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Abstract

This paper studies the role of efficiency in a firm's decision to contract out. Emphasis is on the heterogeneous nature of firms and when firms are only considering outsourcing to domestic suppliers. Firm-level data on Australian manufacturing reveal an ordering of efficiency between firms that contract out and those that do not, in which contracting-out firms are on aggregate less efficient. The analysis further shows that firms experience improvement in their efficiency soon after contracting out, but only if their performance has been below average prior to contracting out. The results show robustness to the choice of efficiency measure, where efficiency is expressed in both productivity and cost advantage.

Keywords: Outsourcing, Productivity, Cost Advantage, Manufacturing.

JEL Code: D24, L21, L24, L6.

1 Introduction

A "new firm" is emerging where the traditional boundaries that used to define a firm are getting increasingly blurred with employers subcontracting more in-house tasks to outside providers and moving further towards a coordinator role. Australia has been no exception to the rule: Wooden (1999) finds that the number of jobs contracted out in Australia rose from 3.5% to 4.7% of the total number of employed workers from 1989 to 1995. The trend has been ongoing in the recent years with the number of independent contractors commissioned by Australian businesses growing to 9.1% and then to 9.8% of the total number of employed workers by 2008 and 2010, respectively (ABS, 2010).

The availability of firm microdata, however, reveals that not all firms outsource at the same level or outsource at all. Antras & Helpman (2004) explain this paradox by pointing to differences in productivities: less efficient firms outsource in order to cut fixed costs and survive. More productive firms integrate or, with the possibility of offshore outsourcing, move some of their operation overseas to take advantage of the cheaper foreign labour. A host of works has already tested these predictions with mostly supportive outcomes.[1]

This paper benefits from the Australian Business Longitudinal Survey (BLS) as a rich source of information on a relatively large sample of firms and studies whether efficiency is a determinant of outsourcing behaviour. The paper makes a few contributions to the current literature. First of all, the Australian data are peculiar in that offshoring is a small part of the data. Following Benson & Ieronimo (1996), most of the jobs contracted out by large Australian firms during the same period are service jobs such as maintenance, janitorial, catering, and transportation jobs; all these jobs have to be done on site and can only be contracted out to domestic suppliers. Besides, most of the firms in the data are small and medium sized, and less than 2% of those firms indicate any desire to open a foreign subsidiary. Consequently, the results are strongly correlated with outsourcing decision to domestic suppliers, whereas other similar works place the emphasis on the differences between offshoring and non-offshoring firms.

Second, the paper proceeds by constructing three measures of efficiency, namely, labour and total factor productivity and cost advantage (i.e., a firm's average production cost relative to the industry's average) for a robust test of the hypothesis. The general picture for Australia is what one would expect: The least productive firms and those with higher relative costs are more likely to contract out. Third, owing to the nature of the data explained above, the efficiency effect of outsourcing is studied with more details and precision. Where other similar works have trouble decoupling the efficiency effects of outsourcing and offshoring, this study shows that firms experience improvement in both productivity and relative costs soon after contracting out. This effect, however, diminishes with the level of efficiency, so that the least efficient firms benefit the most from contracting out. Relatively efficient firms seem to contract out for other reasons such as penetrating export markets and focusing on innovation.

The rest of the paper is organised as follows: The next section presents some theoretical background on the subject of outsourcing and productivity. Section 3 describes the data and

[1] See Girma & Görg (2004) for a study of UK, Tomiura (2007) for a study of Japan, Kohler & Smolka (2009) and Farinas & Martin-Marcos (2010) for studies of Spain, and Federico (2010) for a study of Italy.

discusses the measurement of efficiency, size, and wage. Section 5 runs a few tests to relate efficiency level and contracting out. The same section also documents the efficiency effects of contracting out. Paper is concluded afterwards.

