Uncovering the Urban Advantage of Australian Firms: New Evidence from BLADE Data

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Motivation

- Regional development policies have attracted significant attention among academics and policymakers over the years.
- These initiatives (such as RDA) are particularly relevant for Australia - which ranks 30th for urbanisation and 226th for population density.
- The relocation of businesses form the backbone of recent proposals:

  "The Committee recommends that the Australian Government implement a program for promoting the advantages of locating businesses in regional areas (...) and look at ways to incentivise business into regional areas."

  House of Reps Select Committee on Regional Australia (2022)

- A key opportunity cost: Firms are, on average, more productive in cities.
  - "The Urban Advantage."

This Paper: What We Do

- Quantify the productivity advantages of urban firms within and across Australian states and industries.
- Decompose the source of urban advantages into agglomeration (A) and selection (S) effects.
  - As well as dilation (D) effects due to the higher productivity of workers in agglomerated areas.
- Use administrative data in BLADE, the most exhaustive data set on Australian businesses.

This Paper: What We Find

- Urban advantage differs substantially across Australian states.
  - Ranges from 10.0% in WA to 1.5% in SA in terms of relative urban productivity gains for a firm of mean productivity in any industry.
- States differ significantly in terms of urban advantages across industries.
  - Urban advantages are twice as large for manufacturing firms in QLD (5.0%) vs NSW (2.3%).
  - Urban advantages are nearly three times as large for service firms in NSW (12.3%) vs QLD (4.4%).
- Agglomeration effects explain most of the differences in urban advantages, and are concentrated among mature firms.
  - We find evidence of substantial differences in agglomeration effects among young firms across states and industries.

Related Literature

The literature on the productivity advantages of cities is divided into two main mechanisms:

- Agglomeration economies: Regardless of underlying firm productivity, cities provide productivity-enhancing externalities. (Marshall, 1890).
- Firm selection: Firm competition is higher within cities, productive firms may choose larger markets: Syverson (2004), Nocke (2006).

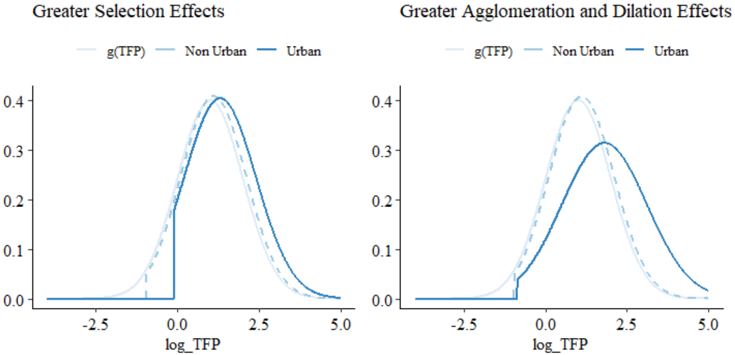
There is also a growing literature on the distribution of economic activity in Australia.

- The urban wage premium in Australia suggests wages rise 1.6% with a doubling in population density (Meekes, 2022).
- Urban wage premiums are insufficient to mitigate congestion costs which may continue to increase over time under current policy settings (Vij et al. 2021) .

Model: Graphical Illustration

Objective is to simultaneously estimate agglomeration and selection effects

Figure: 1 An illustration of the different impacts of agglomeration and selection



Methodology

We follow that of Combes et. al (2012).

- Aim: Estimate shift (due to Agglomeration), Dilation (due to worker productivity gains in agglomerated areas) and truncation (due to Selection) of the TFP distribution ($\theta = (A, D, S)$).

- The CDF of a given location i:

$$F_i(\phi) = \max\left\{0, \frac{\tilde{F}\left(\frac{\phi - A_i}{D_i}\right) - S_i}{1 - S_i}\right\}.$$

- Issue: the unobserved nature of $\tilde{F}(\phi)$.

