

Exploring intensive and extensive margin in a CGE model

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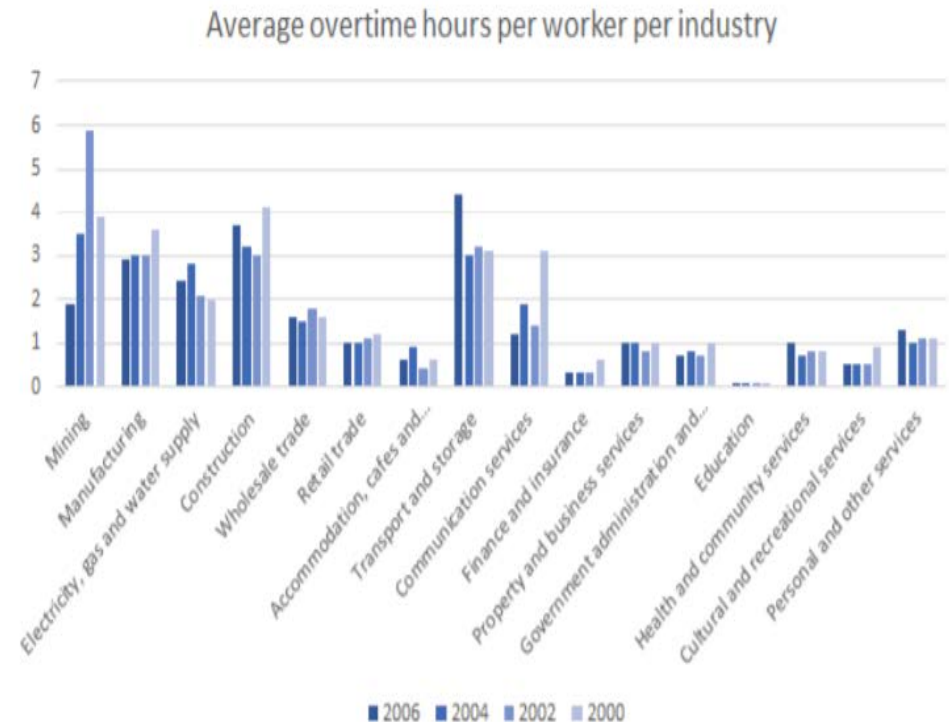
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Overview

- CGE models tend not to explain what determines hours worked and number of workers employed.
- Some industries consistently use more overtime than other industries.
- I introduce hours worked per person (intensive margin) and number of workers (extensive margin) into a CGE model.
- I look at how different overtime premium regulations and fixed costs of labour impact the demand for hours of work and number of employees
- Simulated the effects of increasing the Superannuation Guarantee (SG) from 9.5% to 12%



Labour Demand model

The cost of labour consists of ordinary, overtime and fixed costs:

$$cN = [WL + W_P(L - L_0) + Z]N$$

Labour is produced according to the labour services function:

$$H = L^\alpha N^\beta$$

Wage premiums are a positive function of overtime hours worked:

$$W_P = A(L - L_0)^{\gamma-1}$$

For example, in construction we have $W = \$39$, $L_0 = 33.5$, $L - L_0 = 3.4$ and $W_P = 0.44$

Equilibrium conditions

Minimise costs subject to the effective labour constraint:

$$\mathcal{L} = [WL + W_P W(L - L_0) + Z]N + \lambda[H - L^\alpha N^\beta]$$

$$IF \frac{dW_P}{dO_T} \frac{O_T}{W_P} = (\gamma - 1),$$

$$L = \frac{\alpha}{\beta[1 + \gamma W_P - \frac{\alpha}{\beta}(1 + W_P)]} \left[\frac{Z - W_P W L_0}{W} \right]$$

Special case: $\gamma = 1$,

$$L = \frac{\alpha}{\beta - \alpha} \left[\frac{Z - W_P W L_0}{(1 + W_P)W} \right]$$

Compiling the database

ORANIG is an economy-wide model calibrated to a base year.

This version of ORANIG has 19 industries and only 1 occupation is used, and is based on the 2016 Input-Output (IO) tables.

The new theory requires the following data:

- Ordinary, overtime and fixed cost data
- Ordinary and overtime hours data
- Wage premium data

Base year was chosen due to data availabilities.

Fixed Costs

Fixed costs are sourced from the labour account survey and other labour costs.

Major Fixed costs:

- Superannuation payments
- Sick and Annual leave
- Training, recruitment and firing
- Human resources

Fixed costs = Other costs + Superannuation – Payroll + Sick and holiday leave

Fixed costs account for 17% of total expenditure on labour on average.