2 Theoretical Background

The theory of outsourcing generally relies on the notion of contractual incompleteness introduced by Grossman & Hart (1986). In such a relationship, there are aspects of the intermediate input received from the supplier that cannot be precisely specified or verified by a third party such as a court of law. For instance, the exact design and measurement of a component can be specified, but its quality is not immediately observed. Based on this concept, Grossman & Helpman (2002) compose an outsourcing framework in which firms have the option to outsource the entire manufacturing. Supplier needs to receive an incentive not to shirk on the non-contractible aspects of the product; therefore, the outsourcing firm transfers less than half the share of revenue to supplier after input is ready. Grossman & Helpman (2002) show that this mechanism leads to a holdup situation, in which the supplier underinvests in the production process. In return, the outsourcing firm needs less management resources to run the operation, and fixed costs go down. Where the benefit outweighs the loss of revenue, outsourcing happens.

Antras & Helpman (2004) put the above framework into a heterogeneous model of firms. Firms are different in productivity, and each firm has the option to outsource to a domestic supplier, outsource to a foreign supplier, or take over the foreign supplier (foreign direct investment). Again, to prevent the supplier from utilising the non-contractible aspects of the intermediate input to its own benefit, the outsourcing firm offers less than half the share of revenue after input is ready, and the holdup situation arises again. Holdup acts as a virtual drop in the firm's productivity, but firms still reduce fixed costs if they outsource to a domestic supplier. As a result, The less productive firms opt for domestic outsourcing, since they are not losing much from sharing revenues with their suppliers and the holdup problem, but they gain much by the reduction in fixed costs. Some of those firms could not have even survived without the outsourcing option. More efficient firms, Antras & Helpman (2004) anticipate, would offshore outsource to benefit from cheap overseas wages. The next sections set up a few measures of efficiency to account for productivity and production costs.

These measures are then used to test the hypothesis that lower efficiency raises the likelihood of outsourcing to domestic suppliers the way Antras & Helpman (2004) predict.

3 Business Longitudinal Survey

The Business Longitudinal Survey (BLS) derives from four waves of Business Growth and Performance Survey conducted by the Australia Bureau of Statistics during years 1994–95 to 1997–98.[2] The version available to researchers is a Confidentialised Unit Record File (CURF) in which some measures are taken to protect the confidentiality of individual firms, such as adding some noise to numerical values and suppressing the extreme observations. The data are a unique source of detailed information on Australian firms from a wide array of industries such as manufacturing, mining, construction, etc.[3] Particularly, in the first three years firms report if they contracted out jobs previously done by their employees, which is used to classify outsourcing decision.

The first wave in year 1994–95 covers about 13,000 firms randomly selected from the Australian Business Register and each firm in the sample is weighted so as to make the number of firms representative within the corresponding industry×size stratum (Will & Wilson, 2001). The sample was further broken into two categories, where the first category of about 3,400 firms was selected based on innovation, exports and growth in sales and kept in the continuing panel. Another 3,400 firms were selected from the rest and kept in the continuing panel (Breunig & Wong, 2008). In the CURF version, the BLS drops all firms with more than 200 full-time employees from the data to protect their confidentiality. This exclusion limits the application of results derived from CURF to small and medium-size enterprises and slightly affects the number of available observations.[4]

The sample used for analysis is restricted to the manufacturing sector (ANZSIC2x). When a firm is coded as ANZSIC 20 (unknown manufacturing) the industry code reported for the following years is used to determine the subdivision. If no information is available, then these firms are coded as Miscellaneous Manufacturing (ANZSIC 29). This way, ANZSIC 29 is closer to the *average* manufacturing and is subsequently set as the control group. To

[2]Fiscal year in Australia is from beginning July to the end of June next year, the reason for the use of two-year combinations.

[3]For the list of the survey questions of this data please refer to ABS Catalogue Number 8141.0.15.001 on http://www.abs.gov.au.

[4]The ABS Business Counts (Cat.No.8165.0) show that only about 1% of manufacturing firms in Australia have been larger than 200 employees; therefore, the omission is not damaging.

