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Productivity of Unionized and Non-Unionized Workers in the Construction Sector: A Review of the Literature

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Abstract

In their seminal work, Brown and Medoff (1978) argue that unions could have both positive and negative impacts on productivity. Negative examples include restrictive rules imposed on working arrangements or resistance to new technologies. Positive examples include higher levels of capital per worker, more training, lower worker turner, and the attraction of better workers through higher wages. Brown and Medoff (1978) argue, along with a number of authors in the following decades, that in the end the impact of unions on productivity is an empirical question. This report reviews the literature on the topic, focusing mostly on empirical works. While early works found a large positive impact of unions on productivity, later results are more conflicted. More recently, new methods of causal inference such as Regression Discontinuity Design have shed light on the topic, finding either a positive impact or inconclusive results. One main take away from the literature is that null effects can often hide heterogeneous impacts. For example, unions could affect productivity differently in different countries or industries, or depending on the composition of the workforce in different plants. Developments of more detailed datasets at the firm level, as well as matched employee-employer datasets should allow for better and more precise results in the future.

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Productivity of Unionized and Non-Unionized Workers in the Construction Sector: A Review of the Literature[1]

The unionization rate has been decreasing steadily over the last decades in Canada and even more so in the United States. Recently, however, in a climate of increasing inequality, unions seem to be enjoying a surge in popularity among the public, at least in the United States. For example, in a recent Gallup poll, 64 per cent of Americans approved of labour unions, up from 48 per cent in 2009.[2]

That being said, whether unions play a negative or positive role in the economy is still an open question. Employers may take the negative side, arguing against the increased wages they need to pay or the inflexibility introduced in working arrangements. Employees, on the other hand, would usually take the positive side, arguing that unions provide them with a voice to discuss openly with management, thus staying with their current employer for a longer period and reducing employee turnover.

Economists have studied this debate in the past, looking at the impact of unions on a number of economic outcomes such as labour productivity. Theoretically, unions can affect productivity in positive and negative ways, many of which are listed in Brown and Medoff (1978) and Freeman and Medoff (1984), for example. Since the overall effect is ambiguous in theory, they argue, along with a number of authors in the following decades, that the impact of unions on productivity is an empirical question.

Therefore, Brown and Medoff (1978) and Freeman and Medoff (1984) provide some empirical evidence on the question. Their results support the view that unions increase productivity. They use a relatively simple econometric approach, based on the production function and measuring average quantities at the level of US industries and states, using cross-section data. Their results were subject to a number of criticisms and replications over time, which are discussed in this report. More recently, researchers have turned to more credible methods of statistical inference,[3] to estimate the true causal impact of unions on productivity and other outcomes.

This report provides an overview of the literature studying the impact of unions on productivity. The first section summarizes the channels through which unions could increase or decrease

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[1]This report was prepared by Simon Lapointe, economist at the Centre for the Study of Living Standards (CSLS) for the Ontario Construction Secretariat, under the supervision of CSLS Executive Director Andrew Sharpe. The CSLS thanks the Ontario Construction Secretariat for financial support. Email: simon.lapointe@csls.ca.
[2]The poll was published on August 28, 2019 and results are available at https://news.gallup.com/poll/265916/labor-day-turns-125-union-approval-near-year-high.aspx.
[3]These include the Regression Discontinuity Design (RDD) and, more generally, finding natural experiments where union coverage varies exogenously to productivity. Section 3 provides a description of the methods used in this literature.

productivity. The second section discusses the empirical findings. In particular, it will discuss papers that use Canadian data. The third section will focus on the construction industry. Since unions in that sector tend to be occupation-based instead of plant- or firm-based, the impact of unions might differ. The last section concludes.

1. Positive and Negative Effects of Unions on Productivity

In their seminal book *What Do Unions Do?*, Freeman and Medoff (1984) argue that the impact of unions on the economy can be best understood by recognizing the two faces of unions: the Monopoly face and the Collective Voice/Institutional Response face. According to the first, unions have monopoly power, which they can use to increase wages and thus reduce efficiency in the economy. The second face of unions is based on the duality between exit and voice. As in any free market situation, employees can respond to problems in their workplace by leaving the firm, just as a dissatisfied customer would choose another product. However, another way to deal with dissatisfaction at work is the voice mechanism: direct communication between employees and their management. Individually, workers might be reticent to voice disagreements for a number of reasons, such as fear of retaliation. Unions allow workers to express their voice in a collective way, thus avoiding the public good problem inherent in many workplace improvements, and sheltering individual workers against retaliation by their employer. The organization of the debate around these two faces proved useful, and became the standard lenses to study the impact of unions (Hirsch, 2007).

More specifically, Freeman and Medoff (1984) identify a number of channels through which unions could affect productivity. Many of the factors negatively affecting productivity could be categorized as in the "monopoly" face of unions, but as argued by Hirsch (2007), the two faces often blend together.

1.1 Negative Impacts

One of the ways in which unions negatively impact productivity is through rules they impose on working arrangements, often reducing the flexibility of managers. One common example of such a rule is featherbedding: demanding a larger number of employees than strictly necessary to complete a set of tasks. Unions might also restrict the tasks that can be carried out by any given worker. Another example is the use of seniority rules. Instead of choosing the most skilled or productive employee for a promotion or a specific task, employers are often forced to select the worker with the most seniority, thus leading to lower productivity on average. That being said, seniority rules can also reduce the rivalry between workers, which could increase productivity through increased cooperation and skill transferring. Indeed, senior workers might be wary of teaching younger ones if they fear being replaced.

Unions might also resist introduction of new technologies. This is also tied to seniority rules: older workers with fewer years of work left before retirement would prefer to keep working with the technology for which they were trained rather than learn new methods. Notably, this resistance to change would lead to lower investment and R&D activities, thus lowering productivity growth in the long term.

Unions also affect investment and R&D through a second, indirect channel related to what economists call the holdup problem. When a firm invests in a new plant and equipment the operation becomes less mobile. If the firm is unionized, the workers can take advantage of that fact and capture some of the "quasi-rents" created by new investment, i.e., the additional income received by the firm as a reward for investing. Effectively, the union knows that the firm's bargaining position is weakened, and that they can demand higher wages. Since the firms expect this, unionized firms would tend to have lower investment as well as lower R&D expenditures.

