The Competitive Impacts of Leveraged Training Outcomes

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1. Introduction

The broad focus of this paper is the competitive effect of government policies aimed at securing training outcomes from public construction contracts. Its context is the trend towards the contracting out of public construction works and the attempts that have been made to use construction contracts to 'leverage' a wide range of social outcomes. In federal and state jurisdictions it is now common for governments to impose a range of additional requirements on public works contractors that relate to broad social/community objectives. These requirements include commitments to train apprentices and trainees; to provide local and/or indigenous employment opportunities; to buy local materials; and to include art works.

The cost and benefits of using public construction contracts to achieve social/community goals have, to our knowledge, not been thoroughly researched in an Australian context. This is likely to reflect in large part the relatively short history of contracting out public works. As Jensen and Stonecash (2004) explain, most previous empirical studies of contracting out have attempted to measure the cost savings achieved through privatization, as this was the focus of policy debate in the 1980s and 1990s. Relatively few studies have addressed the ability of contracting arrangements to ensure the delivery of desired 'quality' outcomes[2], or the costs of achieving these outcomes via contracting arrangements.

One of the potential costs of attempting to leverage social/community outcomes on public construction projects is a reduction in the amount of competition for these projects, with obvious consequences for average bid prices and choice. In jurisdictions, such as Western Australia currently, where construction market conditions are already causing a shortfall of tenderers and rising costs, this potential competitive effect is of particular concern.

This paper aims to contribute knowledge on the nature and extent of the competitive effects of the leveraging of social/community outcomes on public construction projects. It does so by examining the effects on the level of bid activity for public construction projects of two policies of the Western Australian government: the Priority Access Policy and the Building Skills Policy. Both of these policies aimed at ensuring an adequate

[1] This paper forms part of the results of the Multi-outcomes Construction Policies research project, funded by the Cooperative Research Centre for Construction Innovation (Project 2006-036-A). A key industry partner in this research project is the Western Australian Department of Housing and Works, which has a legislated responsibility to ensure the efficient administration of public construction contracts in the State.

[2] A notable exception is Domberger and Jensen (1997) which explored the ability of a public authority to ensure adequate investments in vehicle maintenance in its contractual arrangements for the provision of refuse collection services

supply of skilled labour in the construction industry[3]. The Priority Access Policy, first implemented in August 1999, required contractors to meet a range of minimum training requirements[4] before being eligible to tender on public building and construction contracts. The Building Skills Policy, which was first implemented in October 2002, specified that 10% of deemed labour hours be allocated to the employment of apprentices and/or trainees. On January 1 2007 both policies were integrated into the Priority Start – Building Policy.

The paper's analysis of the competitive effects of these policies is based on data drawn from the WA Department of Housing and Work's (hereafter DHW) Tender Registration System between 1997 and 2006. The Tender Registration System (TRS) was implemented in 1996 as a way of recording the tender details of all WA government construction projects. The TRS database contains records on the details of each project: a description of the works to be undertaken; the location of the planned work; and the estimated pre-tender value of the project. The database also contains information on the number of tender documents requested for each project, together with details on each of the tenders received and the winning bid. As such, the TRS is a unique and comprehensive resource for examining changes and variations in bid activity in an important segment of the construction 'market'.

In this study use is made of the TRS project and tender details on 2519 government non-residential construction contracts awarded between 1997[5] and 2006. For these contracts 11525 tender bids were submitted. This represents close to all the contracts and bids included in the TRS over the ten year period. Only a very small number of contracts were excluded from the analysis due to incomplete recording of their details[6].

The analysis presented in this paper is important for a number of reasons. First, it comprises a detailed quantitative analysis of a large set of data on public construction contracts. To our knowledge, little use has been made by academics of the data that now exists on tender bids and outcomes in most Australian jurisdictions. This paper hopefully highlights the potential to draw on these sources to gain greater insights into the trends and issues affecting the construction market in Australia. Second, it is a novel attempt to examine the efficiency of using the contracting arrangements of public works authorities to achieve training goals. Specifically, the analysis generates unique information on the effects on competition for public construction contracts that may stem from different types of 'leveraged' training policies. The rising trend towards the contracting out of public sector activity, together with concerns about the availability of skilled labour makes this type of information of great policy relevance.

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[3] *Priority Access n.d.* Retrieved October 20, 2006, from http://policies.det.wa.edu.au/ ; *Building Skills n.d.* Retrieved October 20, 2006, from http://policies.det.wa.edu.au/ .

[4] Contractors need to meet a minimum of 100 points in order for them to be able to tender. Points are allocated based on the contractor's involvement in specified employment and training activities, such as employing apprentices and/or trainees, staff with recognised VET qualifications, staff with tertiary qualifications, or having staff participating in work related training programs.,

[5] Although the TRS was initiated in 1996, records in this year were incomplete and, thus, excluded from our investigation

[6] The omission of records on location and tender value appeared to be due to record keeping errors and is, thus, unlikely to be a source of systematic bias in the results of our analysis.