ANZSIC	Description	Number of Firms	Contracting Out 1994–95	1995–96	1996–97
21	Food, Beverages and Tobacco	150	8.7%	4.7%	7.3%
22	Textile, Clothing, Footwear and Leather	119	10.1%	9.2%	10.9%
23	Wood and Paper Products	76	7.9%	6.7%	6.6%
24	Printing, Publishing and Recorder Media	107	14.0%	12.2%	5.6%
25	Petroleum, Coal, and Chemical Products	177	5.7%	8.5%	6.2%
26	Non-metallic Mineral Products	68	7.4%	8.8%	4.4%
27	Metal Products	193	11.9%	4.7%	6.7%
28	Machinery and Equipment	371	13.8%	8.6%	6.7%
29	Miscellaneous Manufacturing	195	11.3%	10.3%	9.2%
2x	All Divisions	1,456	10.8%	8.1%	7.2%

Table 1: The composition of manufacturing in the selected sample.

Contracted Out in t	Contracted Out in $t+1$: No	Yes
No	84.9%	5.7%
Yes	7.4%	2.0%

Table 2: Percentage of firm–years contracting out in $t+1$ conditional on contracting out in t. $t = 1994-95, 1995-96$.

look at stable firms and for the possibility of forming longitudinal links, the sample is also restricted to a balanced panel of firms by keeping firms that have been present and active in all four years of the panel. Contracting out is not reported in 1997–98, therefore, this year is only used to construct forward looking changes in efficiency and then discarded.

Table 1 reports the composition of manufacturing in the balanced panel. The counts already point to some cross-industry differences in the choice of outsourcing, also some trend over the years. The dynamic nature of contracting out is emphasised in Table 2. In particular, contracting out in the context of the BLS is an incremental activity: firms report if they sent out some jobs previously done internally during the year. The table shows that most of the firm–years do not plan to send out jobs from year to year. Also, a significant proportion, about 7%, of firm-years contract out in one year but do not make a move in the next year, thus keeping their level of contracting out put. A smaller proportion, about 2% of firm-years, do increase the number of contracted jobs in two consecutive years.

4 Measuring Employment Size and Productivity

4.1 Employment Size

The number of full-time (FTWORK) and part-time (PTWORK) non-managerial employees and the number of managers and owners (MAN) are reported in the last pay period of June each year. First, the ratio of part-time to full-time hours for each year are obtained from the ABS report on earnings and hours (Cat.No.6306.0) and used to get a full-time equivalent of part-time employee numbers. For an over-the-year estimate, the average of each variable in two consecutive years is computed and used in the remainder. The total number of workers (WORK) is the sum of full-time and prorated part-time non-managerial employees. The total employment (EMP), which is the measure of firm size, is the total number of workers plus the number of managers and owners.

4.2 Productivity

The measure of productivity is the Total Factor Productivity (TFP) based on the following Cobb-Douglas presentation of production:

$$y_{ij} = \log(TFP_{ij}) + \beta_i^l l_{ij} + \beta_i^k k_{ij},$$

where y_{ij} is the log of real value added for firm j in industry i. l_{ij} is the log of total employment and k_{ij} is the log of real capital. Values of β^l and β^k are those reported in Breunig & Wong (2008), where they apply a two-stage Olley & Pakes (1996) method to the uncensored version of the BLS to find consistent estimates of β_l and β_k and control for selection bias. Real value added output is constructed as the sum of sales, change in inventories minus purchase of input and other operational costs and deflated by the ABS reported commodity price indexes at two-digit ANZSIC (Cat.No.6412.0).

Capital is the sum of the asset value of plant and machinery plus the leasing stock. Leasing stock for each firm is constructed as the reported leasing expenses divided by $(r + \delta_i)$, where $r = 0.05$ is the average return on capital. δ_i is the depreciation rate of capital for each ANZSIC subdivision computed as

$$\delta_i = \frac{Depreciation_i}{Plant\ and\ Machinery_i + Depreciation_i},$$

where the firm-level book value of plant and machinery capital and depreciation reported in 1994/95 are aggregated to ANZSIC level.

