School of Economics and Finance and Property

Essays on Economics of Immigration into Australia

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Declaration

To the best of my knowledge and belief this thesis contains no material previously published by any other person except where due acknowledgment has been made.

This thesis contains no material, which has been accepted for the award of any other degree or diploma in any university.

This thesis comprises three original papers, including one submitted publication. The core theme of the thesis is the economics of immigration.

The ideas, development and writing up of the papers in the thesis were the principal responsibility of myself, the student, working within the Bankwest Curtin Economics Centre at Curtin University under the supervision of Professor Alan Duncan, Professor Mark Harris and Associate Professor Astghik Mavisakalyan.

I confirm that Chapter 2 has been accepted or publication in the European Economic Review: **https://doi.org/10.1016/j.euroecorev.2020.103458**.

Collaboration

Chapter 2 is based on joint work conducted with my supervisors Alan Duncan, Mark Harris, and Astghik Mavisakalyan, Curtin University. My contribution included the concept, development, analysis and writing up the Chapter. I conducted these steps with rigorous discussions, supervisions, ideas sharing, and draft polishing provided by my supervisors.

The concept, development, analysis and writing up of Chapter 3 of this thesis were my principal responsibility, with advice, comments, and draft polishing provided by Dr Christopher Parsons at the University of Western Australia. I expect to collaborate with Dr Parsons on the further development of this paper.

Chapter 4 is based on joint work conducted with Associate Rebecca Cassells at Curtin University, Alan Duncan, and Dr Grace Gao from the Department of Treasury and Finance, State Government of Victoria, Australia. My contribution included the methodological innovation, empirical analysis and writing up of the paper

Signature:

Date:

Acknowledgements

I am passionate about exploring economic issues related to labour market and immigration. Therefore, the time that I have been working on this thesis is an interesting time of my life. I am indeed grateful to those people who provided me with great support and encouragement that have made my PhD study indeed a very memorable journey.

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Abstract

This thesis comprises of three related research essays on the economics of immigration in Australia. The first essay sheds light on patterns of regional distribution of immigrants and the role of immigration policy in matching immigrants to regions with labour shortages. More specifically, I investigate how demand driven and supply driven immigration flows respond to regional exogenous economic shocks caused by a commodity cycle. In particular, I find that demand-driven immigration varied in line with commodity prices, with commodity-rich states witnessing stronger growth rates than commodity-poor states over the resources boom period. There is no evidence of any such patterns for supply driven immigration flows.

In the second essay, using nationally representative longitudinal census and survey data, I examine the *relative* and *individual* level labour market impact on natives of a high skilled migration wave. The findings, based on a positively selected immigration wave, highlight many of the positive impacts of immigrants on native Australian workers, including higher wages and fewer workers in part-time employment. Moreover, I find that individuals adjust to immigration inflows by relocating to other regions. Interestingly, this adjustment is heterogeneous across different skill groups of natives. I do not find evidence for the heterogeneous adjustments of different skill groups of natives in terms of occupational mobility and labour market participation status.

In the third essay, I study the impact of regional economic factors on regional mobility in Australia during the commodity boom period from 2006 to 2011. Using the gravity model, in combination with the administrative data on internal migration

flows, the paper shows that regional wages had a positive impact on the migration decisions of middle-aged and older Australians, whilst wage growth positively affected the decision of all age cohorts. In addition, regional wage dispersion only affected young migrants. Furthermore, using industry changes in the commodity boom period as an instrument for wage growth, this paper is able to mitigate the endogeneity concerns.

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Chapter 1: Introduction

The number of international migrants around the world has been constantly rising over time, reaching its peak at 257.7 million persons in 2017 consisting of approximately 133.1 million males and 124.6 million females (see Figure 1-1). This means that about 3 and a half per cent of the world's population were immigrants in 2017. There are several of immigrant types including but not limited to permanent settlers, temporary workers, international students, skilled workers, family reunion immigrants, asylum seekers. Moreover, a large proportion of migrants moved from developing countries to more advanced economies: as of 2017 about a half of immigrants chose OECD countries as their destination (OECD (2018)) and in 2017, over 5 million permanent settlers migrated to the OECD. Data from the United Nations (2017) reveal that during the period 2015-2017 the annual rate of change of the migrant stock has been 4.2 per cent in Western Europe, 1.7 per cent in Northern America, 2.2 per cent in Australia and New Zealand.

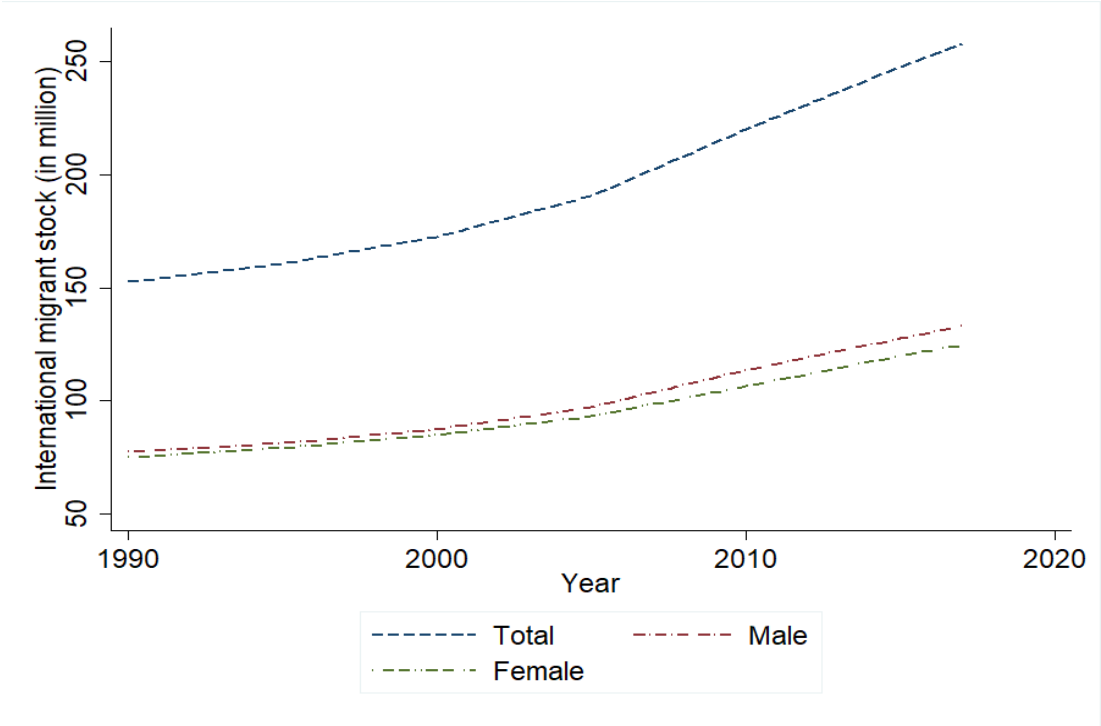

Figure 1-1: International migrant stock

Notes: Data are collected from the United Nations (2017)

The rise in migration flows has turned migration into a global issue of perennial economic, cultural and societal importance, arguably more so now than ever given the prevailing public and political discourse. As an unsurprising result, we have seen an increase in interest among the world's leading economists around migration. According to the seminal book of Borjas (2014), economists are devoting their time and efforts to explore such questions as: *What are the costs and benefits that immigrants bring to the host countries? What are the impacts of immigration on the labour market outcomes and productivity of natives? Which immigrants will bring more benefits and which immigrants cost more? How do immigrants assimilate with the society of immigrant-receiving countries? How do immigrants contribute to entrepreneurship, innovation and trade? How do immigrants affect natives' welfare*

and well-being? How to maximize the benefits and reduce the cost of immigration? And *what policies should immigrant-receiving countries adopt?*

To address such questions, the literature has adopted different methodological approaches, and has applied these in different contexts. Economists have not reached a consensuses on many of these issues. Empirical results are often highly context- and approach-specific, and at times even inconsistent with theoretical predictions. Some controversies have been emerging around the questions on what methods should be used to measure the impact of immigration on native's wages. For example, *how do we measure the adaptation costs of natives?* Economists have been arguing about the methods to capture native displacement caused by inflow of immigrants. Natives might also adjust their labor force participation, education, and skills. In addition, empirical results are sensitive to the geographic boundaries (e.g. cities, states, and communities).

Furthermore, *are the effects of immigration on the native's wages homogenous or heterogeneous? And if they are heterogeneous, how do we measure the effects on different groups of natives?* Economic theory suggests that different skill groups of natives are differently affected by immigration inflows, but there is few empirical work that estimates the heterogeneity of native's adjustments. Another issue that might complicate the empirical measurements is the role of illegal immigration. Economists are often not able to observe undocumented immigrants, therefore might lead to estimation bias. Equally important, empirical work on the context of low-skill immigration appear to be abundant, but there are not many studies investigating the impact of high-skilled immigration. There is a consensus that the impact on wages of native workers is influenced by the characteristics of immigrants though. In recent years, economists are concern more about addressing the causality concerns.

There is no doubt that addressing issues such as these will significantly improve the quality and precision of empirical findings thereby progressing our understanding on these important migration issues, and generating more appropriate policy implications that can increase the net gain from immigration. Recent advancements in data, particularly administrative data, allow researchers to better estimate the labour market adjustments of natives in terms of their education, labour force participation at the *individual* level, and therefore are able to account for individual time-constant unobservable characteristics. However, administrative data are only generally available in some specific countries, such as: Germany, Denmark, Norway, Sweden and Finland. Hence, studies using administrative data are limited to particular contexts, for example, low-skilled immigration.

Another central issue in the economics of immigration that economists have been attempting to address is the sorting and self-selection of immigrants and the searching and matching of native and immigrant workers within and across national/regional/sectoral labor markets. Specifically, *who will migrate?* Researchers are tempting to understand whether immigrant's skills are higher or lower than the average skills of the labor force in countries of origin. *Can the labor markets of receiving countries efficiently absorb migrants' skillsets? Are skills of immigrants comparable to natives? Are there movements of native workers from sectors that are more exposed to immigration inflows to less immigration-intensive sectors or along the distribution of wages?* Moreover, there is an obvious desire to understand the role firms in the process of absorbing migrants' skills. These questions are important and need to be answered to achieve economic efficiency, especially with the rise of automation, technology changes and the rise in skill-biased jobs. Understanding the regional distribution of immigrants is an additional task of economic and policy

significance. As immigration policies in some places are shifting to favour high-skilled immigration, it is crucial to understand the role of immigration policies in addressing the above questions. However, as shown in a survey of Abramitzky and Boustan (2017), evidence on the role of immigration policy in shaping migrant selection is scarce.

Questions related to international migration flows are obviously important and of interest not only to economists but also to politicians and the general public. In addition, economists have been interested in some other questions related to labour flows within a country. For example, why regional economic disparities persist over long periods of time, even though people can move across regions? Why some residents choose to reside in regions with lower economic outlooks? In other words, what are the drivers of geographical mobility? Topics such as the impact of export and import shocks, job loss and natural disasters on migration decision have generated interest. However, the limitations of data have restricted the findings in previous empirical work.

These controversies and gaps in the literature have inspired me to write this thesis to better understand the drivers of migration, and the role that government policies have in shaping migration patterns, and the economic choices or opportunities among both migrant and native populations. The availability of quasi-natural experiments and administrative data from Australia allow this thesis to apply methodological innovations leading to more accurate estimations compared to what has been achieved in the literature to date. Moreover, drawing on the context of Australia where a majority of immigrants are highly-educated and there is very little undocumented immigration, I have been able to look at aspects that have been largely overlooked in the literature. While the analysis is placed within the Australian context,

the key findings from this research provide strong evidence that can help inform policy-makers across jurisdictions around the world.

Organization of the thesis

This thesis is comprised of three related research chapters on the economics of immigration in Australia. I spent the vast majority of my time on Chapters 2 and 3. More specifically, Chapter 2 sheds light on the role of immigration policies in shaping immigration flows in response to labor market changes. Using data from Australia during the 2001 to 2015 commodity cycle as a *quasi*-natural experiment, I find that employer-sponsored immigration and Australia-born population growth, varied in line with commodity prices, with commodity-rich states witnessing stronger growth rates than commodity-poor states over the resources boom period. Industry level analysis shows that employers in the commodity sector sponsored more visas for immigrants than their counterparts in other sectors during the boom period. There is no evidence of any such patterns for points-based immigrants. Moreover, an instrumental variables approach highlights labor demand as the principal allocative mechanism for the regional distribution of employer-sponsored immigrants. These findings emphasize the importance of employer-sponsored immigration in alleviating local labor shortages. This Chapter has been accepted for publication in the *European Economics Review*.

In Chapter 3, adopting the skill cell approach of Borjas (2003) using nationally representative longitudinal census and survey data, I examine the *relative* and *individual* level labour market impact on natives of a high skilled migration wave. The Australian context exploits i) the abolition of the White Australia Policy, and in

particular the exogenously timed increase in migration from Asia post-1973, a large proportion of which comprised forced migrants; and ii) the shift from humanitarian to high skilled migration policy in 1996 that was then significantly expanded post-2005. In combination these effects provide an exogenous shift in the composition of migration to Australia in terms of country of origin, skill and age in favour of highly-educated young Asians. In contrast to existing *national* skill-cell studies that have instead relied upon contexts in which successive cohorts are of lower quality, the results, based on a positively selected immigration wave, rather highlight many of the positive impacts of immigrants on native Australian workers, including higher wages and fewer workers in part-time employment. Moreover, I find that individuals adjust to immigration inflows by relocating to other regions. Interestingly, this adjustment is heterogeneous across different skill groups of natives. I do not find evidence for the heterogeneous adjustments of different skill groups of natives in terms of occupational mobility and labour market participation status.

Finally, Chapter 4 investigates the impact of regional economic factors on regional mobility in Australia during the commodity boom period from 2006 to 2011. Applying the gravity model, in combination with the administrative impact on internal migration flows, this paper shows that regional wages had a positive impact on the migration decisions of middle-aged and older Australians, whilst wage growth positively affected the decision of all age cohorts. In addition, regional wage dispersion only affected young migrants. Using industry changes in the commodity boom period as an instrument for wage growth, this paper addresses endogeneity concerns.

Chapter 2: Migration flows in commodity cycles: Assessing the role of migration policies

2.1 INTRODUCTION

A key challenge in advanced economies is the allocation of immigrants to areas with labor shortages. Understanding the extent to which immigration policies shape the distribution of immigrants in response to labor market changes is therefore essential. The aim of this paper is to investigate whether, and how, employer-sponsored (permanent) and points-based immigration flows respond to regional labor demands over the course of commodity cycles. Such policies should ideally deliver long term benefits, given that accessing the best and brightest individuals is crucial to company performance (Kerr et al., 2016) with skilled immigrants contributing to innovation, patenting and scientific publications (Hunt & Gauthier-Loiselle, 2010; Kerr & Lincoln, 2010; Moser et al., 2014). In addition, migration networks facilitate bilateral trade (Parsons & Vezina, 2018), boost total factor productivity (Hornung, 2014; Peri et al., 2015) and enhance international research and development collaborations (Foley & Kerr, 2013; Kerr & Kerr, 2018). However, it is unclear whether points-based schemes, which are supply-driven, or employer-sponsored schemes, which are demand-driven, can fulfil unexpected labor demand due to fluctuations or exogenous shocks to the regional economy.

To clarify this issue, we analyse the distribution of employer-sponsored and points-based immigrants in Australian regions during the commodity cycle between 2001 and 2015.

The Australian context is beneficial in a number of respects when comparing the effects of employer-sponsored and points-based migration systems. First, Australian states and territories are relatively heterogeneous in terms of commodity dependence. This provides us with an important source of regional variation in labor demand. Second, endogeneity concerns are mitigated by the fact that Australia is a small open economy and commodity price fluctuations in Australia over the period of our study were mainly driven by global demand. Third, Australia operates both employer-sponsored and points-based immigration schemes. By exploiting the combined operation of these two policy tools in a single country, it is possible to avoid the problems in cross-country studies caused by disparities in legal migration costs and institutions across countries. Finally, the period chosen for our study (2001 to 2015) covers three contrasting periods of economic activity, with the steady time window from 2001 to 2003, resource boom from 2004 to 2011 followed by a period of commodity prices slowdown from 2012 to 2015. This provides us with interesting opportunities to compare the locational distributions of employer-sponsored and point-based immigrants over different periods of the commodity cycle.

Explicitly, this paper estimates the impact of commodity price fluctuations on the regional distribution of employer-sponsored and points-based immigrants to explore how different immigration policies affect immigration flows. The basic premise is that where a commodity occupies a larger, pre-existing share of the economy, a greater (lower) demand for workers will result in higher (lower) demand for immigrants. On this basis, our empirical identification strategy first leverages interactions between commodity prices and the initial contributions of commodities to the economies of different Australian states to shed light on regional differences in labor demand. In a further innovation, we use administrative data on visa categories to estimate the effect of commodity price fluctuations on the scale of migration flows across different regions under the two immigration schemes, to examine how these

schemes address regional labor shortages. To further reinforce these findings, we augment our empirical strategy by applying a difference-in-differences (DD) approach to the estimation of regional migration flows. Specifically, we limit our sample to observations before and after abnormal price shocks, exploiting the argument that abnormal price shocks can be treated as exogenous. Furthermore, we explore the (possibly) different trends between immigration flows to non-tradable and tradable sectors of the economy.

We find that employer-sponsored immigration flows varied in line with commodity prices fluctuations, with visas predominantly increasing (decreasing) in commodity-intensive states in comparison to remaining states during upturns (downturns) in Australia's commodity cycle. Empirical evidence does not support a similar trend for points-based immigrants. These findings are reinforced by difference-in-difference estimates where we limit our sample to observations before and after abnormal price shocks. In addition, state-industry level analyses (in triple-difference settings) show no evidence for the disparity of migration flows (both employer-sponsored and points-based) across the tradable and non-tradable sectors.

The contribution of this paper is to empirically assess the role of immigration policy in matching immigrants with regional labor market changes. We demonstrate that supply-driven migration flows are not able to fulfil unexpected, short-term labor demand shortages caused by exogenous shocks to the economy, whereas the demand-driven migration flows can. The vast majority of previous research related to the distribution of immigrants test Roy (1951) and Borjas (1987) theoretical predictions on location selection of immigrants (Borjas, 2008; Chiquiar & Hanson, 2005; Grogger & Hanson, 2011; McKenzie & Rapoport, 2010; Moraga, 2011, 2013; Parey et al., 2017). More recent work by Beine et al. (2015) considers the effects of international and internal migration on the size of the non-tradable sector as a mechanism to mitigate the presence of "Dutch disease" in Canada during resources booms. However, the role of immigration policy in the regional distribution of immigrants is an important issue that has

been examined relatively rarely in the migration literature to date (Abramitzky & Boustan, 2017).

2.2 THE CONTEXT

Australia's immigration policy currently relies on a grade point system (DIBP, 2017; Miller, 1999). This system allows Australia to open its borders to high-skilled immigrants while restricting the flow of low-skilled immigrants. Following this, millions of high-skilled workers have sought to migrate to Australia, with India and China accounting for the largest proportions of migrants according to the Australian Department of Social Services' (DSS) Settlement Database (DSS Settlement Database). Antecol et al. (2006) found that in 1990 approximately 50 per cent of Australia's immigrants entered the country under the high-skilled visa policy, compared to only 8.2 per cent for the U.S. Administrative data from the Census shows that in 2016, about 30 per cent of Australian citizens were born overseas. Around 67 per cent of immigrants to Australia in 2016 were skilled migrants.

Figure 1 shows the three main streams of immigration in Australia, as captured through skilled, family re-union, and humanitarian visas. The annual number of permanent migrants entering Australia increased by around 145 per cent between 2001 and 2015, with a peak of around 225,000 people migrating to Australia in 2009. The number of permanent skilled migrants tripled during these fifteen years, accounting for 67.5 per cent of the overall expansion. In contrast, family and humanitarian streams accounted for 23.4 per cent and 2.5 per cent of all migrants, respectively. This reflects the Australian government's prioritisation of immigration under the skilled visa program.

Two backbone sub-classes dominate the Australian skilled immigration stream: the points-based scheme, and the employer-sponsored programme. The employer-sponsored stream enables employers to nominate foreign candidates for permanent residency, allowing

them to fill vacancies they have been unsuccessful in filling from the local job market. This scheme is similar to H-1b admissions in the United States. The points-based scheme permits migration among workers on the basis of their skills, youth, education, experience and fluency in English, recognising their potential benefit to Australia in the medium to long-term. Individuals seeking to migrate under this scheme are not backed by an employer or a family member in Australia, but are rather allocated points, with those awarded points above the Australian government's set threshold invited to apply for a relevant visa. The number of invitations issued are limited and based on government forecasts of labor market demand. Furthermore, a significant reform to Australia's points-based scheme was introduced in 2012. In particular, the government launched the Skilled Migrant Selection Model (SkillSelect), with the aims to curb "supply driven" points-based migration by requiring prospective immigrants to submit an online expression of interest (EOI) (Phillips & Spinks, 2012). Only those receiving an invitation through the SkillSelect program are allowed to lodge a visa application. The legislative modification is only for the points-based migration scheme.

We turn now to examine in more depth the regional distribution of immigrants across Australia. As shown in Figure 2, Australia comprises six states: New South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA), Western Australia (WA), Tasmania (TAS); and two territories: the Northern Territory (NT) and the Australia Capital Territory (ACT). The greatest concentration of mining activity takes place in NT, WA, and QLD, alongside NSW to a lesser degree. Table 1 shows the state population and Gross State Product (GSP) for each of Australia's states and territories for 2001 and 2015. NSW and VIC are the largest states in terms of population, respectively accounting for 32% and 25.3% of the total population for Australia, while the populations of the two mining states of QLD and WA have grown over the period as their economies have strengthened. The WA economy in particular

has expanded on the back of the resources boom, with its Gross State Product rising from 10.7% to 15.5% of Australia's national gross domestic product.

According to the DSS Settlement Database, the number of Australian visas granted between 2001 and 2015 through the points-based stream rose sharply, from 14,000 in 2001 to a peak of 60,000 in 2008 before declining. Points-based migrants prefer to select the most populous states as their destinations. For example, NSW attracts the most skilled immigrants (35.3%), followed by VIC (26.6%). Both QLD (15.9%) and WA (15.7%) attract significantly fewer migrants than the two largest states, with SA accounting for around 4.1 per cent of all skilled migrants. Similarly, the number of Australian visas granted under the employer-sponsored stream increased sixfold, from just over 5,000 to nearly 31,000 during the same fifteen year period. In terms of geographical distribution, 34 per cent of all skilled migrant workers were recruited by businesses located in NSW. VIC accounted for 23 per cent of total offers, followed by WA (20%), QLD (19%) and SA (2%). TAS, NT and ACT collectively accounted only 2 per cent of the total.

Our identification strategy to capture the regional drivers of migration relies on exploiting differences in the impact of exogenous commodity price fluctuations on migration flows across Australia's states and territories, given the integral role that the export of commodities plays in the Australian economy (Bjørnland & Thorsrud, 2016). Table 2 highlights the contributions that agriculture, forestry and fishing (AGFS), and mining respectively make to each state economy in the fiscal years 1999-2000 (the year before our studied panel). In share terms, WA and NT are the most dependent on these industries, with 24.6 and 23.7 per cent of their total factor income (TFI) sourced from commodities. This is far larger than TAS, QLD, and SA where the proportions were only 12, 10.5 and 8.4 per cent respectively. VIC, NSW, and ACT, in contrast, depend the least on these industries, comprising only 5.7, 3.6 and 2.7 per cent of TFI respectively. This strongly suggests that commodity price

fluctuations will affect states' economies and labour markets differently, and lead to divergences in the regional distribution of immigrants across the course of the commodity cycle.

Figure 3 plots the state-level patterns of employer-sponsored permanent migration in Australia since 2001. To highlight the relative changes across states, we normalize the values to be equal to 100 in 2001 for every state. Evidently, employers in commodity intensive states tended to sponsor more immigrants between 2001 and 2011. Figure 4 shows the equivalent state-level patterns for points-based immigration. While there are also strong contrasts across states, there is little evidence to suggest that points-based migrants were allocated in accordance with state commodity cycles. Rather, points-based immigrants tended to target VIC and SA rather than WA or QLD. Moreover, the growth in both employer-sponsored and points-based immigration converged after 2011. The patterns of employer-sponsored migrants' behaviours are indeed consistent with changes in commodity prices, as shown in Figure 5. Over the five years from 2005 to 2010, most commodity prices experienced solid growth, while the more recent years (2011-2015) witnessed a mining downturn. Our conjecture is that higher labour demand will occur during the upturn period in states where commodities capture a larger, pre-existing share of the economy, leading to a higher demand for skilled migrants.

2.3 DATA

We construct a state-level index of gain from commodities (IGC) using the following specification:

$$IGC_{s,t} = CSH_{s,2000} \times Commodity\ Price_{s,t}, \qquad (3.1)$$

where: $Commodity\ Price_{s,t}$ represents state-level commodity prices and $CSH_{S,2000}$ is the pre-existing contributions of those commodities to the state economy in the year 2000 (the year prior to the period of our study). The use of the initial contribution of commodities in the pre-

study period is often used in the literature to mitigate endogeneity concerns (Acemoglu et al., 2013). Data on commodity prices are sourced from International Monetary Fund data (IMF, 2017). We combine this dataset with Australian Bureau of Statistics (ABS) data on the production of agricultural commodities (ABS Cat 7121) and mining commodities (ABS Cat 8415) to assign annual commodity prices to every state. Following Bahar and Santos (2018), the annual commodity price assigned to each state corresponds to the price of the commodity with the largest production value. Given that the AGFS sector is equal in size to the mining sector in New South Wales and Victoria, we choose the prices of commodities those have largest production in each of these sectors, and compute the IGC index for these states by weighting the shares for these two industries, as follows:

$$IGC_{s,t} = \sum_{c} CSH_{s,2000} \times Commodity\ Price_{c,s,t} \times Weight_{c,s}, \quad (3.2)$$

where c indicates the AGFS and mining sectors. The price of each commodity is standardised to a value of 100 in the year 2011. Data on state-level commodity contributions to the economy are retrieved from ABS Australian National Accounts (ABS Cat 5220).

Figure 6 depicts the distribution of IGCs by state over the period 2001 to 2015. In general, IGC had experienced a flat growth in all states from 2001 to 2003. However, the IGC began to surge from 2004, matching the increase in commodity prices. This has led to a growing difference in IGCs across states. In particular, WA, NT, TAS and QLD each experienced a boom from 2004 to 2011. WA headed this group through a tenfold increase in its IGC from 2.4 in 2004, reaching 24 in 2011. In contrast, ACT, NSW, and VIC gained least from the boom. However, IGCs turned a corner in most states and territories from 2011, with large declines from 2012 to 2015.

Data on immigration flows from 2001 to 2015 at local government area (LGA) level are sourced from the Settlement Database, an administrative database maintained by the Australian Department of Social Services (DSS). The database includes information on

Australian permanent residents and some streams of temporary residents who have migrated to Australia since 1991, and currently holds around 4.1 million records. These data are updated quarterly, and combined with other information from DSS, the Department of Immigration and Border Protection (DIPB) and several other sources, such as Medicare Australia. This dataset is pivotal to understanding regional immigration flows, given that it contains information on key relevant variables such as LGA[1] of residence and visa sub-class. In particular, the detailed nature of these data allows us explore patterns of immigration flows between specific LGAs under different migration schemes and in response to IGC variations.

