

High skilled immigration and the occupational choices of native workers: the case of Australia

Daniel Crown^a, Alessandra Faggian^b, and Jonathan Corcoran^c

^aUS Congressional Budget Office, Ford House Office Building, Washington, DC, 20515, United States, crown.17@osu.edu

^bGran Sasso Science Institute, L'Aquila, Italy, alessandra.faggian@gssi.it

^cThe University of Queensland, Brisbane, Australia, jj.corcoran@uq.edu.au

Abstract

This paper estimates the effect of a major skilled visa programme in Australia on the wages and occupation-specific skills performed by native workers. We combine data from the full population of approved Temporary Work Visa applications with the nationally representative Household, Income and Labour Dynamics in Australia (HILDA) longitudinal survey from 2005–2015. Our findings indicate that skilled international workers increase the wages of natives, and induce native workers to specialize in occupations associated with a high intensity of communication and cognitive skills. We find no evidence of negative effects of the visa programme on the wages of high-skilled or low-skilled native workers, or on previous migrants who may be close substitutes to the skilled visa holders.

JEL classifications: J24, J61, F22.

1. Introduction

The share of high-skilled migrants in OECD countries has risen dramatically over the past 20 years, from close to 13 million people in 1990 to 28 million in 2010 (Kerr *et al.*, 2016). Policymakers in many developed economies have designed a suite of policies to attract skilled workers in an effort to attract the ‘best and the brightest’ (Kapur and McHale, 2005). Proponents of skilled immigration policies argue that they allow domestic employers to be efficient in addressing skill deficiencies present in the native workforce by hiring workers with the specific training that they require, circumventing the need to invest time and resources in training the domestic workforce. Recent evidence also suggests that skilled migrants may contribute to increased economic growth through technological innovations and knowledge spillovers to native workers (e.g. Kerr and Lincoln, 2010; Hunt, 2011). However, skilled immigration is often the target of substantial criticism. Opponents

argue that foreign-born workers displace and depress the wages of native workers (Kinnaird, 2002, 2006). As policymakers face increased pressure to adopt or reform immigration policies, empirical evidence of the effects of immigration policies on the native workforce is of utmost importance.

This paper estimates the effect of an Australian skilled immigration visa policy, the Temporary Work Visa, on the wages and occupation-specific tasks performed by native workers. We estimate whether visa holders and native workers are substitutes or complements in the labour market, and how native workers change occupations in response to skilled migrants. We study this question in the context of Australia, which is one of the top destination countries for skilled migrants (Tuccio, 2019).

Our work is related to a large literature that estimates whether immigration contributes to adverse labour market outcomes of native workers.¹ Research studying the impact of low-skilled immigration generally finds mixed results. Recent overviews conclude that the true impact on native workers is probably small in magnitude (Peri, 2014; Dustmann *et al.*, 2016).² However, skilled immigration has received significant interest in recent years due to the rising presence of skilled immigrants in developed economies. Skilled migrants also have a greater potential to generate positive spillovers and contribute to increased economic growth (Boubtane *et al.*, 2016). Thus, the impact of skilled immigration on a host economy will depend critically on the skill composition of immigrants.

In the United States, the innovative capacity of skilled immigrants is attributed to their disproportionate training in science, technology, engineering, and mathematics (STEM) fields (Hunt and Gauthier-Loiselle, 2010; Hunt, 2011).³ Research studying the H-1B visa in the United States finds that the programme increased the patenting rate of foreign-born workers (Kerr and Lincoln, 2010). However, while some authors find minimal effects on the wages and employment of native workers (Peri *et al.*, 2015), others find that the H-1B programme reduced the wages of native workers (Bound *et al.*, 2015), and may substantially crowd out native workers from employment (Doran *et al.*, 2016). Whereas many studies examine skilled immigration in the United States, these findings may not be generalizable to other contexts, as other countries may have different skill needs and attract workers with a different set of skills. Thus, an evaluation of skilled immigration policies of other countries will provide new insights into the labour market impacts of skilled immigration.

The primary contribution of this paper is to evaluate the labour market impact of the Temporary Work Skilled Visa (subclass 457) on native workers in Australia. Along with the United States, Canada, and the United Kingdom, Australia is one of the largest destination countries for skilled migrants (Kerr *et al.*, 2016). The Temporary Work Visa was established in 1996, permitting Australian employers temporarily to sponsor an

1 See Dustmann *et al.* (2016), for a recent survey.

2 This finding is corroborated in the 2016 Productivity Commission report on the migrant intake in Australia. The report shows that, while the effect of immigration on wages and employment is negligible, there may be negative impacts on younger and lower-skilled workers (Productivity Commission, 2016).

3 The largest occupation group held by workers employed under the Temporary Work Skilled Visa programme is that of ICT professionals, indicating some specialization of visa holders in STEM occupations. However, we note that the concentration of immigrants employed in STEM occupations is lower than the H-1B visa in the United States, with Temporary Work Visa holders spanning a diverse set of occupations.

international worker when they require specific skills that cannot be sourced through the domestic workforce. Foreign-born workers trained in occupations that are deemed in shortage by Australian employers are eligible to live and work in Australia for up to four years. However, amid concerns that the Temporary Work Visa reduced the labour market opportunities for native Australian workers (Kinnaird, 2002, 2006), the Temporary Work Visa programme was removed and replaced by a restructured Temporary Skill Shortage (TSS) Visa starting in March of 2018 (DIBP, 2017).⁴ Despite opponents' claims that the programme harmed native workers, there has been no evaluation of the labour market impact of the programme.⁵

A secondary contribution of this paper is to provide more precise estimates of the impact of skilled immigration on the labour market outcomes of native workers. While prior research has examined the impact of the low-skilled, or immigration in general, on the changing occupation-specific tasks performed by native workers (Peri and Sparber, 2009; Amuedo-Dorantes and De La Rica, 2011; Foged and Peri, 2016), studies focused on high-skilled immigration are less common.⁶ As high-skilled migrants perform different tasks in the labour market, the skill complementarity effects of a high-skilled visa policy and the results of the previous literature may differ.

In this paper, we combine data from the population of approved Temporary Work Visa applications with a nationally representative longitudinal survey of native workers. The use of administrative visa application data improves on previous research using national census population estimates, which may measure the regional share of immigrants with error. Additionally, the longitudinal database of native workers permits the use of fixed effects to control for various sources of unobserved confounding factors. The empirical strategy closely follows Foged and Peri (2016). We use an instrumental variables strategy to overcome the differential sorting of immigrants into regions with prospering labour markets. Finally, we control for a variety of fixed effects to account for the differential out-migration of native workers, unobserved time-invariant native worker characteristics, and unobservable time-varying shocks to a given industry and to a given state.

The remainder of the paper is structured as follows: Section 2 provides an overview of the skilled immigration literature. In Section 3, we outline the Australian Temporary Work

- 4 Differences between the Temporary Work Skilled Visa and the Temporary Skill Shortage (TSS) Visa include a reduction in the number of eligible occupations on the Consolidated Specialized Occupation List (CSOL) (from 651 to 435), stricter worker experience requirements, mandatory labour market testing for Australian firms, and the removal of the English language requirement exemption for workers earning AUD96,400 or more (DIBP, 2017). Since 19 April 2017, the maximum duration of employment for Temporary Work Visa applicants from the Short-Term Skilled Occupation List (STSOL) has been two years. The restructuring of the visa occurred relatively recently, and there is insufficient data to conduct a comprehensive evaluation of the TSS Visa.
- 5 Notable studies of immigration in Australia include Kifle (2009), who uses the 2001 Australian Census and finds a positive impact of immigration on the earnings of native workers. Bond and Gaston (2011) study the impact of immigration on the native workforce using the HILDA dataset, with education and experience cell fixed effects, and find that native workers benefit from immigration in general; however, some lower-educated subsets of native workers are harmed. Additionally, the Australian Government's Productivity Commission investigated the impact of immigration on the labour market outcomes of native workers in its migrant intake report.
- 6 With the exception of Peri and Sparber (2011), who study the labour market impacts of skilled immigration in general, and Bound *et al.* (2015) and Bound *et al.* (2017) and the H-1B visa programme.

