Enterprise Bargaining and Productivity: Evidence from the Business Longitudinal Survey*

Yi-Ping Tseng and Mark Wooden
Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

Abstract

The 1990s has seen bargaining, and more specifically, enterprising bargaining supplant arbitration as the dominant industrial relations paradigm. In large part, this change reflects widespread belief that enterprise bargaining would stimulate greater levels of productivity. Evidence in support of this link between enterprise bargaining and productivity, however, is both scant and unconvincing. In this paper the relationship between enterprise bargaining and productivity is revisited using data from the Business Longitudinal Study. This data source is unique in that it provides firm-level data for Australia where the individual firms are tracked over a four-year period. Further, the survey period commenced in 1994-95, which is ideal for studying the impacts of the emerging growth in enterprise agreement coverage. Finally, the BLS data provide an objective measure of value added output.

Estimation of a simple production function using a random effects model revealed evidence of a strong contemporaneous relationship between registered enterprise agreements and productivity. Indeed, firms where all employees are on such agreements are estimated to have productivity levels that are 8.8 per cent higher than comparable firms but where no employees are covered by an enterprise agreement and are forced instead to rely on conditions specified in an industry award. However, despite this finding, it still proved impossible to establish a direct causal relationship between the introduction of enterprise agreements and subsequent productivity growth.

1   Introduction

It is well recognised that the institutional arrangements that regulate employment relationships in Australian workplaces changed markedly during the 1990s. As described in Hawke and Wooden (1998, p. 74):

> The tribunal-based systems of conciliation and arbitration that have shaped labour-management relationships since the turn of the century now play a less pivotal role, and the systems of awards that continue to be administered by the various tribunals are less central to the determination of wages and conditions.

Whereas prior to the late-1980s the wages and conditions of most Australian employees were heavily dependent on centrally arbitrated awards, by the end of the century the wages and conditions that applied to employees were much more likely to be specified in agreements negotiated at either an enterprise, workplace or individual level. Indeed, a recent Federal Government survey of award and agreement coverage (reported on in the Joint Governments' Submission 2000, Table 5.4, p. 5-14) put coverage of employees by registered collective agreements at 42 per cent and by overawards and unregistered agreements at 22 per cent. With a further 14 per cent covered by registered individual agreements or common law contracts, this leaves only 22 per cent of Australian employees as reliant on arbitrated awards as the main mechanism for obtaining variations in their wages and conditions.[1] Bargaining, and more specifically, enterprising bargaining has thus supplanted arbitration as the dominant industrial relations paradigm.

One of the interesting features of this change is that all major parties including employer groups, the union movement and governments, at both the Federal and State levels, eventually came to endorse the enterprise bargaining concept. As Dabscheck (1995, p. 80) observed, following the March 1987 national wage case, with only a few exceptions, the major parties embarked on "a headlong rush to embrace enterprise bargaining". To repeat the much often cited remark made by

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[1] The survey distinguished four types of payment categories. First, employees paid exactly the award rate (the 22 per cent described here as 'reliant' on awards). Second, employees paid overaward rates or by pay rates specified in unregistered agreements. The latter includes persons paid by unregistered individual agreements if, in the absence of that agreement, the relevant award would apply. Third, employees covered by registered collective agreements. Finally, employees paid by other arrangements, which includes persons covered by registered

Bill Kelty in 1990, then Secretary of the Australian Council of Trade Unions (ACTU): "The issue … is not whether or not there will be enterprise bargaining but what sort of enterprise bargaining."[2]

The main reason for this consensus appears to have been the widely held view that workplace and enterprise bargaining would stimulate greater levels of productivity. For example, in 1992 the then Commonwealth Minister for Industrial Relations, Mr. Peter Cook, in justifying the emphasis on enterprise agreements in legislative amendments being introduced into federal parliament, stated that "the key aim of the new agreements provision is to facilitate workplace agreements that boost productivity and improve the living standards of workers". Bill Kelty expressed similar views in a speech delivered at the 1991 ACTU Congress, when he described enterprise bargaining in the following terms:

> The new wage bargaining strategy is a strategy designed to create more interesting and financially rewarding jobs, by stimulating greater worker involvement in all aspects of the way their industry and workplace operates, thereby driving enterprise reform and pushing up productivity levels. (Bill Kelty quoted in Evatt Foundation 1995, p. 73)

The Business Council of Australia in its influential report of the late 1980s advocating the need for an enterprise-based system even went so far as to nominate the size of the productivity improvement that a shift to an enterprise approach might yield – 25 per cent (BCA Industrial Relations Study Commission 1989, p. 8).

Perhaps most importantly, those persons with most responsibility for implementing enterprise agreements – workplace managers – appear to share these views about the supposed productivity benefits from enterprise bargaining. As discussed in Wooden (2000, pp. 47-48), survey-based evidence collected as part of both the 1995 Australian Workplace Industrial Relations Survey (AWIRS) and a smaller survey of workplaces conducted in 1998 indicate that, in the majority of cases, collective agreements had been introduced in the expectation they would result in improved work performance. For example, according to the AWIRS data, over half of those workplaces with collective agreements in 1995 had introduced them in the expectation of

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individual agreements and persons on individual arrangements who are outside the award system. Note the survey coverage was restricted to workplaces with at least five employees.

[2] Quoted in *Australian Financial Review*, 14 February 1990, p. 1.

increased productivity and efficiency. Relatively sizeable proportions also highlighted other performance-related benefits such as improved product or service quality, reduced costs, and improvements in reliability, wastage and downtime. In total, 62 per cent of responding managers at workplace with collective agreements claimed that at least one of the reasons for the presence of such agreements was that they were expected to assist work performance.

Despite this apparent consensus, evidence in support of this link between enterprise bargaining and productivity is not convincing. Indeed, it has been argued that the much promised productivity gains from enterprise bargaining have proved extremely elusive (e.g., Campbell & Brosnan 1999). One of the principal reasons for this, however, has simply been the absence of appropriate data with which to test this hypothesis. Ideally, establishing persuasive evidence of either the existence or absence of a causal relationship between enterprise agreements and productivity requires data that tracks the output performance of firms or workplaces over time. While data of this type are available in the panel component of the AWIRS, the performance measures are extremely crude, being based largely on subjective data provided by management. Perhaps more importantly, enterprise agreements were still in their infancy during the period covered by these data – 1989 to 1995.

In this paper the relationship between enterprise bargaining and productivity is revisited using data from the Business Longitudinal Study (BLS). This data source is unique in that it provides firm-level data for Australia where the individual firms are tracked over a four-year period. Further, the survey period commenced in 1994-95, which is ideal for studying the impacts of the emerging growth in enterprise agreement coverage. Finally, the BLS data provide an objective measure of value added output – essentially sales less expenses – which is comparable across firms operating in a broad spectrum of industries.

Before proceeding to the analysis of these data we provide a brief discussion of the theoretical underpinnings for expecting a positive relationship between enterprise bargaining productivity and a short summary of existing evidence. A description of the BLS data then follows. We then turn to the focus of the paper – the estimation of a simple model of firm output that incorporates measures of the significance of bargaining. The results confirm the presence of a positive relationship between productivity levels and the presence of registered enterprise agreements.

However, it proved impossible to establish a direct causal relationship between the introduction of such agreements and subsequent productivity growth.

2 The Productivity Rationale for Enterprise Bargaining

Following Dowrick (1993), there are at least two avenues through which a shift away from centralised determination of wages and conditions towards enterprise bargaining might facilitate higher productivity. In the first line of reasoning firms are assumed to be not operating as efficiently as they might be and that enterprise bargaining can help firms move closer to best practice by enhancing the incentives to introduce more efficient work and management practices. For example, where wage determination is relatively centralised, with rates of wage increase bearing little or no resemblance to the performance of either the firm or the individual, there is little incentive for workers to cooperate in the removal of inefficient work practices. In contrast, enterprise-based bargaining provides an opportunity for employers to trade-off wage increases for changes in work practices, thereby potentially leaving both individual workers and the firm better off. In this view, enterprise bargaining is largely about negotiating the removal of inefficient work and management practices. Efficiency gains from this process will thus be reaped once only. Productivity will be enhanced in the short run, but once these inefficiencies have been removed, no further productivity growth from this source will be possible.

