Trade Secrets Law and Engineer/Scientist Mobility: Evidence from "Inevitable Disclosure"

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As they change jobs, engineers and scientists carry knowledge from one employer to another. Spillovers of knowledge, and so, innovation and economic growth, depend on institutions that influence professional mobility.

Here, we investigate the impact of the doctrine of inevitable disclosure in U.S. state-level trade secrets law on the mobility and earnings of technical workers. We find that state court rulings against inevitable disclosure were associated with 0.4%-points higher mobility of technical workers. Further, state court rulings against inevitable disclosure were associated with higher return to education among technical workers but not other workers.

Our results have implications for the degree of knowledge spillovers between established organizations as well as the rate of entrepreneurial start-ups, and ultimately, the overall economy-wide rate of innovation and economic growth.

JEL: O32, O34

1. Introduction

In the fall of 1999, three senior engineers quit Intel to join Broadcom, a manufacturer of communications equipment.[1] They were Greg Young, product manager for Fast Ethernet and gigabit MAC products, Steven Lindsay, described as the "chief architect" of software for gigabit MAC products, and Martin Lund, an engineering manager.   Subsequently, in March 2000, Intel engineer, Brad Gunther, approached Broadcom Chief Executive Officer, Henry T. Nicholas III, for a job.

Intel sued Broadcom and the four engineers for misappropriating its trade secrets. In particular, Intel claimed that, in working for Broadcom, the four engineers would "inevitably disclose" Intel's trade secrets. Accordingly, Intel applied for an injunction to bar each of the engineers from working on gigabit Ethernet for Broadcom, pending trial. Judge William F. Martin of the California Superior Court in Santa Clara County refused to grant the injunction against Messrs Young, Lindsay, and Lund. However, Judge Martin described Mr Gunther as "not trustworthy" and enjoined Broadcom from employing him in any capacity pending trial.

Intel's suit against Broadcom and the four engineers illustrates the importance of trade secrets law to the mobility of scientists and engineers. Professionals who move between employers bring technical knowledge from one organization to another. Such communication plays a central role in innovation and economic growth. To the extent that the transfer of knowledge is not completely internalized by the new and original employers, the transfer will result in a spillover of knowledge, which is an externality. Accordingly, it is important for policy-makers and managers to understand the institutions that influence professional mobility.

Prior scholarship has focused on contractual restrictions against mobility of professionals. Information and communications technology germinated in both Silicon Valley, Northern California, and along Route 128, Massachusetts.   Eventually, Silicon Valley eclipsed Route 128. Saxenian (1994) famously attributed the Valley's relative success to a culture of job-hopping and vertically specialized businesses. In turn, Gilson (1999) ascribed the easy professional mobility to a 19th century California statute that prohibits covenants not to compete (CNCs).

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[1] The following case study of the dispute between Intel and Broadcom is based on "Intel Corporation and Level One Communications, Inc. vs Broadcom Corporation and others", CV 788310, Order, Superior Court, Santa Clara County, May 25, 2000, *Los Angeles Times* (2000a and 2000b) and Hyde (2003: 26-27).

However, as observed by various legal scholars (Gilson 1999; Hyde 2003; Graves and DiBoise 2006), the doctrine of "inevitable disclosure" in trade secrets law could effectively serve to enforce CNCs. Indeed, more than 75% of trade secrets cases in state courts and over half of cases in federal courts involved an existing or former employee (Almeling et al. 2010 and 2011). To the extent that fewer professionals move from one employer to another, less knowledge would be communicated from one employer to another.

Professional mobility has profound importance for innovation and entrepreneurship. To the extent of knowledge spillovers through movement of engineers and scientists, professional mobility affects the incentives for investment in research and development (Motta and Ronde 2001), and the rate of spin-offs and start-ups (Samila and Sorensen 2011). Further, reduction in mobility would further diminish the growth of productivity to the extent that engineers and scientists increase their own productivity by moving to better matches. Mobility also influences the incentives of employers to invest in their employee development, and the employees' personal incentives to invest in their own human capital. All of these have consequences for the growth of productivity within organizations and overall economic growth.

Accordingly, it is important to understand the impact of trade secrets law on professional mobility. Here, we focus on the doctrine of "inevitable disclosure", which is the area of trade secrets law that is most pertinent to professional mobility.   By this doctrine, as illustrated by Intel's suit against Mr Gunther, the plaintiff can obtain an injunction without proving that the defendant had used or disclosed any trade secret. Rather, the plaintiff need only show that the defendant would be employed in such a capacity that they would "inevitably disclose" the trade secrets.