Skilled Visa and describe how it compares to programmes in other countries. In Section 4, we introduce the data used in the analysis and the measurement of occupation-specific tasks. We present the identification strategy and empirical model in Section 5 before discussing the results in Section 6, and offering conclusions in Section 7.

2. Skilled immigration and the native workforce

Whether immigration reduces the wages of native workers is a question that has received considerable attention in the academic literature. Theoretical models predict that an increase in the supply of immigrants will reduce wages for native workers who are close substitutes for immigrant workers (Borjas *et al.*, 1997; Borjas, 2003). To determine the degree of substitutability between native and immigrant workers, researchers have studied not only the education and experience levels of the two groups, but also the types of tasks performed by each group. For example, immigrants may choose occupations that require specialized technical skills rather than communication intensive occupations due to their limited English language proficiency relative to native workers (Chiswick and Taengnoi, 2007). If immigrants and native workers specialize in different tasks, then the two groups may not directly compete in the labour market. Rather, immigration may increase productivity and wages if immigrant and native workers perform complementary tasks (Peri and Sparber, 2009, 2011; Amuedo-Dorantes and De la Rica, 2011; McHenry, 2015).

Research studying the occupation-specific tasks of immigrants and natives finds that low-skilled immigration in Denmark increased the complexity of occupation-specific tasks performed by natives (Foged and Peri, 2016). Additionally, in the United States an increase in the share of foreign-born workers increases the communication task intensity and reduces the physical task intensity of occupations performed by natives (Peri and Sparber, 2009). However, the magnitude of these effects varies considerably depending on the country studied. Amuedo-Dorantes and De la Rica (2011) find that the effect of immigration in Spain on the occupation task intensity of native workers is twice as large as comparable findings in the United States.

While much of the previous literature considered the impact of immigration in general, understanding the effects of skilled immigration is increasingly important. Similar to general immigration, the impact of skilled immigration on the wages of native workers depends on the degree of substitutability between native and immigrant workers. Peri and Sparber (2011) study the substitutability of immigrant and native workers, and find that high-skilled native workers respond to an increase in numbers of high-skilled foreign-born workers by specializing in occupations that require a high intensity of interactive and communication skills. In contrast, foreign-born workers specialize in occupations that demand quantitative and analytical skills.

An additional consideration is that skilled immigrants may produce positive spillovers that mediate the negative effect on wages implied by supply and demand models. For example, an inflow of skilled migrants may increase the dissemination of knowledge or development of innovations, which increases the productivity of native workers and induces firms to increase employment. Skilled immigrants in the United States have been shown to contribute significantly to technological innovations, as measured by patents (Hunt and Gauthier-Loiselle, 2010; Kerr and Lincoln, 2010; Hunt, 2011; Islam *et al.*, 2017). However, evidence from the H-1B programme in particular is mixed. Khanna and Lee (2018) find that H-1B visa holders increase firm-level innovation through new product

entry. [Doran et al. \(2016\)](#) find only small impacts of obtaining H-1B employment on firm-level patenting behaviour.

Research studying the impact of the H-1B visa programme on the labour market outcomes of natives has also found mixed results. [Peri et al. \(2015\)](#) find positive effects on the wages of native workers, with larger effects among the college-educated versus the non-college-educated native workers. However, skilled immigrants may ‘crowd out’ high-skilled natives, who perform similar tasks in the labour market. Using variation across firms who ‘win’ or ‘lose’ the H-1B lottery, [Doran et al. \(2016\)](#) find only modest increases in overall employment for firms who hire H-1B workers, implying substantial crowd-out at the firm level. [Bound et al. \(2015\)](#) find that the H-1B programme resulted in lower wages for computer scientists than would have occurred in the absence of the programme; however, overall employment and output would also have been lower in the absence of the programme. Lastly, [Bound et al. \(2017\)](#) find positive impacts of the H-1B programme on profits for firms in the information technology sector, consumer welfare, and domestic innovation. However, the H-1B visa reduced the wages of native-born computer scientists and induced native-born computer scientists to move into other occupations ([Bound et al., 2017](#)).

3. The Australian Temporary Work Skilled Visa (subclass 457)

The Temporary Work Skilled Visa was established in 1996 to admit international workers with skills that were deemed necessary by domestic firms, but were missing from the native Australian workforce. The Temporary Work Visa is an employer sponsored programme that is similar to the H-1B visa in the United States. Employers sponsor an employee to live and work temporarily in Australia, given that the employer and employee are eligible for the programme.⁷ There are important differences between the H-1B visa and the Temporary Work Skilled Visa that may lead to differential labour market impacts for native workers. First, the Temporary Work Skilled Visa is not subject to a cap on the number of migrants accepted per annum. This is important because the cap on the number of H-1B visas in the United States may limit the labour market impact on native workers by restricting the supply of high-skilled migrants. The presence of a cap may also have implications for the skill composition of applicants to the programme, as well as the immigration system as a whole.⁸ Another difference is that the H-1B visa requires a Bachelor’s degree or higher and the Temporary Work Visa has no formal education requirements. Lastly, the

7 Employers apply to become a Standard Business Sponsor with the Department of Home Affairs. Sponsorship lasts for three years and may be extended to six years without reapplying, if the employer complies with all requirements. To reduce dependency on international workers, employers must demonstrate a commitment to training the Australian workforce. Additionally, at least 75% of employees must be Australian residents or citizens. Once approved, employers may nominate a worker for a position on the Consolidated Specialized Occupation List (CSOL). Occupations are deemed as a skill-need by employers if they require specialized skills related to new technological developments, knowledge of company-specific policies/software, and knowledge of specific languages or cultures ([Khoo et al., 2007](#)).

8 We thank an anonymous referee for this comment. [Kato and Sparber \(2013\)](#) find that more restrictive H-1B caps lead to international students of a lower academic quality. Current policy does not select H-1B applicants to fill the quota based on ability or qualifications. [Sparber \(2018\)](#) demonstrates that selecting applicants to fill the quota based on ability would have positive impacts on output, output per worker, and wages for low-skilled workers.

Temporary Work Visa has minimum English language proficiency requirements, while no such requirements exist for the H-1B visa.

As shown in Fig. 1, the size of approved visa cohorts has varied dramatically over the sample period, exhibiting strong growth from its inception in 1996 but, however, falling starkly following the Global Financial Crisis.⁹ At the end of our sample period, the number of newly granted, primary visas fell to around 45,000 in 2015.

Applicants are eligible for the Temporary Work Visa if they provide documentation of training in a skilled occupation, demonstrate proficiency in the English language, and satisfy moral character requirements. Once hired, firms are required to pay workers a minimum salary that is equivalent to or higher than that of comparable natives. Since 2009, the minimum salary has been set in accordance with the Temporary Skilled Migration Income Threshold (TSMIT), which was AUD53,900 per annum from 2015 to 2017. The Department of Home Affairs monitors compliance through a review process comprising paper-based monitoring and site visits to verify employer conformity.¹⁰ Temporary Work Visa holders are expected to work under their approved arrangement for the duration of their visa; however, if they wish to break their arrangement with their employer, they must reapply under another eligible employer, or leave the country.¹¹

Summary statistics comparing the characteristics of skilled migrants and the native population are given in Table 1. Over the sample period, the largest group of skilled migrants hold citizenship from the United Kingdom, followed by India, the Philippines, the United States, and China. From the visa application data, skilled migrants are, on average, younger than native workers. However, there is also a significant portion of visa holders that are 40 years of age or older, which may reflect the fact that visa holders are permitted to bring their spouse and children to live and work in Australia for the duration of their visa.