The ABS commodity price index for "machinery and equipment" (ANZSIC 28) is used to deflate the nominal capital stock. This appears to be a judicial decision since the ABS input-output reports show that more than 90% of the value of capital input to every manufacturing sector is supplied by this sector. The estimate of real capital, however, does not reflect the mix of machinery used by different industry's. Hence, for robustness, the exercises are also performed using Labor Productivity (LP) defined as real value added divided by total employment.

Both LP and TFP are further indexed by dividing their values by their average, so that the average firm in the pooled sample has productivity index equal to one.

4.3 Cost Advantage

The average cost of production in a firm is another indicator of relative efficiency. The average cost is measured as the cost per dollar produced. Formally, for firm j belonging to industry i the average cost is computed as

$$AC_{ij} = \text{Total Cost}_{ij}/\text{Value Output}_{ij}.$$

All values are in nominal terms. Total cost is the sum of employee pays (itemised in the next section), input purchases, capital rentals, capital depreciation, and "other expenses" specified by firms. The value of output is the value of sales plus any change in inventory stock. The cost advantage of the firm is then set to

$$COSTA_{ij} = \frac{\overline{AC}_i}{AC_{ij}},$$

where, $\overline{AC}_i$ is the average taken over all firms belonging to industry i.

4.4 Average Non-managerial Wage

An estimate of the average non-managerial wage, as a proxy for unskilled wage, is constructed as follows:

$$WAGE = \frac{PAY}{WORK + kMAN},$$

	1st Decile	Median	9th Decile	Mean	Std.Dev.
LP	0.30	0.87	1.75	1.00	0.82
TFP	0.18	0.72	1.94	1.00	1.31
COSTA	0.87	1.00	1.30	1.08	0.39
EMP	2.00	5.94	33.9	14.4	24.2
WAGE($1000)	3.35	20.1	36.4	20.5	13.2

Table 3: Simple statistics for the measured values. Using 4,368 firm–years from BLS balanced sample.

	LP	TFP	COSTA	EMP
LP	1			
TFP	0.551	1		
COSTA	0.082	0.075	1	
EMP	0.217	0.106	-0.084	1

Table 4: The correlation table of firm performance measures. Using the balanced sample of firm–years pooling years 1994–95 to 1997–98 from the BLS. Using 4,368 firm–years from BLS balanced sample.

in which PAY is the sum of wages, contributions to the retirement fund and workers' compensations paid over the (fiscal) year. k is the ratio of average weekly pay to managerial versus non-managerial staff, obtained from the ABS report on earnings and hours (Cat.No.6306.0) for each year. The ratios are in general around 2.0.

The simple statistics about the measured quantities are reported in Table 3. The efficiency measures are, in general, positively correlated but not perfectly (Table 4).

5 Empirical Exercises

5.1 Relative Efficiency of Contracting Out Firms

In our first exercise, we make a distinction between contracting-out firms and the rest of firms by ranking their distribution of efficiency using the notion of stochastic dominance. For this purpose, we define a contracting-out firm the one that reports contracting out in $t + 1$ and condition that on the firm's efficiency in period t. Based on the predictions of Antras & Helpman (2004), expectation is that the distribution of productivity (or cost advantage) in period t for contracting-out firms be stochastically dominated by that of other firms if firms contracting out are less efficient as a whole. Note that in this context no contracting out does not convey that the firm is integrated, and the tests actually show whether low efficiency makes firms send out a new set of in-house jobs.

