SKILLS AND RURAL-URBAN WAGE DIFFERENCES IN AUSTRALIA

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ABSTRACT: Evidence from countries around the world suggests that rural-urban wage gaps are not solely explained by skill differences. Using data for Australia, the current study reaches the same conclusion; there is positive relationship between local economy size and local wages. Workers in Australian large urban centres earn around 7.5% more than workers with similar skill levels in rural areas. Urban Australians do not experience higher wage growth than rural Australians. Therefore, high wage growth in the year following rural-urban migration is most likely explained by the migrant taking jobs that below his ability upon arrival.

KEYWORDS: Wage premium; Australia; learning; urban; skills; migration.

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1. INTRODUCTION

The urban wage premium is an important aspect of urbanization that has been observed around the world (for example, the studies of Glaeser and Maré (2001) for the US, Combes, Duranton and Gobillon, (2008) for France and De la Roca and Puga (2017) for Spain). Workers in Australian capital cities have earned 17% to 22% more than workers in other parts of the states since 1995 (Australian Government — Treasury, 2017, based on ABS data). Empirical studies on the topic often aim to measure how much more an urban worker earns than a rural worker who has similar skill levels, and the main interest lies in accounting for individual heterogeneity to isolate location effects on individual wages.

Recent empirical research on the urban wage premium focuses on the use of panel data on individuals to control for individual differences. Using individual fixed effects is standard to capture 'unobserved' individual characteristics (to name a few, Combes *et al.*, 2008; De la Roca and Puga, 2017; Glaeser and Maré, 2001; Yankow, 2006). For example, learning facilities in large cities potentially draw individuals with learning aptitude to the area. These skills and learning habits can be then transferred to their children, who likely live in the same city (Combes and Gobillon, 2015). Ambitious individuals may prefer cities because of the broad range of career options. These individual characteristics, at the same time, affect how much an individual earns. The measures of these characteristics, in many cases, are not available from the data, but omitting without using fixed effects potentially biases wage premium estimates (Glaeser and Maré (2001) for more arguments for the use of fixed effects).

Although individual fixed effects effectively deal with the time-invariant part of unobserved individual characteristics, they do not address the evolution of individual skills that is dependent on locations. Marshall (1890)'s hypothesis on the acceleration of human capital accumulation in cities suggests that a worker' skills appreciate with time that he spent in cities: ideas are easy to spread, and efforts are more likely noticed and rewarded if there are more people nearby. If so, a year in a large city potentially benefits wage growth more than a year in other areas through its effect on worker skills. In the US, Glaeser and Maré (2001) found that workers who move from rural to urban areas experienced wage rises which increase with time postmigration and Yankow (2006) found that a year in a city was associated with a 1.3% increase in individual wages relative to a year in a rural area. A more comprehensive study on urban learning and its effects on wage premium estimates was conducted by De la Roca and Puga (2017) for Spain's cities. Their strategy is to include years of work experience for each type of city sizes. Their findings are consistent to the previous findings in the US and supports the learning hypothesis. In Australia, Rowe, Corcoran and Bell (2017) also found wage gain in subsequent years following metropolitan migration for young workers.

Australia is one of the most urbanized countries in the word. As of 2001, eight in 10 Australians lived within 50 kilometers of the coastline, and most of them lived in capital cities situated near the coast (Australian Bureau of Statistics (ABS), 2004). However, there is a lack of studies on the urban wage premium in the country. One study that I am aware of is Meekes

(2022). Like other empirical wage premium studies, this study primarily focuses on measuring the extent to which urban-rural status affects individual wages. To that end, the study uses a broad range of individual characteristics in the Household, Income and Labour Dynamics in Australia (HILDA) survey to control for rural-urban workers' differences. Unobserved individual differences are addressed using individual fixed effects. The study also examines how urban learnings and transitional noise affect urban wage premium estimates by extending the 'long' difference models of Yankow (2006).

In addition to providing empirical results of the urban wage premium in the case of Australia following Yankow (2006), the study contributes to the literature in several other ways. The effects of personality traits on the urban wage premium are suggested (Combes and Gobillon, 2015), but have not been tested. Glaeser and Maré (2001) and Rowe *et al.* (2017) do not identify whether high wage growth for rural-to-urban migrants in the years following migration indicates urban learning benefits or simply reflects an acclimatization process where it takes time for individual wages to reflect their skills in a new environment. The processes underlying high wage growth post rural-to-urban migration and why urban-to-rural migrants do not experience significant wage loss are not clear in the previous studies (Glaeser and Maré, 2001; Rowe *et al.*, 2017; Yankow, 2006). These are the issues that the study aims to shed light on.

2. DATA

The HILDA is a longitudinal survey in Australia, focusing on family formation, income and work. The study uses Release 16 which follows a nationally representative sample of Australian households and household members from 2001 to 2016.

Restrictions

The HILDA definition of employment includes employee, employer/self-employed, employee of own business and unpaid family workers. This study excludes unpaid family workers and employer/self-employed because these individuals do not often receive and report wages and salaries, making the reported hourly wage calculations for these two groups unreliable. Like related urban wage premium studies (De la Roca and Puga, 2017; Glaeser and Maré, 2001; Yankow, 2006), this study focuses on full-time male workers, working more than 35 hours per week to make comparisons easy. There are other reasons for not including both males and females in a model. First, education and work experience may not have the same influences on males' and females' human capital accumulation. Second, females may earn different wages to similar skilled males due to gender wage discrimination. Nevertheless, analyzing female full-time workers separately suggests that they also experience urban wage premium like male full-time workers.

