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Do payroll tax cuts for Australian firms affect their use of capital and labor?

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Abstract

This paper studies the effects of increases in payroll tax thresholds on wages, employment and capital expenditure in Australia. We use data from the Business Longitudinal Analysis Data Environment (BLADE) and employ a difference-in-differences approach to determine the effect of state-level changes in payroll tax thresholds. Our findings indicate that the effects of numerous increases in state-level payroll tax thresholds between 2006 and 2015, which reduced tax rates from around six to zero percent for small businesses, were insignificant. Our estimates provide no evidence in favor of the hypothesis that a lower payroll tax burden increases wages, employment or capital expenditure. Our results are robust with regards to a range of Placebo tests and sample restrictions.

JEL Codes: H25, H32, J23, J30.
Keywords: Business taxation, tax reform, labor demand, wage level, capital expenditure, difference-in-difference estimation

∗The results of this study are based, in part, on Australian Taxation Office (ATO) data supplied by the Registrar to the Australian Bureau of Statistics (ABS) under A New Tax System (Australian Business Number) Act 1999 and tax data supplied by the ATO to the ABS under the Taxation Administration Act 1953. These require that such data is only used for the purpose of carrying out functions of the ABS. No individual information collected under the Census and Statistics Act 1905 is provided back to the Registrar or the ATO for administrative or regulatory purposes. Any discussion of data limitations or weaknesses is in the context of using the data for statistical purposes, and is not related to the ability of the data to support the ABS's core operational requirements. Legislative requirements to ensure privacy and secrecy of this data have been followed. Only people authorized under the Australian Bureau of Statistics Act 1975 have been allowed to view data about any particular firm in conducting these analyses. In accordance with the Census and Statistics Act 1905, results have been confidentialized used to ensure that they are not likely to enable identification of a particular person or organization. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Australian Government. The authors are grateful to Syed Hasan for outstanding research assistance. All correspondence to Mathias Sinning, Crawford School of Public Policy, College of Asia and the Pacific, JG Crawford Building #132, Lennox Crossing, Australian National University, Canberra ACT 2601, E-mail: mathias.sinning@anu.edu.au.

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1 Introduction

Businesses in Australia have to pay payroll taxes if their payroll – the total amount of wages and salaries – exceeds a certain threshold. From a legal perspective, they bear the *statutory burden* of the tax because they have to transfer money to the tax office. However, it is less clear if they also bear the *economic burden*. Economists often argue that businesses shift the economic burden of payroll taxes by spending less on capital and labor. The ability of businesses to shift the burden of payroll taxes depends on the elasticities of demand and supply in capital and labor markets (Gruber, 2016). Unfortunately, these elasticities are generally unknown and empirical evidence on this issue is relatively scarce.

This paper generates evidence on the effect of payroll taxes on the payment of wages and salaries, employment and capital expenditure of businesses in Australia. We make use of a firm level data source, the Business Longitudinal Analysis Data Environment (BLADE), and exploit variation in payroll tax thresholds across states and changes over time to estimate our parameters of interest. Due to the nature of the observed reforms, our analysis focuses on the extent to which a lower payroll tax burden affects these outcomes. Understanding the link between payroll tax cuts and the use of capital and labor has important implications for the design of payroll taxes in Australia.

Payroll tax is the most important state tax in terms of revenue collection (leaving aside the Goods and Services Tax). The total payroll tax revenue in the Financial Year 2016-17 amounted to $23.1bn, or 28.2 percent of the total tax revenue of the states.[1] The payroll tax is assessed on wages paid by an employer to its employees, when the total wage bill of an employer exceeds a certain threshold.[2] Wages and salaries comprise most forms of employee benefits, including commissions, bonuses and fringe benefits, although there are differences in the definitions across the states.

The payroll tax is affected by interstate competition, which has led to increases in tax thresholds, lower rates and special exemptions (Stewart et al., 2015). The Commonwealth government, local governments, religious institutions and non-profit organizations

[1] `http://www.abs.gov.au/ausstats/abs@.nsf/mf/5506.0`.

[2] `https://www.payrolltax.gov.au/`.

in education, health and welfare are generally exempt from the payroll tax. Moreover, the tax thresholds exempt a significant proportion of businesses from the base. For instance, around 90 per cent of businesses in New South Wales (NSW) were exempt from payroll tax in the Financial Year 2008-09 (IPART, 2008). With a flat marginal payroll tax rate above the exemption threshold, the Australian Capital Territory (ACT) currently has the highest payroll tax rate and threshold in Australia. Queensland has the lowest rate, and the threshold is lowest in Victoria. The payroll tax rates and exemption thresholds are presented in Table 1.

[Table 1 about here.]

Being able to set their own payroll tax rates and thresholds has given the states the opportunity to adjust the tax to their needs, taking into account factors such as industrial structure and revenue needs. However, allowing the states to design their own tax has also led to more complexity, e.g., for businesses operating in more than one state. To address this issue, the states have worked on the harmonization of tax arrangements (Henry et al., 2009) but these efforts did not lead to an alignment of payroll tax rates and exemption thresholds.

Our paper contributes to the literature in several respects. Firstly, we exploit variation across states and over time to estimate the effects of increases in payroll tax thresholds on wages, employment and capital expenditure.[3] We use a difference-in-difference approach to isolate the effect of changes in payroll tax thresholds from other factors. Secondly, we make use of a new data source that allows us to study the effects of payroll taxes at a business level. The Australian BLADE is the first longitudinal database of Australian businesses that permits the estimation of the effects of payroll taxes in Australia at a micro level. Thirdly, we perform a range of Placebo tests and impose various sample restrictions to test the validity of our results.

Our findings indicate that numerous increases in state-level payroll tax thresholds between 2006 and 2015, which reduced tax rates from around six to zero percent, had

[3]We do not study the effect of changes in payroll tax rates because these changes were comparatively small (see Table 1).

no significant effect on our outcome measures. We conclude that our estimates provide no evidence in favor of the hypothesis that a lower payroll tax burden increases wages, employment or capital expenditure. We demonstrate that our results are robust with regards to a range of Placebo tests and sample restrictions.

The remainder of the paper is structured as follows. Section 2 provides a brief overview of the related literature and outlines the theoretical predictions that we use to motivate our analysis. We describe the data in Section 3 and explain our empirical strategy in Section 4. Section 5 discusses our empirical findings. Section 6 concludes.

2 Related literature

From a theoretical perspective, payroll taxes may reduce the after-tax income of workers, leaving them with less money to buy goods and services. Payroll taxes are often viewed as a tax on labor income or, equivalently, as a tax on the consumption of goods and services. In theory, a tax on goods and services and a payroll tax should therefore have similar effects on the incentive to work because both reduce the goods and services that can be purchased through working (Henry et al., 2009).

The overall impact of payroll taxes on the labor market is ambiguous from a theoretical standpoint. On one hand, when workers value the benefits paid for with payroll taxes as much as the amount they contribute, increases in payroll taxes are fully passed through from companies to employees in the form of lower salaries, without any effect on employment. Thus, companies do not experience any increase in their overall labor costs. On the other hand, if wages are not fully flexible or if payroll taxes do not directly benefit all employees, then wages do not fully absorb the payroll tax, leading to higher labor costs and lower employment (Kugler et al., 2017).

The debate about whether labor or capital bears the burden of payroll tax depends on the labor supply elasticity – the degree of responsiveness of labor to a change in the wage rate. If labor is fixed in supply (or if the labor supply elasticity is zero), then labor will bear the full burden of the payroll tax. Conversely, if labor supply is very responsive to a change in the wage rate, then the tax burden will be shifted elsewhere (Kugler and

Kugler, 2002; Alm and López-Castano, 2005).

Based on this, it is possible that businesses may alter their capital expenditure as a result of payroll taxes. Increasing the payroll tax burden may induce businesses to switch to more labor-saving capital, thereby negatively affecting the labor market (Symons and Robertson, 1990). At the same time, higher production costs may reduce all forms of investment, especially if there is not much substitutability between capital and labor.

The incidence of payroll taxes may also depend on whether the tax is imposed on the employer or the employee. For example, Dahlby and Wilson (2003) investigate vertical fiscal externality in a federation in which the taxes or expenditures of one level of government affect the budget constraint of another level of government. They show that, if the demand for labor is inelastic, the vertical fiscal externality with ad valorem payroll taxes is always negative when taxes are levied on employers, while the effect is positive when taxes are levied on employees. The reason for the difference is that when the tax is levied on the employee, the federal wage tax base includes the state's wage tax. The federal wage tax base excludes state's tax revenues if payroll taxes are levied on the employer.

However, with binding wage floors in place, payroll taxes paid by the employer cannot be passed on to minimum wage workers by lowering their pay. If minimum wages misalign labor costs and worker productivity, such taxes may result in lower employment for the groups concerned (Immervoll, 2005).[4]

Empirical evidence on the effects of payroll taxes has produced mixed results. Bennmarker et al. (2009) evaluate the effects of a 10 percentage point reduction in the payroll tax introduced in 2002 in northern Sweden and find that the average wage increases by about 0.25 percent in response to a one-percentage point reduction in the tax rate, while employment effects are insignificant. The effect on wages is also no longer significant when the entry and exit of firms are taken into account.