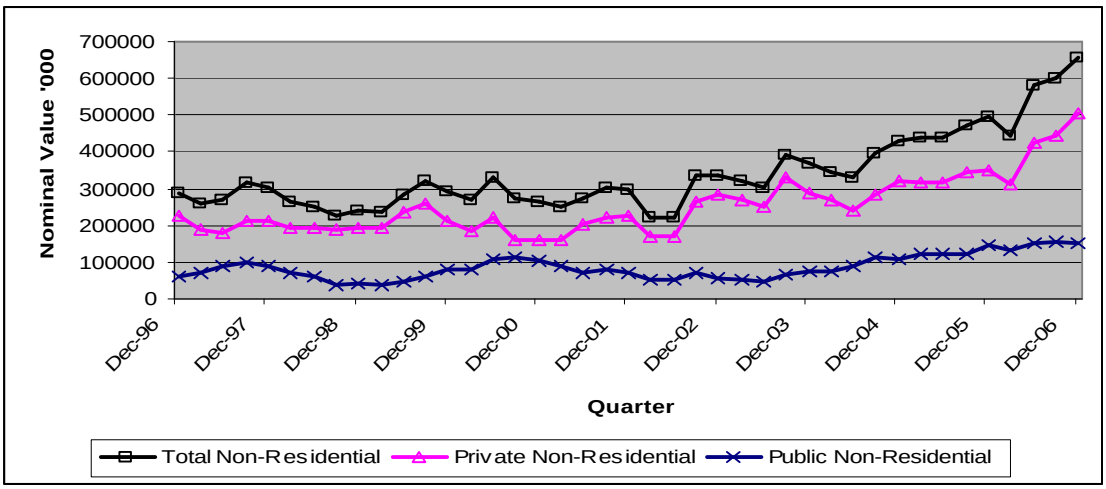
The paper is organised in a straightforward manner. Section 2 gives an overview of activity in the public non-residential construction 'market' in WA generated from the TRS and other data sources. The third section provides an overview of the methodology used to analyse the relationship between the implementation/application of the Priority Access and Building Skills policies and bid activity in the public construction 'market'. Section 4 presents the results of this empirical analysis, whilst the final section provides a discussion and summary.

2. Overview of the Non-Residential Construction Sector in WA, 1997-2006

The total value of non-residential construction activity completed in Western Australia in 2006 was $2280m. As the following chart shows private sector work dominates this total, comprising close to 75% of all non-residential construction work in 2006. Public sector activity in 2006 was valued at $592m.

The information in Figure 1 also shows the strong upward trend in non-residential construction work in the state from the beginning of 2002, with this increase being dominated by private sector activity. Between December 2001 and December 2006 the total nominal value of private sector work increased by 120.6%. This compared to a 3.1% increase between December 1996 and December 2001.

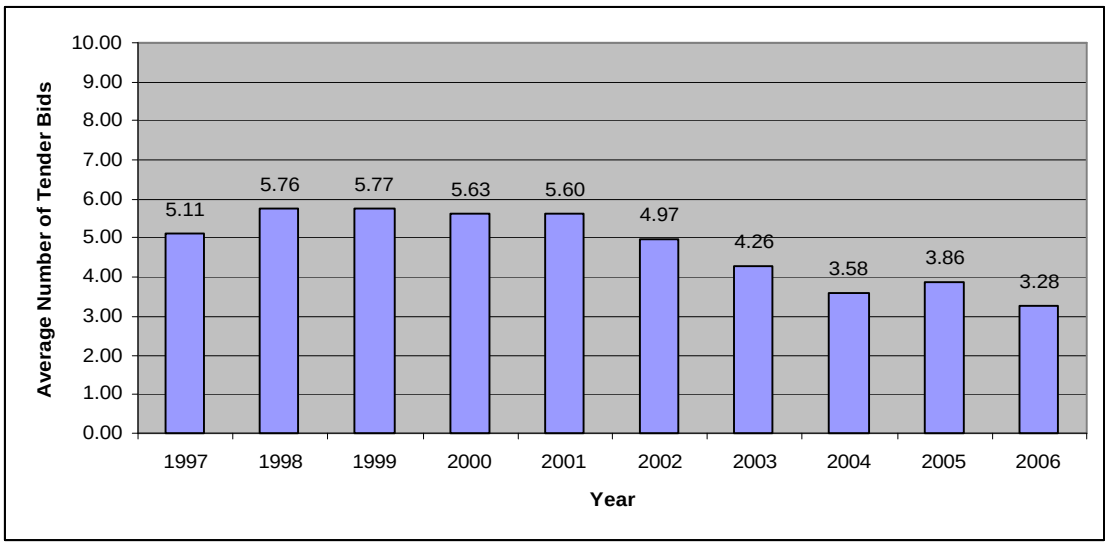
Figure 1: Total, Private, and Public Nominal Values for Non-Residential Construction Work done in Western Australia by Quarter, December 1996 to December 2006.



Source: Australia Bureau Statistics, 8752.0 Building Activity, Australia, Table 45. Value of Building Work by Sector, Western Australia: Original. (Series Identifications: A2057722C, A2034996K, and A2046139R).

