

Industrial & Labor Relations Review

Volume 59, Issue 4

2006

Article 4

Investigating the Cause of Death: Industrial Relations and Plant Closures in Australia

Michelle Brown*

John S. Heywood†

*University of Melbourne,

†University of Wisconsin–Milwaukee,

Copyright ©2006 Cornell University. All rights reserved.

Investigating the Cause of Death: Industrial Relations and Plant Closures in Australia

Michelle Brown and John S. Heywood

Abstract

This is the first study to focus on how unions affect the likelihood of plant closures in Australia. Australia is of special interest in this connection, the authors argue, because of its unique industrial relations institutions, which, at the time of the study (1990–95), limited the capacity of established unionized firms to remove unions except through plant closure. An analysis of Australian Workplace Industrial Relations Survey data shows that two of three measures of unionization had a robust positive influence on the probability of plant closure, and the third had a weaker positive influence. Depending on the specification, for example, a 10 percentage point increase in union density (one of the two measures found to have strong influence) was associated with a 1.3–1.7 percentage point increase in the probability of plant closure—representing a substantial increment, since the mean closure probability among these plants was about 16%.

KEYWORDS: industrial relations and plant closures

INVESTIGATING THE CAUSE OF DEATH: INDUSTRIAL RELATIONS AND PLANT CLOSURES IN AUSTRALIA

MICHELLE BROWN and JOHN S. HEYWOOD*

This is the first study to focus on how unions affect the likelihood of plant closures in Australia. Australia is of special interest in this connection, the authors argue, because of its unique industrial relations institutions, which, at the time of the study (1990–95), limited the capacity of established unionized firms to remove unions except through plant closure. An analysis of Australian Workplace Industrial Relations Survey data shows that two of three measures of unionization had a robust positive influence on the probability of plant closure, and the third had a weaker positive influence. Depending on the specification, for example, a 10 percentage point increase in union density (one of the two measures found to have strong influence) was associated with a 1.3–1.7 percentage point increase in the probability of plant closure—representing a substantial increment, since the mean closure probability among these plants was about 16%.

The influence of unions on the likelihood of plant closure has been understudied in the huge literature examining unions and firm performance. The existing studies of this influence come largely from countries with highly flexible labor markets and decentralized unions and institutions (the United States and United Kingdom). As a result, evidence that unions increase the chance of closure may reflect the larger wage premiums and greater re-

duction in performance associated with highly unionized plants in these countries. On the other hand, these same flexible systems allow for the removal of union representation without plant closure, potentially reducing the influence of unionization on closure. Indeed, these countervailing influences may help explain the mixed pattern found by past econometric studies.

This paper examines the determinants of plant closings in Australia between the two waves—1990 and 1995—of the Australian Workplace Industrial Relations Survey. During this period, the more centralized institutions of the Australian labor market were taking their first steps toward

*Michelle Brown is Senior Lecturer, Department of Management, University of Melbourne, and John S. Heywood is Professor, Department of Economics and Graduate Program in Human Resources and Labor Relations, University of Wisconsin–Milwaukee. They thank the Faculty of Economics and Commerce at the University of Melbourne for a travel grant that allowed them to work together and Sophie Holloway from the Australian Social Science Data Archive for help with the data.

The authors would be pleased to make the original data and representative programs available upon request.

a more decentralized approach. We raise the possibility that, among other reasons for a connection between unionization and plant closure, these centralized institutions create their own impetus for managers to close heavily unionized plants. This follows because Australian industrial relations institutions of the period combine the absence of a workable way to avoid existing unionization with substantial wage premiums and reduced performance for highly unionized plants. As we will outline, this combination makes an association between plant closure and unionization more likely.

Theoretical Considerations

The suggestion that unions influence plant closure has enjoyed longevity in policy discourse. Nearly a quarter-century ago, Bluestone and Harrison (1982) dramatically described the "runaway shop," a plant closure motivated by the desire to avoid costly labor problems. More generally, the theory for an association between unions and closure builds from evidence that unionized plants perform less well on average. Statistical studies make reasonably clear that the positive union wage premium comes at the expense of profitability (see, among others, Hirsch 1991; Becker and Olson 1992; and Menezes-Filho 1997) and reduced investment (Hirsch 1991; Bronars and Deere 1993; Fallick and Hassett 1999). Thus, increased costs, reduced profitability, and reduced investment threaten union firms' survivability, especially when they are competing with nonunion firms.

Yet, three themes from the theoretical literature argue against an association. First, efficient bargain models suggest that firms and unions maximize the surplus and use wage bargaining simply to divide the surplus. Thus, unions play a distributional role but should not influence plant closings. Second, the "collective voice" view of unionism argues that unions can increase the productivity of workplaces (Freeman and Medoff 1984). Voice allows employers to adopt a more efficient mix of working conditions and to improve information flows. It also reduces costly turnover,

thereby encouraging investment in firm-specific human capital. The ability of unions to enhance efficiency reduces the likelihood that they will be associated with plant closures. Third, there remains the basic contention that unions will not imperil their own survival by threatening that of the establishment. Freeman and Kleiner (1999) made the point most directly: "The rational union will not raise wages to the point where the firm is sufficiently unprofitable to go out of business."

None of these arguments persuades us against empirical inquiry. If unions reduce investment, they have real effects beyond simply dividing the surplus. Moreover, demand curve models of bargaining can be easily reconciled with a heightened chance of closure (see Lazear 1983). Union voice may have important influence in some cases, but it may not be sufficient to outweigh the overall negative influence on profit. Finally, while destroying the organization may appear irrational, the logic from the business monopoly research suggests otherwise. The monopoly may set a very high price, earning very high profit and inviting large-scale entry that eventually eliminates its monopoly position and ability to earn profit (Gaskins 1971; Milgrom and Roberts 1982). Similarly, the optimal pattern of rent extraction for a monopoly union may involve extracting very high wages in the near term even while negotiating away the possibility of rents in the future.

Indeed, unions may extract rents even more quickly than implied by the calculus above. Martin (1980) suggested that the typical union member has a time horizon shorter than that of a stockholder and thus may be more willing to countenance eventual closure for higher near-term rents.¹ Unlike stock shares that capitalize the value of future rents, membership rights may not be traded, meaning that members only care

¹Some would argue the reverse. Managers are often criticized for their short time horizons, and some families may work at the same industrial plant for several generations.

about the profile of rents before their own retirement. Thus, the union's time horizon depends on the age of its median member, and if the horizon is sufficiently short, the union, acting with "rational myopia" (Hirsch 1991), may cause closure of the establishment. Further, even if Freeman and Kleiner (1999) are correct and there is no rational myopia, unions may simply make mistakes in the process of extracting rent. As Hirsch (2004:438) put it, "In an uncertain world, it is implausible that unions will not sometimes miscalculate economic conditions or management actions, resulting in 'accidental' business failures in the union sector."

Managerial and owner behavior deserves scrutiny in its own right. While unions extract rent, owners may want to close even a profitable plant or managers may simply prefer to operate without unions. Thus, owners may close a profitable union plant in order to "reopen" a more profitable nonunion plant or to move production to nonunion plants, resulting in still greater profit. For their part, managers increasingly prefer a free hand to manage regardless of the extra cost incurred by the union or how reasonable its behavior. Managers see unionization both as a failure to manage successfully and as a constraint on the managerial function (Kochan et al. 1994). Thus, Cooke and Meyer (1990) argued that while managers weigh costs and benefits when considering union avoidance strategies, they prefer a nonunion setting to a union setting, all else equal, and such anti-union positions can be viewed, in part, "as a matter of ideology or philosophy."² In discussing the Australian context, we build

on these themes, showing both an influence of union rent-seeking on performance and the possibility that the resulting managerial strategy generates an association between unionization and plant closure. While we cannot ultimately identify either union rent-seeking or managerial preferences as the paramount cause of death, we do confirm that Australian unions were at the scene of the crime.