The usual weekly gross wages and salaries (before tax) in all jobs include earnings from main jobs and from other jobs. Hourly wages are the total gross earnings divided by the combined weekly hours that the person usually works across all jobs (Summerfield *et al.*, 2017). With these restrictions, the sample consists of 9,257 individuals and 54,636 individual-year observations with valid location information.

Individual Characteristic Variables

The Mincer earnings function, based on human capital approaches, describes an individual's current human capital level through his education and work experience (Mincer, 1974). Following that tradition, studies on spatial wage differentials often use individual wages in log form, and include some types of education and work experience variables (Di Addario and Patacchini, 2008; Duranton and Monastiriotis, 2002; Glaeser and Maré, 2001; Yankow, 2006). Considering nonlinear return to years of schooling, some studies include education levels (De la Roca and Puga, 2017; Di Addario and Patacchini, 2008).

Years of schooling can be estimated based on the highest level of education achieved (Leigh and Ryan, 2008; Peng Yu, 2004). This calculation ignores the fact that people take different paths to the highest level and that the qualifications obtained may not all be relevant in achieving the highest level. For that reason, this study measures years of schooling by the sum of years of school education (the highest year of school completed plus one year for Kindergarten/Preparatory) and the total estimated duration of all qualifications obtained after leaving school. A qualification's duration is the number of full-time years needed to achieve the course's learning outcomes (Australian Qualification Framework Council, 2013). Extreme values of more than 30 years of schooling are excluded. Years of work experience are accumulated years in paid work. Year 12, Bachelor (or Honours) and Postgraduate (Masters or Doctorate) variables indicate the highest level of education achieved.

In addition to the traditional Mincerian measures of human capital, the HILDA data contains measures of individual cognitive ability and personality. These variables provide direct measures of individual skills, in the spirit of the Armed Forces Qualification Test (AFQT) scores in the US' National Longitudinal Survey of Youth (NLSY) (Glaeser and Maré, 2001; Gould, 2007; Yankow, 2006) and Bacolod, Blum and Strange (2009)'s motor and cognitive skills. The argument is that education levels are not the same as intelligence and capability and so do not accurately predict how well people do their jobs. The three cognitive tests are Backwards Digit Span, Simple Digit Modalities and short National Adult Reading Test (short NART). The Backwards Digit Span test measures working memory span, the Simple Digit Modalities test measures 'divided attention, visual scanning and motor speed' in general (Strauss *et al.*, 2006, p. 617) and the short NART measure reading ability which highly correlates with intelligence (Wooden, 2013).

The HILDA provides scores on the Big Five Personality Traits, namely extraversion, emotional stability, openness to experience, agreeableness and conscientiousness. The higher a participant scores on a personality trait, the more the trait describes the person (Summerfield *et al.*, 2017). Cognitive tests were in waves 12 and 16, and personality tests were in waves 5, 9 and 13 only. Because both cognitive ability and personality are relatively stable for working-age adults (Cobb-Clark and Schurer, 2012) and to preserve observations in regressions, I use an individual's average score on a type of test as his score on that test in all waves.

Section of State (SOS) Structure

The SOS structure (edition 2011) divides Australia into four areas of Major Urban, Other Urban, Bounded Locality and Rural Balance. Major Urban and Other Urban are built from Urban Centres, areas with high population density (at least 200 persons per sq. km or 50 dwellings per sq. km) or with 'urban' infrastructure. Urban infrastructure includes facilities such as airports, parks, education institutions, hospitals, office complexes, sport facilities and shopping centres. Major Urban represents all Urban Centres with a population of 100,000 or more, and Other Urban represents all Urban Centres with a population ranging from 1,000 to 99,999. (ABS, 2012). In the study sample, around 70% of observations are in Major Urban while only around 2% and 8% are in Bounded Locality and Rural Balance respectively. I merge these two areas and call them Rural Area in this study. Rural Area represents all small population clusters of below 1,000 persons and the rest of Australia.

Table 1. Sample Statistics. Source: the Author.

	Major Urban		Other Urban		Rural Area	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Hourly wage	31.205	18.784	26.525	15.089	25.751	15.004
Hourly wage adjusted by inflation	24.707	14.090	21.031	11.111	20.410	11.301
Married (or de facto)	0.716	0.451	0.721	0.449	0.735	0.442
Born overseas	0.250	0.433	0.088	0.284	0.114	0.318
Years of schooling	14.062	3.126	12.820	2.950	12.971	3.011
Years of experience	19.955	12.304	20.718	12.674	22.605	13.003
Postgraduate	0.072	0.259	0.020	0.141	0.025	0.158
Bachelor	0.250	0.433	0.116	0.320	0.141	0.349
Year 12	0.525	0.499	0.585	0.493	0.565	0.496
Years in current occupation	9.636	9.771	9.798	9.899	12.089	11.702
Years with current employer	7.114	8.061	7.312	8.471	8.379	9.499
Backwards Digit Span	5.130	1.341	4.924	1.255	4.907	1.302
Symbol Digit Modalities	50.927	9.946	48.639	10.407	47.129	9.633
Short NART	14.668	5.149	12.748	5.257	12.992	5.466
Extroversion	4.341	0.964	4.336	0.921	4.310	0.887
Agreeableness	5.161	0.797	5.110	0.830	5.109	0.810
Conscientiousness	5.039	0.900	4.961	0.886	4.982	0.886
Emotional stability	5.112	0.929	5.098	0.930	5.156	0.920
Openness to new experience	4.354	0.918	4.145	0.909	4.095	0.924
Union	0.264	0.441	0.322	0.467	0.277	0.447
Observations of dependent variables	37,709		11,159		5,768	