For the comparison, the non-parametric cumulative distribution function (CDF) of the efficiency measure is computed using a simple counting rule, which is

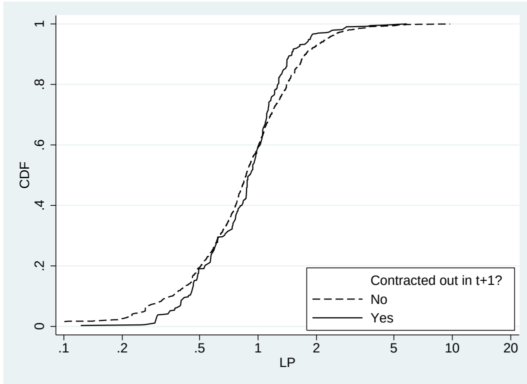
$$F(EFF) = Prob(\theta \leq EFF) = \frac{\sum_{j=1}^{n} w_j I(\theta_j \leq EFF)}{\sum_{j=1}^{n} w_j}, \quad (1)$$

where θ is an individual firm's level of efficiency using any of the alternative measures. The estimated CDFs by each efficiency measure is illustrated in Figure 1. With TFP and cost advantage, there is a pattern of stochastic dominance, and the CDF for contracting out firms practically stays on top. LP is a cruder measure of productivity when dealing with firms pooled from various manufacturing subdivisions, and the CDFs for the contracting out firms and others cross, but it is still clear that firms with high labour productivities are not contracting out in any significant proportion. A more formal analysis of the effect is undertaken in the next section using a model of propensity.

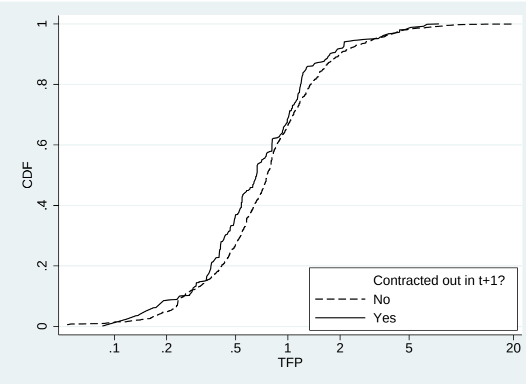
5.2 A Propensity Model of Contracting Out

Contracting out information in the BLS is of Boolean type, just indicating if a firm contracted out a new set of jobs or not. On this account, the best way to model the decision is to use a probit probability model and to estimate the propensity that a firm would opt for contracting out conditional on its level of efficiency.

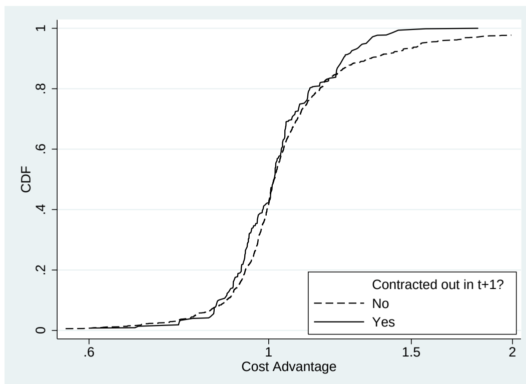
However, efficiency is not the only factor to influence the decision to contract out. A few other variables are also included to account for other relevant factors. Two dummies will indicate if the percentage of union employees from the workforce is 25–50% ($UNION25-50$) or above 50% ($UNION > 50$). Abraham & Taylor (1996) posit that union representation forces a firm to outsource those union jobs to gain business flexibility, but high levels of union representation could hinder this strategy by unions exerting too much control over the firm's decisions. Firms paying higher wages to their workers also have the incentive to outsource those jobs in favour of contractors (Abraham & Taylor, 1996). The average non-managerial wage ($WAGE$) is used to proxy for unskilled wage. Firms that export or plan to commence exporting could resort to outsourcing, so that they can become competitive on an international scale. Export intensity ($EXPINT$) is included to indicate the level of export activity. Firms that do not export but intend to are controlled for by the dummy $STARTX$. Firms with product innovation are less concerned with cost cutting and more



(a)



(b)



(c)

Figure 1: The non-parametric cumulative distribution functions estimates of efficiency measures for contracting out and non-contracting out firms. Using 4,368 firm–years from the BLS balanced sample.