The Econometric Evidence

We first review seven economy-wide studies that directly examine unionization as a determinant of plant closings. While our focus will be on the role of unions, it is worth reviewing the findings on plant closure from industrial economics and regional science in order to establish the context for our investigation.

Two central findings emerge across countries and time: plant closings are more likely in younger and in smaller establishments (Reynolds 1988; Dunne et al. 1989; Gibson and Harris 1996). Both influences may reflect a survivor effect. Successful plants are likely to persist and to grow. These influences are sufficiently robust that they have typically been accounted for in studies focusing on unions. While the closure of relatively high-cost plants might be anticipated, research has not always confirmed a consistent pattern of such closures (Reynolds 1988; Whinston 1988). As Gibson and Harris (1996:527) made clear, a multi-plant firm may sacrifice a low-cost plant if the higher-cost plants have sufficiently large offsetting benefits. Thus, unions would seem to be associated with higher costs, and the issue is whether there exist offsetting benefits.

We summarize the existing evidence on unions and plant closure in Table 1. The early U.K. evidence, based on the 1984–90 Workplace Industrial Relations Survey (WIRS), showed no evidence of an association (Machin 1995; Stewart 1995). None of the critical variables—recognition of a union, the presence of closed shops, or the predicted union wage premium—emerge as statistically significant determinants.

²In a subsequent analysis, Meyer and Cooke (1993) showed that strategies associated with the closing of unionized plants and the decertification of unions negatively affected firm profits. The resulting decline in profit may have flowed from managerial error in calculating relevant costs and benefits (the authors suggested unanticipated union reprisals), or may have been a function of the time-frame of the analysis; it may also have been the role that managerial preferences played in adopting such strategies.

Importantly, Machin (1995) found that single plants (not part of multi-plant enterprises) were less likely to close and that controlling for capacity utilization and financial performance did not alter the absence of a union influence on closure.

The U.S. evidence presents a similar pattern, generally showing few union influences on closure. Dunne and Macpherson (1994) showed that sectors with high union membership did not experience significantly greater employment loss due to plant closings than did their less unionized counterparts. Yet, they did show that highly unionized sectors downsized more and had lower growth rates, other things equal. Freeman and Kleiner (1999) presented a detailed U.S. study consisting of three related examinations. First, they used COMPUSTAT data to examine 633 business units of which 126 became insolvent between 1983 and 1990. They found that a union's presence reduced the chance of closure, but that the larger the proportion of the work force unionized, the greater the chance of closure. These offsetting influences were such that a positive net influence of unionization emerged only when density was 60% or greater, far above the average unionization rate. Second, Freeman and Kleiner used evidence from National Labor Relations Board (NLRB) certified elections to show that newly unionized firms closed no more frequently than other firms. Third, they showed that the probability of a worker being displaced by plant closure was not associated with that worker's union status. While the COMPUSTAT estimations controlled only for the size of the establishment, Freeman and Kleiner concluded that unionization had little or no influence on plant closure.³

The more recent U.K. evidence shows that unions do influence plant closures. Addison et al. (2003) revealed that both

union recognition and union density have a robust positive correlation with the likelihood of plant closure. The authors suggested that multi-plant employers became emboldened to close unionized establishments and that union influence over employment in such settings waned following anti-union legislation (Machin 1995). They confirmed this with evidence that the influence of unions on closure was unique to those plants that were parts of multi-establishment enterprises. To keep their analysis comparable with Machin's (1995), the authors included capacity utilization and financial performance; doing so in this case, they found, did not alter the positive influence of unions on plant closure within multi-plant enterprises. Bryson (2004) confirmed the positive association between unions and closure in the United Kingdom but found that where unions are strong there is no greater likelihood of closure. Bryson claimed that while unions raise costs, strong unions have offsetting voice benefits that neutralize any influence on plant closing. He presented evidence of a statistically significant union influence on closure among those plants without closed shops but no statistically significant influence among those plants with closed shops (stronger unions). He also showed that the influence of unionization does not vary with the number of unions with which the establishment must bargain.

Addison et al. (2004), relying on the framework of Freeman and Lazear (1995), noted that German works councils potentially provide the same positive voice functions as U.K. or U.S. unions, but that they also rent-seek and can have a negative influence on performance. Using the IAB establishment panel, Addison et al. (2004) documented a positive association between works councils and plant closures. The authors used their evidence to criticize recent German legal changes strengthening works councils, arguing that far from enhancing efficiency, as proponents suggested, the new law will simply encourage plant closure.

In sum, the econometric evidence must be described as modest in aggregate size

³DiNardo and Lee (2002) concurred, showing that in the United States, the closure probability for plants where unions just barely won representation elections was similar to that for plants where unions just barely lost.

Table 1. International Evidence on Union/Representation Effects on Plant Closings.

<i>Study</i>	<i>Country</i>	<i>Data</i>	<i>Union/Representation Variable</i>	<i>Results</i>
Duanne and Macperhson (1994)	USA	Sectoral closure rates from the 1982 and 1987 Census of Manufactures	Sectoral union density from the CPS	Insignificant
Machin (1995)	UK	1984 and 1990 WIRS	Union recognition	Insignificant
Stewart (1995)	UK	1984 and 1990 WIRS	Predicted union wage differential	Insignificant
Freeman and Kleiner (1999)	USA	Primary Analysis uses firms/lines from 1983-90 COMPUST	Unionization dummy and unionization density	Negative coefficient on the dummy and positive coefficient on density with the net effect positive only above a density of 60%
Addison, Heywood, and Wei (2003)	UK	1990 WIRS and 1998 WERS	Union recognition and union coverage	Positive effect of each measure but driven by strong results for multi-establishment plants
Bryson (2004)	UK	1990 WIRS and 1998 WERS	Union recognition and various measures of union strength	Generally positive union effects but strongest where unions are weak
Addison, Bellmann, and Kolling (2004)	Germany	IAB Panel	Union coverage and presence of works council	Positive effect of works councils not moderated by union coverage

with variations in results across countries and time periods. The two U.S. studies and the two early U.K. studies suggested no association between unions and plant closure. The two later U.K. studies and the German study suggest a positive association, but under quite different institutional arrangements. Against this backdrop, we provide the first Australian evidence on this issue.

The Australian Context

The Australian industrial relations system, with its history of compulsory arbitration of disputes and legally binding awards, stands out as distinct from the more decentralized and voluntary collective bargain-

ing found in the United States, the United Kingdom, and Canada. Traditionally the size and strength of legally registered unions were irrelevant, as any union was able to access the tribunal and present a case based on its merits. Awards by the tribunal (for compensation or other terms of employment) applied to employees irrespective of their union status and typically covered entire occupations or industries.

Despite this structure, over-award bargaining (bargaining resulting in a rate of compensation higher than that awarded by the federal tribunal) based on union strength generated a union wage differential of about 10% (Miller and Mulvey 1993). More recently, Wooden (2001) examined the effect of unionization on worker earn-

ings both within and between establishments. While differences within enterprises between union and nonunion members were very small, a strong union presence in the establishment provided workers a 15–17% wage advantage compared to equivalent workers in establishments without such a presence.

In line with their emphasis on union-generated restrictions on work practices, Miller and Mulvey reviewed unanimous findings (albeit they are taken from only three studies) that unions are associated with statistically significant lower productivity.⁴ In addition, Wooden and Hawke (2000) presented evidence that Australian unions are associated with reduced employment growth. Indeed, their estimates of the magnitude of the reduction fit very closely with U.S. estimates (Leonard 1992; Linnemann et al. 1990) and are broadly consistent with the U.K. pattern (Blanchflower et al. 1991; Fernie and Metcalf 1995; Booth and McCulloch 1999).