Figure 2 displays the geographic distribution of Temporary Work migrants in Australia. The Temporary Work Visa programme has incentives to assist the development of rural and remote regions in Australia.¹² Despite these incentives, the majority of migrants are located in large urban areas, such as Sydney, Melbourne, Brisbane, and Perth.¹³ This is

9 Strong post-recession growth is attributable, in part, to the natural resource boom associated with iron ore, coal, and liquefied natural gas extraction—which increased the demand for foreign-born workers in the mining and construction industries.

10 In 2007, penalties for non-compliance included cancellation of their current visa sponsorship, affected future applications, and incurred monetary penalties of AUD6,600, for an individual employer, and AUD33,000, for a corporation (Randall, 2007).

11 The Temporary Work Visa is a popular pathway to permanent residency through the Temporary Residence Transition Visa. Applicants must have worked for an eligible employer for two years, and the employer must offer a permanent position in the same occupation in which they worked as a temporary worker. In the 2015–2016 programme year, 51,110 Temporary Work Visa holders were granted permanent residence (DIBP, 2016).

12 Applicants to specific areas designated as rural or remote are subject to less severe labour market testing and occupational skill shortage requirements. Previous research has explored the individual characteristics of overseas graduates that locate in regions that offer rural development incentives (Corcoran et al., 2010; Tang et al., 2014).

13 Specifically, 30.6% in Sydney, 20.4% in Melbourne, 10.1% in Brisbane, and 16.8% in Perth. In comparison, 1% of migrants live in Greater Darwin, 0.4% in the Northern Territory, 3.1% in Greater Adelaide, and 0.6% in South Australia. To compare, 20.9% of the Australian population lives in Sydney, 19.8 in Melbourne, 9.8% in Brisbane and 8.2% in Perth. Of the Australian population, 0.6%

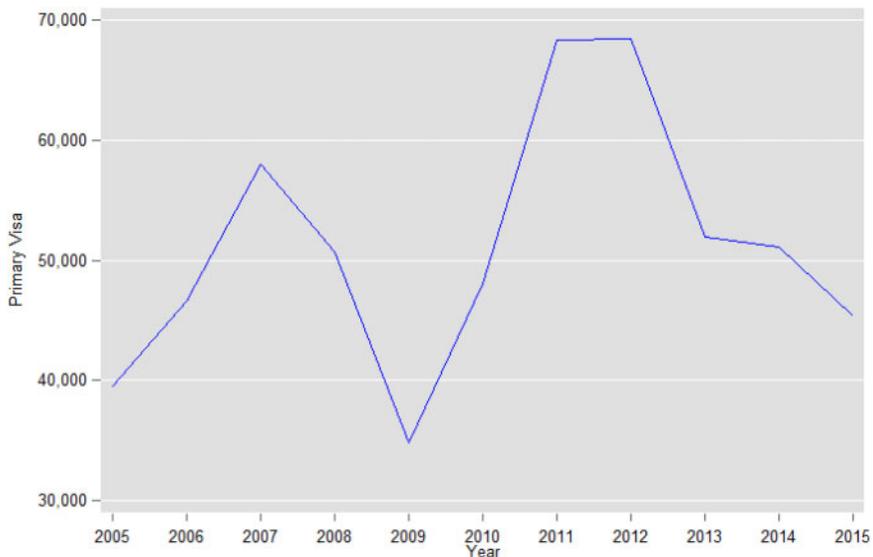


Fig. 1. Annual number of granted subclass 457 visas. Source: authors' calculation with approved temporary work visa application data supplied by the Department of Home Affairs, 2005–2015.

Table 1. Demographic characteristics of visa holders and native workers

	Visa holders %	Native workers %
Demographic variables		
Male	55.60	49.30
<i>Age distribution</i>		
<20	0.10	8.80
20–24	8.40	10.40
25–29	32.10	9.10
30–34	25.10	8.70
35–39	14.40	8.80
40–44	8.90	9.30
45+	11.02	46.70
<i>Top 5 visa countries of citizenship</i>		
United Kingdom	21.70	
India	17.20	
Philippines	6.30	
United States	6.20	
China	5.20	
Sample size	979,883	29,685

Notes: Cells represent summary statistics from the full population of Temporary Work visa applications, from the Department of Home Affairs and the Household, Income, and Labour Dynamics in Australia (HILDA) data. Survey weights from the HILDA data have been applied. Sample size for visa holders represents all primary and secondary approved visa holders over the sample period.

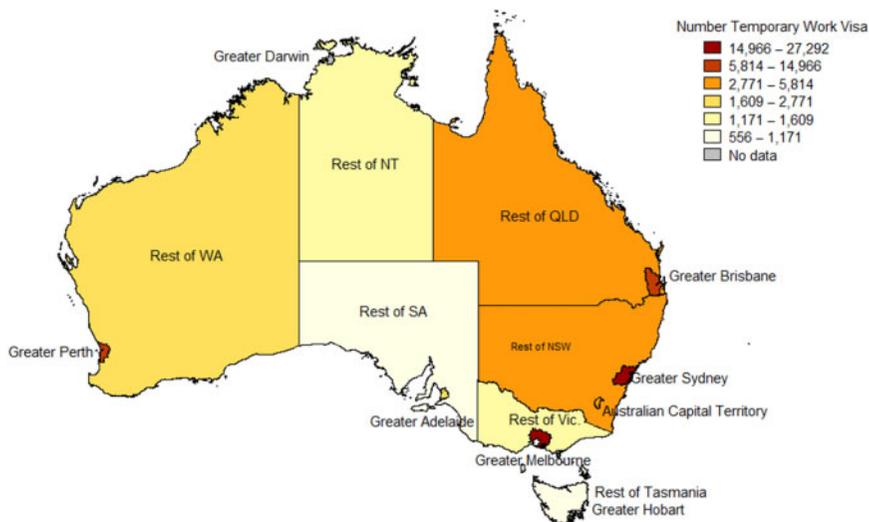


Fig. 2. Geographic distribution of Temporary Work Visa holders. Source: authors' calculation with approved Temporary Work Visa application data supplied by the Department of Home Affairs, 2005–2015.

consistent with the finding that high-skilled migrants concentrate in areas with existing high concentrations of high-skilled native workers (Kerr *et al.*, 2016). Workers may be attracted to these areas for a variety of reasons, including the presence of ethnic networks, agglomeration of high-skilled workers, urban amenities, and the presence of firms that employ high-skilled workers.

4. Data

We merge individual data from the full population of Temporary Work Visa applications with the longitudinal Household, Income, and Labour Dynamics in Australia (HILDA) survey. The HILDA follows a nationally representative sample of the Australian population and contains individual-level characteristics including the two-digit Australian and New Zealand Standard Classification of Occupations (ANZSCO) occupation code, annual salary, region of residence, country of birth, and industry of employment. This allows us to identify native-born workers at a relatively fine geographic level, and control for both observable worker characteristics and unobservable confounding factors in the analysis.

Administrative data from the Australian Department of Home Affairs covers all approved Temporary Work Visa applications from 2005–2015.¹⁴ In total, we have information on 979,883 primary and secondary applicants over the entire sample period, and an average of 90,000 combined primary and secondary approved applications per year.¹⁵ The

lives in Greater Darwin, 0.4% in the Northern Territory, 5.4% in Greater Adelaide, and 1.5% in South Australia.