1.2 Positive Impacts

Unions can also positively affect productivity. One way they do so is through the wage premium enjoyed by unionized workers, which favours a more intensive use of capital. Indeed, faced with higher labour costs, managers of unionized firms substitute capital for labour. Notably, this would translate into more investment by unionized firms, and higher levels of capital per worker. In turn, it can translate into higher labour productivity growth, counteracting the negative impact of unions on investment noted above. However, by distorting the relative prices of labour and capital in that way, unions produce efficiency losses. It is important here to make a distinction between labour productivity and total factor productivity. Higher levels of capital per worker increases labour productivity, but does not necessarily translate in higher total factor productivity.

As a result of the wage premium, the higher wages of unionized firms should attract better workers, which should lead to higher productivity. As noted by Hirsch (2007) as well as Freeman and Medoff (1984), however, this comes at the price of a smaller number of jobs in that sector than otherwise. Moreover, less productive workers are more likely to queue for union jobs, since they gain more from the job security and the "flatter" wage curve in unionized firms. Obviously, since the supply of workers for union jobs most likely exceeds the available number of jobs, firms are then free to choose the most productive workers, but the total effect is nevertheless unclear (Barth *et al.*, 2017).

Another channel through which unions can increase productivity is through lower turnover, since this reduces hiring costs for the firm and increases retainment of experienced workers (and their knowledge) in their jobs. For workers who are unsatisfied with their current job, unions offer an alternative to quitting and finding employment elsewhere: voicing their grievances, and possibly coming to an agreement with managers to change the working environment. In other words, unions can improve the flow of information between workers and management. Unions can also reduce turnover by making the outside option (i.e., the wages and benefits that they would receive somewhere else) of unionized workers less attractive. Indeed, if wages in unionized jobs are higher, workers are less likely to try to find work elsewhere.

This lower turnover contributes to another channel through which unions might increase productivity. If the employer is confident that workers will stay in the firm longer, it is more likely to pay for on-the-job training. This would increase human capital, and in turn labour productivity.

The positive impacts listed in this section are often attributable to the "voice" aspect of unions. The "voice" mechanism is also available for non-unionized workers, but by organizing and voicing their concerns as a group, unions offer protection against retaliation from the employer.

Collective voice also allows management to address concerns that are shared by a greater number of workers. Without collective bargaining, the marginal employee (the one with the most skills and better options outside the firm) would be the one most likely to voice complaints and be heard by management, since they can credibly threaten to leave. Under collective bargaining, workers who are not as mobile are more likely to also have their voices heard.

Table 1: Summary of the Impacts of Unions on Productivity

Positive Impacts	**Negative Impacts**
Unions provide a voice for workers: • Grievance system makes workers more satisfied with their job. Unions lower rivalry between workers: • Seniority rules increase job security for older, more experienced workers. Unions offer a wage premium: • Can attract better workers; • Provide more on-the-job training; • "Shock Effect" translate in increased managerial efficiency; • Lower worker turnover, and thus lower hiring costs. Unions can increase investment and R&D activities: • Due to substitution of capital for labour due to higher wages.	Workplace rules can hinder productivity: • Task restrictions; • Higher firing costs; • Seniority rules; • Featherbedding; • Reduced managerial flexibility (e.g., to pay better wages to better workers). Unions distort relative prices of labour and capital. Unions can decrease investment and R&D activities: • Hold-up problem; • Resistance to new technologies. Frequent strike activity can bias the workforce toward more managerial positions.

Freeman and Medoff (1984) point out the importance of a good relationship between management and workers for firms to fully benefit from the improvements to productivity from the "collective voice" face of unions. For example, improvements in productivity might be conditional on the responses of managers to the formation of a union. If managers and the union are fighting each other, the opportunities for increased productivity are lower. At a more extreme level, if disagreements between workers and management cannot be solved, it may lead to recurrent strikes, and thus lower average productivity.[4] On the other hand, good labour relations improve worker morale and cooperation, thus also reducing worker turnover.

The response and reaction of management to unionization can also affect productivity through a "shock effect" where managers suddenly have to improve efficiency. Indeed, when a firm's

[4]As argued by Maki (1983), a single strike does not affect productivity. Output flows stop, but so do input flows if measured correctly. However, recurrent strikes might affect shift the mix of workers in the firm towards more supervision staff that can take over during a strike.

workers decide to unionize, labour costs increase, possibly leading to lower profits. In turn, managers who might have been complacent have to improve the firm's efficiency, thus increasing productivity. This effect is related to the concept of X-inefficiency of Leibenstein (1966), where firms have some "organizational slack" resulting from a misalignment of incentives between the owners and management. Notably, this channel highlights a major challenge in the empirical analysis of the productivity impact of unions: firms which do not manage to improve efficiency post-unionization exit the market, and thus do not exist in researchers' data, leading to biased results. Table 1 summarizes the various negative and positive channels discussed in this section.

2. Empirical Evidence on the Impact of Unions on Productivity

Since the theoretical literature fails to provide an unequivocal conclusion regarding the impact of unions on productivity, researchers have turned to empirical analyses to study this question. One of the earliest and most influential empirical studies on the impact of unions of productivity is Brown and Medoff (1978).Their starting point, as well as many empirical papers that followed is a Cobb-Douglas production function as such (Addison and Hirsch, 1989):

$$Q = AK^{\alpha}(L_n + cL_u)^{1-\alpha}$$

That equation describes the relationship between output (Q) and the two inputs (capital, K, and labour, L). The parameter c captures the degree to which union workers are more or less productive than their non-union counterparts, and that is the parameter that these authors try to estimate. In their paper, Brown and Medoff (1978) use data on the manufacturing industry across US states in 1972, estimating that unions increase total factor productivity by between 22 and 24 per cent.

