Square Foot Construction Costs

for Newly Constructed State and Local

Schools, Offices and Warehouses

in Nine Southwestern and Intermountain States

1992-1994

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by

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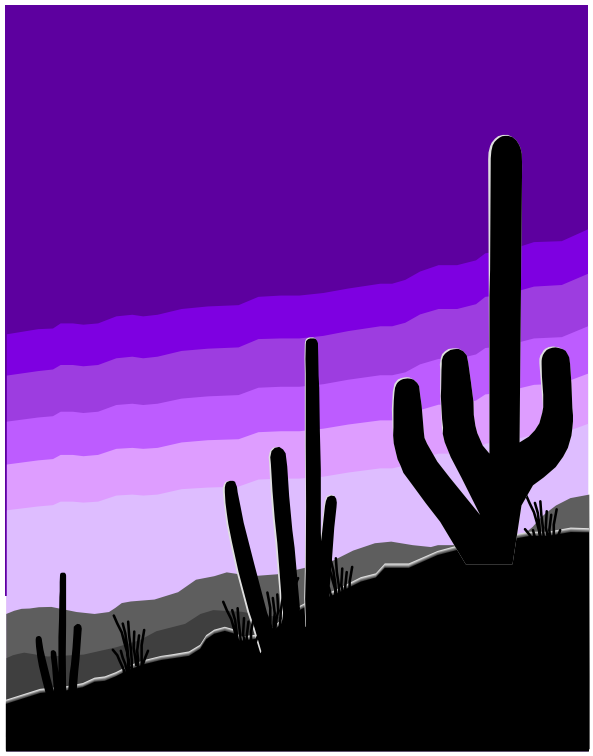
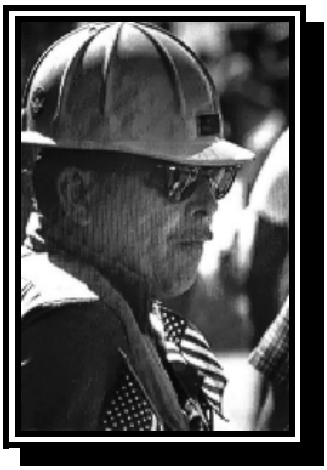
Abstract: This study compares public square foot construction costs in five southwestern and Intermountain states that have state prevailing wage laws with four states in the same region that do not have state prevailing wage laws. The five "have-law" states are New Mexico, Texas, Oklahoma, Wyoming and Nevada. The four "no-law" states are Arizona, Utah, Idaho and Colorado.[1] These states are often used by either New Mexico or Utah in making public school teacher salary comparisons. During the time period of the study, 1992-94, elementary schools cost $6 per square foot less in the five-state group with prevailing wage laws. Middle schools cost $11 less per square foot in the states with prevailing wage laws. High schools cost $11 less per square foot in the states with prevailing wage laws. Warehouses cost $35 dollars less per square foot in states with prevailing wage laws and office buildings cost $2 per square foot more in the five state group with prevailing wage laws. When Texas is removed from the "have-law" group, elementary and middle schools still cost less in the remaining four "have-law" states while high schools cost $5 more per square foot in the remaining "have law" states and offices cost $8 more per square foot in the remaining "have law" states. By far, the highest number of observations is for elementary schools and this group generates the most stable and reliable results with an 8% cost advantage favoring the "have-law' group when Texas is included and a 5% cost advantage favoring the "have-law" group when Texas is excluded. New Mexico's 14 newly built elementary schools during the time period of the study, 1992-94, cost $66 per square foot as compared to $72 in Arizona, $72 in Utah and $80 in Colorado, the three surrounding states without state prevailing wage laws. Construction costs are sensitive to regional differences in cost of living as well as prevailing wage law regulations, building design and other factors. Consequently, when the number of observations falls for a specific building type, these results must be treated cautiously. An aggressive conclusion from these data would be that prevailing wage laws promote collective bargaining and apprenticeship training and consequently lower public construction costs. A more conservative conclusion from these data notices that these cost differences found do not provide support for the proposition that the elimination of prevailing wage laws saves on public construction costs.



[1] Two cities in Colorado, Denver and Peublo retain prevailing wage regulations.



Contents

I. About the Author

Peter Philips received his B.A. from Pomona College (1970) and his M.A. (1976) and Ph.D. (1980) from Stanford University. He is a Professor of Economics at the University of Utah. He is co-editor of *Three Worlds of Labor Economics* and co-author of *Portable Pensions in Casual labor Markets*. Philips has published widely on the canning and construction industries in a variety of academic journals including *Industrial and Labor Relations Review*, *Industrial Relations*, *Business History Review*, the *Journal of Economic History*, and the *Cambridge Journal of Economics.* Philips has received awards for his teaching and community service including the University of Utah Presidential Teaching Scholar and the Lowell Bennion University Service Professor. Philips has served as an expert advisor to the U.S. Justice Department on the history and impact of the Davis-Bacon Act. He has testified before legislative committees in California, Indiana, Ohio and Oklahoma regarding aspects of those states' prevailing wage laws. Some of Philips' previous research has been funded by the U.S. Labor Department, by alumni of the University of Utah's economics department, by the AFL-CIO and by construction industry organizations. Readers of this report who have questions, comments, suggestions or criticisms may contact the author at the Economics Department, University of Utah, Salt Lake City, UT 84112; (801) 585-6465; PHILIPS@ECON.SBS.UTAH.EDU. The author welcomes and encourages such communication.

II. Acknowledgments

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III. Introduction

A primary reason to repeal state prevailing wage laws is to attempt to save on state public construction costs. It is argued that state prevailing wage laws encourage the use of unionized construction contractors. It is well known that union construction workers receive higher wage rates and consequently, it is argued that these higher wage rates lead to unnecessarily higher public construction costs. This report attempts to test the proposition that the elimination of state prevailing wage laws lowers public construction costs by focusing on the states surrounding New Mexico that do and do not have state prevailing wage laws. The design of this study is to select states that New Mexico uses when making comparisons of public teacher salaries. New Mexico is well situated for such a study design because some of the surrounding states have state prevailing wage laws (Texas and Oklahoma[2]) and some do not (Utah, Arizona, Colorado).

In addition, because the author is from Utah and has an interest in the effect of Utah's repeal of its prevailing wage law on state expenditures, the states surrounding Utah are also included in this study.

[2] The time period for this study is 1992 to 1994. In the fall of 1995, Oklahoma's state supreme court declared its state law unconstitutional. In 1982 Oklahoma's legislature, in order to save administrative costs, dropped its procedure for determining what the prevailing wage rate was and adopted the federal Davis-Bacon rates. In 1995, the state supreme court declared this an unconstitutional delegation of state powers to the federal government. For the purposes of this study, Oklahoma is treated as a state with a prevailing wage law.

These are Nevada and Wyoming which have state prevailing wage laws and Idaho which does not have a prevailing wage law. Also, I understand Nevada school teacher salaries are sometimes used in comparison with New Mexico public teacher salary comparisons. In any case, the data are presented in such a way as to see the effects of the inclusion or exclusion of any one or several of these states. States such as California are excluded from this comparison of public construction costs for the same reason that California would be excluded from a comparison of school teacher salaries. Significant variations in the cost of living alter private and public sector construction costs. One way to control for this effect is to select states with similar costs of living.

This study also focuses on a short time period, 1992 to 1994 in order to reduce the confounding effects of inflation and the business cycle on comparison of construction costs. All costs are analyzed in 1994 dollars using the consumer price index urban as a deflator.