To control for a richer set of regional time-varying characteristics, we include information from the ABS National Regional Profile (NRP). This source captures detailed information on housing affordability at a local area level, including average house prices, number of dwelling units, the proportion of residential houses and the number of private houses across LGAs[2]. This dataset also allows us to control for time-varying characteristics that might affect the regional distribution of immigrants.

2.4 Employer-sponsored versus point-based immigration flows

We begin with a baseline specification that explores the locational distribution of employer-sponsored and points-based immigrants in response to IGC variations during the period 2001-2015. Our expectation is that employer-sponsored immigrants will prefer commodity-intensive states to remaining states if the IGC increases, while points-based immigrants will be less likely to locate to these areas. Based on this conjecture, our specification for the locational distribution of migrants is as follows:

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[1] Local Government Authorities (or LGAs) represent the third tier of government in Australia, and are administered by states and territories. In 2016, there were 547 LGAs across the country.
[2] Due to changing LGA boundaries in 2006, the data required a concordance of LGA codes for years 2001 and 2006 to those for 2011.

$$\ln(IM_{lt}) = \gamma_l + \lambda_t + \beta \ln(IGC_{st}) + \zeta X_{l(t-1)} + \varepsilon_{lt} . (4.1)$$

The dependent variable IM_{lt} represents the number of employer-sponsored or points-based immigrants to local government area *l* within state *s* in year *t*. Area fixed effects γ_l are included to capture any time invariant differences across LGAs, while λ_t account for year fixed effects. $X_{ls(t-1)}$ is a vector of housing affordability characteristics, including the number of dwelling units (in logarithm form), housing price (in logs), a quadratic in the log housing price, the proportion of private houses (per cent), and the share of residential houses (per cent) for each LGA in year *t*-1. Controlling for the variation in local housing market reflects the fact that housing affordability is an important component of the local amenity in area *l*. Earlier studies indicated that amenities play a non-trivial role in migration decisions (Albert & Monras, 2019; Graves, 1983; Knapp & Gravest, 1989; Lux & Sunega, 2012). IGC_{st} is an index of gain from commodities in state *s* for year *t,* while ε_{lst} is an independent and identically distributed disturbance term.

The coefficient of interest, β, captures the impact of IGC fluctuations on immigration flows. As Australia is a small open economy, we make the assumption that the IGC index is exogenous. This assumption appears reasonable, given that although Australia's commodity production massively expanded from 2005 to 2011 (see ABS Cat 7121 (2017) and ABS Cat 8415 (2015)), it turned out that most commodity prices accelerated during the corresponding period. Obviously, commodity prices were driven by global demand, perhaps coupling with the rise of China's economy. Our main variable of interest, IGC, is constructed at state level as data are unavailable at the LGA level. Furthermore, we include only LGAs with non-zero immigration flows in our regressions. This is based on the reasonable assertion that migration flows in resource-intensive states in response to the commodity boom will expand in those

LGAs that already have immigrants. It is unreasonable to believe that immigrants will come to LGAs that have never received immigrants in the past[3].

Table 3 provides descriptive statistics for employer-sponsored and points-based immigration flows across LGAs. In most states, the baseline level of points-based immigration is larger than employer-sponsored immigration, reflecting the fact that the Australian government provides larger quotas for the former stream.

Table 4 reports our estimation results. Clearly, not all immigration schemes are the same. Column 2 of Table 4 shows that LGAs with an IGC index that is larger by 1 per cent tend to have 0.21 per cent larger (employer-sponsored) migrant inflows. This coefficient of interest hardly changes when the vector of standard controls are removed (Column 1). In contrast, points-based migrants did not move to commodity intensive states during the corresponding time window. Column 4 shows a negative relationship between IGC and points-based immigration. More specifically, LGAs with an IGC index that is larger by 1 per cent tend to have 0.21 per cent smaller (point-based) immigration. These estimates remain stable when the vector of standard controls are removed (Column 3). All estimates are statistically significant at 1 per cent. There are fewer observations in the regressions shown in Column 2 and Column 4 (where added vectors of controls have been included) than in Column 1 or Column 3. The reason is that we add a series of controls at time *t-1* and our data for these controls are only available from 2001. As a result, the reported regressions include only those observations with migration flows from 2002 to allow for the inclusion of lagged control variables. While not reported in the paper, estimates are very similar when we instead include a contemporaneous set of controls at time *t*.

[3] This assertion is tested through the use of inverse hyperbolic sine transformations for the dependent variables in regressions including zeros. These regressions (not reported in this paper due to time constraints, but available from the authors on request) generate similar results in terms of both signs and significance levels.

Overall, our results convey a consistent message that employer-sponsored migration flows are in line with IGC changes, and served to overcome local labor shortages in commodity-intensive states during boom periods. However, there is no evidence that points-based migrants preferred commodity-intensive states to commodity-poor states. In addition, the Australian government significantly increased the general annual migrant intake during the period 2001 to 2011, especially through the skilled migration stream (see Figure 1). Moreover, points-based migrants typically preferred larger metropolitan locations, for example Sydney in NSW and Melbourne in VIC, neither of which are commodity-intensive states. This resulted in the negative coefficients shown in the regressions of points-based migration flows in Columns 3 and 4. This preference is potentially due to two main reasons: (1) migrants may prefer locations with larger existing communities of immigrants - the network effects (Munshi, 2003), and; (2) large cities might have better connections to migrants' home countries, making it easier for immigrants to acquire products and services from their countries of origin (Albert & Monras, 2019).

2.5 DIFFERENCE-IN-DIFFERENCES ANALYSIS

This section presents further robustness checks for our baseline analysis. Our identification strategy can be considered as an extension of the simple, and popular, DD regression approach (Angrist & Pischke, 2008). Our variable of interest, IGC, is constructed at state level. However, dependent variables are at LGA level and LGAs are nested within states. Bertrand et al. (2004) argue that the DD approach may suffer from serial correlation problems if a large number of time periods are involved, resulting in an overstatement of significance levels. Our baseline estimations use panel data spanning from 2001 to 2015, and while our period is less than the average 16.5 years surveyed in Bertrand *et al.'s* seminal work, we apply their simple solution

to correct for possible serial correlation. Following Bahar and Santos' (2018) approach, we restrict the sample to the *ex-ante* and *ex-post* periods of an abnormal increase in commodity prices. Our DD specification is as follows:

$$\ln(IM_{lt}) = \gamma_l + \lambda_t + \beta(\mathrm{CSH}_{0s}.T_t) + \zeta X_{ls(t-1)} + \varepsilon_{lt}, \quad (4.2)$$

where CSH_{0s} is the commodity share of total factor income in state *s* in fiscal year 1999-2000 (the year before our studied panel). The dummy variable T_t takes value of 1 if a price spike occurs in year *t*, and takes value of 0 for the year prior (*t-1*). The list of commodity price spikes is defined according to Bahar and Santos (2018) and is shown in Table 5. In particular, coal exhibited price spikes in 2004, 2008, and 2010; wheat and gas prices hiked in 2008, beef in 2004 and 2010, and liquefied natural gas in 2008. We include iron ore, which does not appear in the Bahar and Santos (2018) study, in the set of commodity prices, given that it not only represents the largest mining production commodity in WA, but also experienced abnormal price increases in 2005, 2008 and 2010 (Cassells et al., 2014). Table 5 also highlights the changes in IGC in years during which abnormal price hikes were witnessed. The lowest change in IGC was 15.51 per cent in NSW in 2010, while the highest rise of 102.93 per cent occurred in QLD in 2004. Our coefficient of interest β is the DD estimate of the effect of commodity price spikes on immigration flows (IM_{lst}). If fixed effects are removed by differencing, we have an alternative expression that has been used in previous work (Fleming & Measham, 2015; Weber, 2012).

Table 6 presents estimates of the regional distribution of employer-sponsored and points-based immigration. Our results show that the effects of commodity price spikes on employer-sponsored migration are statistically significant and sizeable, whether estimates are presented with or without the addition of controls (Columns 2 and 1 respectively). The magnitudes of the DD treatment coefficients are about 0.73 and 0.75 respectively, meaning that one per cent larger commodity share contribution to the state's economy yielded a 0.73 per

cent increase in the level of employer-sponsored migration following a commodity price spike. Estimates of the impact of commodity price spikes on points-based immigration are not statistically significant. To sum up, these additional results are in line with previous findings, and suggest that Australia's employer-sponsored immigration scheme has been effective in allocating skilled migrants to meet regional labor market demands. No such evidence exists for the points-based scheme.

2.6 NON-TRADABLE VERSUS TRADABLE SECTORS ANALYSIS

Commodity booms can lead to an expansion of output and employment in the non-tradable sectors of an economy, but may cause tradable sectors to contract (Corden & Neary, 1982). Therefore, this section looks further to the possibly different patterns of migration flows between the tradable and non-tradable sectors across state and territory economies in Australia.

The DSS Settlement database does not contain information on occupation or industry of employment. To overcome this limitation, we exploit information provided by the Australian Census and Migrants Integrated Dataset (ACMID) (ABS ACMID 2011, 2016). The ACMID is a project managed by Australian Bureau of Statistics that links settlement data with the Australian Censuses for 2011 and 2016. This provides us with the means to capture administrative information on the industry of employment for permanent migrants[4]. In the ACMID, industries of employment are categorised following the Australian and New Zealand Standard Industrial Classification (ANZSIC). In particular, the 1-digit ANZSIC identifies nineteen industry sectors and three unclassified categories: 1) Agriculture, Forestry and

[4] The ACMID records migrants who are present on Census nights only; thus, there are minor but inconsequential differences in the total number of immigrants in this section compared with previous sections.

Fishing, 2) Mining, 3) Manufacturing, 4) Electricity, Gas, Water and Waste Services, 5) Construction, 6) Wholesale Trade, 7) Retail Trade, 8) Accommodation and Food Services, 9) Transport, Postal and Warehousing, 10) Information Media and Telecommunications, 11) Financial and Insurance Services, 12) Rental, Hiring and Real Estate Services, 13) Professional, Scientific and Technical Services, 14) Administrative and Support Services, 15) Public Administration and Safety, 16) Education and Training, 17) Health Care and Social Assistance, 18) Arts and Recreation Services, 19) Other Services; 20) Inadequately described, 21) Not stated, and 22) Not applicable. Sectors 1 to 3 are grouped into the tradable sector, sectors 4 to 19 into the non-tradable sector, and 20 to 22 into an unclassified category.

Table 7 provides descriptive statistics for migration flows between the tradable and non-tradable sectors of the Australian economy. Both sectors are shown to have experienced significant increases in the share of employer-sponsored migrants over the course of the commodities boom. In particular, employer-sponsored immigration grew by 114.6 per cent and 65.3 per cent in the non-tradable and tradable sectors respectively in the five years from 2006 to 2010, compared with the previous 2001-2005 period. The comparable figures for points-based immigration were 25.39 per cent and -14 per cent, respectively. In contrast, the post-boom period from 2011 to 2015 saw declines of 34.3 per cent and 6.7 per cent relative to the 2006-2010 period in employer-sponsored immigration in the non-tradable and tradable sectors respectively, and declines of 48.0 per cent and 1.0 per cent in points-based immigration, respectively. These figures suggest that skilled migration (both employer-sponsored and points-based) correspondingly increased more and declined faster in the tradable sector than the non-tradable sector of the economy during the commodities boom and post-boom periods.

To quantify the (possibly) different trends in migration flows in the non-tradable and tradable sectors of the economy, we extend our DD equation (4.2) as follows:

$$\ln(IM_{ist}) = \beta.(\mathrm{CSH}_{0s}.Boom.NTR_i) + Boom.NTR_i$$

$$+ \ \mathrm{CSH}_{0s}.Boom + \ \mathrm{CSH}_{0s}.NTR_i + \delta_i + \mathrm{CSH}_{0s} + \ Boom + \ \varepsilon_{ist} \ , \qquad (4.3)$$

where IM_{ist} represents the number of employer-sponsored and point-based migrants observed in industry i in state s in period t; δ_i represent unobserved industry fixed effects; and CSH_{0s} is the commodity share of total factor income in state s in fiscal year 1999-2000, similar to equation 4.2. The dependent variable is the logarithm of the number of immigrants across state-industry cells, given that data for migration flows are not available for LGA-industry cells. The dummy variable NTR_i is coded 1 to capture the non-tradable sector, and 0 to capture the tradable sector. We perform two different analyses for the boom and the post-boom periods. For the analysis during booms, we restrict the sample to the two periods 2001-2005 and 2006-2010. The dummy variable $Boom$ is equal to 1 if the time window is 2006-2010 and equal to 0 if the time window is 2001-2005. In the post-boom exercise, the sample is restricted to two time-windows 2006-2010 and 2011-2015; in this case we replace the $Boom$ variable with $PostBoom$ which takes a value of 1 if the time-window is 2011-2015, and 0 otherwise. The equation 4.3 therefore can be rewritten as:

$$\ln(IM_{ist}) = \ \beta.(\mathrm{CSH}_{0s}.PostBoom.NTR_i) + PostBoom.NTR_i$$

$$+ \ \mathrm{CSH}_{0s}.PostBoom + \ \mathrm{CSH}_{0s}.NTR_i + \delta_i + \mathrm{CSH}_{0s} + \ PostBoom + \ \varepsilon_{ist} \ . \qquad (4.4)$$

The parameter of interest in both exercises, β, measures the average difference in migration flows between the non-tradable and tradable sectors. We remove unclassified group (industries 20-22). Each regression contains about 304 observations, which is product of 19 industries, 8 states and territories, and 2 time periods.

Results are provided in Table 8. Columns 1 and Columns 2 respectively show estimates for β for employer-sponsored and point-based immigration flows in the boom period. Columns 3 and 4 present respective estimates for the post-boom period. Estimates for β are statistically insignificant in each case, which implies that there is no evidence of differential patterns of employer-sponsored and points-based migration flows between the tradable and non-tradable

sectors. To test the robustness of these findings, we repeat the exercise using a more granular 2-digit ANZSIC classification. We also exclude the agriculture, forestry and fishing, and mining industries from the estimating sample. Results are presented in Table 9, and reveal similar findings to those reported in Table 8. Overall, these findings suggest no difference between skilled-migration flows to tradable and non-tradable sectors in resource-intensive and remaining states.

2.7 CONCLUDING REMARKS

This research fills an important gap in the literature by assessing the role of immigration policies in matching immigrants to the needs of local labor markets. There is very little work that considers this significant issue. To this end, we compare Australia employer-sponsored (demand-driven) and points-based (supply-driven) immigration flows to regions over the period of the commodity cycle that occurred between 2001 and 2015. We find that demand-driven migration flows helped to reduce regional labor shortages caused by the commodities cycle. More specifically, employers' visa sponsorship patterns varied in line with changes in the regional gains/losses from commodities. In contrast, there is no systematic evidence that supply-driven immigrants preferred commodity-intensive states to other states during the boom period. A suite of robustness checks confirm these findings. These joint findings do indeed suggest that demand-driven schemes can complement a supply-driven system in allocating workers to where they are needed. Moreover, when migration flows were compared across industry sectors, we found no evidence that employers in the non-tradable sector sponsored immigrants to a greater extent than their counterparts in the tradable sector over the course of commodities boom.

Although our research finds that supply-driven immigrants did not favour commodity-intensive states over other states, this may not necessarily reflect the misallocation of

immigrants given that the purpose of the supply-driven (points-based) system is to admit immigrants who potentially bring long-term benefits to the country. Our research, instead, highlights the important role of demand-driven immigration in addition to supply-driven migration in shaping the distribution of immigrants across regions.

2.8 FIGURES AND TABLES

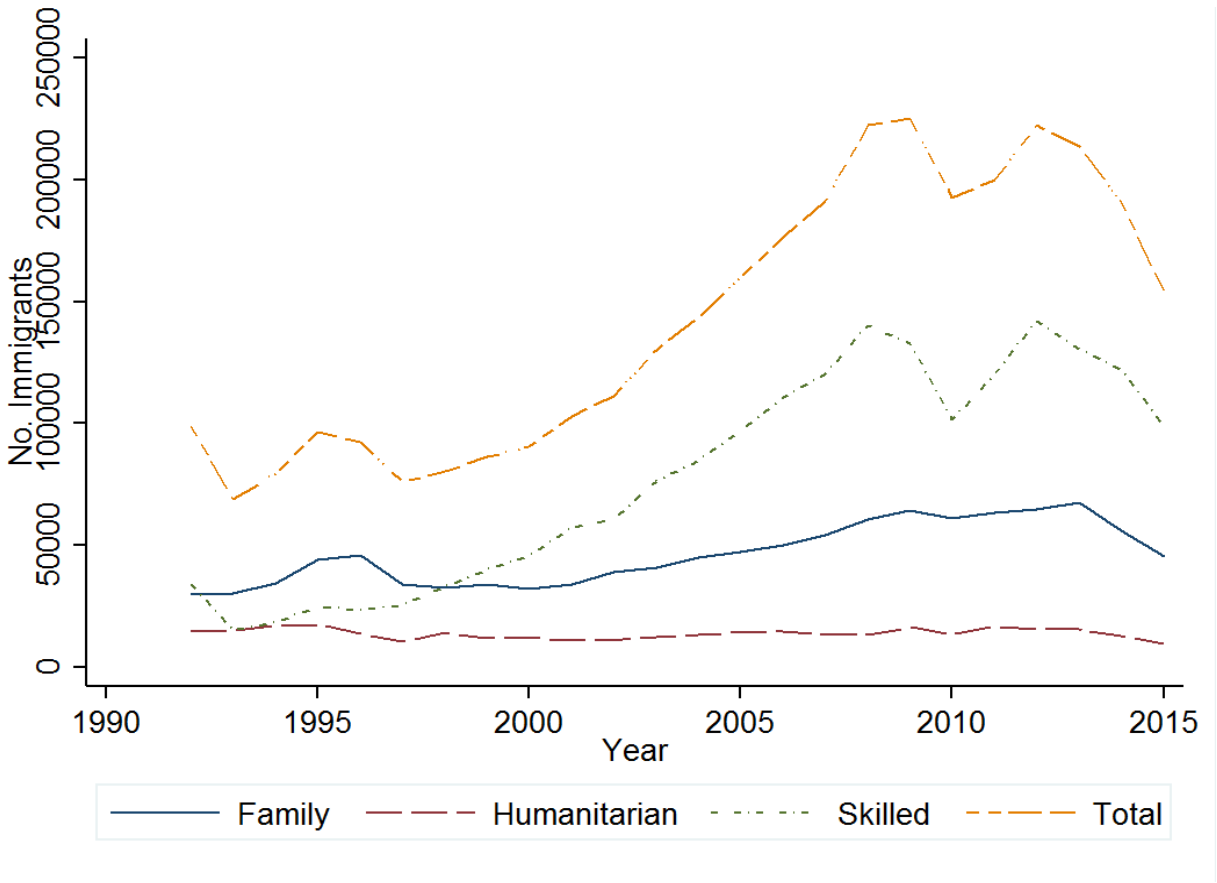

Figure 2-1: Immigration to Australia, by migrant streams, 1992-2015.

Notes: Data are sourced from the Australian Department of Social Services (DSS) Settlement Database.

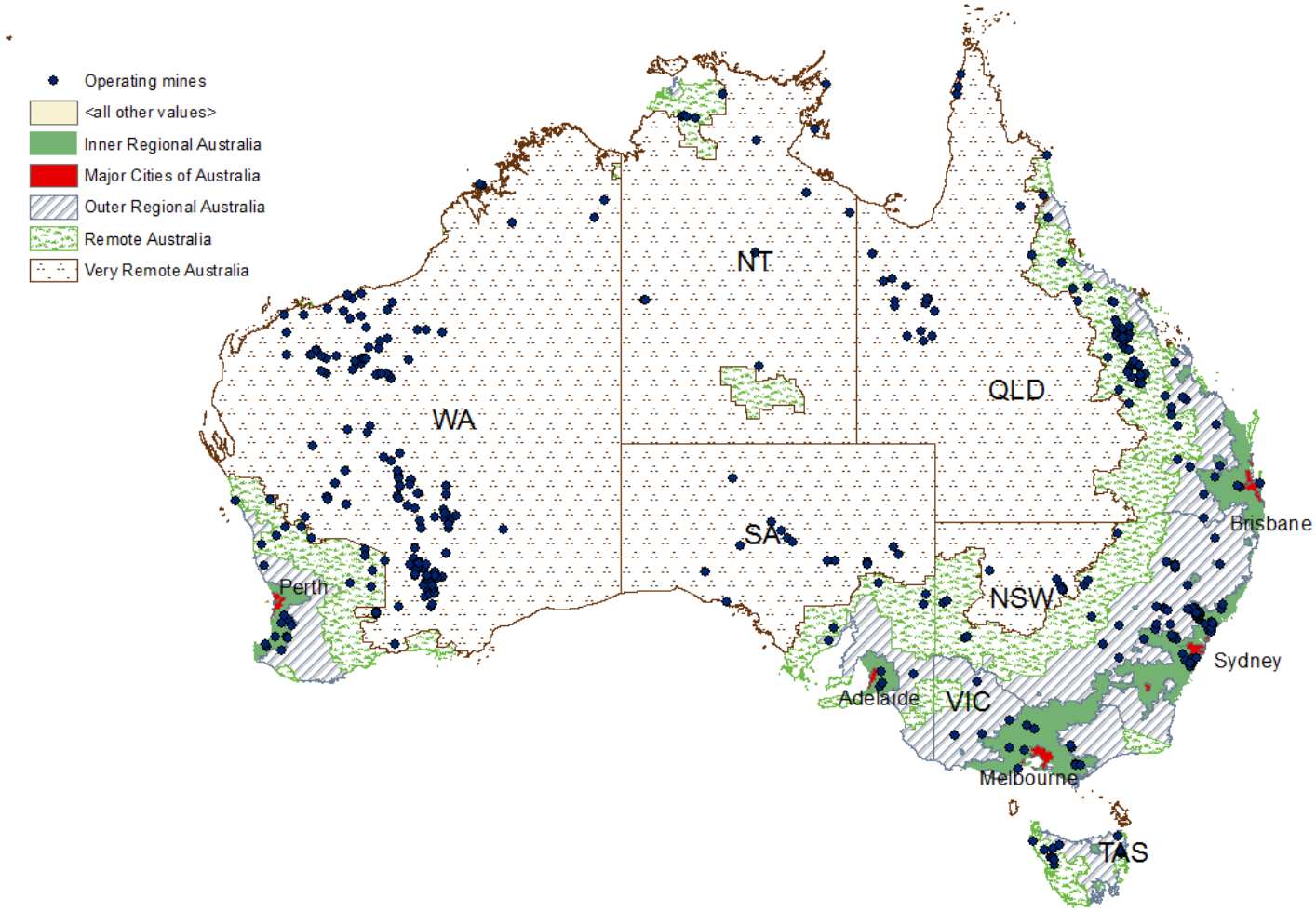

Figure 2-2: Regions of Australia.

Notes: Data are sourced from the ABS remoteness index (ABS Cat 1270) and ABS mining operations (ABS Cat 8415).

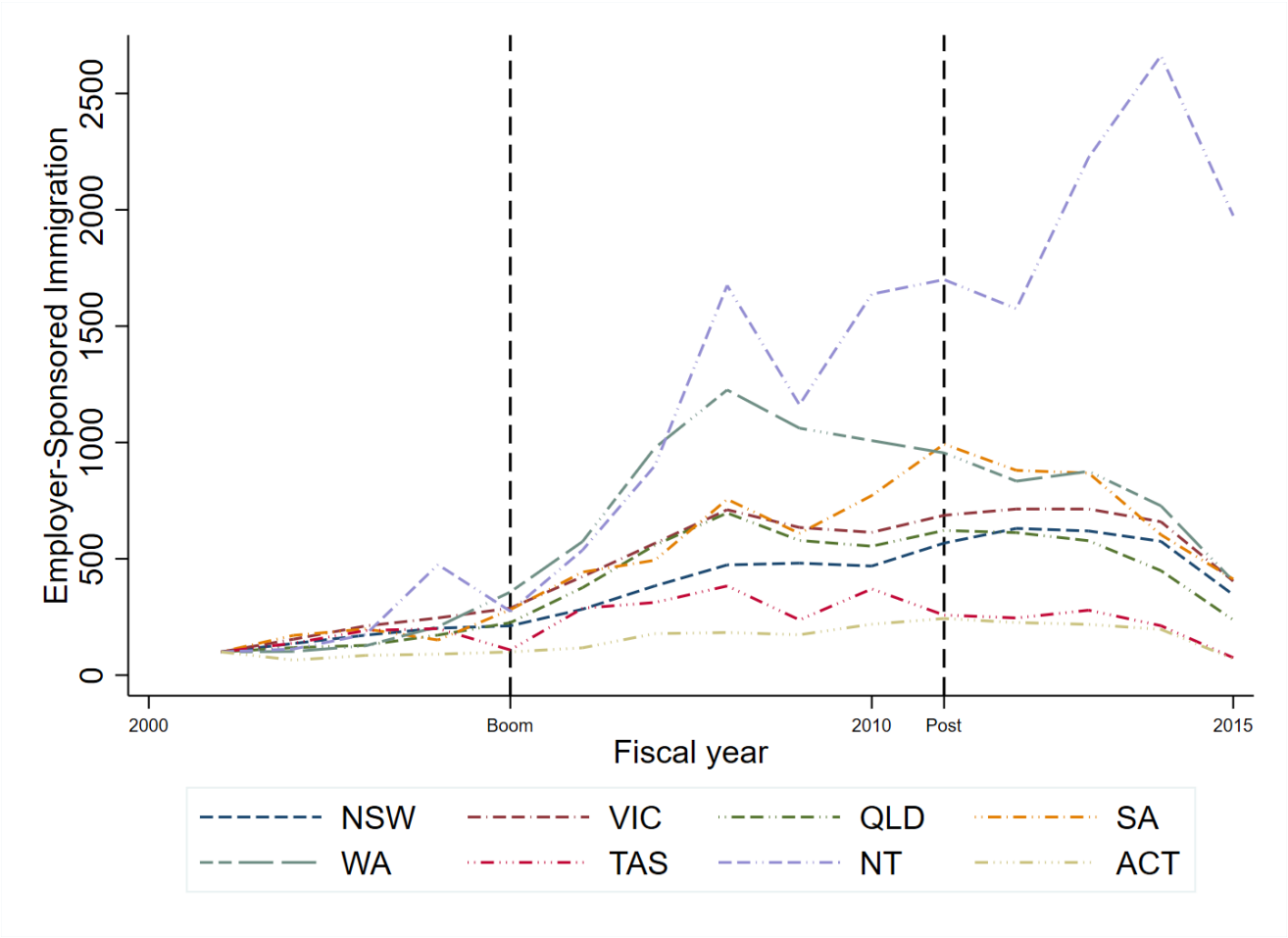

Figure 2-3: Changes in the regional distribution of employer-sponsored immigrants.

Notes: Data are sourced from the Settlement Database.