eager to promote their new products and to extend a streak of innovations. Outsourcing helps these firms to narrow down focus on R&D and innovation by eliminating peripheral jobs. For this purpose, the dummy $INNOV$ is included that indicates whether a firm introduced a substantially different product during the year. Decentralised production also overburdens the management, and outsourcing helps release management resources for core production tasks. This effect is taken care of by including the dummy $MULTI$, which is one if the firm operates more than one location. Large size, in the number of employees, adds to the number of tasks undertaken internally and spurs the same outsourcing incentives. Therefore, total employment EMP is added to the list. The details of these variables can be found in the Appendix section.

Putting it all together, we propose the following probit model to estimate the probability that firm j belonging to industry i would contract out in $t+1$ conditional on its characteristics at t:

$$P[OUTS_{ij,t+1} = 1|t] = \Phi\bigg(a_0 + a_1 OUTS_{ij,t} + a_2 EFF_{ij,t} + X_{ij,t} b\bigg). \quad (2)$$

To account for the possible intertemporal correlation in outsourcing activity which is inferred from Table 2, $OUTS_t$ is added to the right-hand side. EFF is the measure of efficiency, which is alternatively set to the log of labour, the log of total factor productivity, and the firm's cost advantage in different specifications. All the effects discussed earlier are in X. The propensity model also includes controls for the industry of operation, the age of the firm, and the year effect. Given the scope of data, $t = 1994 - 95, 1995 - 96$.

Table 5 reports the estimation results. As Antras & Helpman (2004) predict, the results show a negative and statistically significant effect with all the measures of efficiency. In other words, inefficiency unequivocally leads to a higher likelihood of contracting out. Quantitatively, the estimates show that deviating from the average efficiency by one unit value causes the propensity to contract out to change by about 1.5%.

The estimated models also shows a positive intertemporal correlation in contracting out activity: firms contracting out in one years are at least 11% more likely to contract out another round of jobs the next year. The rest of the estimated coefficients has the expected signs. Note that both non-managerial wage and cost advantage use total employee pay as a component; therefore, there is some level of correlation between the two variables. Consequently, the wage coefficient for the last model in Table 5 is a bit affected by this correlation.

5.3 Efficiency Effect of Contracting Out

Did contracting out assist firms to reduce production costs and to improve efficiency? To investigate, we follow Davis et al. (1996) in defining the relative change in efficiency as

$$\Delta EFF_{ij,t+1} = \frac{EFF_{ij,t+1} - EFF_{ij,t}}{\frac{1}{2}(EFF_{ij,t+1} + EFF_{ij,t})}, \quad (3)$$

in which contracting out is still taking place in period $t + 1$. The definition above restricts relative change within a -2 to 2 bound, thus controls and limits the impact of measurement noise in computing change. Some firms also have zero productivity in one year (they reported more input costs than output) but positive productivity in the next period. The definition

Variable	(1)	(2)	(3)	(4)
$OUTS_t$	0.132***	0.131***	0.110***	0.131***
	(0.007)	(0.007)	(0.006)	(0.007)
$UNION_t 25-50$	0.006	0.012	0.016*	0.006
	(0.006)	(0.006)	(0.007)	(0.006)
$UNION_t > 50$	-0.025***	-0.022***	-0.023***	-0.024***
	(0.003)	(0.003)	(0.003)	(0.003)
$\log(1 + WAGE_t)$	0.008***	0.018***	0.012***	0.006***
	(0.001)	(0.002)	(0.002)	(0.001)
$EXPINT_t$	0.010**	0.037***	0.038***	0.009**
	(0.003)	(0.007)	(0.007)	(0.003)
$STARTX_t$	0.032***	0.033***	0.037***	0.030***
	(0.005)	(0.005)	(0.005)	(0.005)
$INNOV_t$	0.015***	0.013***	0.013***	0.016***
	(0.003)	(0.003)	(0.003)	(0.003)
$MULTI_t$	0.017***	0.018***	0.021***	0.017***
	(0.004)	(0.004)	(0.004)	(0.004)
$\log(EMP_t)$	0.015***	0.013***	0.014***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)
EFF_t		-0.017***	-0.016***	-0.014***
		(0.002)	(0.002)	(0.003)
Measure of Efficiency	$\log(LP)$	$\log(TFP)$	$COSTA$	
Controls	Industry, Age, Year			
Log Likelihood	-8469.9	-8361.8	-8093.3	-8463.8
χ^2	2498.1	2558.0	2223.7	2541.8
Liklihood-Ratio Test		LR_{21} 216.2***	LR_{31} 753.2***	LR_{41} 12.2***