Thus, despite substantial institutional differences, unions in Australia have effects similar to those of their North American and U.K. counterparts. They are associated with substantial wage premiums, lower productivity, and reduced employment growth. In addition, Loundes (2000) found that unions were associated with worse “workplace outcomes.” Using a composite measure built up from lost work days (including from absence), worker-management climate, and quits, she found that workplaces with higher union density performed more poorly. As a consequence, concern about an association between unions and plant closure cannot be ruled out based on the known effects of Australian unions.

Throughout a substantial part of the 1980s the union movement, through the

Australian Council of Trade Unions/Australian Labour Party (ACTU/ALP) Accord, played a central role in public policy-making. However, as the decade progressed, employers increasingly criticized the prevailing industrial relations system and proposed alternatives that reduced the role of unions (HR Nicholls 1986; Business Council of Australia 1989). This resurgence of management with a strong anti-union flavor provided the inspiration for a number of high-profile anti-union disputes involving employers in the food and cattle industries (Brian and Kitay 1999) and in mining (Waring 1999). Many other employers publicly challenged the role of unions, claiming they adversely affected work flexibility and competitiveness. Survey evidence reflects such attitudes: by the middle 1990s nearly 90% of managers in Australia expressed a clear preference for dealing with employees directly rather than through a union.⁵

While the performance differential associated with unions might be broadly similar to that found in the United States and United Kingdom, and while managerial attitudes are also becoming similar, there exist important institutional differences. A critical aspect of Australian industrial relations has been the absence of an equivalent to U.S. union decertification. The registration of unions in Australia is not plant-specific and has only the purpose of creating separate legal entities that represent groups of workers before the industrial tribunal. While entire unions can be deregistered, the process is time-consuming and the grounds for deregistration are very limited, reducing the value of union deregistration as a managerial strategy (see Creighton and Stewart 2000). Further, there is no Australian equivalent to perma-

⁴This fits well with the results from the United Kingdom but contrasts with the more mixed U.S. results. In their meta-analysis of the impact of unions on productivity, Doucouliagos and Laroche (2003) concluded that a negative relationship has been established for the United Kingdom but that a weaker positive relationship emerges in the United States.

⁵Specifically, the question was whether or not “management preferred to deal with employees directly, rather than through trade unions.” Overall, 88% of managers agreed, with 96% agreement among managers at establishments without unions and 83% agreement among managers at establishments with unions (Morehead et al. 1997:461).

ment strike-breakers or to the failure to reach first contracts. Management therefore has fewer tools in its arsenal to reduce union influence.

One potential strategy available to Australian managers is to write individualized contracts with workers, separating individual workers from the collective bargaining and award system. Yet, this was not a widespread practice even by the end of our period of examination. Morehead et al. (1997:333) reported that only 5% of workplaces used predominantly individualized contracts and that these were concentrated in smaller workplaces. Using this evidence, the authors suggested that individual contracts did not appear to be a widespread or effective anti-union tool in large workplaces at that time. The preponderance of individual contracts existed in smaller plants because the establishment and coordination of individual contracts was easier in that setting. Despite this, the majority of managers express a preference for individualized contracts (Wooden 2000), and survey data from the National Institute of Labor Studies reveal that among establishments that used primarily individual contracts, the major reason for doing so was “managerial preferences” rather than “to obtain better outcomes” (Wooden 2000:87).

Plant closure may be a consequence of few alternative management strategies to avoid unions. Plant closure may seem extreme, but it could be reasonable in several circumstances. First, if the employer has multiple plants, closing highly unionized facilities in order to concentrate on, or expand, less unionized facilities could make sense. Second, the employer of even a single facility may close a unionized plant in one location in order to open a new, and potentially nonunion, plant in a second location. Indeed, Baird (2001) explicitly linked the opening of “greenfield sites” in Australia to union avoidance in her detailed case studies of two manufacturing firms and a mail processing firm. She even presented internal strategy documents from one manufacturer claiming that the objective of the new site was “to eliminate union involvement” (Baird 2001:73). Such a strat-

egy is made easier in Australia because union members at old facilities typically have no job rights at the new facilities.

The likelihood of closing heavily unionized facilities is enhanced by two institutional changes at the time of our study. First, the data were collected during a time of political support for a more individualist approach to employment relations (Deery, Plowman, Walsh, and Brown 2001). This change dramatically influenced employer attitudes toward unions (Wooden 2000). In particular, the change in policy attitudes, by diminishing the political censure of plant closure, might make management more likely to close a union plant rather than renegotiate.⁶ Second, the period of our investigation is one of increasing trade liberalization for Australia. The reduction in tariffs increased the viability of moving production overseas, a move potentially driven by the costs of unionization and managerial preferences to avoid heavily unionized facilities.

The foregoing general theoretical arguments and institutional considerations generate a series of testable hypotheses. First, and most important, unionization is associated with an increased chance of closure. Again, this could result from unionization’s effects on performance alone or from managerial strategy in the face of these effects. Second, establishments that are part of multi-plant firms are more likely to show an association between unionization and the probability of closure. This follows from the greater ability of managers in those firms to play plants off against each other and move production between plants. Third, larger plants, in which individualized contracts are a less likely strategy for union avoidance, are more likely than smaller plants to show an association between unionization and closure. We now turn to analyses that test these hypotheses.

⁶At this time, employees displaced by plant closure received both generous severance payments (Taylor and Yerbury 1986) and unemployment benefits, often of unlimited duration.

Data and Methodology

The data come from the 1990 Australian Industrial Relations Survey (AWIRS) and from a trawl survey that served as a first step in the construction of the separate panel component of the 1995 AWIRS (Moorehead et al. 1997:48–51). The purpose of the trawl survey (returning to already sampled plants) was simply to identify those plants from 1990 that remained active in 1995. The unit of observation is the workplace as defined by the Australian Bureau of Statistics (ABS), “a single physical area occupied by the establishment from which it engages in productive activity on a relatively permanent basis.” The sampled workplaces were drawn from the ABS register of all establishments in Australia excluding agriculture, forestry and fishing and hunting, and defence. Callus et al. (1991) provides complete details on AWIRS’s definitions and its sampling frame, while Kelly (1990) provides a theoretical discussion of the ABS definition of workplaces.

Most of our data come from that portion of the main questionnaire in which the respondent was either the most senior management official at the establishment or the most senior human resources manager (this varied by the question asked).⁷ This 1995 trawl survey attempted to contact all of the establishments that participated in the 1990 survey. Of the original 2004 establishments in the 1990 survey, 1,705 were identified as still surviving, while 299 had ceased to exist and were identified as “dead.”⁸ Establishments that changed ownership, participated in mergers, or were spun off but remained operating were identified as surviving. After we limited the

sample to the private sector (the sector to which our theoretical arguments apply), 1,234 establishments remained (both manufacturing and non-manufacturing), of which 1,036 survived and 198 were identified as dead. Our dependent variable takes the value of one if the establishment closed between the survey dates and has a mean of .16.

We estimate probit regressions with the covariates constructed from the 1990 AWIRS. Thus, we use the 1990 characteristics to predict whether or not the establishment is dead by 1995. This methodology replicates that of Addison et al. (2003) for the United Kingdom. Chief among the independent variables are three indicators of unionization: union density, poor climate, and union activity. Density is the share of the workplace unionized as built up from establishment-specific occupational data.⁹ Poor climate is a dummy variable identifying those establishments that have union members and where both management and the union delegate identify the industrial relations climate as poor or very poor.¹⁰ Union activity identifies whether or not the establishment has a union delegate who (i) spent more than one hour per week on union activities, (ii) did more than simply recruit members, and (iii) satisfied at least one of the following: met with management above the first line supervisor at least once a month, organized general meetings of membership at least twice a year, or had a union committee

⁷Upper-level managers were targeted as respondents because “they were the best people at the workplace to provide an overall account of what the workplace did, how it was structured, what occurred at the workplace, and so on” (Moorehead et al. 1995:15).

⁸While it is safe to say that most establishments classified as dead are closed, some may have fallen into the “dead” category because their work force fell below ten employees (the cut-off for inclusion in the survey).

