2004

Three Essays on the Relationship Between Labor Disputes And Employee Performance: Dissertation Summary

Alexandre Mas
Princeton University

Three Essays on the Relationship Between Labor Disputes and Employee Performance

Alexandre Mas

Industrial relations events such as strikes, slowdowns, or work stoppages can have important economic consequences for firms. These episodes may impact firm-level measures of productivity and output, especially if workers refrain from producing. In cases where output is contractible, adverse conditions of employment may induce workers to lower effort in other dimensions of production, for example, through diminishing the quality of the product. However, a relationship between worker treatment and the quality of production has proved difficult to establish. Since quality is often unobserved or hard to measure, little is known about the impact of adverse labor relations on workers' efforts when they are on the job and even producing at full capacity. This dissertation sheds light on the question of how conditions of employment affect the performance of workers by exploring two natural experiments that allow for direct tests of the effect of labor disputes on product quality. In addition, I present evidence from arbitration systems demonstrating that the precise characteristics of wage settlements can have important implications for the performance of workers.

Chapter 1 examines the construction equipment resale market and assesses the impact of contract disputes on Caterpillar, the world's largest manufacturer of construction machinery. Chapter 2, which is coauthored with Alan Krueger, explores whether a long, contentious strike and the hiring of replacement workers at Bridgestone/Firestone's Decatur plant in the mid 1990s contributed to the production of defective tires. In Chapter 3 I construct a matched dataset of arbitration cases involving compensation of police in New Jersey and monthly arrest rates at the municipality level to test whether arrest rates depend on the arbitration outcome, the arbitrator award, and, crucially, the expected outcome.

The unifying theme of this dissertation is that industrial relations, particularly wage policy, requires careful accounting of employee effort. The three studies show that the extent to which workers choose to exert effort on the job can have economically important implications for firms, consumers, and even public safety. The effects are large, economically significant, and provide insight into possible avenues through which policymakers and managers can mitigate these hidden costs of disputes.

Chapter 1: Labor Unrest and the Quality of Production— Evidence from the Construction Equipment Resale Market

In the first chapter I examine the construction equipment resale market in order to assess whether equipment produced by the world's largest manufacturer of construction machinery, Caterpillar, experienced lower product quality in several facilities where workers underwent extended contract disputes during the 1990s. Since the physical quality of construction machinery is inherently difficult to measure, I rely on resale market outcomes to infer whether machines produced during the dispute were of inferior quality. An analysis of transaction-level data from auctions occurring between 1994 and 2002 reveals that resale market participants significantly discounted machines produced in these facilities during the dispute, by about 4 percent. Because in any given year of production identical models of equipment were produced in plants both affected and unaffected by the dispute, the statistical model employed in this paper is able to address numerous confounding factors since I can essentially "hold constant" factors that affected the resale prices of a cohort of models in a given calendar year. I also find that pieces of equipment produced in facilities experiencing labor unrest were resold more often in the auction market, received lower reports by independent construction equipment appraisers, and had lower list prices in the new market relative to other comparable equipment. Finally, I also present evidence that resale market participants learned over time about the change in quality corresponding to this cohort of construction equipment, suggesting the presence of additional inefficiencies resulting from goods being misallocated to consumers. Taken together, the evidence supports the hypothesis that workmanship at dispute-affected facilities declined.

Cost–Benefit Analysis of the Caterpillar Dispute

The results from this paper allow for a cost–benefit analysis of the labor dispute from management's perspective, since the focus of the analysis is on prices. On balance, the analysis suggests that the equipment produced in facilities undergoing labor disputes was discounted by the resale market by about 4 percent. I outline a model of the durable goods resale market that predicts that the change in resale price for dispute-affected equipment relative to the comparison group can be interpreted as the change in the discounted stream of service flows—economic quality. Based on this theoretical prediction, the analysis suggests that equipment produced during the dispute experienced almost a quarter of a billion dollars in lost service flows due to price depreciation alone.