Much of the empirical work in developed countries concludes that labor supply is almost completely inelastic, so the usual assumption made is that labor bears the full

[4]Thus it is not surprising that Melguizo and González-Páramo (2013), based on a meta-analysis of 52 empirical studies, find that economic institutions significantly affect the incidence of the tax burden. They also find that a significant part of the variability of findings remains unexplained even after controlling for a large number of factors in the model. The work of Nickell (1997) confirms that labor market rigidities can affect employment.

burden of any payroll tax (Alm and López-Castano, 2005). However, if wages can increase flexibly but have downward rigidity, there could be full shifting in response to a reduction in payroll taxes but not in response to a large increase (Kugler and Kugler, 2002). In some countries, minimum wages are relatively high and constitute a binding restriction on formal sector employment and increases in payroll taxes may reduce formal employment.

Egebark and Kaunitz (2013) examine the effect of a large-scale cut of Swedish employer-paid payroll tax for young workers in 2007 that substantially reduced labor costs. They find small effects on employment and wages and they conclude that the payroll tax cut is not an efficient way to boost youth employment because the estimated tax revenue loss could have been used to hire four times as many workers at an average wage than were actually hired in response to the reform. In a similar setting, Egebark and Kaunitz (2014) find no effect of the payroll tax reduction on hours worked. Egebark and Kaunitz (2017) show that the lower costs induced by the reduced taxes in Sweden have no impact on exit rates from formal employment or profitability. They also find negligible effects on gross investments, and negative, but not statistically significant, effects on labor productivity.

Korkeamäki (2011) evaluates the effects of a regional experiment that reduced payroll taxes by 3-6 percentage points in Northern and Eastern Finland. By comparing employment and wage changes before and after the experiment to a control region, they find that the reduction in payroll taxes has no effect on employment, payroll, profits, hourly pay and monthly hours worked.

Some empirical studies confirm that payroll taxes also affect employment and wages in developing countries. Kugler and Kugler (2009) find that manufacturing employment reduces by 5 percent among the least skilled workers as a result of a 10 percent increase in payroll tax rates in Colombia. Kugler et al. (2017) find that a payroll tax reduction in Colombia led to an increase in formal employment and an increase in the likelihood of transitioning into registered employment. Gruber (1997) finds that a reduction in payroll taxes in Chile is completely passed through to employees in the form of higher wages, without an impact on employment.

Empirical evidence on payroll taxes in Australia is limited. Dixon et al. (2004) estimate the deadweight loss of a payroll tax and find that the deadweight loss in Victoria is

about 10 percent of the size of the payroll tax collections. They conclude that the payroll tax also affects the number of employees. Freebairn (2002) finds that the combination of high payroll tax rates with exemptions generates a large deadweight loss and concludes that important efficiency gains can come from broadening tax bases and reducing rates. Ralston (2018) uses data from the BLADE and finds that firms generally do not bunch below the payroll tax threshold. He also shows that firms generally do not attempt to avoid paying payroll taxes by hiring contractors.

Against this background, we contribute to the literature by studying the effects of payroll tax cuts on wages, employment and capital expenditure. While economic theory suggests that payroll tax cuts may lead to increases in some of these outcomes, it remains unclear how large the effects are and which outcomes are affected the most. The effects of payroll tax cuts on labor market outcomes are particularly relevant for state revenues because wages and employment are integral parts of the payroll tax base.

3 Data

We use data from the Business Longitudinal Analysis Data Environment (BLADE) of the Australian Bureau of Statistics (ABS). BLADE is a series of integrated, linked longitudinal datasets over the period 2000-01 to 2015-16.[5] The data resource combines data from ABS surveys with administrative records from the Australian Taxation Office (ATO) and the Department of Industry, Innovation and Science. We received access to a limited set of variables after going through a formal approval process. A complete list of variables that we could use for our analysis is provided in Appendix-Table A.1.

We restrict our sample to the period 2006 to 2015 because we observe no payroll information before 2006. Moreover, we focus on employers in the private sector with at least one full time equivalent (FTE) and a payroll of at least $100,000. After imposing these sample restrictions, our sample includes 2,430,954 firm-year observations over the period 2006 to 2015. Because changes in payroll tax thresholds only affect small firms, we also remove 74,816 large firm observations (about 2% of the sample) with a

[5]For simplicity, we will refer to these years as 2000 to 2015 from hereon.

payroll above $5,000,000, which reduces our final analysis sample to 2,356,138 firm-year observations.

Table 2 includes descriptive statistics for our outcome variables. The average payroll of a firm in our full analysis sample is about $488,000, while the median is only $251,000, indicating that a considerable fraction of firms in our sample is rather small. We observe employment of 10.0 FTE on average and of 5.3 FTE at the median. Only a small fraction of firms employ a large number of employees. We also find that the distribution of capital expenditure is very skewed, with an average of about $134,000 and a median of about $2,600. Table 2 also contains the corresponding numbers for alternative sub-samples, which we will use in our analysis to account for the possibility that firms may have been affected by threshold changes even though their payroll was above or below the relevant tax thresholds. Our preferred sub-sample is the sample of firms with a payroll between $500,000 and $2 million because these firms were most likely affected by changes in payroll tax thresholds, which varied from $504,000 to $1,850,000 over the sample period.

[Table 2 about here.]

It is useful to consider variation in our outcome measures across states and over time. We do this for the sub-sample of firms with a payroll between $500,000 and $2,000,000. Figure 1 shows how the changes in outcome measures between two points in time differ across states. The corresponding means and standard deviations are presented in Appendix-Table A.2. The circles in Figure 1 represent changes over time, with changes reported in year t ($t = 2007, \ldots, 2015$) referring to changes between $t-1$ and t. Moreover, the dark and light grey circles in Figure 1 depict treatment and control states, respectively.[6] The size of the circles varies because the changes were weighted by the underlying sample size of each state in year t.

Figure 1 provides no clear evidence of a treatment effect on our outcome measures. We do observe that payroll changes in treatment states are slightly higher than payroll

[6]Treatment assignment may change over time. The definition of treatment states is based on the shaded values in Panel B of Table 1.

changes in control states in 2007, and FTE changes in treatment states are less negative in 2009 than FTE changes in control states. However, we also observe a few cases in which changes in treatment states are lower than the corresponding changes in control states (such as payroll changes in 2009 and capital expenditure changes in 2007). Overall, the raw data do not confirm the hypothesis that higher payroll tax thresholds lead to increases in wages, employment or capital expenditure.

[Figure 1 about here.]

Before studying the effects of changes in payroll tax thresholds, we examine whether firms actively try to avoid the tax by bunching below these thresholds. This behavior would not only imply that payroll taxes have adverse effects on firms, but it would also make it more difficult to study the effects of changes in payroll tax thresholds. Figure 2 presents payroll distributions and payroll tax thresholds by state in 2015. Bunching would imply that a considerable number of firms would stay just below the payroll tax threshold in order to avoid the tax. In the case of bunching, we would expect to see an unusually large fraction of firms immediately below the payroll tax threshold, and a correspondingly small fraction above the threshold.

[Figure 2 about here.]

Figure 2 provides no evidence of bunching below the payroll tax threshold in 2015 because there is no discontinuity in the observed fraction of firms around the payroll tax threshold. Instead, the fraction of firms around the threshold declines continuously along the payroll distribution in all states and territories, indicating that our analysis is not affected by behavioral responses to the tax threshold. This result is consistent with a more detailed analysis of Ralston (2018), which concludes that, with a few exceptions, firms in Australia generally do not bunch below the payroll tax threshold. The result justifies the use of a difference-in-difference estimator, which is based on a comparison of changes in wages, employment and capital expenditure of firms that experienced a threshold change and firms that did not.

4 Empirical Strategy

Our empirical analysis exploits variation in payroll tax thresholds across states and over time. Our starting point is a pooled regression model, which is used to examine the link between changes in payroll tax thresholds and our outcome measures. Specifically, we estimate a pooled regression model of the following form:

$$\log(y_{jst}) = \beta_0 + \beta_1 Treatment_{st} + \theta_d + \lambda_s + \phi_t + u_{jst}, \quad (1)$$

$$j = 1, \ldots n, \quad s = 1, 2, \ldots, 8, \quad t = 0, 1, 2, \ldots, 10,$$

where y_{jst} is the outcome measure of firm j in state s at time t. Our analysis uses data from eight Australian states and territories over a ten-year period (2006 to 2015). We consider three outcome measures: (i) the total amount of wages and salaries paid by a firm in a given year (in the following, we refer to this measure as the "payroll", which constitutes the tax base of payroll taxation), (ii) the full-time equivalent (FTE) of workers employed by a firm in a given year, and (iii) the capital expenditure of a firm in a given year.