In contrast, the second avenue raises the possibility that enterprise bargaining may have a sustained impact on productivity by affecting the long-run rate of productivity growth. This might arise if enterprise bargaining is able to promote more cooperative relations in the workplace, thereby potentially encouraging innovation, facilitating greater acceptance of new technology and promoting the development of worker skills, and thus enabling a shift outwards in the production function. Buchele and Christiansen (1999, p. 326), for example, have argued "… that all of the basic determinants of productivity growth … depend crucially on the cooperation and effective participation of workers". Such cooperation and participation, however, will only be forthcoming where employment relationships are characterised by trust and where workers feel they have "a secure stake in the long-run success of their employer" (Buchele & Christiansen 1999, p. 326).

Buchele and Christiansen (1999), however, go on to argue that trust is fostered by worker rights, which they equate with strong labour market institutions such as highly coordinated sectoral bargaining and wage settlements that automatically extend to the non-union sector. That is, they claim that encouraging cooperative and productive relationships within workplaces requires strong external institutions regulating the employment relationship within the firm. Such arguments are highly contentious.[3] As already noted, if wages and conditions are determined on a national and sectoral basis, the incentives for productivity-enhancing cooperative behaviour between workers and employers are surely weakened, not enhanced. Trusting, cooperative relationships can undoubtedly be assisted by regulations and institutions that enhance and protect worker rights, but those regulations must be firm and/or workplace-based. It is well recognised, for example, that trade unions have the potential to enhance productivity through the 'voice effects' they provide (Freeman & Medoff 1984). Moreover, trade unions provide a degree of countervailing power effectively underwriting worker cooperation with management. However, and as argued in Drago, Wooden and Sloan (1992), the effectiveness of these union voice effects can be expected to vary with a number of contextual variables, one of which being the level at which bargaining takes place. Specifically, voice effects can be expected to be far stronger where unions negotiate directly with management on a workplace or enterprise basis. Such conclusions sit well with the conclusions drawn by Freeman and Medoff in their seminal work, *What Do Unions Do?* In their view: "Unionism is neither a plus nor a minus to productivity. What matters is how unions and management interact at the workplace" (Freeman & Medoff 1984, p. 179).

What the arguments of Buchele and Christiansen do alert us to is that the productivity impacts of bargaining structure depend crucially on how they influence worker behaviour. Structures that foster competitive, rivalrous behaviour among workers within workplaces may impede productivity growth, a view that has long received support in the organisational behaviour literature (e.g., Johnson et al. 1981). The recent emphasis on individual agreements thus may

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[3] Buchele and Christiansen (1999) report the results of estimating simple regression models of inter-country differences in productivity growth that they claim support their hypothesis. Their analysis, however, is far from convincing. First, the data set employed contained a grand total of 18 observations, raising concerns about the statistical properties of their estimates (none of the usual diagnostics are reported). Second, the analysis does not control for differences across countries in other determinants of productivity growth. Most critical here are differences in the absolute level of productivity. This is vital given rates of productivity growth will vary with the scope for technological catch-up (see Dowrick 1993). Third, the estimated coefficient on the collective bargaining variable declines to insignificance (and in one case, changes sign) once a measure of employment protection is included.

well be counter-productive, though it is certainly true that this does not appear to be a view shared by managers at those Australian workplaces where such agreements exist (see Wooden 2000, pp. 86-87). Similarly, if enterprise bargaining leads to an enhancement in managerial prerogatives at the expense of consultative modes of practice, then this can be expected to foster a climate of resentment and distrust among workers.

3 Existing Evidence

3.1 Evidence from Aggregate Data

As observed by Wooden (2000, p. 153), if enterprise bargaining has worked to enhance productivity, then the period following the introduction of the Enterprise Bargaining Principle by the Australian Industrial Relations Commission (AIRC), in late 1991, should have been accompanied by a rise in observed productivity. The aggregate data are entirely consistent with this hypothesis. Wooden (2000), for example, draws attention to a Productivity Commission paper (Parham 1999) which uses national accounts data to plot, over time, an index of labour productivity (output per hour) against the capital-labour ratio. The data are reproduced in Figure 1 for the period 1964-65 to 1998-99 and reveal that a distinct upward movement in Australia's productivity growth path took place during the 1990s.

Note that the data reported here are based on Australian Bureau of Statistics (ABS) estimates that were extensively revised and published in 2000. In particular, major changes were made to the method by which capital inputs are derived.[4] The consequence of these revisions is that the extent of the productivity improvement in the 1990s is not as marked as reported in Parham (1999) or Wooden (2000). Nevertheless the shift is still sizeable.

Note further that the productivity surge only becomes noticeable from about 1994-95 on. This too is entirely consistent with the possibility that enterprise bargaining is partly responsible for the improvement. Data compiled by the Department of Employment, Workplace Relations and Small Business, for example, indicate that the number of agreements registered within the federal system was negligible until the last quarter of 1992. Thereafter coverage of employees by

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[4] These changes are outlined in detail in the 1997-98 issue of *Australian System of National Accounts* (ABS cat. no. 5204.0), ABS, Canberra.

agreements gradually accelerated (see Wooden 2000, Figure 2.1, p. 8), though it was probably not until late 1994 or early 1995 that such agreements applied to a majority of eligible employees (that is, those workers covered by federal awards).

Figure 1: Productivity Growth (in the market sector), 1964/65-1998/99
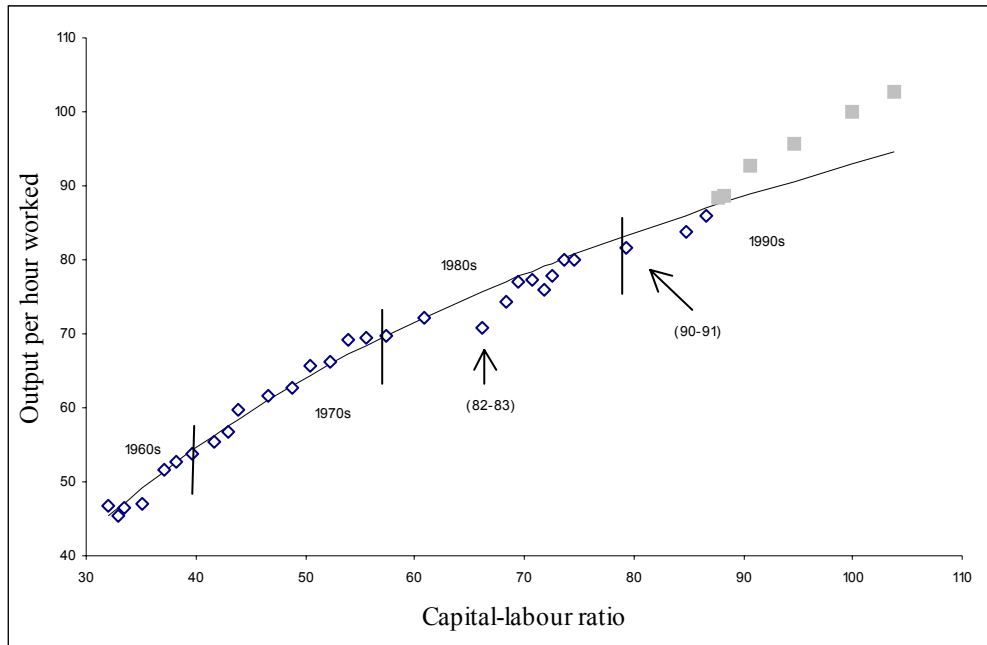
Note: As defined by the ABS, the market sector only covers those sectors in which output can be meaningfully measured. Industries not covered by this definition are: Property and business services; Government administration and defence; Education; Health and community services; and Personal and other services.

Source: ABS, *Australian System of National Accounts, 1998-99* (cat. no. 5204.0), Table 1.17, p. 28.

