Financial Constraint, Employment and Innovation: Evidence from Australian Businesses

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Motivation

- Firm decision making is important to understanding labour market outcomes and economic growth
- Labour market shocks at the macro-economic level reflect micro-decisions of firms in hiring and firing decisions
- We know that labour responds to economic shocks, but often with a lag
- This is the product of contract structures and firm decisions

Motivation

- In this paper we look at how firm's hiring practices and innovative activity respond to financial difficulty
- This can provide evidence for understanding the transmission of firm-level shocks to macro-economic shocks
- Our study also provides evidence for those seeking to design policy to assist firms to cope with financial difficulty.
- Having access to external funding support is a critical to firm's decisions with cash flow implications.
- Though being a core question in corporate finance research, the available evidence is far less from adequate nor clear.

Motivation

- Early empirical studies lack direct measurements of the firm's financial situation with any accuracy (Kaplan and Zingales, 1997; Chen and Chen, 2012; Farre-Mensa and Ljungqvist, 2016).

- Australian evidence has been rare, nearly non-existent, in this stream of literature.

- Comparison of Australian firms' responses when facing financial difficulties with enterprises in other countries provides insights into how firm behaviour contributes to Australian long-term economic growth.

This Paper

- With the BLADE 1617 release, this study examines the effect of financial constraint on firm's workforce composition and innovation activities.

- We deal with the endogenous issue of firm's financial condition by exploiting the variation in enterprises' foreign ownership and balance sheet information on profitability.

Preview of Findings

- Our findings suggest significant and robust causal relationships that financially constrained firms have a higher share of casual employees (contingent workers) in their labour force composition and execute fewer activities in core innovative processes.

- Non-core innovations, such as introducing new operational or managerial processes, don't respond to financial constraints in the same way as core innovative activity does.

- The elasticity of hiring contingent employees and engaging in successful innovations for new goods or services with respect to financial constraints are about 0.39 and -0.23.

- Comparison with other countries suggests that core innovative processes are less responsive to financial constraints in Australia.

Data

- The Business Longitudinal Analysis Data Environment 1617 release
  - Business Characteristics Survey (BCS) module
    - Annual data, fiscal years of 2006/2007 through 2016/2017
  - Business Expenditure on Research and Development (BERD) module
    - Annual data from fiscal years of 2006/2007 through 2011/2012, biennial data on 2013/2014 and 2015/2016

Identification

- Defining firm level financial constraint
  - A firm reports "lacking access to additional funds",
  - Or "outstanding accounts receivable limiting cash flow" as factors that
  - "significantly hamper general business activities or performance",
  - Or cites that "lacking access to additional funds significantly hampers innovation"

Identification

- Potential main threat to our identification:
  - Reverse Causality:
    - Firms engaging in more innovative activities are likely to seek funding support more frequently than firms with less innovative activities.
    - Firms with small amounts of employees could be more inclined to be financially constrained simply because they are small.

Identification

- External shifter that captures the variation in firm's financial situation but does not have a direct influence on the firm's hiring and innovative strategy at that period.

  - Net business income or loss in the current period, reflecting the shock to firm's internal funds.
  - Firm's foreign ownership, capturing firm's own capability of fund-raising and how it might appear in profitability to external creditors during difficult times.

- The "local average treatment effect" (LATE) for firms whose variation in foreign ownership and business income would in fact change their ability to access funding support.

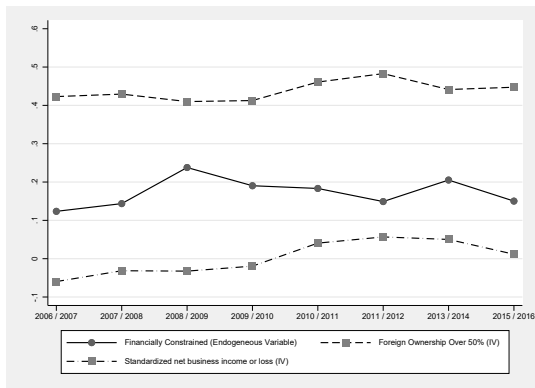# Relevance of Instrumental Variables

- The Trend of IV and Endogenous Variable: Full Sample
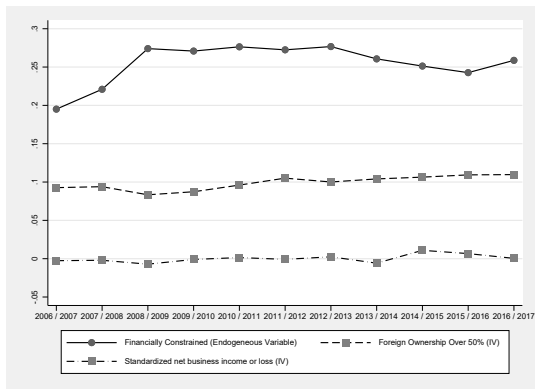
Source: BLADE, full BCS