- Ordering firms into urban (i) and non-urban (j), the quantiles λ_i, λ_j are as follows where ranks are $u \in [0, 1]$:

$$\lambda_i(u) = D\lambda_j(S + (1 - S)u) + A.$$

Methodology - Data

- Business Longitudinal Analysis Data Environment (BLADE).
- Coverage:
  - Data spans financial years 2002-2018.
  - BAS, BIT, PAYG datasets integrated by Type of Activity (TAU).
  - Approx. 2m observations each year which submit business income tax returns.
  - Sole traders do not submit balance sheet information.
  - Postcodes are used to identify a firm's Remoteness Area.
- Measuring productivity.
  - The residuals of a log Cobb-Douglas specification at the two-digit ANZSIC level

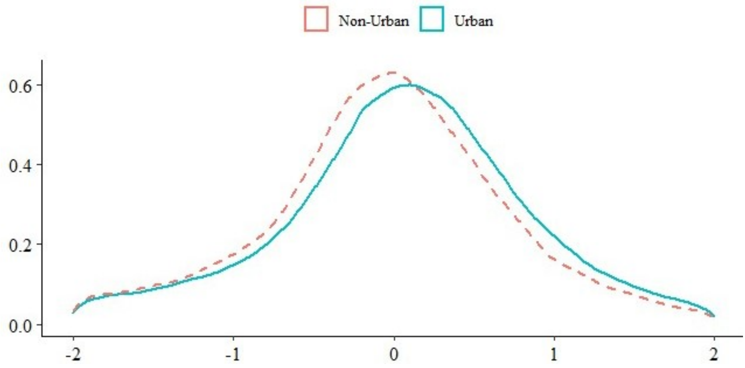
$$y_{it} = \beta_0 + \beta_m m_{it} + \beta_l l_{it} + \beta_k k_{it} + \phi_{it}.$$

  - Methods - OLS, Olley-Pakes (1996), Levinsohn-Petrin (2003).
  - Non-current assets (BIT), full-time equivalent employees (PAYG), purchases (BAS) and revenue (BAS) are used to estimate TFP.

Overall Effects (Country Level)

On average, firms in cities are approximately 6.8% more productive than their regional counterparts.

Figure: 2 Urban and Non-Urban TFP distributions



Results

Table: 1 Country level effects by industry

Industry	Advantage	A	D	S
Food,Beverage, and Tobacco	-1.0%	-0.01011 (0.00535)*	0.95698 (0.01635)***	-0.00047 (0.00107)
Textiles and Furniture;	6.9%	0.06659 (0.00551)***	0.89755 (0.01722)***	-0.00507 (0.00128)***
Wood and Paper	7.6%	0.07297 (0.00721)***	1.05577 (0.0348)	0.00666 (0.00356)*
Printing	1.8%	0.01738 (0.00696)***	1.0789 (0.02543)***	-0.00047 (0.00149)
Petroleum	-9.4%	-0.09905 (0.05394)*	0.87421 (0.10924)	-0.09896 (0.04108)**
Chemicals, Polymers, and Minerals	2.6%	0.02584 (0.00699)***	0.93608 (0.02391)***	-0.00352 (0.00147)***
Metal and Metal Products	5.6%	0.05422 (0.00479)***	0.92754 (0.01828)***	-0.00061 (0.00143)
Transport, Equipment and machinery	5.4%	0.05271 (0.00563)***	1.00432 (0.0164)	-0.00008 (0.00136)
Professional, Scientific and Technical Services	8.7%	0.08307 (0.00263)***	1.07664 (0.00432)***	0.00131 (0.00028)***