$Treatment_{st}$ is an indicator variable that takes on the value 1 if the payroll tax threshold in a given state has changed compared to the previous year (the shaded values in Panel B of Table 1), and 0 if the payroll tax threshold has stayed the same. θ_d includes division fixed effects that account for time-invariant differences between divisions, such as structural differences between service and manufacturing sectors that do not change over time. λ_s denotes state fixed effects that pick up state-specific characteristics that do not change over time, such as location, natural resources, etc. ϕ_t includes year fixed effects, which capture changes that affect all firms simultaneously, such as inflation, changes in overall economic conditions, etc. β_0 and β_1 are model parameters and u_{jst} is the model error term. We are particularly interested in estimating β_1 because it measures the effect of a change in the payroll tax threshold on the change in one of our outcome variables if the error term is uncorrelated with treatment assignment.

We impose several sample restrictions. We consider a payroll interval of between

$100,000 to $5 million, which we gradually narrow down to $500,000 to $2 million to study the impact of alternative sample restrictions. We are mainly interested in firms with a payroll between $500,000 and $2 million because many firms within that interval are likely to be affected by changes in payroll tax thresholds, which range from $504,000 to $1,850,000 over the sample period. Moreover, we compare a sample that includes cases in which tax rate changes take place ("unrestricted sample") to a sample that excludes these cases ("restricted sample"). We prefer the restricted sample because it allows us to isolate the effects of threshold changes from the effects of rate changes. The shaded values in Panel A of Table 1 indicate years in which tax rate changes took place. These years were removed from the restricted sample used in our analysis of threshold changes.

In addition to the pooled model regression model specified above, we also estimate a standard difference-in-difference model based on data from two consecutive years to ascertain the effects of changes in payroll tax thresholds:

$$\log(y_{jst}) = \gamma_0 + \gamma_1 Treatment_s \times After_t + \gamma_2 After_t + \theta_d + \lambda_s + v_{jst}, \qquad (2)$$

$$j = 1, \ldots n, \quad s = 1, 2, \ldots, 8, \quad t = 0, 1,$$

where y_{jst} is one of our outcome measures (see Equation (1) for details), $Treatment_s$ indicates a change in the payroll tax threshold in a given state compared to the previous year (the shaded values in Panel B of Table 1), and $After_t$ indicates the period after the threshold change. θ_d includes division fixed effects that account for time-invariant differences between divisions and λ_s denotes state fixed effects that capture time-invariant state-specific characteristics. γ_0, γ_1 and γ_2 are model parameters and v_{jst} is the model error term. The difference-in-differences approach relies on the assumption that there are no temporary changes that have differential effects on the states, such as temporary state-level economic fluctuations. If the assumption holds, then the parameter γ_1 measures the causal effect of a change in the payroll tax threshold on one of our outcome measures.

Similar to Equation (1), we estimate the difference-in-difference model using alternative sample restrictions. We start with a broad payroll interval of $100,000 to $5 million and we study the impact of using alternative sample restrictions by gradually narrowing

the interval to $500,000 and $2 million. We also consider a sample that includes cases in which tax rate changes take place ("unrestricted sample") and a sample that does not include these cases ("restricted sample").

5 Results

Table 3 summarizes the results of our pooled regression analysis based on Equation (1). The tables show the effects of reducing the payroll tax threshold on our outcome measures for various samples. Columns (1) to (3) include the estimates of the unrestricted sample. The estimates of the restricted sample are presented in Columns (4) to (6). The results in Panel A of Table 3 are based on the sample including firms with a payroll of between $100,000 and $5 million, and Panels B through F include the results of more restrictive payroll intervals.

The numbers in Table 3 indicate that, with the exception of the samples including firms with a payroll above $300,000 (but not including firms with a payroll above $100,000), the effects of increasing the payroll tax threshold are not statistically significant at conventional levels. Even within the samples including firms with a payroll above $300,000 (Panels B and E), we only observe effects on employment, while the effects on total wages (the payroll) and capital expenditure are insignificant. Our preferred estimates presented in Panel F indicate that increases in payroll tax thresholds did not affect our outcome measures.

[Table 3 about here.]

The coefficients presented in Table 3 measure the link between variation in tax thresholds and variation in outcome measures over the entire sample period 2005 to 2015. The results may be interpreted as causal under the assumption that the threshold changes are uncorrelated with the unobserved variation in outcomes captured by the model error term. We relax this assumption by estimating a difference-in-differences model, which still requires that that there are no systematic differences in temporary fluctuations in outcome variables over time.

Empirical studies usually examine whether outcome measures in different states follow a common trend during the period before a policy intervention. Unfortunately, we do not observe longer periods without changes in payroll tax thresholds that would allow us to verify whether treatment and control states are comparable because they follow a common trend. However, we can exploit the absence of changes in payroll tax thresholds in 2008 and 2011. We can use these two years to obtain 'Placebo' estimates to confirm whether our difference-in-differences models produce reliable results. For example, suppose we are interested in estimating a difference-in-differences model to examine the effect of threshold changes in treatment states on our outcome variables for the years 2012/2013. Then our Placebo estimates are based on moving the 2012/2013 model back in time by estimating the same model using data for the years 2007/2008 and 2010/2011. Because there were no threshold changes in 2008 and 2011, we would expect that the Placebo estimates show no effects. Therefore, we can use the Placebo estimates to test the validity of our model.

We observe numerous threshold changes over our sample period, which allows us to estimate a large number of difference-in-differences models for various sample restrictions. For each of these models, we can ask two questions. Firstly, do we conclude from our Placebo estimates that our difference-in-difference models pick up a treatment effect or something else? And secondly, are the treatment effects that are supported by Placebo estimates statistically significant?

Table 4 reports the p-values associated with our treatment effects estimates for the unrestricted model. The shaded p-values in Table 4 are supported by the Placebo estimates (which are presented in Appendix-Tables A.3 and A.4). The darker shades indicate statistical significance at a 5% level, i.e. $p < 0.05$, of values that are supported by the Placebo estimates. There are only a few cases in which we observe significant effects that are supported by the Placebo estimates and most of them are negative. The only significantly positive effect is the effect on the payroll in 2007, which confirms the pattern observed in the raw data (Figure 1).[7]

[Table 4 about here.]

[7]Similar to Figure 1, estimates reported in year t ($t = 2007, \ldots, 2015$) refer to changes between $t-1$ and t.

The picture changes somewhat if we exclude tax rate changes from our sample. The numbers in Table 5 (Panels A to E) indicate that tax threshold increases led to a significant increase in capital expenditure, either in 2009 or in 2013. However, we do not observe a significant treatment effect for our core sample (Panel F), suggesting that these effects are either driven by relatively small firms with a payroll between $100,000 and $500,000 or by relatively large firms with a payroll between $2 and $5 million. Many of these firms were probably not affected by tax threshold increases, which varied from $504,000 to $1,850,000. We also obtain negative estimates on capital expenditure in 2015, suggesting that factors other than payroll taxation may have driven capital expenditure of both relatively small (Panels A and D) and relatively large firms (Panel A).

[Table 5 about here.]

Turning to the effects on labor market outcomes, we observe both positive and negative effects on the payroll, and no positive employment effects (the only significant effect on FTE is negative). The positive effect on the payroll in 2007 is consistent with the differences observed in Figure 1. Taken together, the estimates in Tables 3 to 5 provide no evidence to support the hypothesis that a lower payroll tax burden leads to increases in wages, employment or capital expenditure.

6 Conclusions

This paper provides evidence on the effects of payroll tax cuts on wages, employment and capital expenditure in Australia. We use data from the newly available Business Longitudinal Analysis Data Environment (BLADE), the most comprehensive firm-level data source in Australia, in combination with differences-in-differences estimation, to obtain the effects of increases in state-level payroll tax thresholds between 2006 and 2015 on capital and labor market outcomes.

We find no evidence in favor of the hypothesis that businesses alter their use of capital and labor in response to payroll tax cuts. Our difference-in-differences estimates are based on the assumption that there are no systematic differences in temporary fluctu-

ations in capital and labor market outcomes over time. We perform robustness checks to ensure that our estimates are robust with regards to a range of sample restrictions and Placebo tests. Our findings are consistent with empirical findings generated in other developed economies but inconsistent with the largely theory-driven work produced in the Australian context.

The evidence presented here is limited because we only observe increases in payroll tax thresholds, which are associated with reductions in payroll tax rates from about six to zero percent for firms within certain payroll intervals. Therefore, we are unable to say how firms would have reacted to payroll tax increases. However, our results indicate that payroll taxes are a more efficient way of collecting tax revenues than often recognized, as we find no measurable effects of payroll tax cuts on capital and labor market outcomes.