3. SKILLS AND URBAN WAGE PREMIUM

Ordinary Least Squares (OLS) Estimates

To see how various skills affect urban wage premiums, I first ignore the possible unobserved individual heterogeneity and estimate the following relationship using OLS:

$$y_{ict} = \beta_c + X_{it}\theta + \epsilon_{ict} \quad (1)$$

i, c and t indicate individual, area and year respectively. y_{ict} is the log of hourly wages, X_{it} and θ are individual characteristics and their corresponding coefficients, and ϵ_{ict} is an error term. β_c, the wage premium of area c (or location effects of c), is the parameter of interest. They are estimated by including $C-1$ location dummies, τ_{ict}; τ_{ict} takes the value of one if worker i is in area c in year t and zero otherwise. There are three areas in this analysis: Major Urban, Other Urban and Rural ($C = 3$). Rural Area is the base. All regressions include yearly time indicators to control for countrywide time shocks such as increases in overall price levels.

Individual characteristic variables X_{it} consist of marital status, born overseas, years of schooling, years of work experience and its square, education levels, three cognitive ability measures, five personality traits measures, occupation and industry indicators. I add them by groups to examine the effects of each type of skill on urban wage premium estimates. An advantage of OLS is that OLS uses cross individual variations as well as within individual variations rather than only within-individual variations like Fixed Effects and First Difference for Fixed Effects models. Estimating wage premiums through movers assumes that stayers would receive the same benefits as movers if they moved. That may not always true because of the potential self-selection process (Combes *et al.*, 2011; Gould, 2007).

Columns (1) to (7) in Table 2 present OLS results. Column (1) is the baseline regression with no controls for differences in individual skills. Workers in Major Urban, population centres from 100,000 persons, earn a wage premium of 19.3% relative to their counterparts in Rural Area. Workers in Other Urban, population centres of above 1,000 but below 100,000 persons, also earn a wage premium, albeit only about a fifth of Major Urban's premium, of 4.9%. The results are statistically significant at the 1% level. The premiums are less than the premiums of around 30% observed in the US and France or the premiums of as much as 60% of Paris or Madrid relative to those countries' rural areas (Combes *et al.*, 2008; De la Roca and Puga, 2017; Glaeser and Maré, 2001). Controlling for individuals' demographic differences in marital status and being born overseas in Column (2) does not change urban wage premiums significantly.

Columns (3) and (4) add traditional human capital controls of education and work experience. Column (3) considers a traditional Mincerian human capital specification with years of schooling, years of work experience and work experience squared. Column (4) provides more details on education and work experience, namely education levels and years in current occupation and with current employer. Education levels account for nonlinear effects of education on wages. Time in current occupation will predict the amount of occupation specific skill. Likewise, spending more time with the same employer can increase performance as workers get used to the staff and procedures.

Table 2. Estimation of Wage Premiums Considering Individuals Heterogeneity.
Source: the Author.

