educational, Racial and Ethnic and Residual Inequality to Total Wage Inequality among Foreign-born Male and Female workers by Different Types of Metros by Gender, 1980-2009

A. Education
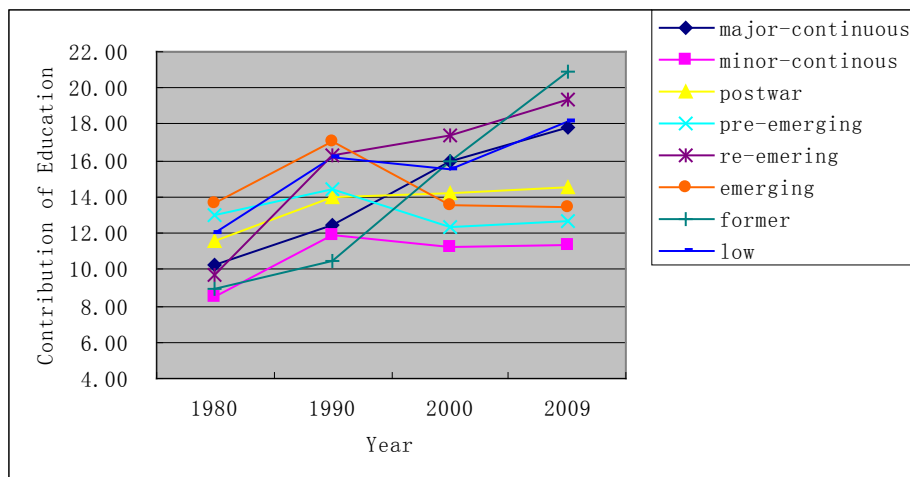
B. Residual
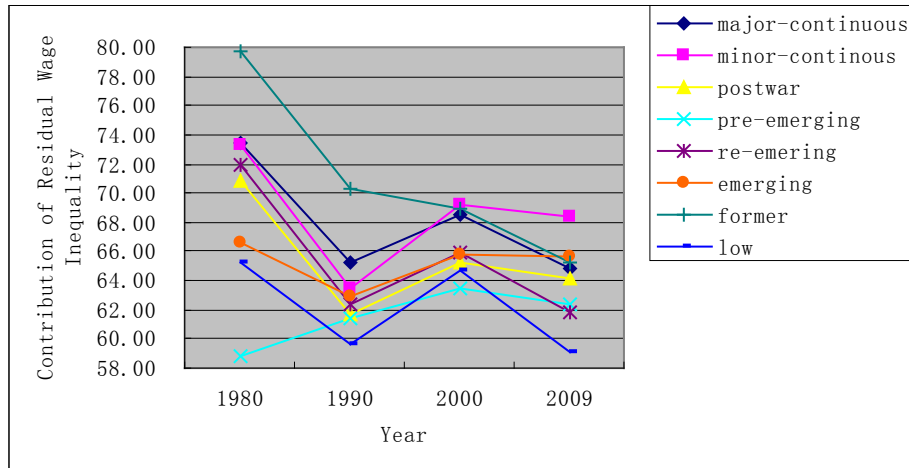
C. Race and Ethnicity
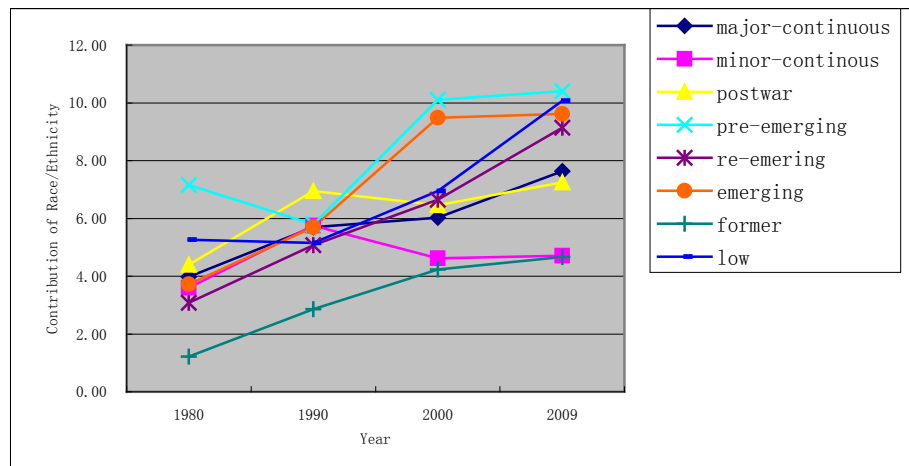
4.3.2 Sources of Changes in Overall Immigrant Wage Inequality

In accounting for the level of income inequality at different time points, I

examine the contributions of the same factors to the differences in wage inequality

during the last three decades. Based on results from Section 4.3.1, I conduct a

difference analysis introduced by Fields (Fields 2002) to find out which factors are

relatively more important sources of the rise in overall immigrant wage inequality

during the past three decades. Fields (Fields 2002) writes the contribution of the j'th factor to changes in a particular inequality measure between time 1 and time 2 as

$$\prod_j (I(.)) = [s_{j,2} * I(.)_2 - s_{j,1} * I(.)_1] / [I(.)_2 - I(.)_1] \tag{3},$$

in which, $\prod_j (I(.))$ denotes the contribution of the j'th factor to the changes in any given inequality measured by I(.). $I(.)_1$ and $I(.)_2$ are total inequalities at time 1 and time 2. $s_{j,1}$ and $s_{j,2}$ are each period's factor inequality weight for the j'th factor, which are also known as the contribution of j'th factor to total wage inequality as found in Section 4.3.1. The formula makes it clear that as a function of I(.), the values of Πj vary depending on the measures of inequality used.

Tables 4.6 and 4.7 analyze rising earnings inequality for male and female immigrant workers separately. The two columns on the right side, $s_j (\ln Y)_{1980}$ and $s_j (\ln Y)_{2009}$ are the factor inequality weights for the year 1980 and 2009 for each of the factors listed in the tables. The first four columns on the left present the contribution of each factor to the changes in total wage inequality as measured by Theil-T Index, Percentile Ratio (90th to 10th) , Gini, and Coefficient of Variance.

For both genders, the contributions of the four key variables, which are all statistically significant determinants of earnings (education, race and ethnicity, potential experience, year of stay in the U.S.), as well as the residual wage inequality are calculated. Despite all observable factors being statistically significant, their contributions to rising inequality differed substantially. For both genders, education

was a leading observable factor accounting for rising earnings inequality in the past

three decades, followed by race and ethnicity. Other factors played a rather smaller

role, with the experience variable even making a negative contribution to the rising

inequality (except for $\pi_j(C.V.)$ of female immigrants). In comparison, residual wage

inequality had the largest effect among all factors (except for its Gini values of both

genders).

Given the difference in inequality measures used, I find similar results in values

of $\pi_j(Theil)$, $\pi_j(LogDiff)$, and $\pi_j(C.V.)$ for each factor among male and female

workers. The value of $\pi_j(Gini)$ has a different pattern in terms of the relative

importance of inequality explained by the residual and education factors.

Table 4.6 Contributions of Each Explanatory Factor to Changes in Inequality for Male
(% for $\prod_j(I(.))$)

	$\pi_j(Theil)$	$\pi_j(LogDiff)$	$\pi_j(Gini)$	$\pi_j(C.V.)$	$s_j(\ln y)_{1980}$	$s_j(\ln y)_{2009}$
Residual	50.79	37.33	33.91	55.26	0.71	0.64
Experience	-3.43	-8.57	-9.88	-1.72	0.04	0.02
Education	25.05	33.90	36.15	22.11	0.12	0.16
Race and Ethnicity	16.47	24.20	26.16	13.90	0.05	0.09
Duration in the U.S.	3.46	3.22	3.16	3.54	0.04	0.04

Table 4.7 Contributions of Each Explanatory Factor to Changes in Inequality for

Female (% for $\prod_j (I(.))$)

	$\pi_j(Theil)$	$\pi_j(LogDiff)$	$\pi_j(Gini)$	$\pi_j(C.V.)$	$s_j(\ln y)_{198}$	$s_j(\ln y)_{200}$
Residual	41.85	41.59	16.00	45.97	0.79	0.64
Experience	-0.04	-0.04	-0.60	0.06	0.01	0.01
Education	30.80	30.93	43.64	28.76	0.12	0.20
Race and Ethnicity	15.33	15.42	24.52	13.87	0.02	0.07
Duration in the U.S.	6.53	6.57	10.17	5.95	0.01	0.03

Using Theil-T values by metro retrieved from Chapter 3, I mapped the spatial distributions of contributions to rising inequalities by education, race and residual wage inequality. On average, residual inequality played a dominant role in explaining the rise in overall wage inequality among immigrant workers, accounting for more than half of the rise in both male and female wage inequalities. Similar to results at the national level, education, and race and ethnicity were the second and third most important factors. The former factor accounted for 25.9% and 31.1% of the male and female wage inequality respectively, and the latter accounted for 16.2% and 8.2% of the male and female wage inequality respectively. However, the large positive contributions of residuals to differences in total wage inequality were largely attributable to the sharp rise in total inequality in most of the metropolitan areas, rather than the growth in percentage contribution of residual inequality between 1980 and 2009. In fact, as indicated in Section 4.3.1, more than half of the metros had a

decline in percentage contribution of residual differences to total wage inequality from 1980 to 2009. In contrast, both Theil-T values and factor inequality weights of education and race and ethnicity increased, enhancing the contributions of education and race and ethnicity to the rising wage inequalities across metropolitan areas.