An important question to consider is whether any of these large losses in service flows were internalized by Caterpillar, or equivalently, whether prices for new equipment were also discounted, so as to affect Caterpillar's revenue, and to what extent these prices were discounted relative to resale prices. The model of the durable goods market presented in the paper predicts that when equipment experiences increased physical depreciation, it may also experience increased price depreciation, suggesting that the effect of the labor dispute on resale prices may not have fully shifted to Caterpillar revenues.[1]

One approach to estimating the cost of the dispute due to lower product quality is to assign an upper bound on the effect of lower quality equipment on Caterpillar revenues. Suppose that increased physical depreciation of older equipment was fully capitalized in new prices. The dispute would have led to a $240 million reduction in Caterpillar revenue arising from the labor dispute. Of interest is how this reduction in revenue compares to labor cost savings brought about by Caterpillar's decision to demand concessions from the United Auto Workers (UAW). This comparison is possible since the counterfactual labor contract is known—the contract Deere signed with the UAW in 1991. Prior to 1991, bargaining in the construction equipment industry was characterized by pattern bargaining, by which the UAW would sign a contract with one company in the industry and others would follow suit. In 1991 the target company for negotiations was Deere, and a settlement resulted. According to industry analysts at the time of the strike, the contract signed with Deere would have increased labor costs at Caterpillar by about $250 million over the life of the three year contract (Kelly 1992). Over the entire six-plus years of the dispute, the difference in wage bills between Caterpillar and Deere was on the order of $500 million, since in 1995 Deere signed a new contract with the UAW that extended the base wages set in the previous contract (*Daily Labor Report* 1995). Assuming that the only costs of the strike were due to quality reductions, and that new prices fully capitalized future quality depreciation of dispute-affected equipment, then the loss in revenue resulting from inferior equipment produced during the dispute was about half as large as the labor cost savings over the dispute period, provided that Caterpillar reverted back to the Deere contract after six years. If Caterpillar did not revert back to the Deere settlement after six years, then the net present value of breaking from pattern would be on the order of $1.4 billon, clearly outweighing the costs associated with the quality reductions alone. However, under this assumption, the results of the paper show that the hidden costs of the dispute, due to the quality reductions, are approximately 16 percent of total labor cost savings, which is quite a sizable quantity, especially when one considers that this estimate does not take into account the direct costs of the strike as well as reputation costs Caterpillar may have incurred.

Chapter 2: Strikes, Scabs, and Tread Separations—Labor Strife and the Production of Defective Bridgestone/Firestone Tires

The second chapter, which is written jointly with Alan Krueger, is a second case study of the effect of labor relations on product quality. We consider whether a long, contentious strike and the hiring of permanent replacement workers by Bridgestone/Firestone in the mid 1990s contributed to the production of defective tires, which received substantial media attention in the early 2000s. Using several independent data sources, we find that labor strife in the Decatur, Illinois plant closely coincided with lower product quality. Count data regression models based on two data sets of tire failures by plant, year, and age show significantly higher failure rates for tires produced in Decatur during the labor dispute than before or after the dispute, or than at other plants. Also, an analysis of internal Firestone engineering tests indicates that type-P235 tires from Decatur performed worse if they were manufactured during the labor dispute compared with those produced after the dispute, or compared with those from other, nonstriking plants.

Consumer Safety and Policy Implications of the Bridgestone/Firestone Case

While in the Caterpillar case the reductions in product quality had significant economic effects, the Bridgestone/Firestone case had additional implications on consumer safety. The results in this chapter suggest that about 46 lives were lost because of the excessive number of defects occurring in P235 tires manufactured in the Decatur plant at the time of the labor dispute. These results have consequential implications for policymakers. We estimate that in the absence of the tire recall there would have been 249 additional fatalities. This estimate makes clear the importance of government, in this case the National Highway and Transportation Safety Administration (NHTSA), monitoring. Additional deaths may have been avoided had there been increased monitoring of the tires produced in plants undergoing labor disputes. Less encouraging are the results from the high-speed stress tests. These tests show that tires produced at Decatur during the dispute were less resistant to wear than tires produced at the Joliette and Wilson plants, or tires produced at other times. Nevertheless, even the defective cohort of tires were above the threshold established by the Society of Automotive engineers for the test analyzed in the paper. In light of this finding, existing thresholds should be reevaluated and set to ensure minimal failure rates on the roads.