Figures and Tables

Table 1: Payroll tax rates and thresholds

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
Panel A. Payroll tax rates (%)								
2006/1	6	5.25	4.75	5.5	5.5	6.1	6.2	6.85
2006/2	6	5.25	4.75	5.5	5.5	6.1	6.2	6.85
2007/1	6	5.25	4.75	5.5	5.5	6.1	6.2	6.85
2007/2	6	5.15	4.75	5.5	5.5	6.1	6.2	6.85
2008/1	6	5.05	4.75	5.5	5.5	6.1	6.2	6.85
2008/2	6	5.05	4.75	5.25	5.5	6.1	6.2	6.85
2009/1	6	5.05	4.75	5.25	5.5	6.1	6.2	6.85
2009/2	6	4.95	4.75	5	5.5	6.1	5.9	6.85
2010/1	5.75	4.95	4.75	5	5.5	6.1	5.9	6.85
2010/2	5.75	4.95	4.75	4.95	5.5	6.1	5.9	6.85
2011/1	5.65	4.95	4.75	4.95	5.5	6.1	5.9	6.85
2011/2	5.5	4.9	4.75	4.95	5.5	6.1	5.9	6.85
2012/1	5.45	4.9	4.75	4.95	5.5	6.1	5.9	6.85
2012/2	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2013/1	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2013/2	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2014/1	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2014/2	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2015/1	5.45	4.9	4.75	4.95	5.5	6.1	5.5	6.85
2015/2	5.45	4.85	4.75	4.95	5.5	6.1	5.5	6.85
Panel B. Payroll tax thresholds ($1,000s)								
2006	600	550	850	504	750	1,010	1,000	1,250
2007	600	550	1,000	504	750	1,010	1,250	1,250
2008	600	550	1,000	504	750	1,010	1,250	1,250
2009	623	550	1,000	552	750	1,010	1,250	1,500
2010	638	550	1,000	600	750	1,010	1,250	1,500
2011	638	550	1,000	600	750	1,010	1,250	1,500
2012	678	550	1,000	600	750	1,010	1,500	1,500
2013	689	550	1,100	600	750	1,250	1,500	1,750
2014	750	550	1,100	600	750	1,250	1,500	1,750
2015	750	550	1,100	600	800	1,250	1,500	1,850

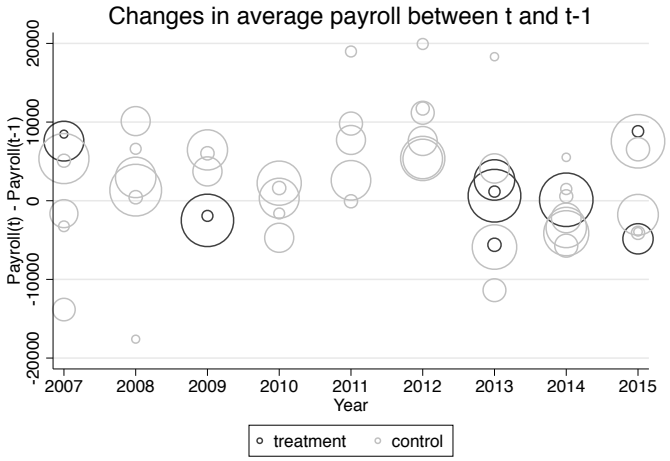
Note: Panel A: Shaded values indicate years in which payroll tax rates changed. These years were removed from the restricted sample used in our analysis of threshold changes. Panel B: Shaded values indicate changes in payroll tax thresholds compared to the previous year.

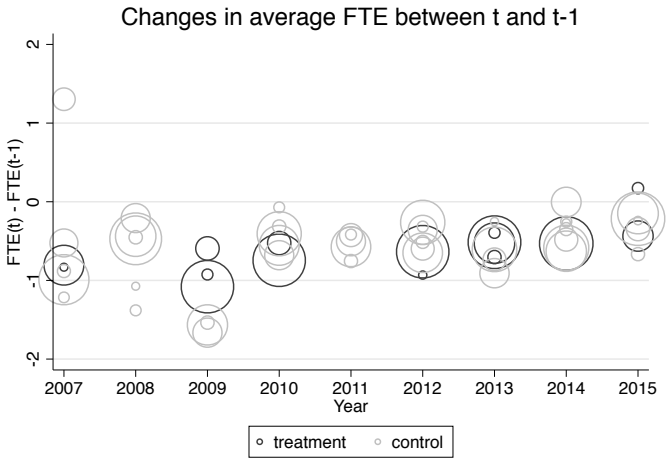
Table 2: Descriptive statistics

	Payroll ($)	Employment (FTE)	Capital expenditure ($)	Payroll ($)	Employment (FTE)	Capital expenditure ($)
	Payroll >$100,000 <$5,000,000			**Payroll >$100,000 <$2,000,000**		
Mean	487,875	10.0	134,220	377,946	7.9	88,369
SD	654,419	31.8	16,700,000	353,201	14.0	5,972,370
p1	101,378	1.1	0	101,304	1.1	0
p10	117,980	2.0	0	117,125	2.0	0
p25	152,780	3.2	0	150,000	3.1	0
p50	250,613	5.3	2,618	239,500	5.1	2,214
p75	505,009	10.5	37,253	454,361	9.5	32,523
p90	1,087,480	21.5	144,078	847,819	17.1	118,814
p99	3,649,826	70.9	1,405,208	1,756,973	38.2	1,014,755
N	2,356,138	2,356,138	2,356,138	2,259,157	2,259,157	2,259,157
	Payroll >$300,000 <$5,000,000			**Payroll >$300,000 <$2,000,000**		
Mean	911,386	18.4	250,979	682,233	14.0	148,979
SD	831,517	47.1	25,000,000	390,608	19.5	7,377,849
p1	303,297	1.5	0	302,982	1.5	0
p10	335,317	5.8	0	331,579	5.6	0
p25	402,767	8.0	0	390,510	7.7	0
p50	583,688	12.0	10,829	537,902	11.1	8,401
p75	1,037,311	20.6	75,027	847,263	17.1	59,949
p90	1,959,729	37.4	287,734	1,292,140	25.8	211,793
p99	4,307,285	89.8	2,503,468	1,892,029	45.5	1,646,374
N	1,001,503	1,001,503	1,001,503	904,522	904,522	904,522
	Payroll >$500,000 <$5,000,000			**Payroll >$500,000 <$2,000,000**		
Mean	1,269,437	25.3	375,251	923,356	18.7	214,377
SD	918,796	59.7	32,500,000	380,253	23.9	9,906,257
p1	504,582	2.2	0	503,829	2.0	0
p10	549,765	9.1	0	541,017	8.7	0
p25	645,335	12.5	0	616,482	11.7	0
p50	905,125	18.0	21,740	800,348	16.0	15,870
p75	1,519,606	29.4	118,497	1,139,395	22.7	87,765
p90	2,605,142	49.0	435,822	1,534,431	31.2	297,959
p99	4,563,931	101.7	3,460,086	1,938,206	50.2	2,189,198
N	595,565	595,565	595,565	498,584	498,584	498,584

Note: Sample of private sector employers with at least 1 FTE.

FIGURE 1: CHANGES IN OUTCOME MEASURES IN TREATMENT AND CONTROL STATES (SAMPLE BASED ON PAYROLL >$500,000 <$2,000,000)