Results

Table: 2 State level effects - industry

Industry	State	Advantage	A	D	S
Services	NSW	11.7%	0.11064 (0.00496)***	1.07043 (0.01008)***	0.00059 (0.00087)
	VIC	8.1%	0.07783 (0.00443)***	1.08223 (0.01066)***	0.00077 (0.00084)
	QLD	4.1%	0.0403 (0.00519)***	1.08166 (0.00899)***	0.00155 (0.00061)**
	SA	1.6%	0.01541 (0.01038)	1.04058 (0.0202)**	-0.00071 (0.00236)
	WA	13.5%	0.12668 (0.01054)***	1.09349 (0.01588)***	0.0005 (0.0012)
Manufacturing	NSW	2.4%	0.02323 (0.0043)***	0.96925 (0.01494)***	-0.00212 (0.00095)**
	VIC	4.4%	0.04307 (0.00487)***	0.98409 (0.01425)***	-0.00068 (0.00083)
	QLD	5.0%	0.04896 (0.00473)***	0.95523 (0.01388)***	-0.00078 (0.00101)
	SA	3.3%	0.03269 (0.00655)***	0.96556 (0.02296)*	0.0011 (0.00173)
	WA	4.6%	0.04539 (0.00834)***	0.90289 (0.02213)***	-0.00687 (0.00198)***

Results

Table: 3 State level effects - Firm Age (Services)

State	Advantage	A	D	S
Mature (> 3 yrs)				
NSW	11.3%	0.10684	1.07478	0.0025
		(0.00428)***	(0.01028)***	(0.0008)***
VIC	9.3%	0.08859	1.04768	-0.00043
		(0.00493)***	(0.01067)***	(0.00078)
QLD	4.9%	0.0475	1.07902	0.00251
		(0.00482)***	(0.00974)***	(0.00088)***
SA	4.6%	0.04489	0.99832	-0.00471
		(0.01161)***	(0.01919)	(0.00246)*
WA	13.9%	0.13042	1.09533	0.00162
		(0.01166)***	(0.02279)***	(0.00274)
Young				
NSW	9.1%	0.08742	1.1179	0.00101
		(0.01222)***	(0.01892)***	(0.00098)
VIC	4.6%	0.04522	1.12372	0.00102
		(0.01036)***	(0.01927)***	(0.0013)
QLD	-0.2%	-0.00254	1.11099	0.00173
		(0.00811)	(0.0169)***	(0.0009)**
SA	-8.8%	-0.09214	1.20904	0.00301
		(0.02529)***	(0.04103)***	(0.00494)
WA	14.1%	0.13161	1.1263	-0.00019
		(0.01633)***	(0.02978)***	(0.0021)

Results

Table: 4 State level effects - Firm Age (Manufacturing)

State	Advantage	A	D	S
Mature (> 3 yrs)				
NSW	4.6%	0.04516	0.95415	-0.00076
		(0.00428)***	(0.01567)***	(0.00123)
VIC	6.9%	0.06692	0.93158	-0.00042
		(0.00439)***	(0.01736)***	(0.00185)
QLD	6.7%	0.06485	0.93944	0.00131
		(0.00528)***	(0.01868)***	(0.00162)
SA	4.4%	0.04303	0.8986	-0.00399
		(0.00629)***	(0.01863)***	(0.00199)**
WA	6.0%	0.05789	0.88835	-0.00686
		(0.00743)***	(0.02657)***	(0.00181)***
Young				
NSW	-4.8%	-0.04927	1.07227	0.00127
		(0.01146)***	(0.03035)***	(0.002)
VIC	-3.8%	-0.03897	1.09128	0.00405
		(0.01434)***	(0.02799)***	(0.00188)***
QLD	0.8%	0.00782	1.07164	0.00211
		(0.01152)	(0.02497)***	(0.00193)
SA	0.7%	0.00736	1.06193	0.00275
		(0.02076)	(0.05083)	(0.00419)
WA	-0.2%	-0.002	0.98625	-0.00412
		(0.02359)	(0.04433)	(0.00546)

Conclusion

- Urban productivity advantages in Australia are driven largely by agglomeration externalities rather than selection effects.

- This paper quantifies these productivity advantages to inform policy development:
  - As a whole, the average firm in a city is 6.8% more productive than the average firm in a regional/rural area.
  - In NSW this advantage is 7.7% whereas it is only 1.5% in SA.
  - For manufacturing, the urban advantage is highest in QLD (5.0%) and lowest in NSW (2.4%).
  - There is some evidence of congestion effects for young manufacturing firms in large cities such as Melbourne and Sydney.