The major focus of this study is on school construction costs because this type of construction is commonly affected by state prevailing wage laws and because this type of public construction provides many observations allowing for more reliable statistical results. For comparison, this study also includes public offices and warehouses. Not surprisingly, there are considerably fewer public office buildings and warehouses built in the selected region during the selected time period. The results for these types of buildings should be viewed conservatively for both statistical and practical reasons. Statistically, the fewer observations only permit more tentative conclusions. Practically, if one wished to save public construction cost by altering prevailing wage law regulations, one should focus on where most state public construction takes place. That would lead to a relatively sharper focus on school construction compared to other building types.

This study is in three main parts plus two appendices. Section IV reviews the relevant literature on school construction. No published studies exist that focus on school construction and prevailing wage laws. However, the U.S. Bureau of Labor Statistics did publish one study of school construction costs in the early 1970s. This study found that despite an almost 50% wage rate differential in school construction between the Northeast and the South in 1972, labor costs as a percent of total construction costs were basically the same. The study attributed this to possible differences in labor productivity and the cost of materials by region.

Again studying construction in the 1970s, economist Steven Allen found that union construction labor productivity was 20 percent to 50 percent higher than nonunion construction labor productivity. However, Allen also found that schools built by union contractors were more expensive than schools built by nonunion contractors. Allen's sample was small so that he was forced to combine elementary schools with middle and high schools. Furthermore, Allen's sample contained only 11 nonunion schools and 57 union-built schools across the entire U.S.. In contrast to Allen, this study presents data for 223 schools built only in nine Intermountain and Southwestern states. This allows me to control for differences in square foot costs associated with differences between high schools and elementary schools as well as eliminate the confounding effects of regional differences in cost of living.

Section V presents an analysis of training in construction as it relates to prevailing wage laws and union/nonunion differences in contractor strategies. This section shows that in the case of Utah, apprenticeship training declined dramatically after the repeal of Utah's state prevailing wage law. Neither nonunion contractors nor state vocational education programs significantly made up for the loss in jointly managed union-contractor programs in the union sector of construction. Economic theory identifies two problems or market failures that lead to greater training when there is collective bargaining in construction. These are the free rider problem and the bait-and-switch problem. Basically, because construction workers often move from contractor to contractor as work shifts from construction site to construction site, nonunion contractors are hesitant to train workers who will only end up working for their competitors. In the collective bargaining context, the rule is "who comes around goes around". For example, I train the apprentice who may end up working for you while you train the apprentice who because he or she is a member of the union and I am a union contractor, I know he or she may end up working for me. Thus, the

collectively bargained contract tends to overcome the free rider problem and permit training. U.S. Bureau of Apprenticeship data reflect this by showing that three out of every four construction apprentices enrolls in a joint union-management apprenticeship program even though union contractors employ only 25% to 50% of the labor force. Furthermore, in union-management apprenticeship programs graduation rates are relatively high. This is because there is a jointly hired apprenticeship coordinator who serves as a policeman insuring that the quality of the training is good and apprentices are rotated through a variety of work experiences. On the nonunion side there usually is no policeman insuring that training takes place. Thus, some nonunion contractors are tempted into a bait-and-switch strategy of promising training but only providing helper experience. Consequently, the graduation rate on the nonunion side of apprenticeship training is much lower. The combined consequence of free-ride and bait-and-switch problems means that almost nine out of every ten journeyman construction workers graduating from formal, monitored, structured and planned apprenticeship programs come from the unionized sector of construction. This accounts for the higher productivity of unionized construction contractors that tends to pay for the higher union wage rates.

Section VI presents the results of comparing the square foot construction costs in five types of public buildings (elementary schools, middle schools, high schools, offices and warehouses) in five states with prevailing wage laws (New Mexico, Texas, Oklahoma, Wyoming and Nevada) with four states without prevailing wage law regulations (Utah, Arizona, Colorado and Idaho). These results show that if anything, square foot construction costs are lower in the states with state prevailing wage laws compared to those without these laws. Comparing New Mexico to the four states without prevailing wage laws yields the same result. Excluding Texas from the group of states with prevailing wage laws (because Texas has a majority of observations in this group) also yields the same result. While one cannot conclude that prevailing wage laws definitely lower state construction costs, one can conclude that in this region of the country and these types of structures, especially schools and especially elementary schools (where we have the largest number of observations) there is no evidence to support the proposition that state prevailing wage laws raise public construction costs.

Appendix A lists the F.W. Dodge data for New Mexico used in this study. It should be noted that all cost data in this study are accepted bid prices or start costs. These costs do not include change orders or other sources of cost over-runs. F.W. Dodge does not collect final cost data. An attempt was made to collect final cost data but this proved to be impractical. A large and well financed study might succeed in collecting final cost data but there is no central source for these kind of statistics.

In Appendix B to this report, this study presents data from the *U.S. Census of Construction* showing that labor costs as a percent of total costs in construction runs around 25% to 30%. This is helpful data in setting the limits on plausible estimates of how much money one might save by eliminating state prevailing wage laws. Clearly any estimate asserting that one might save 25% to 30% on total public construction costs by eliminating state prevailing wage laws is unrealistic given that labor costs including benefits are only 25% to 30% of total costs.

IV. Review of the Relevant Literature.

Summary of a U.S. Bureau of Labor Statistics Study of Wages and School Construction Costs

In 1979, the U.S. Bureau of Labor Statistics published a study of school construction costs by region in the United States. In contrast to the material I will present below, the BLS study did not break out schools into elementary, middle and high schools. Nor did it break down construction by state. Rather, the BLS study aggregated school types and presented data on four regions, northeast, midwest, south and west. The relevant data for our purposes is presented below.

Table 1: Hourly Wage Rates and Total Costs as a % of Total Construction Costs

Elementary and Secondary School Construction		
1972	**Hourly Wage Rate**	**Wages as a Percent of Total Cost**
Northeast	$7.75	27.9%
North Central	$7.43	29.3%
South	$5.22	27.3%
West	$7.22	29.0%

Source: U.S. Bureau of Labor Statistics, John G. Olsen, "Labor and Material Requirements for New School Construction," *Monthly Labor Review*, April 1979, Vol. 102, Number 4, p. 41.

The key point to be derived from Table 1 is to note that hourly wage rates varied considerably between the Northeast region and the South ($7.75 versus $5.22 in 1972). In contrast, wage costs as a percent of total costs were almost the same in the two regions (27.9% versus 27.3%). The analyst, John Olsen, commented on these facts as follows:

> Average hourly earnings also varied by region. Hourly earnings for all construction workers averaged $6.78, ranging from $5.22 in the South to $7.75 in the Northeast. Wages as a percent of contract costs varied from just above 27 percent in the South to slightly above 29 percent in the North Central. Although average hourly wage rates in the Northeast were higher than those in the North Central region, wage costs as a percent of total contract costs were lower. Among other factors, this irregular trend could result from regional differences in productivity rates and in relative material costs. (pp. 40-41)

Why could differences in labor productivity account for the fact that an almost 50% difference in wage rates between the South and the Northeast did not result in any difference in labor costs as a percent of total costs? The answer is simple. If labor productivity in the Northeast was 50% greater than labor productivity in the South, either because of better training, better equipment or both, then the higher wage rates of the more productive workers would be offset by that greater labor productivity. Is it reasonable to believe that construction workers in the Northeast in 1972 were roughly 50% more productive than Southern construction workers at the time?