In part, this slow uptake simply reflects both the lags involved in parties becoming aware of the possibilities that the new agreements offered, and the time and effort required to negotiate such agreements. It may also have been due to an initial unwillingness of the AIRC to certify agreements. While the concept of enterprise bargaining had been officially endorsed by the AIRC in 1991, at that time the AIRC was, at best, a reluctant supporter of enterprise bargaining. Indeed, the AIRC had previously rejected the demands by the Accord partners for wage increases based on enterprise bargaining in its April 1991 National Wage decision. The Federal

Government, with the support of the ACTU, thus took steps to introduce legislation that would have the effect of severely limiting the ability of the Commission to use its discretion to refuse to register agreements (e.g., because they were contrary to the public interest). The outcome of this process was the *Industrial Relations Reform Act* 1993, the provisions of which came into force in March 1994. Discussed in greater detail in McCallum (1994) and Stewart (1994), the changes affected by this legislation have been described by some labour law academics as the most significant since the introduction of the conciliation and arbitration system in 1904 (e.g., Creighton & Stewart 2000, pp. 45-46). In particular, under this new Act awards would function very much in a subservient way to agreements. Moreover, the requirements for the AIRC failing to endorse an agreement were made much more stringent. Indeed, as Stewart (1994, p. 158) observed:

> Provided an agreement involves at least one union, is confined to a single business and does not reduce the employment conditions of the workers affected, the Commission has virtually no way of preventing that agreement taking effect, no matter how much it might believe the agreement to be contrary to the public interest.

The other main reason for not expecting any immediate impact on productivity is simply the time lags involved. Indeed, if the productivity benefits from enterprise bargaining arise mainly through changes in work climate rather than the removal of inefficient management and work practices, then it would be expected that the lag between the introduction of bargaining and any subsequent productivity improvement would be considerable.

Of course, the evidence presented in Figure 1, while suggestive of an association between enterprise bargaining and productivity is hardly conclusive. As Wooden (2000) readily acknowledges, other explanations for the rise in productivity cannot be discounted. He points in particular to other microeconomic reforms underway during this period, especially those affecting the way many public services are delivered. Wooden, however, is also quick to point out that some of the other usual suspects, such as trade liberalisation, rising skill levels and new technology, can probably be ruled out. The process of trade liberalisation, for example, has been very gradual dating back to at least the 1970s; there is certainly nothing peculiar about the reform process in the 1990s. A similar line of reasoning can be applied to the role of rising levels of workforce skills. While higher skills undoubtedly contribute to economic growth, this is not a

new trend. The education level of the workforce, for example has been rising since at least the 1970s, and hence it is difficult to see how changes in the quality of labour could account for more than a small proportion of the recent rise in productivity growth. Very differently, if the explanation lay in more rapid rates of adoption of new technology then it follows that we would have seen similar upsurges in productivity growth elsewhere in the world. As Parham (1999), however, demonstrates, the shift in the productivity growth path appears to be peculiar to Australia.[5]

Somewhat differently, perhaps the acceleration in productivity growth reflects some lagged response to increased levels of innovation? Here the evidence appears to be more persuasive. Not only is there evidence of a rising relationship between productivity growth and the intensity of research and development expenditure (R&D) in cross-country data (Bassanini, Scarpetta & Visco 2000, pp. 26-29), but a marked increase in business expenditure on R&D did occur in Australia during the late 1980s and mid-1990s which, given the long lags between innovation and productivity, is consistent with a productivity pick-up beginning around 1994.

Finally, it might be argued that the recent rise reflects nothing more than the usual cyclical movements in productivity. The problem for this explanation, however, is that the response appears to be more sustained than we might expect if it were solely a response to business cycle variations. Further, it is again instructive that the recent pick-up in productivity growth is not a feature Australia shares with many other developed economies, even though all industrial economies went through the same recessionary episode in the early 1990s

3.2   Evidence from Micro Data

While the marked rise in aggregate productivity growth during the 1990s is consistent with the hypothesis that expansion in the coverage of enterprise bargaining may be partly responsible, such evidence is largely circumstantial; it certainly does not establish causation. Far more revealing would be evidence collected at the workplace and firm level, and here the evidence is far less supportive. It has, for example, been claimed that most enterprise agreements do not contain provisions that will have a significant enhancing effect on productivity (e.g., Wailes &

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[5] Dowrick (forthcoming) identifies only Ireland and Norway as experiencing similarly large shifts in productivity performance.

Lansbury 1997, pp. 24-27; Sheridan & Provis 1998). However, what is well established is that enterprise agreements have facilitated the reorganisation of working hours at a large number of workplaces. ACIRRT (1999, p. 44), for example, reported that in a sample of 4700 agreements, 79 per cent dealt with changes in working time arrangements. The changes involved were extremely varied, but included increases in the span of what constitute normal hours, averaging working hours over some period longer than the standard work week, absorbing penalty payments for work on weekends and at other so-called 'unsociable' times into annualised wages, and increasing the flexibility with which working hours arrangements can be varied. All of these changes should have the effect of improving the match between labour inputs and product demand, thus reducing the incidence of low productivity hours.

Of course, as Rimmer and Watts (1994) have observed, the presence of provisions in agreements does not guarantee their effective implementation. Even more importantly, it would be erroneous to assume that if an agreement makes no specific reference to some productivity-enhancing measure it cannot have any effects on productivity. Indeed, if the key to productivity growth is fostering a more cooperative, trusting work environment, then it will be the process by which agreements are reached and implemented, rather than their actual content, that will be most critical for productivity.

Ultimately, what are needed are data on the productivity growth performance of large numbers of Australian enterprises (or workplaces) which can then be analysed with a view to quantifying associations with enterprise bargaining coverage and uptake. To date, the only data of this type that have been subjected to any degree of scrutiny come from the 1995 AWIRS, which arguably was conducted too soon to detect any strong relationships. Further problems are presented by the nature of the productivity data available in these data – crude rankings, both relative to other firms and previous years, based on manager perceptions. It is thus perhaps not surprising that researchers have generally not been able to detect significant relationships between productivity measures and agreement coverage in these data (Hawke & Drago 1998b, Loundes 1999, Saleheen & McCalman 2000, Wooden 2000).[6] But will more timely data lead to different conclusions? Seeking the answer to this question is the objective of the study reported on here.

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[6] After splitting the sample according to productivity level, Wooden (2000, pp. 174-175) reported some evidence of a positive association between agreement coverage and productivity growth among the lowest productivity

4   The Business Longitudinal Survey

4.1   Survey Design and Data Collection Methods

At the centre of this research are data from the Business Longitudinal Survey (BLS). Described in more detail in ABS (1999, pp. 38-41), Hawke (2000) and McCann and Tozer (undated), the BLS involved a series of self-completion questionnaires administered to 'management units' over a four-year period beginning with 1994-95.[7] According to the ABS (1999, p. 38): "The surveys were designed to provide estimates on the growth and performance of Australian employing businesses and to identify selected economic and structural characteristics of these businesses." It also needs to be noted that the survey was designed with a focus on small and medium size firms. Thus while large firms are included, the relative standards errors for population estimates for large businesses are typically much larger than that for smaller businesses.

4.1.1   Statistical Unit

The statistical unit for the survey is referred to by the ABS as the 'management unit'. This is the "highest level accounting unit within a business … for which detailed accounts are maintained" (ABS 1999, p. 38). In most cases this unit will be the legal entity owning the business. In the case of large diversified businesses, however, there may be more than one management unit, typically coinciding with different business divisions.

4.1.2   Survey Design and Scope

The ABS Business Register was used as the population frame, with a random sample of approximately 13,000 business units selected for inclusion in the first year of the survey. The sample was stratified by industry and firm size. The sample was selected with the aim of being representative of all non-Government employing businesses with the exception of businesses units operating in the following industries:

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workplaces. Wooden also highlighted the possibility that part of the productivity effect from enterprise bargaining might be captured in variables representing the incidence of major organisational change in the previous two years.

[7] Participants actually knew the survey as the Business Growth and Performance Survey, the name given to each annual wave of the survey.