Interestingly, a close investigation of the spatial distributions of contributions by different factor sources to changes in total inequality in Figure 4.16 shows that most metros with a large positive percentage contribution by residual inequality had a negative or slightly positive percentage contribution by education. Some examples are Daytona Beach, FL, Youngstown, OH/PA, Birmingham, AL, Provo-Orem, UT, Harrisburg, PA, Wilmington, DE/NJ/MD, Des Moines, IA, Mobile, AL, Greenville, SC. Likewise, in most metros—such as Memphis, TN/AR/MS, Toledo, OH/MI, Pittsburgh, PA, Colorado Springs, CO, Rochester, NY, Tucson, AZ—where the rise in total inequality are mainly attributable to a large and positive contribution by education, the role of residual is almost neglectable or even negative. This phenomenon is true vice versa and for both genders. However, there is no such pattern found with the distribution of percentage contributions by race and ethnicity to growth in total inequality.

Figure 4.16 Contributions of Each Explanatory Factor to Changes in Inequality by Gender in Three Decades (%)

Male Education   Female Education

Male Race   Female Race

Male Residual   Female Residual

Legend

● -327.500 - 0.000
● 0.100 - 25.000
● 25.100 - 50.000
● 50.010 - 100.000
● 100.010 - 464.000
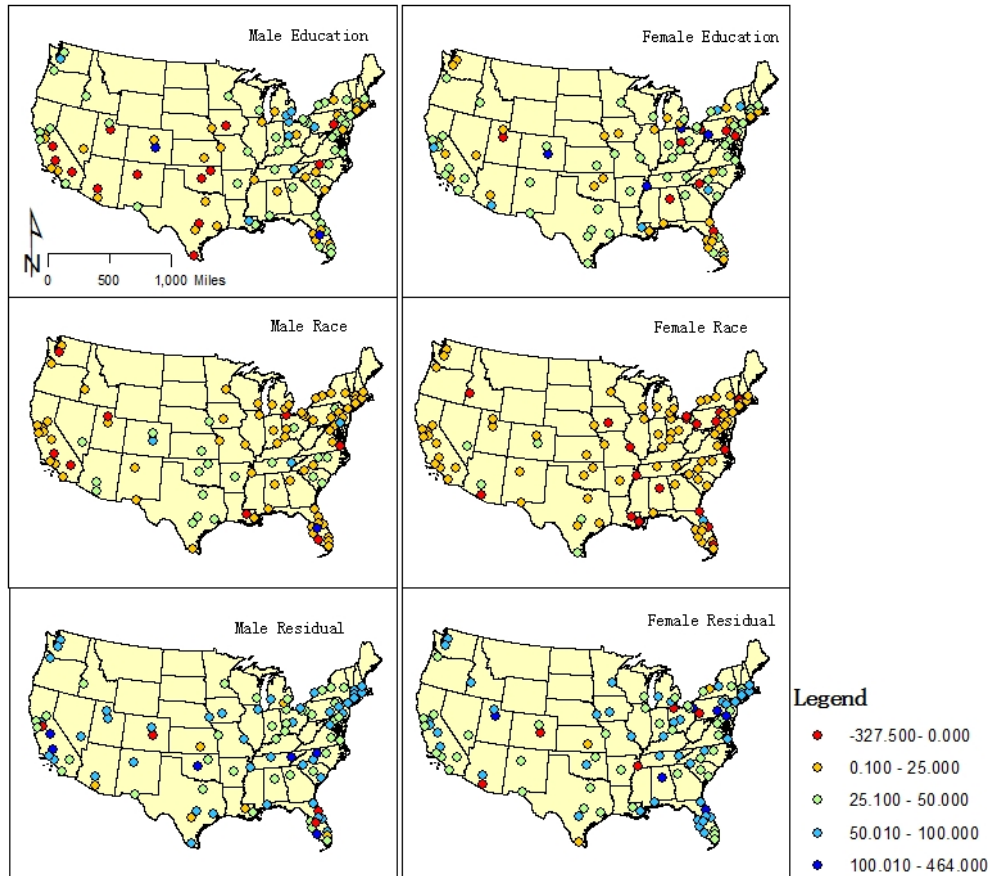
4.4 Conclusions

This chapter analyzes the between- and within-group wage inequalities of immigrant workers by gender. In terms of between-group inequalities, I lay special emphasis on wage differentials between educational and racial and ethnic groups controlling for other factors. At both the national and metro scales, levels of educational wage gap for both genders continued to increase in the past three decades. Among all observed factors, the growth rate of educational wage gap was the highest. The temporal trend of wage inequality between different racial and ethnic groups was a combined result of the increasing wage gap between Hispanics and non-Hispanics

(especially White and Asian workers) and the narrowing wage gap between Asian and White immigrants. Similar trends were found for the White/Asian and White/Hispanic average wage gaps at the metropolitan area level. Metros that had a higher predicted wage among Asian immigrant workers than their White counterparts were mostly non-traditional gateways in the Mid-West and Northeast and had a high or at least balanced skill profile of immigrant workers in 2009. High White/Hispanic inequalities were concentrated in two types of metros: multi-racial settlements for immigrant workers with a high or balanced skill profile of them in 2009, and border-region low-immigrant and minor-continuous gateways with a low skilled profile of them in 2009. Meanwhile, residual wage inequality for male and female immigrant workers continued to grow at both the national and metro levels. Over time, there was a convergence in the levels of residual wage inequality, as its variation across metros declined by around 50% for both male and female immigrant workers between 1980 and 2009. The spatial patterns of racial and ethnic and residual wage inequalities reflect variations in historical legacy of immigrant settlement patterns, recent changes in immigrant skill distribution, and demand for skills across metropolitan labor markets.

Similar to previous findings on the contribution of residual wage inequality to the overall wage inequality of the U.S. labor force, residual wage inequality of immigrant workers also played an important role in explaining their total wage inequality during all observed years. However, the contribution of residual to total

immigrant wage inequality declined moderately in 1990—from over 70% to over 60% at the national level and from an average of 67% to an average of 62% across metros for men—and kept fluctuating subsequently. In contrast, the decomposed percentages of contributions by education and race and ethnicity to overall wage inequality both increased rapidly since 1980. Further examining contributions of changes in inequalities of different factor sources and residuals to the changes in immigrant wage inequality between 1980 and 2009, I find the effects of residual wage inequality to be the most influential among all. However, this is largely due to the rapid increase in total foreign-born wage inequality rather than the changes in the contribution of residual foreign-born wage inequality to foreign-born total wage inequality. In fact, more than half of the metros experienced a decline in the contribution of residual inequality for both genders. Education and race and ethnicity, on the contrary, contributed greatly to the rise in total wage inequality among immigrant workers during the past three decades.

In conclusion, findings in Chapter 4 identify education, race and ethnicity, and residual wage inequality as three major sources of wage inequality growth among immigrant workers. Despite of the fact that residual wage inequality continued to grow over the past three decades, and it still accounted for over half of the wage inequality among immigrant workers in many metropolitan areas in 2009, my analyses shed light on the increasingly important role of race and ethnicity in differentiating wages between different foreign-born worker groups.

Chapter 5

Modeling Temporal Changes and Spatial Variations in

Overall Wage Inequality and in Residual Wage Inequality

among Immigrant Workers

This chapter aims to identify the key forces that shape spatial variations and temporal changes in overall wage inequality and in residual wage inequality for immigrant workers across metropolitan areas in the U.S.. I construct a series of fixed-effects and mixed-effects models to fit the time-series cross-sectional data structure. The dependent variables are the Theil-T index as a measure of overall wage inequality for immigrant workers and the mean squared error (MSE) (Frey, Berube et al. 2009) from the OLS wage regression model as a measure of the residual wage inequality for immigrant workers. Both variables are constructed over time and by metropolitan area.