	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	Fixed (7)	Fixed (8)	Fixed (9)
Major Urban	0.193*** (0.02)	0.193*** (0.02)	0.167*** (0.02)	0.121*** (0.01)	0.116*** (0.02)	0.118*** (0.02)	0.075*** (0.02)	0.077*** (0.02)	0.077*** (0.02)
Other Urban	0.049*** (0.02)	0.054*** (0.02)	0.073*** (0.02)	0.063*** (0.01)	0.048*** (0.02)	0.048*** (0.02)	0.046*** (0.01)	0.041*** (0.01)	0.041*** (0.01)
Married or de facto		0.275*** (0.01)	0.120*** (0.01)	0.088*** (0.01)	0.086*** (0.01)	0.081*** (0.01)	0.046*** (0.01)	0.045*** (0.01)	0.045*** (0.01)
Born overseas		0.039*** (0.01)	—0.019 (0.01)	—0.016 (0.01)	—0.007 (0.01)	—0.006 (0.01)			
Years of schooling			0.045*** (0.00)	0.008*** (0.00)	0.003 (0.00)	0.003 (0.00)	0.027*** (0.00)	0.023*** (0.00)	0.023*** (0.00)
Years of experience			0.035*** (0.00)	0.030*** (0.00)	0.031*** (0.00)	0.030*** (0.00)	0.050*** (0.01)	0.048*** (0.01)	0.047*** (0.01)
Years of experience sq.			—0.001*** (0.00)	—0.001*** (0.00)	—0.001*** (0.00)	—0.001*** (0.00)	—0.001*** (0.00)	—0.001*** (0.00)	—0.001*** (0.00)
Postgraduate				0.329*** (0.03)	0.327*** (0.03)	0.333*** (0.03)		0.090* (0.05)	0.091* (0.05)
Bachelor				0.241*** (0.02)	0.229*** (0.02)	0.232*** (0.02)		0.056 (0.04)	0.057 (0.04)
Level 12				0.095*** (0.01)	0.079*** (0.01)	0.078*** (0.01)		0.084*** (0.02)	0.086*** (0.02)
Years in current occupation				0.003*** (0.00)	0.003*** (0.00)	0.003*** (0.00)		0.001** (0.00)	0.001** (0.00)
Years with current employer				0.001 (0.00)	0.001* (0.00)	0.001 (0.00)		0.000 (0.00)	0.000 (0.00)
Backwards Digit Span					0.004 (0.00)	0.004 (0.00)			
Symbol Digit Modalities					0.003*** (0.00)	0.003*** (0.00)			
Sort NART					0.005*** (0.00)	0.006*** (0.00)			
Extroversion						0.008 (0.01)			
Agreeableness						—0.022*** (0.01)			
Conscientiousness						0.035*** (0.01)			
Emotional stability						—0.011* (0.01)			
Openness to experience						—0.012* (0.01)			
Union									0.035*** (0.01)
Occupation indicator	No	No	No	Yes	Yes	Yes	No	Yes	Yes
Industry indicator	No	No	No	Yes	Yes	Yes	No	Yes	Yes
N	54,636	54,613	53,622	53,079	42,246	40,155	53,630	53,087	53,076
R sq.	0.150	0.203	0.328	0.432	0.436	0.441	0.381	0.389	0.390

Note: All regressions include a constant term and time indicators. Dependent variable is log of nominal hourly wages. Numbers in brackets are robust standard errors, clustered on individuals. ***, ** and * are significant at 1%, 5% and 10% respectively. Reported R sq. is overall for OLS regressions and within-individual for Fixed Effects regressions. Sample sizes are different because variables have different numbers of observations in the sample.

The study includes occupation (one-digit ANZSCO 2006) and industry (ANZSIC 2006 division) indicators in Column (4). Because the ANZSCO groups are linked with skill levels that workers in the group often possess (ABS, 2006, p. 21), occupations are also indirect measures of skills. Wages vary by industries, and the concentration of highly-paid industries in large cities may explain the urban wage premium. Furthermore, workers may move to cities to participate in white-collar work (Gould, 2007), and so any increase in wages is due to sectoral change rather than changes in location effects. Accounting for individual differences in education, work experience, occupation and industry in Column (4) reduces Major Urban's premium by nearly half of the baseline estimate to 12.1%. The estimates are in line with the estimates obtained with similar specifications in Yankow (2006), 18.7% for the US' Big City and 8.2% for Small City. In Yankow (2006)'s study, Big City has a population of more than one million and Small City has a population of more than 250,000 but less than one million, and that may explain why the estimates obtained are slightly higher. D'Costa and Overman (2014), also with age, occupation and industry controls, obtained smaller estimates for the UK: the wage premium of 6.2% for big cities, and 4.8% for small cities in the UK.

Columns (5) and (6) add direct measures of skills available in addition to Mincerian skill controls and the Big Five personality traits. The direct measures of skills have very small impact on the estimations. The results are similar to those of Glaeser and Maré (2001) and Yankow (2006) who found that a basic ability test, AFQT scores, made little differences in wage premium estimates. Ambitiousness, adventurousness, and cognitive ability may not drive the bulk of spatial wage differentials as some may expect (Combes and Gobillon, 2015). As using individual fixed effects significantly reduces urban wage premium estimates as Column (7) and (8) show, other individual characteristics explaining rural-urban wage differentials remain to be determined. Wage premium estimates for the smaller population centres, Other Urban, are not affected as much by individual controls, staying at around 5% during the process. That is not surprising given that urban theories emphasize the effects of the largest population centres on individual wages (Glaeser and Maré, 2001).

Fixed Effects Estimates

I assume the following relationship:

$$y_{it} = \beta_c + \mu_i + X_{it}\,\theta + \epsilon_{it} \quad (2)$$

and estimate by Fixed Effects (Glaeser and Maré, 2001). β_c is identified through movers as for non-movers, τ_{ict} is fixed during the period and $\tau_{ict} - \bar{\tau}_{ic} = 0$. Table 3 shows that there are enough migrations in the sample, allowing reliable estimation of location effects. μ_i represents innate abilities that are not captured by observed characteristics. These unobserved abilities like intelligence or family background likely relate to highest education levels achieved and job tenures. As μ_i potentially correlates with X_{it}, Fixed Effects are preferred to Random Effects: Fixed Effects estimators are consistent while Random Effects are not. In fact, Hausman tests resoundingly reject Random Effect models.

Table 3. Migrations for Major Urban, Other Urban and Rural Area. Source: the Author.