It is not particularly surprising that the 1996-2007 period was also characterised by a sharp fall in the average number of tender bids for WA government non-residential construction contracts. As is shown in the following diagram, between 1997 and 2006 the average number of bids on these contracts fell from 5.1 to 3.3 bids, or by 35.3%. A large part of this change was concentrated in the years from 2001.

Figure 2: Average Number of Tender Bids on WA Public, Non -Residential Construction Contracts by Year, 1997 to 2006

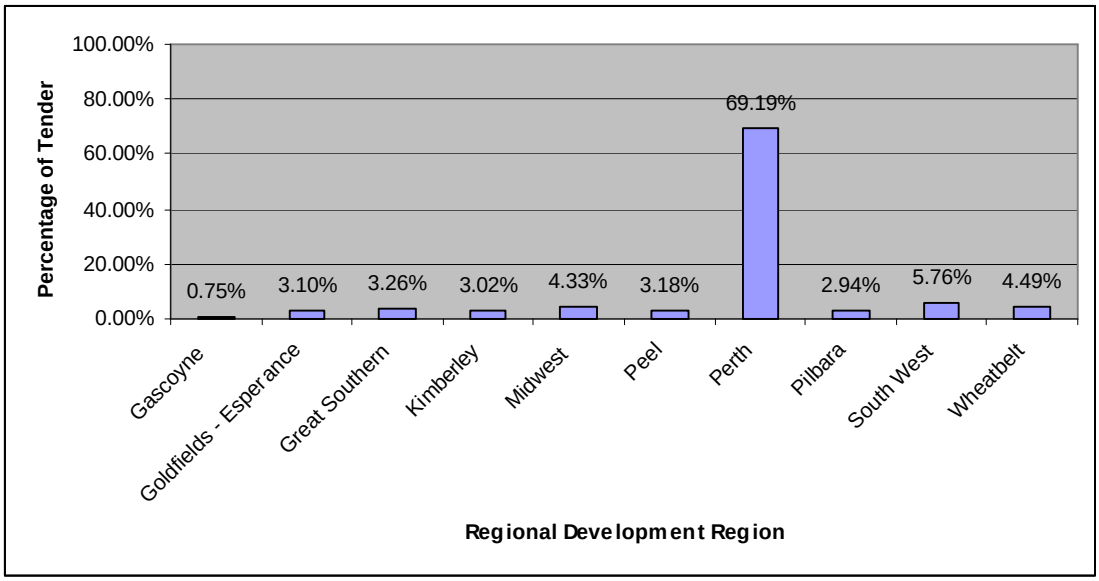


Western Australia is a large and geographically diverse state and, as such, any analysis of construction activity needs to take into account sizeable regional differences in costs of production. In the study period, the large majority (70%) of public construction contracts related to work undertaken in the Perth region [7]. A further 9% of contracts were located in the South West and Peel regions, both of which are relatively close to Perth. As is shown in Figure 3, the remaining contracts were spread across a range of remote regions.

The decrease in bid numbers observed in the state as a whole also occurred in the two groups of regions identified here. In the regions located relatively close to Perth – that is, the Perth, Peel, and South West regional development regions – the average number of tender bids declined by 42% between 2001 and 2006. In the remaining, more remote regions, this decline was 35%.

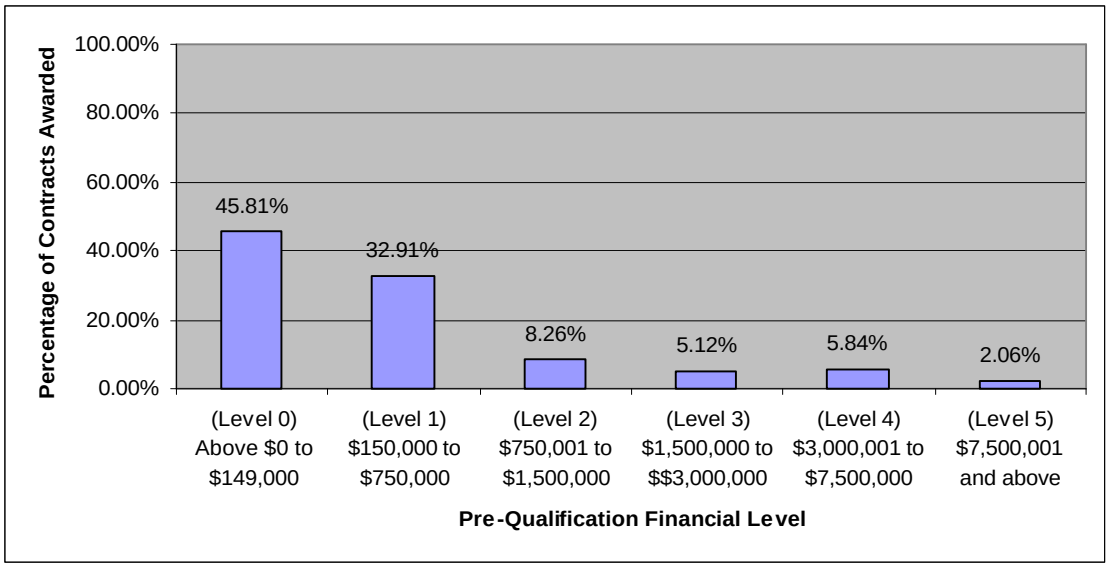
[7] This study matched the postcode information contained in the TRS with the WA Department of Land Information's regional development regions [7] to identify the regional distribution of contracts