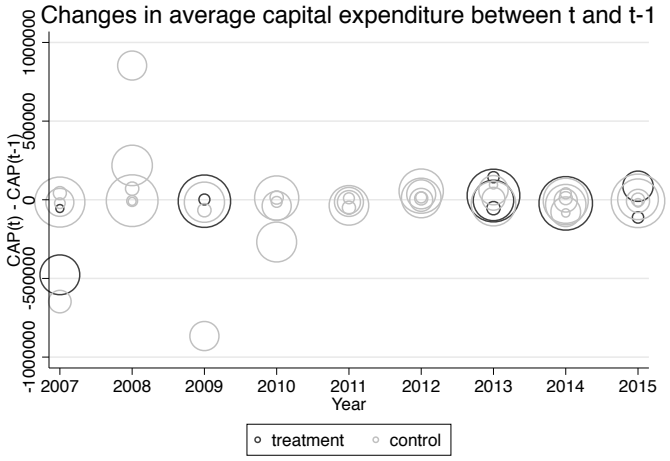


FIGURE 2: PAYROLL DISTRIBUTIONS AND PAYROLL TAX THRESHOLDS, 2015

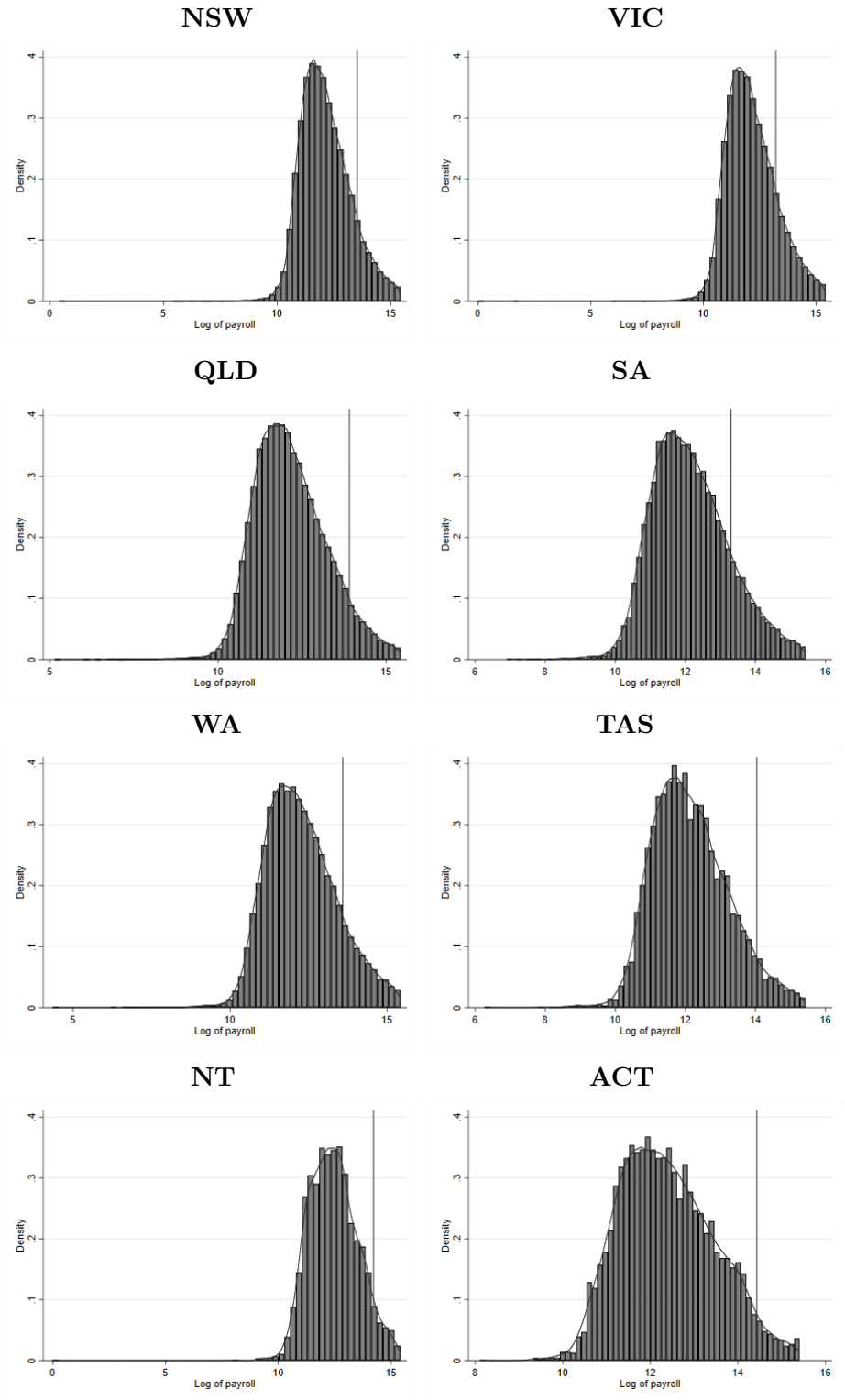


Table 3: Pooled model

	Sample including tax rate changes (Unrestricted sample)			Sample excluding tax rate changes (Restricted sample)		
	Payroll (1)	FTE (2)	Capital expenditure (3)	Payroll (4)	FTE (5)	Capital expenditure (6)
	Panel A. Payroll >$100,000 <$5,000,000					
Coefficient	-0.00113	0.00297	0.02790	-0.00166	0.00265	0.02327
	(0.00299)	(0.00194)	(0.03114)	(0.00384)	(0.00171)	(0.03832)
R^2	0.0306	0.0663	0.0333	0.0315	0.0667	0.0356
N	2,356,138	2,356,138	2,356,138	1,790,035	1,790,035	1,790,035
	Panel B. Payroll >$300,000 <$5,000,000					
Coefficient	0.00072	0.00474***	-0.00949	0.00275	0.00664***	-0.02157
	(0.00124)	(0.00184)	(0.03691)	(0.00183)	(0.00161)	(0.04414)
R^2	0.0249	0.0686	0.0342	0.0265	0.0720	0.0365
N	1,001,968	1,001,968	1,001,968	762,648	762,648	762,648
	Panel C. Payroll >$500,000 <$5,000,000					
Coefficient	-0.00009	0.00363	-0.03383	0.00173	0.00500*	-0.04078
	(0.00245)	(0.00276)	(0.04342)	(0.00306)	(0.00275)	(0.05064)
R^2	0.0217	0.0685	0.0406	0.0233	0.0725	0.0431
N	595,610	595,610	595,610	453,619	453,619	453,619
	Panel D. Payroll >$100,000 <$2,000,000					
Coefficient	-0.00207	0.00226	0.03053	-0.00336	0.00131	0.02392
	(0.00269)	(0.00143)	(0.02932)	(0.00337)	(0.00092)	(0.03688)
R^2	0.0229	0.0803	0.0337	0.0233	0.0804	0.0359
N	2,259,158	2,259,158	2,259,158	1,717,084	1,717,084	1,717,084
	Panel E. Payroll >$300,000 <$2,000,000					
Coefficient	-0.00094	0.00354**	-0.00614	-0.00038	0.00424*	-0.02364
	(0.00103)	(0.00152)	(0.03441)	(0.00191)	(0.00235)	(0.04133)
R^2	0.0144	0.1036	0.0331	0.0151	0.1074	0.0353
N	904,988	904,988	904,988	689,697	689,697	689,697
	Panel F. Payroll >$500,000 <$2,000,000					
Coefficient	-0.00257	0.00175	-0.03137	-0.00223	0.00206	-0.04455
	(0.00157)	(0.00160)	(0.04071)	(0.00219)	(0.00192)	(0.04670)
R^2	0.0101	0.1159	0.0381	0.0109	0.1215	0.0402
N	498,630	498,630	498,630	380,668	380,668	380,668

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

TABLE 4: p-VALUES OF DIFFERENCE-IN-DIFFERENCE ESTIMATES, SAMPLE INCLUDING TAX RATE CHANGES (UNRESTRICTED SAMPLE)

	2007	2009	2010	2012	2013	2014	2015
				Panel A. Payroll >$100,000 <$5,000,000			
Payroll	(+) 0.165	(−) 0.445	(−) 0.068	(−) 0.096	(−) 0.989	(−) 0.533	(−) 0.000
FTE	(−) 0.453	(−) 0.813	(−) 0.019	(+) 0.981	(+) 0.850	(−) 0.327	(−) 0.929
Capital expenditure	(+) 0.047	(+) 0.269	(+) 0.094	(−) 0.527	(+) 0.822	(+) 0.620	(−) 0.000
				Panel B. Payroll >$300,000 <$5,000,000			
Payroll	(+) 0.986	(+) 0.402	(−) 0.403	(−) 0.061	(+) 0.665	(+) 0.176	(−) 0.141
FTE	(−) 0.054	(+) 0.060	(−) 0.673	(−) 0.555	(+) 0.391	(+) 0.696	(+) 0.127
Capital expenditure	(+) 0.577	(+) 0.328	(+) 0.456	(−) 0.149	(+) 0.289	(+) 0.516	(−) 0.000
				Panel C. Payroll >$500,000 <$5,000,000			
Payroll	(+) 0.023	(+) 0.830	(−) 0.008	(−) 0.010	(+) 0.372	(+) 0.271	(−) 0.889
FTE	(+) 0.644	(−) 0.520	(−) 0.388	(−) 0.683	(+) 0.201	(+) 0.406	(+) 0.488
Capital expenditure	(+) 0.807	(+) 0.350	(−) 0.243	(−) 0.215	(+) 0.759	(+) 0.382	(−) 0.003
				Panel D. Payroll >$100,000 <$2,000,000			
Payroll	(+) 0.025	(−) 0.339	(−) 0.204	(−) 0.414	(+) 0.960	(−) 0.327	(−) 0.000
FTE	(−) 0.209	(−) 0.864	(−) 0.049	(+) 0.293	(+) 0.701	(−) 0.251	(−) 0.283
Capital expenditure	(+) 0.013	(+) 0.245	(+) 0.066	(−) 0.609	(+) 0.911	(+) 0.478	(−) 0.000
				Panel E. Payroll >$300,000 <$2,000,000			
Payroll	(+) 0.978	(+) 0.955	(+) 0.922	(−) 0.805	(+) 0.607	(+) 0.042	(−) 0.000
FTE	(−) 0.024	(+) 0.066	(+) 0.990	(+) 0.469	(+) 0.361	(−) 0.520	(+) 0.246
Capital expenditure	(+) 0.281	(+) 0.289	(+) 0.295	(−) 0.159	(+) 0.514	(+) 0.345	(−) 0.000
				Panel F. Payroll >$500,000 <$2,000,000			
Payroll	(+) 0.004	(−) 0.516	(−) 0.563	(−) 0.542	(+) 0.225	(+) 0.001	(−) 0.097
FTE	(+) 0.411	(−) 0.998	(−) 0.860	(+) 0.415	(+) 0.090	(+) 0.815	(+) 0.947
Capital expenditure	(+) 0.359	(+) 0.269	(−) 0.499	(−) 0.341	(−) 0.907	(+) 0.185	(−) 0.089

Note: Shaded values are supported by Placebo estimates. Darker shades indicate significance (p <0.05) of values that are supported by Placebo estimates. All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