	Move in	Move out	Stay
Major Urban	423	479	16,927
Other Urban	501	517	7,952
Rural	434	362	3,904

Column (7) in Table 2 suggests that workers moving from Rural to Major Urban experience a 7.5% increase in wages relative to stayers. The coefficient is less than half of the OLS estimate with similar controls for individual differences in Column (3). The estimate is also significantly smaller than the OLS estimate with all individual controls in Column (6). The point estimate for Other Urban decreases, to a lesser extent, to 0.046. For movers from Other Urban to Major Urban, the predicted increase in wages is around 2.9% (i.e. $\approx 7.5\% - 4.6\%$). Adding more detailed variables on education and work experience, occupation skills and industry indicators in Column (8) makes small differences to the estimates.

These estimates with Fixed Effects are in line with the findings of Glaeser and Maré (2001) and Yankow (2006) of around 5% to 10% for large cities and 2% to 7% for small cities. Compared to OLS estimates with all individual controls, the estimate of 7.7% for Major Urban by Fixed Effects is around 35% lower.

Besides individual characteristics, I consider whether individuals' union membership affects their wages in Column (9). In Australia, union wage effects may be slightly positive, ranging from 2% to 11% (Cai and Liu, 2008; Cai and Waddoups, 2011; Waddoups, 2005) or even negative (Nahm *et al.*, 2017). Although union membership (or employee association) is associated with an increase of 0.035 in the log of wages in this study, it makes no differences in the urban wage premium estimates.

While this study focuses on full-time male workers, the results are likely similar for other worker groups. Concerning higher pay rates of casual employment, I add an indicator for casual work to Column (8) in Table 2. The change of Major Urban's estimates to 8.4% (p-value = 0.00) is likely due to the change in observations used rather than the control as the number of observations decreases by nearly half because of invalid responses to the survey question. In another regression, I include a 'part-time' indicator and uses a sample having both part-time and full-time male workers. Again, the differences are small; the estimates are 7.6% (p-value = 0.00) for Major Urban and 3.6% (p-value = 0.01) for Other Urban. Lastly, Fixed Effects estimate for female full-time workers in Major Urban with a specification in Column (8) is 6.3% (p-value = 0.00).

The above results with specifications without individual fixed effects and Fixed Effects models show that urban wage premiums in Australia, like in other countries, do not solely result from differences in skills between urban and rural workers. While the rural-urban wage differentials of around 20% are smaller, the advantage of around 7.5% after accounting for individual differences with fixed effects is relatively larger than in other countries. Agglomerations may contribute more to spatial wage differentials in Australia than in other countries.

4. URBAN LEARNING BENEFITS

First Difference Estimates

Assume that there are only two types of areas, rural and urban areas and all migrations are from rural to urban areas. The location effect of urban areas relative to rural areas $\beta_{Urban} = \delta$, and for each year working in urban areas, workers acquire skills that increase their wages by σ relative to working in rural areas. A rural-to-urban migrant will enjoy an extra wage of $\delta + n\sigma$ after n years after the migration; the average wage benefit associated with urban areas estimated by the Fixed Effects estimation is $\hat{\delta}_{FE} = \delta + \frac{(n+1)}{2}\sigma$. In that case, the urban wage premium δ is overestimated by $\frac{(n+1)}{2}\sigma$. If all migrants move in the other direction from urban to rural areas, estimated wage benefits associated with living n years in the city is $\hat{\delta}_{FE} = \delta - \frac{(n+1)}{2}\sigma$. In that case, Fixed Effects underestimate the urban wage premium by $\frac{(n+1)}{2}\sigma$. If movement among areas is balanced, $\hat{\delta}_{FE}$ will be close to δ as these biases cancel out each other. (Combes *et al.*, 2011; De la Roca and Puga, 2017)

In the sample, migrations are slightly from urban to rural areas. Migrations from Rural Area to Other Urban is 210 and other way around is 246. For Rural Area to Major Urban, the numbers are 152 and 188. Also, between Major and Other Urban, there are more migrations from Other to Major Urban, 291 compared to 271. The above argument and potential learning acceleration in urban areas mean that the Fixed Effects estimates could be biased downwards. Consider the first difference of Equation (2) between years $t+1$ and t

$$\Delta y_{ict} = \Delta X_{it}\theta + \beta_c\left(\tau_{ic(t+1)} - \tau_{ict}\right) + \Delta\epsilon_{ict} \quad (3)$$

In this specification, β_c is identified when $\tau_{ic(t+1)} \neq \tau_{ict}$. Thus, β_c is identified via movers and is associated with wage changes right before and after the move rather than wage changes for the whole studied period like Fixed Effects. The longer time a person stays in an area or the larger n, the greater the area affects his skills via affecting his skill accumulation. Within a short timeframe of a year, a jump in wages associated with location changes, controlling for other skill changes, probably better reflects the difference in location effects between the locations of arrival and departure. Assume that there are two areas, in the first case when all migrations are from rural to city, $\hat{\delta}_{FD} = \delta + \frac{\sigma}{2}$ and in the second case when all migrations are from city to rural $\hat{\delta}_{FD} = \delta - \frac{\sigma}{2}$. Besides the advantage of First Difference estimators that they are less affected by learning-location time dependence, I use First Difference to check the robustness of the results by Fixed Effects.