Figure 3: WA Public Non-Residential Construction Awarded Contracts by Regional Development Region, 1997 to 2006 (per cent)



Another source of diversity in public non-residential construction work in WA is the size of the work undertaken. Projects range from small additions to local schools to large infrastructure projects. This diversity is especially important in the context of the current investigation because the training policies being studied only apply to relatively large projects. The Priority Access Policy applies only to contracts with a pre-tender value of $150,000 or more; the Building Skills Policy to contracts with a pre-tender value of more than $2 million. 1019 contracts (or 54.2% of all awarded contracts) have been subject to the Priority Access Policy since its introduction in August 1999. The Building Skills Policy has applied to 160 contracts (or 11.8% of all awarded contracts) since its introduction in October 2002. Further information on the size distribution of awarded contracts is contained in Figure 4.

Figure 4: WA Public Non-Residential Construction Contracts by Pre-Qualification Financial Level, 1997 to 2006 (per cent).



The downward trend in tender bid numbers was common to each of the pre-qualification levels associated with the contracts, but it was largest in magnitude in the Level 2-4 (mid-range) categories. This pattern is summarised in the following table.

Table 1: Percentage Decline in the Average Number of Tender Bids by Pre-Qualification Financial Level between 2001 and 2006.

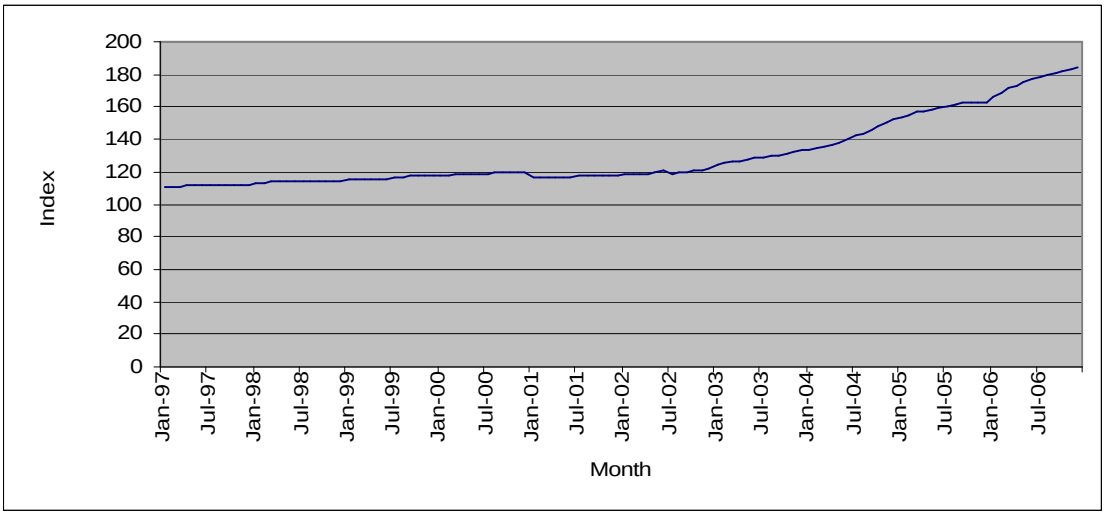
Pre-Qualification Financial Level	Percentage Decline in the Average Number of Tender Bids
(Level 0) - $1 to $149,000	22.9%
(Level 1) - $150,000 to $750,000	50.2%
(Level 2) - $750,001 to $1,500,000	56.4%
(Level 3) - $1,500,001 to $3,000,000	60.4%
(Level 4) - $3,000,001 to $7,500,000	56.4%
(Level 5) - $7,500,001 and above	26.2%

The observed trends in bid numbers are likely to have been strongly influenced by changes in factors affecting the availability of other construction work and the cost/availability of resources. The years since 2002 have been associated with substantial growth in WA's resource and construction industries and this has produced large pressures on available labour and materials.

A number of related statistical measures convey information on these pressures. For example, as is shown in the following chart, the DHW's Building Cost Index[8] there was only a slight rise in building costs (by around 8%) from the beginning of 1997 up to mid 2002 but these then increased rapidly (by around 55%) to the end of 2006.

[8] for the Perth region this includes both labour and material costs.

Figure 5: Building Cost Index for the Perth Region by Month, January 1997 to December 2006.