Fixed costs vary across industries with finance being the highest (23%) and agriculture the lowest (7%)

Fixed Costs as fraction of ordinary costs

Fixed costs	Other costs	Super-annuation	Payroll Tax	Sick and Holiday leave	Fixed costs
Agriculture, Forestry and Fishing	0.02	0.03	0	0.02	0.07
Mining	0.08	0.06	0.04	0.06	0.16
Manufacturing	0.06	0.07	0.03	0.06	0.15
Electricity, Gas, Water and Waste Services	0.08	0.07	0.04	0.08	0.2
Construction	0.04	0.05	0.02	0.06	0.13
Wholesale Trade	0.04	0.07	0.03	0.08	0.16
Retail Trade	0.03	0.07	0.03	0.08	0.16
Accommodation and Food Services	0.04	0.07	0.02	0.11	0.2
Transport, Postal and Warehousing	0.06	0.06	0.03	0.06	0.15
Information Media and Telecommunications	0.06	0.07	0.04	0.08	0.17
Financial and Insurance	0.13	0.05	0.02	0.07	0.23
Rental, Hiring and Real Estate Services	0.07	0.07	0.02	0.09	0.2
Professional, Scientific and Technical services	0.06	0.06	0.02	0.09	0.19
Administration and Support Services	0.06	0.06	0.03	0.08	0.17
Public Administration and Safety	0.03	0.09	0	0.07	0.1
Education and Training	0.07	0.09	0	0.08	0.17
Health and Social Assistance	0.02	0.08	0.01	0.09	0.14
Arts and Recreation Services	0.07	0.06	0.02	0.11	0.21
Other Services	0.06	0.05	0.02	0.08	0.16

Ordinary and overtime hours

Industry	Ordinary hours	Overtime hours
Mining	39.49	1.70
Manufacturing	33.97	2.02
Electricity, Gas, Water and Waste Services	34.19	3.03
Construction	33.47	3.40
Wholesale Trade	31.74	1.22
Retail Trade	24.20	0.41
Accommodation and Food Services	21.57	0.31
Transport, Postal and Warehousing	32.68	2.61
Information Media and Telecommunications	29.33	0.28
Financial and Insurance	31.23	0.24
Rental, Hiring and Real Estate Services	28.77	0.8
Professional, Scientific and Technical services	29.34	0.28
Administration and Support Services	29.39	1.39
Public Administration and Safety	30.08	0.68
Education and Training	25.77	0.16
Health and Social Assistance	27.51	0.39
Arts and Recreation Services	22.45	0.31
Other Services	26.77	0.80

Ordinary hours and overtime hours are sourced from the Employment and Earnings Hours survey.

Ordinary hours is an average of full-time and part-time workers.

Overtime hours are the unconditional average of all workers. In each period only a fraction of workers perform overtime.

Wage Premiums

Industries	Wage Premiums
Agriculture, Forestry and Fishing	0.49
Mining	0.28
Manufacturing	0.50
Electricity, Gas, Water and Waste Services	0.64
Construction	0.44
Wholesale Trade	0.52
Retail Trade	0.49
Accommodation and Food Services	0.46
Transport, Postal and Warehousing	0.49
Information Media and Telecommunications	0.52
Financial and Insurance	0.49
Rental, Hiring and Real Estate Services	0.50
Professional, Scientific and Technical services	0.36
Administration and Support Services	0.54
Public Administration and Safety	0.51
Education and Training	0.49
Health and Social Assistance	0.48
Arts and Recreation Services	0.56
Other Services	0.46

Data is sourced from the EEH survey.

Wage premiums vary across industries between 28% (mining) and 64% (Electricity, Gas, Water).

Wage premiums are calculated using the following formula:

$$W_P = \frac{W_1 - W}{W}$$

Wage premiums represent the average wage premium for an overtime hour.

Legislated wage premiums are defined in absolute terms, not percentages. This causes some wage premiums to be less than 0.5.

Elasticity between wage premium and overtime

Table : 2SLS regression output

	(1)	(2)
	log(Wage Premium)	log(Overtime)
log(overtime)	0.7*** (0.03)	-
log(Wage Premium)	-	-0.10* (0.04)
Ordinary hours	-	-0.06 (0.04)
log(Wage Rate)	-0.81*** (0.053)	0.08* (0.036)
Observations	6300	6300

t statistics in parantheses

* p <0.05, ** p <0.01, *** p <0.001

Wage premium schedules vary based on hours worked, time performed, industry, occupation and union status.

Legislation too complicated to embed within a CGE model

Relationship between wage premium and overtime econometrically estimated.

2SLS model used to control for endogeneity.

The elasticity assumed to be constant across industries.

Control variables omitted from regression output.

Superannuation overview

Australia establishes a mandatory savings scheme called Superannuation Guarantee (SG) which mandates that employers contribute 3% of an employees earnings to a retirement account for each worker

1992

2002

The rate is increased to 9%, however, is only levied on Ordinary Time Earnings (OTE), i.e, excluding overtime earnings.