With the three areas in the study, Equation (3) can be written as

$$\Delta y_{ict} = \Delta X_{it}\theta + \beta_{Major}\Delta Major\ Urban + \beta_{Other}\Delta Other\ Urban + \Delta\epsilon_{ict} \quad (4)$$

Column (1) in Table 4 presents OLS estimates of Equation (4). $\Delta Major\ Urban$ or $\Delta Other\ Urban$ takes the value of one if worker i moves in the area between years t and $t+1$, minus one if he moves out, and zero otherwise. Independent variables besides location variables are the difference between years $t+1$ and t of year indicators, marital/de facto status, years of schooling, education levels, years of work experience and its square, tenure in current occupation and with current employer, occupation and industry. The reference group includes people who do not move during the period between years t and $t+1$. The point estimate of $\Delta Major\ Urban$ is 0.031, statistically significant at the 5% level. In other words, moving from Rural Area to Major Urban is associated with an immediate wage rise of 3.1% relative to not moving, and moving in the opposite direction is associated with an immediate wage fall of 3.1%. The effect is smaller for Other Urban with an estimated wage premium of 2.4% (p-value = 0.11). The urban wage effects are weaker with the First Difference than with Fixed Effects. Compared to the respective wage premium estimates by Fixed Effects in Column (9) in Table 2, the urban wage premium estimated by First Difference is only about half. On the contrary, Yankow (2006) found that differences between Fixed Effects and First Difference estimates of the urban wage premium are insignificant. The reduction in wage premium estimates is also not what we expected given the urban-to-rural migration direction in the data and assuming learning benefits in big cities as discussed in the econometric specifications. Even though the wage gain is smaller than expected, rural-to-urban migrants do not experience an immediate wage loss as found by Rowe *et al.* (2017) for young Australians. It could be that career paths are important for young workers, and they accept the loss for future career development while other workers do not.

Table 4. Estimation of Urban Wage Premium by First Difference. Source: the Author.

	OLS (1)	OLS (2)
ΔMajor Urban	0.031^{**} (0.02)	
Stay in Major Urban		–0.002 (0.00)
Move in Major Urban		0.049^{**} (0.02)
Move out Major Urban		–0.018 (0.02)
ΔOther Urban	0.024 (0.02)	
Stay in Other Urban		–0.003 (0.00)
Move in Other Urban		0.030 (0.02)
Move out Other Urban		–0.020 (0.02)
N	40,101	40,101
R sq.	0.012	0.012

Notes: Dependent variable is the change in the log of wages between years $t+1$ and t, i.e. $\Delta lnw_{it} = lnw_{i(t+1)} - lnw_{it}$. Other independent variables are changes between years $t+1$ and t in year indicators, marital/de facto status, years of schooling, years of experience and its square, education levels, tenure in current occupation and with current employer, occupation indicators and industry indicators. Numbers in brackets are robust standard errors, clustered on individuals. ***, ** and * are significant at 1%, 5% and 10%, respectively.

Following Yankow (2006), I augment $\Delta Major\ Urban$ and $\Delta Other\ Urban$ into 'Move in', and 'Move out' indicators. The 'Move in' indicators take the value of one if people are not in the area in year t and in the area in year $t + 1$ and the 'Move out' indicators are the reverse. The purpose is to allow the effects of moving in and out to be different rather than to constrain them to be the same as in Column (1). If wage change is solely associated with change in location effects, we expect that a worker who gains a wage premium when moving into an area will lose the same premium when moving out of the area. If so, the estimated coefficients of Move in and Move out will be equal in magnitude but have opposite signs. I add two indicators, Stay in Major Urban and Stay in Other Urban. The indicators take the value of one if the person stays in the same area in both years and zero otherwise. The specification examines whether people staying in Major Urban or Other Urban receive learning benefits relative to staying in Rural Area, as proposed by Glaeser (1999) and Marshall (1890). If urban learning benefits exist, everything else being equal, wage growth of urban stayers will be higher than wage growth of rural stayers or the estimated coefficients of the two indicators will be positive. The reference group with this specification consists of people who stay in Rural Area in both years t and $t + 1$.

In Table 4, workers moving from Rural to Major Urban enjoy a 4.9% increase in wages relative to workers staying in Rural Area for the period. Other coefficients are not significantly different from zero above the 10% level even though the signs are in line with the expectation: moving into an urban area gains wages and moving out loses wages. Notably, workers moving out of Major Urban or Other Urban to Rural Area do not experience expected wage reductions. Contrarily, Yankow (2006) found wage gains associated with moving in and wage losses associated with moving out of cities were equal in magnitude at around 6.5% in the US. The imbalance of wage gain and wage loss for opposite migrations suggests that the immediate shift in wages does not totally reflect the difference between the two locations' effects. One explanation is that experience gained in Major Urban or Other Urban is well-regarded in Rural Area, so urban-rural movers do not lose wages despite losing the urban wage premium. Another explanation, of Glaeser and Maré (2001), is that workers who move out cities are presented with good job prospects at their destination.

The coefficients of 'Staying in Major Urban' and 'Staying in Other Urban' are not significantly different from zero, suggesting that there are no learning benefits associated with living in urban Australia. The result contradicts findings for Spain and the US where workers stay in large urban centres enjoyed higher wage growth than workers in those countries' other areas (De la Roca and Puga, 2017; Yankow, 2006). The result that there is no 'extra' urban wage growth, however, is consistent with Wheeler (2006)'s finding in which the sample was constrained to US workers who did not move during the period. If experiences in different areas have similar effects on individual capital accumulation in Australia, possible endogeneity due to correlation between location and local learning is of little concern. In that case, Fixed Effects models will provide accurate wage premium estimates.