⁹Following the practice of others who have used these data, we approximate Density based on answers to questions as to whether “all” (100%), “most” (66.6%), “some” (33.3%), or “none” (0%) of employees in one-digit occupations within the establishment are union members. The responses are aggregated into an establishment average by using the occupational distribution in the workplace (sources: Wooden and Balchin 1993; Drago and Heywood 1995).

¹⁰We recognize that when only one side describes the industrial relations climate as poor, questions are raised about the balance and health of employment relations. Therefore, we limit our attention to cases in which bad relations are most likely to influence closing—that is, where both sides agree that the industrial relations climate is poor.

meeting with management at least once every three months. The latter two variables (poor climate and union activity) exist only for plants that employ union members. In Australia employing union members is an extremely weak indicator of union power, but we will test the sensitivity of these compound measures by including an indicator of whether or not the establishment employs union members. Following reductions in sample size due to missing data associated with these critical variables as well as with the other controls, we were left with 730 observations in the longest specification using union density and 934 in the longest specifications using either poor climate or union activity.¹¹ The potential consequences of the missing data will be addressed when we consider the estimations.

Table 2 presents the descriptive statistics for the closure variable and the three union indicators for the smaller of these samples. The mean of the dependent variable continues to be .16, as it was for the full sample. The table also shows that the plants that closed had, on average, higher union density, a greater probability of having an active union, and a greater probability of having a poor labor relations climate.

Given the construction of the three union indicators, it is possible that they are highly correlated and that a single composite measure might be appropriate. Yet, the actual correlations suggest they reflect different dimensions of unionism: .230 between union density and union activity, .065 between union activity and poor climate, and only .004 between density and union climate. Moreover, the Cronbach's alpha across the three indicators is only .02, far below the standard of .70 required to identify a single index (Nunnally 1978).

Thus, we follow the tradition of earlier studies, using the variables as alternative dimensions and entering them both separately and together in our estimations rather than creating a single index.

We took from the 1990 AWIRS a series of other independent variables to control for differences across establishments. These include whether or not the establishment is part of a multi-plant firm, size, age, and the work force composition of the establishment. We include a particularly wide range of variables designed to control for industrial relations factors: indicators of various employee involvement schemes, the use of compulsory redundancy, the use of financial participation schemes, performance appraisal, and individual performance-related pay schemes. Also included are new capital investment and whether there was a takeover by a new owner. The full set of variables and their descriptive statistics are shown in Table 2.

Previous studies identify these variables as predictors of plant closure, and their inclusion acknowledges that plants close for many reasons. As discussed, establishments that are part of multi-plant enterprises are more likely to close than single establishments (Addison, Heywood, and Wei 2003; Kirkham et al. 1998, 1999; Colombo 2001). Smaller and younger workplaces are also more likely to close (Reynolds 1988; Dunne et al. 1989; Gibson and Harris 1996; Addison et al. 2004). Plants with more part-time workers, short-time workers, and women may be less likely to close if such workers lower labor costs (for contrasting evidence, see Freeman and Kleiner 1999; Machin 1995; Addison et al. 2003; Addison et al. 2004). Following this tradition, we control for gender composition, as well as for the use of casual workers and the use of outworkers (workers who do most of their work at or from home on a contract for service). We also control for the use of employee involvement schemes. Workers involved in (or at least informed about) a closure decision have an opportunity to help avoid closure (Deery et al. 1986). Indeed, organizations often seek to involve employees in times of crisis (Cressey et al.

¹¹Out of the 1,234 private sector observations, there are 820 valid observations on the density measure and 982 on the other two union dimensions. The only other variables with substantial missing data are percent manager (1,038 observations), percent female (1,041), percent casual (1,040), and price sensitivity (1,143).

Table 2. Descriptive Statistics: Means and Standard Deviations.

Name	Description	Full Sample n = 730	Alive n = 613	Dead n = 117
Independent Variable				
Closed	Workplace dead in 1995 equals 1; otherwise 0	.16 (.37)	NA	NA
Measures of Unionization				
Union Density	Proportion of union members among total employees. ^a	66.06 (26.90)	65.16 (27.22)	70.75 (24.71)
Poor Union Climate	Rating of the relationship between management and delegates of the largest union at the workplace is poor or very poor equals 1; otherwise 0 (which includes all non-union workplaces)	.02 (.16)	.02 (.14)	.05 (.22)
Union Active	Equals 1 if the establishment has a union delegate who meets three activity criteria (see text); otherwise 0	.39 (.49)	.38 (.49)	.44 (.50)
Other Control Variables				
<i>Specification 1</i>				
Age	Workplace has been undertaking its main activity for more than two years equals 1; otherwise 0	.97 (.16)	.98 (.14)	.93 (.25)
Size	Log of the total number of employees at the workplace	4.72 (1.09)	4.78 (1.09)	4.40 (1.03)
Domestic Ownership	Wholly Australian owned equals 1; otherwise 0	.81 (.39)	.81 (.39)	.84 (.37)
Price-Sensitive	Price is the most crucial factor for competitive success equals 1; otherwise 0	.36 (.48)	.34 (.47)	.45 (.50)
Industry	Sixteen dummy variables identifying the industrial grouping for the major product	NA	NA	NA
Occupations	8 dummy variables identifying the establishments' most common occupation	NA	NA	NA
<i>Specification 2</i>				
Single	The workplace is the only one in the organization equals 1; otherwise 0	.14 (.34)	.14 (.35)	.10 (.30)
Redundancy	Management has intentionally reduced the size of the workforce in the last year, equals 1; otherwise 0	.13 (.33)	.11 (.32)	.20 (.40)
New Owner	A reorganization of management structure in the last two years equals 1; otherwise 0	.38 (.48)	.36 (.48)	.44 (.50)

Continued

1985), and pre-notification of closure is promoted as good practice for employee involvement schemes (Gerhart 1987). Compulsory redundancy (layoff) has also been a predictor of plant closure (Addison, Heywood, and Wei 2003; Addison, Bellmann, and Kolling 2004). Redundancies reduce labor costs and may forestall plant closure or may presage such closure. Financial participation schemes and indi-

vidual performance pay (and its prerequisite performance appraisal) provide more flexible production costs (Addison, Heywood, and Wei 2003), making redundancies and even closure less likely (Azfar and Danninger 2001). We also control for investment in new capital and the takeover by new owners. Colombo and Delmastro (2001) and Kirkham et al. (1998) reported that adopting new capital and technology

Table 2. Continued.

<i>Name</i>	<i>Description</i>	<i>Full Sample n = 730</i>	<i>Alive n = 613</i>	<i>Dead n = 117</i>
New Capital	Introduction of major new plant, equipment, or office technology in the last two years equals 1; otherwise 0	.38 (.49)	.40 (.49)	.30 (.46)
Percent Managers	Proportion of all workers who are managers	.06 (.05)	.06 (.05)	.06 (.05)
Percent Female	Proportion of all workers who are female	.35 (.27)	.35 (.27)	.33 (.29)
Percent Casual	Proportion of all workers who are casual workers	.17 (.25)	.17 (.25)	.15 (.25)
Outworkers	A slight or significant increase in the use of contractors, outworkers, and agency employees equals 1; otherwise 0	.19 (.39)	.18 (.39)	.20 (.40)
<i>Specification 3</i>				
Profit Sharing	Presence of a profit sharing scheme for non-managerial employees at the workplace equals 1; otherwise 0	.07 (.26)	.07 (.26)	.07 (.25)
ESOP	Presence of a share ownership scheme at the workplace to which any employees can belong equals 1; otherwise 0	.25 (.43)	.24 (.43)	.31 (.46)
JCC	An ongoing formal joint consultative committee used to communicate with employees equals 1; otherwise 0	.16 (.37)	.17 (.38)	.13 (.34)
Quality Circles	Quality circles or productivity improvement groups used to communicate with employees equals 1; otherwise 0	.17 (.38)	.17 (.38)	.15 (.36)
Secure	Security of employment offered by the employer to a majority of employees at the workplace equals 1; otherwise 0	.61 (.49)	.62 (.49)	.54 (.50)
Individual PRP	Employees paid on the basis of individual performance equals 1; otherwise 0	.32 (.47)	.32 (.47)	.28 (.45)
Performance Appraisal	Employees' work is evaluated at least once a year equals 1; otherwise 0	.60 (.49)	.61 (.49)	.58 (.50)

^aFollowing convention, Density is approximated from questions on whether "all" (100%), "most" (66.6%), "some" (33.3%), or "none of" (0%) employees in one-digit occupations within the establishment are union members. These are aggregated to an establishment average by using the occupational distribution in the workplace. Sources: Wooden and Balchin (1993); Drago and Heywood (1995).

reduces the probability of plant closure, while new owners (included as a control variable in Addison et al. 2003) can increase the chance of closure by consolidating production with previously owned plants or improving the firm's ability to close an unprofitable plant (Deery et al. 1986).