The superannuation is increased to 9.5% of OTE.

2014

planned to increase the SG to 14% of OTE.

Currently

Shocks to superannuation

Superannuation is considered a *fixed cost* as it is not levied on overtime hours worked.

Firms face a choice between hiring an additional worker and paying SG or extending overtime hours and paying a wage premium.

Fixed costs approximately equal 22.4% of ordinary wage earnings.

An increase in SG from 9.5% to 12% represents a 11.16% increase in fixed costs.

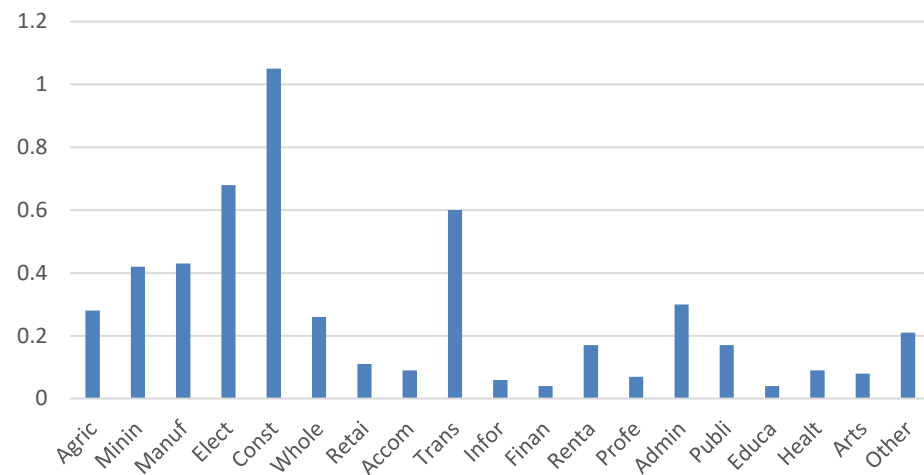
The simulation is executed using a short-run simulation.

Macroeconomic results

Macroeconomic variable	Percentage change
GDP	-0.89
Nominal price of labour	4.04
Real price of labour	2.32
Employed workers	-2.15
Hours per worker	0.24
CPI	1.72
Terms of Trade (TOT)	0.81
Export volume index	-4.05
Import volume index, duty-paid weights	0.24

Intensive margin results

Intensive margin adjustment

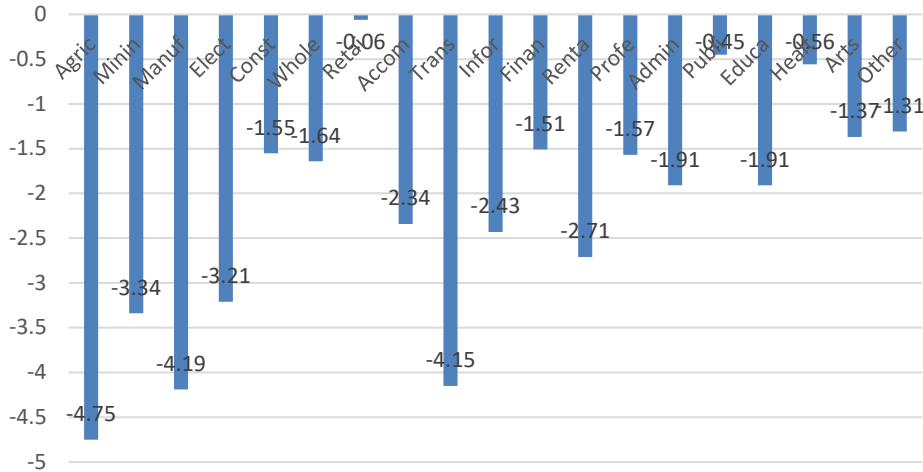


Industries ability to increase intensive margin employment depends on:

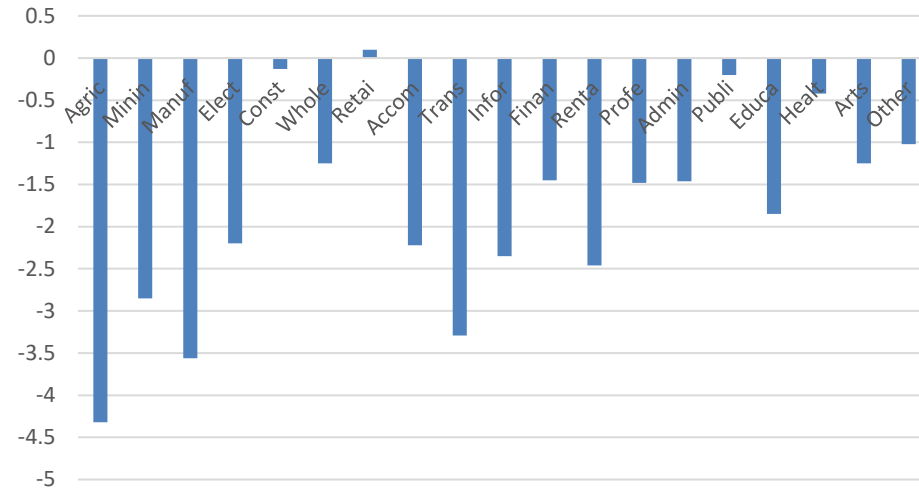
- Fixed costs
- Wage premium schedule
- Ordinary hours