In Chapter 2, I reviewed the literature on the determinants of wage inequality for the total labor force in U.S. metropolitan areas. Previous studies have pointed to international trade, skill-biased technological change, changes in industrial composition, unionization, minimum wage legislation, and urban population size as major factors contributing to   rising wage inequality since the early 1980s. In this chapter, I develop panel models to evaluate the effects of these factors on wage

inequality among immigrant workers. Grouping these independent variables into four different types of labor market conditions, I test whether the factors that explain overall wage inequality hold in predicting spatial variations and temporal changes in overall wage inequality and residual wage inequality among immigrant workers. Regional approaches to wage inequality acknowledge the role of metropolitan areas in shaping labor market outcomes and the spatial distribution of the U.S. labor force, including immigrant workers (Frey, Berube et al. 2009, Glaeser, Resseger et al. 2009, Fallah, Partridge et al. 2010). Therefore, I also consider including time-invariant locational attributes of metropolitan areas, such as being in the South and being classified as a type of immigrant gateway metros in my models (Singer 2004), in a random-effect panel model. By doing so, I am able to observe the inter-metro variations in wage inequality and residual wage inequality among immigrant workers.

This chapter is organized in four sections that follow. Section 5.1 introduces the independent variables used in the models and it provides basic summary statistics for all variables. It then continues to explain why fixed- or mixed-effects models are chosen to fit the data. Section 5.2 and 5.3 show results of panel modeling for overall and residual wage inequalities, respectively, in an attempt to understand the roles of different time-variant and time-invariant factors in shaping spatial variations and temporal changes in immigrant wage inequalities. These analyses are conducted for male and female foreign-born workers separately. Section 5.4 concludes the chapter, highlighting spatial variations in overall and residual wage inequalities for immigrant

workers and the role of geography in mediating the effects of foreign-born skill structure on wage inequalities for both male and female foreign-born workers.

5.1 Summary of Data and Methods

5.1.1   Data Manipulation and Summary Statistics

The dependent variable for the panel models that I estimate are measures of overall wage inequality and residual wage inequality for male and female FTFY (Full-Time Full-Year) non self-employed workers aged between 16 and 64. These data were generated in Chapter 3 and Chapter 4, based on the IPUMS Decennial Census 1980, 1990, 2000, and ACS 2009 data. As mentioned in the introduction, the potential causal factors of wage inequality among immigrant workers can be divided into two sets of variables, those that are time-variant and those that are time-invariant. I further classified time-variant variables into four groups of factors, namely trade and technology, shifts in industrial composition, institutional changes, and regional demographic profiles.

My choice of independent variables includes those suggested as important determinants of increased wage inequality in the U.S. in previous literature .To measure the related effects of trade and skill-biased technological change on wage inequality, I develop measures of trade competition and R&D spending. These variables are related in that skill-biased technological change might be a response to growing trade

competition. At the same time, skill-biased technological change might be the result of outsourcing or offshoring certain parts of production chains (Baldwin 2006; Blinder 2006). As mentioned in Chapter 2, both factors have been found to have a causal effect on the rise in wage inequality in the U.S., yet controversy persists (Freeman and Katz 1995, Card and DiNardo 2002, Autor, Katz et al. 2008, Rigby and Breau 2008). As an alternative to trade and skill-biased technological change, shifts in industrial compositional also influence changes in wage inequality by increasing the demand for non-routine skills (Card and Dinardo, 2002; Hoskins, 2005). These shifts might also be related to trade, though they may be independent. Job shifts from durable goods manufacturing to services indicate a decline of traditional middle-income jobs and an increase in both high- and low-paying jobs in a regional labor market (Madden 2000). Empirical studies have found a statistically significant negative association between the ratio of manufacturing employment over service employment and residual wage inequality among workers in U.S. regional labor markets (Madden 2000, McCall 2001, McCall 2011). Institutional changes, such as differences in unionization rates and minimum wage legislation have also been discussed as possible determinants of changes in wage inequality (Card and DiNardo 2002, Breau 2007). A decline in unionization is likely to result in an increase in wage inequality while the relationship between minimum wage laws and wage inequality remains unclear (Card, Lemieux et al. 2003, Autor, Katz et al. 2008). Controlling for regional and demographic characteristics is a conventional way of measuring differences in wage inequality across different labor markets (Parks 2011). Finally, two time-invariant geography

variables, namely types of immigrant gateway cities and Census Region are also included to reveal how the unevenness of wage inequality is embedded spatially. In the rest of this section, I show the data sources of the different variables and how they were manipulated to fit the model.

Table 1 provides descriptive statistics for the dependent variables analyzed below, along with the key independent variables that are separated according to whether or not they vary over time.

Table 5.1 Descriptive Characteristics for Dependent Variables, Time-variant and Time-invariant Variables in the Analysis

Variables		Obs	Mean	Std. Dev.	Min	Max
Dependent variables						
Theil-T index for foreign-born male		392	0.1645	0.0402	0.0719	0.3092
Theil-T index for foreign-born female		392	0.1517	0.0388	0.0627	0.2664
Residual wage inequality for foreign-born male		392	0.2459	0.0503	0.1178	0.7520
Residual wage inequality for foreign-born male		392	0.2233	0.0465	0.0883	0.4743
Level 1 time variant variables						
Trade and technology	Trade competition	392	0.2247	0.6015	-1.3689	7.1392
	R&D spending	392	0.0318	0.0383	0.0003	0.3731
Shifts in Industrial Composition	Durable goods manufacturing employment as share of service employment	392	0.4473	0.3293	0.0348	2.2428
Institutional	Percent of union	392	13.6152	7.4156	1.2000	36.6000

changes	membership (%)					
	Minimum wage	392	4.3929	1.4791	1.2500	7.9060
Regional demographic profiles	Percent of Hispanics (%)	392	11.2854	15.1831	0.3692	89.3526
	Percent of native-born high-school dropouts (%)	392	9.3210	6.3283	1.7542	37.0565
	Percent of foreign-born female workers (%)	392	38.0253	5.8101	23.2274	65.8537
	Skill structure of immigrants	392	2.0293	2.9122	0.0408	45.4778
	Total population size	392	12.7582	0.8844	10.6223	15.5939
Time controls	Time control	392	N/A	N/A	1980	2009
Level 2 time invariant variables						
Metro type	Low	40	N/A	N/A	0	1
	Former	7	N/A	N/A	0	1
	Postwar	9	N/A	N/A	0	1
	Pre-emerging	10	N/A	N/A	0	1
	Emerging	5	N/A	N/A	0	1
	Re-emerging	10	N/A	N/A	0	1
	Major-continuous	4	N/A	N/A	0	1
	Minor-continuous	13	N/A	N/A	0	1
Census region	South	38	N/A	N/A	0	1

Sources: IPUMS, Decennial Census and ACS 1980-2009, NBER U.S. Patent Data 1980-2005; U.S. Department of Labor Minimum Wage, 1980-2009 , U.S. Bureau of Economic Analyses Total Employment by NAICS industry,1980-2009, Current Population Survey (CPS) Outgoing Rotation Group (ORG) Earnings Files 1986-2009

Note: IPUMS Decennial Census Data does not report wage inequality in Monmouth-Ocean, NJ in 1980 and Newburgh-Middletown, NY in 1990. The panel models are conducted based on information of 98 metros in 4 years.

As mentioned earlier, the time-variant measures are divided into the four main categories of explanations for wage inequality that are commonly found in the literature. The trade competition index is constructed from exports, imports and shipments data by industry and by time. These variables are prepared by Rigby and Breau (Rigby and Breau 2008) based on National Bureau of Economic Research (NBER) data and other resources (Feenstra and Hanson 2001, Bernard, Jensen et al. 2006). However, all trade variables are compiled at the national rather than the metro level. According to a simple industry mix argument (that the amount of trade activities of a city in each industry is in proportion to its manufacturing employment size), I create a city-industry weight by year, defined as the share of manufacturing employment in each city for each industry by year. The weights are derived from IPUMS Population Censuses, whose sum by each year equals one. The trade competition index for each city by year becomes the weighted sum of imports as a share of output available for domestic consumption for each industry and year. To merge the trade data with employment data from IPUMS, I use a SIC-Census industry crosswalk to standardize the industry definitions in each data set. This is because industries in the trade files are classified according to 1987-based 4-digit Standard Industrial Classification codes, whereas industries in the Population Censuses are classified using a different scheme

$$TradeCompetition_t^n = \sum_{it}^{n} Weight_{it}^n * \left(\frac{IMPORTS_{it}^n}{IMPORTS_{it}^n + SHIPMENTS_{it}^n - EXPORTS_{it}^n} \right) (1),$$

where $EXPORTS_{it}^{n}$, $IMPORTS_{it}^{n}$ and $SHIPMENTS_{it}^{n}$ represent the values of U.S. exports, imports, and shipments for industry i in city n at time t (1980, 1990,2000,2009). The denominator indicates the apparent consumption for industry i in city n at time t.