The above analysis with First Difference, as with Fixed Effects, finds urban wage premiums in Australia, especially for large population centres. A more detailed analysis on migration direction suggests a rather complex relation between wage outcomes and movements. A self-selection process where migrating decisions are dependent on opportunities at the destination is possible. It is an inherent issue with using individual fixed effects and within-individual estimation and addressing it requires another approach. However, if workers move from an urban to a rural area when they have a good opportunity, this also applies to workers moving from a rural to an urban area. The first suggests a downward bias in urban wage premium estimates and the second an upward bias. Because movements are in both directions, some of their effects on Fixed Effects estimates are cancelled out.

Long Difference Models

There are several reasons why the wage shift may not accurately reflect an area's wage premium. Ashenfelter and Card (1984) observed a fall in the earnings of trainees relative to the comparison group before the trainees participated in training programs. An Ashenfelter's dip would mean that wage gains from rural-to-urban migration will overestimate the urban wage premium and wage loss while moving from urban-to-rural will underestimate the premium. Another possibility is that migrants consider 'long run' labor market outcomes rather than immediate wage gains. If so, rural-urban migrants might receive less than the urban wage premium immediately after moving but experience high wage growth in subsequent years postmigration (Glaeser and Maré, 2001; Rowe *et al.*, 2017; Yankow, 2006). Individual wages will follow similar patterns if migrants go through a settlement period, looking for suitable jobs or getting used to the new environment, when they earn less than their ability would suggest. Migrants' wages will recover in later periods and reflect their skills and the area's wage premium as normal. Both the relative wage dips immediately before and after migration will result in inaccurate First Difference estimates of the urban wage premium.

I adapt Yankow (2006)'s long difference models to address that concern. Like before, $\Delta Major\ Urban$ and $\Delta Other\ Urban$ are augmented into 'Move in' indicators and 'Move Out' and 'Stay in' indicators are included. While these indicators take the value for the period between years t and $t+1$, the changes in individual wages as well as individual characteristics are for longer periods. For example, in a two-lagged difference model, changes in individual wages and individual characteristics are between years t and $t+2$. Similar set-ups are for longer lagged difference models; for example, for three-lagged difference, the wage change is for the period between years t and $t+3$, etc. As in the previous specification, the reference group consists of people who stay in Rural Area in both years t and $t+1$.

I also condition that individuals do not move in other years in the period. For example, in the two-lagged difference specification, people stay in the same place in years $t+1$ and $t+2$ and in the three-lagged difference, people stay in the same place from years $t+1$ to $t+3$. In this way, people who move to an area in year $t+1$ are in the same area in the later years in the period. The wage changes associated 'Move in' or 'Move out', controlling for individual skill development, will better reflect areas' wage premiums. Furthermore, as individual wages right before the move in year t might suffer an Ashenfelter's dip, making wages in year t do not truly reflect individual ability, I extend the long difference models for wage changes for the period between years $t-1$ and $t+2$ (one year before the move to one year after the move) to the migration decision between years t and $t+1$. As in the previous condition, the observations are from individuals who stay in the same place in year $t-1$ and t, and in the same place in year $t+1$ and $t+2$. Thus, people either change places between t and $t+1$ or stay in the same place for the whole period from year $t-1$ to $t+2$.

Because of the requirements of valid observations at the beginning and the end of the period and staying in the same place after the first year, we lose observations quickly for longer lagged difference models. In the study's sample, there are 19,656 observations with valid individual wages in years t and $t+4$ and individuals stay in the same location in years $t+1$ to $t+4$. Among them, 163 migrations were to Major Urban, 155 to Other Urban, and 132 out Major Urban, 182 out Other Urban.

Table 5 presents the results with long difference models. The reference group consists of stayers in Rural Area in years t and $t + 1$ but they also stay in the same area in other years in the period following $t + 1$. In effect, the reference group consists of stayers in Rural Area for the whole period. Again, workers residing in Major Urban or Other Urban for the period – two years in Column (1), three years in Column (2) and four years in Column (3) – do not receive rises in their wages relative to workers residing Rural Area for the same period. Migrants from Rural Area to Major Urban between years t and $t + 1$ experience a rise of 0.084 in the log of wages for the period from years t to $t + 2$ relatively to stayers in Rural Area. The wage rises are relatively stable for longer periods in Columns (2) and (3): for the three-year period, the rise is 11.7%, and for the four-year period, the rise is 8.2% relatively to stayers in Rural Area. Movers from Rural Area to Other Urban receive a wage rise of 5.3% for the three-year period and a wage rise of 8.7% for four-year period relative to stayers in Rural Area (results in Columns (2) and (3)).

Table 5. Wage Premium Estimates by Long Difference Models. Source: the Author.