- Agriculture, forestry and fishing (ANZSIC division A);

- Electricity, gas, and water (ANZSIC division D);

- Communication services (ANZSIC division J);

- Government administration and defence (ANZSIC division M);

- Education (ANZSIC division N);

- Health and community services (ANZSIC division O);

- Other services (ANZSIC subdivision 96);

- Private households employing staff (ANZSIC subdivision 97);

- Libraries, Museums and Parks and gardens (ANZSIC groups 921, 922 and 923).

According to data provided in McCann and Tozer (undated), the businesses within the scope of the BLS accounted for just over three quarters of employment in the non-agricultural private sector in 1996-97 and just under 60 per cent of all employment in Australia.

4.1.3   Sample Size

Since the Business Register is unable to keep pace with the constant turnover in businesses, it was fully expected that many of the selected businesses would no longer exist. Unpublished estimates indicate that just over 10,500 of the initial selections were existing businesses.[8] Of these, completed forms were received from 8868 business units, providing an initial response rate of 84 per cent.[9] Some of these respondents, however, were found to be out of scope, leaving a total effective sample size of 8745 cases.

In subsequent years, the decision was taken to follow only a sub-sample – about 5600 – of all businesses responding in the first year. This decision was undertaken partly for cost reasons and partly to reduce respondent burden (DEWRSB 1998, p. 12). Further, the sub-sample selected for the second year was not entirely random. Specifically, all businesses that indicated that they had been innovative in 1994/95, had exported goods or services in 1994/95, or had indicated that they had increased employment by at least 10 per cent or sales by 25 per cent between 1993/94

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[8] Information provided by John Purcell, Australian Bureau of Statistics, Canberra.
[9] Hawke (2000) reports a response rate of 95% claiming that the contacted sample numbered 8745 and the number of respondents was 8287. Advice provided by the ABS indicates that this is incorrect and that there were in fact 8745 valid responses in the first year of the survey (though not all of these respondents completed all sections of the questionnaire).

and 1994/95 were included in the sample. A random selection was then made of all the remaining businesses. Finally, in order to maintain the cross-sectional representativeness of each wave, a sample of about 800 new businesses (i.e., businesses added to the Business Register since the previous collection) was drawn each year. In total, the target sample in later years numbered about 6400, with questionnaires returned from 5143 business units in 1995/96, 5175 in 1996/97 and 5198 in 1997/98 (thus providing response rates in the order of 80 per cent).

Users of the BLS data will be aware that the reported sample size in the various publications issued by the Office of Small Business are larger. In DEWRSB (2000), for example, the total sample sizes reported for each of the first three years were 8750, 5379, and 5621, respectively. The difference reflects the fact that information for non-respondents in years 2, 3 and 4 were imputed on the basis of their returns in previous years. We were extremely uncomfortable with using this imputed data and hence all fully imputed responses were excluded from the analysis reported on here.

4.1.4 Questionnaire Content

The coverage of the BLS is very broad. Moreover, the data items collected varied from year to year. Most of the items collected however fall into the following six categories.

(i)   Background characteristics of the business, such as location, type of activity (i.e., industry), years of operation, legal status, foreign ownership, and nature of business (sole proprietor, franchise, family business etc.).

(ii)   Employment and employment arrangements, including the number of employees and their composition, and the type of agreements and contracts under which workers are employed.

(iii)   Business operations, including the number of days a business operates, types of business practices, employee training, major changes in business operations, and business intentions for the next three 3 years.

(iv)   Participation in government programs, such as the R&D tax concession, export incentives and government employment programs.

(v)   Innovation, including a measure of whether any type of product or process innovation had been undertaken in the survey year and the value of expenditure on such innovations.

(vi)   Financial information, including business income, expenditure, profit or loss, assets and liabilities and equity finance

4.2   The Appeal of the BLS Data

Given the weaknesses in existing data collections, the BLS seemed an almost ideal vehicle for examining the relationship between enterprise bargaining and productivity growth. First, it was conducted over a period – 1994/1995 to 1997/1998 – when the coverage of enterprise agreements had been spreading quite rapidly. Second, it was established with the specific objective of measuring firm performance, and especially financial performance, and hence collected data on a raft of objective measures of both outputs and inputs of individual businesses. Third, while the emphasis was on the performance and growth of businesses, the BLS also collected data on coverage of employees under different types of contractual arrangements; specifically, registered enterprise (i.e., collective) agreements, unregistered enterprise agreements, individual contracts or agreements, and awards. Fourth, the BLS was a panel survey, meaning that the same enterprises were followed over time. This is undoubtedly the most attractive feature of the BLS, and potentially enables causal associations between the introduction and spread of enterprise agreements and business performance to be identified without the recall biases often associated with the collection of retrospective data. Finally, the BLS was conducted by ABS, arguably the only survey organisation in Australia that has the resources to deliver a representative sample of Australian businesses.[10] In particular, through its Business Register, the ABS possesses a population frame from which to draw a representative sample. Moreover, through the authority provided to it under the authority of the Census and Statistics Act 1905, the ABS has the power to compel cooperation. As a consequence, and as noted above, response rates for each wave of the BLS were reasonably high.

These attractive features of the BLS data thus provided the stimulus behind this paper. Nevertheless, there were at least three features of the BLS that detracted from its value. First,

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[10] While the ABS was responsible for the fieldwork, much of the survey development came from the funding agency, the Office of Small Business.

data on employee coverage by agreements were not collected in the first wave, only whether or not any such agreements were in place. Second, the time period covered by the panel is relatively short, rendering analysis of change in productivity quite difficult, if not impossible. Third, the emphasis of the BLS was on small business. As a consequence, medium and large-sized firms were under-enumerated in this survey compared with other ABS surveys. Indeed, concerns with confidentiality led the ABS to exclude large firms – defined by the ABS for the purposes of this survey as those with 200 or more employees – from the public-use micro-data file on which this analysis is based. This exclusion is potentially of large significance for this study given coverage by enterprise agreements is much more pronounced in both large establishments and large firms (see Wooden 2000, p. 57). Indeed, as reported in Appendix Table A2, the average level of employee coverage per firm by registered agreements for the three years 1996 to 1998 is, in the unweighted data set used in this study, just 6 per cent. This rises to 14 per cent when calculated as a proportion of all employees of the firms covered by our sample. By comparison, other surveys report coverage estimates ranging from 35 to 42 per cent.[11]

Thus from the outset it was recognised that the BLS data were not perfect. What we did not know when we set out on this exercise, however, was how far from perfect these data would eventually prove to be.

5   Method

5.1   Specification

The model employed here is an augmented Cobb-Douglas production function taking the form:

$$\ln Y_{it} = \alpha + \beta \ln K_{it} + \gamma \ln L_{it} + Z_{it}\phi + \varepsilon_{it} \tag{1}$$

where Y_{it} is real value added for firm i at time t, K and L are capital and labour respectively, Z is a set of firm-specific characteristics expected to be associated with productivity levels within the firm, and ε_{it} is a random error term. The term, Z, is intended to reflect firm-specific levels of

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[11] See Joint Governments Submission (2000, p. 95) and ABS (2001, p. 44). Strictly speaking, however, the ABS survey only produces estimates of the method by which people are paid, which does equate exactly with agreement coverage. Thus in the ABS survey a person who is covered by an enterprise agreement but is then paid a loading on top of the rate specified in the agreement will be classified to the category "unregistered agreement".

effort, cooperation and innovation, but following overseas research (e.g., Nickell, Wadhwani & Wall 1992; Gregg, Machin & Metcalf 1993), these effects typically have to be substituted out by including measures of other variables expected to influence them. Nickell et al. (1992), for example, in their study of productivity growth in a sample of UK firms, included measures of: (i) the degree of competition in product markets, on the assumption that competition stimulates the removal of inefficient work practices; (ii) firm financial structure, with more highly geared companies expected to be under more pressure to operate efficiently given the greater threat of bankruptcy; and (iii) the level of trade union membership, to capture union voice effects. To this list, of course, we would add the nature of the employment contract and in particular, the extent of coverage of employees by collective agreements.