2.1 Early Papers and Criticisms

The methodology of Brown and Medoff (1978) has been subject to criticism. Reynolds (1986) offers a particularly sharp critique, arguing that in a perfectly competitive market with all firms maximizing profits, the parameter c estimated by Brown and Medoff (1978) captures both the productivity and wage differentials, such that it is impossible to statistically distinguish the two. Reynolds (1986) in fact observes that the wage differential found by Brown and Medoff (1978) is equal to the productivity differential. Another issue raised in the literature is that the authors were unable to correctly control for worker quality or firm quality (Clark, 1980b; Kuhn, 1998). Addison and Hirsch (1989) point to another important criticism of Brown and Medoff's results: the use of value-added to measure output. In a similar point to the one made by Reynolds (1986), when using that measure, part of the productivity differential reflects the higher prices of the unionized sector, or the wage differential between unionized and non-unionized firms.

One way to improve the research is to use physical measures of output. Clark (1980a) does so by focusing on the cement industry in the US. By focusing on a sector with homogenous and standardized products, the author can measure output with a physical measure instead of value-added. However, the focus on a single industry comes at the cost of a loss in generality of the results. More specifically, Clark uses establishment-level survey data in multiple time periods (1973 to 1976), controlling for firm-specific effects. Clark conducts his analysis separately for

newer and older firms, arguing that newer firms are more similar across union status. More precisely, newer firms are more likely to have similar technology (especially kilns). Clark finds that newer unionized firms have productivity on average about 10 per cent higher than newer non-unionized firms. In a complementary analysis, the author focuses on firms that changed union status over the study period. He finds that unionization increases productivity in these firms by between 8 and 10 per cent. Clark (1980b) provides more analysis on a set of cement plants that unionized between 1953 and 1976, finding again a positive effect in the range of 6 to 8 per cent.

Clark (1980b) also interviews union and management officials in these firms, in an attempt to qualitatively explain this increase in productivity. Unfortunately, the answers provide only limited explanations, as surveys were not conducted before unionization, only after. The surveys indicate that the relationship between management and labour changed after unionization. Previously authoritarian management styles had to make way to new tools such as staff meetings, and plants introduced new managers and supervisors. Union interviewees indicated either no change or an improvement in worker morale. These results, however, are only anecdotal.

Mitchell and Stone (1992) study sawmills in the United States, also using a physical measures of output: board feet of lumber produced. They find that unionized firms are 12 to 21 per cent less productive than non-unionized ones. They estimate a translog production function instead of a Cobb-Douglas, arguing that it's more flexible, and also control for the quality of the lumber produced in each firm. Finally, Allen (1984; 1986; 1988) published a number of papers on the construction industry. These papers are discussed in the next section.

Another criticism of the methodology of Brown and Medoff (1978) is concerned with the assumptions on the production function. For example, the original results assumed that the production function was the same for the union and non-union sectors. The work of Clark (1980) partly answers that criticism by conducting industry-specific analysis, such that he does not need to account for technology differences between industries. Other researchers such as Bemmels (1987) opted instead to use a translog production function instead of the usual Cobb-Douglas function, arguing that the translog function is more flexible. Bemmels (1987) finds a negative impact of unions on productivity, but with a limited sample of 46 firms in 1982.

Finally, Mitchell and Stone (1992), as well as Addison and Hirsch (1989) and Reynolds (1986) point to another problem with the Brown and Medoff (1978) study that is also present in some later papers. They argue that if unions translate in higher wages, unionized firms may switch to less labour-intensive products and production techniques. Omitting controls for product quality or for major inputs, then, would bias the results of the analysis. To test this hypothesis, Mitchell and Stone (1992) repeat their analysis on US sawmills omitting control variables for quality. They find that unions have no impact on productivity. In other words, omitting these controls biased their estimates upwards.

Despite the issues, the Brown and Medoff paper has proved very influential and their estimates were subject to a number of replication attempts in different industries, different countries, or using different methods. Some of them are discussed in the previous paragraphs. In-depth reviews are found, however, in papers by Addison and Hirsch (1989), Kuhn (1998), and Hirsch (2007), as well as in a meta-analysis by Doucouliagos and Laroche (2003).

Notably, some authors find a negative impact of unions on productivity. Clark (1984), for example, attempts to replicate Brown and Medoff's (1978) findings using panel data from the Profit Impact of Market Strategy dataset, including data from 902 manufacturing businesses over the 1970-1980 period. With this dataset, Clark finds that the regression coefficient of unions on productivity ranges from -0.03 to -0.02, indicating a small negative effect. However, Clark also found that the impact varies by industry. Running his regressions separately for two-digit industries, he finds positive coefficients in textiles, furniture, and petroleum. Similarly, Hirsch (1991) also finds a negative impact of unions on productivity, using data on over 600 manufacturing firms in the United States from 1968 to 1980. Adding more controls, Hirsch's results become statistically insignificant, leading him to conclude that unions probably have no positive effect on productivity, or possibly weakly negative effects. Other papers which find negative effects of unions on productivity include Lovell, Sickles, and Warren (1988) and, for Canada, Baldwin (1992) who finds a weakly negative effect of unions on efficiency.

Some authors have replicated the positive impact of unions on productivity found by Brown and Medoff (1978). Using a novel firm-level dataset, Black and Lynch (1997) find that the impact of unions on productivity depends on the type of labour-management relations within the plant. Unionized firms that adopt new workplace practices that promote greater employee participation in the firm's decision-making have higher productivity levels than both unionized firms who do not adopt such practices, and non-unionized firms that do adopt these practices. Black and Lynch (1997) argue that unions make it easier to adapt these practices, since there will be a designated team to negotiate with, and employees are more likely to participate when a union is present, protecting their jobs. As noted above, Clark (1980a) also finds a positive effect of unions on productivity.

The numerous studies cited so far find conflicting results. As Kuhn (1998) argues, the impact of unions on productivity may in fact vary by industry, time period, and geographical location. That being said, Addison and Hirsch (1989) offer some systematic patterns emerging from the results, at least up to 1989. First, the impact of unions on productivity seems to be larger in industries where the union vs. non-union wage differential is largest. They argue that in such industries, management must respond more intensely to the increase in labour costs by organizing the firm more efficiently. Second, positive union impacts on productivity are mostly found in the private sector. This observation may also be due to the "shock effect" on labour costs, which is only relevant when product market competition is present to promote greater efficiency. Another pattern observed by Kuhn (1998) is that studies tend to find a negative effect of unions on productivity when the data come from sectors with adversarial union-management relations. One is the study by Hoxby (1996), who finds a negative effect of unions by looking at public schools in the United States, measuring productivity using high school dropout rates. Another example is the aforementioned study by Black and Lynch (1997), who find that unions have positive effects on productivity when labour relations are not adversarial.