Source: The Western Australian Department of Housing and Works. Works and Building Construction Building Cost Index – Perth, File BB 576/87, Personal communication DHW, May 30 2007

The building cost index is derived from measures of labour and materials costs and reflects the costs of accomplishing standard types of public and private sector construction projects[9]. The influence of labour costs on the index is apparent in the similar pattern of change in construction industry wages over the study period. These remained relatively stable between February 1996 and August 2002 (increasing by only 1.6%). However, they rose rapidly from August 2002 onwards, increasing by 40.8% by November 2006 (ABS, 2006a). Materials costs rose by only 6.1% between December 1996 and September 2002 but rose by 23.6% between the September 2002 and December 2006 (ABS 2006b).

Labour shortages emerged in the state post 2002 and were an important contributor to the rising wage costs. Illustrating this, the Department of Employment and Workplace Relations skills vacancy index (DEWR n.d.), which provides a monthly indicator of the degree of difficulty that employers have in filling vacancies in occupations or specialised skill needs, recorded a 129.5% increase between the start of 2002 and the end of 2006.

3. Multi-Factor Analysis of Bid Activity

The central research question addressed in this paper is whether the additional training requirements imposed as a result of the Priority Access and Building Skills policies had a *measurable and distinct* impact on bid activity for public construction contracts. That is, was there a measurable effect of these policies on bid numbers that was separate from the impacts on bid activity generated by changing economic conditions in the state?

Conducting such an analysis clearly requires a multi-factor approach that is able to 'control' for the influence of the range of other factors on bid numbers (such as changes

[9] For example, it reports the current cost of a typical school and prison.

in private construction activity and costs, as well as variations in contract region and project size) before focusing on the relationship between the implementation of the policies and bid activity.

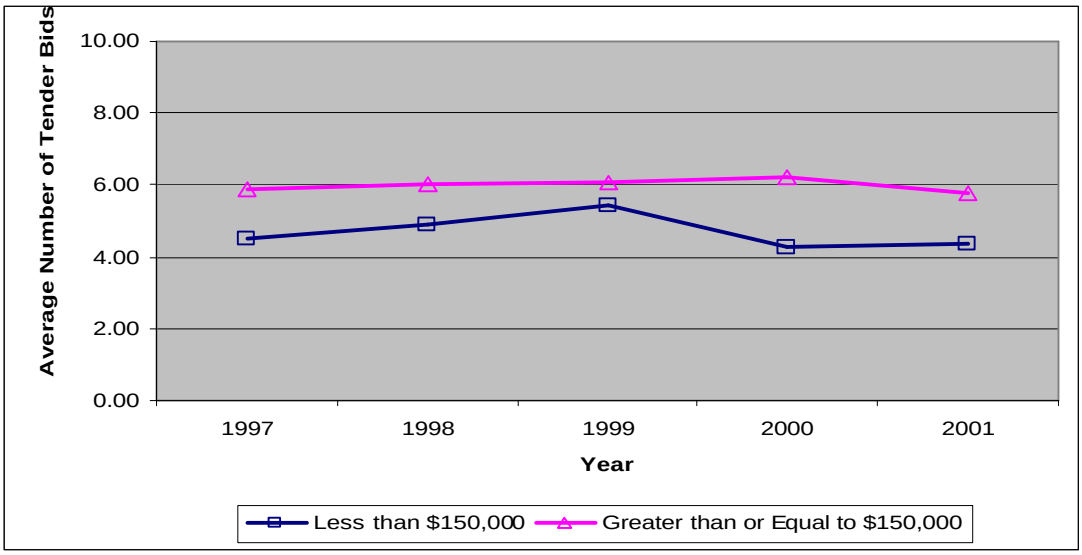
The approach adopted for this investigation is to examine variations in the number of tender bids for non-residential government construction contracts around the time of the implementation of each policy [10]. In the case of Priority Access policy, the analysis period is August 1997 to August 2001, which encompasses the 24 months prior to and the 24 months after the implementation date of the policy. In the case of the Building Skills policy, the 48 month analysis period is October 2000 to October 2004.

The analysis focuses on differences in bid activity between the 'market' segments affected and unaffected by the policy. In the case of the Priority Access Policy this involves a comparison of changes in bid activity across the analysis period between a) projects with a pre-tender value of at least $150,000 (and thus potentially affected by the policy); and b) projects with a pre-tender value of less than $150,000 (not affected by the policy). In the case of the Building Skills Policy the two comparison groups are a) projects with a pre-tender value of more than $2million; and b) projects with a pre-tender value of $2 million or less. In each case we hypothesise that if the policies were affecting bid activity, activity levels would fall in relative terms in the market segment affected by the policy. Furthermore, this fall would be observed in the analysis period.

The following chart shows bid activity in the two market segments associated with the Priority Access policy over the analysis period. This data is clearly not supportive of the above hypothesis. In fact an opposite pattern is apparent: the average number of bids declined for contracts *not* subject to the Priority Access policy over the analysis period, whilst there was negligible change in the average number of bids for tenders subject to the policy.