Summary of Steven G. Allen's Work

In 1984, an economist at North Carolina State university, Steven G. Allen, published in The Quarterly Journal of Economics an article entitled "Unionized Construction Workers Are More Productive".[3] Professor Allen summarizes his study as follows:

> Apprenticeship training and hiring halls probably raise union productivity [compared to nonunion workers] while jurisdictional disputes and restrictive work rules lower it. Using Brown and Medoff's methodology, union productivity measured by value added per employee is 44 to 53 percent higher than nonunion. The estimate declines to 17 to 22 percent when estimates of interarea construction price differences are used to deflate value added. (p. 251)

In other words, prior to adjusting for differences in regional cost-of-living and differences in regional construction material costs, union construction labor in the 1970s, the period of Allen's study, was roughly 50% more productive than nonunion labor. The wage rates and material costs in the BLS study were not altered to factor in the effect of differences in regional cost-of-living. Thus, the BLS study is quite consistent with Allen's work and their conclusions are similar. Wage rate differences of 50% across regions with differences in productivity and cost-of-living may not alter labor costs as a percent of total costs. Within a region such as New Mexico or the Intermountain west, where the cost-of-living and the material costs of construction is similar, 20 percent differences in wage rates in construction can be offset by differences in productivity between union and nonunion labor.

In a subsequent paper also published in the *Quarterly Journal of Economics*, Allen comes up with slightly different conclusions. In "Can Union Labor Ever Cost Less?" Allen concludes:

> ...union contractors have greater economies of scale. This gives them a cost advantage in large commercial office buildings, but in school and hospital construction, nonunion contractors have lower costs at all output levels. Despite the cost differences, profits for nonunion contractors in school and hospital construction are no higher than those for union contractors because the burden of higher union costs is shifted to the buyer.[4]

In other words, based on a study of 57 union built elementary and secondary schools and 11 nonunion built elementary and secondary schools, Allen concludes in his second article that the union built schools cost more and that the union contractor did not absorb those added costs. Rather those added higher costs were passed on to the school boards and tax payers who paid for that construction.

I emphasize Allen's result because it is not consistent with the data I have analyzed for New Mexico and eight other Intermountain or Southwestern states from the early 1990s. The differences in my results which I present below compared to Allen's may be due to 1) differences in time, Allen's data are from the early 1970s, 2) differences in region, Allen does not indicate what region of the country his school data are drawn from while my results are specific to nine states, 3) effects of mixing elementary, middle and high schools together--Allen does not break out school types while I do; or 4) differences in sample size. Allen is comparing 57 union built schools with 11 nonunion built schools while I compare 223 schools built in prevailing wage law states with 109 schools built in non-prevailing wage law states.

As I will point out below, the results of the this study are that square foot cost of school construction in the selected states are, if anything, lower in the states with prevailing wage laws compared to those without prevailing wage laws. Obviously, not all schools in states with prevailing wage laws in this region are built

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[3] *Quarterly Journal of Economics*, May, 1984, pp. 251 to 274. *The Quarterly Journal of Economics* is the second oldest economics journal in the United States and is published by Harvard University. It is considered one of the premier journals in economics.

[4] Steven G. Allen, "Can Union Labor Ever Cost Less?" *Quarterly Journal of Economics*, May, 1987, pp. 347 to 373.

by union contractors and not all schools in states without prevailing wage laws are built by nonunion contractors. Allen does not break his analysis down along the dimension of legal regulations. For the purpose of analyzing the advisability and usefulness of prevailing wage law regulations, it is more useful to break construction projects out by whether they were built under these regulations or not rather than whether they were built union or nonunion. Nonetheless, it is appropriate to address the question of differences between union and nonunion contractors as this issue underlies much of the debate surrounding prevailing wage laws.

V. Why Union Contractors Train More

The Case of Utah's Prevailing Wage Law Repeal[5]

When Utah repealed its state prevailing wage law in 1981, training for construction, both in union apprenticeships and through vocational schools declined in Utah. Union apprenticeships are tied to the availability of union jobs. For example, unionized plumbers and pipe fitters in Utah, United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, historically have attempted to maintain apprenticeship rates at between 10 and 15 percent of the number of union journeymen plumbers in the state (fig. 14.3). As employment boomed in the 1970s, however, the union could not meet the demand for journeymen from the unionized contractors. Consequently, the union increased apprenticeship rates to a peak of 25 percent in 1975. The boom persisted, but the backlog had been remedied. So the union lowered its apprenticeship rate back to normal ranges by 1978. Employment during the construction boom peaked in 1979 and membership in the plumbers and pipe fitters' union peaked in 1981. With the repeal of the Utah prevailing wage law, the union dropped its apprenticeship rate to 10 percent, a historical low. Union membership fell slightly in 1982 and then began a steeper decline in 1983. Faced with these sustained declines in membership, the union cut its apprenticeship rate to historical lows in 1986 and thereafter. Unions hit harder by declines in membership have scaled back their apprenticeship programs further. The carpenters' union, Utah locals 184 and 1498 of the United Brotherhood of Carpenters and Joiners of America, which graduated seventy in a class in 1977, graduated five in 1992 (Hansen, Paul. Weber Basin Job Corps Carpenters Union Instructor, personal interview, Sept. 2, 1993). The Utah International Union of Bricklayers and Allied Craftsmen suspended its apprenticeship program altogether.

The decline in union apprenticeship training in Utah has not been offset by a rise in other sources of training. Because the repeal of Utah's prevailing wage law was motivated by a desire to limit state expenditures, state legislators were not eager to raise funding for state-sponsored vocational training. Delmar Stevens, who has taught building trades construction at Salt Lake Community College since 1971, chronicles the decline in enrollment.

> I started at the college in 1971. We went about two or three years and then the enrollment just really started to grow. [When I started we had] probably about 45 students with the first year and second year programs. Then about 1973 or 74 it really started to grow. It jumped up to 200 students and then the crunch came in the last part of the 70s and early 80s it just dropped back to 30 or 40 students. Right now we let in anybody who can walk or crawl. We'll probably graduate 6 or 7 this year (Personal interview, September 14, 1993).

Although the number of vocational graduates in construction grew in the 1970s, the construction labor force grew more rapidly. Thus, while the 1970s was the heyday of vocational training at Salt Lake Community College, vocational graduates as a percentage of the construction labor force had already begun to decline.

[5] The next two subsections of this report are drawn from Hamid Azari, Anne Yeagle and Peter Philips, "The Effects of the Repeal of Utah's Prevailing Wage Law on the Construction Labor Market" in Sheldon Friedman, et al., *Restoring the Promise of American Labor Law*, Cornell University, ILR Press, 1994, pp. 207-22.

Stevens argues that the decline in enrollment is driven by a lack of demand for training. "The staff is hanging on by their fingernails because there's not enough students that want to get into the program." He adds that many of his graduates do not stay in construction: "They get out, and they find out that they don't want to work in the cold in the winter and they want to get into something more secure, something that's got benefits." Construction has always required workers to work in the cold, but the loss of benefits and security has occurred since 1980 along with stagnating employment, declining rate of unionization, and falling relative wages.

Stevens also argues that the decline in construction training is a function of shifting government priorities in education:

> I can't speak for the school—I don't want to get in trouble that way—but we do have more general ed classes feeding the University [than in the past] and the vocational programs are really suffering. You look at Weber State. They used to have vocational programs and with academic drift, they don't have any vocational programs anymore.