A question that is explored in the paper is whether Bridgestone/Firestone should have detected a break in the defect rate prior to the NHTSA investigation. In this chapter we ask when Bridgestone/Firestone should have detected a problem with Decatur produced tires had they been specifically monitoring the this facility in light of the dispute. We estimate that by 1996 there were already a statistically significant number of excessive claims originating from the Decatur plant at the time of the dispute relative to other plants and the years prior to the dispute. Had Bridgestone/Firestone initiated a recall in 1996, and reduced the defect rate of tires produced in the Decatur plant to predispute levels, we estimate that 38 deaths could have been averted.

Implication of the Bridgestone/Firestone and Caterpillar Cases for the Debate over Amending the National Labor Relations Act

Chapters 1 and 2 are pertinent to the debate for legislation on whether the National Labor Relations Act (NLRA) should be amended to prohibit employers from hiring permanent replacement workers during a strike.[2] The data on Bridgestone/Firestone tire consumer complaints and claims to the manufacturer provide a unique opportunity to investigate tire defect rates at relatively high frequencies. Detailed comparisons can be made between defect rates and the precise composition of the workforce at the Decatur plant during the period of labor unrest. Monthly data suggest that the production of defective tires was particularly high in early 1994, around the time when wage concessions were demanded by Firestone, and in late 1995 and early 1996, when large numbers of replacement workers and permanent workers worked side by side. These results accord with the pattern of resale prices for Caterpillar equipment affected by the labor dispute. Decomposing the resale price discount on Caterpillar construction equipment produced during the labor dispute by each individual year of production shows that this discount was most pronounced for equipment made after striking workers had returned to work, but before they had signed a new contract with Caterpillar. Therefore, both cases provide evidence that changes in product quality cannot be attributed solely to an inexperienced replacement workforce. The results suggest that whether replacement workers are building dangerous products due to inexperience or lack of training should not be the central focus in the debate over legislation that seeks to amend the NLRA.

Chapter 3: Do Disappointing Pay Raises Lower Productivity? Final-Offer Arbitration and the Performance of New Jersey Police Officers

While much of our understanding of labor markets derives from the idea that workers respond to incentives, an emerging body of experimental work provides evidence that psychological or nonmarket factors are also important determinants of employee performance (Fehr and Gachter 2000). Surveys of employers suggest that deviations from reference wages impact worker morale and that managers are reluctant to lower wages (Bewley 1999, 2002; Blinder and Choi 1990; Kaufman 1984; Agell and Lundborg 1999). While the theoretical literature on gift exchange has emphasized the role of social norms in determining worker performance, there is little understanding of the determinants of reference points and how workers perceive and act on surprises and disappointments in the workplace (Koszegi and Rabin 2004). Moreover, as Verhoogen, Burks, and Carpenter (2003) note, while the proposition that productivity declines when wages deviate from a reference point is commonly used by economists to explain such empirical regularities as wage rigidities, involuntary unemployment, and interindustry wage differentials within occupational categories, evidence from real labor markets of this proposition is limited.

The goal of this paper is to empirically assess the relationship between relative wages and worker performance in a real labor market, as well as to explore the mechanism through which this relationship could operate. It is a challenge to empirically identify the causal effect of wage growth on performance due to the scarcity of instances where a variation in compensation is plausibly uncorrelated to changes in productivity. Testing whether performance is affected by deviation of wages from reference points is further complicated by the lack of guidance from the theoretical literature on the characteristics of the comparison wage. I argue in this paper that arbitration systems offer an attractive real-world laboratory to investigate how on-the-job performance of labor market participants responds causally to changes in compensation.