TABLE 5: p-VALUES OF DIFFERENCE-IN-DIFFERENCE ESTIMATES, SAMPLE EXCLUDING TAX RATE CHANGES (RESTRICTED SAMPLE)

	2007	2009	2010	2012	2013	2014	2015
Panel A. Payroll >$100,000 <$5,000,000							
Payroll	(+) 0.261	(−) 0.064	–	–	(+) 0.661	(−) 0.533	(−) 0.000
FTE	(−) 0.726	(−) 0.544	–	–	(+) 0.779	(−) 0.327	(+) 0.691
Capital expenditure	(+) 0.062	(+) 0.014	–	–	(+) 0.107	(+) 0.620	(−) 0.000
Panel B. Payroll >$300,000 <$5,000,000							
Payroll	(+) 0.752	(+) 0.915	–	–	(+) 0.971	(+) 0.176	(−) 0.261
FTE	(−) 0.094	(+) 0.103	–	–	(−) 0.672	(+) 0.696	(+) 0.100
Capital expenditure	(+) 0.024	(+) 0.180	–	–	(+) 0.008	(+) 0.516	(−) 0.001
Panel C. Payroll >$500,000 <$5,000,000							
Payroll	(+) 0.002	(−) 0.765	–	–	(+) 0.359	(+) 0.271	(−) 0.824
FTE	(+) 0.118	(−) 0.675	–	–	(+) 0.212	(+) 0.406	(+) 0.505
Capital expenditure	(+) 0.233	(+) 0.281	–	–	(+) 0.035	(+) 0.382	(−) 0.003
Panel D. Payroll >$100,000 <$2,000,000							
Payroll	(+) 0.144	(−) 0.017	–	–	(+) 0.480	(−) 0.327	(−) 0.000
FTE	(−) 0.318	(−) 0.357	–	–	(+) 0.623	(−) 0.251	(−) 0.492
Capital expenditure	(+) 0.044	(+) 0.006	–	–	(+) 0.146	(+) 0.478	(−) 0.001
Panel E. Payroll >$300,000 <$2,000,000							
Payroll	(−) 0.922	(−) 0.167	–	–	(+) 0.821	(+) 0.042	(−) 0.000
FTE	(−) 0.029	(+) 0.442	–	–	(−) 0.525	(−) 0.520	(+) 0.282
Capital expenditure	(+) 0.019	(+) 0.124	–	–	(+) 0.028	(+) 0.345	(−) 0.000
Panel F. Payroll >$500,000 <$2,000,000							
Payroll	(+) 0.023	(−) 0.009	–	–	(+) 0.152	(+) 0.001	(−) 0.133
FTE	(+) 0.339	(−) 0.152	–	–	(+) 0.101	(+) 0.815	(−) 0.939
Capital expenditure	(+) 0.264	(+) 0.199	–	–	(+) 0.134	(+) 0.185	(−) 0.067

Note: Shaded values are supported by Placebo estimates. Darker shades indicate significance (p <0.05) of values that are supported by Placebo estimates. All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

References

Alm, J. and H. López-Castano, "Payroll taxes in Colombia," Andrew Young School of Policy Studies Working Paper 06-36, Georgia State University, Atlanta, USA 2005.

Bennmarker, H., E. Mellander, and B. Öckert, "Do regional payroll tax reductions boost employment?," *Labour Economics*, 2009, *16* (5), 480–489.

Dahlby, B. and L. S. Wilson, "Vertical fiscal externalities in a Federation," *Journal of Public Economics*, 2003, *87* (5), 917–930.

Dixon, P. B., M. R. Picton, and M. T. Rimmer, "Payroll taxes: Thresholds, firm sizes, dead-weight losses and Commonwealth Grants Commission funding," *Economic Record*, 2004, *80* (250), 289–301.

Egebark, J. and N. Kaunitz, "Do payroll tax cuts raise youth employment?," IFAU Working Paper 27, Institute for Evaluation of Labour Market and Education, Uppsala, Sweden 2013.

_ **and** _ , "Payroll taxes and youth labor demand," IFN Working Paper 1001, Research Institute of Industrial Economics, Stockholm, Sweden 2014.

_ **and** _ , "Payroll taxes and firm performance," IFN Working Paper 1175, Research Institute of Industrial Economics, Stockholm, Sweden 2017.

Freebairn, J., "Opportunities to reform State taxes," *Australian Economic Review*, 2002, *35* (4), 405–422.

Gruber, J., "The incidence of payroll taxation: evidence from Chile," *Journal of Labor Economics*, 1997, *15* (S3), S72–S101.

Gruber, Jonathan, *Public Finance and Public Policy, Firth Edition*, MacMillan Learning, 2016.

Henry, K., J. Harmer, J. Piggott, H. Ridout, and G. Smith, "Australia's future tax system: Report to the Treasurer," Report, Canberra: Commonwealth of Australia 2009.

Immervoll, H., "Minimum wages, minimum labour costs and the tax treatment of low wage employment," IZA Discussion Paper 2555, Institute for the Study of Labor (IZA), Bonn, Germany 2005.

IPART, "Review of State taxation: Report to the Treasurer," Report, Independent Pricing and Regulatory Tribunal NSW, NSW Treasury, Sydney, Australia 2008.

Korkeamäki, O., "The Finnish payroll tax cut experiment revisited, or where did the money go?," Technical Report, Paper presented at the 51st Congress of the European Regional Science Association: New Challenges for European Regions and Urban Areas in a Globalised World, 30 August - 3 September, 2011, Barcelona, Spain 2011.

Kugler, A. and M. Kugler, "Effects of payroll taxes on employment and wages: Evidence from the Colombian social security reform," Center for Research on Economic Development and Policy Reform Working Paper 134, Stanford University, CA, USA 2002.

_ **and** _ , "Labor market effects of payroll taxes in developing countries: Evidence from Colombia," *Economic Development and Cultural Change*, 2009, *57* (2), 335–358.

_ **,** _ **, and L. O. H. Prada**, "Do payroll tax breaks stimulate formality? Evidence from Colombia's reform," NBER Working Paper 23308, National Bureau of Economic Research, Cambridge, USA 2017.

Melguizo, A. and J. M. González-Páramo, "Who bears labour taxes and social contributions? A meta-analysis approach," *SERIEs*, 2013, *4* (3), 247–271.

Nickell, S., "Unemployment and labor market rigidities: Europe versus North America," *Journal of Economic Perspectives*, 1997, *11* (3), 55–74.

Ralston, B., "Does Payroll Tax Affect Firm Behaviour?," Treasury Working Paper 2018-02, The Australian Government the Treasury 2018.

Stewart, M., A. Moore, P. Whiteford, and R. Q. Grafton, "A stocktake of the tax system and directions for reform: Five years after the Henry Review," Report, Tax and Transfer Policy Institute, Crawford School of Public Policy, ANU, Canberra, Australia 2015.

Symons, J. and D. Robertson, "Employer versus Employee Taxation: The Impact on Employment," in "OECD Employment Outlook," OECD, Paris, 1990, pp. 153–177.

Appendix

Table A.1: List of variables

Variable name	Description
birth_date	Birth year of the firm
x_anzsic06	ANZSIC 2006 codes
x_sisca08	SISCA 2008
x_state	State
x_tolo	Type of legal organization
x_pcode	Postcode
exports_amt	Exports amount
bas_wages	Wages (based on business activity statement)
tsid	Year
fte	Employment (full time equivalent)
hcnt	Employment (head count)
foreign_share	Foreign share
total_busines_income	Total business income
net_income	Net income
bit_wages	Wages (based on BIT)
contract_sub_other	Contract workers
k_stock	Capital stock
superann	Employee superannuation
rnd_expenses	R&D expenses
go	Gross output
intuse	Intermediate use
cap	Capital expenditure
id	Australian Bureau of Statistics identifier
x_st_op	State of operation
div	Division of the firm

Table A.2: Outcome measures (based on payroll >$500,000 <$2 million)