The objective is to initially control for a parsimonious set of controls that seem least likely to be the result of unionization, then

expand the list of controls, guided by the recognition that the latter controls may be influenced by unionization and will reduce the apparent impact of unionization on closure. To the extent that these additional controls reflect the influence of unionization, their influence on closure represents an indirect effect of unions on closure. On the other hand, the additional controls may introduce variation indepen-

dent of unionization for which it is appropriate to account. In the end, the estimates provide a range of the influence of unionization. We emphasize that varying the order in which we add variables to the estimation does not produce large variations in the size of the direct influence of unionization. Each of the probit estimations presents the derivatives as marginal coefficients to ease the understanding of the magnitudes involved.

Results

The first column of Table 3 presents the parsimonious specification using the density measure of unionism. We recognize that the industry of the establishment and its occupational composition significantly influence the probability of closure. To capture this heterogeneity we include 12 one-digit industries and eight broad occupational controls. Many of the occupation and industry controls are individually statistically significant. The results also confirm the common findings that older plants and larger plants are less likely to close.¹² It also shows that establishments in more competitive environments, as measured by the importance of price sensitivity, are statistically significantly more likely to close. The coefficient for the domestic ownership variable is negative but fails to achieve statistical significance. After we account for these influences, the role of unionization is substantial. The statistically significant coefficient on union density indicates that a 10 percentage point increase in density is associated with a 1.7 percentage point in-

crease in the probability of closing. Given the mean closing probability of about 16%, this represents a more than 10% increase.

Column (2) adds a series of workplace and worker characteristics as controls. Several of these emerge as important, and the relevant log-likelihood ratio test rejects the hypothesis that the new variables do not add to the model's explanatory power. In accord with the theoretical discussion, the results show that single establishments (not part of a multi-plant firm) are less likely to close, all else equal. Moreover, establishments with new owners are more likely to close. This supports the view that the sale of an establishment is a potential threat to its continued existence. New owners of a firm may attempt to improve performance by closing establishments that the earlier owners would not. The percentage of managers is negatively associated with closure. The proportion of managers in a work force may be a proxy for the complexity and size of the establishment and the professionalism of its operation. Alternatively, there may be an excessive share of managers in establishments protected from competition, and these same establishments may be less likely to close; or high concentrations of managers may be associated with headquarters that would be least likely to close. Without more richly detailed data, these alternative interpretations all remain speculative. The share of women emerges as a positive partial correlate with closure. The share of women may proxy for the labor force longevity and commitment of the work force, suggesting that lower levels of longevity and commitment are associated with an increased chance of closure. This contrasts with the result of Addison et al. (2003), who showed that the share of women was negatively associated with closure in the United Kingdom, a result they found consistent with the greater flexibility and reduced cost of using a more female work force.¹³

¹²We have also augmented the dummy for less than two years of age with additional dummies for 2 to 5 years and for 5 to 10 years. The estimations reveal that plants less than two years of age are statistically significantly more likely to close but that the coefficients on the additional dummies remain small and not statistically significant. Even if we had a continuous measure of establishment age, its inclusion would likely serve only to strengthen the association between unionization and closure. Age, as an omitted variable, correlates positively with unionization and negatively with closure, likely biasing unionization coefficients down.

¹³We recognize the still remaining possibility that unmeasured differences at the most detailed levels of industry and occupation are correlated omitted variables.

Table 3. Probability of Closure: Union Density.

<i>Independent Variable</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>Independent Variable</i>	<i>1</i>	<i>2</i>	<i>3</i>
Union Density	.0017** (2.96)	.0013** (2.25)	.0013** (2.20)	Percent Casual		.0214 (0.23)	.0232 (0.25)
Age	.2092** (2.30)	.2323** (2.52)	.2307** (2.49)	Outworkers		.0244 (0.71)	.0243 (0.70)
Size	-.0581** (-4.27)	-.0665** (-4.51)	-.0647** (-4.27)	Profit Sharing			-.0384 (-0.83)
Domestic Ownership	-.0135 (-.041)	-.0016 (-0.05)	-.0149 (-0.44)	ESOP			.0616* (1.81)
Price-Sensitive	.0529* (1.90)	.0512* (1.79)	.0493* (1.76)	JCC			-.0055 (-0.14)
Single		-.0862** (-2.40)	-.779** (-2.11)	Quality Circles			-.0109 (-0.30)
Redundancy		.0634 (1.56)	.0582 (1.42)	Secure			-.0348 (-1.27)
New Owner		.0524* (1.89)	.0526* (1.91)	Individual PRP			-.0011 (-0.04)
New Capital		-.0394 (-1.43)	-.0341 (-1.24)	Performance Appraisal			.0028 (0.10)
Percent Manager		-.5866* (-1.77)	-.5969* (-1.81)	1-Digit Industries	Included	Included	Included
Percent Female		.0017** (2.57)	.0019** (2.81)	Occupations	Included	Included	Included
				Log Likelihood	63.81**	85.87**	90.63**
				Pseudo R-Squared	.0982	.1340	.1415
				N	742	725	724

Note: Asymptotic t-statistics in parentheses.
*Statistically significant at the .10 level; **at the .05 level.

The specification shows no role for the percentage of casual workers, outworkers, the use of redundancy, or new capital investment.¹⁴ Although the new controls do slightly lower the influence of a 10 percentage point increase in union density—from a 1.7 percentage point increase in the probability of closure to a 1.3 percentage point increase—union density remains a statistically significant determinant of establishment closure.

The final specification in Table 3 adds a wide variety of human resource manage-

ment (HRM) policies that might be expected to alter the success of establishments and so their chances of closure. These include the use of individual performance pay schemes, profit sharing, performance appraisal, the use of employee stock ownership plans (ESOPs), the presence of joint consultative committees, the use of quality circles, and whether or not the employer sees itself as providing secure jobs. Despite evidence that both the use of performance pay and the use of profit sharing can increase performance (Heywood et al. 1997) and despite evidence that employee involvement can enhance performance (Kato and Morishima 2002), the inclusion of these variables does very little to change the established patterns and adds very little to the estimation. The pattern of statistical significance for the previous controls is completely unchanged. The only one of

¹⁴In specifications that exclude industries and occupations, redundancy is a statistically significant positive determinant of closure. Redundancy may be a precursor to closure or may simply reflect the employment variability associated with the establishment's product.

the added variables to take a statistically significant coefficient is the use of ESOPs, which tends to be associated with an increased chance of closure.

We had thought these HRM policies might help reduce the chance of closure, but they appear to play no role. The paradoxical ESOP result may reflect the tendency of organizations in trouble to install an ESOP and the fact that such plants are nonetheless likely to close. Importantly, because of data limitations, we could use only dummy variables to signal the presence of many of these HRM policies. Thus, we know a given establishment uses performance-related pay, but we do not know the share of workers the policy applies to or the portion of worker wages it provides. Thus, the indicators may be measured without sufficient precision. Nonetheless, we note that Addison et al. (2003) also found virtually no role for HRM policies as determinants of plant closure in Britain despite the routine inclusion of HRM policies in estimates. The fundamental point remains that despite the addition of the HRM variables, the size and statistical significance of the coefficient on union density remain unaffected.