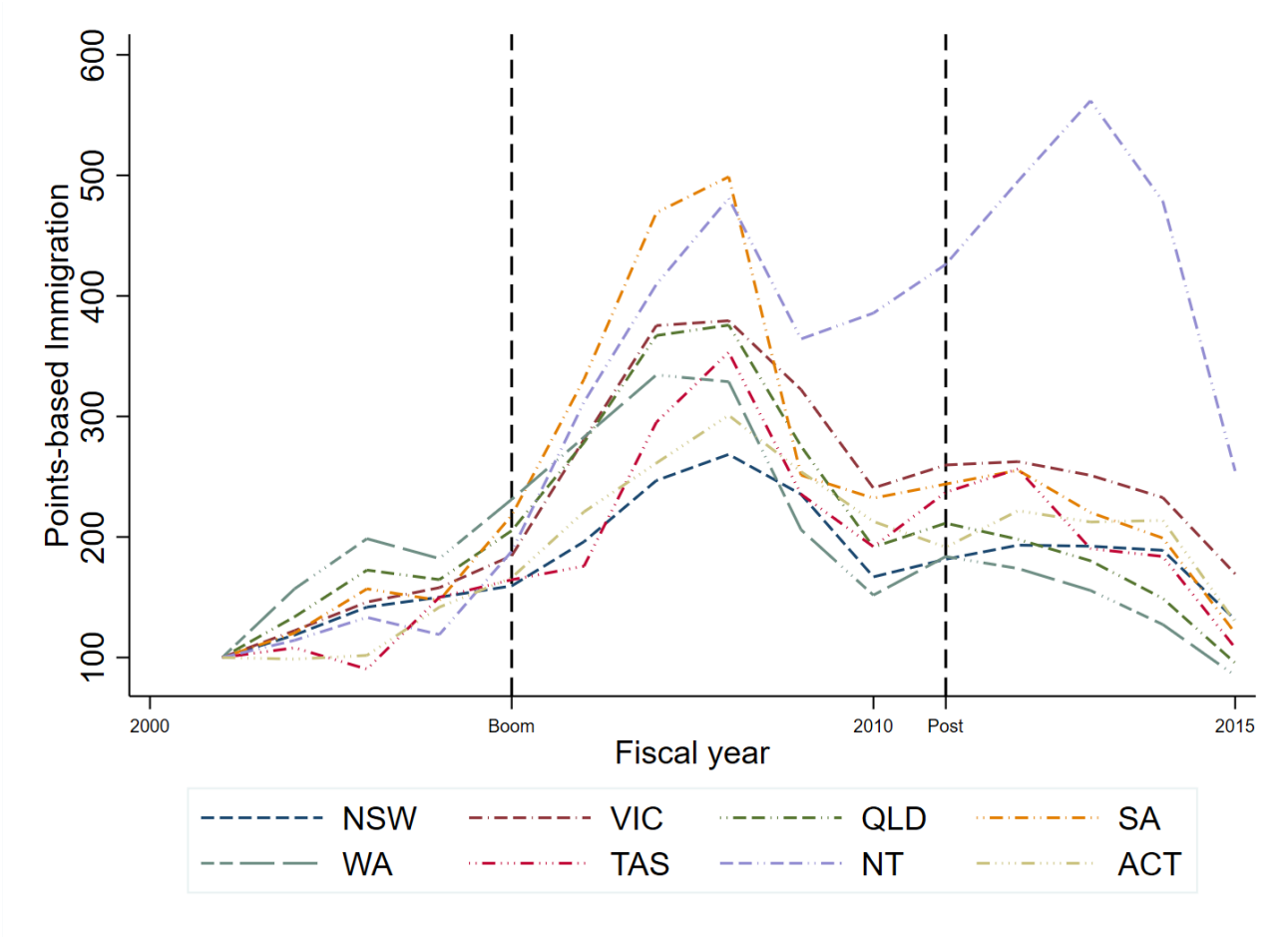

Figure 2-4: Changes in the regional distribution of points-based immigrants.

Notes: Data are sourced from the Settlement Database.

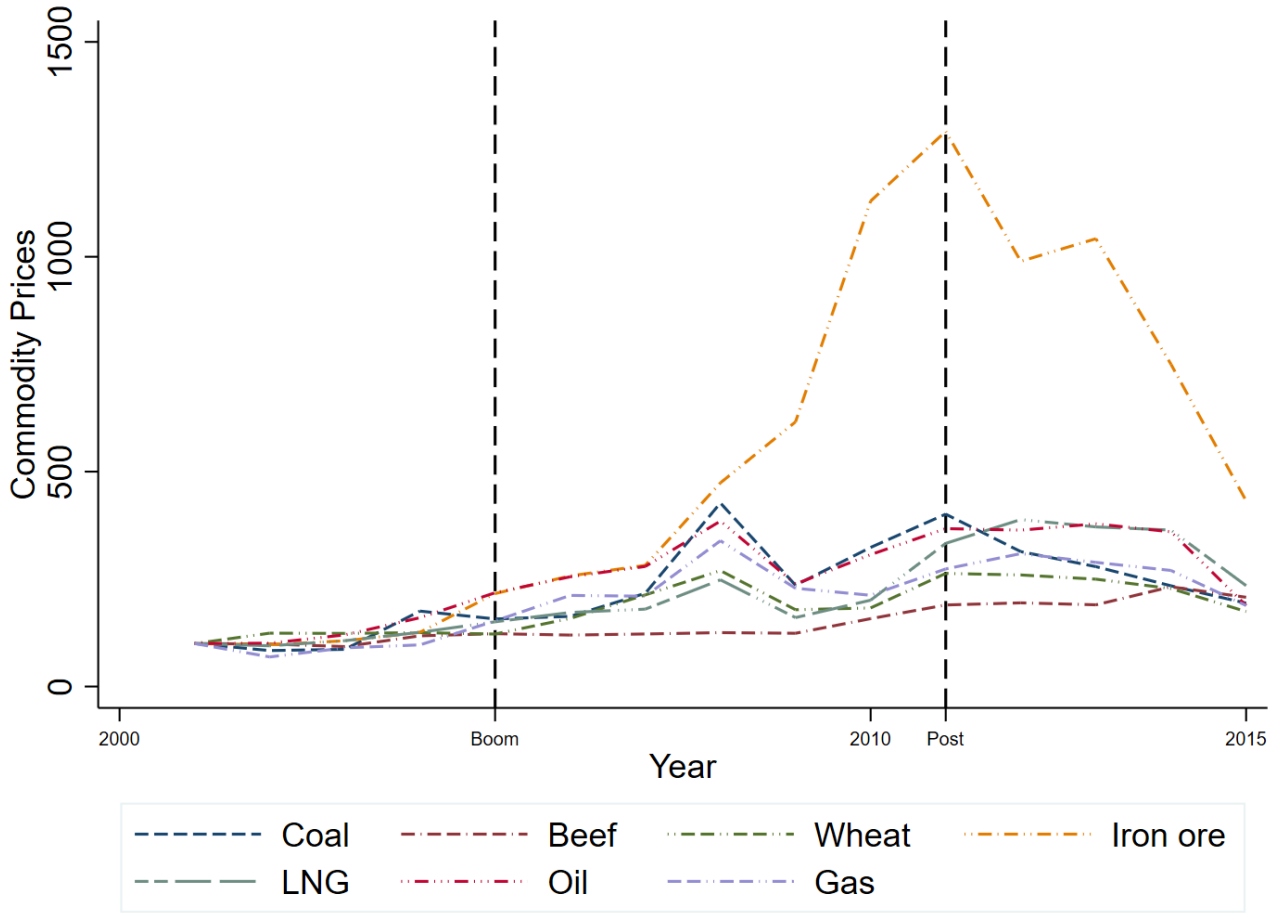

Figure 2-5: Selected commodity prices.
Notes: Data are sourced from IMF commodity prices (2017).

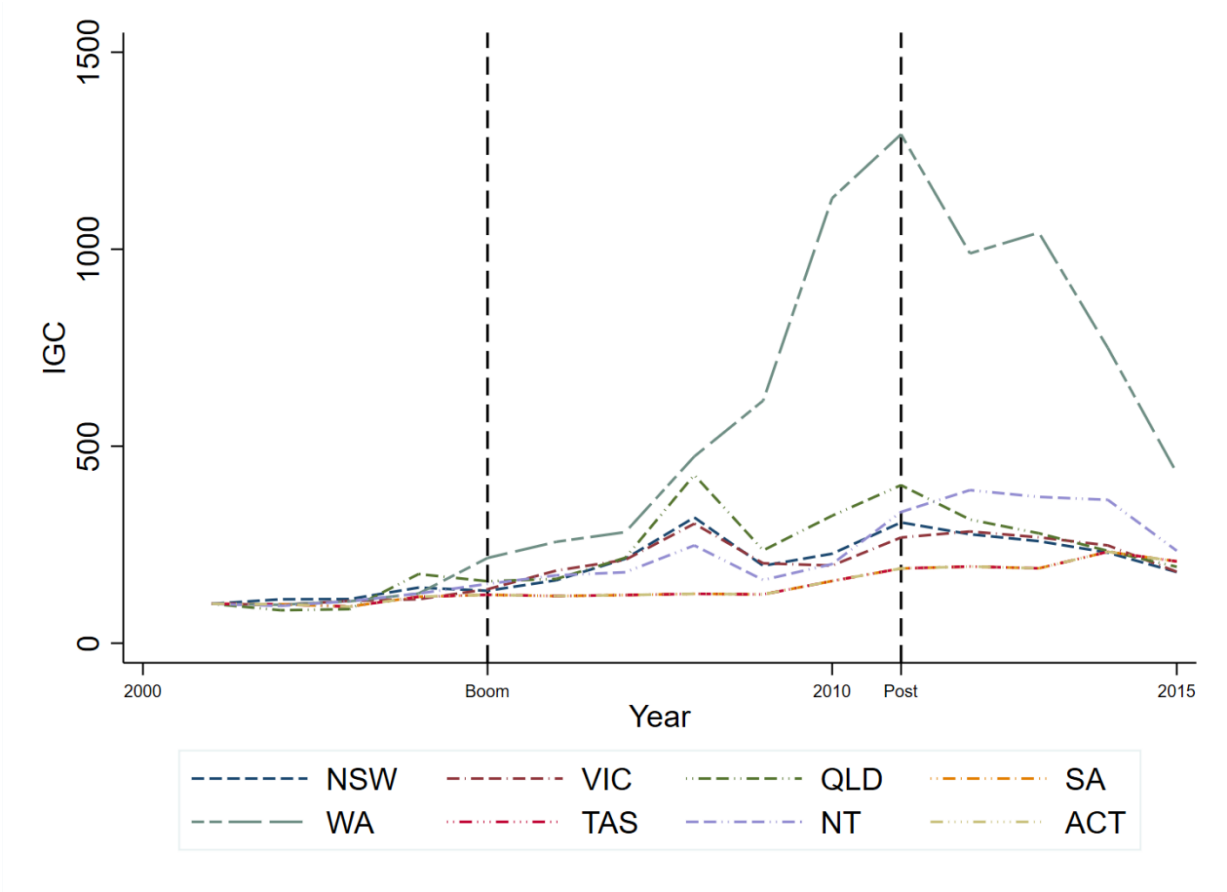

Figure 2-6: State-level index of gain from commodities.

Table 2-1: Australian state populations and Gross State Products, 2001 and 2015.

State	Population at end September 2001		Population at end September 2015		Gross State Product (GSP) in 2001		Gross State Product (GSP) in 2015	
	'000's	share	'000's	share	AUD$bn	share	AUD$bn	share
NSW	6,544.9	33.9%	7,656.0	32.0%	253.5	36.0%	517.9	31.9%
VIC	4,776.1	24.7%	6,065.9	25.3%	174.8	24.8%	371.6	22.9%
QLD	3,591.0	18.6%	4,799.0	20.0%	115.0	16.3%	295.3	18.2%
SA	1,505.0	7.8%	1,704.9	7.1%	49.8	7.1%	99.1	6.1%
WA	1,912.2	9.9%	2,548.5	10.6%	75.5	10.7%	251.2	15.5%
TAS	473.5	2.4%	516.0	2.2%	13.2	1.9%	27.6	1.7%
NT	202.0	1.0%	245.0	1.0%	8.8	1.3%	24.5	1.5%
ACT	321.9	1.7%	398.5	1.7%	14.1	2.0%	34.2	2.1%
Australia	19,329.1	100%	23,936.8	100%	704.8	100%	1,621.4	100%

Notes: Data are sourced from Australian Demographic Statistics (ABS Cat 3101) and ABS State Accounts (ABS Cat 5220). Gross State Product (GSP) figures are expressed in current prices, from the 2016-17 national accounts.

Table 2-2: Industry contributions to total factor income in 1999–2000

State	Agriculture, forestry and fishing (AGFS)	Mining	Total
NSW	2.1%	1.5%	3.6%
VIC	2.9%	2.8%	5.7%
QLD	4.6%	5.9%	10.5%
SA	6.4%	2%	8.4%
WA	4%	20%	24.6%
TAS	10.6%	1.4%	12%
NT	6%	17.7%	23.7%
ACT	1.7%	1%	2.7%

Notes: Data are sourced from ABS State Accounts (ABS Cat 5220).

Table 2-3: Summary statistics of migration flows at the LGA-level (2001–2015).

State	Migration stream	No. observations	Mean	Std. dev.	Min	Max
NSW	Employer-sponsored	2146	54.42	120.07	0	1354
	Points-based	2191	80.63	182.75	0	1648
VIC	Employer-sponsored	1183	65.29	110.64	0	821
	Points-based	1183	119.71	217.57	0	1696
QLD	Employer-sponsored	792	78.37	325.47	0	3251
	Points-based	747	102.58	368.67	0	3855
SA	Employer-sponsored	794	8.57	20.49	0	190
	Points-based	929	25.89	64.80	0	685
WA	Employer-sponsored	1671	39.11	112.01	0	1072
	Points-based	1566	46.12	135.84	0	1597
TAS	Employer-sponsored	405	2.01	3.86	0	24
	Points-based	405	4.35	9.24	0	64
NT	Employer-sponsored	166	8.27	21.81	0	126
	Points-based	166	12.16	29.57	0	181
ACT	Employer-sponsored	15	190.53	79.70	82	307
	Points-based	15	424.13	142.09	222	677

Notes: Data are sourced from Settlement Database. As we exclude missing values, there is a slight difference between numbers of observations between the two migration streams.

Table 2-4: The effect of IGC fluctuations on regional distribution of employer-sponsored and points-based immigrants in 2001-2015.

	Employer-sponsored		Points-based	
	(1)	(2)	(3)	(4)
ln(IGC)	0.2122***	0.2158***	-0.1573***	-0.1376***
	(0.000)	(0.000)	(0.000)	(0.000)
Year fixed effects	Yes	Yes	Yes	Yes
LGA fixed effects	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes
N	4541	4219	4715	4364
R^2	0.414	0.421	0.212	0.222
F	191.2706	136.1036	75.6195	55.3742

Notes: The dependent variable is the log yearly number of employer-sponsored immigrants (Columns 1-2) and points-based immigrants (Columns 3-4) who arrived to Australian LGAs in 2001-2015, respectively. P-values are shown in parentheses * $p < 0.10$, * $p < 0.05$, *** $p < 0.01$. Standard deviations are clustered at the LGA level. All regressions include LGA and year fixed effects. The vector of standard controls includes number of dwelling units (log), a quadratic

in the log mean housing price, and the shares of proportion of private houses (per cent), and residential houses (per cent) at LGA level in year *t*-1. Ln(IGC) is our main variable of interest.

Table 2-5: State-commodity price spikes

State	commodities	t=0	t=1	IGC (t=1)	change
NSW	Wheat, Coal	2003	2004	1.67	26.09%
NSW	Wheat, Coal	2007	2008	3.78	48.89%
NSW	Wheat, Coal	2009	2010	2.69	15.51%
VIC	Wheat, Gas	2007	2008	6.52	43.23%
QLD	Coal	2003	2004	4.59	102.93%
QLD	Coal	2007	2008	11.17	96.93%
QLD	Coal	2009	2010	8.46	37.34%
SA	Beef	2003	2004	5.26	26.93%
SA	Beef	2009	2010	7.05	27.46%
WA	Iron ore	2004	2005	4.12	71.50%
WA	Iron ore	2007	2008	9.01	68.07%
WA	Iron ore	2009	2010	21.48	83.41%
TAS	Beef	2003	2004	7.48	26.93%
TAS	Beef	2009	2010	10.01	27.46%
NT	Liquefied Natural Gas	2007	2008	17.69	37.80%
ACT	Beef	2003	2004	0.17	26.80%
ACT	Beef	2009	2010	0.23	28.00%

Notes: Data are sourced from Bahar and Santos (2018) and IMF commodity prices data (2017).

Table 2-6: The effect of IGC fluctuations on the regional distribution of employer-sponsored and points-based immigrants: Difference-in-differences analysis.

	Employer-sponsored		Points-based	
	(1)	(2)	(3)	(4)
CSH*T	0.7602**	0.7331**	-0.0140	0.0370
	(0.021)	(0.036)	(0.966)	(0.916)
Year fixed effects	Yes	Yes	Yes	Yes
LGA fixed effects	Yes	Yes	Yes	Yes
Additional controls	No	Yes	No	Yes
N	1498	1387	1549	1428
R^2	0.440	0.433	0.176	0.186
F	121.5622	63.0669	34.0212	19.2482

Notes: The dependent variable is the log yearly number of employer-sponsored immigrants (Columns 1-2) and points-based immigrants (Columns 3-4) at LGA level, respectively. P-values are shown in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard deviations are clustered at the LGA level. All regressions include LGA and year fixed effects. Sample is restricted to years containing price shocks and the year prior. The vector of standard controls includes

number of dwelling units (log), housing price (log), quadratic of log housing price, proportion of private houses (per cent), and residential houses (per cent) at LGA level in year *t*-1.

Table 2-7: Industry of employment of immigrants: descriptive statistics.

Period	Tradable sector		Non-tradable sector		Unclassified
	No. of immigrants	Change	No. of immigrants	Change	No. of immigrants
	Employer-sponsored immigration				
2001 - 2005	4533.2		32676.7		54435.5
2006 - 2010	9729.8	114.63%	53997.5	65.25%	105706
2011 - 2016	6397.2	-34.25%	50375.3	-6.71%	102414.7
	Points-based immigration				
2001 - 2005	9144		86171.3		36013.3
2006 - 2010	11465.6	25.39%	74457.7	-14%	59108.5
2011 - 2016	5961	-48.01%	73692.8	-1%	57734

Notes: Data are sourced from ACMID (2011, 2016). Unclassified category includes inadequately described, not stated, and not applicable industries.

Table 2-8: Industry of employment and the regional distribution of employer-sponsored and points-based immigrants: Triple-differences, 1-digit industry classification analysis.

	Boom period		Post-boom period	
	Employer-sponsored (1)	Points-based (2)	Employer-sponsored (3)	Points-based (4)
$CSH_{0s} * NTR * Boom$	-0.2335	1.9966		
	(0.969)	(0.819)		
$CSH_{0s} * NTR * PostBoom$			-0.0189	5.8839
			(0.998)	(0.460)
$CSH_{0s} *Boom$	3.2947	0.5963		
	(0.548)	(0.942)		
$NTR * Boom$	-0.5389	-0.6611		
	(0.522)	(0.546)		
$CSH_{0s} * NTR$	-1.5652	-9.5100	-1.9460	-7.3502
	(0.705)	(0.124)	(0.654)	(0.223)
CSH_{0s}	-1.3992	4.6511	2.1321	4.9485
	(0.711)	(0.424)	(0.597)	(0.382)
$CSH_{0s} * PostBoom$			0.6359	-8.1374
			(0.911)	(0.275)
$NTR * PostBoom$			0.2813	0.0905
			(0.741)	(0.931)
Period FE	Yes	Yes	Yes	Yes

Industry FE	Yes	Yes	Yes	Yes
N	257	249	268	259
R^2	0.281	0.170	0.287	0.201
F	3.9672	1.9978	4.2643	2.5740

Notes: The dependent variable is the log number of employer-sponsored immigrants (Columns 1-2) and points-based immigrants (Columns 3-4), respectively. P-values are shown in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2-9: Industry of employment and the regional distribution of employer-sponsored and points-based immigrants: Triple-differences, 2-digit industry classification analysis.

	Boom period		Post-boom period	
	Employer-sponsored (1)	Points-based (2)	Employer-sponsored (3)	Points-based (4)
$CSH_{0s} * NTR * Boom$	0.5009	0.5970		
	(0.832)	(0.847)		
$CSH_{0s} * NTR * PostBoom$			-0.6989	-1.5485
			(0.758)	(0.597)
$CSH_{0s} *Boom$	2.2629	2.9332		
	(0.332)	(0.306)		
$NTR * Boom$	-0.1377	0.1068		
	(0.685)	(0.791)		
$CSH_{0s} * NTR$	0.4372	1.0546	1.0668	-1.5401
	(0.823)	(0.639)	(0.529)	(0.469)
CSH_{0s}	-3.0988*	-4.3193**	-0.9623	-1.2846
	(0.082)	(0.037)	(0.532)	(0.506)
$CSH_{0s} * PostBoom$			1.4637	-1.2152
			(0.515)	(0.667)
$NTR * PostBoom$			0.6350*	0.2410
			(0.061)	(0.540)
Period FE	Yes	Yes	Yes	Yes

Industry FE	Yes	Yes	Yes	Yes
N	817	863	894	890
R^2	0.453	0.354	0.466	0.389
F	6.7595	4.6441	7.5875	5.4522

Notes: The dependent variable is the log number of employer-sponsored immigrants (Columns 1-2) and points-based immigrants (Columns 3-4), respectively. P-values are shown in parentheses * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

2.9 REFERENCES

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Chapter 3: The labour market impact of a high skilled migration wave: evidence following the abolition of the white Australia policy

3.1 INTRODUCTION

It is not the bad qualities, but the good qualities of these alien races that make them so dangerous to us. It is their inexhaustible energy, their power of applying themselves to new tasks, their endurance and low standard of living that make them such competitors.

Alfred Deakin, Australia's Second Prime Minister (1901)

Policy makers' interest in the labour market impact of immigration on natives' labour market outcomes continues unabated, not least since estimates, and indeed the research question to be addressed, depend upon the methodology adopted, and the specific context in question, in terms of the skill composition of the immigrants and natives (Dustmann et al., 2016a). In this paper, and in contrast to much of the existing literature, we examine the impact of a large highly skilled immigration wave. Specifically, we use the national skill-cell approach of Borjas (2003), with the natural setting of Australia's changing migration policies to provide causal estimates on wages and employment native's workers. Australian immigration policy changes

have exogenous shifted the composition of immigrants to Australia, in terms of country of origin, and in particular across education-age cells in favour of highly-educated young Asians; which we use to mitigate the endogenous allocation of immigrants across cells (Llull, 2017a). In addition, we quantify the heterogeneous responses of detailed groups of natives to immigration in terms of: relocation, labour market participation, unemployment, and occupational mobility.

The labour market impact of immigration on native workers endures as one of the central debates in labour economics. Empirical studies have been adopted different approaches that ultimately answer different questions relating to the topic, however, results are highly context specific and methodological dependence (Dustmann et al., 2016b; Edo, 2019). In general, empirical work can be categorised into one of three methodologies.

The first approach, the regional, spatial correlation or "*total effect"* approach, relates the distribution of immigrants with natives' outcomes across local labour markets, for example, cities or metropolitan areas (Altonji & Card, 1991; Card, 2001, 2005; Dustmann et al., 2005; Dustmann et al., 2013; Grossman, 1982; Peri, 2012; Peri, 2016; Zorlu & Hartog, 2005). This methodology has the advantage of examining the *total effect* of immigration on native labor market outcomes. In other words, the approach is able to evaluate not only the partial impact of immigration on competing groups but also the total-effects on the labour market outcomes of natives with different skills, as well as the role of capital adjustment in a region. This approach could however result in biased estimates if immigrants migrate to regions that imbue them with economic advantages or disadvantages or if native workers differentially adjust to immigration by out-migrating (Borjas et al., 1997; Edo, 2017; Monras, 2018; Ottaviano & Peri, 2012). To mitigate the former issue, spatial correlation studies have often relied upon instruments derived from historical immigrant allocations, the *shift-share* instruments (Jaeger et al., 2018) else leveraged natural experiments to overcome the endogenous location decision

of migrants. Data limitations however, have posed challenges to researchers being able to account for natives' labour market adjustments, especially natives' regional mobility, which may be one reason why studies reach differing conclusions. Card (1990) and Friedberg (2001) for example, find virtually no effects of immigration supply-shocks on native wages; while conversely (Dustmann, Schonberg, et al., 2017; Hunt, 1992; Mansour, 2010) find negative impacts. Glitz (2012) rather concludes that immigrants while displacing German natives exerted no downward pressure on wages.

The second approach, motivated by Borjas (2003)'s pioneering study, the so-called skill-cell approach, divides national labour markets into cells based on age and education. This, therefore, identifies the *relative* labour market effects of immigration; in other words the extent to which immigrants fare relative to natives. Previous studies employed this methodology tends to yield more negative results in the U.S context (Borjas, 2003, 2006) when compared to the spatial correlation or other countries (Breunig et al., 2017; Manacorda et al., 2012). One possible explanation is that successive cohorts entering the United States tend increasingly to be lower skilled than previous cohorts and those in other countries (Antecol et al., 2003; Borjas, 1985; Clarke et al., 2019; Lewis, 2011). This would lead to the negative bias in the estimations.

The skill-cell approach, however, has the obvious advantage of dealing with natives' internal migration. Similarly to the spatial correlation approach however, the *relative* skill-cell method is also subject to the critique of the endogenous location decision of migrants, across space and between skill cells (Llull, 2017a). As acknowledged by Borjas (2003), skill-cell approaches have historically not addressed this issue. Recently, Llull (2017a) has proposed a two-stage solution to resolve the issue with an application in the U.S context. More importantly, this approach assumes that labour supply is fixed across cells, while natives might respond to immigration by upgrading education, changing their occupation, or their labour force participation status (Llull, 2017b)

The third approach, which emerged recently given advancements in data availability, tracks the labour market outcomes of natives at the *individual* level. This thereby allow researchers to control for individual fixed-effects, while concurrently examining the labour market adjustments of natives in terms of their education, labour force participation. Pioneering works, for example Cattaneo et al. (2015) and Foged and Peri (2016) have shown that low-skilled natives upgrade their occupations resulting in a positive effect of immigration on natives' wages. Some studies have combined the first and second approaches (Card 2001;(Borjas, 2006; Card, 2001), andthe first and third identification strategies (Dustmann, Schonberg, et al., 2017; Glitz, 2012).

In this study, we combine for the first time, the second and third approaches to provide analyses for long-run and short-run effects of high-skilled immigration. In the long-run analysis, utilising data from the 1981-2016 Australia Censuses of Population and Housing (the Census) merged with Surveys of Income and Housing (SIH), we begin with the Borjas (2003) national skill-cell approach to estimate the *relative* impact of skilled migration on native male's wages and part-time work. Exploiting the natural setting of Australia's rapidly improving immigrant skill composition following the abolition of the White Australia Policy, we are able to isolate our results from concerns of the endogenous allocation of immigrants across skill cells (Llull, 2017a). Central to the labour market impacts of immigration are the relative skill compositions of immigrants and natives (Manacorda, Manning, & Wadsworth, 2012; Ottaviano & Peri, 2012**,** Borjas 2019). In contrast to the existing literature, our study is the first to focus specifically on the labour market impacts of a positively selected high skilled migration wave.