		Payroll ($)		Employment (FTE)		Capital expenditure ($)	
		Mean	SD	Mean	SD	Mean	SD
2006	NSW	907,494	371,667	21.7	25.2	230,575	4,136,677
	VIC	932,716	382,881	22.9	29.9	182,863	1,284,668
	QLD	892,986	363,879	22.7	16.3	726,839	4.57e+07
	SA	920,163	385,169	23.1	12.5	911,275	3.56e+07
	WA	918,626	377,580	21.6	16.2	253,897	1,581,574
	TAS	884,022	359,965	22.9	15.5	169,997	364,824
	NT	957,369	394,874	24.4	27.5	297,664	1,853,596
	ACT	898,663	381,434	19.6	12.1	105,355	369,400
2007	NSW	912,855	376,204	20.7	26.5	216,056	2,880,590
	VIC	935,758	387,261	21.9	20.5	265,708	5,648,760
	QLD	900,565	364,073	21.9	16.2	250,090	2,607,612
	SA	906,330	371,983	24.4	111.0	264,292	3,959,791
	WA	916,985	371,757	21.1	27.3	237,466	1,200,771
	TAS	889,114	367,988	22.0	12.3	212,553	705,908
	NT	965,838	408,865	23.5	17.6	242,233	1,203,891
	ACT	895,415	364,283	18.4	11.4	83,648	274,606
2008	NSW	914,204	377,491	20.3	36.6	210,531	2,952,203
	VIC	937,926	388,801	20.9	25.4	188,971	1,503,338
	QLD	903,532	369,329	21.4	63.5	468,520	1.31e+07
	SA	911,178	376,944	20.9	10.9	246,403	4,437,906
	WA	927,107	379,138	20.9	53.5	1,090,635	6.04e+07
	TAS	889,563	352,505	21.6	14.7	283,228	1,901,737
	NT	948,244	400,318	22.5	16.9	232,106	685,352
	ACT	902,021	351,222	17.0	10.3	75,941	350,158
2009	NSW	911,709	374,526	19.2	29.7	201,599	3,363,231
	VIC	935,037	387,462	19.7	15.2	175,636	2,682,482
	QLD	909,995	369,304	19.9	15.5	453,245	2.13e+07
	SA	917,554	380,610	20.3	11.1	167,510	568,797
	WA	930,838	384,896	19.2	24.5	224,570	1,114,418
	TAS	895,596	365,487	20.0	9.6	217,021	767,454
	NT	945,519	402,619	21.5	17.4	200,188	492,894
	ACT	900,096	344,850	16.1	9.2	77,809	498,964
2010	NSW	910,418	375,571	18.4	25.6	152,546	972,863
	VIC	937,274	389,572	19.3	14.0	187,113	2,520,163
	QLD	910,324	370,988	19.3	13.2	184,871	1,159,795
	SA	918,640	382,705	19.8	10.2	146,508	563,526
	WA	926,133	382,987	18.5	24.3	185,632	710,398
	TAS	897,215	360,916	19.7	10.2	231,598	1,530,901
	NT	930,450	372,962	19.6	9.1	148,233	361,516
	ACT	898,478	341,983	16.0	10.0	64,335	179,073

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Table A.2 Continued

		Payroll ($)		Employment (FTE)		Capital expenditure ($)	
		Mean	SD	Mean	SD	Mean	SD
2011	NSW	911,942	379,457	17.9	22.6	154,187	2,032,863
	VIC	944,320	390,811	18.7	13.5	136,633	508,804
	QLD	912,924	373,491	18.8	13.3	149,380	701,526
	SA	928,451	383,773	19.4	12.5	131,712	468,449
	WA	933,863	382,558	18.0	23.6	172,138	680,552
	TAS	897,147	365,751	19.0	9.8	181,437	821,335
	NT	929,836	389,329	19.1	9.1	147,164	446,906
	ACT	917,453	345,413	15.6	10.6	73,961	268,382
2012	NSW	917,762	380,722	17.3	19.0	172,846	3,068,553
	VIC	949,697	391,506	18.4	20.6	191,784	5,359,418
	QLD	918,237	377,192	18.1	14.1	160,787	846,823
	SA	939,637	398,227	18.8	10.2	131,380	667,042
	WA	941,459	386,783	17.7	27.1	206,743	1,224,128
	TAS	908,870	370,082	18.5	9.6	190,000	1,079,553
	NT	907,943	366,974	18.1	8.5	139,199	575,906
	ACT	937,382	337,043	15.3	9.8	88,854	657,501
2013	NSW	918,403	381,844	16.8	20.0	199,830	3,911,893
	VIC	943,816	389,068	17.8	21.0	167,202	4,918,613
	QLD	920,880	378,394	17.6	13.0	156,642	3,019,039
	SA	928,267	392,181	18.0	11.3	137,893	884,528
	WA	945,567	389,237	16.8	13.4	267,759	6,356,472
	TAS	903,273	374,185	17.7	9.4	136,775	380,206
	NT	926,255	369,254	17.9	8.8	233,740	2,673,964
	ACT	938,548	354,589	14.9	8.7	232,320	1,964,781
2014	NSW	918,526	380,888	16.2	17.6	177,151	3,224,253
	VIC	939,691	386,441	17.3	19.9	161,087	4,383,447
	QLD	917,482	371,694	16.9	12.8	126,015	733,789
	SA	922,560	381,894	17.6	11.3	133,151	911,039
	WA	943,385	393,362	16.8	25.0	191,654	3,628,866
	TAS	903,845	371,369	17.4	8.9	146,944	369,161
	NT	931,775	368,139	17.6	8.3	150,225	756,737
	ACT	940,042	356,232	14.6	7.7	273,242	2,337,070
2015	NSW	926,086	384,920	16.0	17.2	170,385	2,897,702
	VIC	942,068	387,691	17.1	22.4	165,966	4,607,475
	QLD	915,706	372,928	16.8	20.3	129,252	1,291,098
	SA	929,105	380,993	17.2	8.6	125,753	607,310
	WA	938,547	389,400	16.3	13.5	277,794	8,858,594
	TAS	899,762	366,621	16.7	8.3	147,869	435,074
	NT	927,828	350,866	17.4	7.8	130,960	416,132
	ACT	948,868	370,882	14.8	7.3	160,865	1,524,755

Table A.3: Placebo estimates 2008,
sample including tax rate changes (unrestricted sample)

	2007	2009	2010	2012	2013	2014	2015
				Panel A. Payroll >$100,000 <$5,000,000			
Payroll	(+) 0.496	(+) 0.638	(−) 0.807	(−) 0.937	(+) 0.526	(−) 0.893	(+) 0.038
FTE	(−) 0.211	(+) 0.001	(+) 0.008	(+) 0.004	(+) 0.041	(+) 0.001	(+) 0.931
Capital expenditure	(−) 0.197	(−) 0.856	(+) 0.746	(+) 0.339	(−) 0.394	(+) 0.602	(−) 0.127
				Panel B. Payroll >$300,000 <$5,000,000			
Payroll	(−) 0.909	(+) 0.177	(+) 0.732	(+) 0.169	(+) 0.050	(+) 0.178	(−) 0.933
FTE	(−) 0.266	(+) 0.056	(+) 0.069	(+) 0.008	(+) 0.194	(+) 0.005	(−) 0.029
Capital expenditure	(+) 0.198	(+) 0.993	(+) 0.524	(+) 0.271	(+) 0.489	(+) 0.560	(−) 0.001
				Panel C. Payroll >$500,000 <$5,000,000			
Payroll	(−) 0.006	(+) 0.079	(+) 0.296	(+) 0.030	(+) 0.595	(+) 0.031	(+) 0.157
FTE	(−) 0.006	(+) 0.022	(+) 0.023	(+) 0.001	(+) 0.584	(+) 0.001	(+) 0.885
Capital expenditure	(+) 0.131	(−) 0.291	(−) 0.526	(−) 0.820	(−) 0.825	(−) 0.103	(−) 0.024
				Panel D. Payroll >$100,000 <$2,000,000			
Payroll	(+) 0.402	(+) 0.992	(−) 0.557	(−) 0.376	(+) 0.838	(−) 0.407	(+) 0.007
FTE	(−) 0.269	(+) 0.002	(+) 0.002	(+) 0.102	(+) 0.060	(+) 0.004	(−) 0.868
Capital expenditure	(−) 0.118	(−) 0.705	(+) 0.911	(+) 0.561	(−) 0.246	(+) 0.855	(−) 0.160
				Panel E. Payroll >$300,000 <$2,000,000			
Payroll	(+) 0.398	(−) 0.725	(−) 0.192	(−) 0.020	(+) 0.565	(−) 0.019	(+) 0.774
FTE	(−) 0.692	(+) 0.250	(+) 0.175	(+) 0.115	(+) 0.325	(+) 0.063	(−) 0.000
Capital expenditure	(+) 0.180	(−) 0.819	(+) 0.683	(+) 0.434	(+) 0.725	(+) 0.845	(−) 0.001
				Panel F. Payroll >$500,000 <$2,000,000			
Payroll	(−) 0.254	(−) 0.744	(−) 0.406	(−) 0.105	(−) 0.418	(−) 0.155	(+) 0.000
FTE	(−) 0.003	(+) 0.084	(+) 0.030	(+) 0.003	(+) 0.758	(+) 0.002	(−) 0.556
Capital expenditure	(+) 0.124	(−) 0.191	(−) 0.384	(−) 0.467	(−) 0.550	(−) 0.030	(−) 0.026

Note: Shaded values indicate statistical significance ($p < 0.05$). All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

Table A.4: Placebo estimates 2011,
sample including tax rate changes (unrestricted sample)