To measure technological change at the metropolitan or regional level, I would like a measure of research and development (R&D) spending. Unfortunately, R&D data are not produced at the metropolitan level. Thus, I use patents, a measure of the output of R&D spending, to proxy for investment in technological development. I divide the number of patents each year in each city by city employment to estimate the level of technology creation relative to the size of the workforce in each city. The patent data come from the NBER Patents Database developed by Hall et al. (Hall, Jaffe et al. 2001) that includes information on total employment and number of patents in a given metropolitan area between 1975 and 2005. Employment data for metropolitan areas come from the Bureau of Economic Analysis.

To evaluate shifts in industrial composition across metropolitan areas, I use employment data retrieved from the Bureau of Economic Analysis website to create a measure of durable goods manufacturing employment as a share of service jobs by metro in 1980, 1990, 2000, and 2005-2009. Changes in the relative share of middle-income manufacturing jobs to service industry employment in a regional labor market indicate the degree of deindustrialization and are hypothesized to drive changes in local wage structure.

The unionization rate is the percentage of workers covered by a union contract. Unionization data come from the Current Population Survey and are compiled at the CMSA/MSA level by Hirsch and Macpherson (Hirsch and Macpherson 2003). The data are available from 1986 to 2009. The Department of Labor provides information on state-level minimum wages. I made further adjustments to metropolitan level minimum wages that cannot be directly obtained based on the state-level values, such as creating the weighted average of minimum wages for cross-state metros.

Indicators of regional demographic profiles are all derived from the IPUMS data. Among them, the skill structure of immigrant workers in a given metropolitan labor market is the ratio of college graduates to high-school dropouts in that area.

Finally, two time-invariant measures were created to indicate geographic differences between metropolitan areas, including whether a metropolitan area is in the South Census Region, and which immigrant gateway city category a metropolitan area falls into according to Singer's definition (Singer 2004). Detailed information on the definition of eight different types of gateway cities can be found in Chapter 3.

It is important to point out that although all data are collected at the metropolitan area level, the definition of metropolitan areas varies over time and is not consistently used in different datasets. The wage inequality variables are collected using metropolitan area variable in IPUMS, which are consistent over time and are commensurate with the Census 2000 metropolitan area definitions. Variables

from other sources have been adjusted to correspond to the IPUMS defined geographic scale. I use the Geographic Correspondence Engine of the Missouri Census Data Center (MABLE/Geocorr2K) to build bridges between pre- and post-2000 metropolitan area definitions and the 2000 Census Bureau standard.

5.1.2   Model Selection for Time-Series and Cross-Sectional Data

In order to observe how differences and changes in wage inequalities can be explained by the potential causal factors listed above, I take advantage of the panel structure of the data. A series of panels are constructed that capture variation in the data across metropolitan areas (my cross-section dimension) and across the years 1980, 1990, 2000 and 2009 (my time-series dimension). The primary advantage of panel models is that they control for unobserved heterogeneity across the cross-sectional units of the data. If that heterogeneity is correlated with the independent variables, estimates will be biased and inconsistent. F-tests from the fixed effects panel model reveal that there are significant differences in inequality across metropolitan areas and thus running a pooled-OLS would be inappropriate. The equation for a fixed-effects model is shown below:

$$Y_{it} = \beta_i X_{it} + \alpha_i + u_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(2)$$,

where α_i is the intercept for each entity, Y_{it} is the dependent variable, X_{it} is the dependent variable with a coefficient of β_i, and u_{it} is the error term. The *within group* model can then be derived as

$$Y_{it} - \overline{Y_i} = \beta_i(X_{it} - \overline{X_i}) + (u_{it} - \overline{u_i}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(3),$$

where $\overline{Y_i}$, $\overline{X_i}$, and $\overline{u_i}$ are the group means of the dependent, independent, and error terms respectively. Note that the intercept and time-invariant variables have been canceled and therefore their effects cannot be evaluated in the *within group* model.

However, the fixed-effects model has its drawbacks. First and foremost, a fixed-effects model does not account for the effects of time-invariant variables on the dependent variable. Second, unlike a random-effects model or the random part of the mixed-effects model, a fixed-effects model does not allow for variation in intercept or/and slopes of the independent variable(s) across panels. In contrast, a random-effects model (See Equation (4)) not only extends the study on causes of changes from that within each entity to that across entities, but also allows for cross-level interactions between independent variables. Despite the fact that a random-fixed effects model does not necessarily overcome the potential problem of correlation between covariates and residuals, scholars (Bafumi and Gelman 2006, Bartels 2008, Bell and Jones 2014) have more recently come to believe that the need to understand the role of context overweighs the existence of heterogeneity in a random-effects model because "whatever defines the higher level is usually of profound importance to a given research question" (Bell and Jones 2014).

$$Y_{it} = \beta_i X_{it} + \alpha_i + u_{it} + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4),$$

where u_{it} is the between-entity error term and ε_{it} is the within-entity error term.

In light of the locally contingent nature of employment outcomes, more geographic studies have addressed the spatial unevenness in wage inequality and poverty across metropolitan labor markets (Ellis 2001, Bolton and Breau 2011, Parks 2011, Ellis, Wright et al. 2013). However, most of them use Census regions as a control factor in the OLS model. Hardly any studies have explored the relationship between historic settlement patterns of racial and ethnic workers and local wage inequality. The findings in Chapter 3 and Chapter 4 of the dissertation show that the historical settlement patterns of immigrant workers reflect the long-term uneven spatial effects of local context on immigrant wage inequality. Therefore, the availability of time-invariant variables in this study, namely immigrant gateway types (with a controlling factor of Census region) allow me to further explore how geography helps explain the spatial variation in wage inequality among immigrant workers and how space moderates the influence of (the time-variant factor of) immigrant skill profiles on   wage inequality in a local labor market.

Three mixed-effects models are developed to determine overall wage inequality and residual wage inequality among immigrant workers: a random intercept model, a random slope model with geographic variables, and a random slope model with cross-level interactions. All models can be viewed as a repeated measures multilevel model, which is a special case of the mixed-effects model. Level-1 includes all time-variant metro-level variables, which are observed repeatedly between 1980 and

2009 and therefore nested within the level-2 time-invariant variables representing the geography of the metros[7].

5.2 Determinants of Overall Wage Inequality among Immigrant Workers

5.2.1 Effects of Labor Market Conditions on Overall Wage Inequality of Foreign-born Male Workers

Table 2 focuses on labor market outcomes of male immigrant workers and presents four models that predict wage inequality across metropolitan areas. The four models used include the fixed-effects model (Model 1), the random-intercept wage inequality across metropolitan areas (Model 2), the random-slope wage inequality with effects of the level-2 time-invariant geography factors (Model 3), and the random-slope wage inequality with a cross-level interaction between local skill structure of immigrant workers and the time-invariant immigrant gateway types of each metro area (Model 4).

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[7] Note that the ideal panel model here is a 3-level multilevel model which allows us to control variations in individual characteristics. However, the design of the data structure in this study only allows for a two-level panel model.

Table 5.2 Fixed-effects and Mixed- effects Models for Overall Wage Inequality among Male Foreign-Born Workers

		Model 1	S.E.	Model 2	S.E.	Model 3	S.E.	Model 4	S.E.
Trade and Technology	Trade competition with Less Developed Countries	0.0051	0.0022 **	0.0100	0.0004 **	0.0071	0.0022 **	0.0010	0.0004 *
	R&D spending	0.1129	0.0455 *	0.0984	0.0352 **	0.0966	0.0351 **	0.0953	0.0352 **
Shifts in Industrial Composition	Durable goods manufacturing employment as share of service employment	-0.0271	0.0088 **	-0.0336	0.0062 ***	-0.0307	0.0065 ***	-0.0293	0.0065 ***
Institutional changes	Percent of union membership	-0.0001	0.0005	-0.0015	0.0002 ***	-0.0015	0.0003 ***	-0.0014	0.0003 ***
	Minimum wage	0.0019	0.0024	0.0000	0.0019	0.0000	0.002	0.0000	0.002
Regional demographic controls	Percent of Hispanics	-0.0016	0.0005 **	-0.0001	0.0001	-0.0001	0.0002	-0.0002	0.0002
	Percent of Native-born High-school Dropouts	0.0008	0.0007	0.0002	0.0005	0.0004	0.0005	0.0005	0.0005
	Skill Structure of Immigrants (Ratio of College Graduates to High-school Dropouts)	0.0010	0.0039	0.0019	0.0033	0.0015	0.0034	0.0007	0.0056