In addition, using the longitudinal dimension of the Australian censuses in the years 2006, 2011, and 2016 to we examine short-run impact not only on *native workers' labor market outcomes*, but also heterogeneous adjustments across groups. We focus on natives' regional

movements (inflows and outflows) across space and their occupational (upward and downward) mobility, unemployment, labour force participation and income, all at the *individual* level. The levels of detail that our data help us taking into account these factors that have received scant attention to date (Dustmann, Schönberg, et al., 2017).

Llull (2017b) highlights that natives respond to immigration by altering their education, occupation and labour force participation and that these responses differ across groups. Accordingly, Dustmann, Schonberg, et al. (2017) find a difference in the wage outcomes of skilled versus unskilled workers and from inflows of natives into work and outflows of natives to other areas or non-employment; the latter effects of which were not included in Llull (2017b). Furthermore, empirical studies haven't reached consensus on how immigration affects natives' regional mobility. Card (2001) and Borjas (2006) aggregate data and examine changes of labour market size. However, they reached differing conclusions; with the former highlighting the insensitivity of inter-city migration in response to immigration and the latter providing evidence in favour of net native displacement. In addition, Peri and Sparber (2011) criticise Borjas (2006), since the number of natives features in both the dependent variable and the denominator of the main explanatory variable, which, it is argued potentially results in a negative bias.

To address this critique, we track native displacement at the individual level, examining the margins of adjustment across various groups. Our national skill-cell estimates provide evidence of the positive labour market impacts of immigration in terms of increasing log weekly wages and lower numbers of workers in part-time employment. Importantly, we document these effects for both the group that is the closest substitute for our immigration wave, namely the young and highly skilled *and* all other natives. In our baseline results, a 10% increase in migration flows to a particular skill cell results in an increase in native male wages of 4.1% and a reduction in part-time work of 1.7%.Additionally, high skilled immigration

reduces the probability that natives change or downgrade their occupations and increases natives' upward occupational mobility. Immigration also have positive impact on natives' labour force participation.

Looking further to different groups of native workers, our triple-differences estimates, where we incorporate three dimensions: region, age, and education show that young and high-educated natives have significant higher rate of migration outflow than other groups. Though, we also find the positive effect on migration inflow but the magnitude is much smaller, hence, leading to net migration outflow. There isn't, however, difference impact of immigration on upskilling, income, and labour force participation. Immigration does cause decline in male unemployment, but has no similar effect on female. Further analysis suggest that immigration reduces the probability of occupational mobility too. On the contrary, our difference-in-difference estimates, where we control for differences in regions and education, and remove young and high-educated natives out of the estimation sample, find that the probability of low-educated natives to move out of the region is much lower than other groups. Across other investigated outcomes, there is no difference on the probability of being unemployed, not in labour force, downward occupational mobility, upskilling. Native males in this group tend to change occupations at a lower rate, while there is no such a likewise effect on female.

Though our work uses both the second and the third empirical specification, our results stand in contrast to Borjas (2003) and Llull (2017a) that applied in the U.S context. We speculate that the differential impacts of immigration on native outcomes in the U.S. versus Australia may be attributed to the skilled composition of immigrants leading to the different adjustments of natives. We advocate this hypothesis by looking at the adjustments of different groups and the results were supportive as we have mention earlier in this section and on the contrary to Llull (2017b) that studied in the context of low skilled immigration in the U.S . The main contribution of this paper is to show the role of skilled composition of immigrants in the

way immigration affect native's labour market outcomes. Moreover, exploiting natural experiments from policy changing, in combination with high-quality data, and appropriate identification strategy, we are able to provide a closer look at individual's adjustments in different groups than previous literature. We conclude along the lines of Borjas (2016) that selection is paramount when examining the labour market effects of a migration wave, in our highly-skilled case, one of positive selection.

3.2 HISTORICAL BACKGROUND

The very first act of the newly federated Australia parliament in 1901, under the stewardship of Edmund Barton, the nation's first Prime Minister, was to pass a series of laws that would, from then on, be infamously referred to as the 'White Australia Policy'. This policy would arguably constitute the most important piece of legislation and change the face of the country for over seven decades. The seeds of the policy were sown by the animosity shown toward non-British and principally Asian migrants, especially during the Gold Rush, an era commonly associated with the so-called "Yellow Peril". Despite propping up the economy, especially in the country's North (Broome, Cairns, Darwin) while being deemed 'servile' and racially inferior, the 2% of the population that were Asian, evoked fears in the white population that felt threatened both by their work ethic and for fear of them working at lower wages. These overtly racist laws were motivated by the dream of creating a utopian society for the working man, with equality, democracy and freedom at its core. For whites only. The great irony is that Australia, a country oft-touted to be one accepting of migrants, one celebrated for its multiculturalism was founded on racist policies of exclusivity.

Although the White Australia Policy comprised three laws, the 1901 Immigration Restriction Act, the 1901 Pacific Island Labourers Act and the 1903 Naturalization Act; it is the former that is most associated with the policy ("Immigration Restriction Act," 1901).

Specifically, the Immigration Restriction Act, modelled on a South African policy, mandated incoming migrants to pass a dictation test in any European language, wherein individuals would need to perfectly transcribe particularly difficult passages of text consisting of 500 words (Jupp, 1995, 2002; Stratton, 1996; Sydney, Oct 1925). If someone passed, they could simply be mandated to repeat the test until they failed. The 1905 amendment of the policy allowed the dictation test to be carried out in any language. As Alfred Deakin, Australia's second Prime Minister stated that year: "the object of applying the language test is not to allow persons to enter the Commonwealth but to keep them out" (Pg. 14 Imm. Dept.); but so too was the test used to deport migrants. British immigration was favoured throughout this period, to populate lands 'cleared of natives'. Whereas 78% of the population heralded from the British Isles in 1901, by the outbreak of World War II, over 99% of Australia was 'white' (see Figure 1).Various aspects of the White Australia were subsequently abolished over time, until ultimately the Whitlam government removed all remaining elements pertaining to race and colour as criteria to select immigrants in 1973 (Jupp, 2002). Following this reform, as shown in Figure 1, immigration from Asia rose dramatically from 167 thousand in 1971 to around 2.7 million in 2016. Importantly, Australia's immigration policy at this time was predominantly humanitarian in nature. Table 1 shows most dominant sources of Asian immigrants. Between 1976 and 1986, the number of Asians in Australia more than doubled from 240 thousand to 536 thousand. This increase largely comprised low-skilled forced migrants, 30% of whom where Vietnamese refugees, welcomed to Australia following its adoption of a comprehensive legislative humanitarian programme framework in 1978 (York, 2003) following the fall of Saigon. . Large numbers of Asian migrants were also welcomed from Lebanon in the wake of their civil war, Chinese-Malays following the Malaysian Government's adoption of their New Economic Policy and Filipinos following the declaration of martial law in 1972. The timing of all these events can all be considered exogenous to our labour market outcomes of interest,

thereby insulating our results from concerns of the endogenous location of immigrants across skill cells. While many fleeing political persecution and civil disorder entered both through family reunification and skilled channels; those entering for humanitarian reasons have significantly influenced the diversity of birthplace groups in Australia today. "The Asianisation of migration to Australia after 1971 is notable" and between 1971 and 2006 the numbers of Asians in Australia grew almost tenfold[5] (Jupp, 2002). The subsequent migrations, in stark contrast to the policies of earlier decades, resulted in significant non-White migration generally and exogenous allocations of immigrants across education–age cells in Australia in particular.

On ANZAC day 1976, five Vietnamese men sailed into Darwin harbour in a small fishing vessel after two months at sea and guided only by a school atlas; stoking fears in the hearts of the Immigration Department. Following the Fall of Saigon, hundreds of thousands of Vietnamese subsequently fled the now wholly communist Vietnam for fear of being sent to agricultural collectives and re-education camps [**X**] by 1978 the Fraser government faced a crisis as ever more Vietnamese arrived in Darwin. While off shore processing was established in Bangkok and Kuala Lumpur to stem the flow - thereby re-establishing the indirect route through which could be resettled in Australia, albeit this time for Asians for the first time – in July 1979, Malcom Fraser made the valiant decision, consulting neither the cabinet nor the public, to welcome large volumes of Vietnamese refugees, 14,000 in that year alone and over 70,000 during his prime ministership. The White Australia Policy was consigned to history and the foundations of multicultural Australia had been laid; although the fears of boats on the Australian horizon still strongly influences migration policy to this day. Between 1980 and 1983, John Menadue, Secretary of the Department of Immigration and Ethnic Affairs - who

[5] Whereas in 1972 approximately 10% of immigration heralded from Asia, (excluding the Middle East (Pg. 35), by 1991 Asians comprised 51% of inflows.

had once moved from rural South Australia to board with Asian students at the University of Adelaide - made Asian migration Australia's top migration priority.

Post-1985, Asian migration to Australia continued rising unabated, although the skill composition of the flows improved significantly. The 2016 census recorded 2.7 million Asian-born Australian residents, at which time Asia had overtaken Europe as the source continent of the largest foreign-born population in Australia (see Figure 1). While Vietnamese refugee arrivals continued, immigration from China, Hong Kong, India, Indonesia, Malaysia, the Philippines, Sri Lanka and Singapore contributed larger fractions of overall Asian inflows. Concurrent with the diversification in origin source countries was a broad shift away from humanitarian migration toward skilled immigration and family reunification (Jupp, 1995; Millbank., 1996) (see Table 1). From 1985 onward, the Australian Government also promoted tertiary education as a key export sector (Adams et al., 2012), see Figure 4, with the majority of students heralding from Asian countries. This trend was compounded by the rise in student migration from China following the Tiananmen Square protests, after which Chinese students that studied in Australia were provided with a clear four-year pathway to settle in Australia (ABS, 1994).

In 1996, Australian immigration policy shifted overtly in favour of the highly-skilled, at which time the share of family-based immigration dropped from 49% to 29% in 2001, after which it has remained stable (Settlement Database: (Department of Social Services, 2018). Concurrently, the proportion of skilled immigration rose from 20% in 1995-1996 to around 70% in 2001, a level at which it has remained (see Figure 2). Those entering Australia as highly skilled do so either as employer-sponsored or points-based immigrants, i.e. under a demand or supply-led channel. Both streams require candidates to be under the age of 45, with exemptions made for universities and government institutions. The points-based scheme awards points to

potential migrants on the basis of age, education, experience, and English proficiency so as to maximize their long term contribution to Australia (see Table 2). Given that three-quarters of high skilled immigrants entered Australia under the points-based system, it is of no surprise that a large proportion of incoming migrants are young and highly educated. Between 1996 and 2015 the share of skill stream migrants increased from 29% to 68% of the total.

A final series of major reforms occurred following the election of labour government in 2007.[6]. Inflows to Australia peaked approximately 200,000 in 2011, resulting in more than 1.4 million (roughly 6.6% of Australia population) new migrants in the ten years after 2006. Since 2001, around 70 per cent of migrants entering Australia did so under the skilled stream (see Figure 2) further reinforcing the rapidly improving skill composition of immigration to Australia. It should also be emphasised that the period 2006-2016 witnessed the most significant increases in skilled immigration in Australian history, during which time 1.34 million Asian residents, equal to 6.6% of the Australian population were added, which is more 3.3 times **as many immigrants as** in the previous decade and equal to 50 per cent of all Asian residents recorded in the 2016 Census. Taken collectively, these reforms, in tandem with flat growth from traditional sources of immigrants, resulted in an exogenous shift in the origin, skill, and age composition of immigration in Australia in favour of positively selected young, educated Asian cohorts.

3.3 DATA

The paper comprised of two parts of analysis. The first part analyses labor market impact of immigration in long term from 1981 to 2016. In this part, data on immigration and employment

[6] In 2007, the government also mandated changes to the conditions on which citizenship could be granted, which included: an increase in the minimal waiting period extended to up to four years, one of which must be with permanent residence, the introduction of a citizenship test and a good knowledge of English.

are drawn from the Australian Census of Population and Housing 'Basic CURF' at five year intervals from 1981 to 2016. These datasets comprise 1% weighted random samples of census unit records, providing detailed information on personal characteristics such as: country of birth, year of arrival, age, education, hours worked and employment status.

Since data on income and wages are banded however, we merge our census data with Surveys of Income and Housing (SIH) in each corresponding year. The SIH comprises 15-30,000 observations for those aged fifteen and above in each round. We use age as a proxy for experience. We select those who are full-time employed and have wages and salaries as the principal source of income. We then construct the average wages of each age-education cell and match these with the Basic CURF. Following (Manacorda et al., 2012), we restrict our sample to those aged 25 to 59 and also focus on full-time employed workers, whose main source of income are wages and salaries.[7]

In line with the existing literature, we group individuals into five year-age cells ranging from 25-29, to 55-59. Whereas previous studies have considered two (Card & Lemieux, 2001; Manacorda et al., 2012) (Card, 2009) else four educational groups (Borjas, 2003); we instead rely on three educational groups (university graduates, diploma graduates and high school graduates and dropouts), since this maintains the greatest level of granularity in the data, while maintaining consistent data across years. Following Borjas (2003), we denote a cell that is formed by educational attainment *e* and age-cohort *a,* observed at year *t* as (*a, e, t*). Our key measure of labour supply shock as a result of immigration is the immigration share of the workforce in a specific cell:

$$F_{aet} = \frac{M_{aet}}{(N_{aet} + M_{aet})},$$

[7] Indeed, (Manacorda et al., 2012) restricted the sample to those who aged 26-60, however, SIH groups do not allow us to do so.

where, M_{aet} and N_{aet} represent the number of foreign-born and native-born workers respectively.

Figure 3 shows number of immigrants in Australia whose age between 25 and 59 by level of education. Clearly, there was a significant expansion in those whose tertiary or higher degrees. Correspondingly, Figure 4 documents immigrants-to-population shares over time by educational attainment. Strikingly, post-1996 witnessed a significant rise in the shares of university graduates and graduates with 'some college', reflecting the change in government policy at that time. As of 2016, the shares of university graduates was 0.45, which is far higher than the comparable figures for the U.S. for which the comparable figures ranges between 0.05 and 0.15 (Borjas, 2003) and indeed higher than the U.K that exhibits shares ranging from 0.14 to 0.3 (Manacorda et al., 2012). Contrastingly, the share of 'high school and dropouts' remained stable between 0.25 and 0.3 over the same period. Figure 6 rather displays the shares of immigrants by age-cohorts: 25-34, 35-44, and 45-59. Notably those aged under 35 dramatically increased from 2000 onward, from 0.21 to 0.4, while the oldest cohort those aged 45-59 experienced a small decline from 0.35 in 1996 to 0.33 in 2016. Clearly, the patterns are in stark contrast to the U.S which instead witnessed a sharp increase in young low-skilled immigration. Table 3 shows shares of immigrants in education-age cells. The most expanded groups are those have university degrees and whose age smaller than forty five, coinciding with the immigration policy.

Figure 6 provides basic descriptive statistics on the wages of native male workers across education groups. While real wages declined in the pre-1996 period they recovered and then surpassed their pervious maximum from 1996 onward i.e. at the time of the skilled immigration policy reform. Looking further to wage by skilled-cell in Table YY, we can see that university-educated workers enjoyed real-wage growth in most age-band. However, similar trends can be found at lower skilled cells. Figure 7 shows part-time rate of male native workers. Obviously,,

shares of those in part-time work first declined in 1981-1986, before sharply increasing especially between 1986 and 1996. Since 1996, the trends of university graduates and high-school and dropouts in part-time work have been parallel. Again these patterns are in stark contrast to those detailed in Borjas (2003).

In short-run analysis, we employ the Australian Census Longitudinal Dataset (ACLD) 2006-2016, which links data from three waves of the census, in 2006 (wave 1), 2011 (wave 2) and 2016 (wave 3). The ACLD comprises a five percent random sample of the Australian population and provides individual level data for one million individuals, including: gender, country of birth, labour force participation, level of highest educational attainment, place of usual residence, hours worked (categorical variable), income and employment type (employees versus owner business). Data on occupations is provided at the 3-digit level (based on the Australian and New Zealand Standard Classification of Occupations (ANZSCO)). In addition, occupation skill levels has been defined by the ABS to classify of the skill content of occupations. This definition is constructed based on (a) the prerequisite formal education and training, (b) experience (c) the level of on-the job training (Coelli & Borland, 2016).

Our analyses is conducted at the Statistical Area level 4 (SA4) geographical unit of observation. Australia is comprised of 107 SA4 regions, 18 of which refer to non-spatial units, such that our sample is composed of 89. The SA4 areas, equivalent to U.S. commuting zones, such that workers live and work in same geographical unit i.e. closed labour markets, host between 100,000 and 500,000 individuals (Deutscher, 2019).[8] We restrict our sample to those aged 25-59. Our final sample includes 410 thousand female and 382 thousand male observations, respectively. Of these, 44 thousand males and 63 thousand females have university degrees or higher and were aged below 45. Our large (population-weighted) sample,

[8] There are small changes between 2016 and 2011 SA4 lists, we therefore concord these difference using the concordance file provided by the ABS.

insulates our analysis from concerns of attenuation bias resulting from sampling error (Aydemir & Borjas, 2011)

We construct/include the following variables in our analysis:

- Total personal weekly income. Since income is a categorical variable in the census, we assign the mean value of the band to individuals.
- Unemployment. A dummy variable is set equal to 1 if an individual is unemployed and 0 otherwise.
- Labour force status. A dummy variable is set equal to 1 if an individual is not in the labour force and 0 otherwise.
- Occupational mobility. We construct a binary indicator that takes the value of 0 in our base year (2006) and the value of 1 if an individual *i* moves into a different occupation in year *t* in comparison to year t-5, while maintain the value of 0 otherwise.
- Upward and downward occupational mobility**.** We further construct binary indicators that delineate between upward and downward occupational mobility, which similarly to our indicator for occupational mobility adopt the value of 0 in the initial year (2006) and the value of 1 if an individual *i* downgraded (upgraded) their occupation skill in year *t* in comparison to year t-5, while taking the value of 0 otherwise. To identify occupational ranks, we aggregate occupations from 3-digit to 1-digit ANZSCO level as: (1) Managers, (2) Professionals, (3) Technicians and Trades Workers, (4) Community and Personal Service Workers, (5) Clerical and Administrative Workers, (6) Sales Workers, (7) Machinery Operators and Drivers and (8) Labourers.
- ABS indicator of downward occupational mobility. This variable is defined identically to our downward occupational mobility variable with the exception that mobility is captured using the five pre-defined "occupation skill level" bands proposed by the ABS.

- In-migration and out-migration. These binary indicators take the value of 0 in our base year (2006) and take the value of 1 if an individual *i* moved in to or out of a region that is different to the region they lived in five years hence and 0 otherwise.

Table 4 illustrates descriptive statistics of our dependent variables in "male" sample. Obviously, part-time work has slightly increased from 12% to 13% during the period 2011-2016, while kept constant between 2006 and 2011. Australian male workers highly mobilized across occupations, with respectively 57 per cent and 5 3 per cent changed their occupations in the five years period to 2011 and 2016. Of which, 33 per cent and 30 per cent moved to higher occupations, while 18 per cent downgraded, correspondingly. In our sample, unemployment status is about 3 to 4 per cent, while there is about 10 per cent decided not to participate in the labor force. In addition, from 2006 to 2011, there was 17% of our sample relocated to a different SA4, while the number was 18% in the period 2011-2016.

Table 5 provides summary statistics for female sample. In general, much larger proportion of female part-time work than male, with the statistics are around 37 per cent. Female workers were also highly occupational mobilized, with about 54% changed their occupations. Of those female workers, around 30 per cent moved to higher positions while 17 per cent accepted lower positions. The unemployment rate was just about 3 per cent. Much higher number of females decided not to join the labor force than male, with 20 per cent. In 2011 and 2016, there was about 17 percent of individual changed their address compare to five years ago.

3.4 EMPIRICAL STRATEGY

We adopt a number of econometric specifications to address our research questions. First, we begin with long-term analysis by replicating the canonical *national skill-cell* approach of Borjas (2003). This approach can be seen as a triple difference design to examine the *relative*

labour market impact of immigrants using repeated cross-sectional data over the period 1981 to 2016.

Furthermore, in short-run analysis from 2006 to 2016, we exploit longitudinal census data to examine the labour market impact of immigration on *individual natives'* outcomes. We continue by examining the heterogeneous impacts of immigration on natives' outcomes, again adopting a triple difference design, first by focusing on young and educated natives, those that might be considered closest substitutes and hence those most likely in competition with the largest component of immigration to Australia over the period. Finally, we examine the labour market impact on native high-school graduates and dropouts, which might otherwise be deemed those least substitutable, else most likely complimentary to the predominantly high skilled migration over the period of study (Cortés & Pan, 2019; Manacorda et al., 2012; Ottaviano & Peri, 2012).

3.4.1 Long-term analysis

The foundation of our analysis is the main specification from Borjas (2003):

$$Y_{aet} = \beta F_{aet} + A_a + E_e + \vartheta_t + A_a.E_e + A_a.\vartheta_t + E_e.\vartheta_t + \varepsilon_{aet} \quad (1)$$

where: Y_{aet} represents our initial primary labour market outcomes of interest: log real weekly wages, else the fraction of part-time workers in cells of dimensions $a, e,$ and t, where $a = \overrightarrow{1 \dots 7}$ denotes age cohort, $e = \overrightarrow{1 \dots 3}$ stands for educational attainment and $t = \overrightarrow{1981, 1986, \dots, 2016}$ are years at which labour market outcomes are observed. $F_{aet} = \frac{M_{aet}}{(N_{aet} + M_{aet})}$ is our key explanatory variable, which measures the immigration share of the workforce in a specific cell, where M_{aet} and N_{aet} represent the number of foreign-born and native-born workers respectively. β is therefore our coefficient of interest. This measures the *relative* impact of immigration on our labour market outcomes. A_a, E_e, and ϑ_t capture age-

cohort, education and year fixed effects, respectively, which account for potential correlations across cells (a, e, t). We also include their pairwise interactions. Initially, we provide estimates of the relative impact of immigration on native males. All our regressions are weighted by the sample size of the cell.

Motivated by the fact that Australia's immigration policy has favoured the young and the educated, we further extend equation (1) to identify the impact of immigration on this specific native group as follows:

$$Y_{aet} = \beta F_{aet}.DA.DE + \delta(1 - DA.DE).F_{aet} + A_a + E_e + \vartheta_t$$
$$+ A_a.E_e + A_a.\vartheta_t + E_e.\vartheta_t + \varepsilon_{aet}, \quad (2)$$

where : $$DA = \begin{cases} 1, & age < 45 \\ 0, & otherwise \end{cases},$$

and $$DE = \begin{cases} 1, & university\ or\ higher\ degree \\ 0, & otherwise \end{cases}.$$

A_a, E_e, and ϑ_t are defined as in equation (1). Our coefficients of interest are β and δ, which identify the effects of immigration on young and high-educated, else other, natives.

3.4.2 **Short-term analysis**

Exploiting the advantage of administrative data, our short-run analysis focuses on the impact of immigration on native workers at the *individual* level, which few existing studies have been able to do given the paucity of available data (Foged & Peri, 2016). Though the time span of our longitudinal dataset is far shorter than our repeated cross-sectional analysis, the period 2006-2016 witnessed no less than half of all Asian immigration to Australia.[9] As described in the historical Section, due to the policy changes in 2007, number of migrant intakes has been

[9] See more at https://www.homeaffairs.gov.au/research-and-statistics/statistics/visa-statistics/live/migration-program.

significantly expanded in this period. In this Section, we estimate the impact of this large shock of labor supply on outcomes of native workers. Our individual-fixed effects empirical specifications is as followings:

$$Y_{iaet} = \beta F_{aet} + \alpha X_{it} + \delta_t + \gamma_i + \varepsilon_{iaet}, (3)$$

where: Y_{iaet} represents natives' income, unemployed status, labour force status, occupational mobility as measured by our variables as defined on page 13. δ_t and γ_i are year and individual fixed effects. X_{it} is a vector of individual time-varying characteristics: including age, quadratics of age, marital status and the number of children ever born. In those regressions in which the dependent variable is income, we further add employment type, occupation and hours worked as controls. We examine the impact of immigration on both males and females.

Heterogenous Native Adjustment: Young and University-Educated Migrant Substitutes

We further investigate theheterogeneity in the labour market impact of immigration. The economic theory predicts asymmetric effects across groups; specifically that immigration might benefit those with complementary skills, while putting downward pressure on those wages of competing groups in a closed labour market (Borjas, 2006). We begin our analysis examining the latter group, those in closest competition with the incoming migration flows, namely young and university-educated natives. Given that native adjustment can take place along one of several dimensions, we examine regional mobility, occupational mobility and labour force participation decisions.

Australia's immigration over the period favoured the young and skilled, therefore, we further single out young and educated natives and extend our individual approach with a the triple-difference strategy as follows:

$$Y_{irt} = \beta F_{rt}.DE_{it}.DA_{it} + F_{rt} + DE_{it} + DA_{it} + F_{rt}.DE_{it}$$
$$+ F_{rt}.DA_{it} + DA_{it}.DE_{it} + \alpha X_{it} + \gamma_i + \varepsilon_{irt}, \qquad (4)$$

where:

$$DE_{it} = \begin{cases} 1, & university\ or\ higher\ degree \\ 0, & otherwise, \end{cases}$$

and:

$$DA_{it} = \begin{cases} 1, & age < 45 \\ 0, & otherwise, \end{cases}$$

Y_{irt} represents income, unemployment, labour force status one of our measures of occupational mobility, else indicator variables capturing in- or out-mobility. The variable F_{rt} measures the fraction of immigration in region r. DE_{it} is a dummy variable, taking the value of 1 if an individual holds a university or higher degree. DA_{it} takes the value of 1 if the age of an individual is less than 45 and 0 otherwise. We include the pairwise interactions of F_{rt}, DE_{it}, and DA_{it}. The vector X_{it} comprises the same time-varying controls as in equation (3). Our main variable of interest is the interaction of F_{rt}, DE_{it} and DA_{it}, which reflects the margins of adjustments of young and university-educated natives in comparison to other groups.

Heterogenous Native Adjustment: High-school Graduate and Dropout Complements

Finally, we examine how low-educated natives, those most likely to complement incoming high skilled migrants respond to immigration over the period. To this end, we run the following model:

$$Y_{irt} = F_{rt} + DL_{it} + \beta F_{rt}.DL_{it} + \alpha X_{it} + \gamma_i + \varepsilon_{it}, (7)$$

$$DL_{it} = \begin{cases} 1, & highschool\ or\ dropouts \\ 0, & otherwise, \end{cases}$$

where Y_{irt} are adjustment indicators including: unemployment status, labour force status, our various measures of occupational mobility and indicator variables again capturing in- and out-migration. The dependent variables, F_{rt}, X_{it}, and γ_i are defined similarly as in sections 5 and 6. The variable DL_{it} takes the value of 1 if an individual's highest degree is not higher than high-school certificate. Our coefficient of interest is β, which captures the margin of

adjustments for low-educated natives in response to immigration. We remove the young and high-educated natives from the sample.