Tom Lewis, director of the plumber and pipe fitters' union apprenticeship program, agrees with Stevens that there is an institutional tendency to move away from vocational education.

> We used to have a pretty good relationship with the community colleges. The reason we bought our own building and moved out here [away from Salt Lake Community College] is that you have an administrator of a vocational school and they don't want to remain the administrator of a vocational school. They move to an applied technology center, then they're a community college, and then they're a university. I started my apprenticeship at Weber Vocational Center which is now Weber State University. Vocational training seems to get set aside as this evolution happens and we eventually just get moved out the back door(Personal interview, Sept.3,1993).

The steady decline in vocational training as a percentage of the construction labor force through good times and bad supports the notion that the state has simply tried to get out of the business of vocational training in construction. The fall in union membership and wages has made construction a less attractive career. At the same time, unions are less able to train construction workers. As unions are weakened and schools drift toward academic offerings, the capacity to respond smoothly to an upsurge in construction jobs is undercut. And federally sponsored Job Corps vocational training is not in a position to fill in the gap.

Federal revenues pay for Job Corps training in Utah at both the Weber Basin and Clearfield centers. Federal funding in real terms for these centers has not expanded, but the Weber Basin Job Corps Center, which draws predominately from the Utah population, has significantly contracted its construction worker training throughout the 1980s. This center committed itself to changing from an all-male student population in 1980 to 50 percent female by 1990. To accommodate this switch, training for traditionally male occupations such as construction have been scaled back to accommodate new offerings in traditionally female occupations, such as office management and clerical work. Cement masonry and heavy-equipment training have been eliminated, and instruction in carpentry, painting, and brick laying has been cut in half.

The Clearfield Center has graduated approximately one hundred construction trainees per year since the early 1970s. Fewer Clearfield graduates go into the Utah labor market compared with Weber Basin because most of Clearfield's students are from out of state. On the whole, perhaps 10 percent of Clearfield's graduates go into the Utah labor market, but this percentage rises during periods of local labor shortage. It is estimated, however, that at most only 25 percent of Clearfield's graduates will stay in Utah (Hill, Merle. Vocational Education Manager, Clearfield Job Corps, personal interview, Sept. 9, 1993).

Even without union pressure, a skill shortage in Utah construction may raise wages and induce a new generation of young people to enter vocational training. When that happens, however, high-quality training programs, which take time to create, may not be in place to meet that demand, which will add an additional lag to the natural time it takes to train a skilled laborer.

Why the Nonunion Sector Did Not Make Up for the Loss of Union Training

The market has not successfully made up for the decline in union and state-sponsored training. At the national level, the nonunion Association of Building Contractors (ABC) has attempted to replicate the union system of bargaining for hourly contributions to a training fund. It is difficult, however, to induce ABC's member contractors to include general training costs in their bids. Each contractor fears his competitors will not include training costs. Thus, in an attempt to be low-cost bidder, ABC contractors often refrain from including training costs despite the ABC's initiative. Consequently, very little ABC training has occurred in Utah.

Nonunion apprenticeship programs operate, however, in the licensed trades of electricians and plumbers. In 1992, there were 846 nonunion licensed apprentice electricians in Utah and 2,068 nonunion journeymen. Thus, there are 4 apprentices for every 10 journeymen in the nonunion sector. In contrast, there were 123 apprentices and 607 journeymen in the union sector in 1992 or 2 apprentices for every 10 journeymen. In the nonunion sector, apprentices begin at around $6 per hour with no benefits. Over a four-year period, the state mandates that their wage rise to 80 percent of a journeyman's pay. In the union sector, apprentices begin at $7 per hour with an additional $3 in benefits. Their wages rise to $14 per hour plus $3 in benefits over a five-year period (Leroy, Julie. Assistant Business Manager, IBEW Local 354, Sept.25, 1993). Nonunion apprentices are sponsored by a particular contractor that oversees their on-the-job training, and these apprentices also take classwork at a participating community college. Union apprentices work under the direction of an apprenticeship coordinator, rotate among employers for on-the-job training, and take classes at community colleges and union apprenticeship centers. Roughly 90 to 95 percent of the union apprentices complete their programs and graduate to journeymen status, while only 15 to 20 percent of the nonunion apprentices graduate (Dean, Frank. Home Builders Institute Electrical Instructor, Clearfield Job Corps, Sept. 9, 1993). Given these rates, in four years, out of 846 nonunion apprentices, we should expect 125 to 170 journeymen to be graduated. In five years in the union sector, out of 123 apprentices, 110 to 115 apprentices would graduate to journeymen electrician. Thus, while the nonunion sector accounts for more than 85 percent of all electrician apprentices, it accounts for about 60 percent of journeymen graduates. Economic theory is consistent with this pattern wherein nonunion apprentices are paid less and graduate at a lower rate than union apprentices.

Economic theory posits that in the absence of marketwide institutions or government subsidies, individual workers will have to pay for their own on-the-job training when the skills learned are general to an industry and not specific and unique to the activities of a particular firm. The worker-learner pays for training by accepting a wage that is lower than the value to the firm of that worker's marginal product. By working for less than what the worker is worth to the employer, the worker pays the employer for on-the-job training. That beginning nonunion electrical apprentices earn $6 per hour while union apprentices earn $10 per hour (including benefits) is consistent with the theoretical proposition that nonunion apprentices pay for their own training by taking a discounted wage below their marginal value to the contractor.

Because the employer does not pay for nonunion training, the theory suggests that the employer has no stake in the worker's training. Consequently, if the worker leaves, the employer does not lose any investment in the worker's human capital. Thus, the employer will tolerate high levels of turnover. Because the worker is receiving less than what the worker can earn in other jobs with no on-the-job training, the worker may be tempted to exit jobs with training when current personal budget needs become pressing. So, on both the employer side and the worker side, turnover is tolerated in the nonunion sector. This is consistent with the higher turnover rates among nonunion apprentices, but other factors also contribute to the 15 to 95 percent differential in nonunion to union graduation rates.

Because the nonunion employer prices new hands at discounted wages that shield the employer from investing in the human capital of the new workers, the employer does not screen new workers extensively to forestall subsequent turnover. Failure to preselect new workers for aptitudes and attitudes consistent with a long-term attachment to construction work adds to the turnover among nonunion construction apprentices. In contrast, the joint apprenticeship boards of unions and union contractors do considerable preselection for both aptitude and attitude before letting a candidate into an apprenticeship program. This is because both the union

contractors and unions will invest in the union apprentices' training. Not wanting to lose their up-front investment, they seek to eliminate exit once the apprenticeship is begun.

In the nonunion sector, workers may also leave apprenticeships if it becomes apparent that the employer offering training at a discounted wage is not delivering on that training promise to train. Because employers are able to discount wages of apprentices below their current worth to the employer, it is tempting to engage in bait-and-switch tactics whereby training is promised but not delivered. By saving on training costs, the employer can earn an additional profit from employing green hands at discounted wages. In the union sector, because employers and union journeymen invest in the training of the apprentices, bait-and-switch tactics are less attractive. Because the apprentices' wage is not discounted as much below what they could earn elsewhere, the apprentices are not as tempted to leave. Thus, economic theory predicts the observed pattern whereby the nonunion sector must begin training five apprentices to graduate one journeyman while the ratio in the union sector is close to one to one.