		M1 coef	M1 SE	M2 coef	M2 SE	M3 coef	M3 SE	M4 coef	M4 SE
Time controls	Total Population Size	-0.0211	0.0081 **	0.0080	0.0018 ***	0.0063	0.0039 *	0.0046	0.0027 *
	1990	0.0337	0.0078 ***	0.0141	0.0057 *	0.0200	0.0063 **	0.0201	0.0064 **
	2000	0.0621	0.0114 ***	0.0225	0.008 **	0.0346	0.0091 ***	0.0327	0.0091 ***
	2009	0.0796	0.0142 ***	0.0316	0.0103 **	0.0456	0.0116 ***	0.0441	0.0118 ***
	Cons	0.2617	0.0084 ***	0.1569	0.0063 ***	0.1457	0.0083 ***	0.1376	0.0095 ***
Time Invariant Variables	South Region					0.0008	0.0044	0.0021	0.0043
	Former					-0.0108	0.0060 *	-0.0218	0.0121 *
	Postwar					0.0142	0.0083	0.0155	0.0102
	Pre-emerging					0.0002	0.0055	0.0000	0.0098
	Emerging					0.0084	0.0081	0.0020	0.0121
	Re-emerging					0.0080	0.0062	0.0045	0.0227
	Major-continuous					0.0165	0.0106	0.0145	0.0154
	Minor-continuous					-0.0014	0.0064	0.0061	0.0091
Cross-level Interactions	Former*FB skill structure							0.0117	0.0146

Postwar*FB skill structure		-0.0021	0.0097
Pre-emerging*FB skill structure		0.0116	0.0102
Emerging*FB skill structure		0.0105	0.0136
Re-emerging*FB skill structure		0.0022	0.0224
Major-continuous*FB skill structure		0.0042	0.0137
Minor-continuous*FB skill structure		-0.0187	0.0103 *

Table 5.3 Fixed-effects and Mixed- effects Models for Overall Wage Inequality among Female Foreign-Born Workers

		Model 1	S.E.	Model 2	S.E.	Model 3	S.E.	Model 4	S.E.
Trade and Technology	Trade competition with Less Developed Countries	0.0007	0.0004	0.0006	0.0004	0.0031	0.0021	0.0006	0.0004
	R&D spending	0.0765	0.0475	0.0881	0.0334 **	0.0925	0.0329 **	0.1114	0.0322 **
Shifts in Industrial Composition	Durable goods manufacturing employment as a share of service employment	-0.0290	0.0092 **	-0.0216	0.0058 ***	-0.0200	0.0060 **	-0.0205	0.0059 **
Institutional changes	Percent of union membership	0.0000	0.0005	-0.0006	0.0002 **	-0.0003	0.0002 *	-0.0006	0.0002 *
	Minimum wage	0.0003	0.0025	0.0001	0.0018	0.0006	0.0019	0.000	0.0019
Regional demographic controls	Percent of Hispanics	0.0001	0.0005	0.0001	0.0001	0.0000	0.0001	0.0002	0.0001 *
	Percent of Native-born High-school Dropouts	0.0013	0.0007	0.0011	0.0004 *	0.0010	0.0005 *	0.0009	0.0005
	Skill Structure of Immigrants (Ratio of College Graduates to High-school Dropouts)	-0.0031	0.0041	0.0014	0.0031	0.0011	0.0036	0.0015	0.0056

Time controls									
Total Population Size	0.0114	0.0086	0.0089	0.0016 ***	0.0106	0.0024 ***	0.0119	0.0023 ***
1990	0.0191	0.0084 *	0.0209	0.0055 ***	0.0165	0.0061 **	0.0185	0.0060 **
2000	0.0386	0.0121 **	0.0403	0.0075 ***	0.0353	0.0087 ***	0.0376	0.0084 ***
2009	0.0636	0.0153 ***	0.0672	0.0098 ***	0.0577	0.0111 ***	0.0643	0.0109 ***
Cons	0.1275	0.0090 ***	0. 1199	0.0059 ***	0. 1204	0.0079 ***	0.1202	0.0088 ***
Time Invariant Variables								
South Region					0.0063	0.0038	0.0051	0.0037
Former					-0.0055	0.0055	-0.0232	0.0131 *
Postwar					-0.0084	0.0073	-0.0136	0.0092
Pre-emerging					0.0009	0.0051	0.0035	0.0094
Emerging					-0.0126	0.0069	-0.0134	0.0111
Re-emerging					-0.0110	0.0052	-0.0214	0.0224
Major-continuous					-0.0110	0.0090	-0.0087	0.0144
Minor-continuous					-0.0029	0.0055	0.0136	0.0084
Cross-level Interactions								
Former*FB skill structure							0.0181	0.0137

Postwar*FB skill structure		-0.0099 0.0093
Pre-emerging*FB skill structure		0.0139 0.0098
Emerging*FB skill structure		0.0044 0.0124
Re-emerging*FB skill structure		0.0116 0.0223
Major-continuous*FB skill structure		0.0005 0.0137
Minor-continuous*FB skill structure		-0.0222 0.0097 *

*Significance at the .05 level

**Significance at the .01 level

***Significance at the .001 level

The results of level-1 time-variant variables in all models indicate how observable local labor market conditions matter for wage inequality among male immigrant workers. Overall, there is great resemblance in the sign, size, and statistical significance of most parameters between the fixed-effects and mixed-effects models.

Both measures of trade and technology have a significant impact on male immigrant wage inequality. A rise in trade competition and R&D spending per worker leads to a widening wage gap among male immigrant workers. In particular, the size of the coefficient for R&D spending is the largest among all parameters. A one-unit increase in R&D spending would increase wage inequality among male immigrant workers by about 0.1 units. The significantly negative coefficient of durable goods manufacturing employment as a share of the service employment reflects a strong shifts in demand for skills, as induced by a compositional change in employment from manufacturing to service industries.

As pointed out in previous literature, as unionization falls, inequality increases. Likewise, the decline of labor unions in a local labor market was associated with a rise of wage inequality among immigrant workers in all models. However, there is little association between the other institutional factor-- minimum wage and wage inequality. This is also in line with a series of previous findings by Autor and coauthors (2008).

As for regional demographic controlling variables, the significantly negative coefficient of city population size in the fixed-effects model is confusing and contradicts findings in the mixed-effects models. It is likely that the other unobserved

confounding factors are correlated with the city population variable. But this effect was removed in the random-effects models. In the mixed-effects models, the significantly positive estimates of city population size are in line with previous findings that a larger cities are associated with higher wage inequality (Glaeser, Resseger et al. 2009, Baum-Snow and Pavan 2010, Bolton and Breau 2011).

In sum, factors that have induced a rise in wage inequality among the total labor force in the U.S., such as trade and technology, a shift of employment from durable goods manufacturing industry to service industry, de-unionization, and city population size also have a strong impact on the foreign-born male wage inequality as well. In contrast, minimum wage and other regional demographic controls are not found to have a significant role in determining wage inequality among male immigrant workers. Finally, all time controls have a positive impact on wage inequality, suggesting a widening wage gap among immigrants over time.

5.2.2 The Role of Geography

The two random-slope models (Model 3 and Model 4) allow me to further explore the role of geography in determining spatial variation in wage inequality. In model 3, I allow the variance of level-1 errors to vary by skill structure of immigrant workers across local labor markets. In Model 4, I further interact the immigrant gateway type of each metro with the foreign-born skill structure to allow both intercept and slope to differ by immigrant settlement patterns. The design of the random-slope

models are based on the findings in previous chapters that the effect of a unit change in the skill structure of immigrant workers on wage inequality was   not uniform across metropolitan areas. For example, Chapter 3 indicated that many metros in the West or Southwest started with a high level of wage inequality but experienced slower growth in wage inequality over time. This hypothesis is supported by the negative covariance of the random intercept and slope in both Model 3 (-0.0001) and Model 4 (-0.0001), which can be interpreted as metros with steep slopes have smaller intercepts and metros with shallower slopes have larger intercepts.

For male workers, Model 3 and Model 4 both show that foreign-born wage inequality was more likely to be lower in a former immigrant gateway than in a low-immigrant gateway city. The more equal wage distribution in former immigrant gateways is likely due to a lack of newly arrived immigrants who are more diversified in skills in these labor markets. Interestingly, Model 4 further finds the interaction-term between the minor-immigrant gateway city variable and foreign-born skill structure to be negative and significant. Both findings correspond to the spatial pattern of foreign-born wage-inequality found in Chapter 3. Given many minor-continuous immigrant gateway cities, such as Tucson, San Antonio, and Bakersfield, are close to the Southern border with Mexico and have a high percentage of low-skilled Mexican immigrants, the effect of high-skills on the wage distribution of immigrant workers was reduced in these metropolitan areas.