The use of arbitration as a dispute resolution procedure is prevalent in the public sector and is becoming increasingly important in the private sector following the U.S. Supreme Court's ruling in 2001 that employees can be required to submit all employment disputes to binding arbitration. A commonly used arbitration procedure to resolve contract disputes is final-offer arbitration (FOA), in which disputing parties submit offers to an arbitrator who is constrained to choose one of the disputant's offers in a binding settlement. As described in the next section, while the decision to engage in arbitration may be correlated with a variety municipal finance and labor market conditions, economic theory, as applied to FOA, suggests that there is a random component to arbitration rulings, and when disputing parties submit Nash equilibrium offers, the arbitrator's ruling is random and orthogonal to the facts of the case. Moreover, information drawn from arbitration cases includes both the wage that is enacted as well as the counteroffer, information that allows for a unique perspective on the role of reference points on employee outcomes.

I employ a dataset containing information on FAO cases involving compensation disputes between New Jersey Police Bargaining Units (PBUs) and municipalities between 1978 and 1996. These data are matched to data on monthly municipal arrest rates. Using the resulting dataset, I test whether arrest rates are different in the months following arbitration in municipalities where the arbitrator ruled in favor of the PBU to municipalities where the arbitrator ruled against the PBU. This paper provides evidence that a tangible effect of arbitration is discerned through recognizing postarbitration disparities in arrest rates, depending on the arbitrator's ruling. Specifically, I estimate that per-capita arrests were 10 percent higher in the months following arbitration when arbitrators ruled in favor of PBUs relative to when arbitrators ruled in favor of the municipal employer. I provide additional evidence that the disparities in arrests are not the result of changing crime rates or employment levels in police departments following arbitration.

An attractive feature of the dataset is that information is available on the final offers of the parties in dispute. Using this information, it is possible to examine the determinants of arrest rate differentials due to differing arbitration rulings. The degree to which an arbitration decision is considered a win or a loss may depend on expectations upon entering arbitration. A growing number of laboratory experiments provide evidence that subjects behave as if they have reference-dependent preferences (Bateman et al. 1997; Mellers, Schwartz, and Ritov 1999; Thaler 1980; Tversky and Kahneman 1991). Consider, for example, the following lottery: a person can win \$32 with probability 0.8 or lose \$8 with probability 0.2. Mellers, Schwartz, and Ritov (1999) find that losing \$8 in this lottery is less painful to participants than losing \$8 in a lottery where the alternative is a loss of \$32. These results suggest that preferences depend not only on actual outcomes, but also what could have occurred in a different state of the world.

What are the implications of surprise and disappointment for workers in the labor market? The natural experiments considered in this paper can be motivated by the following simple example which is similar in spirit to the experiments described in Mellers, Schwartz, and Ritov (1999). Suppose that a worker's raise depends on the outcome of a lottery. With probability p she will receive a 6 percent raise in the following year and with probability $(1 - p)$ she will receive a 2 percent raise. How does the outcome of this lottery affect the worker's productivity? In particular, is the worker's productivity lower if she receives the 2 percent raise relative to the case in which she receives the 6 percent raise? Does the productivity effect of obtaining the 6 percent raise depend on the magnitude of the alternative point on the lottery's support, or some other reference point? Lastly, how does the value of p, or the probability of the larger raise, affect her productivity following either a win or a loss?