The General Pattern of Training in Construction

In basic terms, nonunion contractors have difficulty training because one, the relationship between the contractor and the construction worker is often brief. This leads to a free-rider problem. Why should I train you when you are likely to go down the road and work for my competitor. I would just be helping him out and not myself. Two, without an apprenticeship coordinator there is no one policing the training to insure that on-the-job training takes place and is of decent quality. Thus, some contractors are tempted into bait-and-switch strategies where they promise an apprenticeship experience but deliver only the job experiences of a helper. The apprentice spends his or her time holding the dumb end of a measuring tape. The result of these two market failures, the free-rider and bait-and-switch phenomena lead to lower numbers of apprentices in the nonunion sector and lower rates of graduation into journeyman status. Data from the U.S. Bureau of Apprenticeship Training illustrate these effects.

Table 2 shows data for the entering class of construction apprentices in 1989. The data exclude California, New York, Delaware and Hawaii . These states currently do not report into the U.S. Bureau of Apprenticeship Training data base. For the remaining states, basically three out of every four construction apprentices enrolled into a jointly managed union-contractor apprenticeship programs despite the fact that union contractors account for less than half of all construction workers.

Table 2: Apprentices Enrolled in 1989 by Union and Nonunion Sectors and Craft

Apprenticeship in Construction The Class of 1989			
(1)	(2)	(3)	(4)
	Entering Apprentices		
	Total	% Union	% Nonunion
Electrician	7,245	58.4%	41.6%
Carpenter	4,752	88.8%	11.2%
Plumber/Pipefitter	4,467	65.6%	34.4%
Sheet Metal	1,856	74.0%	26.0%
Structural Steel	1,234	97.4%	2.6%
Roofer	1,162	88.0%	12.1%
Painter	972	90.6%	9.4%
Bricklayer	830	90.0%	10.0%
Operating Engineer	729	87.9%	12.1%
Other	3,675	78.5%	21.5%
All trades	**26,922**	**74.8%**	**25.2%**

Table 3 shows that the graduation rates are very different in the union and nonunion sectors of construction. By 1995, six years after enrollment, 55.8% of the apprentices in joint union-management programs had turned out as journeymen. In contrast, among the smaller number of nonunion apprentices only 28.7% turned out as journeymen by 1995. The lower number of apprentices in the nonunion sector despite the fact that the nonunion sector employs more workers is an example of the problem of free-rider market failures. The lower graduation rate among the nonunion apprentices reflects the problem of bait-and-switch. Together these problems feed on each other.

Table 3: Graduation Rates for the Entering Class of 1989 by Sector and Craft

Apprenticeship in Construction The Class of 1989		
(1)	(5)	(6)
	% of Each Group Graduating	
	Union	Non-union
Electrician	69.0%	29.5%
Carpenter	44.8%	29.5%
Plumber/Pipefitter	61.5%	26.0%
Sheet Metal	67.4%	43.6%
Structural Steel	56.2%	9.4%
Roofer	29.2%	17.9%
Painter	39.9%	18.7%
Bricklayer	49.9%	48.2%
Operating Engineer	53.8%	6.8%
Other	57.3%	25.7%
All trades	**55.8%**	**28.7%**

Table 4 shows the combined effects of free rider and bait-and-switch problems. The higher ratio of apprentices to journeymen in the union sector combines with the higher graduation rate in the union sector resulting in union contractors accounting for 85% of all the new journeymen coming from the entering class of 1989.

Table 4: The Share of All New Journeymen Coming from the Entering Class of 1989

Apprenticeship in Construction The Class of 1989		
(1)	(7)	(8)
	Share of All Graduates	
	Union	Nonunion
Electrician	76.7%	23.3%
Carpenter	92.3%	7.7%
Plumber/Pipefitter	81.8%	18.2%
Sheet Metal	81.5%	18.5%
Structural Steel	99.6%	0.4%
Roofer	92.3%	7.7%
Painter	95.4%	4.6%
Bricklayer	90.3%	9.7%
Operating Engineer	98.3%	1.7%
Other	89.1%	10.9%
All trades	**85.2%**	**14.8%**

Not all good construction workers learned their trade through formal apprenticeship. Not all union construction workers come from formal apprenticeship. Not all union apprenticeship graduates stay within the union sector of construction. However, the fact that almost nine out of every ten journeymen coming out of formal, monitored, planned and supervised apprenticeships come out of union apprenticeships means that union construction contractors are more likely to have a core of well trained craft workers. This allows these contractors to confidently invest in larger or more specialized machinery that require greater skill. This allows those contractors to employ capital intensive and human capital intensive technologies where wage rates can be higher without necessarily raising unit costs.

VI. An Analysis of Square Foot Public Construction Costs in Nine Southwestern and Intermountain States

The F.W. Dodge Corporation collects data on the accepted bid price or start cost of construction projects across all states and in both the public and private sector. Dodge does this as an information service to contractors bidding on construction jobs. From these data, I have selected five types of new structures built for non-federal public entities for analysis. These structures are elementary schools, middle schools, high schools, offices and warehouses. I limited my analysis to new construction in order to bring my

comparisons as closely as possible to similar construction projects.[6] Renovations have more widely varying characteristics. (For instance a new boiler put into an elementary school will have a much higher square foot cost than would the installation of a portable class room.) I looked at construction that began sometime between July 1, 1992 to July 1, 1994. I translated all accepted bid prices into 1994 dollars using the consumer price index.

I selected construction in nine western states. These states include five states with state prevailing wage laws regulating wage rates on public construction and four states free from these regulations on state and local public construction. The states selected were Utah which does not have a state prevailing wage law and New Mexico which does have such a law. Plus I selected all surrounding states that either border New Mexico or border Utah or both. Based on this criterion, the five selected states with prevailing wage laws are 1) New Mexico, 2) Texas, 3) Oklahoma[7], 4) Wyoming and Nevada. The four states in which contractors were free from state prevailing wage regulations in my selected group are Arizona, Utah, Colorado and Idaho. With the exception of Nevada where the two main cities, Las Vegas and Reno tend to have cost-of-living characteristics similar to California, the states in this selected group tend to have similar cost-of-living characteristics.

Table 5: The Distribution of Construction by Type within the Selected Nine States

New State Construction 1992-94 in 9 States	Count	Column %
Structure Type		
OFFICES	43	10.90%
WAREHOUSES	20	5.10%
ELEMENTARY SCHOOLS	175	44.30%
MIDDLE SCHOOLS	104	26.30%
HIGH SCHOOLS	53	13.40%

In the nine selected states, during the years 1992 to 1994, elementary schools accounted for the largest single type of new non-federal public construction.

Table 5 shows the distribution of construction projects across the five selected types. Elementary schools are the most common while warehouses are the least common. In order to make statistically meaningful comparisons between the average square foot public construction costs in states with and without state prevailing wage laws it is necessary to have a sufficient number observations. Thus, results for elementary schools are most reliable and results for warehouses are least reliable.

[6] I excluded from my sample any project that reported square foot costs less than $20 or over $500. In unreported statistical analyses, I included these outliers. The conclusions of this report are not substantially altered by the exclusion of these cases.

[7] In October, 1995, Oklahoma's state supreme court declared Oklahoma's law unconstitutional. It is no longer in effect. However, during the period under study, Oklahoma had a prevailing wage law regulating state public works.