To the specifications in Table 3 we added measures of the rate of return and the extent of capacity utilization. These measures were found to be influential by Machin (1995) and responsible for eliminating an otherwise apparent association between unionism and plant closing in the early U.K. data. From the AWIRS we have a rate of return variable that places an establishment's performance in one of five categories and a capacity utilization variable that places the establishment in one of three categories. Thus, we add six additional dummy variables (four measuring performance and two measuring utilization) to the estimates shown in Table 4. The results confirm that establishments in the highest rate of return category are statistically significantly less likely to close but none of the other added variables have statistically significant coefficients. Critically, the pattern of results for union density is unchanged from

that in Table 3.¹⁵ While our measures are categorical and so may be too imprecise, it does appear that the influence of unionization goes beyond a simple effect on these measures of performance.

The top of Table 4 repeats the three estimations from Table 3, replacing union density with the other two measures of unionization. The table presents the critical coefficients on these measures and compares them with the coefficients for density. The full estimations are available upon request. The pattern of the control variables is virtually identical to that already presented, but the results for the alternative union dimensions show a contrast. As with union density, a poor labor relations climate is consistently associated with an increased chance of closure. These results indicate that establishments that have union members and have a poor industrial relations climate are more likely to close than those that have union members and good climate or that have no union members. The coefficient indicates a very substantial influence, with poor climate being associated with roughly a 20% increase in the probability of closing. In contrast, establishments that have an active union are no more likely to close than establishments that have no unions or no active unions.¹⁶

The inability to identify an influence for the union activity variable may flow from

¹⁵These estimations are available from the authors upon request.

¹⁶We used treatment models to test whether the resulting sample of complete observations yields representative results. These models estimate the determinants of an observation having complete values and use the results to correct for the influence of sample selection on the closure estimate (Heckman 1978). Details of the specifications are available from the authors. The results indicate that the treatment model is irrelevant when the climate variable is used but that when union density is used, the hypothesis that the two estimates (for the probability of having complete values and the probability of closure) are uncorrelated is rejected at the 10% level. Yet, the pattern of size and significance of the coefficient remained identical to the patterns from estimates that did not account for selection (.0015 and a t-statistic of 2.20).

Table 4. Estimates of the Probability of Closure:
Union Density, Union Activity, and Poor Climate.

<i>Description</i>	<i>Specification 1</i>	<i>Specification 2</i>	<i>Specification 3</i>
Individual Estimates			
<i>Union Activity</i>	.0334 (1.11)	.0474 (1.43)	.0378 (1.14)
Log Likelihood	69.38**	99.53**	107.71**
Pseudo R-Squared	.0705	.1204	.1303
N	1130	935	.934
<i>Poor Climate</i>	.2051** (2.16)	.2058** (2.06)	.1905* (1.93)
Log Likelihood	72.56**	101.55**	109.97**
Pseudo R-Squared	.0737	.1228	.1331
N	1130	935	934
<i>Density</i>	.0017** (2.96)	.0013** (2.25)	.0013** (2.20)
Log Likelihood	63.81**	85.87**	90.63**
Pseudo R-Squared	.0982	.1340	.1415
N	742	725	724
Combined Estimates			
Union Activity	.0410 (1.19)	.0404 (1.17)	.0350 (1.01)
Poor Climate	.2056** (2.06)	.1787* (1.83)	.1687* (1.72)
Density	.0015** (2.61)	.0012* (1.95)	.0012* (1.95)
Log Likelihood	69.61**	90.72**	94.72**
Pseudo R-Squared	.1071	.1416	.1479
N	742	725	724

Note: Asymptotic t-statistics in parentheses.

*Statistically significant at the .10 level; **at the .05 level.

several sources. First, the level of union activity may not be highly correlated with success in negotiating higher wages and may therefore have no influence on closure. Second, it may be that there is a correlation but that the particular measure of activity available is not sufficient to identify it. Having a single delegate and holding regular meetings may be too low a standard to capture powerful unions that change the terms of employment. Yet, as will be discussed, even the activity variable appears to have an influence on closure among larger establishments.

As the variables for poor labor relations climate and active union exist only for those establishments that have union members,

they capture the compound influence of, for example, having a union and having a poor labor relations climate. Yet, in the industrial relations system of Australia, having union members is a particularly weak indicator of union power. The establishment may simply have a single member, or very few members. Such a circumstance makes over-award bargaining impossible and likely implies few, if any, changes in workplace relations relative to the absence of any members. To check for evidence of this compound effect, we ran estimates (rows 2 and 3 of Table 4) including both the original indicators of unionization and a dummy for whether the establishment employs union members. In none of the six

estimates does the dummy variable for employing union members approach statistical significance, and it does not change the pattern of results for either poor climate (which retains a positive and statistically significant coefficient in all three estimates) or union activity (which retains a coefficient in all three estimates that is not statistically significant). Thus, the failure to include the dummy for employing union members does not play a substantial role, and including it serves to underline its lack of importance.¹⁷

The bottom of Table 4 repeats the three estimations from Table 3 using all three indicators of unionization simultaneously as controls. The pattern mirrors that shown by the individual estimates, with both union density and poor labor relations climate taking positive and statistically significant coefficients.

A final series of investigations focuses on the importance of interactions involving the critical unionization measures. One of the most robust findings from previous studies and from this one is that larger plants are less likely to close than are smaller ones, all else equal. At the same time, unionization is positively associated with establishment size. Larger plants may have more invested capital and greater chances for unions capturing quasi-rents, and so rent-seeking may be greater at larger establishments. Moreover, the Australian evidence cited earlier suggests that the option of individualizing contracts is more difficult to effect in larger workplaces. This indicates that the role of unionization in plant closure may be stronger in larger plants. The potential inter-relationships between establishment size, unionization, and closure lead us to include an interaction between our union measures and establish-

ment size. The first column of Table 5 summarizes the results.

The interactions between size and union density and between size and union activity both indicate that the influence of unionization is greater among larger plants. We included a size interaction with poor labor relations climate, but it never approaches significance (and so it is excluded from the table). As before, union density positively influences closure and size negatively influences closure. With the interaction, an increase in the size of the establishment increases the influence on closure of a ten percentage point change in unionization. Indeed, the coefficient on the interaction is nearly half the size of that on density itself and is statistically significant. For the first time, union activity plays a role in closure. While the variable itself continues to have a coefficient that is not statistically significant, the interaction with size acquires a statistically significant positive coefficient. Among larger plants, those with an active union are more likely to close.

In order to follow up on the evidence from Addison et al. (2003), we also tested whether or not multi-plant status interacted with unionization in influencing closure. In most cases, the interaction coefficient is not statistically significant. We also undertook a specification search for the best cut-point in the density measure from which to create a dichotomous variable (much as Freeman and Kleiner [1999] divided union density when looking for its influence). Presented in the second column is the interaction of low density (30% or less) with the single plant variable. Despite the fact that this cut-point resulted in the best fit, the positive coefficient remains far from statistically significant.¹⁸ Our Australian evidence differs from the U.K. evidence of Addison et al. (2003) that the influence of unionization is statistically significantly

¹⁷Adding the new variable leaves the coefficient on a poor labor relations climate virtually unchanged at .197, .195, and .183 across the three specifications, with the first two significant at the 5% level and the final coefficient estimate just missing 5% but easily meeting 10% with a t-statistic of 1.9. These estimates are available from the authors.

¹⁸Tests of statistical significance no longer apply following such a search, but modifying t-statistics to account for the search would simply confirm the already statistically insignificant coefficient.

lower in single establishments than in plants that are part of multi-plant firms. Our results hence fail to support the hypothesis that managers in multi-plant firms can more easily close a heavily unionized plant because of their ability to shift production to other (possibly non-union) facilities.