A review of the intra-class correlation of each model in Table 4 also shows that spatial variation in wage inequality is large even controlling for labor market conditions within a metropolitan area. Known as 'rho', it explains the proportions of the variance due to differences (across cities) in the cross-sectional dimension of the panels,.

$$rho = \frac{(sigma\_u)^2}{(sigma\_u)^2 + (sigma\_e)^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots(4),$$

where $sigma\_u$ is the standard deviation of residual u_i, and $sigma\_e$ is the standard deviation of residual e_i. For both genders, the unexplained proportion of spatial variance in overall immigrant wage inequality declines consecutively from Model1 to Model 4. The difference in levels of intra-class correlation is especially significant between Model 1 (a fixed-effects model) and Model 2 (a random-intercept model). Shrinkage in the proportion of the variance across the models suggests that geography explains part of the spatial variance in overall wage inequality above and beyond differences in local labor market conditions.

Table 5.4 Intra-Class Correlations of Fixed-Effects and Mixed-Effects Models

	Model 1	Model 2	Model 3	Model 4
Foreign-Born Male	0.6325	0.2838	0.2416	0.2267
Foreign-Born Female	0.4681	0.1954	0.1559	0.1048

5.2. 3 Gender Differences

The level-1 estimates for female wage inequality in Table 5.3 resembles those for male wage inequality in sign, though the statistical significance of a number of these variables has been lost. This could be due to the fact that wage variation is lower among female workers. R&D spending remains a significant causal factor of wage inequality among female foreign-born workers. In addition, low durable goods manufacturing employment as a share of service employment, high percent of union membership, city population size, and year controls play an important role in predicting female immigrant wage inequalities across U.S. metropolitan areas.

The effects of the level-2 factors on immigrant wage inequality are similar across gender. Former gateway cities tend to have a significantly lower wage inequality among female foreign-born workers, as well as among male workers, than low-immigrant gateway cities. For both genders, the significant interaction term between foreign-born skill profile and minor-continuous gateway city indicates that the impact of foreign-born skill profile on the foreign-born wage inequality was significantly reduced in a minor-continuous gateway city. These findings fit with my hypotheses that the spatial settlement pattern of immigrants and their racial and ethnic concentrations shape their wage structure in a local labor market.

5.3 Determinants of Residual Wage Inequality among Immigrant Workers

In this discussion below, attention shifts from overall to residual wage inequality.

5.3.1 Effects of Labor Market Conditions on Residual Wage Inequality of

Foreign-born Male Workers

In this section of the chapter I rehearse many of the arguments above focusing on residual wage inequality among immigrant workers rather than on their overall wage inequality. Table 5.5 reports and compares results of fixed-effects and mixed-effects models, regressing the estimated residual wage inequalities among male immigrant workers on a set of labor market conditions. Since the residual wage inequality measures variance in earnings of workers with their observed individual characteristics controlled, the variable capturing foreign-born skill profiles is not included in the model.

Table 5.5 Fixed-effects and Mixed-effects Models for Residual Wage Inequality among Male Foreign-born Workers

		Model1	S.E.		Model2	S.E.		Model3	S.E.	
Trade and Technology	Trade competition with Less Developed Countries	0.0040	0.0051		0.0085	0.0049		0.0080	0.0049	
	R&D spending	0.0178	0.1023		0.0106	0.0703		0.0035	0.0706	
Shifts in Industrial Composition	Durable goods manufacturing employment as share of service employment	-0.0825	0.0202	***	-0.0613	0.0123	***	-0.0641	0.0127	***
Institutional changes	Percent of union membership	-0.0007	0.0011		-0.0009	0.0004	*	-0.0009	0.0005	
	minimum wage	0.0003	0.0055		-0.0002	0.0039		-0.0020	0.0040	
Regional demographic controls	Percent of Hispanics	0.0000	0.0010		-0.0003	0.0002		-0.0003	0.0003	
	Percent of Native-born High-school Dropouts	0.0027	0.0016		0.0011	0.0010		0.0014	0.0011	
	Total Population Size	-0.0578	0.0181	**	0.0031	0.0035		-0.0040	0.0051	
Time controls	1990	-0.0115	.0045	*	-0.0209	0.0066	*	-0.0190	0.0066	**
	2000	0.0190	0.0262		0.0081	0.0070		0.0119	0.0073	
	2009	0.0066	0.0327		0.0073	0.0076		0.0119	0.0080	
	Cons	0.2167	0.0189	***	0.2473	0.0052	***	0.2462	0.0083	***

Time Invariant Variables				
	South Region	0.0065	0.0074	
	Former	0.0149	0.0123	
	Postwar	0.0133	0.0138	
	Pre-emerging	-0.0115	0.0097	
	Emerging	-0.0012	0.0139	
	Re-emerging	0.0153	0.0111	
	Major-continuous	0.0339	0.0187	*
	Minor-continuous	-0.0025	0.0113	

Table 5.6   Fixed-effects and Mixed-effects Models for Residual Wage Inequality among Female Foreign-born Workers

		Model1	**S.E.**	**Model2**	**S.E.**	**Model3**	**S.E.**
Trade and Technology	Trade competition with Less Developed Countries	0.0050	0.0044	0.0033	0.0041	0.0034	0.0041

		Coef	SE		Coef	SE		Coef	SE	
	R&D spending	0.0851	0.0897		0.0722	0.0632		0.0907	0.0648	
Shifts in Industrial Composition	Durable goods manufacturing employment as share of service employment	-0.0359	0.0175	*	-0.0224	0.0109	*	-0.0245	0.0118	*
Institutional changes	Percent of union membership	-0.0007	0.0009		0.0003	0.0004		0.0006	0.0005	
	minimum wage	-0.0128	0.0147		-0.0026	0.0035		-0.0031	0.0034	
Regional demographic controls	Percent of Hispanics	-0.0001	0.0009		-0.0002	0.0002		0.0001	0.0002	
	Percent of Native-born High-school Dropouts	0.0025	0.0013		0.0024	0.0008	**	0.0019	0.0009	*
	Total Population Size	0.0233	0.0157		0.0064	0.0032	*	0.0102	0.0044	*
Time controls	1990	0.0021	0.0138		0.0084	0.0102		0.0000	0.0118	
	2000	0.0309	0.0191		0.0427	0.0141	**	0.0247	0.0155	
	2009	0.0428	0.0221	*	0.0559	0.0180	**	0.0326	0.0198	
	Cons	0.1916	0.0136	***	0.2072	0.0105	***	0.1960	0.0138	***
Time Invariant Variables	South Region							0.0038	0.0071	
	Former							-0.0154	0.0105	
	Postwar							-0.0062	0.0125	

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	Pre-emerging	-0.0032	0.0086
	Emerging	-0.0217	0.0120
	Re-emerging	-0.0137	0.0103
	Major-continuous	-0.0144	0.0167
	Minor-continuous	-0.0041	0.0096

*Significance at the .05 level

**Significance at the .01 level

***Significance at the .001 level

The remaining regional demographic controls are the percent of Hispanics, percent of native-born high-school dropouts and total population size, all of which have an impact on returns to unobserved skills of immigrant workers. Therefore, Model 3 for residual wage inequality becomes a random-intercept model with the South Region and immigrant gateway types as level-2 variables. And no random-slope regression with cross-level interaction is reported.

Overall, the sign, size, and statistical significance of most labor market parameters remains quite stable across models. In comparison to the effects of level-1 parameters in overall wage inequality among foreign-born workers (Table 5), the sign of the estimates remain almost the same. However, the significance levels of most parameters in these models are lower than those reported from the analysis of overall wage inequality.

The only major causal factor that had a significant impact on foreign-born male residual wage inequality is the proportion of durable goods manufacturing employment as a share of service employment. In fact, its impact on residual wage inequality among male immigrant workers was even more significant than that on overall wage inequality among male immigrant workers. This suggests that shifts in industrial composition have a large impact on returns to unobserved male immigrant skills.

Finally, all time factors had a positive impact on wage inequality, suggesting a long-term widening residual wage gap among immigrants across all metropolitan

areas. Yet the level of residual wage inequality was only significantly higher in 1990 than in 1980.

In sum, similar to my findings on the insignificant effects of trade and technology on residual wage inequality among immigrant workers, they have been reported to have little effects on residual wage inequality among overall labor force in the U.S. as well (McCall 2001). In addition, my results are also similar to McCall (2011) in that we both find   changes in industrial composition to have a significant effect on the rise in wage inequality. However, wage inequality among immigrant workers was not as sensitive to changes in minimum wages and unionization as that among the total labor force.

5.3.2 The role of geography

Model 3 allows for random-intercept of wage inequality across metropolitan areas and includes estimates of geography on their spatial variation. Results in Model 3 are highly consistent with findings in Chapter 4 on the spatial distribution of foreign-born male residual wage inequalities across metropolitan areas. Foreign-born male workers in major-continuous, former, re-emerging, post-WWII, and low immigrant gateway cities tend to have a higher level of residual wage inequality than the foreign-born workers in cities of other gateway types. In particular, major-continuous gateway cities have a significantly higher level of residual wage inequality among immigrant workers.