Table 5: Probit estimates of the propensity to contract out in $t+1$ using different measures of productivity. Marginal effects are reported. $t = 1994-95, 1995-96$. The numbers in parentheses are robust standard errors. LR_{ij} tests model i against the restricted model j. All the estimates are controlled for industry, year and age effects by including the appropriate dummies. Using 4,368 firm–years from the BLS balanced sample.

	Dependent Variable					
	One-period difference			Two-period difference		
Variable	ΔLP_{t+1}	ΔTFP_{t+1}	$\Delta COSTA_{t+1}$	ΔLP_{t+2}	ΔTFP_{t+2}	$\Delta COSTA_{t+2}$
EFF_t	-0.132***	-0.194***	-0.224***	-0.181***	-0.291***	-0.235***
	(0.007)	(0.008)	(0.005)	(0.007)	(0.007)	(0.005)
$OUTS_{t+1}$	0.039***	0.015	0.193***	0.089***	0.034**	0.294***
	(0.007)	(0.008)	(0.022)	(0.009)	(0.011)	(0.030)
$EFF_t \times$	-0.231***	-0.161***	-0.179***	-0.223***	-0.147***	-0.298***
$OUTS_{t+1}$	(0.018)	(0.010)	(0.021)	(0.024)	(0.012)	(0.029)
Measure of Productivity	$\log(LP)$	$\log(TFP)$	$COSTA$	$\log(LP)$	$\log(TFP)$	$COSTA$
R^2	0.051	0.068	0.202	0.077	0.125	0.193
σ_ϵ^2	0.484	0.518	0.188	0.546	0.550	0.206

Table 6: Models of change in efficiency. Marginal effects are reported. $t = 1994-95, 1995-96$. The numbers in parentheses are robust standard errors. All estimates are controlled for industry and year effects. Using 4,368 firm–years from the BLS balanced sample.

above helps to include these firms in the analysis.

The impact of contracting out on the relative change is estimated using a linear regression model of the form

$$\Delta EFF_{ij,t+1} = a_0 + a_1 OUTS_{ij,t+1} + a_2 EFF_{ij,t} + a_3 OUTS_{ij,t+1} \times EFF_{ij,t} + \epsilon_{ij,t+1} \qquad (4)$$

Of particular interest is the interaction term that will highlight the impact of contracting out on firms of different efficiency levels. Model (2) is estimated with each of the three measures of efficiency. The first three columns of Table 6 report the estimation results.

The results in the table show that, as a whole, contracting out has a positive effect on all measures of efficiency, causing productivity and cost advantage to increase. The estimate for the interaction term is negative and statistically significant. The implication is that the efficiency effect benefits the least efficient firms only. At the same time, using $EFF = 1$ and summing up coefficients for $OUTS$ and $EFF \times OUTS$ shows that an improvement is practically non-existent for a contracting out firm with an average efficiency level. Since firms in the upper tail of efficiency experience an overall increase in costs, they must have had expectations other than cutting costs from contracting out. This last assertion is further validated by the fact that the estimate for the stand alone productivity term also shows a diminishing effect, meaning that improving your efficiency becomes increasingly harder as your firm gets closer to the production frontier. Those firms are more engaged in pushing the frontier outward by investing in innovation. This trend is already predicted by the theory model of Acemoglu et al. (2003).[5]