2.2 Unions, Job Turnover, and Productivity

These patterns and conflicting results highlight the need for researchers to not simply study the impact of unions on productivity, but also the channels through which this effect operates. Indeed, when trying to evaluate the role of unions in a specific sector or location, it is necessary to evaluate which channels are most likely to be relevant to that sector.

One channel that was evoked earlier is the unions' impact on job turnover. Freeman (1980a) analyzes the role of unions in the tenure and quit rates of workers using three sources of data on individuals in the United States: the National Longitudinal Survey (NLS), the Michigan Panel Survey of Income Dynamics (PSID), and the Current Population Survey (CPS). Controlling for a number of socio-economic factors as well as industry and occupation, Freeman (1980a) finds that unionized workers have on average longer tenure at their current employer than non-unionized workers. Similarly, they have lower quit rates and separation rates (which include both workers quitting a job and workers laid off because of a plant closing, for example). While the exact results differ between the three datasets, they qualitatively point in the same direction.

Freeman (1980b) provides more detail on the relationship between unions and job tenure. He argues that unions increase tenure through higher wages and fringe benefits, "voice" mechanisms to resolve issues between workers and management, and tougher firing or discharge rules. He also points out that unions could theoretically decrease tenure if firms are more likely to go out of business under unionization. Freeman (1980b) tests the relationship using the same datasets as in Freeman (1980a). In Freeman (1980b), however, the author attempts to explain *how* unions increase job tenure, by looking at sub-samples with different institutions regarding grievance and seniority rules. He concludes that longer tenure is due not to the higher monopoly wages, but to the grievance system and seniority clauses.

In addition to increasing tenure, another way unions can increase productivity is through reducing absenteeism. Leigh (1981) argues that unions can impact absenteeism from work for three reasons. First, the opportunity cost of missing work is higher since unions increase wages. Therefore, workers stay at home for shorter periods. Second, unions can positively affect work conditions for workers. If unions are found in "safer" industries, the correlation could be negative (i.e., unionized workers have lower absenteeism). Moreover, unions could themselves affect working conditions with stricter safety rules. Third, unions might provide more generous sick leave, thus potentially increasing absenteeism. Empirically, Leigh (1981) finds that unions increase absenteeism, while higher wages decrease it. In other words, the higher wages in unionized jobs do tend to lower absenteeism, but the more generous sick leave benefits might encourage workers to miss more work days. The net effect is that unions increase absenteeism, thus possibly negatively impacting productivity.

In Canada, Renaud (2002) studies a related issue: the impact of unions on job satisfaction. Indeed, workers who are more satisfied with their job might remain in that job longer. This is at the heart of Freeman's (1980b) argument regarding the grievance system. Renaud (2002) starts by noting that much of the literature on job satisfaction finds that unions tend to reduce it. However, the lower job satisfaction could be due to the politicization of the workforce. In other words, it is a side effect of the "voice" mechanism allowed by unions: unionized workers are more likely to express their disagreements with management. Renaud (2002) also points out possible selection bias in the data: union jobs might be on average more unpleasant jobs, and might have (on average) poorer work environments. Renaud (2002) provides new empirical estimates of the relationship between unions and job satisfaction using data from the Canadian General Social Survey, including several additional control variables capturing the working conditions of workers that may reduce the bias in the estimates (chances for promotion, pleasantness of surroundings at work, freedom in deciding how to work, whether the work

involves repetitive tasks). The author does find that when including these controls, unions have no effect on job satisfaction.

2.3 Unions and Productivity Growth

Most papers that followed Brown and Medoff (1978) looked at the impact of unions on productivity at a given point in time. However, unions might also affect investment, research and development, or the training of workers. In turn, these factors might affect productivity growth. Kuhn (1998) offers a comprehensive review of the literature on the topic. This section will review some contributions, and extend the review to more recent papers.

An early paper looking at the effect of unions on productivity across time is the one by Connerton *et al.* (1983). The authors use repeated cross-sections with data on bituminous coal mines, finding that unionized firms in that sector were 33 to 38 per cent more productive than non-union ones in 1965, but 14 to 20 per cent *less* productive in 1975 and 1980. These results point to dynamic effects of unions. In this sector, Connerton *et al.* (1983) attribute this decline to a deterioration of labour relations.

In their book studying productivity growth across 19 industries, Kendrick and Grossman (1980) find similar results. They use several union indicators, including the share of organized workers and average days lost to strikes. They find that when they include both of these indicators in their regressions, union coverage itself does not impact productivity growth. However, the number of days lost to strikes did lower productivity growth. Their results support previous results implying that conflictual work relations are what impedes productivity, and not unions per se. However, due to multicollinearity, these results should be interpreted with caution.

Hirsch and Link (1984) study the impact of unions on productivity growth directly using data from 19 industries in the United States. When including both the level of unionism and the change in union coverage, they find a negative impact of both on the growth in total factor productivity. They argue that one avenue worth exploring would be the asymmetry between increases and decreases in unionism. While an increase in union coverage may lead to a reduction in X-inefficiency, as mentioned earlier, a decrease in union coverage need not be accompanied by an increase in X-inefficiency (the more efficient work rules can stay in place even when unions leave). Since their dataset covers a period in which union coverage was declining, the negative result might not be surprising.

Allen (1988a) also studies the impact of unions on productivity growth, both in the manufacturing and construction industries. In the manufacturing sector, Allen uses data covering the 1972-1983 period, with output measures based on physical quantities obtained from the US Department of Labor. In that sector, the author finds no significant impact of unions on labour productivity growth. However, productivity growth in that sample is strongly correlated to R&D intensity, and the author finds that more unionized industries spend less on R&D.

Using Canadian data, Maki (1983) makes the point that unions initially increase productivity through the “shock” effect mentioned earlier, but are then associated with lower productivity growth in the future. Specifically, Maki finds that for the period in his study in which total factor productivity grew at an average rate of 1.3 per cent per year, the contribution of the increase in

union coverage was 0.2 percentage points, while long-term unionization contributed -1.3 percentage points.[5]

Reviewing the literature, Hirsch (1997) points out that overall, the impact of unions on productivity growth is still unknown. Some authors find an impact, but taken together, the results are inconclusive. One possible explanation for the inconclusive results is that positive and negative effects cancel each other out. Another possibility suggested by Hirsch (1997) is that by controlling for factor-input usage, studies ignore the indirect effect of unions on productivity growth acting through investment.