14 Though the programme began in 1996, we only have application data as from 2001, and the applications for the period 2001–2004 do not contain the geographic location of applicants.

15 Primary applicants are the workers themselves; secondary applicants may include the spouse and/or children of the primary applicant.

visa application data contain a rich set of individual worker characteristics including age, country of origin, and gender. Additionally, the data contain the nominated occupation of the visa holder, which we use to compare the occupation-specific tasks performed by natives and visa holders. For the analysis, we aggregate the data to construct the share of Temporary Work Visa holders in each Greater Capital City Statistical Area (GCCSA) region and year.

4.1 O*NET occupation skill data

The United States Department of Labor's Occupational Information Network (O*NET) database contains variables representing the importance of occupation-specific tasks for a large set of occupations.¹⁶ This is an especially relevant measure for immigration research, compared to educational qualifications, because recent immigrants may face assimilation costs, which create a mismatch between their qualifications and attained occupation. Moreover, the O*NET data provides measures of tasks such as communication, cooperation, and social perceptiveness—which cannot be observed using educational qualifications alone. Measuring tasks is critical to this analysis because we estimate whether native workers respond to the presence of visa holders by changing occupations to tasks involving more intensive use requirements, in which they have a comparative advantage.

To operationalize this concept, we construct three indexes using 87 distinct skills for 954 occupations from the Abilities and Skills components of the O*NET Content Model. To incorporate these into the empirical model, we first reduce the dimensionality using the descriptions of the O*NET content model to form three groups of skills: cognitive skills, communication skills, and physical skills. Cognitive skills include tasks such as complex problem-solving, critical thinking, mathematics, and science. Communication skills capture how often one interacts with the public, clients, and co-workers. Physical skills reflect the intensity of manual labour required to perform a job. The full grouping of tasks is found in Table A1.

Next, we use principal component analysis (PCA) to reduce the full set of tasks into three distinct skill indexes, which measure the cognitive, communication, or physical intensity of an occupation. PCA transforms each of the three sets of tasks into one variable that captures as much of the variation in the original group as possible. Thus, PCA condenses a large set of occupation-specific tasks into the principal component that contributes to the cognitive, communication, and physical skill of an occupation. All three indexes are formed using the weights generated from the first component.¹⁷ To ease interpretation of the results, each index is standardized to have a mean equal to 0 with a standard deviation of 1.

Table A2 displays the top and bottom five ANZSCO occupation classifications for each index. The occupations with the highest cognitive rank are surgeons; medical practitioners; and educators, including college professors and deans. The lowest cognitive scores are occupations such as laundry workers, factory workers, and car detailers. Religious ministers, professors, and chief executives have the highest values of the communication index, while caretakers, garden labourers, and laundry workers have the lowest values of the communication index. Lastly, firefighters, roof tilers, and bricklayers score the highest on the

16 The O*NET data has been used international contexts before (e.g. Amuedo-Dorantes and De la Rica, 2011). Its use in other countries relies on the assumption that the general tasks and skills required for each 2-digit ANZSCO level occupation is constant across countries (e.g. that managers in the United States and Australia both use communication and problem-solving skills).

17 The first component explained between 70–72% of the variance for each of the three indexes.

Table 2. Top visa holder and native worker occupations

Occupation	Share of native (%)	Share of visa (%)	Cognitive skill (%)	Communication skill (%)	Physical skill (%)
<i>Native workers: top 5 occupations</i>					
13—Specialist managers	6.6	4.2	1.417	1.413	-1.066
62—Sales assistants and salespersons	6.1	0.1	-0.708	0.197	0.063
24—Education professionals	5.8	1.3	1.174	1.319	-0.775
22—Business, human resources, and marketing professionals	5.5	6.3	1.124	0.990	-1.331
25—Health professionals	5.5	4.1	1.770	1.207	-0.070
<i>Visa holders: top 5 occupations</i>					
26—ICT professionals	1.8	6.4	0.172	-0.590	-0.748
22—Business, human resources, and marketing professionals	5.4	6.3	1.124	0.990	-1.331
23—Design, engineering, science, and transport professionals	3.1	5.5	1.600	0.779	-0.793
25—Health professionals	4.1	5.5	1.770	1.207	-0.070
13—Specialist managers	6.6	4.2	1.417	1.413	-1.066

Note: Authors' calculation with Department of Home Affairs approved visa application data and HILDA data. The three skill indexes are calculated by merging occupation task data from the Occupation Information Network (O*NET) by an occupation code crosswalk. Skill index values are calculated by PCA, and are normalized to have mean = 0 and standard deviation = 1. The native worker occupation shares are calculated with HILDA sample weights.

physical skill index, while financial investment managers, telemarketers, and human resource managers score the lowest.

Table 2 compares the skill content of the top occupations held by native workers and visa holders. Compared to the native population, a greater share of skilled migrants are trained in high-skill, technical occupations. The most common occupation of visa holders is that of ICT professional, which consists of software engineers, web developers, and business systems analysts. Second, is a broad group of business professionals, consisting of accountants, financial brokers, and investment advisers. Overall, the aggregate ANZSCO category titled 'Professionals' comprises nearly 60% of the Temporary Work Visa holders.¹⁸

5. Empirical framework

We conduct our analysis at the GCCSA level to capture the effect of foreign workers at the labour market level.¹⁹ There are a total of 16 GCCSA regions in Australia, representing two regions within each of the eight Australian states and territories. The GCCSA regions are designed to approximate the labour market of a major city and the surrounding population that probably commutes into the city for work or consumption.²⁰

18 Followed by ANZSCO 3 – Technicians and Trades Workers, and ANZSCO 1 – Managers.

19 This choice is based on the level of geographic refinement available in the publicly accessible version of the HILDA dataset.

20 For example, the GCCSA of Greater Sydney had a population of 4.8 million people in 2016, and the entire state of New South Wales contained nearly 7.5 million people in 2016.

Our empirical framework estimates the effect of the share of Temporary Work Visa holders who arrive in a given region and year on the labour market outcomes of native workers. We use the gross inflow of visa holders to construct the independent variable, rather than the net inflow or the stock of visa holders, due to data limitations.²¹ We believe the gross inflow is a valid proxy for the stock of migrants in an area, given that visa holders are contracted to work for a given employer and are likely to exhibit limited internal mobility.²² Moreover, as discussed in Section 3, the Temporary Work Visa programme is considered a popular pathway to permanent residency, which lends credibility to the gross inflow approximating the stock of migrants in a given location.

The specification of our empirical model, given in Equation 1, follows that of Foged and Peri (2016):

$$Outcome_{irt} = \beta_0 + \beta_1 S_{rt} + \beta_2 X_{it} + \phi_i + \phi_{st} + \phi_{lt} + \epsilon_{irt} \quad (1)$$

The dependent variable, $Outcome_{irt}$, is the log annual salary of native workers, or one of the three skill indexes derived from the PCA of the O*NET skills (cognitive, communication, or physical). We include individual i fixed effects, state-by-year fixed effects, and industry-by-year fixed effects. Individual fixed effects control for unobserved time-invariant individual characteristics such as one's ability or motivation.²³ The identifying variation in this specification changes in the share of visa holders in a particular region within an individual-time spell. State-by-year fixed effects control for common time-varying factors that affect all individuals located within a given state over the sample period. This could include regional shocks to labour demand that affect workers across all industries. Industry-by-year fixed effects capture labour demand shocks within an industry that could influence the hiring of Temporary Work Visa holders, as well as the wages of native workers. Additionally, we control for a vector of time-varying individual-level characteristics, X_{it} , which includes the worker's level of education, marital status, age, age squared, experience, and experience squared.