Labour market results – Change in employment

Variation in employment



Variation in effective labour

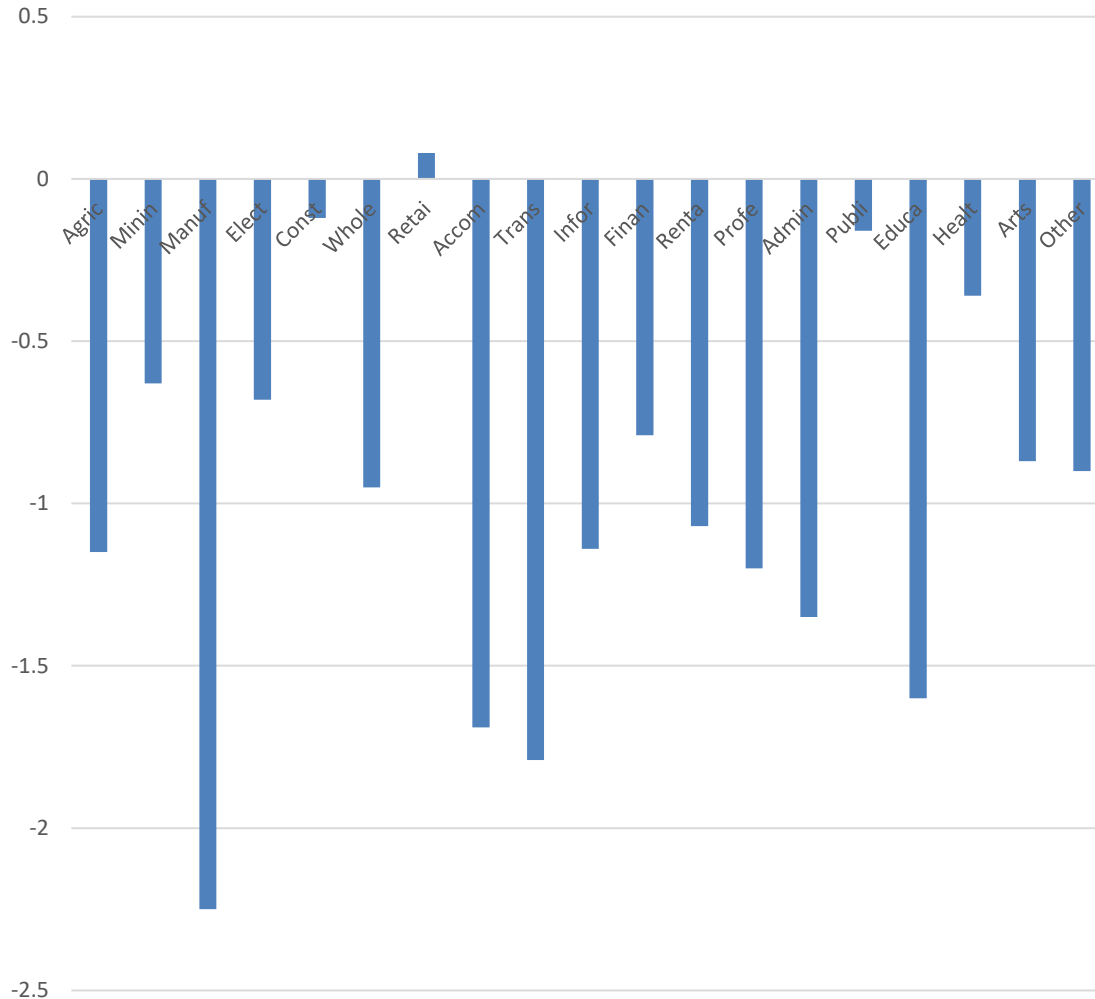


Number of workers and effective hours are strongly related. The difference between them depends on ability to adjust hours worked.

Number of workers adjusts to ensure the market is in equilibrium since intensive margin is determined based wage rate and fixed costs.

Industry Results

Industry activity



Industry activity depends primarily on the following three factors:

- Capital/Labour ratio
- Export oriented
- Intermediate usage

Summary: concluding remarks

The addition of an hours and workers dimension provides further insight to the labour market effects of policies such as superannuation increases.

Future research could involve further disaggregation, using a dynamic model and modelling the impact of the removal of the SG from overtime.

Thank you!

Questions?