In the United States, trade secrets law is a matter of state jurisdiction and the law combines statute and case law. Drawing on various legal authorities, we characterized the state trade secrets law with regard to the doctrine of inevitable disclosure. To date, courts in 24 states have ruled on this doctrine, with eight states (Arkansas, Delaware, Illinois, Iowa, Ohio, Pennsylvania, Utah, and Washington) clearly embracing it, four states (California, Louisiana, Maryland, and Virginia) clearly rejecting it, and twelve states giving mixed rulings. Prior to a precedent ruling in favor of inevitable disclosure, the owner of a trade secret would have to prove actual or threatened misappropriation to obtain an injunction against the (potential) misappropriator.

Our research question is how state law with respect to inevitable disclosure affected the mobility of engineers and scientists. Here, we draw on various legal authorities to compile a chronology of court rulings on trade secrets cases citing inevitable disclosure up to the year 2012. We then combine the legal analysis with records from the Current Population Survey. We found that a precedent ruling against the doctrine of inevitable disclosure was associated with a 0.4%-point or 20% increase in the probability of an engineer or scientist changing employer. By contrast, a precedent ruling in favor of the doctrine was not associated with any significant effect.

In addition, we found a relation between state law on inevitable disclosure and earnings. A precedent ruling against the doctrine of inevitable disclosure was associated with higher earnings for postgraduate and bachelor qualified engineers and scientists and lower earnings for those with associate qualifications. This is consistent with the returns to human capital being higher in states that rule against inevitable disclosure. By contrast, a precedent ruling in favor of the doctrine was not associated with any significant difference.

These findings were robust to the exclusion of California and the inclusion of state time trends. They suggest that the doctrine of inevitable disclosure was associated with economically and statistically significant effects on the mobility and earnings of technical professionals. Our results have implications for the degree of knowledge spillovers between established organizations as well as the rate of entrepreneurial start-ups, and ultimately, the overall economy-wide rate of innovation and economic growth.

2. Inevitable Disclosure

In the United States, trade secrecy is a matter of state rather than federal jurisdiction (see, generally, Pooley 1997-). Historically, trade secrets were governed by common law, i.e., the accumulation of precedents set by decisions in previous cases within the same legal jurisdiction. Under principles of common law, a trade secret would be misappropriated and the owner of a trade secret would be able to take legal action only if the trade secret had been *acquired* by improper means. Improper means includes fraud, use of surreptitious means, and participation in a wrongful conspiracy (Chapman 1986).

In 1979, the National Conference of Commissioners on Uniform State Laws approved and recommended the Uniform Trade Secrets Act (UTSA) to the states. By the time of writing, 47 states and the District of Columbia had enacted the UTSA or some similar statute, the exceptions

being Massachusetts, New York, and Texas. Under the UTSA, the owner of a trade secret can obtain an injunction to prevent "actual or threatened misappropriation" (Section 2).

Accordingly, in all states, whether by prior common law or statute, the owner of a trade secret would only be able to obtain an injunction in the event of actual or threatened misappropriation.   The doctrine of inevitable disclosure is a concept of common law that substantially enlarges the protection of trade secrets. By this doctrine, the owner of a trade secret can obtain an injunction to prohibit a person from working for a competitor, on the ground that she would *inevitably disclose* trade secrets. By this doctrine, the plaintiff (owner of the trade secret) need not prove that the defendant had used or disclosed any trade secret, or even threatened to do so. Rather, the plaintiff only needs to show that the defendant would be employed in such a capacity that they would "inevitably" disclose the trade secrets.

In 1960, the Florida Court of Appeal cited inevitable disclosure in an action by Hudson Cush-N-Foam Corporation against Mr Kenneth Fountain and Miami Foam Products Co. Mr Fountain was the chief production supervisor of Hudson Cush-N-Foam, which manufactured polyurethane foam products. In enforcing an agreement by Mr Fountain not to compete, the Court remarked, "employment by the appellee [Hudson Cush-N-Foam] was the occasion for his acquiring knowledge of the appellee's trade secrets and manufacturing processes, it would seem logical to assume that his employment by a competitor of the appellee would *eventually* result in a disclosure of this information" (emphasis added).