3.5 RESULTS

3.5.1 LONG-TERM ANALYSIS

Table 6 reports our benchmark national results from estimating equation (1). Across all three rows of results, which capture our basic results and those results when additionally including females in the labour force and the log of the labour force as an additional explanatory variable, natives experienced wage growth and concurrently a reduction in part-time work. Following Borjas (2003), the wage elasticity can be measured as:

$$\frac{\partial \log(w_{aet})}{\partial(\frac{M_{aet}}{N_{aet}})} = \frac{\beta}{(1+\frac{M_{aet}}{N_{aet}})^2}, \quad (8)$$

Since in 2016, immigration accounted for 34.7% of the total labour force, we can infer the implied wage elasticity by multiplying our estimated β by $\frac{1}{1.347^2} \approx 0.55$. Our estimates in row 1 imply therefore that a 10% increase in immigration flows into the domestic labour force results in an increase in weekly wages of native males by 4.1% and a reduction in the fraction of part-time work by 1.7%. These results are in stark contrast to those reported in Borjas (2003), although they are similar in sign and magnitude to those reported in Breunig et al. (2017), although those authors failed to find any statistically significant results. It is worth noting that Breunig et al. (2017) used different and shorter set of years than in this paper. We use four education groups instead of three; we use 8 age groups instead of 7. The wage results in row 3 are strikingly larger than the comparable estimates in rows 1 and 2, implying a more than 9% increase in weekly wages in response to a 10% growth in immigration flows.

In Table 7, while recognising the limitations of our sample size, we nonetheless attempt to disaggregate our baseline results according to education group. This exercise proves

informative in terms of the sign and magnitude of the estimated coefficients, which are large and positive for wages and generally smaller and negative for part-rime work for high school graduates and dropouts and diploma graduates, both groups which *a priori* might be expected to complement incoming high skilled migrants. Similarly, we find a small negative effect on native university graduate wages, which is also intuitive given that this group will most likely be in competition with incoming high skilled migrants.

Table 8 presents estimates from estimating equation (2). Strikingly, the fraction of those working in part-time work decreased for *both* the young and highly educated (between -1.9% and 3.1%) *and* all other natives (between -1.6% and 2.5%). Similarly, in column (1) we consistently estimate positive wage coefficients, although the statistical significance of the estimates of other natives is far greater than the comparable estimates for the young and highly educated, the group in closest competition with the predominantly young highly-skilled Asian migrants. In other words, the results from our second specification, which includes a full battery of unilateral and dyadic fixed effects, provide evidence of a positive complementarity of high skilled migration with native workers, both in terms of increasing their remuneration and working in full-time employment.

3.5.2 SHORT-TERM ANALYSIS

Next we turn to our *individual* approach, to examine in greater detail the mechanisms underpinning our observed *relative* impacts of high skilled migration on natives. Table 8presents our estimates from equation (3), which examines the aggregate individual responses to high skilled migration. Column (1) shows our results for native males and column (2) our estimates for native females. Our estimates in row 1 imply that a 10% increase in immigration flows result in a greater than 10% increase in male natives' income and a 7% increase in female natives' income; an effect which is significantly larger than our national estimates in Table 3. Our results also show a significant decrease in part-time work of 2% for native males in

response to a similar sized shock, although no comparable effect is found for native females, which are commensurate with our national skill-cell results. Our results provide little support that immigration affects natives' unemployment, while our estimates in row 3 show that the probability of natives falling out of the labour force fell by between 1.5% and 0.8% in response to a 10% increase in the immigration flows into region *r*, for native males and females respectively. Our results also suggest significant native occupational mobility. Most specifically, in response to a 10% increase in immigrant flows, both males and females are predicted to increase their upward occupational mobility by 2.4% and conversely in response to a similar shock the probability of downward occupational mobility is reduced by between 2% and 1.3% for males and females respectively. Our results are in line with Cattaneo et al. (2015)'s work on the European context**.** Interestingly, since the magnitude of (overall) occupational mobility is smaller in magnitude than the net of the estimated coefficients on upward and downward mobility, our results provide evidence that immigration also lowers occupational mobility within the same strata of occupations.

Heterogeneous Native Adjustment: Young and University-Educated Migrant Substitutes

While our aggregate individual-level estimates paint an overall rosy picture of the impact of the highly skilled migration wave on Australian *native* workers, in the following two subsections we examine in further detail the heterogeneous margins of adjustments of young and university-educated natives i.e. likely migrant substitutes, and native high-school graduates and dropouts i.e. likely migrant complements.

Table 9 contains the estimates from equation (4), indicating the marginal adjustments of young and highly educated natives. The starkest results emerge in rows 8 and 9, which show that the probability of this group moving out of a region (relative to other natives) increases by 2.8% and 2.6% for males and females respectively in response to a 10% increase in the flow of immigrants into a particular region. So however, does the probability of young and highly

educated natives moving-in to a region hosting greater numbers of immigrants (relative to other natives), although the magnitudes of these estimates are far smaller, being approximately 0.4% for both males and females in response to a similar sized migration shock. In summary, our results on regional mobility are broadly in line with Borjas (2006) that natives will relocate as a result of immigration ,while contrasting with Card (2001)'s estimations that immigration does not cause effect on intercity mobility rates of natives and earlier immigrants. Moreover, estimations do not show the difference in labour market participation, occupational mobility or unemployment status of young and high-educated group, which is in contrast to Llull (2017b).

Heterogeneous Native Adjustment: High-school Graduate and Dropout Complements

Table 11 reports the results from estimating equation (7). Whereas no significant effects on income were found in our examination of young and university-educated native males and females, in Table 10 we can observe a 1.5% margin of downward adjustment in income for high-school graduate and dropout native females, whereas our results are suggestive that the overall rise in income is otherwise spread more evenly across our groups of interest. In contrast to the internal migration results for our young and university-educated native sample, the results in table 9 rather suggest that relative to other groups high school graduates and dropout native males and females are 4.4% less likely to out-migrate and similarly between 0.4% and 0.5% less likely to in-migrate, relative to other groups for females and males respectively.

3.6 CONCLUSION

In this paper and in contrast to the existing literature, we examine the labour market impact of a positively selection high skilled immigration wave. In accordance with the central unifying theme of Borjas (2016) and in comparison with existing national skill cell studies, we document the positive labour market effects of our positively selected immigration wave.

Specifically, using unique quasi-natural experiments in Australia immigration policy, we show (in the national relative skill cell approach) that skilled immigration has positive impact on wages and salaries while reduces the part-time worked ratio of native male workers during period 1981-2016. These effects spread over all groups but more profound on low-skilled natives. Using rich longitudinal data in a shorter period, we show the same findings in estimations with the individual approach that controls for individual fixed-effects and other individual time-variant characteristics. Natives adjusted their behaviours such as labour force participation and occupational mobility.

In addition, we show the heterogeneity in native's adjustment in different groups, especially regional mobility. In particular, young and university-educated natives those are migrant substitutes have much higher rate of migration out of regions that are exposed to immigration than other groups. In contrast, high-school graduate and dropout natives have much lower rate of regional mobility than others. These results suggest the important role of considering native's adaptation in evaluating the impact of immigration on labour market.

3.7 TABLES AND FIGURES

Table 3-1: Top 10 largest Asian communities in Australia, 1985-1995

Birthplace	Total population			Increase 1985-1995
	1985	1990	1995	
Vietnam	83028	122347	151053	68,025
China	37461	78,866	111,009	73548
Philippine	33724	73660	92949	59225
India	47820	61606	77,551	29,731
Malaysia	47784	72611	76255	28471
Lebanon	56332	68995	70224	13892
Hong Kong	28293	58984	68430	40137
Sri Lanka	-	37283	46,984	
Indonesia	-	33264	44175	
Singapore	-	24563	29490	

Notes: Data are sourced from census 1996, 1991, and 1986

Table 3-2: Points table for points based migrants

Age		English proficiency		Skilled employment in the last 10 years – outside Australia		Skilled employment in the last 10 years – in Australia		Qualifications	
Age	Points	English	Points	Number of years	Points	Number of years	Points	Qualifications	Points
18-24 years	25	Competent English	0	Less than 3 years	0	Less than 1 year	0	A Doctorate degree	20
25-32 years	30	Proficient English	10	3-4 years	5	1-2 years	5	A Bachelor degree	15
33-39 years	25	Superior English	20	5-7 years	10	3-4 years	10	A diploma or trade qualification completed in Australia	10
40-44 years	15			8-10 years	15	5-7 years	15		10

			An award or qualification the relevant assessing authority for your nominated skilled occupation recognises.
		8-10 years	20

Notes: data are sourced from https://immi.homeaffairs.gov.au/visas/getting-a-visa/visa-listing/skilled-independent-189/points-table

Table 3-3: Fraction of immigrants in skilled-cells

Education	Age	1981	1986	1991	1996	2001	2006	2011	2016
High school and dropouts	25-29	0.23	0.22	0.24	0.20	0.17	0.21	0.24	0.29
	30-34	0.30	0.26	0.27	0.25	0.21	0.21	0.24	0.29
	35-39	0.31	0.32	0.28	0.27	0.26	0.25	0.26	0.29
	40-44	0.33	0.32	0.33	0.30	0.28	0.29	0.29	0.28
	45-49	0.32	0.35	0.34	0.36	0.30	0.29	0.29	0.30
	50-54	0.29	0.34	0.36	0.35	0.35	0.31	0.31	0.31
	55-59	0.29	0.30	0.35	0.38	0.34	0.34	0.35	0.32
Some college	25-29	0.20	0.15	0.23	0.25	0.28	0.28	0.36	0.40
	30-34	0.28	0.19	0.26	0.32	0.32	0.30	0.35	0.40
	35-39	0.30	0.26	0.27	0.30	0.40	0.37	0.39	0.37
	40-44	0.27	0.30	0.30	0.31	0.36	0.43	0.42	0.41
	45-49	0.24	0.29	0.26	0.31	0.35	0.39	0.41	0.46
	50-54	0.26	0.27	0.28	0.32	0.39	0.37	0.38	0.38

	55-59	0.30	0.26	0.26	0.33	0.40	0.38	0.43	0.43
University	25-29	0.25	0.23	0.31	0.25	0.29	0.38	0.45	0.52
	30-34	0.33	0.24	0.30	0.36	0.32	0.35	0.41	0.50
	35-39	0.38	0.36	0.32	0.33	0.38	0.38	0.41	0.44
	40-44	0.40	0.33	0.34	0.33	0.34	0.44	0.43	0.42
	45-49	0.32	0.35	0.35	0.39	0.36	0.41	0.40	0.46
	50-54	0.23	0.36	0.32	0.36	0.39	0.37	0.37	0.39
	55-59	0.47	0.33	0.37	0.38	0.41	0.41	0.41	0.40

Table 4: Real weekly wages of male native workers

Education	Age	1981	1986	1991	1996	2001	2006	2011	2016
High school and dropouts	25-29	334	281	254	247	269	303	354	368
	30-34	352	301	276	286	286	333	410	379
	35-39	370	321	289	287	303	351	469	433
	40-44	356	332	307	321	318	341	449	453
	45-49	349	328	288	315	354	356	440	448
	50-54	333	313	280	338	337	355	440	410
	55-59	342	292	273	278	420	365	431	401
Some college	25-29	355	309	276	285	293	322	427	388
	30-34	389	336	287	298	334	369	458	455
	35-39	396	344	315	314	347	398	505	502
	40-44	407	376	341	337	334	438	478	479
	45-49	399	357	354	341	355	413	472	541

	50-54	421	353	343	308	352	404	457	493
	55-59	385	385	308	333	377	372	494	486
University	25-29	422	372	379	306	332	379	448	406
	30-34	513	422	424	406	459	529	553	535
	35-39	555	518	452	449	454	610	661	716
	40-44	556	528	521	498	548	625	803	828
	45-49	611	580	487	481	524	644	743	727
	50-54	658	514	546	621	610	624	711	891
	55-59	758	585	630	447	501	684	780	908

Table 3-4: Summary statistics for native male workers's labor market outcomes

Variables	Year	No. Obs	Mean	SD
Panel A: Male				
Part-time work status	2006	152,123	0.12	0.33
	2011	152,123	0.12	0.33
	2016	102,702	0.13	0.33
Index of occupational mobility	2011	126,951	0.57	0.49
	2016	102,702	0.53	0.50
Index of upward occupational mobility	2011	126,951	0.33	0.47
	2016	102,702	0.30	0.46
Index of downward occupational mobility	2011	126,951	0.18	0.39
	2016	102,702	0.18	0.38
ABS index of downward occupational mobility	2011	101,031	0.16	0.37
	2016	81,932	0.35	0.35
Unemployed status	2006	151,528	0.03	0.18
	2011	126,658	0.03	0.17
	2016	102,533	0.04	0.18
"Not in the labour force" status	2006	151,528	0.10	0.30
	2011	126,658	0.09	0.29
	2016	102,533	0.10	0.29
Income	2006	152,123	941.6	562.6
	2011	126,951	1141.7	607.1

	2016	102,702	1381.0	833.1
Regional Mobility	2011	126,951	0.18	0.38
	2016	102,702	0.17	0.38

Table 3-5: Summary statistics for native female workers's labor market outcomes

Variables	Year	No. Obs	Mean	SD
Panel B: Female				
Part-time work status	2006	157,258	0.34	0.47
	2011	138,296	0.37	0.48
	2016	113,745	0.38	0.48
Index of occupational mobility	2011	138,296	0.58	0.49
	2016	113,745	0.54	0.50
Index of upward occupational mobility	2011	138,296	0.34	0.47
	2016	113,745	0.31	0.46
Index of downward occupational mobility	2011	138,296	0.18	0.38
	2016	113,745	0.17	0.37
ABS index of downward occupational mobility	2011	87,871	0.16	0.37
	2016	76,444	0.14	0.35
Unemployed status	2006	156,635	0.03	0.16
	2011	137,964	0.03	0.16
	2016	113,532	0.03	0.17
"Not in the labour force" status	2006	156,635	0.24	0.43
	2011	137,964	0.21	0.41
	2016	113,532	0.19	0.39
Income	2006	157,258	606.5	470.7

	2011	138,296	765.3	552.9
	2016	113,745	930.2	699.8
Regional Mobility	2011	138,296	0.17	0.38
	2016	113,745	0.17	0.38

Table 3-6: Effect of immigration supply shock on real wages and part-time worked ratio of native male workers, by education-age groups

Empirical identification:	Dependent variable	
	Log weekly wages	Fraction of part-time workers
	(1)	(2)
1. Basic estimates	0.7478*	-0.3060**
	(0.3339)	(0.0777)
2. Includes women in labour force counts	0.7865*	-0.4334**
	(0.3315)	(0.0696)
3. Includes log labour force as regressor	1.6435**	-0.4367**
	(0.4070)	(0.0988)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient of immigrant share variable in equation (1), where the dependent variables are the mean of real wages and the fraction of part-time workers for a native education-age group at a particular moment. Standard errors are in parentheses and are clustered within education-age cells. All regressions have 168 observations which is the product of 3 education groups and 7 age cohorts and 8 periods. All regressions are weighted by the sample size of the education-age-period cell and include education, age-cohort, and period fixed effects. We also include pairwise

interactions between education and age-cohort fixed effects, education and period fixed effects, and age-cohort and period fixed effect.

Table 3-7: Effect of immigration supply shock on real wages and part-time worked ratio of native male workers (estimates of parameter β), by education-age groups

Education group:	Dependent variable	
	Log weekly wages	Fraction of part-time worked
	(1)	(2)
High school graduates and dropouts		
1.1. Basic estimates	0.5558	-0.0481
	(0.3661)	(0.0987)
1.2. Includes women in labour force counts	0.6906^{+}	-0.0171
	(0.3631)	(0.0996)
Diploma graduates		
1.1. Basic estimates	0.2753	-0.2468*
	(0.1886)	(0.1081)
1.2. Includes women in labour force counts	0.8739**	-0.1214
	(0.2407)	(0.1631)
University graduates		
3.1. Basic estimates	-0.0504	-0.0313
	(0.3226)	(0.1216)

3.2. Includes women in	0.0759	-0.0388
labour force counts	(0.3264)	(0.1231)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient of immigrant share variable, where the dependent variables are the mean of real wages and the fraction of part-time workers for a native education-age group at a particular moment. Standard errors are in parentheses and are clustered within age-cohort cells. All regressions have 56 observations which is the product of 7 age cohorts and 8 periods. All regressions are weighted by the sample size of the education-age-period cell and include age-cohort, and period fixed effects.

Table 3-8: Effect of immigration supply shock on real wages and part-time worked ratio of native male workers, by education groups, and by distinguishing young and high-educated groups

Empirical identification:	Dependent variables	
	Log weekly wages	Fraction of part-time worked
	(1)	(2)
1. Basic estimates		
β	0.5554	-0.3396**
	(0.3889)	(0.0907)
δ	0.8782*	-0.2832**
	(0.3603)	(0.0840)
2. Includes women in labour force counts		
β	0.2438	-0.3904**
	(0.4170)	(0.0895)
δ	1.1034**	-0.4585**
	(0.3591)	(0.0771)
3. Includes log native labour force as repressor		
β	1.7276**	-0.5575**
	(0.5117)	(0.1222)

δ	1.6344**	-0.4237**
	(0.4107)	(0.0981)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient of immigrant share variable in equation (2), where the dependent variables are the mean of real wages and the fraction of part-time workers for a native education-age group at a particular moment. β and δ identify the effects of immigration on young and high-educated, else other natives. Standard errors are in parentheses and are clustered within education-age cells. All regressions have 168 observations which is the product of 3 education groups and 7 age cohorts and 8 periods. All regressions are weighted by the sample size of the education-age-period cell and include education, age-cohort, and period fixed effects. We also include pairwise interactions between education and age-cohort fixed effects, education and period fixed effects, and age-cohort and period fixed effect.

Table 3-9: Effect of immigration supply shock on labour market outcomes of natives: individual approach

Dependent variable	Male	Female
	(1)	(2)
1. Income	1.2616**	0.5021*
	(0.1963)	(0.1982)
2. Part-time work status	-0.2017**	0.8370**
	(-0.0505)	(0.0620)
3. Unemployed status	-0.0820**	-0.0539*
	(-0.0264)	(0.0234)
4. "Not in the labour force" status	-0.017	0.9651**
	(-0.034)	(0.0463)
5. Index of occupational mobility	-0.0899	-0.0557
	(-0.0633)	(0.0562)
6. Index of upward occupational mobility	-0.8631**	-1.5430**
	(-0.0589)	(0.0539)
7. Index of downward occupational mobility	0.2560**	0.8144**
	(-0.0562)	(0.0492)

8. ABS index of downward	0.0176	0.0711
occupational mobility	(-0.059)	(0.0570)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient of immigrant share variable in equation (3), where the dependent variables are the income, unemployed status, "not in the labour force" status , index of occupational mobility, index of upward occupational mobility, index of downward occupational mobility, ABS index of downward occupational mobility of natives at a particular moment. Standard errors are in parentheses and are clustered at individual level. All regressions for males and females are based on the samples of approximately 382 thousand and 410 thousand observations, respectively. All regressions include individual fixed effects, year fixed effects, and a vector of time-variant characteristics such as: education groups, age groups, log of age, marital status and the number of children ever born. In Row 1, where dependent variable is income, we further add employment type, occupation, and hours worked as controls.

Table 3-10: Heterogenous Native Adjustment: Young and University-Educated Migrant Substitutes

	Male	Female
	(1)	(2)
1. Income	0.1044	0.0952
	(-0.1196)	(0.1201)
2. Unemployed status	-0.0440**	-0.0229
	(0.0161)	(0.0142)
3. "Not in the labour force" status	0.0367+	0.0885**
	(0.0207)	(0.0281)
4. Index of occupational mobility	-0.0848*	-0.1476**
	(0.0386)	(0.0342)
5. Index of upward occupational mobility	-0.0223	-0.0849**
	(0.0359)	(-0.0328)
6. Index of downward occupational mobility	-0.0047	-0.0361
	(0.0343)	(0.0299)

7. ABS index of downward occupational mobility	0.0696*	0.0426
	(0.0346)	(0.0335)
8. Index of migration-out	0.3996**	0.3742**
	(0.0287)	(0.0250)
9. Index of migration-in	0.0684*	0.0559*
	(-0.0296)	(-0.0257)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient β in equation (4), where the dependent variables are the income, unemployed status, "not in the labour force" status , index of occupational mobility, index of upward occupational mobility, index of downward occupational mobility, ABS index of downward occupational mobility, index of migration-in, and index of migration-in of natives at a particular moment. Our coefficients of interest reflect the margins of adjustments of young and university-educated natives in comparison with other groups. Standard errors are in parentheses and are clustered at individual level. All regressions for males and females are based on the samples of approximately 329 thousand and 334 thousand observations, respectively. All regressions include individual fixed effects, year fixed effects, and a vector of time-variant characteristics such as: education groups, age groups, log of age, marital status and the number of children ever born. In Row 1, where dependent variable is income, we further add employment type, occupation, and hours worked as controls.

Table 3-11: Heterogenous Native Adjustment: High-school Graduate and Dropout Complements

	Male	Female
	(1)	(2)
1. Income	-0.0772	-0.2778**
	(0.0872)	(0.0868)
2. Unemployed status	-0.0151	-0.0176+
	(0.0117)	(0.0106)
3. "Not in the labour force" status	-0.0053	-0.0236
	(0.0152)	(0.0202)
4. Index of occupational mobility	-0.1056**	0.0359
	(0.0305)	(0.0270)
5. Index of upward occupational mobility	-0.1000**	-0.0020
	(0.0266)	(0.0241)
6. Index of downward occupational mobility	-0.0291	-0.0324
	(0.0252)	(0.0219)
7. ABS index of downward occupational mobility	0.0428	0.0060
	(0.0261)	(0.0340)

8. Index of migration-out	-0.8073**	-0.8004**
	(0.0142)	(0.0134)
9. Index of migration-in	-0.0983**	-0.0728**
	(0.0204)	(0.0175)

Notes: ** p<0.01, * p<0.05, +p<0.1. Each cell of the table reports the coefficient β in equation (7), where the dependent variables are the unemployed status, "not in the labour force" status , index of occupational mobility, index of upward occupational mobility, index of downward occupational mobility, ABS index of downward occupational mobility, index of migration-in, and index of migration-in of natives at a particular moment. Our coefficients of interest measures the margin of adjustments for low-educated natives in response to immigration in comparison with other groups. Standard errors are in parentheses and are clustered at individual level. We remove young and high-educated natives out of the sample. Therefore, all regressions for males and females are based on the samples of approximately XX thousand and YY thousand observations, respectively. All regressions include individual fixed effects, year fixed effects, and a vector of time-variant characteristics such as: education groups, age groups, log of age, marital status and the number of children ever born.

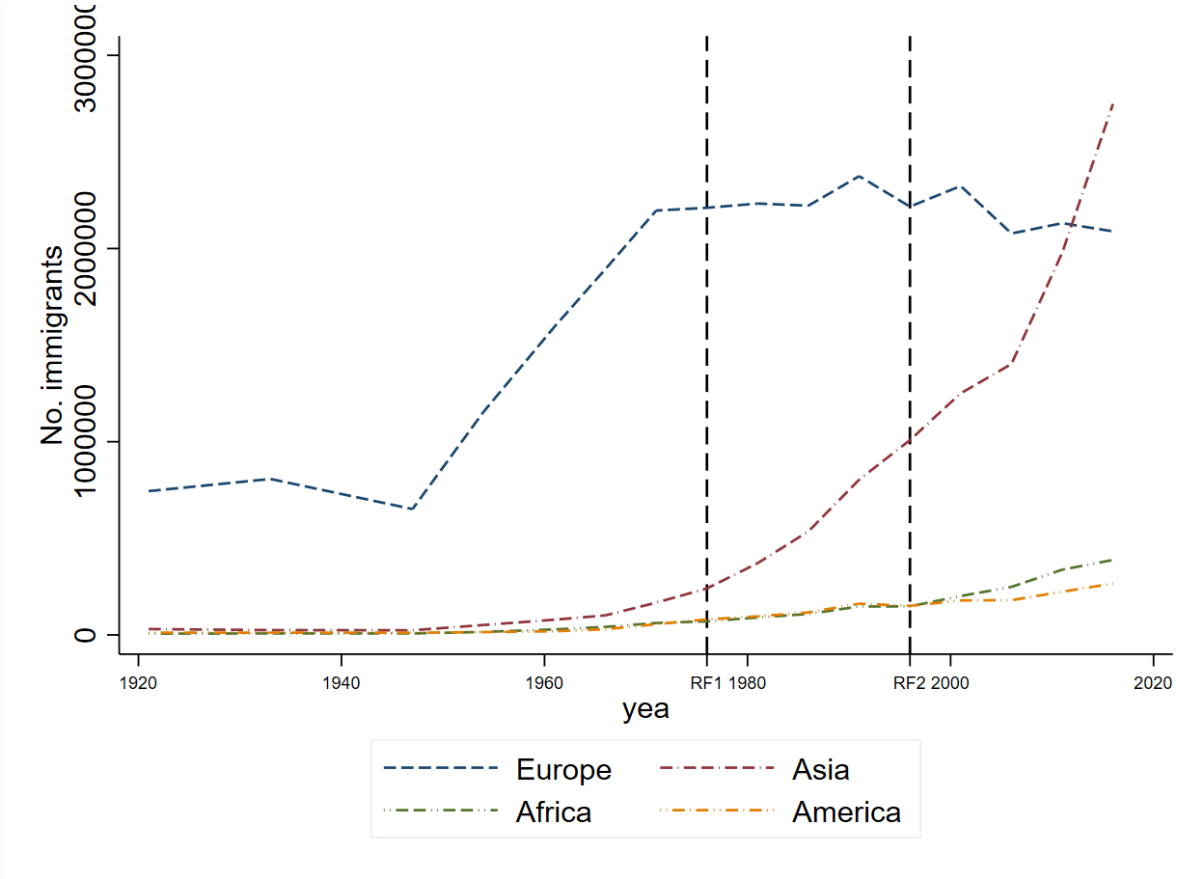

Figure 3-1: Country of origin of immigrants into Australia from 1921 to 2016.

Notes: Data are collected from the census of population and housing: 1921-2016.