There is, however, the possibility that these estimates are affected by short term fluctuations: firms contracting out are going through a phase of readjusting employment and capital to the new business order. To make sure that the improvement in efficiency is not a short-term shock, but a longer-term effect, also to alleviate some endogeneity concerns, the relative change in efficiency is redefined by eliminating period $t+1$ from differencing, so that

$$\Delta EFF_{ij,t+2} = \frac{EFF_{ij,t+2} - EFF_{ij,t}}{\frac{1}{2}(EFF_{ij,t+2} + EFF_{ij,t})}. \tag{5}$$

Using this new definition on the left-hand side in (4), we estimate a second set of results, which appear in the last three columns of Table 6. The qualitative implications all stay the same and statistically become even stronger by this choice of differencing formula.

6 Conclusion

Using a survey of Australian manufacturing firms, this paper provides some evidence that firms that opt for contracting out a new set of jobs in each year are those with relatively low efficiency levels. This evidence is taken to provide some support to the prediction of Antras & Helpman (2004) when the options are integration and outsourcing to domestic suppliers. For robustness, efficiency is defined in both productivity and cost advantage, and the implications are shown to be the same. On aggregate, contracting out is shown to have improved efficiency and lowered costs in those firms that contracted out, but only if those firms were inefficient to begin with.

There are some caveats too. The theory of Antras & Helpman (2004) explains outsourcing as an attempt to send out manufacturing. However, outsourcing in Australia during the period studied was mostly about service jobs. It is not clear whether the fixed cost story of Antras & Helpman (2004) and contractual incompleteness is the best description of the mechanism. In the US, Dube & Kaplan (2010), in particular, show that outsourced services supplied by janitors and security guards had been cheaper per employee than when those jobs were internalised. Based on the study, if services are counted as non-production and part of

[5] Given that a few firms fall on the -2 and 2 boundaries, the same models are also estimated using tobit estimates, and the results are very similar.

the fixed cost, then outsourcing reduces fixed costs. Also, offshore outsourcing, although a very small presence, might be having some affect on the results. Especially, some contracting out activity by the relatively efficient firms could be explained by offshoring. Data is silent about foreign outsourcing, but offshoring firms are shown to be more productive than the average firm and having controlled for those firms would have made the role of efficiency estimated in this study even more pronounced, thus findings would not be refuted.

A Description of Variables

A collection of variables are constructed using the information available from the BLS and used as control variables in the empirical exercises. The description and construction details for each variable is as follows:

UNION25–50: Dummy indicating if a the proportion of union members in a firm's employment is 25% to 50%. The BLS reports the proportion in bins of 0%–10%, 11%–25%, 26%–50%, 51%–75%, and 76%–100%. Using the BLS variable UNIONME5–8.

UNION>50: Dummy indicating if the proportion of union members in a firm's employment is more than 50%. Using the BLS variable UNIONME5–8.

EXPINT: Export intensity is formed by dividing nominal value of exports by the nominal value of sales. Using the BLS variables SALES5–8 and EXPORTS5–8.

STARTX: Firm's intention to commence exporting. In 1994–95 and 1995–96, the BLS reports if the firm intends to commence or maintain exporting in the next three years. STARTX in those years is set to one if the firm has the intention and did not report any exports. In later years, the BLS directly reports if the firm intends to commence exporting. Using the BLS variables INTCOEX5–8 and EXPORTS5–6.

INNOVAT: Dummy indicating if a firm introduced a substantially new product during the year. Using the BLS variable INNOVAT5–8.

MULTI: Dummy indicating if a firm has multiple locations. Using the BLS variable BUSLOCS5–8 that reports the number of business locations.

AGE: The BLS reports the age of a firm in a few bins. The age bins are 0–1, 2–4, 5–9, 10–19, and 20+. Dummies are constructed using the same bins. Using the BLS variable AGE5–8.

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