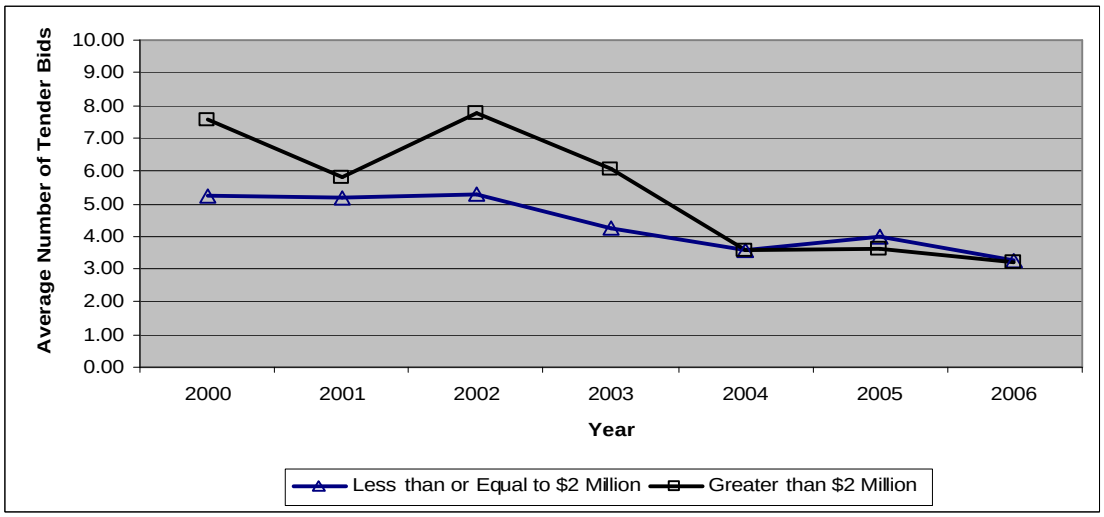
[10] This approach to restricting the time period allows us to focus more fully on the effects of the policy whilst allowing for the possibility of anticipatory or delayed effects

Figure 6: Average Number of Tender Bids for Contracts with a Pre -tender value < $150,000 and Tenders with a Pre -tender value • $150,000 by Year, 1997 to 2001



The following chart provides information on changes in the average number of bids for contracts affected/not affected by the Building Skills policy between 2000 and 200 4. At face value this data is more supportive of a h ypothesis that the policy affected bid activity: the average number of bids for contracts subject to the policy fell at a greater rate than those not subject to the policy over the analysis period. There is also an apparent alignment between the introducti on of the policy and this relative change. However, given the strength of the other influences on the construction market (as described in the previous section), there is a need for caution before reaching firm conclusions about the effects of the policy. The following section provides more definitive insights.

Figure 7: Average Number of Tender Bids for Tenders with a Pre -tender value • $2m and Tenders with a Pre -tender value > $2m by Year, 2000 to 200 6.



3.1 Econometric Strategy

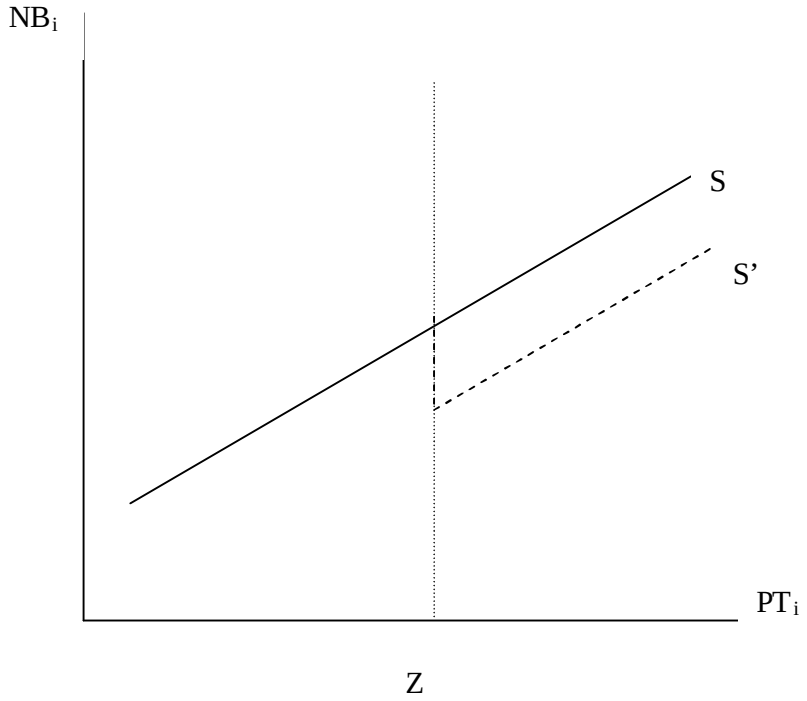
The multi-factor analysis of the relationship between bid activity and policy settings is structured into two parts, each relating to the key policy initiatives: Priority Access and Building Skills. In each part, however, the same approach is taken to the measurement of the effects of the policy. Specifically, linear (OLS) regression techniques are used to estimate the following equation, which relates to the determination of the number of bids for public construction contracts.