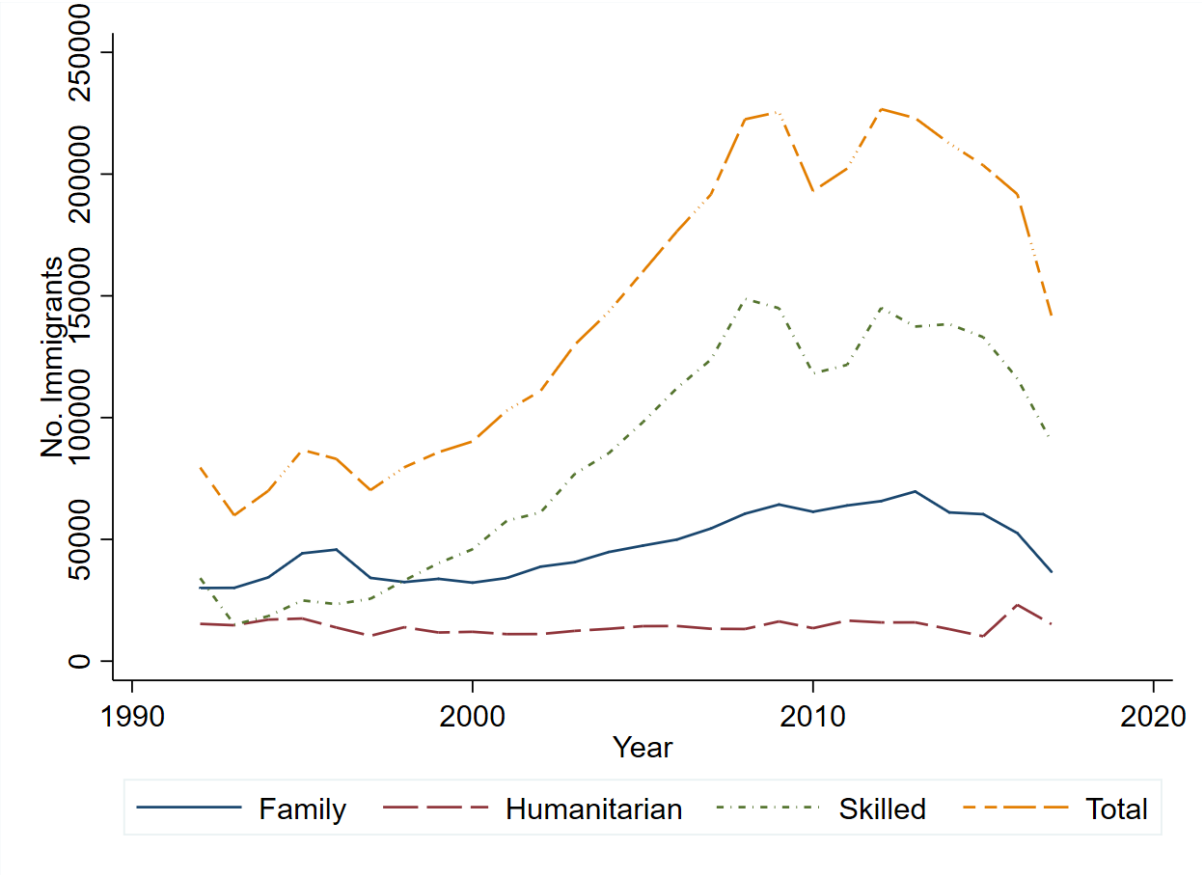

Figure 3-2: Annual migrant intakes by migration stream since 1992.

Notes: Data are collected from the Settlement Database.

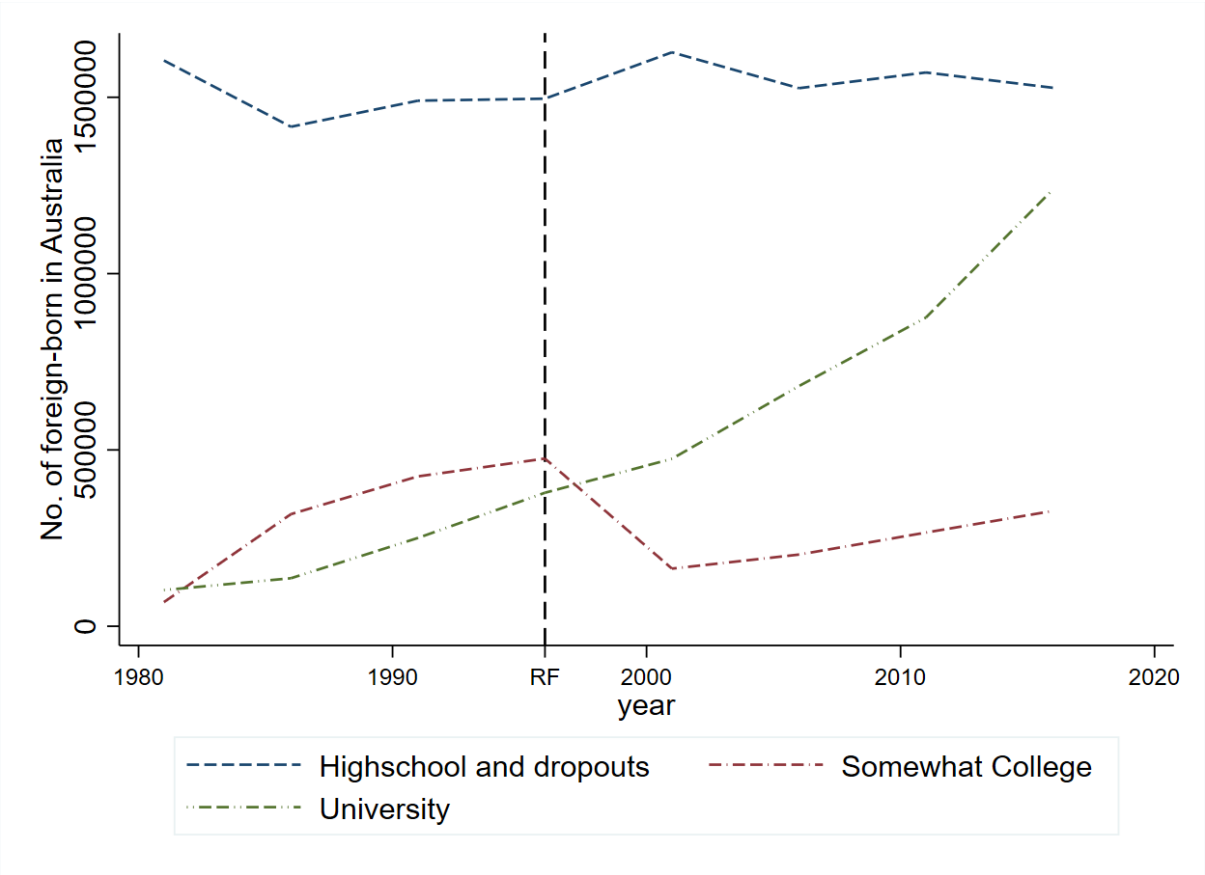

Figure 3-3: No. of foreign-born in Australia whose age between 25 and 59 by education.

Notes: Data are collected from census Basic Curf: 1981-2016

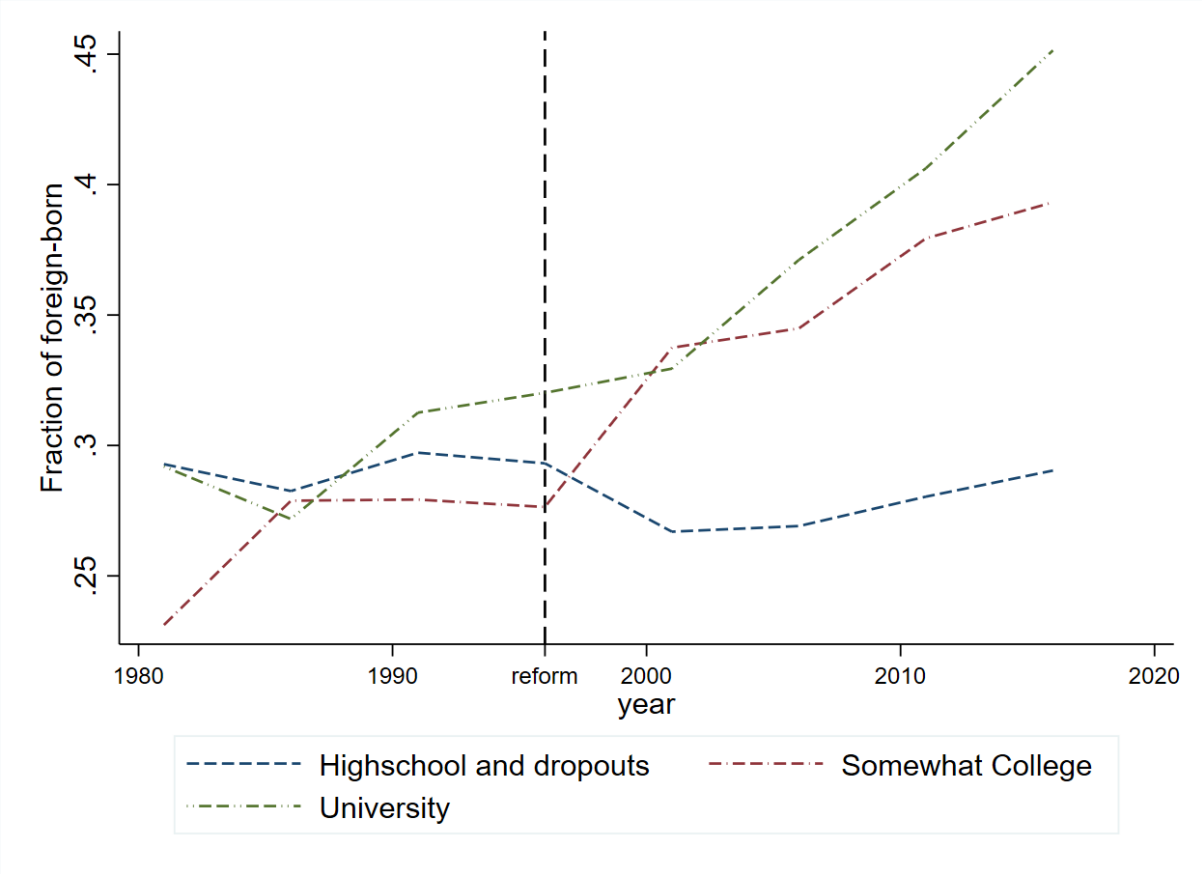

Figure 3-4: Fraction of foreign-born by education
Notes: Data are collected from census Basic Curf: 1981-2016

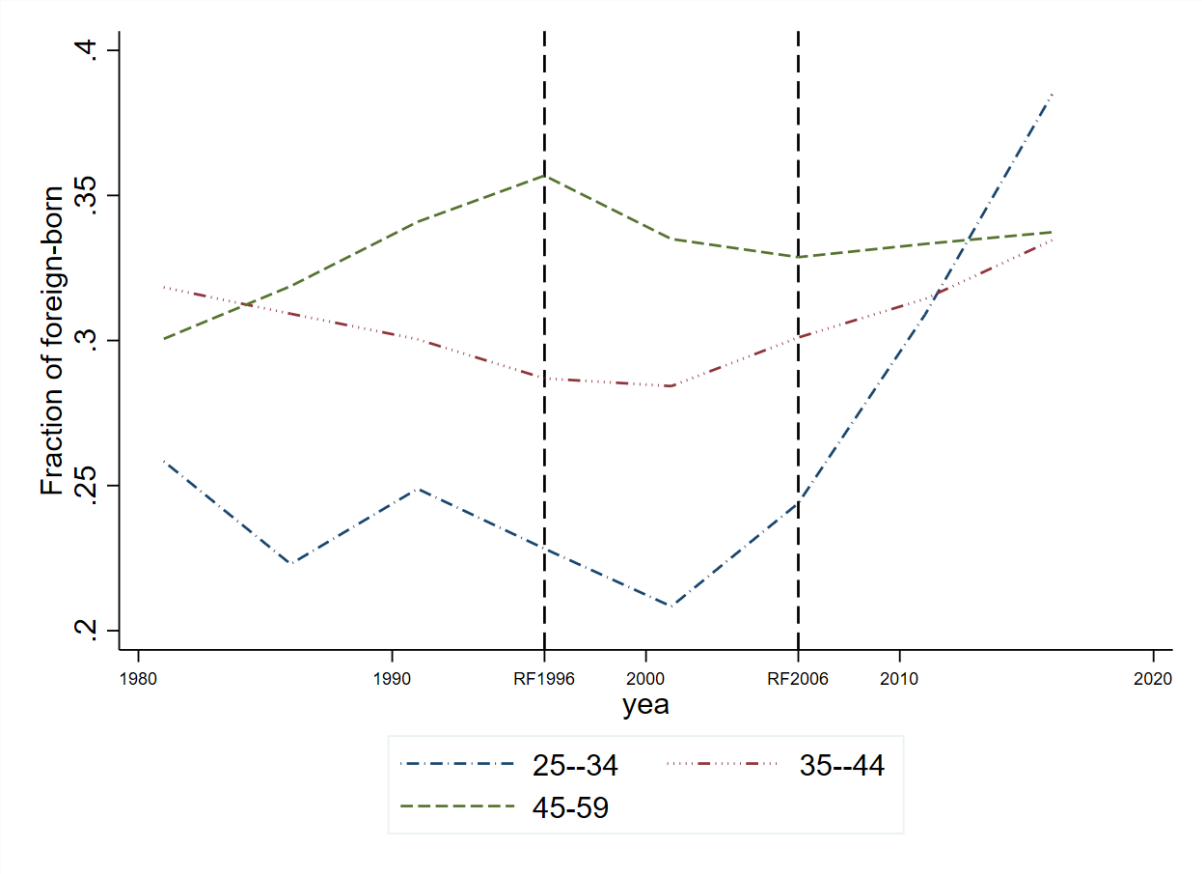

Figure 3-5: Fraction of foreign-born by age cohorts
Notes: Data are collected from census Basic Curf: 1981-2016

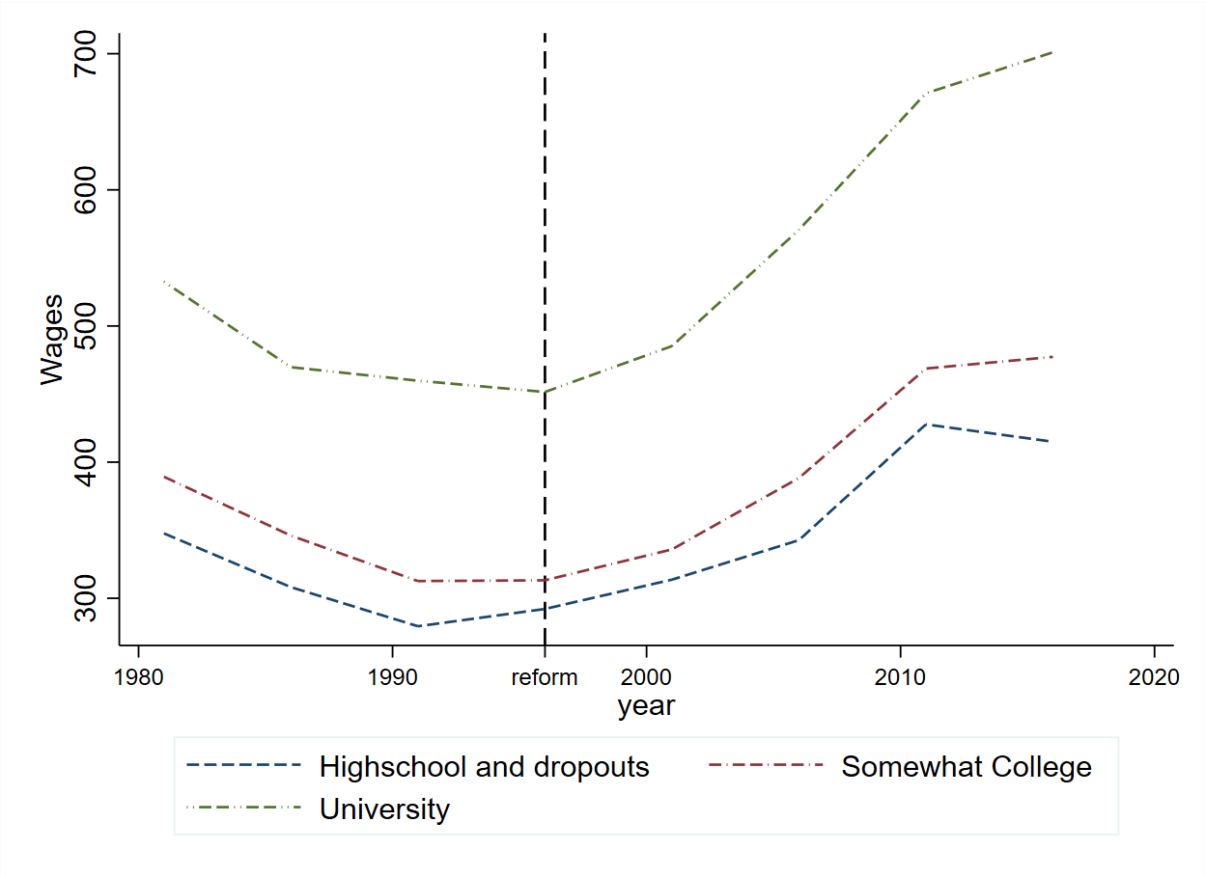

Figure 3-6: Native male workers wages and salaries
Notes: Data are collected from Survey of Income and Housing

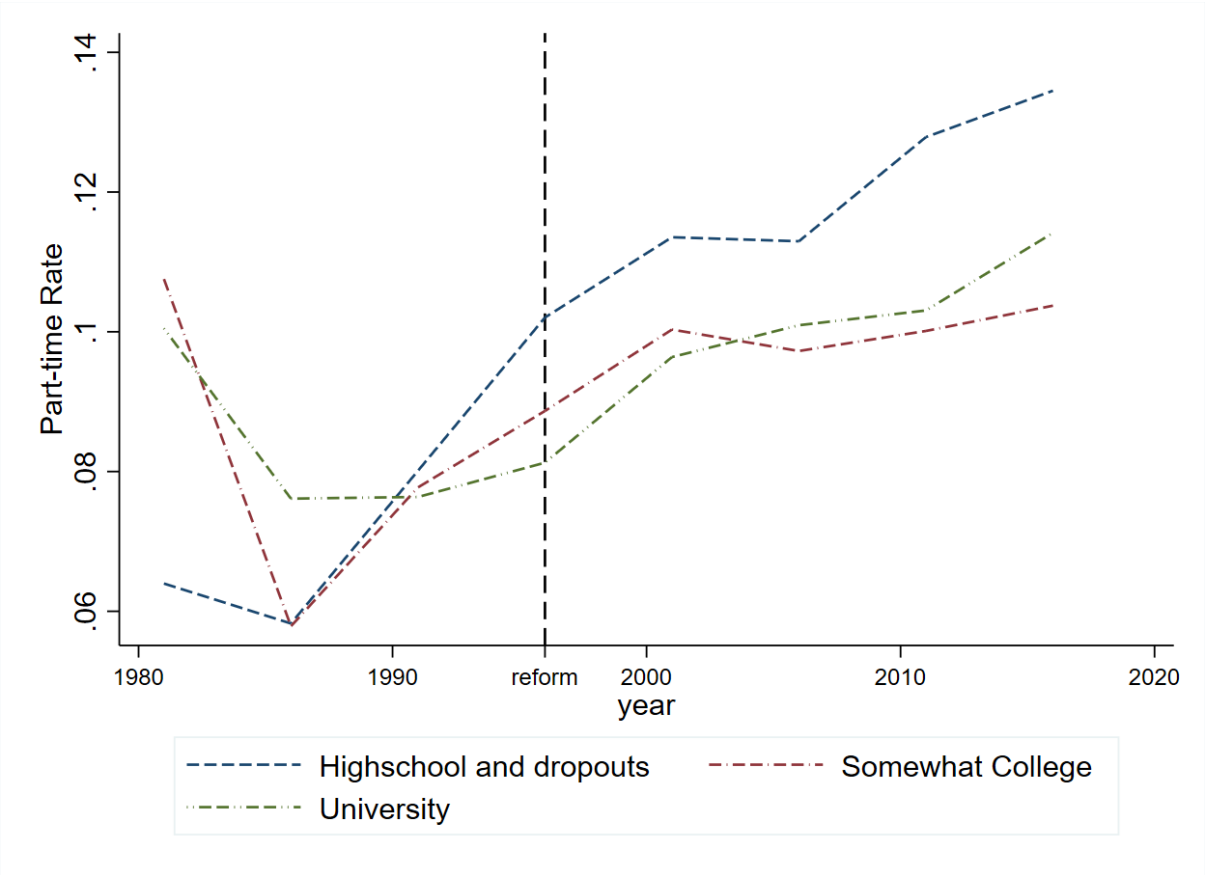

Figure 3-7: Native male workers part-time rate by education
Notes: Data are collected from census Basic Curf: 1981-2016

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Chapter 4: The impact of regional economic factors on labor mobility: evidence from Australia

4.1 INTRODUCTION

Australia has a very high internal migration rate, according to the Australian Bureau of Statistics (ABS) 2011 census, 37.7 per cent of Australians changed their usual place of residence between 2006 and 2011, and approximately 15 per cent of Australians moved from one Statistical Area Level 4[10] region to another in this time period. Most Australian cities and towns are inclusive and multi-cultural. Internal migrants have almost no cultural or social policy obstacles that hinder them moving from one place to another. In the first decade of the 21st century, the mining production States of Queensland and Western Australia have consistently recorded annual interstate migration gains from the rest of the country. Internal migrants contributed greatly to the economic growth and labor market equilibrium in terms of both economic expansions and contractions. Understanding the incentives for internal migration, therefore, informs potential policy implications on economic development and population dynamics.

In this paper, we investigate the effect of regional wages and wage growth disparities on inter-regional migration flows in Australia during the period 2006-2011. As movements

[10] Statistical Area Level 4 (SA4) is defined by Australian Bureau of Statistics, which reflects one or more whole labour markets for the release of Labour Force Survey data. See ABS website for details, http://www.abs.gov.au/websitedbs/censushome.nsf/home/factsheetsas.

within the same SA4 are mostly due to family reasons that have very limited impact on labor market, this paper focuses on migration flows between 87 SA4 in Australia from 2006-2011[11]. Earlier migration studies recognised regional disparities as the major cause of internal migration; for example, Roy (1951), Borjas (1987) considers immigration as an investment activity when explaining migration behaviours between countries. In recent decades, applied economists have typically estimated the role of regional wage and wage dispersion disparities when accounting for regional migration (see Tapia and Salanova (2017), De la Roca (2017), Borjas et al. (1992) and Collins and Wanamaker (2014)). While economic factors such as wages and wage dispersion play a crucial role in migration decisions (Andrienko & Guriev, 2004; Dao et al., 2017; Etzo, 2011; Greenaway-McGrevy & Hood, 2016; Huttunen et al., 2018; Jackman & Savouri, 1992; Kennan & Walker, 2011; McCormick, 1997; Molloy et al., 2011); non-economic factors such as weather, quality of life, and amenities are also important (see Rappaport (2007), Partridge (2010), and Zheng (2016)).

Moreover, migration behaviours are heterogeneous across different age cohorts. For example, local employment opportunities have a dominant impact on working-age migrants who care about local employment opportunities, while retirees care more about the climate and go in search of a warmer winter (see Greenwood and Hunt (1989)). In addition, Borjas et al. (1992) found that young workers in the United States were more likely to migrate if the mismatch between their skill endowments and the return paid to skills in their native place was greater. They also found that skilled workers tended to move to places with greater wage dispersion than their native place, whereas unskilled workers are more likely to move toa place with less dispersion. Chen and Rosenthal (2008) suggest that retirees seek out locations with attractive consumer amenities, while an increasing share of young people migrates towards

[11] Totally, 88 SA4 covers the whole Australia. However, due to data availability, SA4 named "Other Territories" is omitted in our study.

cities that are attractive to business. Studying migration by age groups is therefore necessary and offers more information about the importance of those economic and non-economic drivers.

Our empirical specification is adapted from the gravity model, in which migration data are collected from the total census of population and housing. One major threat to research that estimates the impact of regional wages and wage growth disparities on an inter-regional level is the reverse causality that might lead to estimation bias. To mitigate this issue, we construct a Bartik-style instrument for wages growth. In particular, wages growth is formed by interacting local industry shares and national industry wage increases (see Bartik (1991)). This index is widely used in applied economics to counter endogeneity issues, (see a survey from Goldsmith-Pinkham et al. (2018)). In our context, there are additional reasons to apply the Bartik-style instrument. First, Australia is a resource-intensive country with relatively different levels across regions. Second, the period 2006-2011 witnessed a boom in most commodities that was driven by global demand (Duncan et al., 2019). Third, trade shocks typically have a heterogeneous impact on regional labor markets and economic conditions (Caliendo et al., 2019; Helm, 2017; McCaig, 2011; McCaig & Pavcnik, 2018; Topalova, 2010), resulting in impacts on regional mobility (Dix-Carneiro & Kovak, 2017).

Our estimations show that regional wages and wage growth are important drivers for internal migration. Moreover, wage dispersion has a positive impact of young migrants' decisions, but not so for middle-aged and older migrants. In addition, we explore the importance of factors such as rainfall, remoteness and distance. The paper contributes to the literature by shedding light on the heterogeneous impact of regional wages and wage growth on the migration decisions of different age cohorts. Moreover, using the industry changes caused by the commodities boom period as an instrument for regional wage growth, we are able to mitigate the estimation bias caused by endogenous issues.

The reminder of this paper is organised as follows. Section 2 presents the context. Section 3 provides the theoretical background. Section 4 depicts the data and Bartik-style spatial wage growth index. Section 5 describes the econometric specification: the gravity model. Section 6 presents the empirical results of the gravity model and conclusions are in Section 7.

4.2 THE CONTEXT

The decline or increase in resources prices have important effect on economies that rely on natural resources. Figure 4-1 shows that prices of some Australian key export commodities have widely fluctuated from 2001 to 2016. In particular, most prices have flown up from 2005 and reached a peak at the year 2011. However, the period the five years from 2011 to 2015 witnessed a mining downturn. The commodity prices have slightly recovered since 2016. Australia is a small open economy that emphasizes on exporting natural resources. The commodity price fluctuations, therefore, have significant impact on the country's economy.

Figure 4-2 reveals the components of Australian merchandised exports. Apparently, mining exports have soared since 2005, which are consistent with the increase in the prices. This increase constitutes the main contribution to the expansion of Australian total goods and services export. Mining exports, however, have flatten from 2011 to 2015, the period that experienced the mining prices downturn, and recovered since 2016. On the opposite site, manufactured goods export has not gained much since 2009. In overall, there is a shift to natural resource exports during the commodity boom period.

As Australian experienced the structural changes in industry, some sectors have created more jobs and need more labour than other sectors. For instance, Figure VII-3 shows the employment by selected industry since 1996. To better illustrate the relative changes across industry, we normalize the values to be equal to 100 in 1996 for every industry. What is striking

in the Figure is the decline of jobs in manufacturing, meanwhile, jobs in mining sector has tripled between 2003 and 2012.

The industry changes also lead to the regional changes where some regions benefit more than other regions from the commodity boom. This leads to the heterogeneity of labour mobility across regions. Table VII-1shows the usual address of Australians at state level. What are striking in the Table is that about 40 per cent of Australians had changed their address in the five years from 2006. However, the major proportion was relocating within states. As shown, six states NSW, VIC, QLD, WA, SA and TAS recorded about 30 to 38 per cent of their population had relocated within the state. Two territories ACT and NT reported 26.5 and 23.6 per cent respectively. Interstates migration, however, appeared to be higher in ACT and NT, with respective numbers are 15.8 and 19.2 per cent. These other state's figures vary from 3 to 7 per cent. In addition,Table VII-2 shows the population growth in selected mining towns during the period 2006-2011. Mining towns such as Karratha (Western Australia), Roxby Downs (South Austraila) and Newman (Western Australia) experienced a solid population growth with more than 7 per cent a year. In the next section, we discuss the theoretical background behind this population dynamics.