Table 6 shows the breakdown of construction sites by type of structure grouped by states with and without state prevailing wage laws. The distribution of structure types is basically the same in the five states with prevailing wage laws compared to the four states without such laws. Elementary schools are most common and public warehouses are least common. More construction in the selected structure types took place in the five states with prevailing wage laws compared to the four states without such laws. In general, there are sufficient numbers of sites by type in each group of states to make meaningful comparisons with the possible exception of warehouses where there were only 12 built in states with prevailing wage laws and 8 built in states without prevailing wage laws. In contrast, 116 elementary schools were built in states with prevailing wage laws and 59 in states without prevailing wage laws. This is clearly enough observations to overcome the random effects of special aspects on any one particular job site that might raise or lower square foot construction costs.

Table 6: Distribution of New Construction by Type and Prevailing Wage Law Status

	Status of State Prevailing Wage Law			
	Has P.W. Law		No P.W. Law	
	Count	Column %	Count	Column %
Structure Type				
OFFICES	23	8.90%	20	14.60%
WAREHOUSES	12	4.70%	8	5.80%
ELEMENTARY SCHOOLS	116	45.00%	59	43.10%
MIDDLE SCHOOLS	76	29.50%	28	20.40%
HIGH SCHOOLS	31	12.00%	22	16.10%

More new public construction took place in the five states with state prevailing wage laws compared to the four states without prevailing wages laws during the period under study. However, the distribution of types of structures was similar in the two groups of states.

Table 7 shows Texas (a state with a prevailing wage law) accounts for the most construction projects of any of the nine selected states. Arizona (a state without a prevailing wage law) is second while Wyoming provides the least number of construction sites to analyze. New Mexico built 24 new public structures of the types under analysis during the time period under analysis. Of these 24, 14 were elementary schools. This is a sufficient number to make comparisons using New Mexico alone compared to other states. (These structures are listed in Appendix A.)

Table 7: Distribution of New Construction by Type and State

Number of New State and Local Construction Projects by State									
State	***AZ***	***CO***	***ID***	***NM***	***NV***	***OK***	***TX***	***UT***	***WY***
OFFICES	6	4	5	4	2	1	13	5	3
WAREHOUSES	1	6	1	0	0	0	12	0	0
ELEMENTARY	24	14	8	14	10	12	79	13	1
MIDDLE SCHOOLS	9	6	7	4	5	8	58	6	1
HIGH SCHOOLS	10	2	5	2	5	3	21	5	0
Total	***50***	***32***	***26***	***24***	***22***	***24***	***183***	***29***	***5***

Texas accounts for the largest amount of new construction projects. Arizona is a distant second. Wyoming accounts for the fewest projects.

Table 8 presents data on average square foot cost of construction in 1994 dollars broken down by structure type for the selected four states that do not apply prevailing wage regulations to state and local public works. In addition to average (or mean) square foot costs, Table 4 shows the number of new structures built, the minimum square foot cost on the least costly of these structures and the maximum square foot cost on the most costly of these structures.

In each state, elementary schools were the most common structure built. Average square foot costs ranged from a low of $60 per square foot for 8 elementary schools in Idaho to $80 per square foot for 14 elementary schools in Colorado. In terms of individual schools, one elementary school in Arizona and one in Idaho were built for $46 per square foot while at the other extreme, one elementary school in Arizona was built at the cost of $155 per square foot. These cost variations in elementary school construction may have to do with urban versus rural settings, differences in installed equipment, the size of the school or other factors. In comparing square foot construction costs across states with and without prevailing wage laws, my analysis assumes that with increased sample size the effects of these special factors driving costs up or down will offset each other in state averages. This is more likely to be true as the sample size rises.

In Table 9 the same square foot construction costs are presented for states with prevailing wage laws. Again, elementary schools are the most commonly found type of new public structure in each state. The average square foot cost ranges from a low of $49 per square foot for 8 elementary schools in Oklahoma to a high of $96 per square foot for 10 elementary schools in Nevada. The 14 elementary schools in New Mexico averaged $66 per square foot with the cheapest coming in at $35 per square foot and the most expensive at $87.[8] Oklahoma had the single cheapest elementary school built at $27 per square foot while Texas had one elementary school cost $368 per square foot. The difference in these very cheap and very expensive projects are probably due primarily to distinct differences in specifications of the buildings. However, when the expensive Texas school is averaged in with the 78 other elementary schools built in that state, its effect on the statewide average is minimal.

[8] The cheapest New Mexico elementary school project involved portable metal classroom buildings and the most expensive was the building of Chaparral Elementary School in Santa Fe. In comparing construction costs, one tries to compare apples to apples. Elementary schools as a building type are relatively homogeneous. However, as the example of portable classrooms suggests, even within the category of elementary schools/new construction there can be considerable differences in building design driving square foot cost differences. Similarly, it may be that Santa Fe is a more expensive region within New Mexico. This is why more observations lead to better comparisons of averages as the atypical project or the atypical area gets swamped by a larger number of more typical projects and more representative areas within a state.

Table 8: Square Foot Construction Costs in States without Prevailing Wage Laws

Arizona	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	6	$100	$64	$179
WAREHOUSES	1	$65	$65	$65
ELEMENTARY	24	$72	$46	$155
MIDDLE SCHOOLS	9	$77	$53	$100
HIGH SCHOOLS	10	$86	$69	$104

Colorado	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	4	$108	$62	$168
WAREHOUSES	6	$106	$21	$297
ELEMENTARY	14	$80	$61	$95
MIDDLE SCHOOLS	6	$79	$41	$130
HIGH SCHOOLS	2	$107	$96	$118

Idaho	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	5	$96	$44	$174
WAREHOUSES	1	$65	$65	$65
ELEMENTARY	8	$60	$46	$71
MIDDLE SCHOOLS	7	$62	$53	$78
HIGH SCHOOLS	5	$77	$59	$106

Utah	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	5	$71	$34	$121
WAREHOUSES	-	-	-	-
ELEMENTARY	13	$72	$53	$98
MIDDLE SCHOOLS	6	$91	$59	$205
HIGH SCHOOLS	5	$65	$50	$86

Average square foot cost of construction by structure type in four states without state prevailing wages laws by structure type. Also lowest and highest cost projects for each structure type by state.

Table 9: Square Foot Construction Costs in States with Prevailing Wage Laws

New Mexico	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	4	$76	$64	$95
WAREHOUSES	-	-	-	-
ELEMENTARY SCHOOLS	14	$66	$35	$87
MIDDLE SCHOOLS	4	$71	$58	$85
HIGH SCHOOLS	2	$105	$92	$117

Nevada	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	$2	$127	$85	$170
WAREHOUSES	-	-	-	-
ELEMENTARY SCHOOLS	10	$96	$67	$146
MIDDLE SCHOOLS	5	$99	$75	$110
HIGH SCHOOLS	5	$101	$79	$115

Oklahoma	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	1	$119	$119	$119
WAREHOUSES	-	-	-	-
ELEMENTARY SCHOOLS	12	$49	$27	$70
MIDDLE SCHOOLS	8	$49	$38	$71
HIGH SCHOOLS	3	$49	$48	$50

Texas	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	13	$90	$25	$191
WAREHOUSES	12	$61	$22	$178
ELEMENTARY SCHOOLS	79	$67	$34	$368
MIDDLE SCHOOLS	58	$66	$30	$199
HIGH SCHOOLS	21	$63	$39	$90

Wyoming	Count	Mean	Minimum	Maximum
Structure Type				
OFFICES	3	$112	$96	$142
WAREHOUSES	-	-	-	-
ELEMENTARY SCHOOLS	1	$69	$69	$69
MIDDLE SCHOOLS	1	$39	$39	$39
HIGH SCHOOLS	-	-	-	-

Average square foot cost of construction by structure type in five states with state prevailing wages laws by structure type. Also lowest and highest cost projects for each structure type by state.