The explanatory variable of interest is given in Equation (2):

$$S_{rt} = \frac{V_{rt}}{N_{rt}} \quad (2)$$

The variables V_{rt} and N_{rt} are the number of granted Temporary Work Visa applicants, and total population in a region, r , and year, t .²⁴ The parameter of interest from Equation (1)

- 21 We know of no publicly available data on net flows or stock of Temporary Work Visa holders at narrowly defined geographic concentrations.
- 22 A limitation of our approach is that we are unable to confirm that all approved visa applicants actually arrived in Australia. However, we contend the number of applicants who arranged for employment, paid application fees, and were approved for employment in Australia and subsequently failed to arrive in the country is, in all probability, small.
- 23 Results without the inclusion of fixed effects are found in Table A6. Point estimates from these specifications show wage effects that are similar in magnitude. However, the occupational task impacts are consistent in sign, but larger in magnitude. This suggests that unobserved confounding factors (such as one's innate ability) and the inter-regional migration of native workers can introduce positive bias into the estimation of the impact of immigration.
- 24 Using the full population of approved visa applications, the share of visa holders variable should be free of the measurement error that introduced bias in prior work (Aydemir and Borjas, 2011).

is $\hat{\beta}_1$, which represents the impact of an increase in the share of Temporary Work Visa holders in a region on the wages and occupation-specific tasks performed by native workers.

The full set of individual, state-by-year, and industry-by-year fixed effects control for unobservable confounding factors that could bias the estimation. However, the fixed effects regression will still lead to biased estimates if there is an unobservable demand shock that simultaneously influences the location decision of immigrants and the wages of native workers. To overcome this potential source of endogeneity, we follow an empirical strategy that isolates variation in the share of visa holders that is attributable to supply-driven factors associated with immigrant enclaves (Bartel, 1989; Altonji and Card, 1991; LaLonde and Topel, 1991; Card, 2001). We construct an instrumental variable for the share of Temporary Work Visa holders in a region by interacting the share of foreign-born workers from the four country of birth groups in the 1966 census with each country of origin group's national growth rate.²⁵ The instrument projects the share of the foreign-born population in the current period that would arise if the share of the immigrant population in 1966 grew by each country of origin group's national growth rate. While the actual share of immigrants in a given area is correlated with regional labour demand conditions, the predicted share based on lagged settlement patterns is plausibly exogenous to labour demand conditions in the current period.

The instrument is calculated as shown in Equation (3):

$$\hat{S}_{rt} = \sum_c I_{cr}^{1966} * N_{ct} \quad (3)$$

where I_{cr}^{1966} is the share of foreign-born individuals from a country of birth group, c , residing in a GCCSA region, r , in 1966. The initial share is interacted with the national growth rate, N_{ct} , of a particular country of birth group, c , from the base year of 1966 to year t .

Although this instrument is widely used in the literature, it is important to recognize its potential limitations. The settlement patterns of immigrants 40 years prior to our sample period are arguably exogenous to the labour market conditions in 2005. However, because the lagged period is long, the instrument may not be a strong predictor of the settlement patterns of Temporary Work Visa holders in 2005. Second, while the intuition behind the instrument is clear for low-skilled migrants, high-skilled migrants may not be as attracted to regions with a high share of past migrants from their country of origin. To ensure that the instrument is valid, we will first show that it has sufficient predictive power by reporting the F-statistic from the first stage regression in each specification. The instrument satisfies the relevance condition in all specifications, with F-statistics sufficiently larger than the conventional guidelines for weak instruments. Second, we plot the predicted share of foreign-born workers from our instrument and compare it to the actual share of visa holders in the year 2005 (Fig. A2). Together with the F-statistics from the regressions, we conclude that the instrument satisfies the relevance condition.

For the instrument to be exogenous, the immigrant location decisions in the baseline period should be uncorrelated with labour market conditions during the sample period of 2005–2015. This assumption will be violated if there exists a persistent shock that

25 The groups are defined according to the Australian 1966 Census and include Asia, Europe, Africa, and America. Results using the 2001 census, which provides a wider group of countries of origin, yields similar results. However, they may not be sufficiently lagged to ensure that the instrument is exogenous.

influences both immigrant location decisions and labour market conditions during the period 1966–2015. To test this assumption, we perform falsification and over-identification tests. Due to the built-in persistence of Bartik-style instruments, we follow Goldsmith-Pinkham *et al.* (2018) and perform falsification tests by regressing the residualized wages in past periods on current values of the instrument. If there is a persistent demand shock, future values of the instrument will be correlated with wages in the current period. Using one- and two-year lags, we find no significant effect of the instrument on wages, indicating no evidence of a persistent demand shock. Second, though our model is identified with just one instrument and one endogenous variable, we follow Goldsmith-Pinkham *et al.* (2018) and include each individual country of origin share in 1966 in a PCA. Using the first two estimated components as instrumental variables in an over-identified estimation, we obtain qualitatively similar results and the instruments pass the over-identification test. Lastly, we implement the double instrumentation procedure of Jaeger *et al.* (2018) to account for the potential bias from the dynamic adjustment process that may produce a correlation between an unobservable demand shock and the instrumental variable. We include the current and lagged share of Temporary Work Visa holders and instrument for both endogenous variables with the current and lagged instrumental variables. The full details and output from this exercise are in the Appendix.

6. Results

Table 3 reports the results from estimating the baseline specification of Equation (1).²⁶ Although the Temporary Work Visa programme is relatively large, the number of visa holders is small relative to the entire population of a region. To ease interpretation of the primary independent variable of interest, we rescale the ‘share of visa holders’ variable to represent an increase of 0.1 percentage points in the share of Temporary Work Visa holders.²⁷

The results imply that a greater share of visa holders increases wages for native workers. Specifically, a 0.1 percentage point increase in the share of skilled visa holders increases the wages of native workers by 4.7%. Due to the scaling of the independent variable, the magnitude of this effect corresponds to an increase in the annual programme size of skilled migrants by 24%. As an illustrative example, a 0.1 percentage point increase in the share of Temporary Work Visa holders corresponds to a 17% increase, or an additional 4,600 visa holders, in the Greater Sydney region. Applying the point estimate to the average annual salary in the sample (AUD42,596) implies that the increase in the share of visa holders would, on average, increase annual salaries for native workers by AUD2,011. The positive impact on the wages of native workers contrasts with the popular criticism that skilled immigrants ‘crowd-out’ native workers. Instead, it is consistent with the explanation that immigrant and native workers perform complementary tasks, rather than substitutable tasks, in the labour market. This is consistent with the context of the Skilled Visa

26 Results from the estimation without fixed effects are found in Table A6 of the Appendix. The estimate for wages is statistically indistinguishable; however, the results for the skill indexes are of the same sign, but larger in magnitude.

27 This is accomplished by multiplying the share of visa holders in a region by 1,000. Then, a one unit increase in the independent variable corresponds to a 0.1 percentage point increase. An increase of one percentage point is equivalent to about 4,600 additional visa holders (or a 17% increase) in the Greater Sydney region, or a 24% increase in the total Temporary Work Visa programme.

Table 3. Effect of Temporary Work Visa holders on the wages and skill indexes of native workers

	(1) Log wage	(2) Cognitive index	(3) Communication index	(4) Physical index
Share visa holders (0.1 percentage point increase)	0.0472*** (0.00655)	0.00799 (0.00623)	0.0103* (0.00600)	-0.0118** (0.00589)
Observations	56,564	66,563	66,563	66,563
Individuals	10,144	11,200	11,200	11,200
Sample mean	42,567	0.0874	0.0542	4.94e-05
First stage F-statistic	155.95	94.34	94.34	94.34
Individual FE	Yes	Yes	Yes	Yes
State x Year FE	Yes	Yes	Yes	Yes
Industry x Year FE	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the GCCSA region-by-individual level and are reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. All specifications control for age, age squared, experience, experience squared, marital status, and highest level of educational attainment; and include individual, industry-by-year, and state-by-year fixed effects. The independent variable is rescaled to represent a 0.1 percentage point increase in the share of Temporary Work Visa holders for ease of interpretation.

programme, where visa holders are hired to perform a specific occupation that domestic employers cannot hire a native worker to perform.