	2007	2009	2010	2012	2013	2014	2015
				Panel A. Payroll >$100,000 <$5,000,000			
Payroll	(−) 0.057	(+) 0.664	(−) 0.930	(−) 0.826	(−) 0.627	(−) 0.906	(+) 0.001
FTE	(−) 0.036	(+) 0.253	(+) 0.520	(+) 0.242	(+) 0.714	(+) 0.190	(+) 0.006
Capital expenditure	(−) 0.000	(+) 0.216	(+) 0.187	(+) 0.142	(−) 0.461	(+) 0.092	(+) 0.140
				Panel B. Payroll >$300,000 <$5,000,000			
Payroll	(−) 0.730	(+) 0.637	(+) 0.778	(−) 0.638	(+) 0.996	(−) 0.909	(+) 0.000
FTE	(+) 0.790	(+) 0.712	(+) 0.832	(−) 0.967	(+) 0.499	(+) 0.727	(+) 0.001
Capital expenditure	(−) 0.020	(+) 0.205	(+) 0.188	(+) 0.126	(−) 0.862	(+) 0.058	(+) 0.014
				Panel C. Payroll >$500,000 <$5,000,000			
Payroll	(−) 0.036	(−) 0.601	(−) 0.532	(−) 0.197	(−) 0.037	(−) 0.346	(+) 0.001
FTE	(−) 0.091	(−) 0.296	(−) 0.282	(−) 0.262	(−) 0.170	(−) 0.376	(+) 0.002
Capital expenditure	(−) 0.251	(+) 0.086	(+) 0.138	(+) 0.230	(+) 0.751	(+) 0.075	(+) 0.003
				Panel D. Payroll >$100,000 <$2,000,000			
Payroll	(+) 0.277	(+) 0.919	(−) 0.303	(−) 0.449	(+) 0.911	(−) 0.138	(+) 0.291
FTE	(−) 0.997	(+) 0.054	(+) 0.287	(+) 0.024	(+) 0.025	(+) 0.040	(+) 0.579
Capital expenditure	(−) 0.000	(+) 0.221	(+) 0.191	(+) 0.128	(−) 0.462	(+) 0.087	(+) 0.221
				Panel E. Payroll >$300,000 <$2,000,000			
Payroll	(+) 0.067	(+) 0.785	(−) 0.864	(−) 0.332	(+) 0.764	(−) 0.327	(+) 0.069
FTE	(+) 0.103	(+) 0.495	(+) 0.693	(+) 0.790	(+) 0.107	(+) 0.626	(+) 0.135
Capital expenditure	(−) 0.028	(+) 0.228	(+) 0.212	(+) 0.080	(−) 0.897	(+) 0.043	(+) 0.018
				Panel F. Payroll >$500,000 <$2,000,000			
Payroll	(−) 0.228	(−) 0.465	(−) 0.207	(−) 0.007	(−) 0.002	(−) 0.008	(+) 0.045
FTE	(−) 0.257	(−) 0.193	(−) 0.121	(−) 0.138	(−) 0.093	(−) 0.163	(+) 0.000
Capital expenditure	(−) 0.860	(+) 0.116	(+) 0.209	(+) 0.235	(+) 0.512	(+) 0.102	(+) 0.018

Note: Shaded values indicate statistical significance ($p < 0.05$). All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

Table A.5: Placebo estimates 2008,
sample excluding tax rate changes (restricted sample)

	2007	2009	2010	2012	2013	2014	2015
				Panel A. Payroll >$100,000 <$5,000,000			
Payroll	(−) 0.662	(−) 0.698	(−) 0.152	(−) 0.169	(−) 0.004	(−) 0.152	(+) 0.063
FTE	(−) 0.048	(+) 0.004	(+) 0.021	(+) 0.059	(+) 0.034	(+) 0.021	(−) 0.905
Capital expenditure	(−) 0.308	(+) 0.677	(+) 0.250	(+) 0.085	(−) 0.821	(+) 0.250	(−) 0.210
				Panel B. Payroll >$300,000 <$5,000,000			
Payroll	(−) 0.598	(+) 0.158	(+) 0.646	(+) 0.633	(+) 0.005	(+) 0.646	(−) 0.833
FTE	(−) 0.389	(+) 0.011	(+) 0.011	(+) 0.017	(+) 0.003	(+) 0.011	(−) 0.038
Capital expenditure	(+) 0.216	(−) 0.953	(+) 0.653	(+) 0.325	(+) 0.423	(+) 0.653	(−) 0.001
				Panel C. Payroll >$500,000 <$5,000,000			
Payroll	(−) 0.001	(+) 0.101	(+) 0.341	(+) 0.334	(−) 0.494	(+) 0.341	(+) 0.261
FTE	(−) 0.001	(+) 0.012	(+) 0.012	(+) 0.013	(+) 0.831	(+) 0.012	(−) 0.888
Capital expenditure	(+) 0.096	(−) 0.152	(−) 0.241	(−) 0.885	(−) 0.943	(−) 0.241	(−) 0.054
				Panel D. Payroll >$100,000 <$2,000,000			
Payroll	(−) 0.984	(−) 0.271	(−) 0.050	(−) 0.048	(−) 0.019	(−) 0.050	(+) 0.014
FTE	(−) 0.170	(+) 0.013	(+) 0.029	(+) 0.172	(+) 0.047	(+) 0.029	(−) 0.798
Capital expenditure	(−) 0.248	(+) 0.757	(+) 0.264	(+) 0.105	(−) 0.769	(+) 0.264	(−) 0.266
				Panel E. Payroll >$300,000 <$2,000,000			
Payroll	(+) 0.344	(−) 0.466	(−) 0.072	(−) 0.043	(+) 0.203	(−) 0.072	(+) 0.742
FTE	(−) 0.939	(+) 0.110	(+) 0.067	(+) 0.103	(+) 0.000	(+) 0.067	(−) 0.000
Capital expenditure	(+) 0.163	(−) 0.894	(+) 0.682	(+) 0.379	(+) 0.348	(+) 0.682	(−) 0.002
				Panel F. Payroll >$500,000 <$2,000,000			
Payroll	(−) 0.332	(−) 0.467	(−) 0.230	(−) 0.154	(−) 0.139	(−) 0.230	(+) 0.000
FTE	(−) 0.003	(+) 0.020	(+) 0.003	(+) 0.005	(+) 0.810	(+) 0.003	(−) 0.542
Capital expenditure	(+) 0.059	(−) 0.111	(−) 0.186	(−) 0.722	(−) 0.948	(−) 0.186	(−) 0.074

Note: Shaded values indicate statistical significance ($p < 0.05$). All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.

Table A.6: Placebo estimates 2011,
sample excluding tax rate changes (restricted sample)

	2007	2009	2010	2012	2013	2014	2015
				Panel A. Payroll >$100,000 <$5,000,000			
Payroll	(−) 0.002	(+) 0.003	(−) 0.000	(−) 0.075	(−) 0.014	–	(+) 0.000
FTE	(−) 0.001	(+) 0.002	(−) 0.000	(−) 0.047	(−) 0.034	–	(+) 0.002
Capital expenditure	(−) 0.066	(+) 0.525	(−) 0.000	(−) 0.057	(−) 0.002	–	(+) 0.000
				Panel B. Payroll >$300,000 <$5,000,000			
Payroll	(−) 0.060	(+) 0.116	(+) 0.323	(−) 0.000	(−) 0.167	–	(+) 0.003
FTE	(−) 0.072	(+) 0.195	(+) 0.003	(−) 0.000	(−) 0.343	–	(+) 0.009
Capital expenditure	(−) 0.124	(+) 0.832	(−) 0.011	(−) 0.013	(−) 0.010	–	(+) 0.002
				Panel C. Payroll >$500,000 <$5,000,000			
Payroll	(−) 0.011	(+) 0.532	(−) 0.000	(−) 0.000	(−) 0.088	–	(+) 0.001
FTE	(−) 0.019	(−) 0.595	(−) 0.038	(−) 0.003	(−) 0.013	–	(+) 0.002
Capital expenditure	(−) 0.360	(+) 0.015	(−) 0.000	(−) 0.001	(−) 0.151	–	(+) 0.024
				Panel D. Payroll >$100,000 <$2,000,000			
Payroll	(−) 0.608	(+) 0.000	(−) 0.000	(+) 0.000	(−) 0.857	–	(+) 0.494
FTE	(−) 0.594	(+) 0.000	(+) 0.001	(+) 0.000	(+) 0.756	–	(+) 0.617
Capital expenditure	(−) 0.098	(+) 0.491	(+) 0.000	(−) 0.094	(−) 0.002	–	(+) 0.000
				Panel E. Payroll >$300,000 <$2,000,000			
Payroll	(−) 0.726	(+) 0.000	(−) 0.000	(−) 0.006	(+) 0.999	–	(+) 0.252
FTE	(+) 0.829	(+) 0.000	(+) 0.000	(−) 0.000	(+) 0.304	–	(+) 0.569
Capital expenditure	(−) 0.225	(+) 0.847	(+) 0.000	(−) 0.039	(−) 0.008	–	(+) 0.005
				Panel F. Payroll >$500,000 <$2,000,000			
Payroll	(−) 0.021	(+) 0.000	(−) 0.004	(−) 0.003	(−) 0.168	–	(+) 0.009
FTE	(−) 0.082	(+) 0.306	(+) 0.000	(−) 0.050	(−) 0.004	–	(+) 0.001
Capital expenditure	(−) 0.816	(+) 0.004	(−) 0.001	(−) 0.001	(−) 0.349	–	(+) 0.107

Note: Shaded values indicate statistical significance ($p < 0.05$). All regressions include state, time and division fixed effects. Standard errors were clustered at the state level.