$$NB_i = \bullet_1 + \bullet_2 PD_i + \bullet_3 Z_i + \bullet_4 PT_i + \bullet_5 RN_i + \bullet_6 OF_i + \bullet_2 (Z_i \times PD_i) + \bullet_i \qquad (1)$$

NB_i, is the number of bids submitted on contract *i*; PD_i is a dummy variable that is based on the date of implementation of the policy (for example, in the case of Priority Access this variable takes on a value of 1 for all contracts dated after August 1999); Z_i is a dummy variable that identifies whether the contract falls within the scope of the policy's application (in the case of Priority Access this variable is coded as '1' for all contracts with a value of $150,000 or more); PT_i is a continuous measure that relates to the contract's pre-tender value; RN_i is a dummy variable that identifies whether the location of the project was in the Perth, South-West or Peel Regions, or in another, more remote region. OF_i is a continuous variable based on the value of the Building Cost index in the month that the bids were recorded. It is used in this model to proxy the level of competition in the construction market [11]. Finally, the interaction term (Z_i*PD_i) identifies those projects that were affected by the implementation of the policy (for example, in the case of Priority Access this variable will only take on a value of 1 for contracts with a pre-tender value of $150,000 or more and dated after August 1999). $\bullet_i$ is a random error term, which is assumed to be normally distributed with $E(\bullet_i)=0$ and the var $(\bullet_i)= \bullet^2$.

The modelled relationship can be described in the following simplified terms. First, the function S, shown in the diagram below, represents the positive relationship between the pre-tender value of the contract and the number of bids.

[11] As noted in the previous section, this index reflects current costs of accomplishing the types of construction projects contracted for via the TRS. A variety of measures of market conditions (such as indexes of labour availability, materials costs, etc) are available. However, testing indicated that these are strongly correlated with the Building Cost Index.



The other factors in the model are hypothesised to be associated with shifts in this function. For example, in more remote regions the function S could be expected to shift downwards (implying a positive coefficient on the variable RN_i in equation 1) due to the greater difficulties in accomplishing construction work in these areas as compared to less remote regions. The background statistics shown in earlier parts of this paper support this hypothesis. Higher building costs are likely to be associated with a downward/rightward shift in the function (implying a negative value on the coefficient on OF_i). If the introduction of a training policy has a negative effect on bid activity, its application only to projects with a $PT_i \bullet Z_i$ would cause a discontinuity in S around point Z_i (as represented by the function S'). Evidence in support of this hypothesis would be a significant negative coefficient on the interactive term (Z_i*PD_i). The individual term PD_i controls for the possibility (seemingly remote) that there was a change in bid activity for all contracts around the time of the introduction of the policy. The individual term Z_i controls for the possibility (more likely) that there are underlying differences in the relationship between tender activity and pre-tender prices in the group of contracts 'priced' above and below the trigger value of the policy.

4. Results

The estimated relationships between tender bid numbers and the various explanatory variables included in the RHS of equation 1 using DHW data are outlined in this section. Reflecting the above discussion, these results are presented separately for the Priority Access and Building Skills policies.

Priority Access Policy

Equation 1 was first estimated with reference to data on bid numbers on DHW contracts for the period August 1997 to August 2001. In this case Z_i is defined by the introduction

of the Priority Access Policy in August 1999 and PD_i is defined by the policy's application to projects with a value of $150,000 or more.

The results of this analysis are presented in Table 2 below.

Table 2: Estimated Coefficients for Equation on Bid Numbers on Government Non-Residential Construction Contracts (*Priority Access Policy*), Western Australia 1997-2001.

Variable	Coefficient	Prob.
Constant	-4.2950	0.6142
Policy Implementation Date (PD)	-0.4990	0.3528
Contract above trigger value (Z)	0.9299	0.0007
Pre-Tender Value (PT)	-1.29E-07	0.0033
Region	1.4243	0.0000
Building Cost Index	0.0720	0.3394
PD*Z	0.0216	0.9612

Notes: Log-Likelihood: 1957.8; Nobs: 789; Method: OLS

The data in Table 2 indicate that the implementation of the Priority Access Policy in August 1999 *did not* have a significant effect on competition for government non-residential construction contracts in WA. The reduction in bid numbers observed around the time of the implementation of this policy was similar in 'market segments' subject to the influence of the policy (i.e. contracts with a value of $150,000 or more) and in other parts of the 'market'. The figures in Table 2 show, rather, that during the analysis period (August 1997 to August 2001) bid numbers varied between contracts firstly due to regional factors. The average number of bids on contracts in more remote regions was 1.42 bids less than the number of bids on contracts in the Perth, South West and Peel group of regions. Bid numbers in the analysis period were also significantly affected by the value of the contract. Contracts with a value of $150,000 or more had, on average, close to 1 additional bid per contract than those with a lower pre-tender value. A somewhat surprising result is the lack of a statistical significant relationship between the building cost index and bid numbers. The most likely explanation for this is that, as was outlined in previous sections, the period 1997 to 2001 was a period of relatively stable economic conditions. There was little variation in the building cost index over the analysis period and, thus, this was not an important source of differences in bid activity.