Next, we estimate whether native workers change the tasks performed in the labour market in response to the skilled migrants. We find that an increase in Skilled Visa holders increases the communication task intensity of occupations performed by native workers by 0.01 of a standard deviation, and decreases the use of physical tasks by 0.012 of a standard deviation. The individual-level occupation adjustment of native-born workers has been found in prior work by Foged and Peri (2016), who find that native workers increase the complexity of tasks in response to the low-skilled migration of refugees. However, our findings for high-skilled migration represent a new contribution to this literature. In response to the increased presence of visa holders, we find that native workers shift into occupations that more intensively utilize communication tasks, and less intensively use physical tasks. We find no effect on native worker's cognitive task intensity, suggesting that the skill-upgrading hypothesis that is found in the low-skilled immigration literature may not apply for high-skilled migrants.

Broadly, our results support the proposition that skilled immigration increases the productivity of native workers. There are several possible mechanisms through which this may occur. First, at the firm level there may be positive externalities generated due to a more diverse set of worker skills. While, unfortunately, this is not observable in our data, other studies have shown that greater diversity increases the productivity of the workforce (Lazear, 1999; Horwitz and Horwitz, 2007). Second, there may exist positive externalities from diversity at the regional level that are at least as important as at the firm-level (Trax et al., 2015). For example, cultural diversity has positive effects on the innovation and productivity of firms located in a given region (Ozgen et al., 2014; Cooke and Kemeny, 2017).

6.1 Results controlling for internal mobility of native workers

Thus far, we have found that the Temporary Work Visa programme has increased the wages of native workers. However, the standard individual fixed effects specification does

not control for the out-migration of native workers. In the individual fixed effects specification, changes in the share of visa holders due to a native worker migrating to another region are included as an identifying variation. This will bias estimates of the effect of immigration on native workers if those who are most likely to be harmed by immigration are the most likely to out-migrate in response to immigration. Using the longitudinal dimension of the HILDA data, we estimate the effect of immigration on native workers within a given local labour market by replacing the individual fixed effects in Equation (1) with individual-by-GCCSA fixed effects. This specification uses variation in the share of visa holders within the same individual-GCCSA region time spell. The results are shown in Table 4.

We find that including individual-by-region fixed effects increases the magnitude of the estimated effect of immigration on wages. A 0.1 percentage point increase in the share of Temporary Work Visa holders in a local labour market increases the wages of native workers by 7.8%. The effects on occupation-specific tasks are also larger, consistent with the restriction on geographical mobility imposed by the empirical model. For native workers within the same local labour market, an increase in the share of Temporary Work Visa holders increases the cognitive task intensity of native workers by 0.154 of a standard deviation, and increases the communication task intensity by 0.067 of a standard deviation.

Comparing the individual-by-region specification to the individual fixed effects specification provides insight into the internal migration response of native workers.²⁸ The larger positive impacts on wages on the inclusion of individual-by-region fixed effects is an interesting result. If those who were most likely to experience adverse impacts on wages were the most likely to out-migrate, then one would expect the point estimates for the individual-region fixed effects specifications to be smaller in magnitude. While we are unable precisely to estimate why this result is different from our expectations, it is consistent with the existence of job search frictions that reduce wages for out-migrants in the short run. However, while our results suggest that out-migrants earn lower wages than in the previous region, we cannot rule out that the out-migrants earn lower wages than in the counterfactual scenario; that is, the future wages that they would have earned if they had remained in the previous region. Moreover, we are unable to estimate whether the out-migrants continue to earn lower wages in the medium or long term.

6.2 Results for subsets of native workers

While the estimates in Tables 3 and 4 represent the effect of the skilled visa programme for the average native-born Australian, there may exist heterogeneous impacts among specific subsets of the native population. For example, previous work has shown that low-skilled immigration decreases the wages of native workers employed in blue-collar occupations, but not among native workers in skilled occupations (Orrenius and Zavadny, 2007).²⁹ We estimate the model separately for high-skilled workers (individuals holding a Bachelor's degree or higher) and low-skilled native workers (with a lower qualification than a Bachelor's degree) to explore this heterogeneity. The results are found in Table 5.

Table 5 shows that the average increase in wages for native workers is primarily among those without a university degree. Additionally, we find no statistically significant impact

28 The estimate in specification (1) of Table 3 is 0.0472, compared to 0.0779 in Table 4.

29 However, we note that there are mixed findings on the effect of low-skilled immigration on domestic blue-collar workers, with Winter-Ebmer and Zweimuller (1996) finding no negative effects of low-skilled immigrants in Austria on the wages of native workers.

Table 4. Effect of Temporary Work Visa holders on wages and skill indexes

	(1) Log wage	(2) Cognitive index	(3) Communication index	(4) Physical index
Share visa holders (0.1 percentage point increase)	0.0779*** (0.0163)	0.154*** (0.0224)	0.0668* (0.0352)	0.0607 (0.0580)
Observations	55,684	65,373	65,373	65,373
Individuals	10,592	11,697	11,697	11,697
Sample mean	42,728.87	0.0899	0.0571	-0.00316
First stage F-statistic	84.803	96.27	96.27	96.27
Individual × GCCSA FE	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the GCCSA region-by-individual level and are reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. All specifications control for age, age squared, experience, experience squared, marital status, and highest level of educational attainment; and include individual-by-region, industry-by-year, and state-by-year fixed effects. The independent variable is rescaled to represent a 0.1 percentage point increase in the share of Temporary Work Visa holders, for ease of interpretation.

Table 5. Effect of Temporary Work Visa holders on wages and tasks performed by native workers

	(1) Log wage	(2) Cognitive index	(3) Communication index	(4) Physical index
<i>Panel A: high-skilled native workers</i>				
Share visa holders (0.1 percentage point increase)	0.0115 (0.0112)	-0.000944 (0.0126)	0.0141 (0.00961)	-0.0257** (0.0103)
Observations	17,758	19,980	19,980	19,980
R-squared	0.804	0.792	0.767	0.777
First stage F-statistic	90.627	110.942	110.942	110.942
<i>Panel B: low-skilled native workers</i>				
Share visa holders (0.1 percentage point increase)	0.0611*** (0.00715)	0.0114 (0.00841)	0.00497* (0.00269)	-0.00535 (0.0102)
Observations	38,759	46,267	46,267	46,267
R-squared	0.791	0.749	0.771	0.832
First stage F-statistic	134.605	158.611	158.611	158.611
Individual FE	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the GCCSA region-by-individual level and are reported in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. All specifications control for age, age squared, experience, experience squared, marital status, and highest level of educational attainment; and include individual, industry-by-year, and state-by-year fixed effects. Panel A displays results from the estimation of Equation (1) for native workers who have a Bachelor's degree or higher. Low-skilled workers are defined as those with a qualification lower than a Bachelor's degree. The independent variable is rescaled to represent a 0.1 percentage point increase in the share of Temporary Work Visa holders for ease of interpretation.