5.1.1 Dependent Variable (ln Y)

The dependent variable is the log of value added deflated by the GDP price deflator, where value added is defined as sales less purchases plus the value of closing stocks minus opening stocks. The main attraction of this variable is that it enables output levels for firms from a diverse range of industries to be compared. Further, given this measure will reflect differences across firms in the price of output, it should also reflect variations not just in the quantity of output but in its quality. On the other hand, a major drawback with a prices-based measure is that it will be affected by differences across firms in market power.

5.1.2 Independent Variables: Labour and Capital

Capital is measured as the total book value of non-current assets plus imputed leasing capital. As reported in Rogers (1999), the importance of leasing capital relative to owned capital varies significantly with firm size and industry, suggesting that leasing capital should be included if we are to accurately approximate the total value of capital employed in the production process.

Non-current assets are defined as those assets expected to be on the books for longer than 12 months and include property and plant and machinery needed for normal operations, capitalised

interest, and an estimate of the value of goodwill and brand names. Following Rogers (1999), leasing capital is imputed from data on the estimated value of rent, leasing and hiring expenses.[12]

Note that using the book value of non-current assets will, in general, lead to the underestimation of the true value of capital due to the treatment of depreciation. As firms get older, the book value of capital is generally depreciated at a rate greater than the diminution in the true value of the services provided by the capital stock. This, however, can be controlled for, at least partly, through including in our specification a measure of the age of the business.

Labour input is measured as the number of full-time equivalent employees.[13] Since output is a flow measure while employment is measured at a single point in time – at the end of the survey period (the last pay period in June of each year) – we use the average numbers of full-time equivalent employees in year t and year t-1 for each firm as their labour input in year t.[14,15]

Ideally, the labour input should also be adjusted for labour quality. Unfortunately, no data on the composition of the workforce in terms of skill or education that might help us adjust for differences in labour quality were collected as part of the BLS. Such differences will thus be reflected in the error term. This, however, will only be problematic for this analysis if labour quality is correlated with variations in enterprise bargaining coverage, and there seems no obvious reason why this should be so. Indeed, statistical evidence based on AWIRS data and reported in Hawke and Drago (1998a) confirm that, with the exception of being less common in workplaces with high proportions of managers, the coverage of enterprise agreements does not vary significantly with the occupational composition of the workforce. Since the ratio of managerial to total employment is included as one of control variables in our regression analysis, the absence of data on labour quality should have little impact on the estimation.

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[12] Leasing capital is imputed using the following formula: leasing capital = leasing expenses / [1/(20+r)]. Leasing capital is thus assumed to have an average life of 20 years. See Rogers (1999) for more detailed discussion.

[13] The BLS does not provide data on the number of hours worked, only on the number of full-time and part-time employees. The full-time equivalent calculation is thus based on estimated average working hours of part-time and full-time employees for the workforce as a whole, as published by the ABS in its monthly Labour Force publication (cat. no. 6203.0).

[14] This does not result in the loss of any observations since, in the first year, respondents were asked to provide employment data for the current year and each of the preceding two years.

[15] Capital is also a point in time measure. However, capital is far less variable than labour (especially when measured in terms of its book value), and hence the coefficient of capital is not sensitive to switching between flow and point-in-time measures.

5.1.3 Independent Variables: Agreement Coverage

Ideally, the effects of enterprise bargaining should be represented by measures of the coverage of employees by collective (or enterprise) agreements. Further, given our interest here in the impact of institutional change, it is obviously important to be able to distinguish between those agreements registered with industrial tribunals and commissions, and more informal unregistered agreements. Such data are available in the BLS, though data on employee coverage were only collected in the last three years. In the first year of the survey respondents were simply asked whether any such agreements were in operation. Thus two types of measures are constructed. The first measures the number of employees covered by different types of agreements as a proportion of total employment, and the second provides simple dummy variables indicating the presence of any such agreements. Thus when we use measures of employee coverage, observations in the first year are automatically excluded.

Note that for completeness we also include measures of coverage by, and presence of, individual contracts or agreements.[16] It is expected that the sign on these variables will be positive, both because individual contracts and agreements tend to be more commonly used with more skilled workers (see Wooden 1999), and because such agreements tend to be used in tandem with performance-based pay incentives.

Finally, the BLS data also separately distinguish persons covered by an award only. There are thus four types of employment arrangements distinguished in the BLS data: registered enterprise agreements, unregistered enterprise agreements, individual contracts or agreements, and award only. While the first three of these categories are not mutually exclusive, it is nevertheless clear from the data that, when determining employee coverage, most managers treated all categories as being mutually exclusive. In effect, therefore, we only have one variable consisting of four distinct categories. The award only category has thus been selected as the reference group for all of the analyses reported.

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[16] While, in theory, all workers are covered by a common law individual contract, it is clear that managers interpreted this question as identifying those workers who had their pay primarily determined by an individually negotiated contract or agreement.

5.1.4 Independent Variables: Other Control Variables

As mentioned above, previous overseas research suggests the need to augment our estimating model with measures of product market competition, financial structure and union membership. The most obvious measures for competition are market share and industry concentration. Unfortunately, we are only able to construct such measures at an industry level and in the data set made available to researchers only highly aggregated industry divisions are identified for businesses with 100 employees or more.[17] Given this constraint we did not pursue the construction of these variables any further. The effects of product market competition are thus not well controlled for in our model. They will be partly reflected in the inclusion of one-digit industry dummies and partly controlled for through the inclusion of a simple dummy variable identifying whether or not the business received any income from the export of goods or services during the financial year.

In terms of measuring of how highly geared a firm is, the most obvious variable is a firm's debt to equity ratio. The problem here, however, is that many firms within our sample have negative levels of equity. Thus following Nickell et al (1992), we approximate gearing with a measure of the firm's rate of borrowing (that is, the ratio of total liabilities to total assets). Unfortunately, since all financial data are reported for the end of the year, we need to lag this variable one period, which of course means losing one year of data from what is already a very short panel. Nevertheless, since we already lose one year of observations when using the agreements coverage variable we lose nothing by including this variable in tandem with agreements coverage.

On union membership, survey participants were asked every year to estimate the proportion of employees who were union members within broad ranges. We thus include simply dummy variables indicating whether a majority of employees are union members and whether a minority of employees are union members. The reference category is businesses without any union members at all.

We also included a small number of other variables. These are:

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[17] Smaller businesses are assigned to 2-digit industry sub-divisions.

i)   age of the business;

ii)   whether a business is classified as innovative;

iii)   part-time employees as a proportion of total employment;

iv)   managerial employees as a proportion of total employment; and

v)   whether the firm was a family business.

As noted earlier, business age is needed to control for any bias associated with the mismeasurement of capital. With the exception of public companies and trusts, the age of the firm is measured here as the number of years the business has been controlled or owned by the current owner. This is not a perfect proxy for the age of capital, but is the best we can do with these data.

The introduction of new production processes is generally expected to result in increased productive efficiency, hence justifying the inclusion of the innovation variable. That said, the effect is not expected to be very powerful given the definition of what constitutes innovation is very broad – the development of any new products, the introduction of any substantially changed products, or the development or introduction of any new or substantially changed processes.[18] Further, it is generally expected that the lags between innovation and productivity will be quite long.

A variable measuring the proportion of employees who are employed on a part-time basis is included on the grounds that part-time employment may enable firms to more efficiently match labour inputs to product demand. We thus expect the coefficient on this variable to be positively signed.

Managers as a proportion of total employment is included to correct for any misspecification bias that might arise from its correlation with the agreement coverage variables. As noted earlier, this variable will be inversely correlated with coverage by enterprise agreements. Conversely, it can be expected to exhibit a strong positive correlation with coverage by individual contracts and agreements.

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[18] The definition of an innovator, however, did vary across broad industry sectors (different surveys forms were administered to firms within the manufacturing industry, the finance sector, and firms in all other industries).

Finally, we include a dummy variable for family businesses. In such businesses, there are often numerous persons – that is, other family members – who are counted as employees of the business but have minimal involvement in the operation of the business. We thus expect a negative coefficient on this variable.