Relevance of Instrumental Variables

- The Trend of IV and Endogenous Variable: Matched Sample

Source: BLADE, matched BCS and BERD

Estimation Model

$$Y_{fist} = \beta_0 + \beta_1 FinancialConstraint_{fist} + \beta_2 log(TotalEmployee_{fist})$$

$$+ \beta_3 log(TotalEmployee_{fist})^2 + \beta_4 log(TotalAssets_{fist})$$

$$+ \beta_5 OverseaMarketPresence_{fist} + \beta_6 NewGoodsOrServices_{fist}$$

$$+ \beta_7 MarketCompetition_{fist} + \beta_8 SMEBusiness_{fist}$$

$$+ \beta_9 log(Age_{fist}) + \beta_{10} ShortageOfSkilledPerson_{fist}$$

$$+ \sum \alpha_k NumberOfLocations_{fist} + \lambda_i + \alpha_s + \gamma_t + \varepsilon_{fist}$$

- Y_{fist} represents the set of outcome variables for firm f from industry i located in state s in year t.
- Parameters λ_i, α_s and γ_t are associated with the industry, state and year fixed effects.

The Effect of Financial Constraint on Workforce Composition

Table 3: Instrumental Variable Estimation: Baseline Results

Variables	Share of casual employees			Share of permanent employees		
	OLS	Two-stage		OLS	Two-stage	
	(1)	(2) LS	(3) Fractional probit	(4)	(5) LS	(6) Fractional probit
Financial constraint	0.008***	0.815***	0.788***	-0.023***	-1.693***	-0.876***
	(0.002)	(0.161)	(0.054)	(0.002)	(0.252)	(0.028)
Log total employees	0.070***	0.062***	0.035***	-0.144***	-0.120***	-0.061***
	(0.004)	(0.003)	(0.006)	(0.006)	(0.005)	(0.009)
Squared of log total employees	-0.002***	-0.000	0.001*	0.012***	0.007***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Log total assets	-0.036***	-0.025***	-0.011***	0.020***	-0.003	-0.002
	(0.001)	(0.003)	(0.004)	(0.001)	(0.005)	(0.002)
Overseas market presence	-0.015***	-0.024***	-0.028***	0.035***	0.038***	0.020***
	(0.003)	(0.006)	(0.006)	(0.008)	(0.011)	(0.006)
Market competition	-0.023***	-0.089***	-0.078***	-0.004	0.140***	0.072***
	(0.002)	(0.014)	(0.006)	(0.003)	(0.020)	(0.006)
Small to medium sized business	0.090***	0.060***	0.037***	-0.076***	0.001	0.003
	(0.006)	(0.010)	(0.011)	(0.008)	(0.021)	(0.011)
Log age	-0.005***	0.010***	0.012***	0.014***	-0.019***	-0.010***
	(0.001)	(0.003)	(0.002)	(0.002)	(0.006)	(0.002)
Shortage of skilled person	-0.014***	-0.167***	-0.156***	-0.018***	0.303***	0.157***
	(0.003)	(0.037)	(0.016)	(0.003)	(0.056)	(0.011)
Observations	58725	58236	58236	61002	60477	60477
Over-identification Test (P-value)		0.839			0.168	

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors clustered by year are in parentheses.

All specifications control for year, state, and industry fixed effects.