4.3 THEORETICAL BACKGROUND

The theoretical underpinnings of this research are based on the Roy-Borjas model; Building on the work of Roy (1951) and Sjaastad (1962), Borjas (1987, 1999) which produced an income selection model explaining why people migrate from one place to another. The model considers immigration as an investment activity. There are two regions: the origin region (0) and the destination region (1). Individual earnings can be broken down into an observed part (ζ_j) and an unobserved part (ε_j), where j =0 represents the home country and j =1 the host:

$$\ln(w_0) = \zeta_0 + \varepsilon_0 \tag{2.1}$$

$$\ln(w_1) = \zeta_1 + \varepsilon_1 \ . \tag{2.2}$$

Based on the work of Parey et al. (2015), we assume the earnings' vector ($\zeta_0, \zeta_1, \varepsilon_0, \varepsilon_1$) is normally distributed with means ($\varphi_0, \varphi_1, , 0, 0$) and variances ($\sigma_{\zeta_0}{}^2, \sigma_{\zeta_1}{}^2, \sigma_{\varepsilon_0}{}^2, \sigma_{\varepsilon_1}{}^2$). The base wage of the population at origin and destination are given by φ_0 and φ_1, respectively. Meanwhile, $\sigma_{\zeta_0}{}^2$ and $\sigma_{\zeta_1}{}^2$ are the respective variances, and the correlation is denoted ρ_ζ.

Assuming that individuals are rational, they will make the decision to migrate to a different region if the wage in that region, net of mobility cost (MC), is greater than the wage in their original place. In other words, residents will migrate if the sign of the index function is positive.

$$I = \ln\left(\frac{w_1}{w_0+MC}\right) \approx (\zeta_1 - \zeta_0 - \mathrm{MC}/w_0) + (\varepsilon_1 - \varepsilon_0) > 0. \tag{2.3}$$

Let $\tau = \frac{MC}{w_0}$ be migration costs in time equivalent units, and let $v = (\zeta_1 + \varepsilon_1) - (\zeta_0 + \varepsilon_0)$ be wage disparity between the two regions that has disturbance $\sigma_v{}^2$; the emigration rate can be represented as:

$$P = \Pr\big((\varepsilon_1 - \varepsilon_0) > -(\zeta_1 - \zeta_0 - \tau)\big) = 1 - \Phi\left(-\frac{(\varphi_1 - \varphi_0 - \tau)}{\sigma_v}\right) = 1 - \Phi(Z), \tag{2.4}$$

where $Z = \left(-\frac{\varphi_1 - \varphi_0 - \tau}{\sigma_v}\right)$ and Φ is the standard normal distribution function. It could be interpreted that the emigration rate would be a function of migration cost, and base wages of destination and origin regions. Borjas (1987) shows that the earnings of migrants differs from base wages at home and abroad as follows:

$$E(\zeta_0|\mathrm{I}>0) = E(\zeta_0|((\zeta_1 + \varepsilon_1) > (\zeta_0 + \varepsilon_0 + \tau))$$

$$= \varphi_0 + \frac{\sigma_{\zeta_0}\sigma_{\zeta_1}}{\sigma_v}\left(\rho_\zeta - \frac{\sigma_{\zeta_0}}{\sigma_{\zeta_1}}\right)\frac{\phi(Z)}{1-\Phi(Z)} \tag{2.5}$$

$$E(\zeta_1|\mathrm{I}>0) = E(\zeta_1|((\zeta_1 + \varepsilon_1) > (\zeta_0 + \varepsilon_0 + \tau))$$

$$= \varphi_1 + \frac{\sigma_{\zeta_0}\sigma_{\zeta_1}}{\sigma_v}\left(\frac{\sigma_{\zeta_1}}{\sigma_{\zeta_0}} - \rho_\zeta\right)\frac{\phi(Z)}{1-\Phi(Z)}, \tag{2.6}$$

where $\lambda(z) = \frac{\phi(Z)}{1-\Phi(Z)}$ is the inverse Mills ratio, and $\phi(Z)$ is density function. Obviously, the theoretical model indicates two main factors that affect migration decision: base wages and wage dispersions.

4.4 DATA AND DESCRIPTIVE STATISTICS

Our main internal migration data were taken from the Census of Population and Housing 2011 provided by the Australian Bureau of Statistics. We define matrix M with its rows representing original SA4 units and the columns for destinations of migration flows. The $(\mathrm{i}, \mathrm{j})^{\mathrm{th}}$ element $M_{ij}$is the number of migrants moved from region i to region j and the diagonal elements are residents who stayed in the same region during 2006-2011. Pooling all non-diagonal elements together, we have 7,482 observations.

Table VII-3 show the distribution of migration flows between two SA4. The first Collumn indicates five quintiles of the scale of internal migration flows between 2 SA4 regions: 0 migrants, 1 to 15, 16 to 50, 51 to 500, and over 501 migrants between two regions. We decompose migration flows of three age cohorts: 20 to 34 years old, 35 to 54 years old; and greater or equal to 55 years old. Apparently, young (from 20 to 34 years old) and middle (from 35 to 54 years old) aged cohorts share similar patterns. The scales of migration flows vary, but intensify from 16 to 500 migrants, with more than 65 per cent. The proportions of observations with zero values in these two groups are small, accounting for 4 and 5 per cent respectively. By contrast, the older age cohort are less mobility, with approximately 56 per cent of migration flows distributed in the bracket 0 to 15 migrants.

Data on regional disparities are collected from several sources. We utilized the Household, Income and Labour Dynamics in Australia (HILDA) survey to construct the regional wage index, the regional wage dispersion index, and the regional wage growth index.

The HILDA is a longitudinal representative dataset including 17 waves, with wave 1 conducted in 2001. Those respondents continued to be surveyed in subsequent waves. The survey has been continuously expanded to take into account changes in household composition.

One threat to our empirical identification strategy is that migrants might impact on the wage equilibrium leading to the reversed causality problem. To mitigate this issue, we used HILDA Wave 2006 to construct regional wages and regional wage dispersions. Moreover, used Wave 2006 and Wave 2011 to construct a Bartik style instrument for regional wage growth as follows:

$$\Delta W_{r,06-11} = W_{r,2011} - W_{r,2006} = \sum_{s} \mu_{sr,2006}(W_{S,2011} - W_{S,2006})$$

Where μ_{sr} the fraction working age people is employed in sector s in region r in the year 2006. Due to the purpose of our research, we restricted the sample to working-age individuals (from 18 to 64), who were employed full-time. We used gross financial year wages and salaries to measure individual earnings.

As mentioned earlier in the introduction of this paper, The Bartik instrument is widely used in applied economics to counter endogeneity issues, (see a survey from Goldsmith-Pinkham et al. (2018)). Recent research by Jaeger et al. (2018) argues that the Bartik style instrument might expose to the risk of bias from dynamics adjustments to the past shocks. Moreover, Goldsmith-Pinkham et al. (2018) points out the central threat to the identification is the Bartik-Style instrument might violate the exclusion assumptions. As shown in the (ABS Cat 3412, 2017), internal migration to WA are in parralell trend with other states prior to the boom. This helps us mitigating the critques given in the two mentioned papers. Moreover, during the period 2006-2011, the Australian economy has experienced a significant change in its regional and national industry structure, and this change was caused by an exogenous shock in commodity prices. Therefore, it is reasonable to apply the Bartik instrument for regional wage changes in our research. For example, Figure 1 illustrates the association between the

Index of Commodity Price (ICP) and average wages across Australian states. The ICP (RBA ICP, 2016) is created by the Reserve Bank of Australia's (RBA) and is the weighted arithmetic mean of recent variations in commodity prices, where the input to the ICP given to each commodity takes into account its contribution to the total commodity export values in a base period. Currently, those commodities are rural commodities (wool, beef and veal, wheat, barley, canola, sugar, cotton, lamb and mutton), base metals (aluminium, lead, copper, zinc, nickel), bulk commodities (iron ore, metallurgical coal, thermal coal), other resources (LNG, crude oil, alumina, gold, copper ore). The base-period is regularly updated by the RBA. In the latest update (2016), the 2014/15 average takes a value of 100. It does appear to show that the Index of Commodity Prices (ICP) quadrupled from 2001 to 2011, reaching its peak at 155 points. This coincided with earnings in Western Australia rocketing, making it the highest paying State in 2011 (from third in 2001). New South Wales, Victoria, and South Australia have seen similar changes in average earnings, while in Queensland these have increased slightly faster. We noted that Western Australia and Queensland are the two most resource-intensive states. Figure 2 illustrates the Bartik index for regional wage growth from 2006-2011. Obviously, there are heterogeneities across regions. This is in line with previous literature on trade shocks. Typically, trade shocks usually have a heterogeneous impact on the regional labor market and economic conditions (Caliendo et al., 2019; Helm, 2017; McCaig, 2011; McCaig & Pavcnik, 2018; Topalova, 2010), resulting in an impact on regional mobility (Dix-Carneiro & Kovak, 2017).

The expected future income at the migration destination depends not only on the average income level but also the risk of being outside the realm of expectations. To capture this risk, we defined wage dispersion as the coefficient of variation in income, the ratio of standard deviation and the mean of weekly income calculated from the HILDA Wave 20006. Inspired by Groshen (1991), we summed up the variances within and between industries to

calculate the standard deviation. High wage dispersion implies wide salary scale range within an industry and big difference in average wage between industries.

In addition, rainfall data were sourced from the Climate data online, http://www.bom.gov.au/climate/data/. For large SA4 areas, rainfall record from the nearest bureau station to the population centroid was collected. Distance data was calculated based on longitude and latitude which were collected from ABS Cat 1270.0.55.001 - Australian Statistical Geography Standard (ASGS). The remoteness index was sourced from the ABS cat. no. 1270.0.55.005. Table 4 shows descriptive statistics of our wage variables of interest and additional controls.

4.5 ECONOMETRIC SPECIFICATION

Our empirical identification strategy is based on the gravity model (Anderson, 2011; Anderson & Van Wincoop, 2003; Bergstrand & Egger, 2013; Ravenstein, 1885). The gravity model usually takes the following form:

$$\ln M_{ij} = \alpha_0 + \alpha_1 P_{i,2006} + \alpha_2 P_{j,2006} + \tau . d_{ij} + \sum_k \beta_{ik} X_{ki} + \sum_k \beta_{ik} X_{kj} + \varepsilon_{ij} \quad (3.1)$$

where M_{ij} is the number of migrants moved from region i to region j. It is natural to assume that the determinants of migration vary with age. Young adults migrate for job opportunities in big cities and retirees move for a desirable lifestyle. To have a better understanding of Australian internal migration, the life cycles of three age groups are studied separately: 20-34 years old, 35-54 years old, 55 years old and above. The expected migration flow depends on the ability of the origin to send out migrants and the attractiveness of destination, and is inversely related to the distance, which represents the moving cost for prospective migrants. Therefore, we include in the model the distance between two regions: d_{ij}. $P_{i,2006}$ and $P_{i,2006}$ denote the population size of region i and j in 2006. The demographic equivalent of the

attractive "mass" is population size, which indicates the size of local labor market and family connections. α_0, α_1 , α_2 and λ are coefficients to fit observed data. In more recent migration studies, these coefficients are estimated as constants that are flexible and mainly on the pragmatic grounds that fit observed data better. Migration flows between i and j are asymmetric, and populations and distance alone are inadequate to fully explain the determinants. Regional factors such as average wages and living costs were embraced to explain aggregated level migration. Hence, we added X_i and X_j, which represent region-based characteristics. Our key variables of interest were regional wages, wage dispersion, and wage growth. Moreover, we added other controls such as: mortgage, rainfall, and remoteness.

One problem with the equation (3.1) is that the selection of explanatory variables can be very sensitive with large standard errors. Model (3.1) may also have a serious collinearity problem (see Cheng and Wall (2005)). To avoid an overfitting regression model, We use the differences in the respective variables between two regions. At an aggregated level, if region i offers better amenity/non-economic factors or economic factors than region j does, more people are expected to move out from region j to region i, and vice versa. At the micro-level, a migration decision is made to improve the utility based on a comparison of native place and destination. That is, the difference between two places matters the most. Therefore, model (3.1) can be simplified to:

$$\ln M_{ij} = \alpha_0 + \alpha_1 P_{i,2006} + \alpha_2 P_{j,2006} + \tau . d_{ij} + \sum_k \beta_k (X_{ki} - X_{kj}) + \varepsilon_{ij} \quad (3.2)$$

where we impose a restriction $\beta_{1k} = -\beta_{2k}$. This implies that the vector of explanatory factors, X_k , has the same marginal effect on migrant's utility no matter where he/she inhabits. If two regions offer the same level of factor X_k, this factor is not a driver of migration flow between the two regions. A positive estimate of β_k means that factor X_k is an attractive attribute and a higher value of X_k is desirable, and a negative estimate indicates a push factor. For the

extended gravity model in migration studies, see Ravenstein (1885), Lewer and Van den Berg (2008), Ortega and Peri (2009), Anderson (2011), Beine et al. (2016), and Beine and Coulombe (2018).

A few issues with the gravity model estimation have raised a wide level of interest in the literature. The log transformation ignores all observations with zero values, and the normality assumption of disturbance term in estimations violates the range of the dependent variables. Migration numbers can only be integers or zero between some regions in a given period. Anderson and Van Wincoop (2003) and Anderson and Van Wincoop (2004) suggested using size-adjusted dependent variables to avoid heteroscedasticity resulted from omitted variable bias. Silva and Tenreyro (2006) have found that inconsistent estimates are obtained by a maximum likelihood estimation if heteroskedasticity is present in the data. To fix this issue, they proposed using a Poisson Pseudo-Maximum-Likelihood (PPML) estimation to estimate the gravity equation in multiplicative form. Liu and Shen (2014) indicate that Negative Binomial distribution outperforms Poisson distribution in their study of internal migration data in China. The reason is that the Poisson model is subject to the restriction that the conditional variance of the dependent variable should be close to its conditional mean and their data exhibit over-dispersion. Figure 3 shows the distribution of the size of interregional migration flows. As can be seen, the distribution skews to the left, and similar to the patterns of Poisson distribution. We, therefore, utilise the PPML estimation as our baseline, then we compare with the results from the Negative Binomial estimation.

The PPML estimation considers M_{ij} following the Poisson distribution:

$$\Pr\left(M_{ij} = m\right) = \frac{\exp\left(-\mu_{ij}\right)\mu_{ij}^{m}}{m!}, \quad \text{for } M_{ij} = 0,1,\ldots, \text{ i, j=1,…,R, and i} \neq \text{j.}$$

The conditional mean μ_{ij} is then modelled by an exponential function of explanatory variables given as:

$$\ln \mu_{ij} = \alpha_0 + \alpha_1 P_{i,2006} + \alpha_2 P_{j,2006} + \tau . d_{ij} + \sum_k \beta_k (X_{ki} - X_{kj}) + \varepsilon_{ij}$$

If M_{ij} follows negative binomial distribution, it gives:

$$\Pr(M_{ij} = m) = \frac{\Gamma(m + \alpha^{-1})}{m!\Gamma(\alpha^{-1})} \left(\frac{\alpha^{-1}}{\alpha^{-1} + \mu_{ij}} \right)^{\alpha^{-1}} \left(\frac{\mu_{ij}}{\alpha^{-1} + \mu_{ij}} \right)^{m},$$

where Γ denotes the standard gamma function and α is a parameter of dispersion. When α is approximately zero, negative binomial regression reduces to a Poisson regression.

4.6 RESULTS

Table 2 presents the results from the Poisson regressions. Obviously, economic factors such as wages, wage growth and wage dispersion have a strong influence on the decision to migrate. In particular, every one per cent wage difference leads to 2.8 per cent and 8.2 per cent larger migration flows of those who are aged from 35 to 54, and 55 and above, respectively. This result is consistent with theory predictions and previous empirical studies such as Grogger and Hanson (2011). However, wage difference alone does not explain the migration decisions of young Australians. Interestingly, wage dispersion is a significant driver for this age cohort, but not a significant driver for the others. One possible explanation is the increase in part-time and/or low-paid jobs. Wide wage range implies the possibility of low-paid and high-paid job opportunities. Workers at the bottom levels of the payroll are mainly low-skilled workers such as service workers and other types of labor workers. Young workers with limited or no working experience are not competitive enough for high-paid jobs and might have to accept low-paid positions, so places with greater disparity and inequality are their preferences.

More importantly, regional wage growth has a strong positive impact on the migration decisions of all age-cohorts. The estimations show that each one per cent increase in regional wage growth disparity causes 0.42 and 0.41 per cent expansions of migration flows of young

and middle-age Australians, correspondingly. The magnitude for the coefficient of the older age-cohort is even more profound (0.8 per cent). All estimations are statistically important at 1 per cent level. This suggests the fact that regions with better growth are more attractive to migrants.

Distance has a significant negative effect on migration for all three age groups. This is in line with the prediction of Borjas (1987) on the role of migration cost in the migration function. As the gravity source, population is a significant driver of migration as well. The larger the population size, the more migrants move in and out. Among three age cohorts, retirees left regions with larger population most often, while young migrants were affected the least. On the contrary, destinations with larger population attracted all age cohorts at the same level.

Housing cost has a negative impact on migration decisions. In particular, the scale of migration flows will decline by approximately 0.3 to 0.4 per cent in response to each 1 per cent increase in mortgages. Monthly rainfall is not significant for mid-aged migrants. However, more rainfall as an indicator of a worse climate has a negative impact on retirees' migration decisions. Rainfall also has a moderate negative effect on young migrants' migration decisions. Furthermore, Australians tend to move out of remote regions. Table 3 reports the results from Negative Binominal regressions. The results are actually the same as demonstrated in Table 2 (see Section 4 for reasons). In general, we show that economic factors play an important role in migration decisions.

4.7 CONCLUDING REMARKS

Using administrative data on migration flows, this paper has investigated the role of economic factors on the internal migration of Australians during the commodity boom period. We show that regional wages and wage growth had a strong impact on migration decisions, while regional wage dispersions affected young migrants' decisions. Decomposition to age cohorts,

however, shows different levels of impact. To address the endogenous concerns, we have built a Bartik style instrument to measure regional wage growth. The commodity boom has created heterogeneous industry changes across regions, leading to the heterogeneity in regional wage growth. That provides us with an interesting opportunity to mitigate endogeneity concerns. In addition, we find that other factors such as population size, rainfall, housing price and distance also play important roles.

4.8 FIGURES AND TABLES

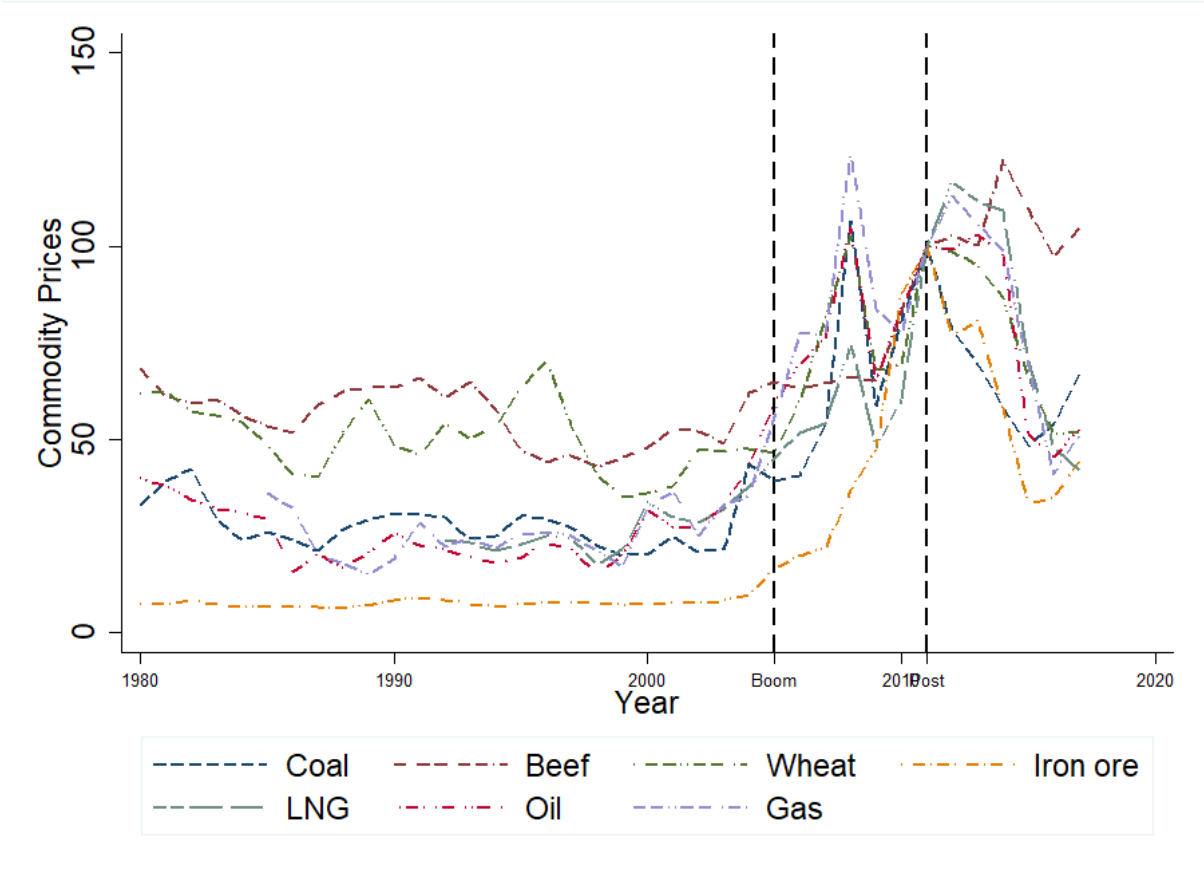

Figure 4-1: Prices of Australia key commodity export
Notes: Data are sourced from IMF commodity prices (IMF, 2019)

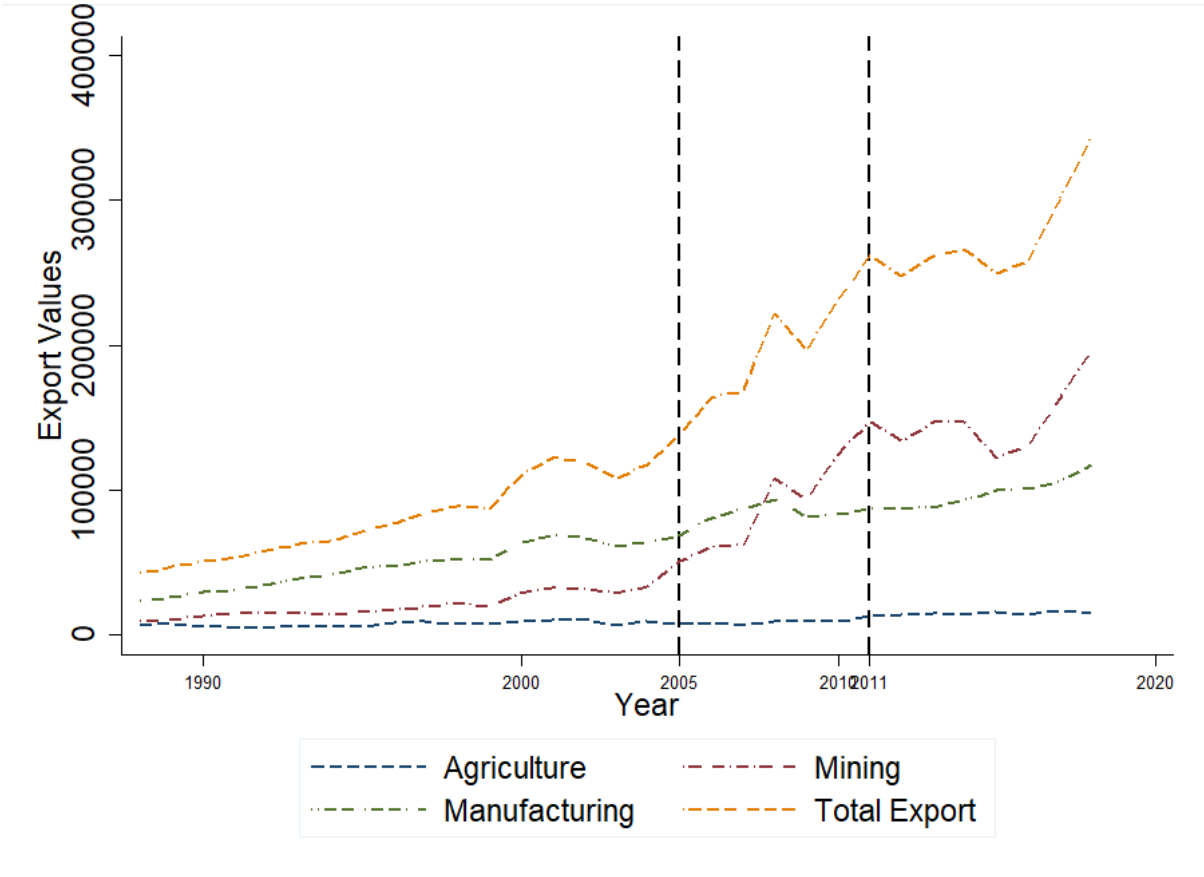

Figure 4-2: Selected merchandized exports
Notes: Data are sourced from the ABS Cat. No. 5368.0: (ABS Cat 5368, 2019)

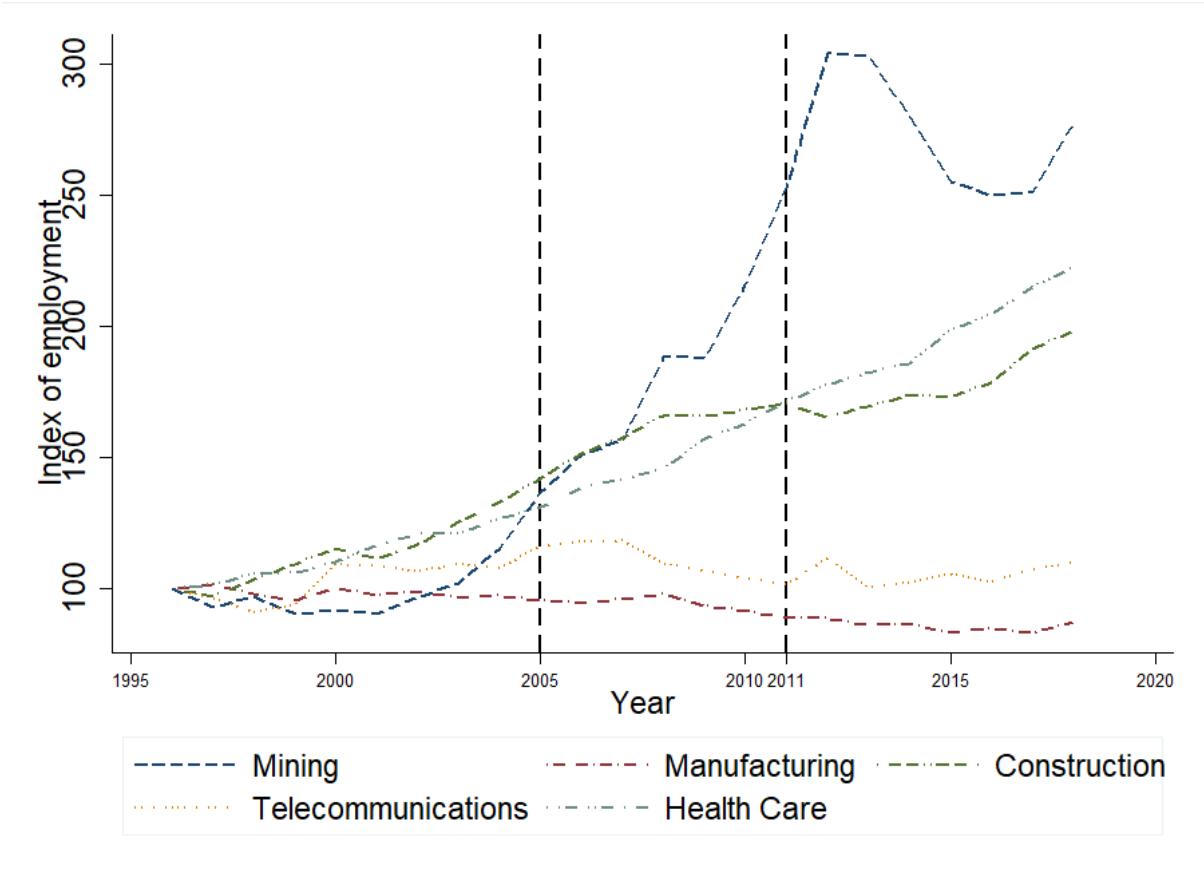

Figure 4-3: Employment by selected industries
Notes: Data are sourced from ABS Cat. No. 6291 (ABS Cat 6291, 2019)