5.2 Estimation Method

The production function is estimated using a random effects model. That is:

$$\ln Y_{it} = \alpha + \beta \ln K_{it} + \gamma \ln L_{it} + Z_{it}\phi + u_i + \varepsilon_{it} \tag{2}$$

where u_i is the random disturbance characterising the ith firm and is constant through time. This component of the disturbance term can be viewed as representing the collection of factors omitted from the regression that are specific to that firm, and are assumed to be random across firms. Given that the within-firm error terms are correlated, the efficient estimator is no longer ordinary least squares. Instead, random effects models are estimated using feasible generalised least squares.

Constant returns to scale ($\alpha+\beta=1$) is not imposed in the estimation. As noted earlier, using the book value of a firm's assets to measure its capital stock will typically mean capital is under-estimated and the extent of under-estimation is likely to increase with a firm's age. The parameter β is, therefore, likely to be underestimated and hence it follows that it would be inappropriate to impose on our estimates the restriction that α and β sum to 1. Instead, and as already noted, we help correct for the effect of underestimating the value of capital through the inclusion of a measure of the age of the firm.

Ideally we would eliminate the firm effects from equation (2) by taking first differences. Moreover, a first-differences model is concerned with growth in productivity rather than its level, and it is the former that is most relevant for assessing the impact of enterprise agreement-making. Unfortunately data limitations prevent sensible estimation of a model of productivity growth. There are at least two obstacles. First, we simply do not have a sufficiently long data period to make estimation of a first-differences model viable. As we have already seen, including measures of agreement coverage and a firm's rate of borrowing require dropping the first year of

data, reducing our panel to three time periods. Differencing would further reduce the data period by a year. In effect, a first-differences model would simply involve analysing the change in productivity growth between 1996/97 and 1997/98. Second, though again related to the short length of the panel, there is simply not enough variation in the key explanatory variables to provide a rigorous test of the key hypothesis. That is, over the data period, within-firm variations in employment arrangements were not pronounced.

A final obvious question is why use a random effects specification rather than a fixed effects specification. There are two reasons behind our choice of the random effects framework. First, it is generally accepted that the fixed effects approach is only reasonable when the data exhaust the population. When the data come from a sample of a larger population the random effects approach is generally preferred (see Nerlove & Balestra 1996, p. 4). Second, the choice of random effects in preference to the fixed effects approach is dictated by a practical consideration. When the number of cross-section units is large and the number of time periods is few, as is the case here, the number of parameters to be estimated in a fixed effects model is simply too large relative to the number of available data points. In other words, with such a short panel the fixed effects tend to swamp the influence of all other variables.

5.3   The Sample Used for Estimation

Within the full data set maintained by the ABS there are just over 4200 observations within the balanced panel (that is, business units with observations in every year). Not all of these cases, however, are made available as part of the public-use unit record file. In particular, concerns about the ease with which large businesses might be identified led the ABS to omitting from the file all businesses with more than 200 employees.[19] Confidentiality concerns also saw the removal of some variables, such as foreign ownership and franchising details. Furthermore, values for financial variables have been perturbed while values on some other variables have been reported as ranges rather than as absolute numbers.

We further reduced the number of cases available for analysis by deleting observations that have been heavily affected by imputation. As already indicated, many of the observations within the

full ABS data set are imputed on the basis of returns for the previous year, thus imposing artificial stability into the data. In our opinion these cases are best ignored. We also discard cases where complete sections of the questionnaire, but not the entire questionnaire, have been imputed. Thus we restrict our sample to businesses that provided full response for the entire four-year survey period.[20]

We also exclude businesses in the financial sector (the Finance and Insurance industries) because of major differences in the definition of variables used in the construction of measures of value added and capital.[21] In addition, observations with negative sales and negative liabilities are also excluded, as are a small number of cases where it was reported that there were no employees. In total, we are left with just 2435 businesses in our sample.

Summary statistics for all variables included in our analysis, and using this sample, are presented in Appendix Table A1.

6 Results

The results of our random effects estimation are presented in Tables 1 and 2. Table 1 uses dummy variables to represent the effect of different employment arrangements and also excludes the borrowing rate variable. It thus makes use of data from all four years. In Table 2 we report a specification which includes the borrowing rate (lagged one period) and replaces the various dummy terms representing the presence of different types of employment arrangements with measures of the numbers of employees covered by these arrangements. Only the last three years of data are available for use in this specification.

Note that for both specifications we report results for the entire sample as well as for separate business size groups. This is justified on a number of grounds. First, business size was an important stratifying variable. Second, there are good reasons for expecting the impact of

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[19] A further 30 records were omitted from the file because they were defined as large businesses on grounds other than employment.

[20] Indeed, the ABS replaces all missing data with an imputed value. However, only those records with imputed value in at least one whole section can be identified. We are unable to identify those records where individual items within a section, but not the full section, have been imputed.

[21] Since only around 1.6% of businesses in the balanced panel are in the financial sector, it is not feasible to undertake separate analysis on this sub-sample.

enterprise agreements to vary with business size given such agreements are very common in large businesses but extremely uncommon within the small business sector. For example, it is generally accepted that small business is in a far better position than large business to establish productive relationships with their workforces without the need for formal industrial relations structures and processes. This reflects the lesser complexity involved in managing small numbers of employees, the greater degree of intimacy inherent in the employer-employee relationship in small business workplaces, and the absence of trade unions. It thus follows that attempts to formalise the employment relationship, such as through the introduction of an enterprise agreement, are unlikely to have the same impact on productivity as they might in larger businesses.[22] Indeed, we may well expect a negative coefficient in a model of output levels. This would result if the introduction of enterprise agreements was a response to labour management problems in the business.

Focusing first on the results reported in Table 1, the signs on most coefficients are as expected. Value added increases with factor inputs, with the coefficients suggesting constant returns to scale for the entire sample, but slightly decreasing returns to scale for small and medium size business. Business age also has the expected positive association with value added, but we are unable to determine whether this is due to growth in productivity as experience is accumulated or whether it simply arises from the greater underestimation of capital within older firms. The innovation variable generally attracts a positive sign but, again as expected, is a long way from achieving statistical significance. Export status, on the other hand, is both positively signed and large, with exporting businesses, all other things equal, almost 9 per cent more productive than non-exporters. This effect, however, is only pronounced among small businesses. Productivity also tends to rise with the manager to employment ratio (though not among small businesses) and but is not affected much by part-time employment ratio (only negative for medium firms at 10 percent significance level). There is also a very powerful negative sign on the coefficient for the family business variable. As explained above, this almost certainly reflects the underemployment of family members in these businesses.

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[22] Barrett (1995, p. 357), for example, concluded that "small business employers appear uninterested in undertaking bargaining", largely because enterprise agreements were irrelevant to them. A high level of disinterest in enterprise bargaining on the part of small business was also documented in Buultjens (1994).

Table 1:   Random Effects Estimates of the Production Function: 4-year Sample

Independent variables	All firms	Small firms (1-19 employees)	Medium firms (20-99 employees)	Medium-large firms (100-199 employees)
Constant	3.450 (0.063)**	3.501 (0.090)**	4.170 (0.116)**	3.657 (0.411)**
ln Capital	0.149 (0.006)**	0.152 (0.009)**	0.136 (0.008)**	0.119 (0.023)**
ln Labour	0.874 (0.013)**	0.784 (0.023)**	0.742 (0.025)**	0.879 (0.077)**
Employment arrangements (Control group: Award only)				
Registered enterprise agreements	0.051 (0.021)*	0.021 (0.049)	0.055 (0.025)*	0.061 (0.050)
Unregistered enterprise agreements	-0.003 (0.014)	0.015 (0.020)	-0.018 (0.019)	0.039 (0.052)
Individual contracts or agreements	0.036 (0.010)**	0.052 (0.017)**	0.020 (0.014)	0.046 (0.036)
Union membership (Control group: Non-union firm)				
1-50%	0.022 (0.017)	0.027 (0.030)	0.010 (0.020)	-0.010 (0.057)
51-100%	0.052 (0.025)*	-0.015 (0.048)	0.051 (0.031)	0.095 (0.080)
Age of business in 1995 (control group: < 2 years				
2-4 years	0.081 (0.050)	0.126 (0.067)#	-0.006 (0.077)	0.310 (0.249)
5-9 years	0.136 (0.046)**	0.179 (0.063)**	0.043 (0.069)	0.378 (0.240)
10-19 years	0.163 (0.046)**	0.185 (0.063)**	0.098 (0.068)	0.216 (0.242)
20+ years	0.187 (0.047)**	0.191 (0.067)**	0.124 (0.068)#	0.193 (0.237)
Innovator	0.011 (0.010)	-0.001 (0.017)	0.016 (0.013)	0.026 (0.034)
Exporter	0.087 (0.017)**	0.151 (0.028)**	0.043 (0.021)*	0.024 (0.053)
Managerial employment %	0.105 (0.052)*	-0.005 (0.065)	0.384 (0.104)**	0.760 (0.301)*
Part-time employment %	0.020 (0.027)	0.002 (0.035)	-0.088 (0.050)#	0.005 (0.141)
Family business	-0.229 (0.022)**	-0.182 (0.032)**	-0.250 (0.032)**	-0.221 (0.084)**
R-squared	0.847	0.680	0.649	0.625
Wald chi-squared	17510.3**	2545.1**	2697.9**	418.67**
ρ (fraction of variance in error term due to u_i)	0.666	0.646	0.685	0.621
No. of observations	9148	4597	3967	584
No. of business units	2435	1251	1033	151