In tests for interactions between the three measures of unionization, none of the interactions emerged as statistically significant.¹⁹ We further tested whether the measure of competitive strategy (price sensitivity) interacted with unionism. While theory might suggest that less competitive environments provide a refuge for unions, the interactions were never statistically significant. In total, the interactions we explored only modestly alter the basic role of unionization in determining plant closure. Both union density and poor climate continue to be associated with an increased chance of closure. Unionization is a stronger determinant of closure among larger plants. Union activity influences closure, but only among large plants.

Conclusions

In this paper we have presented an empirical study of factors influencing the probability of plant closure, focusing on three measures of unionization. Two of the three union variables—union density and poor labor relations climate—have positive and statistically significant coefficients across all specifications. Even as the additional controls that may be associated with unionism are added, the coefficients indicate a large influence for unionization. Interactions of the union measures with establishment size provide evidence that the influence of unionization is greater among larger establishments. Importantly, this interaction emerges as statistically significant for the third union variable, union activity.

¹⁹There are three potential interactions, and whenever an interaction was added, both of the variables that made up the interaction were also included. These estimations are available from the authors upon request.

Table 5. Interaction Estimates.

Variable	1	2
Union Measure 1: Density		
Density	.0012** (2.07)	.0015** (2.35)
Single	-.0807** (2.21)	-.0945** (2.46)
Size	-.0794** (4.59)	-.0790** (4.59)
Density × Size	.0005** (2.05)	.0005** (2.01)
Low Density × Single		.1574 (1.23)
Log Likelihood	93.75**	95.21**
Pseudo R-Squared	.146	.149
N	724	724
Union Measure 2: Union Activity		
Union Activity	.0250 (0.75)	.0263 (0.76)
Single	-.0552* (1.76)	-.0539 (1.62)
Size	-.0742** (4.65)	-.0743** (4.65)
Union Activity × Size	.0184** (2.26)	.0184** (2.24)
Union Activity × Single		-.0132 (0.13)
Log Likelihood	111.97**	111.99**
Pseudo R-Squared	.136	.136
N	934	934

Note: all specifications include the full list of controls listed in column (3) of Table 3.
 **Statistically significant at the .05 level.

Thus, in our most complete specifications, all three measures of unions in Australia are associated with an increased chance of closure. Many of the basic controls behave as anticipated by previous findings on plant closure. Thus, plant size, age, and single plant status (not being part of a multi-plant firm) are associated with a reduced probability of closure, while the presence of new owners is associated with an increased probability of closure.

Several caveats are in order. First, despite our best attempts, it remains possible that omitted variables could be driving both the union measures and closure probabil-

ity. The most likely scenario would be one in which establishments in traditional heavy industry are most likely to close and also have high values of the union measures. While we cannot rule out this possibility, we believe that the many controls, including firm size, age, occupational mix, and the detailed industrial controls, provide confidence in our results. Second, it may be that the role of unions is genuine, but that changes in government policy during the time of our study undermined managerial perceptions of unions. As emphasized, the period of inquiry is one in which the government was actively decentralizing employment relations and liberalizing trade relations. In such an environment, closing heavily unionized

plants may have been easier. This raises the issue of whether the connection between unions and closure is unique to this period of decentralization or whether it issued in a new era and the connection continues. Further, we cannot fully distinguish between two alternative interpretations of the results. On the one hand, it may be that firms with unions are simply more likely to close, and we are picking that up with the establishment data. On the other hand, it may be that firms are closing heavily unionized establishments in an effort to reduce the role of unions within the firm. The data do not allow us to link establishments to specific firms or to know which establishments might be parts of the same firm.

REFERENCES

- Addison, John T., Lutz Bellmann, and Arnd Kölling. 2004. "Unions, Works Councils, and Plant Closings in Germany." *British Journal of Industrial Relations*, Vol. 42, No. 1 (March), pp. 125–48.
- Addison, John T., John S. Heywood, and Xiangdong Wei. 2003. "New Evidence on Unions and Plant Closings: Britain in the 1990s." *Southern Economic Journal*, Vol. 69, No. 4 (April), pp. 822–41.
- Azfar, Amar, and Stephan Danninger. 2001. "Profit Sharing, Employment Stability, and Wage Growth." *Industrial and Labor Relations Review*, Vol. 54, No. 3 (April), pp. 619–30.
- Baird, Marian. 2001. "Greenfield Sites: Purpose, Potential, and Pitfalls." *Asia Pacific Journal of Human Relations*, Vol. 39 (Spring), pp. 66–82.
- Becker, Brian E., and Craig A. Olson. 1992. "Unions and Firm Profits." *Industrial Relations*, Vol. 31, No. 3 (Fall), pp. 395–415.
- Blanchflower, David G., Neil Millward, and Andrew J. Oswald. 1991. "Unionism and Employment Behaviour." *Economic Journal*, Vol. 101, No. 407 (July), pp. 815–34.
- Bluestone, Barry, and Bennett Harrison. 1982. *The Deindustrialization of America*. New York: Basic Books.
- Booth, Alison L., and Andrew McCulloch. 1999. "Redundancy Pay, Unions and Employment." *Manchester School*, Vol. 67, No. 3, pp. 346–66.
- Brian, Bernie, and Jim Kitay. 1999. "Mudginberri Abattoir Dispute of 1985." *Labour History*, Vol. 76 (May), pp. 107–24.
- Bronars, Stephen G., and Donald R. Deere. 1993. "Unionization, Incomplete Contracting, and Capital Investment." *Journal of Business*, Vol. 66, No. 1 (January), pp. 117–32.
- Business Council of Australia. 1989. *Enterprise Based Bargaining Units: A Better Way of Working*. Melbourne: Business Council of Australia.
- Bryson, Alex. 2004. "Unions and Workplace Closure in Britain, 1990–1998." *British Journal of Industrial Relations*, Vol. 42, No. 2 (June), pp. 283–302.
- Callus, Ron, Alison Morehead, Mark Cully, and John Buchanan. 1991. *Industrial Relations at Work: The Australian Workplace Industrial Relations Survey*. Canberra: Australian Government Publishing Service.
- Colombo, Massimo, and Marco Delmastro. 2001. "Technology Use and Plant Closure." *Research Policy*, Vol. 30, No. 1, pp. 21–34.
- Cooke, William, and David G. Meyer. 1990. "Structural and Market Predictors of Corporate Labor Relations Strategies." *Industrial and Labor Relations Review*, Vol. 43, No. 2 (January), pp. 280–93.
- Cressey, Peter, John Eldridge, and John MacInnes. 1985. *Just Managing: Authority and Democracy in Industry*. Philadelphia: Open University Press.
- Creighton, Breen, and Andrew Stewart. 2000. *Labour Law: An Introduction* (3rd ed.). Sydney: Federation Press.
- Deery, Stephen, Gerry Griffin, Michelle Brown, and Peter Dowling. 1986. "The Labour Market Experiences of Redundant Workers: A Study of a Plant Closure." *Australian Bulletin of Labour*, Vol. 12, No. 3, pp. 173–94.
- Deery, Stephen, David Plowman, Janet Walsh, and Michelle Brown. 2001. *Industrial Relations: A Contemporary Analysis* (2nd ed.). Sydney: McGraw-Hill.
- DiNardo, John, and David S. Lee. 2002. "The Impact of Unionization on Establishment Closure: A Regression Discontinuity Analysis of Representation Elections." National Bureau of Economic Research