Table 6. Effect of Temporary Work Visa holders on wages and tasks performed by previous immigrants

	(1) Log wage	(2) Cognitive index	(3) Communication index	(4) Physical index
<i>High-skilled foreign-born workers</i>				
Share visa holders (0.1 percentage point increase)	-0.00646 (0.00617)	0.0369*** (0.00534)	0.0327*** (0.00611)	-0.0135** (0.00626)
Observations	5,919	6,891	6,891	6,906
R-squared	0.793	0.832	0.801	0.825
First stage F-statistic	90.627	320.30	320.30	320.30
<i>Low-skilled foreign-born workers</i>				
Share visa holders (0.1 percentage point increase)	0.0287 (0.0192)	-0.0542*** (0.0167)	-0.0569** (0.0228)	0.0378 (0.0146)
Observations	7,610	9,674	9,674	9,724
R-squared	0.768	0.78	0.797	0.856
First stage F-statistic	12.45	73.45	73.45	73.45
Individual FE	Yes	Yes	Yes	Yes
State × Year FE	Yes	Yes	Yes	Yes
Industry × Year FE	Yes	Yes	Yes	Yes

Notes: Standard errors are clustered at the GCCSA region-by-individual level and are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. All specifications control for age, age squared, experience, experience squared, marital status, and highest level of educational attainment; and include individual, industry-by-year, and state-by-year fixed effects. Panel A displays results from the estimation of Equation (1) for foreign-born workers who have a Bachelor's degree or higher. Low-skilled workers are defined as those with a qualification lower than a Bachelor's degree. The independent variable is rescaled to represent a 0.1 percentage point increase in the share of Temporary Work Visa holders for ease of interpretation.

of the share of Temporary Work Visa holders on the wages of high-skilled native workers. Taken together, these results provide some evidence that the average wage impacts estimated in Table 3 are primarily driven by the effect on low-skilled native workers. This would imply that low-skilled workers may be complementary inputs in the production process with the high-skilled Temporary Work Visa holders. Focusing on the occupation-specific tasks performed by native workers, we find that high-skilled natives change occupations to decrease their intensity of physical tasks performed; however, we find no evidence that they move into occupations with higher or lower intensities of communication or cognitive skills. Low-skilled native workers transition into jobs that require a higher intensity of communication skills; however, the magnitude of this effect is small.

Lastly, we estimate the effect of the visa programme on previous immigrants to Australia. Previous research has found that immigration of highly educated individuals primarily had adverse effects among other highly educated immigrants (Manacorda *et al.*, 2012). This may arise because this subset of the population may be the most substitutable with skilled-migrants. If the skilled migrants 'crowd out' existing workers, we would expect previous migrants to experience negative labour market consequences of skilled immigration. The results are found in Table 6.

Our results indicate that the Temporary Work Visa programme had no effect on wages for either high- or low-skilled foreign-born workers. However, we do find that high-skilled

foreign-born workers move into occupations that require higher intensities of cognitive and communication skills, and a lower intensity of physical skills. Low-skilled foreign-born workers decrease their intensity of cognitive and communication skills. Together, these results could indicate that a greater share of high-skilled migrants induces the upgrading of skills among existing high-skilled foreign-born workers. However, the effect on existing low-skilled foreign-born workers is puzzling. One possible explanation could be that, prior to the arrival of the temporary migrants, low-skilled foreign-born workers are employed in service-based communication intensive occupations. However, with the rise of skilled-migrants, low-skilled workers may transition into lower-skilled occupations that complement the high-skilled visa holders.

7. Conclusion

Skilled immigration continues to be a fiercely debated topic in developed economies. Policies designed to attract skilled migrants, such as the Temporary Work Visa in Australia, receive considerable criticism from opponents, who contend that such policies adversely affect the labour market outcomes of native workers. However, evidence of skilled immigrants crowding out native workers is mixed, with findings of negative effects typically limited to specific subsets of native workers who are the most substitutable with immigrant-supplied labour. In this paper, we investigate the impact of the Temporary Work Visa in Australia on the labour market outcomes of native workers. Our findings indicate positive effects of the Temporary Work Visa on the wages of native workers due to skill complementarities among native and immigrant workers. In response to an influx of skilled migrants, native workers transition into occupations that use a higher intensity of communication, rather than physical skills. When examining particular subgroups that may be most affected by the high-skilled immigrants, we find no evidence of adverse wage effects for native workers. Our results are consistent with the explanation that skilled immigration may increase overall productivity due to skill complementarities among immigrant and native workers.

We make several contributions to the existing literature. This is the first empirical examination of the labour market impact of the Australian Temporary Work Skilled Visa programme on native workers. Our empirical strategy contributes to a growing literature that uses longitudinal data and high dimensional fixed effects models to control for various sources of unobserved heterogeneity, including individual motivation and ability. Lastly, we control for the potential out-migration response of native workers, and the possibility of spurious correlations induced by the changing composition of respondents in cross-sectional samples.

One important limitation of our work is that our sample of native workers includes only those who were currently working at the beginning of the sample period. Thus, while we do not find evidence of crowding out among active labour market participants, skilled-immigration may decrease the probability of entering the labour force for currently unemployed native workers. Second, although our findings support the idea that visa holders and native workers perform complementary occupation-specific tasks, we only observe the job title of each worker, rather than their actual professional interactions. Future research studying the roles of skilled immigrant and native workers in the labour market using employer–employee matched datasets and focusing on the diversity of firms will provide important insights into their roles in the workplace. Lastly, though skilled immigration

induces native workers to change occupations, we are unable to observe the preferences of native workers for occupations and skills. Thus, while we estimate a positive average impact on wages, we are unable to assess the welfare implications for native workers who change occupations.

Disclosure: This paper uses unit record data from the Household, Income, and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS), and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed either to the DSS or to the Melbourne Institute.

This document and the views and opinions expressed in it do not necessarily reflect the views and opinions of the Department of Immigration and Border Protection, or represent their policies. The Department of Immigration and Border Protection gives no warranty or representation about the accuracy for fitness for any purpose of the information, and disclaims liability for any errors and omissions in its contents.

The authors wish to thank the Department of Home Affairs for facilitating access to the data on which the paper is based. In particular, they thank Richard Manderson of Home Affairs for his input on various aspects of the paper. However, the interpretations of the analysis are solely those of the authors and do not necessarily reflect the views and opinions of the Department of Home Affairs or any of their employees.

Supplementary material

[Supplementary material](#) is available on the OUP website. Both the approved Temporary Work Visa application data and HILDA survey data are confidential. However, the replication code is available on the OUP website. An online Appendix is also available as [supplementary material](#).

Acknowledgements

This work was undertaken prior to Daniel Crown working at the Congressional Budget Office. This paper has not been subject to the Congressional Budget Office's regular review and editing process. The views expressed here should not be interpreted as those of the Congressional Budget Office. The authors also wish to thank Mark Partridge, John Winters, Joyce Chen, Abdoul Sam, Leah Bevis, Rodrigo Perez-Silva, Christopher Dunphy, Wade Litt, and Timothy Jaquet, for helpful comments on earlier drafts. Any remaining errors are those of the authors.

References

- Altonji, J.G. and Card, D. (1991) The effects of immigration on the labor market outcomes of less-skilled natives, in NBER, *Immigration, Trade, and the Labor Market*, University of Chicago Press, Chicago, 201–234.
- Amuedo-Dorantes, C. and De la Rica, S. (2011) Complements or substitutes? Task specialization by gender and nativity in Spain, *Labour Economics*, 18, 697–707.
- Aydemir, A. and Borjas, G.J. (2011) Attenuation bias in measuring the wage impact of immigration, *Journal of Labor Economics*, 29, 69–112.
- Bartel, A.P. (1989) Where do the new US immigrants live?, *Journal of Labor Economics*, 7, 371–91.