Table 10: Comparing Average Square Foot Cost of New Public Construction by Type and Prevailing Wage Law Status

Status of State Prevailing Wage Law (All 9 States)	Has P.W. Law		No P.W. Law	
	Count	Mean	Count	Mean
Structure Type				
OFFICES	23	$95	20	$93
WAREHOUSES	12	$61	8	$96
ELEMENTARY SCHOOLS	116	$67	59	$73
MIDDLE SCHOOLS	76	$66	28	$77
HIGH SCHOOLS	31	$70	22	$81

Square foot construction costs on public projects are not higher in states with prevailing wage laws compared to states without prevailing wage laws.

Table 10 presents the key results from the F.W. Dodge data. Let us focus on elementary schools first because this is the largest group. Average square foot new construction costs are $67 in the five Intermountain and southwestern states with prevailing wage laws and $73 per square foot in the four Intermountain and southwestern states without prevailing wage laws. The sample sizes are large and statistical tests show that this difference of $6 per square foot is real.[9] Referring back to Tables 4 and 5 one can compare New Mexico to the group of states without prevailing wage laws. The average square foot cost for building 14 elementary schools in New Mexico was $66 compared to an average of $73 for 59 schools in the group of states without prevailing wage laws. Comparing New Mexico with Colorado, Utah and Arizona, the three non-prevailing wage law states bordering New Mexico yields similar results. In Utah, 13 elementary schools were built at an average square foot cost of $72. In Arizona, 24 elementary schools were newly built at an average square foot cost of $72, and in Colorado, 14 elementary schools were built at a cost of $80 per square foot. These compare with New Mexico's 14 schools built at a cost of $67 per square foot. Of the four states without prevailing wage laws, only Idaho had a lower average than New Mexico. Idaho built 8 elementary schools at a cost of $60 per square foot.

These data do not support the proposition that eliminating prevailing wage laws are likely to lower public elementary school construction costs in a measurable way. Because the sample size for elementary schools is the largest, this is the single most reliable conclusion from the Dodge data.

Table 10 also shows that the square foot construction cost of middle schools and high schools are lower in the five states with prevailing wage laws compared to the four states without these laws. The 76 middle schools built in prevailing wage law states cost an average of $66 per square foot while the 28 middle schools built in the four states without prevailing wage laws cost an average of $77 per square foot. In the case of high schools, the contrast is similar. In states with prevailing wage laws, square foot costs for 31 schools were $70 while in states without prevailing wage laws it was $81 for 22 schools. However, this last result disappears when Texas is removed from the group of states that have prevailing wage laws. The sample of high schools in the remaining four states with prevailing wage laws falls from 31 to 10 and the square foot costs rises to $86. Removing Texas lowers the sample sizes for elementary schools in the remaining prevailing wage law states from 116 to 37 and middle schools from 76 to 18. However, the basic results in these two cases are unaltered. Square foot construction costs are still, on average, lower in the remaining four states with prevailing wage laws compared to the four states without prevailing wage laws.

[9] A two-tailed t-test shows that these are statistically different numbers at the 5% level of significance.

The sample sizes for middle schools and high schools in New Mexico are low. New Mexico built only four new middle schools and two new high schools during the period under study. The four New Mexican middle schools cost on average $71 per square foot. This compares with square foot costs for middle schools in the four states without prevailing wage laws of $77 in Arizona (9 schools), $79 in Colorado (6 schools), $62 in Idaho (7 schools) and $91 in Utah (6 schools).

The two New Mexican high schools cost $105 per square foot (one at $92 and the other at $117). This compares with square foot costs of high schools in the four states without prevailing wage laws of $86 in Arizona (10 schools), $107 in Colorado (2 schools), $77 in Idaho (schools) and $65 in Utah (5 schools). Thus, there is some suggestion that in contrast to elementary schools and middle schools, high school construction in New Mexico might cost more than in surrounding states with state prevailing wage laws. But this conclusion would be premature. The New Mexico sample is small (two schools) and is in line with the more expensive schools built in each of the states without prevailing wage laws. The high-end costs were $104 per square foot in Arizona, $118 in Colorado, $106 in Idaho and $86 in Utah. The small New Mexican sample may simply only include two more richly designed high schools. Basically, as sample sizes fall, conclusions drawn from comparing averages must become more tentative.

The cost of office buildings (Table 6) were basically the same in states with and without prevailing wage laws. The cost of constructing 23 new state office buildings in states with prevailing wage laws was $95 per square foot while the 20 new office buildings in states without prevailing wage laws cost $93 per square foot. When Texas is eliminated from the sample of five states with prevailing wage laws, the sample size falls to 10 and the average square foot cost rises to $101. However, from a statistical standpoint, there is no significant difference between the averages of $101 and $93.[10]

New Mexico built 4 public office buildings during this period with a square foot cost of $76. Contrasting this $76 square foot cost to the four states without state prevailing wage laws—Arizona built 6 office buildings at an average cost of $100 per square foot; Colorado built 4 public office buildings as an average square foot cost of $108; Idaho built 5 public office buildings at a square foot cost of $96 and Utah built 5 public office buildings at a square foot cost of $71.

Texas was the only prevailing wage law state to build public warehouses during the time period under study. Texas built 12 warehouses at an average square foot cost of $61 while in the group of states without prevailing wage laws, Arizona, Colorado and Idaho together built 8 warehouses at a square foot cost of $96. (Utah did not build a public warehouse during this period.)

In summary, start cost data from the F.W. Dodge Corporation do not support the notion that square foot construction costs on state and local construction will be cheaper in the absence of state prevailing wage laws. In the largest and perhaps the most homogeneous sample of public construction, elementary schools, if anything, square foot construction costs are cheaper in Intermountain and southwestern states with prevailing wage laws compared to those without these laws. This conclusion holds when comparing New Mexico to the surrounding states without prevailing wage laws. Even though sample sizes decrease, the general conclusion that construction costs for middle schools and high schools are, if anything, lower in states with prevailing wage laws compared to those without prevailing wage laws continues to hold. This is also true for New Mexico compared to surrounding states without prevailing wage laws in the case of middle schools. However, in the case of two high schools built in New Mexico, their costs were on the high range of square foot costs in surrounding states with no state prevailing wage laws. This may simply be due to the specific design of these two schools. Sample sizes for office buildings and warehouses are smaller than those for schools, particularly if Texas is excluded from the group of states with prevailing wage laws. In these small sample cases, one cannot conclude that construction costs are any different in Intermountain and southwestern states with or without prevailing wage laws.

[10] A t-test indicates that these means are not significantly different at a 5% level. What this means is that given the small sample sizes and the wide variation of square foot cost within each sample, one cannot conclude that the average differences are the result of anything other than randomness.

Table 11: Excluding Texas and Comparing Average Square Foot Cost of New Public Construction by Type and Prevailing Wage Law Status

Status of State Prevailing Wage Law (Only 8 States) (Excludes Texas)	Has P.W. Law		No P.W. Law	
	Count	Mean	Count	Mean
Structure Type				
OFFICES	10	$101	20	$93
WAREHOUSES	-	-	8	$96
ELEMENTARY SCHOOLS	37	$69	59	$73
MIDDLE SCHOOLS	18	$67	28	$77
HIGH SCHOOLS	10	$86	22	$81

Excluding Texas from the group of states with prevailing wage laws does not alter the general conclusion that public construction costs are not higher in states with prevailing wage laws compared to states without prevailing wage laws.