In terms of investment, the theory would predict that unionized firms substitute capital for labour, thus increasing investment. However, as pointed out by Kuhn (1998), installed capital is vulnerable to hold-up by unions. Unionized workers know the plant is less likely to move elsewhere when new capital is installed at a location, thus increasing their demands to obtain a share of the quasi-rents produced by those machines. Unions thus have two counter-balancing effects on investment.

Kuhn (1998) lists a number of studies in the United States, Canada, and the United Kingdom that found negative effects of unions on investment. For example, Hirsch (1991) finds that unionization reduced investment by over 20 per cent, using firm-level data from a US survey covering the 1972-1980 period. Hirsch (1991) finds that the effect of an increase in unionization on investment is non-linear: it is stronger at low levels of unionization. The reason is that in an industry with low but increasing unionization, the threat of unionization induces non-union firms to match union wages to reduce unionization efforts by workers.

In Canada, Odgers and Betts (1997) use industry-level data from 18 manufacturing industries over the 1967-1987 period. They obtain data on unions from Statistics Canada based on annual forms submitted by unions under the Corporations and Labour Unions Returns Act, and combine it with industry data and input-output tables from Statistics Canada.[6] The authors find, in their main specification, that an increase in unionization of 1 per cent is associated in a decrease of 0.725 per cent in net investment. Put differently, for an industry with the mean level of unionization, net investment is between 66 and 74 per cent lower than if that industry had no union, depending on the specification. Their results are robust to the addition of a number of industry-specific controls. In a latter paper that also uses Canadian data, Betts, Odgers, and Wilson (2001) study the link between unionization and research and development. The ability of unions to appropriate quasi-rents from investment might be lower for R&D investment compared to investment in physical capital, since the firm might be able to license new technology to other firms, for example. Their empirical results, however, suggest that as with physical capital, unions tend to be associated with lower R&D investment.

An impact of unions on productivity growth can also arise due to differences in worker training. In particular, unions might favour on-the-job training for workers. Lynch (1992), for example,

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[5] Other contributions were: 3.3 per cent due to output growth, -0.5 per cent due to strike activity, and a -0.5 per cent constant.

[6] The authors argue that Canadian data on unions are much richer than the United States due to the compulsory reporting, thus conferring an advantage on work conducted on Canadian data.

finds that company-provided on-the-job training is most common for white married unionized males. Similarly, past participation in apprenticeship programs is most likely among union workers. Lynch (1992) uses individual-level survey data from the United States on more than 12,000 workers in 1980 and 1983.

More recently, using firm-level survey data from the UK (including both a management and worker survey), Addison and Belfield (2004) find only little association between unions and firm-sponsored off-the-job training. Using data at the individual worker level, the duration of training spells over the year is longer in plants that bargain with multiple unions than those without unions. However, training incidence is unaffected. Using the management survey, Addison and Belfield (2004) find that unions increase training incidence. This result could be due to the survey nature of the data, or indicate a mismatch between what workers and management consider as training in their answers.

2.4 Modern Empirical Studies

The studies discussed so far simply point to correlations between unions and productivity, without making strong causal claims. No amount of sophistication on the estimated production functions would solve all the statistical bias issues inherent to the topic. In particular, as argued by Addison and Hirsch (1989), not all firms are able to respond to the shock on labour costs resulting from unionization. For that reason, only successful firms are in the datasets of researchers, thus biasing the results. Moreover, older firms are more likely to be unionized, as well as more productive firms (Hirsch, 2007). Some studies focus on a specific sector, such as Clark's (1980) studies on the cement industry. That may avoid some of the issues, but then researchers run into issues of what economists call external validity: results might be valid within the sample of the study, but can they be generalized? For example, are the results in the cement industry applicable to firms in the broader manufacturing or construction sectors?

More recently, economists have instead turned to better methods of inference that allow researchers to isolate the causal effect of a variable on another. Usually, to obtain causal effects (instead of simple correlations), researchers need properly-randomized treatment and control groups, as in randomized trials for new medical treatments, for example. Basically, these new methods identify "natural experiments" that allow researchers to divide the population in the data in treatment and control groups with "as-good-as-random" assignment to each group. These developments started mostly in the field of labour economics, and are discussed at length in, for example, the textbook *Mostly Harmless Econometrics* by Angrist and Pischke (2009).

These methods have recently been applied to the study of the impact of unions on the economy, including productivity. For example, Dinardo and Lee (2004) use a method called Regression Discontinuity Design (RDD) to study the impact of unionization on business survival, employment, output, productivity, and wages. They use data from the National Labor Relations Board (NLRB) on unionization elections in the United States, comparing manufacturing firms in which the union barely won the vote to firms where the union barely lost it. This analysis relies on the randomness of election results within a given margin. In other words, they assume that prior to the vote, firms where the union won, for example, 49 per cent of the vote are similar to

firms where the union won 51 per cent of the vote.[7] Importantly for that kind of analysis, the authors find that the probability of securing a collective agreement jumps rapidly at the winning threshold (50 per cent), and stays about the same for firms where the union won the vote by a wider margin. Conversely, the probability of securing a collective bargaining agreement is almost nonexistent when the union barely loses the vote (and new votes are rarely organized later).

Regarding the economic outcomes, Dinardo and Lee (2004) find that union certification has only a small impact. For labour productivity, the difference between firms who barely won and barely lost the unionization election ranges from -2 to 0 per cent. Notably, unionization also does not increase the likelihood of the firm exiting the market. Since they also find a negligible impact of unionization on wages, they argue that unions in the time period under study might have been unsuccessful at securing large wage gains, such that the impacts on the other outcomes would also be small. An alternative interpretation could be that firms increase wages prior to the vote, under a threat of unionization. Dinardo and Lee (2004) test that interpretation by conducting an event-study analysis, looking at the evolution of wages before the vote took place. Again, they find small non-significant results, rejecting the alternative interpretation.