- Working Paper 8993, June.
- Doucoulagos, Christos, and Patrice Laroche. 2003. "What Do Unions Do to Productivity? A Meta-Analysis." *Industrial Relations*, Vol. 42, No. 4 (October), pp. 650-91.
- Drago, Robert, and John S. Heywood. 1995. "The Choice of Payment Systems: Australian Establishment Data." *Industrial Relations*, Vol. 34, No. 4 (October), pp. 507-31.
- Dunne, Timothy, and David A. Macpherson. 1994. "Unionism and Gross Employment Flows." *Southern Economic Journal*, Vol. 60, No. 3 (January), pp. 727-38.
- Dunne, Timothy, Mark J. Roberts, and Larry Samuelson. 1989. "The Growth and Failure of U.S. Manufacturing Plants." *Quarterly Journal of Economics*, Vol. 104, No. 4 (November), pp. 671-98.
- Fallick, Bruce C., and Kevin Hassett. 1999. "Investment and Union Certification." *Journal of Labor Economics*, Vol. 17, No. 3 (July), pp. 570-82.
- Fernie, Sue, and David Metcalf. 1995. "Participation, Contingent Pay, Representation, and Workplace Performance: Evidence from Great Britain." *British Journal of Industrial Relations*, Vol. 33, No. 2 (June), pp. 379-415.
- Freeman, Richard B., and Morris M. Kleiner. 1999. "Do Unions Make Enterprises Insolvent?" *Industrial and Labor Relations Review*, Vol. 52, No. 4 (July), pp. 510-27.
- Freeman, Richard B., and Edward P. Lazear. 1995. "An Economic Analysis of Works Councils." In Joel Rogers and Wolfgang Streeck, eds., *Works Councils: Consultation, Representation, and Cooperation in Industrial Relations*. Chicago: University of Chicago Press, pp. 27-50.
- Freeman, Richard B., and James L. Medoff. 1984. *What Do Unions Do?* New York: Basic Books.
- Gaskins, Darius. 1971. "Dynamic Limit Pricing: Optimal Pricing under the Threat of Entry." *Journal of Economic Theory*, Vol. 2, pp. 306-22.
- Gerhart, Paul. 1987. *Saving Plants and Jobs: Union Management Negotiations in the Context of Threatened Plant Closing*. Kalamazoo, Mich.: W.E. Upjohn Institute for Employment Research.
- Gibson, John K., and Richard I.D. Harris. 1996. "Trade Liberalisation and Plant Exit in new Zealand Manufacturing." *Review of Economics and Statistics*, Vol. 78, No. 3, pp. 521-29.
- H. R. Nicholls Society. "Arbitration in Contempt." Proceedings of the Inaugural Seminar of the HR Nicholls Society (Melbourne, February 28 to March 2, 1986). Melbourne: The Society.
- Heckman, James J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica*, Vol. 47, No. 1 (January), pp. 153-61.
- Heywood, John S., W. Stanley Siebert, and Xiangdong Wei. 1997. "Payment by Results Systems: British Evidence." *British Journal of Industrial Relations*, Vol. 35, No. 1 (March), pp. 1-22.
- Hirsch, Barry T. 1991. *Labor Unions and the Economic Performance of Firms*. Kalamazoo, Mich.: W.E. Upjohn Institute for Employment Research.
- _____. 2004. "What Do Unions Do for Economic Performance?" *Journal of Labor Research*, Vol. 25, No. 3 (Summer), pp. 417-55.
- Kato, Takao, and Motohiro Morishima. 2002. "The Productivity Effects of Participatory Employment Practices: Evidence from a New Japanese Panel Data." *Industrial Relations*, Vol. 41, No. 4 (October), pp. 487-521.
- Kelly, Diane. 1990. "Defining the 'Workplace' in Workplace Industrial Relations." ACIRRT Working Paper #4, University of Sydney, July.
- Kirkham, Janet, Suzanne Richbell, and Doug Watts. 1998. "Downsizing and Facility Location: Plant Closures in Multiplant Manufacturing Firms." *Management Decision*, Vol. 36, No. 3, pp. 189-97.
- _____. 1999. "Manpower Factors and Plant Closures in Multiplant Firms." *International Journal of Manpower*, Vol. 20, No. 7, pp. 458-68.
- Kochan, Thomas A., Harry C. Katz, and Robert B. McKersie. 1994. *The Transformation of American Industrial Relations*. Ithaca, N.Y.: ILR Press.
- Lazear, Edward P. 1983. "A Competitive Theory of Monopoly Unionism." *American Economic Review*, Vol. 73, No. 4 (September), pp. 631-43.
- Leonard, Jonathan. 1992. "Unions and Employment Growth." *Industrial Relations*, Vol. 31, No. 1 (Winter), pp. 80-94.
- Linneman, Peter D., Michael L. Wachter, and William H. Carter. 1990. "Evaluating the Evidence on Union Employment and Wages." *Industrial and Labor Relations Review*, Vol. 44, No. 1 (October), pp. 34-53.
- Loundes, Joanne. 2000. "Management and Industrial Relations Practices and Outcomes in Australian Workplaces." *Australian Journal of Labour Economics*, Vol. 4, No. 1 (March), pp. 19-39.
- Machin, Stephen. 1995. "Plant Closures and Unionization in British Establishments." *British Journal of Industrial Relations*, Vol. 33 (March), pp. 55-68.
- Martin, Donald. 1980. *An Ownership Theory of the Trade Union*. Berkeley: University of California Press.
- Menezes-Filho, Naercio A. 1997. "Unions and Profitability over the 1980s: Some Empirical Evidence on Union-Firm Bargaining in the U.K." *Economic Journal*, Vol. 107 (May), pp. 651-70.
- Meyer, David G., and William Cooke. 1993. "U.S. Labor Relations in Transition—Emerging Strategies and Company Performance." *British Journal of Industrial Relations*, Vol. 31, No. 4 (December), pp. 531-52.
- Milgrom, Paul, and John Roberts. 1982. "Limit Pricing and Entry under Incomplete Information: An Equilibrium Analysis." *Econometrica*, Vol. 50, No. 2 (March), pp. 443-60.
- Miller, Paul, and Charles Mulvey. 1993. "What Do Australian Unions Do?" *Economic Record*, Vol. 69 (September), pp. 315-42.
- Morehead, Alison, Mari Steele, Michael Alexander, Kerry Stephen, and Linton Duffin. 1997. *Changes at Work: the 1995 Australian Workplace Industrial Relations Survey*. Sydney: Longman.
- Nunnally, Jum C. 1978. *Psychometric Theory* (2nd ed.). New York: McGraw-Hill.

- Reynolds, Stanley S. 1988. "Plant Closings and Exit Behaviour in Declining Industries." *Economica*, Vol. 55, No. 220, pp. 493–503.
- Stewart, Mark B. 1995. "Union Wage Differentials in an Era of Declining Unionization." *Oxford Bulletin of Economics and Statistics*, Vol. 57 (May), pp. 143–67.
- Taylor, Vic G., and Dianne Yerbury. 1986. "Redundancy Provisions: Reform from within the Existing System." In Richard Blandy and John Niland, eds., *Alternatives to Arbitration*. Sydney: Allen & Unwin Australia.
- Waring, Peter. 1999. "The Rise of Individualism in Australian Industrial Relations." *New Zealand Journal of Industrial Relations*, Vol. 24 (October), pp. 291–318.
- Whinston, Michael D. 1988. "Exit with Multiplant Firms." *Rand Journal of Economics*, Vol. 19, No. 4, pp. 568–88.
- Wooden, Mark. 2000. *The Transformation of Australian Industrial Relations*. Sydney: Foundation Press.
- _____. 2001. "Union Wage Effects in the Presence of Enterprise Bargaining." *Economic Record*, Vol. 77 (March), pp. 1–18.
- Wooden, Mark, and Jeffrey Balchin. 1993. "Unionization in Australia: Evidence from the AWIRS." *Economic Record*, Vol. 69 (Sept.), pp. 305–14.
- Wooden, Mark, and Anne Hawke. 2000. "Unions and Employment Growth: Panel Data Evidence." *Industrial Relations*, Vol. 39, No. 1 (January), pp. 88–107.