Similar to Table 5.4, I review the intra-class correlations of each model for residual wage inequality among immigrant workers in Table 5.6. A decline in the value of *rho* is noticed in the random-intercept models compared to the fixed-effects model. However, for female foreign-born workers, a random-slope model does not reduce the difference of residual wage inequality across metropolitan areas. In this case, a random-intercept model with census region and metropolitan gateway types at the second level may not be the preferred model fit.

Table 5.7 Intra-Class Correlations of Fixed-Effects and Mixed-Effects Models

	Model 1	Model 2	Model 3
Foreign-Born Male	0.6924	0.1281	0.0939
Foreign-Born Female	0.3555	0.1885	0.1957

5.3. 3 Gender Differences

The level-1 estimates for female residual wage inequality resemble those for male wage inequality in sign. In Model 2, low durable goods manufacturing employment as a share of service employment, the percent of native-born high-school dropouts, city population size, and year controls played a significant role in predicting residual wage inequalities among female foreign-born workers across U.S. metropolitan areas. The significance of all these estimates reduced in Model 3.

5.4 Conclusion

In this chapter, I use a series of panel models to explain changes in overall and residual wage inequality among foreign-born male and female workers over time and across space. Findings in Chapter 5 are important in that they show that many labor market attributes, which have been found to have a significant impact on wage inequality of the overall labor force in the U.S., also matter for the temporal changes in wage inequality among immigrant workers and their spatial variations across metropolitan areas. These models help to identify the key forces that shape the spatial variations and temporal changes of immigrant wage inequality overall and residual wage inequality.

While the effects of trade and technology on overall wage inequality were significant and positive, these variables did not have much impact on residual wage inequality among immigrant workers. This finding suggests that international trade competition and technological development reward returns to observed skills among immigrant workers, but were less associated with returns to unobserved skills.. The significant and negative association between shifts in industrial composition and overall and residual wage inequalities among immigrant workers indicates a rise in demand for both observable and unobservable skills among immigrant workers. Findings on the impacts of institutional factors accept the hypotheses that a decline in union membership corresponded to an increase in overall and residual wage inequalities among immigrant workers while minimum wage legislation does not have a significant impact. The effects of unionization were most significant on overall wage inequalities among both male and female immigrant workers. Among regional

demographic controls, a large urban population is associated with a significant increase in overall wage inequalities and residual wage inequalities for both genders.

Even controlling for observable labor market conditions, time and space variables both had considerable impacts on wage inequalities. Allowing wage inequality to vary by metropolitan areas and including geography variables (such as Census regions and immigrant gateway metro types) significantly reduce the proportions of the variance due to differences across panels. Wage inequality levels among immigrant workers were significantly lower for both genders in former immigrant gateway cities. In addition, residual wage inequality level was significantly higher in major-continuous immigrant gateway cities for male workers. Finally, in minor-continuous immigrant gateways, the impact of foreign-born skill structure on immigrant wage inequality was significantly reduced. These findings indicate a highly uneven distribution and historical concentration of immigrant skills across different regional labor markets in the U.S..

Chapter 6

Conclusions and Discussions

6.1 Introduction

Immigration remains one of the most critical labor-market issues facing federal and regional policymakers. The impact of immigrants is not only on the wages and unemployment rate of native workers or the national-level U.S. economy, but also on earlier and recent immigrant themselves, and in particular, their prospects of economic assimilation in local city-regions of their settlement.

Previous literature provides convincing evidence that the economic outcomes of immigrants depends on the geographic places they settle in (Ellis, 2001). The spatial distribution of immigrant workers is highly related to their race and ethnicity. Historically speaking, immigrants gravitated in a handful of destinations, where they created social networks and found employment in ethnic niches. Over time, both high- and low-skilled immigrant workers have become more geographically responsive to employment opportunities (Cadena and Kovak 2013). The dispersion of immigrant workers from traditional ethnic enclaves to non-traditional immigrant gateway cities is a combined result of spatial variations in labor market conditions and an expansion of ethnic network and cultural experience within and between cities (Ellis and Goodwin-White 2006; Leach and Bean 2008). This process has created an uneven map of wage structures among foreign-born workers across metropolitan U.S..

My dissertation used various research methodologies to explore the temporal trends and spatial patterns of wage inequality among immigrant workers, wage differentials among immigrant groups by individual characteristics, and the roles of different labor market conditions in determining changes in immigrant wage inequality and their spatial variations. These techniques range from a simple decomposition of Theil inequality measures, to a multivariate regression analysis and regression-based inequality decomposition, and to fixed-effects and random-effects panel models. The main theme of my dissertation is to investigate how wage inequality among immigrant workers is produced by their racial and ethnic compositions, historical settlement patterns, and skill disparities, and how the spatial variation in immigrant wage inequality is a function of different types of immigrant gateway metros. Analyzing wage inequality among immigrant workers through the lens of geography and race and ethnicity of immigrant workers, my findings contribute new knowledge about economic outcomes of immigrant workers and their impact on wage inequality among the overall labor force in the U.S., and offer implications for immigrant policies in the U.S..

The next three sections summarize findings on the temporal trends and spatial patterns of foreign-born wage inequality in the U.S. metropolitan areas in each of the three analytical chapters.

6.2 Main Findings from Chapter 3

As predicted in my first research question raised in this dissertation, Chapter 3 found a wider wage gap among foreign-born workers than native-born workers, and foreign-born wage inequality grew at a higher rate during the past three decades. These findings apply to both genders. At the metropolitan area level, wage inequality among immigrant workers was more variable as well. In general, all metros experienced a rapid growth in inequality levels and a convergence in levels of wage inequality. Metropolitan areas varied in levels of wage inequality by immigrant gateway types and skill profiles. In major-continuous and post-WWII immigrant gateway cities, where immigrant skill profiles were high or balanced, the average wage inequality among immigrant workers kept being higher than those in other immigrant gateway metros. Meanwhile, high three-decade growth rates in foreign-born wage inequality often occurred in new immigrant destinations that have experienced a massive foreign-born population growth and have developed a high or balanced immigrant skill profile since the 1980s.

A decomposition of wage inequality of the overall labor force in the U.S. by nativity show that immigrant wage inequality and their local income shares both had an impact on the contribution of immigrant wage inequality to the overall wage inequality. While an increase in foreign-born contribution to the overall wage gap occurred in many Southeast metros, the impacts of immigration on overall wage inequality remained largest in major-continuous immigrant gateways largely due to the high income shares of immigrant populations in these cities.

6.3 Main Findings from Chapter 4

Findings in Chapter 4 provided strong evidence to my hypothesis in Research Question 2 that education, race and ethnicity, and residual wage inequality are three major sources of growth in overall wage inequality among immigrant workers. In particular, the role of race and ethnicity has been important in shaping the uneven distributions of wage gaps between different foreign-born population groups.

My analyses focused on how major individual-level factors, such as education, race and ethnicity, and residual wage inequality (unobserved skills or errors) differentiate wage outcomes across different immigrant population groups. At both the national and metropolitan levels, educational wage gap between college graduates and high-school graduates and racial and ethnic wage gap between the White and Hispanic foreign-born workers kept increasing between 1980 and 2009. During the same period, an upward trend was found in overall residual wage inequality. Yet residual wage inequalities across different educational and racial and ethnic groups were not uniform in their size and direction of changes. For example, while residual wage inequalities among foreign-born White and Asian male immigrants increased significantly over the past three decades, there was a slight decline in Black and Hispanic male residual wage inequality since 1980. Comparing immigrant wage differentials across metropolitan areas, wide White-Hispanic wage gaps were found in either new immigrant destinations with a high or balanced skill structure of immigrant

workers or U.S.-Mexico border gateway cities where low-skilled immigrants predominate. The spatial distribution patterns of immigrant wage gaps reflect skill distribution of immigrant workers and their ethnic persistence across different local labor markets.

A regression-based decomposition of foreign-born wage gap trend helps to identify major sources of changes in immigrant wage inequality. The contributions of residual wage inequality to total immigrant wage inequality declined moderately at both the national and metro levels. In contrast, among all observable individual factors examined in the model, the contribution of race and ethnicity to foreign-born wage inequality increased most rapidly in the past three decades (90% for male workers and 255% for female workers).

6.4 Main Findings from Chapter 5

Chapter 5 tested a series of hypotheses on the associations between wage inequality among immigrant workers and local labor market attributes that have been found to have a significant effect on wage inequality among the total U.S labor force. My findings show that among all labor market level conditions, city population size, trade competition, R&D spending, shifts in industrial composition from manufacturing to services employment, de-unionization in the labor force all contributed significantly to changes and variations in overall wage inequality among immigrant workers over time and across metropolitan areas. However, factors such as

minimum wage laws did not seem to have a significant impact on wage inequality among immigrant workers.