- Bond, M. and Gaston, N. (2011) The impact of immigration on Australian-born workers: an assessment using the national labour market approach, *Economic Papers: A Journal of Applied Economics and Policy*, 30, 400–13.
- Borjas, G.J. (2003) The labor demand curve is downward sloping: re-examining the impact of immigration on the labor market, *The Quarterly Journal of Economics*, 118, 1335–74.
- Borjas, G.J., Freeman, R.B., Katz, L.F., DiNardo, J., and Abowd, J.M. (1997) How much do immigration and trade affect labor market outcomes?, *Brookings Papers on Economic Activity*, 1997, 1–90.
- Boubtane, E., Dumont, J.C., and Rault, C. (2016) Immigration and economic growth in the OECD countries 1986–2006, *Oxford Economic Papers*, 68, 340–60.
- Bound, J., Braga, B., Golden, J.M., and Khanna, G. (2015) Recruitment of foreigners in the market for computer scientists in the United States, *Journal of Labor Economics*, 33, S187–223.
- Bound, J., Khanna, G., and Morales, N. (2017). Understanding the economic impact of the H-1B Program on the US. Working Paper No. w23153, National Bureau of Economic Research.
- Card, D. (2001) Immigrant inflows, native outflows, and the local labor market impacts of higher immigration, *Journal of Labor Economics*, 19, 22–64.
- Chiswick, B.R. and Taengnoi, S. (2007) Occupational choice of high skilled immigrants in the United States, *International Migration*, 45, 3–34.
- Cooke, A. and Kemeny, T. (2017) Cities, immigrant diversity, and complex problem solving, *Research Policy*, 46, 1175–85.
- Corcoran, J., Faggian, A., and McCann, P. (2010) Human capital in remote and rural Australia: the role of graduate migration, *Growth and Change*, 41, 192–220.
- DIBP (2016) Subclass 457 quarterly report, Australian Government, Department of Immigration and Border Protection.
- DIBP (2017) Reforms to Australia's Temporary Employer Sponsored Skilled Migration Programme Abolition and Replacement of the 457 Visa, Fact Sheet, Australian Government, Department of Immigration and Border Protection.
- Doran, K., Gelber, A., and Isen, A. (2016) The effects of high-skilled immigration policy on firms: evidence from visa lotteries, NBER Working Paper No. 20668, NBER, Cambridge, MA.
- Dustmann, C., Schönberg, U., and Stuhler, J. (2016) The impact of immigration: why do studies reach such different results?, *Journal of Economic Perspectives*, 30, 31–56.
- Foged, M. and Peri, G. (2016) Immigrants' effect on native workers: new analysis on longitudinal data, *American Economic Journal: Applied Economics*, 8, 1–34.
- Goldsmith-Pinkham, P., Sorkin, I., and Swift, H. (2018) Bartik instruments: what, when, why, and wow. Working Paper No. w24408, NBER, Cambridge, MA.
- Horwitz, S.K. and Horwitz, I.B. (2007) The effects of team diversity on team outcomes: a meta-analytic review of team demography, *Journal of Management*, 33, 987–1015.
- Hunt, J. (2011) Which immigrants are most innovative and entrepreneurial? Distinctions by entry visa, *Journal of Labor Economics*, 29, 417–57.
- Hunt, J. and Gauthier-Loiselle, M. (2010) How much does immigration boost innovation?, *American Economic Journal: Macroeconomics*, 2, 31–56.
- Islam, A., Islam, F., and Nguyen, C. (2017) Skilled immigration, innovation, and the wages of native-born Americans, *Industrial Relations: A Journal of Economy and Society*, 56, 459–88.
- Jaeger, D.A., Ruist, J., and Stuhler, J. (2018). Shift-share instruments and the impact of immigration. Working Paper No. w24285, NBER, Cambridge, MA.
- Kapur, D. and McHale, J. (2005) *Give Us Your Best and Brightest: The Global Hunt for Talent and its Impact on the Developing World*, Center for Global Development, Washington, DC.
- Kato, T. and Sparber, C. (2013) Quotas and quality: the effect of H-1B visa restrictions on the pool of prospective undergraduate students from abroad, *Review of Economics and Statistics*, 95, 109–26.

- Kerr, S. P., Kerr, W., Özden, C., and Parsons, C. (2016). Global talent flows. *Journal of Economic Perspectives*, 30, 83–106.
- Kerr, W. R., and Lincoln, W. F. (2010). The supply side of innovation: H-1B visa reforms and US ethnic invention. *Journal of Labor Economics*, 28, 473–508.
- Khanna, G. and Lee, M. (2018). High-skill immigration, innovation, and creative destruction. Working Paper No. w24824, NBER, Cambridge, MA.
- Khoo, S.-E., Voigt-Graf, C., McDonald, P., and Hugo, G. (2007) Temporary skilled migration to Australia: employers' perspectives, *International Migration*, 45, 175–201.
- Kifle, T. (2009) The effect of immigration on the earnings of native-born workers: evidence from Australia, *The Journal of Socio-Economics*, 38, 350–6.
- Kinnaird, B. et al(2002) Australia's migration policy and skilled ICT (information communications technology) professionals: the case for an overhaul, *People and Place*, 10, 55.
- Kinnaird, B. et al(2006) Current issues in the skilled temporary subclass 457 visa, *People and Place*, 14, 49.
- LaLonde, R. J. and Topel, R.H. (1991) Immigrants in the American labor market: quality, assimilation, and distributional effects, *The American Economic Review*, 81, 297–302.
- Lazear, E.P. (1999) Globalisation and the market for team-mates, *The Economic Journal*, 109, 15–40.
- Manacorda, M., Manning, A., and Wadsworth, J. (2012) The impact of immigration on the structure of wages: theory and evidence from Britain, *Journal of the European Economic Association*, 10, 120–51.
- McHenry, P. (2015) Immigration and the human capital of natives, *Journal of Human Resources*, 50, 34–71.
- Orrenius, P.M. and Zavodny, M. (2007) Does immigration affect wages? A look at occupation-level evidence, *Labour Economics*, 14, 757–73.
- Ozgen, C., Peters, C., Niebuhr, A., Nijkamp, P., and Poot, J. (2014) Does cultural diversity of migrant employees affect innovation?, *International Migration Review*, 48, 377–416.
- Peri, G. (2014) *Do Immigrant Workers Depress the Wages of Native Workers?* IZA World of Labor, Bonn.
- Peri, G., Shih, K., and Sparber, C. (2015) STEM workers, H-1B visas, and productivity in US cities, *Journal of Labor Economics*, 33, S225–55.
- Peri, G. and Sparber, C. (2009) Task specialization, immigration, and wages, *American Economic Journal: Applied Economics*, 1, 135–69.
- Peri, G. and Sparber, C. (2011) Highly educated immigrants and native occupational choice, *Industrial Relations: a Journal of Economy and Society*, 50, 385–411.
- Productivity Commission (2016) Migrant intake into Australia, Inquiry Report 77, Productivity Commission, Canberra.
- Randall, D. (2007) 457 visa compliance arrangements, communication and program administration: key issues and improved procedures, ch. 3, The Parliament of the Commonwealth of Australia.
- Sparber, C. (2018) Choosing skilled foreign-born workers: evaluating alternative methods for allocating H-1B work permits, *Industrial Relations: A Journal of Economy and Society*, 57, 3–34.
- Tang, A.Z.R., Rowe, F., Corcoran, J., and Sigler, T. (2014) Where are the overseas graduates staying on? Overseas graduate migration and rural attachment in Australia, *Applied Geography*, 53, 66–76.
- Trax, M., Brunow, S., and Suedekum, J. (2015) Cultural diversity and plant-level productivity, *Regional Science and Urban Economics*, 53, 85–96.
- Tuccio, M. (2019), Measuring and assessing talent attractiveness in OECD countries. OECD Social, Employment and Migration, Working Papers, No. 229, Paris.
- Winter-Ebmer, R. and Zweimuller, J. (1996) Immigration and the earnings of young native workers, *Oxford Economic Papers*, 48, 473–91.