- Future research: The paper is silent on other advantages that come with a more resilient non-urban economy:
  - Improved housing affordability
  - Reduced migration costs
  - Increased ability to deal with pandemics, such as COVID.

Appendix

- Productivity Estimation
  - The residuals of a log Cobb-Douglas specification at the two-digit ANZSIC level

$$y_{it} = \beta_0 + \beta_m m_{it} + \beta_l l_{it} + \beta_k k_{it} + \phi_{it}.$$

  - Methods - OLS, Olley-Pakes (1996), Levinsohn-Petrin (2003).
  - BAS, Income Tax Returns and PAYG data used to estimate inputs.

- Parameter Estimation
  - Order ϕ_i into Urban or Non-Urban using ABS Remoteness categorization or SA3 density.
  - The parameters A, D, S minimise the sum of square errors over $u \in [0, 1]$:

$$m_\theta(u) = \lambda_i(r_s(u)) - D\lambda_j(S + (1 - S)r_s(u)) - A.$$

Appendix

Issue: the unobserved nature of $\tilde{F}(\phi)$.

- Solution: one compares two distributions from cities of two different sizes to difference $\tilde{F}(\phi)$ out of the equation.
- As such one can pre-order cities into large (indexed by i) and small (indexed by j) and thus specify the relative parameters.

$$D \equiv \frac{D_i}{D_j}, \;\; A \equiv A_i - DA_j, \;\; S \equiv \frac{S_i - S_j}{1 - S_j}.$$

- Assuming the two distributions are invertible, we can express the quantiles λ_i, λ_j as follows where ranks are $u \in [0, 1]$.

$$\lambda_i(u) = D\lambda_j(S + (1 - S)u) + A.$$

Appendix

To allow the selection parameter to assume negative values we replace:

$$u \to r_s(u) = \max[0, \frac{-s}{1-s}] + [1 - \max[0, \frac{-s}{1-s}]u].$$

Letting $\theta = (A, D, S)$, I then minimise the following two distance functions to obtain parameter estimates.

$$m_\theta(u) = \lambda_i(r_s(u)) - D\lambda_j(S + (1-S)r_s(u)) - A.$$

$$\tilde{m}_\theta(u) = \lambda_j(\tilde{r}_s(u)) - \frac{1}{D}\lambda_i\left(\frac{\tilde{r}_s(u) - S}{1-S}\right) + \frac{A}{D}.$$

The following represents the objective function:

$$\hat{\theta} = \arg\min_\theta \left(\int_0^1 [m_\theta(u)]^2 du + \int_0^1 [\tilde{m}_\theta(u)]^2 du\right).$$

Appendix

For observed data points, ranks u (and hence quantiles λ_i, λ_j) are ordered by ascending observations such that $x_k \in \{x_1, \cdots, x_N\}$:

$$u_k = \hat{F}(x_k) = \frac{1}{N}\sum_{i=1}^{N} \mathbf{1}(x_i \leq x_k) : \hat{F^{-1}}(u_k) = x_k = \hat{\lambda}_k.$$

Linear interpolation is used for the latter ranks.

$$\int_0^1 [m_\theta(u)]^2 du + \int_0^1 [\tilde{m}_\theta(u)]^2 du.$$

The objective function above is approximated by the below:

$$\frac{1}{2} \sum_{k=1}^{1001} (u_k - u_{k-1}) \left[(\hat{m}_\theta(u_k))^2 + (\hat{m}_\theta(u_{k-1}))^2 + \left(\hat{\tilde{m}}_\theta(u_k) \right)^2 + \left(\hat{\tilde{m}}_\theta(u_{k-1}) \right)^2 \right].$$

The Nelder-Mead algorithm is used to minimise the above for $\hat{\theta}$.