The Effect of Financial Constraint on R&D

Table 4: Instrumental Variable Estimation: Baseline Results

Variables	R&D expenditure (log)		HR for R&D (log)		Own funds on R&D (log)	
	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	OLS (5)	2SLS (6)
Financial constraint	0.114	-6.968***	0.203**	-8.665***	0.134	-6.573***
	(0.076)	(1.088)	(0.076)	(1.047)	(0.074)	(1.076)
Log total employees	0.001	-0.960***	0.042	-1.233***	-0.043	-0.958***
	(0.102)	(0.191)	(0.098)	(0.299)	(0.102)	(0.204)
Squared of log total employees	0.029***	0.090***	0.028***	0.110***	0.031***	0.090***
	(0.008)	(0.013)	(0.007)	(0.019)	(0.008)	(0.014)
Log total assets	0.270***	0.168***	0.118***	0.003	0.278***	0.181***
	(0.021)	(0.027)	(0.012)	(0.036)	(0.022)	(0.026)
Oversea market presence	0.301***	0.321**	0.269***	0.321**	0.278***	0.320**
	(0.052)	(0.138)	(0.049)	(0.150)	(0.064)	(0.132)
Market competition	0.006	0.118*	0.049	0.204***	0.026	0.134**
	(0.062)	(0.062)	(0.077)	(0.071)	(0.060)	(0.061)
Small to medium sized business	0.056	0.474***	-0.029	0.504***	-0.003	0.397***
	(0.102)	(0.152)	(0.068)	(0.158)	(0.101)	(0.151)
Log age	0.047**	-0.068	0.066***	-0.084	0.055***	-0.056
	(0.014)	(0.051)	(0.016)	(0.054)	(0.014)	(0.049)
Shortage of skilled person	-0.123	0.982***	-0.060	1.316***	-0.143*	0.904***
	(0.066)	(0.177)	(0.047)	(0.166)	(0.065)	(0.167)
Observations	3932	3902	3877	3847	3893	3863
Over-identification Test (P-value)		0.450	0.515		0.445	

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors clustered by year are in parentheses.

All specifications control for year, state, and industry fixed effects.

The Effect of Financial Constraint on Other Innovation Activities

Table 5: Instrumental Variable Estimation: Baseline Results

Variables	New goods or services			New operational processes			New managerial processes			New marketing methods		
	OLS	Two-stage		OLS	Two-stage		OLS	Two-stage		OLS	Two-stage	
		LS	Probit IV		LS	Probit IV		LS	Probit IV		LS	Probit IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Financial constraint	0.076***	-0.648**	-0.567***	0.101***	0.579*	0.606**	0.116***	1.047***	0.870***	0.040	0.622**	0.590***
	(0.014)	(0.265)	(0.187)	(0.020)	(0.328)	(0.282)	(0.025)	(0.329)	(0.139)	(0.023)	(0.303)	(0.231)
Log total employees	-0.094***	-0.192***	-0.178***	-0.029	0.034	0.039	-0.048	0.077	0.068	-0.130***	-0.052	-0.042
	(0.020)	(0.049)	(0.030)	(0.018)	(0.064)	(0.063)	(0.031)	(0.060)	(0.046)	(0.034)	(0.057)	(0.061)
Squared of log total employees	0.009***	0.015***	0.015***	0.004*	0.0005	-0.000	0.007*	-0.001	-0.001	0.011**	0.006	0.005
	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.005)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)
Log total assets	-0.022***	-0.032***	-0.030***	-0.016**	-0.009	-0.008	-0.010	0.003	0.003	-0.004	0.004	0.004
	(0.003)	(0.004)	(0.002)	(0.007)	(0.008)	(0.010)	(0.006)	(0.006)	(0.005)	(0.004)	(0.007)	(0.007)
Oversea market presence	-0.051**	-0.048***	-0.054**	0.015	0.011	0.011	-0.020	-0.026*	-0.020	-0.046*	-0.050**	-0.053**
	(0.017)	(0.018)	(0.022)	(0.019)	(0.023)	(0.025)	(0.021)	(0.016)	(0.014)	(0.022)	(0.025)	(0.024)
Market competition	0.064**	0.079***	0.074***	0.014	0.006	0.005	0.016	-0.00005	-0.001	0.033	0.023	0.026
	(0.019)	(0.021)	(0.018)	(0.022)	(0.022)	(0.023)	(0.025)	(0.024)	(0.020)	(0.021)	(0.023)	(0.026)
Small to medium sized business	-0.012	0.029	0.034	-0.007	-0.035	-0.037	0.003	-0.045	-0.039	0.022	-0.010	-0.007
	(0.032)	(0.029)	(0.028)	(0.033)	(0.031)	(0.032)	(0.036)	(0.033)	(0.029)	(0.045)	(0.046)	(0.044)
Log age	0.015**	0.003	0.004	0.006	0.014	0.014	-0.008	0.008	0.007	0.002	0.013***	0.013***
	(0.006)	(0.005)	(0.005)	(0.013)	(0.013)	(0.013)	(0.007)	(0.010)	(0.008)	(0.005)	(0.004)	(0.004)
Shortage of skilled person	0.108***	0.221***	0.202***	0.143***	0.071	0.058	0.141***	-0.005	-0.013	0.097***	0.009	0.003
	(0.017)	(0.049)	(0.025)	(0.019)	(0.057)	(0.069)	(0.017)	(0.060)	(0.049)	(0.020)	(0.056)	(0.057)
Observations	4045	4014	4014	4045	4014	4014	4045	4014	4014	4045	4014	4014
Over-identification Test (P-value)		0.728			0.232			0.369			0.728	

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors clustered by year are in parentheses. All specifications control for year, state, and industry fixed effects.