Building Skills Policy

The results derived from the application of Equation 1 to TRS data relevant to the Building Skills Policy are presented in Table 3. In this case the analysis period spans October 2000 to October 2004; Z_i is defined by the introduction of the Building Skills Policy in October 2002; and PD_i is defined by the policy's application to projects with a value above $2 million.

The results of this analysis are presented in Table 3 below.

Table 3: Estimated Coefficients for Equation on Bid Numbers on Government Non - Residential Construction Contracts (Building Skills Policy), Western Australia 2000-2004.

Variable	Coefficient	Prob.
Constant	9.3524	0.0000
Policy Implementation Date (PD)	-0.4719	0.0516
Contract above trigger value (Z)	1.4512	0.1009
Pre-Tender Value (PT)	1.39E-07	0.0008
Region	1.2794	0.0000
Building Cost Index	-0.0436	0.0004
PD*Z	-1.4152	0.0986

Notes: Log-Likelihood: 1873.5; Nobs: 807; Method: OLS

The data in Table 3 provide some evidence of a negative impact of the Building Skills Policy on bid activity relating to government non-residential construction contracts in WA. Bid numbers on contracts affected by the policy (i.e. above $2 million in value and commencing after October 2002) were, on average, 1.42 bids lower than contracts not affected by the policy after 2002. However, this effect was only statistically significant at the 10% level.

A further contrast between the results in Table 3 and those in Table 2 is the significance of building costs as a source of variation in bid numbers. The figures in Table 3 indicate a strong negative relationship between the building cost index and bid numbers. The difference between the results in Table 2 and 3 is likely to derive from the relatively large rate of change in the building cost index between 2000 and 2004, as compared to 1997-2001.

A similarity between the two sets of results is the measured importance of regional factors as a source of variation in bid numbers. In Table 3 the average number of bids on contracts in more remote regions was 1.27 bids less than the number of bids on contracts in the Perth, South West and Peel region. Finally, bid numbers in the analysis period relevant to the Building Skills Policy were positively affected by the value of the contract.

5. Discussion & Conclusion

This paper has identified that the Building Skills Policy, but not the Priority Access Policy, affected bid activity for non-residential construction contracts in WA. Bid numbers were lower on contracts affected by the Building Skills Policy following the implementation of the policy in October 2002. This effect was distinct from the influence of changes in construction costs and regional and project size factors on bid numbers.

These results are significant for two key reasons. First, they indicate that the Building Skills Policy contributed to a lowering of competition for public construction contracts in the 48 month period surrounding its implementation. Such an impact has efficiency consequences for the public construction program, potentially contributing to higher costs and/or lower quality outcomes. Given that WA is currently under the influence of a range of economic pressures, these added costs are of particular concern.

However, this conclusion does not necessarily imply that the Priority Access Policy was a superior training policy. It is important to ask why the Priority Access Policy *did not*

affect the willingness of construction companies to bid for public projects. One possible answer is that it did not impose high training requirements – or affect the training actions of construction firms in a significant manner. If this is the case, the evidence presented in this paper can not be interpreted as supportive of the policy .

In sum, the results in this paper indicate that the Building Skills Policy affected the actions of construction companies, causing some to avoid tendering for public construction contracts. This result also suggests, however, that the policy was effect ive in influencing the inclusion/exclusion of public contractors according to their training commitments. There is little evidence that the Priority Access Policy affected bid activity in the public construction 'market'. Although this may be interpreted i n the positive light – that is, of the policy not having negative competitive effects - it is also possible that the policy did not affect training outcomes on public works.

The two policies had similar objectives: to promote training and, thus, the avail ability of skills in the construction industry in WA. The fact that this paper has identified differences in the behavioural effects of the two policies raises additional research questions about their design. For example, were there features of the design and implementation of the Priority Access Policy that caused it to have very little impact? What can policy makers interested in promoting training learn from a comparison of the two policies that will inform future policy development? Future papers will address these important questions.

References

Australian Bureau of Statistics (ABS) 2006 a. *Average Weekly Earnings by Industry Division (Construction) and Areas of WA, Total Employee Earnings* , Original Persons Data, February 1996 - November 2006, Cat. No. 9941.0.

ABS 2006b. *Producer Price Indexes, Australia, Table 48. Materials used in Building other Than House Building Special Series* , Index Numbers – Perth. Cat. No. 6427.0

Department of Employment and Workp lace Relations (DEWR) *Vacancy Report* n.d., Retrieved April, 20, 2007, from http://www.workplace.gov.au/workplace/Publications/ResearchStats/LabourMarketAnalysis/VacancyReports/

Department of Housing and Works . *Works and Building Construction Building Cost Index* – Perth, File BB 576/87

Domberger, S. & Jensen, P. 1997. 'Contracting out by the Public Sector: Theory, Evidence, Prospects', *Oxford Review of Economic Policy* , Vol. 13, No. 4, pp. 67 -78.

Jensen, P. & Stonecash, R. 2004. 'The Efficiency of Public Sector Outsourcing Contracts: A Literature Review', Melbourne Institute Working Paper No. 29/04, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.