As for residual wage inequality, shifts in industrial composition had a significant impact on the rise in residual wage inequality. Other variables such as city population size, percent of high-school dropouts among native work force and union membership had a significant impact on residual wage inequality in a few but not all panel regression models.

Geography also explained some of the inter-metropolitan variations in overall wage inequality and residual wage inequality among immigrant workers. For both genders, wage inequalities among immigrant workers tended to be lower in former immigrant gateway metros than in low-immigrant metros. Major-continuous gateway cities were more likely to have significantly higher levels of residual wage inequality among male immigrant workers than low-immigrant metropolitan areas.

6.5 Policy Implications

Immigration policies have been of special concern to the public and the state and local government law enforcement agencies, especially in a period when the shadows of Great Recession remain. Due to the recession, net immigration inflow has declined sharply, from its peak of 980,000 in 2005-2006 down to 843,000 in 2012-2013 with small fluctuations during the past three years (Frey 2014). The number of undocumented immigrants to the U.S. has also been on decline since 2007, with deportations from close to 190,000 in 2001 steadily risen to close to 400,000 per

year in the past four years (Passel, Cohn, and Gonzalez-Barrera 2013). The slow recovery of the U.S. economy adds further pressure on the prospects of a comprehensive immigration reform. Since this study answers questions on the impacts of immigration on wage inequality of the overall U.S. labor force and economic outcomes of immigrant workers, it holds important implications for federal legislation on immigration reform and regional or local immigration and development policies.

First, a decomposition of wage inequality among total labor force in the U.S. by nativity showed that highest foreign-born contribution to total wage inequality remained concentrated in traditional major-continuous and postwar II gateway immigrant cities such as Miami, San Jose, Los Angeles, San Francisco, and New York., even during the Great Recession. This is in counter to the public concern that the new destination cities were among the regions that were most struck by the rapid immigrant growths. In fact, previous chapters find that in these re-emerging, emerging, pre-emerging and low-immigrant gateways, the rise in wage inequality were more concentrated among immigrant workers themselves. Because of the weak recovery of their economies, cities in the south and new destinations have already shown a strong tendency to enacted exclusionary policies. The most controversial example is the passage of Arizona Senate Bill 1070, which imposes the broadest and strictest measure against illegal immigrants in recent U.S. history. A number of other new immigrant gateway regions have since mandated similar policy measures which bar immigrants from poverty alleviation and could generate unintended consequences on

the U.S. labor market and the well-being of native-born children of the unauthorized immigrants (Bohn and Lofstrom 2013). Since many of these new destinations lack sufficient resources for healthcare and schooling services to accommodate a sudden growth in new infants and children, these places will suffer a rise in poverty rate and deterioration in skill composition. It is also likely for marginalized populations to return to large traditional gateway cities for the less hostile employment regulations and better opportunities of social welfare programs in these areas.

Second, this study does not find a steepening growth rate of overall wage inequality among immigrant workers between 2000 and 2009 compared to the previous years. A comparison between the foreign-born and native-born overall wage inequality trend in Figure 3.2 showed that the foreign-born was at least no more hit by the recession than the native workers. In fact, previous literature found that the native-born workers even had a higher poverty rate than the foreign-born workers between 2000 and 2007(Ellis, Wright, and Townley 2013). However, the racial and ethnic wage inequality among immigrants, especially the White-Hispanic male wage gap that existed before the economic downturn only widened during the recession (as shown in Figure 4.4). The slope of racial wage inequality between Non-Hispanic White and Hispanic female workers was as steep during the recession as it was in previous decades. Meanwhile, Chapters 4 indicates that the growths in overall and residual wage inequalities slowed down for all male racial and ethnic groups in the 2000s. Among all, the largest decline in wage inequality growth rate occurred to male Hispanic immigrant workers. These findings pointed to the fact that Hispanic

immigrants, among all races and ethnicities, were hit most during the recession. The reduced wage gap within foreign-born Hispanics was largely due to a depression of their wages. The highly skewed distribution in low wages among Hispanic immigrant workers since 2000 also explains why a high percentage of Hispanics had a slightly negative impact on wage inequality in a local labor market, as found in the panel models in Chapter 5. Therefore, social programs and policies that focus on alleviating poverty among specific population groups, such as the Hispanic workers, are key to reduce wage inequality among immigrant workers as a whole.

6.6 Research Limitations and Future Development

Findings of this dissertation underscore the importance of addressing the role of geography and race in studying wage structure of immigrant workers and their contributions to the overall wage inequality in the U.S.. However, this study also leaves open several questions due to research limitations. First, for data induced reasons, I do not have annual data on wage inequality among immigrant workers across metropolitan areas, which would allow me to look at more closely shorter-term movements in earnings inequality.

Second, when modeling changes in wage inequality among immigrant workers, the nature of time-series cross-sectional data does not allow for control of individual level determinants of wage inequality. Instead, I use a mixed-effects model with metro-area time-variant factors as level-1 variables nested within the level-2

time-invariant factors at the metropolitan area level. By that means, my panel model analyses still provide insights as to why these changes occurred.

Finally, traditional panel modeling do not handle spatial autocorrelation as it violates the random sampling assumption (Wooldridge 2001). It does not answer questions on why immigrant worker wage disparity in one labor market is affected by certain conditions in a nearby labor market. In contrast, a spatial panel model takes spatial spill-over effects across labor market into consideration. Descriptive findings in Chapter 3 and Chapter 4 suggest patterns of spatial concentration of high levels of overall and residual wage inequality among immigrant workers in certain geographical regions. In this dissertation, only top 100 metros out of 384 metros are considered in the model. In the future, it would be especially interesting to expand the research to all metropolitan areas and explore the existence of spatial autocorrelations in wage inequality among immigrant workers. Furthermore, we can examine what generated the autocorrelation surface of overall and residual wage inequality among male foreign-born workers.

APPENDICES:

Definition of eight types of immigrant gateways by Singer (2004, 2011):

Former gateways: were major immigrant ports of entry from 1900 to 1930. During that period, the percentage of foreign-born was higher than national average. However, their foreign-born shares declined and were below the national average in every decade through 2010. Mostly are old manufacturing areas in the Northeast or Midwest, such as Cleveland, Milwaukee, and St. Louis.

Major-continuous gateways: have been destinations for large and sustained immigrant populations throughout the past century. The percentage of foreign-born populations exceeded the national average for every decade of the past century. New York, Boston, San Francisco, and Chicago continue to accommodate about one-quarter of all immigrants nationwide, but more recently serve as a way station for new arrivals who eventually may participate in secondary migration to other destinations within the U.S..

Minor-continuous gateways: had a long history of immigrant settlement, but the sustained immigrant inflow is more modest in size than that those to the major-continuous gateways. During the first half of the 20th century, they had an above-average immigrant population share. Currently, their immigrant population shares are above or near the national average. Two distinct sets of minor-continuous metro areas exist. One group of places, such as New Haven and Worcester, historically served as suburban-like destinations for early 20th century immigrants from European countries. The other group, such as McAllen and Stockton, located in border states or California's Central Valley and had long been home to Mexican labor migrants.

Post-World War II gateways: had comparatively small immigrant populations before the 1950s, but emerged as large immigrant hubs since the mid-20th century. These destinations include Los Angeles, Dallas, San Diego, Houston and so on.

Emerging gateways: have become new major destinations for immigrants during the last three decades of the 20th century. Their immigrant population shares have exceeded the national average since 1990. Some examples of emerging gateways are Atlanta and Phoenix.

Re-emerging gateways: had an early 20th century settlement pattern very similar to the former gateways, yet experienced low levels of immigration thereafter until the tail end of the 20th century. Into the last decade, they saw fast immigrant growth and thus has become re-emerging immigrant gateways. Some examples of re-emerging gateways are Portland, San Jose, and Seattle.

Pre-emerging gateways: only in recent two decades have experienced extraordinary growth in their foreign-born populations. These destinations have smaller immigrant populations than the above immigrant gateways. But immigrant population growth has been much faster—at least three times the national average. Examples of pre-emerging gateways are Greensboro and Nashville.

Emerging, Re-emerging, and Pre-emerging gateways are typically referred to as the "new immigrant destinations".

Low-immigration metro areas: have a historical record of modest immigrant inflows or small foreign-born populations, although the size and growth patterns of the immigrant population in these metro areas vary significantly. In some metros, such as Boise, Birmingham and Greenville, the population growth rate is high despite of the relative small size of their immigrant population stocks. If the growth

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trajectories of foreign-born population in these metros continue, they are poised to become "pre-emerging gateways" in the future.

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