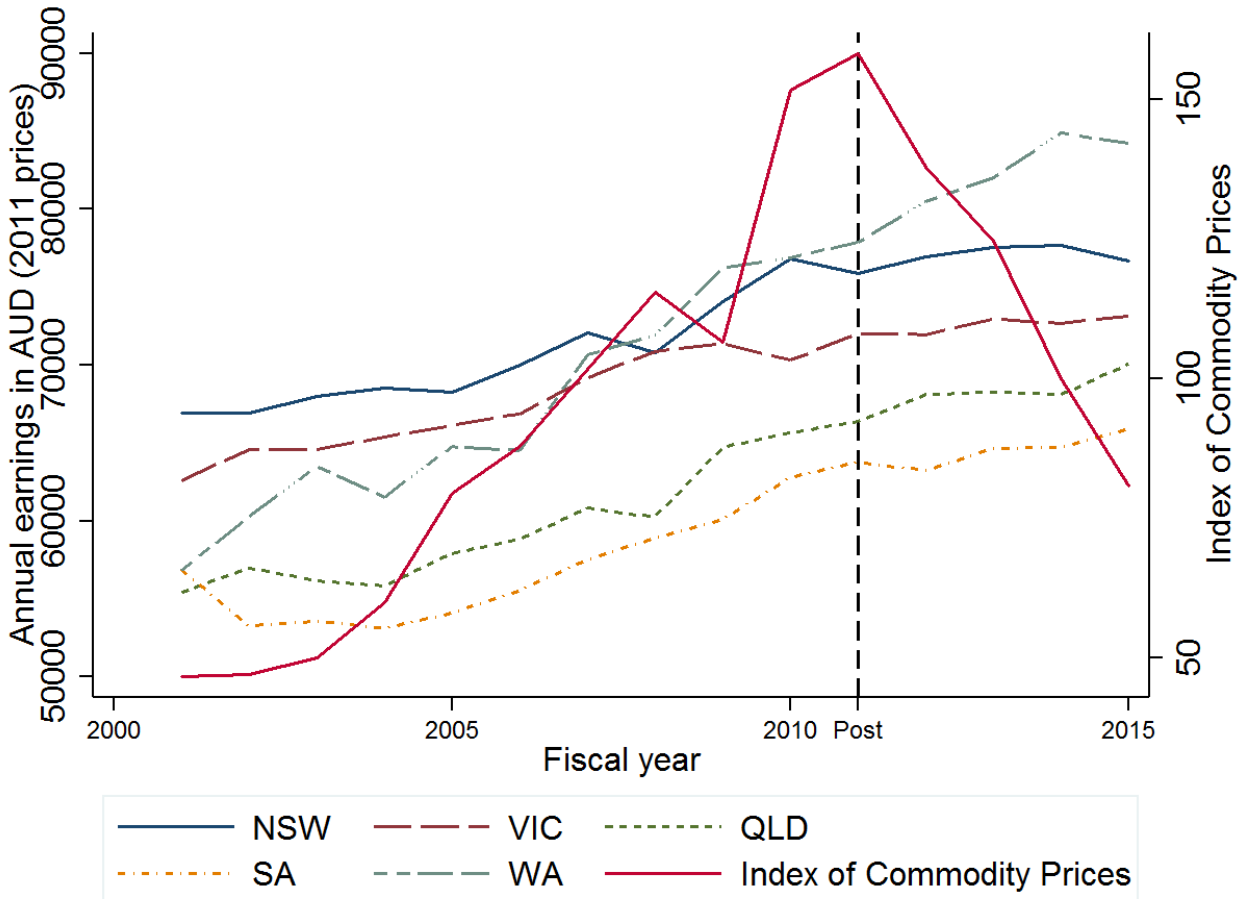

Figure 4-4: ICP and annual average earnings by state.
Notes: The data for earnings and ICP are sourced from the HILDA survey and ICP,

respectively.

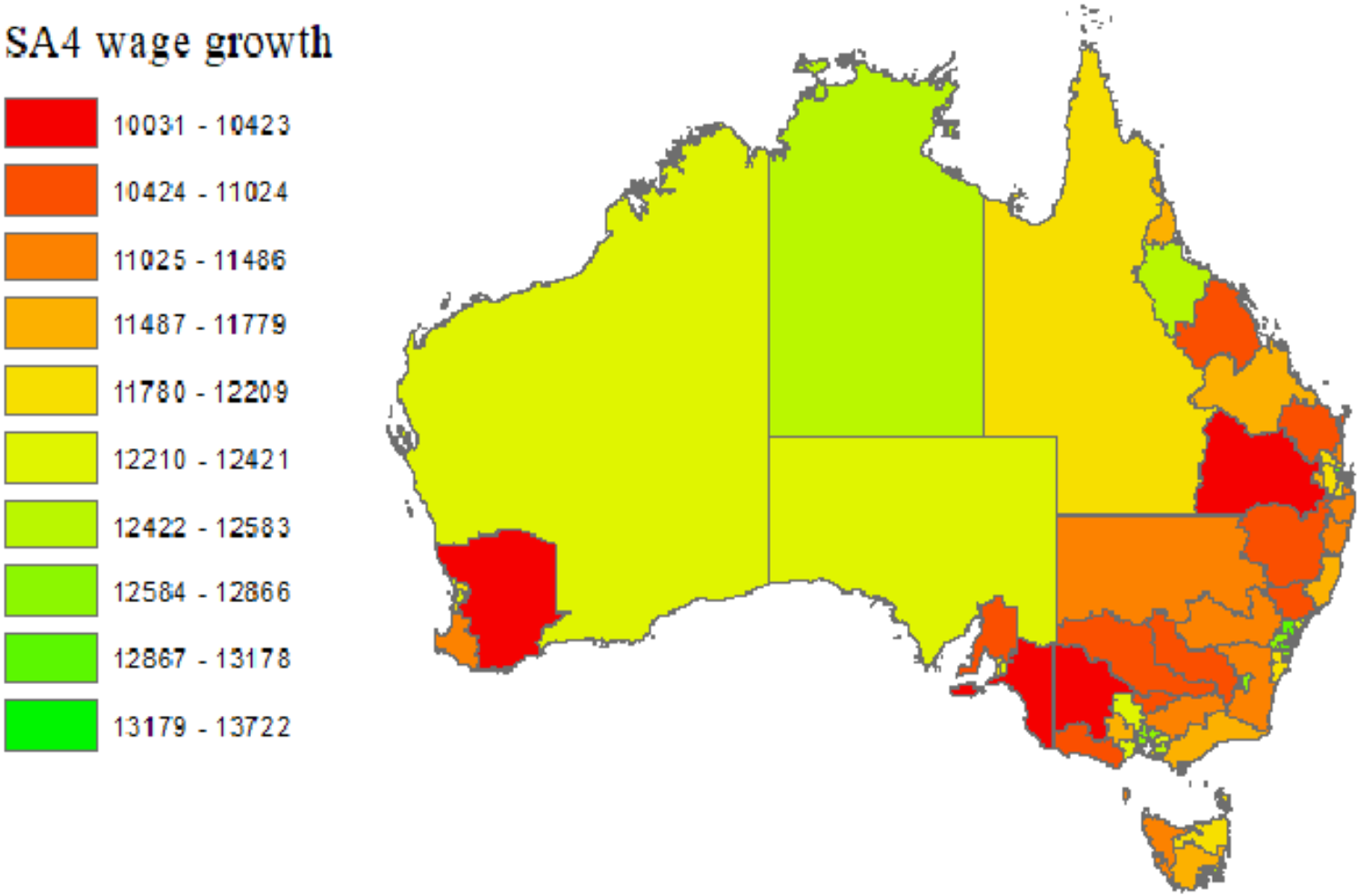

Figure 4-5: SA4 wages growth
Notes: Data are sourced from the HILDA survey and ABS 2006 census.

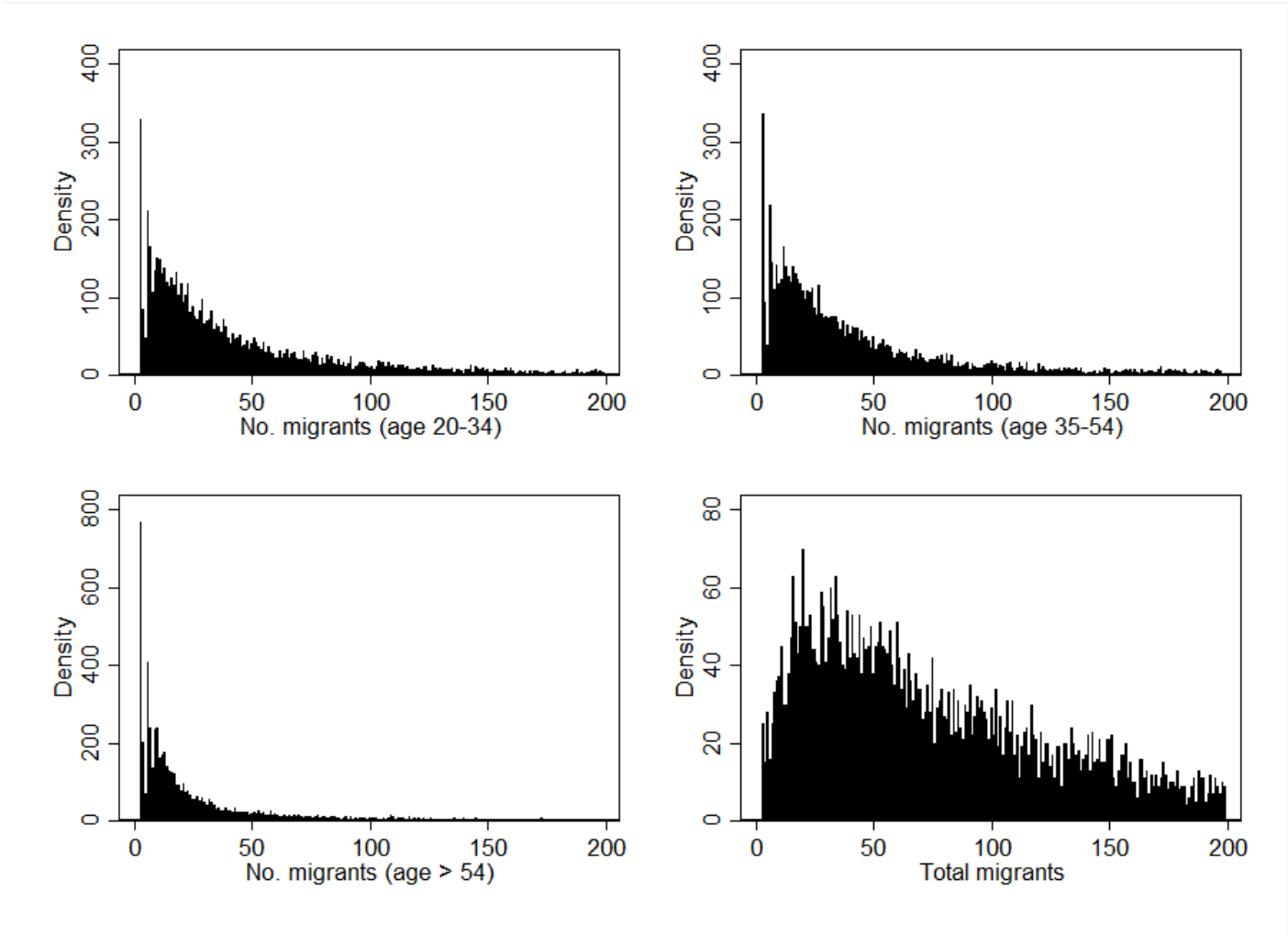

Figure 4-6: Frequency of bilateral SA4 migration flows

Table 4-1: Internal migration in Australia 2006-2011

Usual Address Five Years Ago	Same as in 2011		Elsewhere - same state		Elsewhere - different state	
	No. persons	percentage	No. persons	percentage	No. persons	percentage
New South Wales	4058016.1	63.92%	2091127.7	32.94%	199063.4	3.14%
Victoria	3088735.8	63.86%	1589226.9	32.86%	158177.9	3.27%
Queensland	2161796.4	55.35%	1495853.7	38.30%	248032	6.35%
South Australia	948219.7	64.93%	457275.5	31.31%	54652.9	3.74%
Western Australia	1165510.1	58.52%	733655.2	36.83%	92463.5	4.64%
Tasmania	289221	61.98%	142579.2	30.55%	34871	7.47%
Northern Territory	113672.1	57.22%	46875.6	23.60%	38115.1	19.19%
Australian Capital Territory	183999.5	57.77%	84234	26.45%	50257.9	15.78%

Table 4-2: population growth in selected mining towns from 2006 to 2011

Mining towns	8-Aug-06 No. of residents	9-Aug-11 No. of residents	Average annual increase (per cent)
Karratha (WA)	13,257	20,061	8.6
Roxby Downs (SA)	4,037	5,817	7.6
Newman (WA)	4,746	6,761	7.3
Moranbah (Qld)	8,258	10,439	4.8
Port Hedland (WA)	12,912	16,054	4.5
Weipa (Qld)	3,140	3,823	4
Middlemount (Qld)	2,530	3,067	3.9
Emerald (Qld)	11,471	13,644	3.5
Clermont (Qld)	1,991	2,359	3.5
Dysart (Qld)	3,625	4,284	3.4
Australia	20,061,648	21,727,160	1.6

Notes: Table is adapted from ABS Cat. No. 4102 (ABS Cat 4102, 2019)

Table 4-3: Summary statistics of internal migration flows

No. migrants	Age 20-34		Age 35-54		Age 55 and above	
	No. observations	Percentiles	No. observations	Percentiles	No. observations	Percentiles
0	294	3.93	386	5.16	1,143	15.28
1 to 15	1,879	25.11	1877	25.09	3083	41.21
16 to 50	2,547	34.04	2729	36.47	1757	23.48
51 to 500	2,384	31.86	2200	29.40	1325	17.71
501 and above	378	5.05	290	3.88	174	2.33

Source: ABS 2011 census.

Table 4-4: Summary statistics of main independent variables

Variables	No	Mean	Variation	Standard deviation	Min	Max
Log Wage_d - Log Wage_o	7482	0.250027	0.001911	0.043715	0.174987	0.424115
WageSD_d - WageSD_o	7482	0	0.048597	0.220448	-0.73876	0.738761
WageGrowth_d - WageGrowth_o	7482	0	0.010708	0.10348	-0.31329	0.313295
Log distance	7482	6.728428	1.436374	1.198488	1.655052	8.222165
Log distance square	7482	46.70793	203.945	14.28093	2.739197	67.604
Log population 2006 - Destination	7482	12.22963	0.266454	0.516192	10.42656	13.27791
Log population 2006 - Origin	7482	12.22963	0.266454	0.516192	10.42656	13.27791
Mortgage_d - Mortgage_o	7482	0	0.113003	0.336159	-0.95594	0.955937
Rainfall_d - Rainfall_o	7482	0	0.257728	0.507669	-1.7658	1.7658
Remoteness_d - Remoteness_o	7482	0	0.4347	0.659318	-1.51662	1.516615

Table 4-5: Driver of interregional migration flows 2006-2011: Poisson estimation

	log_mig2034	log_mig3554	log_mig55
	(1)	(2)	(3)
$WAGE_D - WAGE_O$	-1.0093***	-0.5914***	0.6168***
	(0.000)	(0.002)	(0.006)
$WAGESD_D - WAGESD_O$	0.0250	0.0038	0.0104
	(0.437)	(0.908)	(0.785)
$\Delta WAGE_D - \Delta WAGE_O$	0.1447	0.0227	-0.0525
	(0.178)	(0.835)	(0.677)
Log distance	-0.1008***	-0.1868***	-0.0701*
	(0.002)	(0.000)	(0.061)
Log distance square	-0.0073**	0.0011	-0.0137***
	(0.014)	(0.714)	(0.000)
Log population 2006 - Destination	0.1777***	0.1318***	0.0773***
	(0.000)	(0.000)	(0.000)
Log population 2006 - Origin	0.1409***	0.1290***	0.0774***
	(0.000)	(0.000)	(0.000)
$\text{Mortgage}_D - \text{Mortgage}_D$	-0.1221***	-0.2937***	-0.2527***
	(0.005)	(0.000)	(0.000)
$\text{Rainfall}_D - \text{Rainfall}_O$	-0.0203	0.0369**	0.0434**
	(0.203)	(0.023)	(0.018)
$\text{Remoteness}_D - \text{Remoteness}_O$	-0.0402**	-0.0752***	-0.0703***
	(0.020)	(0.000)	(0.001)
Constant	-1.4752***	-0.7044**	0.0143
	(0.000)	(0.011)	(0.964)

Destination State Fixed Effects	Yes	Yes	Yes
N	7188	7096	6339
Pseudo R^2	0.081	0.068	0.082

Notes: *** p<0.01, ** p<0.05, *p<0.1. Standard errors are in parentheses. Dependent variable is in log form.

Table 4-6: Driver of interregional migration flows 2006-2011: Negative Binomial estimation

	log_mig2034	log_mig3554	log_mig55
	(1)	(2)	(3)
$WAGE_D - WAGE_O$	-1.0093***	-0.5914***	0.6168***
	(0.000)	(0.002)	(0.006)
$WAGESD_D - WAGESD_O$	0.0250	0.0038	0.0104
	(0.437)	(0.908)	(0.785)
$\Delta WAGE_D - \Delta WAGE_O$	0.1447	0.0227	-0.0525
	(0.178)	(0.835)	(0.677)
Log distance	-0.1008***	-0.1868***	-0.0701*
	(0.002)	(0.000)	(0.061)
Log distance square	-0.0073**	0.0011	-0.0137***
	(0.014)	(0.714)	(0.000)
Log population 2006 - Destination	0.1777***	0.1318***	0.0773***
	(0.000)	(0.000)	(0.000)
Log population 2006 - Origin	0.1409***	0.1290***	0.0774***
	(0.000)	(0.000)	(0.000)
$\text{Mortgage}_D - \text{Mortgage}_D$	-0.1221***	-0.2937***	-0.2527***
	(0.005)	(0.000)	(0.000)
$\text{Rainfall}_D - \text{Rainfall}_O$	-0.0203	0.0369**	0.0434**
	(0.203)	(0.023)	(0.018)
$\text{Remoteness}_D - \text{Remoteness}_O$	-0.0402**	-0.0752***	-0.0703***

	(0.020)	(0.000)	(0.001)
Constant	-1.4752***	-0.7044**	0.0143
	(0.000)	(0.011)	(0.964)
Destination State Fixed Effects	Yes	Yes	Yes
N	7188	7096	6339
Pseudo R^2	0.081	0.068	0.082

Notes: *** p<0.01, ** p<0.05, *p<0.1. Standard errors are in parentheses. Dependent variable is in log form.

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Chapter 5: Concluding Remarks

Migration issues are a persistent subject of interest. However, the rise of migration flows in recent decades have made this topic to be more topical so now than ever given the prevailing academic, public and political debates. For that reason, it is no surprised that migration has been a growing subject of interest to economists. A wide range of questions have been studied including but not limited to labor market impact of immigration, the assimilation of immigrants, the contribution of immigrants to bilateral trade, innovation and productivity, and labor flows within a country. It is apparent, however, that a large number of important questions are yet to be addressed. Moreover, empirical estimations are inconclusive and controversies have emerged on methods and findings. Not only the remaining issues but also the conflicts in previous empirical studies require further work on this topic. This thesis has provided contribution to the literature in three important areas: the role of immigration policy in matching immigrants with regions with labour shortages; the wage impacts of high-skilled immigration and the heterogeneity in adjustments across different skill groups of natives in response to inflow of immigrants; and the drivers of geographic labor mobility within a country. I have provided evidence based on the context of Australia, an advanced small open economy with high share of immigrant population and prevalence of internal migration.

More specifically, in Chapter 2, I showed that immigration policy plays an important role in shaping the allocation of immigrants. A key problem in immigrant-receiving economies is how to distribute immigrants to regions that need them. To

achieve this objective and enhance the net gain from immigrants, immigrant-receiving countries adopt selective immigration policies to select potential candidates. However, the extent to how immigration policies can shape the distribution of immigrants in response to labor market changes hasn't received enough attention. The Chapter filled a part of this gap in the literature. I provided evidence that demand-driven immigration policy helps to match immigrants with regions and sectors those experience labor shortages caused by commodity price shocks. In contrast, supply-driven immigrants do not move to regions/sectors that experienced labor shortages. In addition to the findings, I contributed methodological innovation in which I estimated the *causal* impact of regional labor demand on migration distribution. Typically, we constructed an index of gain from commodities (IGC) by interacting state-level commodity prices with the pre-existing contributions of those commodities to the state economy in the initial year as a proxy for regional variation in labor demand. This index is not influenced by the migration flows, therefore the Chapter could truly estimate the responses of migration flows to regional economic shocks.

Chapter 3 was concerned about the labour market impact of high-skilled immigration; which topic endures as one of the central debates in labour economics. Economists have made significant progress on understanding this issue in recent years. However different approaches and contexts have yielded different empirical results thus leading to the confusions in interpreting academic findings to policy recommendations. What is more, estimations used the same empirical approach and in the same context are even unstable with different organization of data or geographic boundaries (e.g. cities, metropolitans, or states). Moreover, empirical studies often struggle to deal with biased estimates caused by sorting and self-selection of immigrants across space and between skill cells. Especially, existing literature have

focused on the context of low-skilled immigration. The Chapter contributed to the debate by focusing specifically on the labour market impacts of a positively selected high skilled migration wave, which was little discovered in the existing literature. Exploiting the natural setting of Australia's rapidly changing immigrant skill composition following the abolition of the White Australia Policy, I was able to insulate our results from concerns of the endogenous allocation of immigrants across skill cells. I found that an influx of high-skilled immigrants leads to an increase in natives' wages and to a reduction in natives' share of part-time employment. These effects were spread over all groups but weighed heavier on low-skilled natives.

It is also required that empirical approaches should better take into account the fact that natives respond to immigration by changing their education, occupation, location and labour force participation and that these responses differ across groups. Data limitations however, have posed challenges to researchers being able to account for natives' labour market adjustments, especially natives' regional mobility, which may be one reason why studies reach differing conclusions. In the Chapter 3, I addressed this issue by tracking native displacement at the individual level and examining the margins of adjustment across various groups. I found that natives adjust their behaviours such as labour force participation, occupational mobility, and regional mobility in response to immigration. However, unlike previous studies that often found negative adjustments in the context of low-skilled immigration, I found positive adjustments such as lower part-time work ratios and lower probability of unemployment. Furthermore, we showed that these adjustments, especially regional mobility, are heterogeneous across different skill groups of natives. In particular, natives who can be seen as substitutes for immigrants have much higher rate of migration out of regions that are exposed to immigration compared to other groups. In

contrast, natives whose skills are complimentary to those of immigrants have much lower rate of regional mobility than others. These results suggest that empirical estimations on the impact of immigration on labour market outcomes should take into account the role of adaptation costs.

Chapter 4 investigated the role of regional economic factors as drivers of interregional migration flows. In recent decades, applied economists have tried to understand the role of regional wage and wage dispersion disparities in migration decision, for example rural-to-urban labor migration, inter-cities migration, and urban-to-rural migration. One major threat to existing literature is the endogeneity as immigrants might have reversed impact on economic factors in the receiving regions that might lead to estimation bias. Moreover, data limitations generate obstacles as hardly we know about the sending-migrants regions. In the Chapter, capitalizing on the availability of administrative data, I was able to identify the sources and destinations of interregional migration flows. I was also able to compare the effects of economic factors on migration behaviours of different age-cohorts. Moreover, using the industry changes caused by the exogenous mining boom as an instrument for regional wage growth, I was able to provide the causal estimations. I found that regional wages and wage growth are important drivers for internal migration. However, the effects are heterogeneous across age-cohorts, for example, wage dispersion has no impact on middle-aged and older migrants, but has a significant positive impact of young migrants' decisions. Furthermore, I demonstrated that non-economic factors such as rainfall, remoteness and distance are important drivers as well. The Chapter contributed to the literature by providing a clearer evidence on the heterogeneity in migration decisions of different age cohorts.

Policy recommendations

The findings from this thesis could generate several policy implications. For example, it is evident that demand-driven immigration policy plays an important role in matching immigrants across regions and sectors that experiences short-term labor shortages. Therefore, policy makers should adopt demand-driven policy to address labor shortages in regions and sectors that are not able to attract supply-driven immigrants (e.g. remoteness areas). This, however, does not suggest that policy makers should neglect supply-driven immigration policy as this kind of policy can attract immigrants who potentially bring long-term benefits to the country.

Another important implication is recruiting high-skilled immigrants as they have positive impact on native workers as a whole. However, the policy makers should also have appropriate policy to assist "competing" native workers who are displaced by immigration inflows. Last but not least, the findings from Chapter 4 suggests that there is a need for policy that assist workers who have to migrate due to the industry changes.

Future research

Due to the timing constraints of a PhD thesis, I was not able to fully cover all topical issues in the economics of immigration. I, therefore, select some issues that I intend to investigate in the foreseeable future. It would be interesting to extend Chapter 3 to study how different skill groups of natives adjust their occupational task-intensity: e.g. physical skills to communication skills in response to inflow of immigrants. I also intend to incorporate technological change, firm behaviour, and trade to the analysis to provide a dynamic picture of the impact of high-skilled immigration on native workers. In Chapter 3, data sample covered the period 2006-2011; however, the Census 2016 data has just been released. Thus, it would be desirable to expand the sample in Chapter 4 to include the full commodity cycle, for example, from 2006 to

2016. By doing so we are also able to apply econometric models on panel data and control of region fixed effects. Another interesting angle is to investigate whether individuals need to adjust their occupation when they migrate, and the cost and benefit of internal migration by tracking at individual levels using linked Censuses data.

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