The research design of Dinardo and Lee (2004) allow for a causal interpretation of their results. However, the problem that economists call external validity remains: are the results specific to their sample? In other words, Dinardo and Lee's (2004) results might be valid within the context of their data (internally valid), but the question is whether they are applicable to other situations (externally valid). This is where replication studies become important. In a more recent study, Frandsen (2012) replicates the study design of Dinardo and Lee (2004), but provides additional results suggesting that new unionization increases wages for workers at the bottom of the distribution, thus lowering the returns to skills for workers at the top end of the distribution. Effectively, their results imply that post-unionization, employers substitute away from lower-skilled or lower-paid workers. While these results are mostly important for discussions on the wage effect of unions, they highlight an often ignored point in the discussion on the impact of unions, which is that the absence of average effects statistically different from zero may hide non-null effects in opposing directions at the sub-group level.

In another natural experiment, Sojourner et al. (2014) look at the impact of unionization in nursing homes in the US. They employ the same empirical strategy as Dinardo and Lee (2004), a RDD based on union certification elections using NLRB data on 2,088 facilities. Sojourner et al. (2014) obtain data not only on employment and output, but also output quality. They find that union certification reduces staffing levels, in particular for more educated registered nurses. That decline in staffing, however, is not accompanied by a decline in the quality of care. They measure quality of care using both results from evaluations of the nursing homes and a number of health outcomes for residents that could be associated with low-quality care (e.g., skin pressure sores).

The combination of lower staffing levels with a constant quality of care implies that productivity increases. Sojourner et al. (2014) repeat their analysis using quality-adjusted output (i.e.,

[7] The actual margin to use between the two votes (the bandwidth) is determined using statistical tools.

resident-days of care provided) per labour hour as the outcome variable, to measure the impact of unionization on productivity. They find that productivity goes up post-unionization. One potential reason for this increase advanced by the authors is that unionized nursing homes might provide additional training. This view would be consistent with the results of Dustmann and Schönberg (2009), who find, using German a linked employer-employee panel dataset, that because of wage floors, unionized firms increase firm-financed apprenticeship training.

Another recent natural experiment study is the one by Barth et al. (2017). These authors criticize the study design of Dinardo and Lee (2004), arguing that successful votes for union certification do not always materialize in practice. The authors instead turn to another type of natural experiment. They exploit the fact that in Norway, the net after-tax price of union membership varies by year and income level, due to governments changing the amount of union dues claimable on taxes. A lower net membership price should induce more workers to unionize. They construct a firm-level variable that measures the average firm-level ratio of the subsidy to union membership price, and use that variable as an instrument for union density. They also obtain firm-level data on a number of economic outcomes in Norway from 2001 to 2012. First, using a simple OLS regression, they find that union density is negatively correlated to productivity, measured using value-added.[8] However, when they instrument union density using their measure of the membership subsidy, they find a positive relationship between union density and productivity. The authors provide a number of robustness tests, always finding this positive relationship.

3. Unions and Productivity in the Construction Sector

So far, this report has discussed the impact of unions on productivity in a general sense, or empirical findings in manufacturing or in specific sub-industries. Some aspects of the construction industry, however, might lead to different expectations on the effect of unions in that sector. This section describes the research literature regarding the construction industry in particular.

3.1 Productivity and Unionization in the Ontario Construction Sector

To provide some context for the discussion on unions and productivity in the construction sector, this section first provides some data on trends in construction compared to the overall business sector and manufacturing in Ontario, another larger industry often associated with unions.[9] In the recent period from 2012 to 2017, the construction industry in Ontario experienced total factor productivity growth of 2.8 per cent per year, much greater than the 1.1 per cent of the business sector, but similar to that in the manufacturing sector (2.6 per cent). Over the longer 1997-2012 period, however, total factor productivity grew at a slower pace in construction (0.42 per cent per year) than in the business sector (0.58 per cent) or manufacturing (1.59 per cent). The story is similar using labour productivity, with growth in construction at 2.8 per cent per year over 2012-

[8] The authors use log(value added) as dependent variable. As such, they actually measure the effect on production. However, they also control for the number of workers, which should then give the correlation between production and union density, keeping the workforce fixed. Therefore, the results do reflect productivity.
[9]Productivity data are obtained from Statistics Canada's Productivity Accounts (Table 36-10-0211-01).

2017 (0.53 per cent over 1997-2012), compared to 1.4 per cent in the business sector for the recent 2012-2017 period (1.2 per cent for 1997-2012) and 2.2 per cent for manufacturing (1.9 per cent for 1997-2012).

Regarding unionization, Statistics Canada data[10] on Ontario indicates that the unionization rate remained quite stable in the construction industry over the 1997-2018 period. In 1997, 32.6 per cent of construction employees were covered by a collective agreement, decreasing to 30.4 per cent in 2018. For comparison, the coverage rate in the manufacturing industry decreased from 34.5 per cent to 18.7 per cent. Over the whole goods-producing sector, the coverage rate decreased from 35.2 per cent to 24.1 per cent. Similarly, for the whole private sector, the coverage rate decreased from 19.2 per cent to 13.6 per cent.

3.2 The Impact of Unions on Productivity in the Construction Sector

Mandelstamm (1965) lists characteristics of the construction industry that are important to consider when studying the impact of unions on productivity: seasonal and cyclical work, more casual employee-employer relationships, and opportunities for jurisdictional disputes. Allen (1988) also discusses these idiosyncrasies.

Cyclical work and shorter-lived employee-employer relationships mean that the "voice" face of unions should play a smaller role in the construction industry (Allen, 1984; Addison and Hirsch, 1989). Interestingly, this means that should researchers find a positive impact of unions on productivity, it is more likely to come from the "monopoly" face of unions. In other words, the higher wages are the determining factor to higher (or lower) efficiency.

Another important distinction in the construction industry is the structure of unions. In most industries, unions are organized at the workplace or firm level. In the construction industry, there is a tradition of craft unions, organized along occupations or trades. Under that model, one advantage of unions is that they provide a uniform wage rates with predictable quality among workers, as well as a centralized venue for hiring, which makes hiring easier for contractors (Allen, 1984).