Column 1, 4, 7 and 10 present estimates from simple ordinary least squares regression, column 2, 5, 8 and 11 display results from two-stage least squares regression, and column 3, 6, 9 and 12 report results from probit IV estimation.

The Effect of Financial Constraint on Other Innovation Activities

- Firms with less input to core innovation due to lacking access to extra funds try to increase profit margins through less cost-demanding programs such as organisational re-construction and operational streamlining.

Table 6: Benefits of Introducing New Goods, Services, Processes or Methods

Independent Variables	Reduced costs (1)	Increased revenue (2)	Competitive edge (3)	Customer service (4)
New goods or service	0.041	0.396***	0.256***	0.221***
	(0.055)	(0.052)	(0.052)	(0.050)
New operational process	0.283***	0.126**	0.067	0.144***
	(0.050)	(0.053)	(0.051)	(0.047)
New organisational/managerial process	0.192***	0.060	0.053	0.086*
	(0.048)	(0.053)	(0.050)	(0.046)
New marketing methods	0.039	0.159***	0.145***	0.111**
	(0.052)	(0.053)	(0.050)	(0.049)
Observations	431	431	431	431

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Robust standard errors are shown in parentheses. Each cell represents a separate estimation.

All specifications control for firm characteristics, year, state, and industry fixed effects.

Elasticities

- To compare the sensitivity of different outcomes with reference to firms' financial situation, we compute the elasticities.
- $\delta = \frac{\partial Y}{\partial FC} * \frac{\overline{FC}}{\overline{Y}}$, where $\frac{\partial Y}{\partial FC}$ is the marginal effect of financial constraint on the outcome (evaluated at the mean value), while $\overline{FC}$ and $\overline{Y}$ are the mean values of reported financial constraint and outcomes.

Elasticities

- Every 1% change in the financial constraint will:
  - increase the probability of the firm hiring casual workers by 0.39%;
  - lower the probability of the firm's introducing new good or service by 0.23%;
  - increase the probability of reforming firm's operational, managerial and marketing method by 0.21%, 0.31% and 0.37%.

Concluding Remarks

- With Australian enterprise data, our study gives credence to the notion that financial constraints distort firms' hiring behaviour
- We find that firms higher a larger share of contingent employees when they face financial constraints
- Firms invest less in innovative processes;
- These findings confirm evidence from other countries.
- However, the part of our results which one may find surprising is that firms under financial difficulty and with less core innovative investment do introduce more cost-efficient procedures and processes.

End Note

- Very comprehensive integration of almost all available business surveys
- Representative sample of firms in Australia
- Sample unbalanced over time
- Lack of individual level information on employees
- Due to the fact that the data sources are largely included "as is", there exist some extreme and nonsensical observations
- Macro level industrial indexes couldn't be linked to firm, e.g., commodity price indexes, industrial inputs, outputs, and intermediate input prices indexes etc.

Thank you.

Appendix — RHS variable definition

- Foreign ownership: an indicator equal to 1 if a firm's percentage of foreign ownership is greater than 50% and 0 otherwise.

- Firm's net business income or loss: collected from Business Income Tax (BIT) module, observation standardised.

- *TotalEmployee* and *TotalAssets* are taken logarithm transformation. *SME* is a dummy variable equal to 1 if the number of full-time-equivalent employee is less than 200 following ABS's definition.

- *MarketCompetition* sets equal to 1 if the number of competitors in the market is three or more and 0 otherwise.

- *OverseaMarketPresence* is an indicator set equal to 1 if firm's main source of income is from the sales of goods or service from overseas.

- *Age* is also in logarithm form, and measures the number of years the firm in operation.

- *ShortageofSkilledPerson* captures business which reports lacking skilled persons as factor hampering its innovation or general activity.

- *NumberOfLocations* is a set of binary variables which separate firms with the number of location operated as one, between two and 200, and over 200.