Notes

**, * and # indicate significance at the one, five and ten per cent levels respectively, in a two-tailed test.
1. Figures in parentheses are standard errors.
2. All specifications also include one-digit industry dummies.

Union membership effects are generally positive, and in the case of the all firms model, are statistically significant. That is, our results suggest that businesses where the majority of employees are union members are just over 5 per cent more productive than similar businesses where none of the employees are union members. Such findings are in line with those reported in the US literature, where unions are often found to be associated with higher levels of productivity (see, for example, Belman 1992). As might also be expected the magnitude of this effect is greatest in the larger businesses within our sample. That said, estimated standard errors attached to the coefficients when using the sub-samples are always relatively large and hence the results are statistically insignificant. Such findings contrast with those reported in the US literature, where unions are often found to be associated with higher levels of productivity (see, for example, Belman 1992).

Now we come to the variables of central interest to this study – the variables distinguishing between the use made of different types of employment arrangements. It is immediately apparent that within the entire sample there is evidence of a significant positive association between productivity and the presence of registered enterprise agreements. More precisely, businesses with registered enterprise agreements are found to be 5.1 per cent more productive than businesses without any agreements, either collective or individual. Furthermore, and totally in line with expectations, this productivity differential rises with firm size – from just 2.1 per cent for small business up to 6.1 per cent for the largest businesses in this sample (though it is true that the coefficient for the medium-large business sub-sample is statistically insignificant, a result which we suggest is a function of the relatively small sample size). In other words, enterprise agreements appear to be much more important for the productive performance of large businesses than they are for small businesses. In contrast, informal unregistered enterprise agreements exhibit no significant association with productivity irrespective of size.

The results also suggest that individual agreements and contracts are associated significantly and positively with productivity, though the average productivity differential is much smaller. As indicated earlier, this finding does not necessarily indicate that such agreements motivate better performance (though that is still a possibility). Rather, it could simply reflect a preference by higher productivity workers for individual-based employment arrangements. It is intuitively obvious that the most talented and most skilled workers will prefer employment arrangements

that link rewards to their own performance rather than the performance of others, and almost certainly helps explain why individual employment arrangements are much more common among skilled workers.

One problem with the specification underlying the results reported in Table 1 is that it fails to adequately account for the complex nature of employment arrangements within firms. Collective agreements, for example, may be implemented alongside individual agreements. Similarly, while some workers may have award coverage others may be covered by some type of agreement. To allow for this possibility, we re-estimated the model including a full set of interactions between the different employment arrangement terms. The results are qualitatively similar and hence have not been reported here.[23] There is, however, one important difference – the impact of individual agreements when used on their own or in tandem with enterprise agreements is much larger than when used in tandem with award only coverage. Indeed, for firms with the latter arrangement the estimated productivity differential is zero. In contrast, for firms that either have all employees on individuals arrangements or use them in tandem with enterprise agreements (either registered or unregistered) the estimated productivity differential is just over 8 per cent.

We turn now to Table 2 which reports our production function estimates after replacing the dummy variables for the presence of different employment arrangements with measures of the proportion of employees covered by each arrangement. It also includes a measure of the firm's borrowing rate. Again we emphasise that with this specification we are compelled to drop about one-quarter of our observations.

Overall, with one exception, this specification has little qualitative effect on the estimated coefficients for the other variables in this model. The results are thus relatively robust to this different specification. Further, we find, as predicted, that a high ratio of liabilities to assets is indeed associated with higher productivity, but only for small business. This is an entirely sensible finding, which we argue reflects at least two factors. First, small business managers, many of whom are also the business owners, have a greater incentive not to default on their loans. Second, since access to equity finance is relatively more difficult for small businesses to

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[23] Available on request from the authors.

obtain, it follows that among small businesses it will be the businesses with the best ideas and the best growth prospects that will be most successful in obtaining equity finance.

The exception noted above concerns the estimated coefficients on the trade union variables in the medium-large firm sub-sample. As can be seen, the coefficients on the trade union variables in this sub-sample are implausibly large. It is difficult to explain why the marked change when only one year's worth of data is deleted. It is suspected, however, the reported finding has something to do with the high correlation between unionisation and enterprise agreement coverage, a point we return to shortly.

Focusing then on the coefficients on the employment arrangements variables, individual agreements continue to exhibit a strong positive relationship with productivity. Indeed, the estimated coefficient in the all-firm sample indicates that in businesses where the entire workforce are covered by such agreements, productivity is about 10 per cent higher than in firms where all employees are reliant solely on the relevant award. Furthermore, the magnitude of this relationship diminishes as firm size increases.

Finally, there is once again a significant and positive productivity effect associated with registered enterprise agreements. In this case, the results suggest that businesses where all employees are covered by registered agreements are 8.8 per cent more productive, all other things equal, than businesses where no such agreements are in operation. We again find that the size of this effect is very small among the smallest businesses – in this case the estimated coefficient is zero. What is surprising, however, is that the measured effect in this case is largest among the medium sized firms (with 20-99 employees) rather than among the medium-large firms (100-199 employees). This is not consistent with expectations. There are two possible explanations. One lies in the high correlation between registered agreement coverage and unionisation in the medium-large business sample. Consequently dropping the unionisation variables from the specification does indeed see the estimated size of the coefficient on the registered agreements variable increase. Nevertheless, the re-estimated coefficient is still only a little above 0.06 suggesting that other forces must also be at work. The only explanation we can provide for this result lies in the relatively small sample of medium-large firms available – just 151 businesses, providing a total of 435 observations over the three-year reference period.