Another difference between construction and other industries such as manufacturing is that research and development expenditures are usually smaller in the construction industry. In turn, unions are less likely to affect productivity through an impact on R&D activities (Allen, 1988b). However, Allen (1988a) does warn that innovation might be under-estimated in this industry, and Mandelstamm (1965) gives a number of examples of new techniques that were being adopted at the time of his paper that are completely integrated in today's construction industry (e.g., paint rollers, drywall, premixed aggregate).

In the end, as in the general case, it is an empirical question whether unions affect productivity in the construction sector. Mandelstamm (1965) provides an early attempt at answering that question with quantitative data. The author obtains data from surveys in 1957 in two cities in the United States where the unionization rates of construction workers was different: Ann Arbor and Bay City. The author surveys about 100 persons in each city: contractors, subcontractors, union

[10]Unionization data are available from Statistics Canada's Labour Force Survey(Table 14-10-0070-01).

leaders, building inspectors, etc. They were showed the blueprints for a typical small house, and asked to evaluate how much they would charge the consumer (or contractor in the case of a subcontractor) to complete their task (e.g., plastering). They also ask the people surveyed a number of general questions on the impact of unions on efficiency in the construction sector.

Mandelstamm (1965) finds that workers in the more unionized city (Ann Arbor) were more efficient. Arguments advanced to explain this observation include the fact that higher wages led to a more selective process for hiring workers, an apprenticeship program that resulted in better training, and entrepreneurs who were more likely to improve the efficiency of their business. Regarding entrepreneurial efficiency, Mandelstamm (1965) did find that union contractors were more likely to adopt new techniques such as using drywall and paint rollers. They do so since the opportunity cost of inefficient use of labour is higher in unionized firms than non-unionized ones.[11]

Mandelstamm's (1965) survey also yielded a number of interesting anecdotal observations. The people surveyed by the author reported only few unnecessary restrictions or featherbedding imposed by unions. For example, unions were not seen to promote "slowing down" work, to require unnecessarily high quality levels, or require a sub-optimally high number of workers. Interviewees also did not report overly restrictive hiring or firing rules. They did report some union resistance on overtime, but no evidence of jurisdictional rules, a potential problem with trades-based unions.

The results obtained by Mandelstamm (1965) in his survey are interesting, but they only offer anecdotal evidence. In particular, Ann Arbor differed from Bay City not only by its unionization rate, but also by its proximity to Detroit, another large market with numerous contractors competing. In the 1980s, Steven G. Allen conducted a number of more data-driven studies on the impact of unions in the construction sector. In Allen (1984), the author uses Brown and Medoff's (1978) methodology with US data from the 1972 Census of Construction Industries, combined with unionization data from the Current Population Survey. The results indicate a strong positive impact of unions on productivity in the construction sector, with unionized firms about 20 per cent more productive when controlling for (observable) labour quality and prices.

Allen (1986a) points out that the results in Allen (1984) are subject to the same criticism as the ones in Brown and Medoff (1978). In particular, the data had to be aggregated to the 2-digit level, and price indices were only an imperfect proxy of actual prices, such that the results may capture a union price effect, instead of a union productivity effect. In Allen (1986a), the author attempts to provide better estimates of the productivity impact by using data on two specific types of construction projects: commercial office buildings, and public elementary and secondary schools. Notably, the two types of projects differ by their ownership structure: the office buildings are privately owned, while schools are publicly owned. In both cases, Allen's data allows a physical measure of output, and they are at the project-level instead of aggregated by sub-industry.

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[11] Mandelstamm (1965) does highlight three techniques that met more resistance from unions. The ram-set gun was found unsafe at the time, so its use was restricted. The paint spray gun was limited to some surfaces not found in residential work, and was also rarely used by non-union contractors. Finally, the union restricted the use of prefabricated parts to those that would come from unionized manufacturers.

For commercial office buildings, Allen (1986a) finds that unionized workers are 37.6 per cent more productive than non-unionized ones, when including building characteristics, and when measuring output in terms of square feet built per hour. Using value added per hour instead, the author finds that unionized workers are up to 50 per cent more productive. This result shows the upward bias resulting from the use of value added as a measure of output. For school buildings, Allen's (1986a) results are inconclusive. While productivity is higher for unionized contractors for secondary schools using value added or square footage as output measures (but not student capacity), it is lower or similar for contractors building elementary schools. Allen (1986a) argues that the difference between office buildings and schools could be explained by differences in ownership. State and local governments might put restrictions on materials or techniques used in building schools that would not be imposed in commercial office buildings, for example. Moreover, state and local governments might have less incentives to minimize costs than private building owners, such that unions might be able to capture some rents in the form of shirking.

To explore whether the different findings for public and private buildings are explained by technology (i.e., governments putting restrictions on techniques or materials used in building schools) or by incentives, Allen (1986b) revisits the issue in a study of productivity in the building of privately- and publicly-owned hospitals and nursing homes. His data covers 44 such establishments in the United States that were completed in 1976. In specifications that include building characteristics, Allen's results indicate that the productivity of unionized contractors is 37 per cent lower in publicly-owned hospitals than in privately-owned ones, using square footage as the measure of output. In other words, unionized contractors are more efficient when building privately-owned buildings. Another way to analyze the data is to compare unionized contractors to non-unionized ones. In the construction of privately-owned hospitals, the evidence is weaker; the coefficients are less precisely estimated and are not statistically significant. That being said, the results suggest that unionized contractors are 32 per cent more productive than non-unionized ones, again using square footage as the output measure. Overall, Allen (1986b) argues that these results suggest that the pattern of ownership explains how unions have different effects in private and public buildings, instead of technology. However, the sample in his study is small, and the privately-owned hospitals, while private, are still run as not-for-profit organizations, thus limiting the usefulness of his results.

In 1988, Steven G. Allen published two additional papers on the topic of productivity of unionized contractors in the construction industry. In Allen (1988a), the author describes the declining unionization rate in that industry between 1966 and 1983 in the United States. He argues that the main factor explaining this decline is the erosion of the productivity advantage of union contractors, which itself could be explained by the higher share of union members working for non-union contractors. Allen (1988b) provides another estimation of the productivity differential in the construction of retail stores and shopping centres in the late 1970s. In that sample, Allen does find that union contractors are up to 51 per cent more productive than non-union ones, but warns that these results might not be true even by 1988, when the paper was published, due to the declining share of union workers in the industry.