The results of the paper show that the postarbitration arrest rate differential between cities in which the arbitrator ruled in favor of the PBU and in cities in which he ruled against the PBU is not growing in the arbitrator award, suggesting that a simple effort/wage gradient is not accounting for the postarbitration relationships observed in the data. Conditional on the arbitrator award, however, the postarbitration productivity differentials are increasing in the spread of the final offers, a result that accords with models of disappointment aversion: the performance of police officers following a raise depends not only on the quantity of the raise, but on the alternative raise as well. I also provide evidence that the decline in arrests following a police arbitration loss is increasing in the difference between the expected award and the arbitrator award, suggesting that postarbitration changes in arrests are most serious when the ruling is considered a relative surprise.

The results from this paper are powerful as they suggest a framework that can be extended in a number of directions to answer a variety of questions that are of interest to municipal government, policymakers, and managers. For example, I am currently using this framework to study the causal effect of police performance on crime, an important question that is ultimately difficult to address in a credible way. Arbitration rulings affect arrest rates in the months after arbitration through, presumably, changes in policing tactics. Assuming that criminals do not also respond to arbitration rulings other than through, perhaps, changes in policing patterns, one can test whether crime rates also respond to arbitration rulings and therefore obtain causal estimates of the effect of policing on criminal activity.

References

Agell, Jonas, and Per Lundborg. 1995. "Theories of Pay and Unemployment: Survey Evidence from Swedish Manufacturing Firms." *Scandinavian Journal of Economics* 97(2): 295–309.

Bateman, Ian, Alistair Munroe, Bruce Rhodes, Chris Starmer and Robert Sugden. 1997. "Does Part-Whole Bias Exist? An Experimental Investigation?" *Economic Journal* 107(441): 322–332.

Bewley, Truman. 1999. *Why Wages Don't Fall During a Recession.* Cambridge, MA: Harvard University Press.

———. "Fairness, Reciprocity, and Wage Rigidity." 2002. Cowles Foundation discussion paper no. 1383. New Haven, CT: Yale University.

Blinder, Alan, and Don Choi. 1990. "A Shred of Evidence on Theories of Wage Stickiness." *Quarterly Journal of Economics* 105(4): 1003–1015.

Daily Labor Report. 1995. No. 44, March 7, p. A:12.

Fehr, E., and S. Gachter. 2000. "Fairness and Retaliation: The Economics of Reciprocity." Working paper no. 40. University of Zurich.

Kaufman, Roger. 1984. "On Wage Stickiness in Britain's Competitive Sector." *British Journal of Industrial Relations* 22: 101–112.

Kelly, Kevin. 1992. "This Brawl Could Cost CAT a Couple of Its Lives." *Business Week,* March 23, p. 82.

Koszegi, Botand, and Mathew Rabin. 2004 "A Model of Reference-Dependent Preferences." Photocopy. University of California, Berkeley.

Mellers, Barbara, Alan Schwartz, and Ilana Ritov. 1999. "Emotion-Based Choice." *Journal of Experimental Psychology: General* 128(3): 332–345.

Thaler, Richard. 1980. "Toward a Positive Theory of Consumer Choice." *Journal of Behavior and Organization* 1: 36–60.

Tversky, Amos, and Daniel Kahneman. 1991. "Loss Aversion in Riskless Choice: A Reference-Dependent Model." *Quarterly Journal of Economics* 106(4): 1039–1061.

Verhoogen, Eric, Stephen Burks, and Jeffrey Carpenter. 2003. "Fairness and Freight-Handlers: Local Labor-Market Conditions, Wage-Fairness Perceptions, and Employee Performance in a Trucking Firm." Photocopy.

Notes

1. Indeed, I find that models of new equipment that were uniformly produced in dispute-affected facilities were assigned by Caterpillar approximately 2 percent lower list prices than models that were uniformly produced in facilities that were not subject to dispute, an amount that is relatively modest as compared to the degree of discounting in the resale market, but consistent with the theory. However, one may want use caution in interpreting estimates derived from list prices since list prices do not capture discounts Caterpillar may have given on equipment at the point of sale.
2. In June 15, 1993, the U.S. House of Representatives voted 239–190 to amend the National Labor Relations Act. The bill never reached the Senate due to a threatened filibuster.