Table 2: Random Effects Estimates of the Production Function: 3-year Sample

Independent variables	All firms	Small firms (1-19 employees)	Medium firms (20-99 employees)	Medium-large firms (100-199 employees)
Constant	3.288 (0.068)**	3.358 (0.098)**	3.865 (0.136)**	3.548 (0.490)**
ln Capital	0.162 (0.007)**	0.163 (0.010)**	0.156 (0.010)**	0.129 (0.025)**
ln Labour	0.883 (0.014)**	0.798 (0.026)**	0.775 (0.030)**	0.835 (0.092)**
Employment arrangement: Employee coverage (%) by:				
Registered enterprise agreements	0.088 (0.036)*	-0.007 (0.072)	0.137 (0.045)**	0.023 (0.088)
Unregistered enterprise agreements	0.026 (0.022)	0.040 (0.027)	-0.009 (0.040)	0.044 (0.100)
Individual agreements	0.101 (0.019)**	0.109 (0.026)**	0.075 (0.032)*	0.059 (0.070)
Union membership (Control group: Non-union firm)				
1-50%	0.042 (0.019)*	0.076 (0.035)*	-0.001 (0.025)	0.156 (0.067)*
51-100%	0.073 (0.030)*	0.075 (0.056)	0.026 (0.037)	0.234 (0.091)*
Borrowing rate (t-1)	0.009 (0.004)*	0.019 (0.007)**	0.003 (0.005)	-0.019 (0.045)
Age of business in 1995 (control group: < 2 years				
2-4 years	0.103 (0.051)*	0.151 (0.069)*	-0.003 (0.081)	0.446 (0.261)#
5-9 years	0.145 (0.047)**	0.193 (0.064)**	0.038 (0.072)	0.492 (0.251)#
10-19 years	0.165 (0.047)**	0.195 (0.065)**	0.085 (0.071)	0.325 (0.253)
20+ years	0.176 (0.048)**	0.192 (0.068)**	0.103 (0.071)*	0.295 (0.248)
Innovator	0.017 (0.012)	0.007 (0.018)	0.017 (0.016)	0.036 (0.039)
Exporter	0.109 (0.019)**	0.200 (0.031)**	0.051 (0.025)*	0.027 (0.055)
Managerial employment %	0.084 (0.064)	-0.049 (0.076)	0.496 (0.140)**	1.249 (0.376)**
Part-time employment %	0.026 (0.031)*	0.025 (0.040)	-0.112 (0.059)*	-0.213 (0.170)
Family business	-0.205 (0.023)**	-0.172 (0.033)**	-0.223 (0.034)**	-0.221 (0.088)*
R-squared	0.854	0.702	0.648	0.639
Wald chi-squared	16182.4**	3187.7**	2221.5**	348.4**
ρ (fraction of variance in error term due to u_i)	0.712	0.714	0.699	0.714
No. of observations	6834	3426	2973	435
No. of business units	2424	1242	1031	151

Notes

**, * and # indicate significance at the one, five and 10 per cent levels respectively, in a two-tailed test.
1. Figures in parentheses are standard errors.
2. All specifications also include one-digit industry dummies.

7 Conclusion

This paper set out to determine whether the BLS data could throw any light on the question as to whether or not enterprise bargaining has contributed to higher levels of productivity in Australian workplaces during the 1990s. At first glance the results are very comforting – enterprise agreements registered with, and approved by, industrial relations and tribunals tend to be much more common in high productivity enterprises. Indeed, the productivity advantage is estimated to be as much as 8.8 per cent. Unfortunately, it cannot be concluded on the basis of these results that the introduction of registered enterprise in Australian workplaces has had the effect of raising productivity by 8.8 per cent. This is because our model is specified in terms of levels of productivity, rather than in terms of its growth. Our results are consistent with claims that enterprise agreement-making has been beneficial for productivity, but they are also consistent with the possibility that high productivity firms may have been both more likely and more able to introduce enterprise agreements. Of course, if the benefits of enterprise agreements are most attractive to poor performers, as suggested in Wooden (2000, p. 165), then only one inference could be drawn – enterprise bargaining must have been productivity enhancing.

Nevertheless, we are unable to draw such strong inferences based on these data. In theory, causation might be established by re-specifying our model in terms of first differences. This can be done, but leaves us with a sample involving just one year's worth of observations. Not surprisingly, estimating this model produced statistically insignificant coefficients on the variables representing change in the level of employee coverage by the three different types of employment arrangements.

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Statistical Appendix

Table A1: Variable Definitions and Descriptive Statistics

Variable name	Definition	Mean	Std. dev.
Dependent variable			
Ln value added	Natural log of real value added, where value added is defined as: sales – expenses + change in value of stocks. Constant price equivalents obtained using the industry specific GDP chain price index.	7.041	1.467
Employment arrangements			
Registered enterprise agreements	Binary variable indicating the presence of any employees covered by a registered enterprise agreement, defined as any written agreement negotiated for that business that covers aspects of wages and conditions that have been registered with an industrial commission or tribunal.	0.085	0.279
Unregistered enterprise agreements	Binary variable indicating the presence of any employees covered by an unregistered enterprise agreement, defined as any verbal or written agreement negotiated between a group of employees and the business that covers aspects of wages and condition (and have not been registered with an industrial commission or tribunal).	0.126	0.332
Individual contracts or agreements	Binary variable indicating the presence of any employees covered by an individual contract or agreement of employment covering aspects of wages and condition between an individual employee and the business.	0.445	0.497
Registered enterprise agreements %[a]	Number of employees covered by registered enterprise agreements at 30 June as a proportion of total employment.	0.061	0.425
Unregistered enterprise agreements %[a]	Number of employees covered by unregistered enterprise agreements at 30 June as a proportion of total employment.	0.092	0.257
Individual contracts or agreements %[a]	Number of employees covered by individual contracts or agreements at 30 June as a proportion of total employment.	0.231	0.354
Other independent variables			
Ln capital	Natural log of value of capital stock, measured as the written down valuation of non-current assets plus leasing capital. Value of leasing capital calculated as value of leasing expenses / [1/(20+r)].	6.677	1.648
Ln labour	Natural log of the average number of full-time equivalent persons employed over the financial year.	2.780	1.133

Table A1 (cont'd)

Variable name	Definition	Mean	Std. Dev.
Union membership			
Non-union workplace	Binary variable indicating that on 30 June there were no employees who were members of a trade union [reference category].	0.704	0.456
1-50%	Binary variable indicating that on 30 June between 1 and 50% of employees were members of a trade union.	0.208	0.406
51-100%	Binary variable indicating that on 30 June between 51 and 100% of employees were members of a trade union.	0.087	0.282
Age of business:			
>2 years	Binary variable indicating whether, on 30 June 1995, the business had been in operation for less than 2 years [reference category].	0.063	0.243
2-4 years	Binary variable indicating whether, on 30 June 1995, the business has been in operation for between 2 and 4 years.	0.135	0.342
5-9 years	Binary variable indicating whether, on 30 June 1995, the business has been in operation for between 5and 9 years.	0.253	0.435
10-19 years	Binary variable indicating whether, on 30 June 1995, the business has been in operation for between 10 and 19 years.	0.284	0.451
20+ years	Binary variable indicating whether, on 30 June 1995, the business has been in operation for 20 years or more.	0.264	0.441
Borrowing rate (t-1) [a]	The ratio of total liabilities to total assets measured on 30 June for the preceding financial year.	0.754	1.284
Innovator	Binary variable indicating whether, during the financial year, the business had developed any new products or services, introduced any substantially changed products or improved services, or developed or introduced any new or substantially changed processes.	0.288	0.453
Exporter	Binary variable indicating whether the business had derived any income from exports during the financial year.	0.269	0.443
Managerial employment %	Number of working proprietors, working partners, working directors and managerial employees as a proportion of total employment.	0.257	0.175
Part-time employment %	Number of employed persons working less than 35 hours a week as a proportion of total employment.	0.228	0.302
Family business	Binary variable indicating whether the business was considered to be a family business.	0.516	0.500

Note: a   For these variables the descriptive statistics are based on 6287 observations for 2413 firms. For all other variables the relevant sample comprises 8952 observations from 2422 firms.

Table A2: Employee Coverage by Different Employment Arrangements by Year and Size of Business

	Award only	Individual contracts	Registered agreements	Unregistered agreements	N
All businesses					
1996-98	0.56	0.23	0.06	0.09	6834
1996	0.61	0.19	0.05	0.10	2341
1997	0.54	0.25	0.06	0.09	2263
1998	0.53	0.25	0.07	0.08	2230
1-19 employees					
1996-98	0.59	0.22	0.02	0.12	3426
1996	0.62	0.18	0.01	0.14	1190
1997	0.57	0.23	0.02	0.11	1131
1998	0.56	0.25	0.02	0.10	1105
20-99 employees					
1996-98	0.55	0.24	0.09	0.07	2973
1996	0.62	0.20	0.07	0.07	1006
1997	0.52	0.25	0.09	0.07	986
1998	0.51	0.26	0.10	0.06	981
100-199 employees					
1996-98	0.39	0.26	0.21	0.07	435
1996	0.47	0.25	0.18	0.05	145
1997	0.33	0.30	0.21	0.10	146
1998	0.37	0.24	0.24	0.06	144

Author/s:
TSENG, YI-PING; WOODEN, MARK

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