Dependent variable	(1) $lnw_{t+2} - lnw_t$	(2) $lnw_{t+3} - lnw_t$	(3) $lnw_{t+4} - lnw_t$	(4) $lnw_{t+2} - lnw_{t-1}$
Stay in Major Urban	–0.001	0.000	0.011	0.000
	(0.01)	(0.01)	(0.01)	(0.01)
Move in Major Urban	0.084***	0.117***	0.082**	0.054*
	(0.03)	(0.03)	(0.04)	(0.03)
Move out Major Urban	–0.038	–0.055	–0.091	–0.096**
	(0.03)	(0.04)	(0.06)	(0.04)
Stay in Other Urban	–0.002	–0.002	0.005	–0.002
	(0.01)	(0.01)	(0.01)	(0.01)
Move in Other Urban	0.030	0.053*	0.087*	0.124***
	(0.03)	(0.03)	(0.04)	(0.04)
Move out Other Urban	–0.026	–0.039	–0.027	–0.007
	(0.02)	(0.03)	(0.03)	(0.03)
N	30,829	24,230	19,170	24,189
R sq.	0.029	0.045	0.058	0.045

Notes: Other independent variables are in the same lagged difference as the dependent variable: year indicators, marital/de facto status, years of schooling, years of experience and its square, education levels, tenure in current occupation and with current employer, occupation indicators and industry indicators. Numbers in brackets are robust standard errors, clustered on individuals. ***, ** and * are significant at 1%, 5% and 10%, respectively.

Workers moving from rural areas to Australian large urban centres (Major Urban) experience high wage growth in the year following migration (between years $t + 1$ and $t + 2$): the wage rise associated with the migration increases from 4.9% upon arrival to 8.4%. The results agree with the work of Rowe *et al.* (2017) where they found high wage growth in the years following rural-to-urban migration. It is likely that workers moving from rural areas to urban areas do not receive the urban wage premium in full upon arrival, and the wage rise of 4.9% for 'Moving in Major Urban' relative to 'Staying in Rural Area' probably underestimates the area's wage premium. Indeed, considering a year after rural-to-urban migration rather than upon arrival, the wage rise of 8.4% is close to the urban wage premium estimate of 7.5% by Fixed Effects.

It is evident from the previous results that rural-to-urban migrants experience relative wage dips upon arrival when their wages do not reflect the full urban wage premium. To examine whether the migrants also experience wage dips immediately before migration (Ashenfelter and Card, 1984; Glaeser and Maré, 2001), I compare rural-to-urban migrants' wages a year after the move to a year before the move. Column (4) in Table 5 shows that migrants from Rural Area to Major Urban experience a rise of 5.4% in their wages relatively to stayers in Rural Area. The small rise compared to 8.6% in Column (1) suggests that between years t and $t + 1$, migrants experience a wage dip of around 3% (i.e.$\approx$ $8.4\% - 5.4\%$) for the year before the move (between years $t - 1$ and t) relative to workers who stay in Rural for the same period. The wage dip prior to migration may also explain why movers from Rural Area to Major Urban do not experience notable falls in their wages when we compare wages immediately before and after the move. If we consider a year before the move, movers from Rural Area to Major Urban experience a fall of 9.6% in their wages relative to stayers in Rural Area for the period from years $t - 1$ to $t + 2$. For Other Urban, the coefficient of 'Moving in' indicator increases to 0.124 and the 'Move out' indicator is not significantly different from zero in Column (4), suggesting that movers from Other Urban to Rural Area likely do not experience an earnings dip prior to migration as in the case of movers from Major Urban to Rural Area.

The above results from specifications using migration direction indicators and long difference models are suggestive of relative wage dips immediately before and after rural-to-urban migrations. Contrary to De la Roca and Puga (2017) and Yankow (2006), the acceleration of human capital in urban areas is not evidenced as the study finds no significant relations between high wage growth and urban status. It is also not clear from Table 5 that wage rises associated with rural-to-urban migrations increase over time postmigration as the learning hypothesis suggests. Therefore, the high wage growth within a year upon arrival is likely the realization of the urban wage premium rather than reflecting high growth of individual skills in cities.

To address potential transition noises immediately before and after migrations, I use a sample excluding observations in years t and $t + 1$ if individuals change places between the two years. With the specification as in Column (8) in Table (2), the Fixed Effects estimate for Major Urban's wage premium is 7.1%, (p-value = 0.01). The estimate for Other Urban is not statistically significant in that case.

5. CONCLUSION

The study finds persuasive evidence of the urban wage premium in Australia, consistent with findings around the world. Workers in Australian large urban centres – centres with populations from 100,000 persons – earn around 7.5% more than workers with similar levels of skills in rural areas. The study finds no evidence for urban learning benefits as stayers in urban areas do not experience higher wage growth than stayers in rural areas.

The analyses on wage changes of migrants moving between rural and urban areas paint a complex picture. Rural-to-urban migrants receive only a portion of the urban wage premium upon arrival but experience high wage growth in the year after migration. The high wage growth in the year post rural-to-urban migration is more likely the realization of the urban wage premium rather than resulting from increases in workers' skills. In addition, migrants moving in or out of Major Urban experience wage dips immediately before their migrations. Likely, migrants decided to move when they did not perform well in their place of origin. The sorting of individuals into migration casts doubt on within-individual estimation of the urban wage premium as the method identifies the urban wage premium via migrants. We could argue that those sorting biases are partly cancelled out as migration movements between urban and rural areas are relatively balanced in the sample.

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