Since the late 1980s, only a few researchers have attempted to evaluate the productivity of unionized vs. non-unionized construction workers. Belman and Voos (2006) do study unionization in the construction industry, but their focus is on estimating the wage gap between

union and non-union workers. In Canada, the author is not aware of any study specifically related to the construction industry.

Australia has experienced a more recent debate regarding productivity in union vs. non-union contractors in the construction industry. In 1999, the Australian Productivity Commission released a report arguing that unions were contributing to the low productivity of the construction sector in that country (Productivity Commission, 1999). To explain this finding, the authors cited rules demarcating work tasks, inflexible inclement weather practices, and inflexible rostered days off. These rules were found to lead to industrial disputes, and thus to delays and inefficiencies. Toner *et al.* (2001), however, sharply criticized the Commission's finding, arguing that their methodology was flawed. They do not themselves offer an estimation of the productivity gap between union and non-union contractors, instead relying on anecdotal evidence and offering alternative explanations for poor productivity performance, such as small firm sizes. More recently, Chancellor (2015) provided additional analysis on the union-productivity relationship in Australia using a method called Data Envelopment Analysis. The author's results, however, are inconclusive. Nationally, his results support the Productivity Commission's (1999) results of unions being negatively correlated with productivity. However, his state-level analysis shows that the sign of the relationship varies by state. This mixed result may in fact show the importance of country- and region-level analysis before making strong conclusions.

Conclusion

This report reviewed the economics literature on the impact of unions on productivity. Starting with the influential paper by Brown and Medoff (1978) that suggested a strong positive impact of unions on productivity, economists have refined the analysis. The literature boomed in the 1980s and 1990s following the publication of the paper by Brown and Medoff (1978) as well as the book *What Do Unions Do?* By Freeman and Medoff (1984). Some papers suggested that Brown and Medoff's (1978) results were biased upwards, providing results showing a smaller or non-existent relationship between unions and productivity. Others have replicated Brown and Medoff's (1978) positive result. Table 2 provides a summary of empirical results found in the literature.

More recently, economists have turned their attention to the question again. For example, in 2006, a number of authors contributed to a 20-year retrospective on *What Do Unions Do?* (edited by Bennett and Kaufman, 2007). In addition, following the development of more credible statistical tools, a number of researchers wrote updated analyses of the question. An early example is the paper by Dinardo and Lee (2004), who used Regression Discontinuity Design. They find a negligible impact of unions on productivity. However, other authors refined their analysis using similar methods but different datasets, finding positive impacts.

One main take away from the literature is that null effects can often hide heterogeneous impacts. For example, unions could affect productivity differently in different countries or industries, or depending on the composition of the workforce in different plants. Developments of more detailed datasets at the firm level, as well as matched employee-employer datasets should allow for better and more precise results in the future.

Table 2: Summary of the Impact of Unions on Productivity in the Literature

Positive Impact	Negative Impact	Inconclusive
Impact of Unions on Productivity Level		
Brown and Medoff (1978)	Mitchell and Stone (1992)	
Freeman and Medoff (1984)	Bemmels (1987)	
Clark (1980a)	Clark (1984)	
Clark (1980b)	Hirsch (1991)	
Black and Lynch (1997)	Lovell, Sickles, and Warren (1998)	
Freeman (1980a; 1980b): through longer employment tenure	Hoxby (1996)	
	Leigh (1981): through increased absenteeism	
Impact of Unions on Productivity Growth		
Lynch (1992): through an increase in worker training	Kendrick and Grossman (1980): due to increased number of strikes	Allen (1988b)
	Hirsch and Link (1984)	Addison and Belfield (2004): inconclusive results on worker training
	Maki (1983): positive shock in the short term, followed by a decrease in growth rate.	
	Odgers and Betts (1997): through lower investment	
	Betts, Odgers, and Wilson (2001): through lower R&D activity	
Using Modern Statistical Tools		
Sojourner et al. (2014)		Dinardo and Lee (2004): negligible impact on productivity
Barth et al. (2017)		Frandsen (2012): impact varies along the distribution of workers
Specific to the Construction Sector		
Mandelstamm (1965)	Allen (1986a; 1986b): negative for publicly-owned buildings	Allen (1988b): unions workers more productive, but narrowing of the productivity gap due to declining union coverage
Allen (1984)	Productivity Commission (1999): in Australia	Chancellor (2015)
Allen (1986a; 1986b): positive for privately-owned buildings		

For that reason, this report dedicated a full section to a discussion of the impact of unions in the construction industry. One important characteristic of the construction industry in the context of this report is that unions in that industry are often organized by trade or occupation, instead of by firm or plant. This characteristic affects how we should think unions affect productivity. Mandelstamm (1965) was the first to attempt to quantitatively answer whether unions affected productivity in the construction industry. He finds that unionized workers are more efficient, but only with a limited sample and using a subjective survey. Steven G. Allen followed up with a number of studies on the construction industry. Between his different papers, Allen finds conflicting results. In Allen (1984), the author finds a strong positive impact of unions on productivity. In later papers, Allen (1986a; 1986b) studies the impact separately in the construction of privately-owned and publicly-owned buildings. He finds that in the case of privately-owned buildings, construction workers are more efficient, but not for publicly-owned ones. Two reasons for this difference are advanced: public owners have different requirements for materials or techniques, and public owners might have weaker incentives to control costs, allowing union workers some liberty to shirk. In Allen (1988a), the author revisits the question, finding that the productivity advantage of union workers was eroding. The author argues (also in Allen, 1988b) that this erosion is due to the higher share of unionized workers finding additional work for non-union contractors.

Given the observation above that results are highly sensitive to the industry and country under study, and the observation in Allen (1988a; 1988b) that results can be sensitive to the time period, it is particularly troubling that no study exists on the union productivity differential in the Canadian construction industry. With the development of new large and detailed datasets linking worker and employer characteristics, future work should consider studying the impact of unions in the construction sector in Canada. The necessity of such a study is made more important by the widely different trends in unionization in Canada compared to the United States, the country studied most often, and in the construction sector compared to other sectors.

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