VII. Conclusions

There are no previous published studies that analyze the relationship between state prevailing wage laws and public school construction costs. Steven Allen's study of union and nonunion contractors in the early 1970s found that while union workers were 20% to 50% more productive than nonunion workers, nonunion contractors were the low-cost contractors in public school construction. Allen's study was limited to 57 union-built and 11 nonunion-built schools. Consequently, he had to collapse together elementary and secondary school buildings and include various regions of the country. The U.S. Bureau of Labor Statistics found that in the early 1970s labor costs as a percent of total costs in school construction did not vary widely by region despite wage rate variations of 50%. The BLS attributed this to differences in regional labor productivity and construction material costs.

Azari, Yeagle and Philips show that in the case of Utah, the repeal of the state prevailing wage law in 1981 corresponded to a rapid decline in apprenticeship training in that state, a decline that was not compensated by any increase in job corps or community college training. Bureau of Apprenticeship Training data for the 1990s show that 85% of all apprenticeship-trained construction journeymen come out of jointly sponsored union-management apprenticeship programs. The reasons that nonunion construction contractors are less likely to train are associated with market failures tied to the problems of free-riding contractors waiting for others to train and bait-and-switch contractors offering training but only providing helper experiences on-the-job. Collectively bargained contracts calling for jointly managed apprenticeship programs provides the policing mechanism to overcome these market failures. Thus, regulations that discourage collective bargaining in construction also discourage formal apprenticeship training in construction. The resulting lower productivity helps account for the fact that lower wage rates in construction do not necessarily lead to lower construction costs.

In the case of the nine southwestern and Intermountain states selected for this cost study, Table 10 shows the basic result. The average square foot construction costs for 116 elementary schools built in five states with prevailing wage laws was $67 while for 59 elementary schools built in four states without prevailing wage laws the cost was $73 per square foot. For 76 middle schools built in the states with prevailing wage laws, the average square foot cost was $66 while in the states without prevailing wage laws the cost was $77 per square foot. For 31 high schools built in the five states with prevailing wage laws, the square foot cost

was $70 while in the four states without state prevailing wage laws the cost was $81. The difference in all of these averages was statistically significant.

When New Mexico's 14 newly built elementary schools was compared to elementary schools in the four surrounding states without prevailing wage laws, the average New Mexico square foot cost of $66 was lower than the square foot elementary school cost in Arizona ($72), Colorado ($80) and Utah ($72) but higher than in Idaho ($60). During the time period selected for the study (fiscal years 1992-94) New Mexico built on 4 new middle schools and 2 new high schools. Thus, the average costs for these schools is more sensitive to the effect of small numbers. Nonetheless, the average New Mexico square foot cost for middle schools ($71) was lower than that for Arizona ($77), Colorado ($79) and Utah ($91) while higher than Idaho ($62). In the case of two high schools in New Mexico, the square foot construction cost was $105. This compare with $86 for 10 high schools in Arizona, $107 for 2 high schools in Colorado, $77 for 5 high schools in Idaho and $65 for 5 high schools in Utah. The smaller number of high schools built compared to middle schools and elementary schools make this comparison more sensitive to the effects of small numbers on averages.

Similar small number problems exist for offices and warehouses. During the time period under study, New Mexico built four public office buildings and no warehouses. The average square foot cost for public office buildings in New Mexico was $76. This compares to an average of $93 for 20 public office buildings built in the four surrounding states without prevailing wage laws.

The basic conclusion of this study is that in the case of New Mexico there is no strong evidence to suggest that the repeal of the state's prevailing wage law would save substantial costs in the construction of public schools. This is especially true in the long run. The reason higher wage rates for construction workers do not necessarily lead to higher construction costs is because those higher wage rate appear to be offset by higher labor productivity. In the short run, lower wage rates might not lead to lower productivity simply because trained construction workers might be forced to accept those lower wage rates. However, in the long run, a migration of trained workers out of construction and a decline in the training of new construction workers would lead to lower productivity canceling out any savings from lower wage rates.

Appendix A: New Mexico Data Used in Study

City	Project Description	Structure Type	Project Value	Square Feet	Sq. Ft. Cost	Sq. Ft. Cost 1994 $
SANTA FE	SCHOOL ADMINISTRATION OFFICE(ADD/REMOD/DEMOLITION)	Office	$1,290,600	14,000	$92	$95
ALBUQUERQUE	OFFICE BUILDING	Office	$4,000,000	65,000	$62	$64
ALBUQUERQUE	STATE BAR CENTER PROJECT (OFFICE BUILDING)	Office	$1,800,000	28,000	$64	$66
SOCORRO	EMRTC COMPLEX (OFFICE/LABORATORY/SHOP)(3 BLDGS)(PRE ENGR)	Office	$3,405,596	43,000	$79	$79
ALBUQUERQUE	TOMASITA ELEMENTARY SCHOOL	Elementary	$2,899,900	48,000	$60	$64
SANTA FE	CHAPARRAL ELEMENTARY SCHOOL 12	Elementary	$2,117,922	26,000	$81	$87
PORTALES	PORTALES ELEMENTARY SCHOOL (9212)	Elementary	$3,698,921	59,000	$63	$67
ZUNI	A:SHIWI ELEMENTARY SCHOOL (PH	Elementary	$1,177,080	17,450	$67	$72
ALBUQUERQUE	PAJARITO ELEMENTARY SCHOOL CORE FACILITY	Elementary	$1,287,426	21,000	$61	$65
TOME	TOME ELEMENTARY SCHOOL (PH 2)(	Elementary	$800,000	11,000	$73	$77
ARTESIA	YESO ELEMENTARY SCHOOL (24 CLASSROOM) (944)	Elementary	$3,924,500	51,500	$76	$76
LOS LUNAS	LOS LUNAS ELEMENTARY SCHOOL	Elementary	$2,311,000	42,500	$54	$56
RUIDOSO	RUIDOSO ELEMENTARY SCHOOL	Elementary	$1,879,700	32,000	$59	$61
ALBUQUERQUE	1993 PORTABLE METAL CLASSROOM BLDGS (120 UNITS) (93112)	Elementary	$3,611,080	108,000	$33	$35
LOVING	LOVING ELEMENTARY SCHOOL (NEW)(PH 1) (A9315)	Elementary	$2,000,000	33,000	$61	$61
LAS CRUCES	ELEMENTARY SCHOOL (B9325)	Elementary	$3,257,687	53,768	$61	$61
MORIARTY	MORIARTY ELEMENTARY SCHOOL(PH 2)(23 CLSRMS)	Elementary	$1,741,351	27,000	$64	$67
GALLUP	EAST ELEMENTARY SCHOOL (PH 1)	Elementary	$2,410,000	29,700	$81	$81
SANTA FE	NEW MID SCHOOL	Middle	$7,696,771	94,000	$82	$85
BELEN	BELEN JUNIOR HIGH SCHOOL (PH 2	Middle	$1,504,850	27,116	$56	$59
FARMINGTON	FARMINGTON JR HIGH SCHOOL	Middle	$5,655,423	100,000	$57	$58
AZTEC	KOOGLER MIDDLE SCHOOL (8 CLASS	Middle	$829,616	10,940	$76	$81
LAS CRUCES	ONATE HIGH SCHOOL (B91.04)	High	$19,768,874	180,000	$110	$117
ALBUQUERQUE	LA CUEVA HIGH SCHOOL (PH 3)	High	$2,606,500	30,000	$87	$92