Thirty-five years later, in 1995, the U.S. Court of Appeals for the 7th Circuit cited inevitable disclosure in the PepsiCo case.[2] In June 1993, William E. Redmond, Jr., was promoted to be General Manager for California of Pepsi-Cola's North America Division. In November 1994, Mr Redmond resigned from PepsiCo to take the position of Vice President-Field Operations in the Gatorade division of the Quaker Oats Company. PepsiCo sued to protect its trade secrets regarding business plans, pricing, and distribution systems. In its decision applying the Illinois Trade Secrets Act, the Court of Appeals explained, "Redmond's knowledge of [Pepsi-Cola's] trade secrets and confidential information would *inevitably* shape that integration and that Redmond could not be trusted to avoid that conflict of interest" (emphasis added). Accordingly, the Court of Appeals affirmed the District Court's injunction against Mr Redmond working for Quaker until May 1995, and from ever disclosing Pepsi-Cola's trade secrets and confidential information.

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[2] PepsiCo, Inc. v. Redmond, 54 F.3d 1262, 1272 (7th Circuit 1995).

Although trade secrets are a state matter, federal courts have jurisdiction under two circumstances. One is cases involving parties in different states (as in the PepsiCo action against Mr Redmond). The other is cases that involve both trade secrets and a cause of action under federal law such as patent, trademark, copyright, bankruptcy, or tax. In deciding issues of trade secrets, the federal court would apply the law of the relevant state.

The PepsiCo case, being decided by a federal Court of Appeals and interpreting Illinois Trade Secrets Act, which is based on the UTSA, attracted substantially greater attention to the doctrine of inevitable disclosure than previous cases.[3] Until 1994, courts in eight states had ruled on inevitable disclosure. In just five years following the PepsiCo decision, between 1996-2000, courts in nine states, including California, ruled on inevitable disclosure.

We drew on the American Bar Association's survey of state trade secrets law (Malsberger et al. 2006) and two specific studies (Kahnke et al. 2008; Wiesner 2012) to compile rulings on the doctrine of inevitable disclosure over time. Figure 1 shows the states whose courts had ruled on inevitable disclosure (either for or against) as of 1995, and Figure 2 depicts the situation in 2000.

As Table 1 reports, by the year 2012, courts in 24 states had ruled on the doctrine. Eight states (Arkansas, Delaware, Illinois, Iowa, Ohio, Pennsylvania, Utah, and Washington) clearly embraced, and four states clearly rejected (California, Louisiana, Maryland, and Virginia) the doctrine, while twelve states were either unclear or changed their position over time.

3. Mobility

The stronger is the legal protection of trade secrets, the stronger would be the rights of an employer over its proprietary information, including technical knowledge such as designs, formulas, algorithms, and processes. To the extent that an employer has stronger rights over technical knowledge, its engineering and scientific professionals would be more constrained in the information that they can bring to other employers. So, the engineers and scientists would be less attractive to other employers, and fewer of them would move.

The doctrine of inevitable disclosure in trade secrets law clearly strengthens the rights of an employer over its proprietary information. Many legal scholars have analyzed how inevitable

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[3] As of the time of writing, PepsiCo had been cited 629 times, while, by contrast, Hudson Cush-N-Foam had been cited only 45 times (Google Scholar February 15, 2013).

disclosure inhibits professional mobility, and so reduces innovation and entrepreneurship (Gilson 1999; Hyde 2003; Graves and DiBoise 2006). However, the employer and employee could contract around the law to achieve the economically efficient outcome -- whether it be that the employee remain with the current employer or that the employee leave to use the current employer's proprietary knowledge elsewhere (Hyde 2012). Suppose, for instance, that the law strongly protects trade secrets. If the economically efficient outcome is that a scientist should leave, then she could pay her current employer to use its proprietary knowledge at another organization. With such efficient contracting, the law would only affect the division of profit between employer and scientist.

Accordingly, the law should affect the outcome only to the extent of market imperfections that impede efficient contracting around the law. The possible imperfections include the actions of the employee and/or employer are not contractable (Motta and Ronde 2001; Garmaise 2011), asymmetry of information between employee and employer about the external value of the employee's work (Franco and Mitchell 2008; Shalem and Trajtenberg 2009), and limits on the amount that the employee can borrow (Fosfuri and Ronde 2004). Thus, to the extent of market imperfections that impede efficient contracting, laws that provide stronger protection of trade secrets would lead to lower professional mobility.

Lacking information on market imperfections, our empirical analysis focuses on the direct impact of the doctrine of inevitable disclosure on mobility. Nevertheless, it should be kept in mind that the investigation is actually a joint test of the effect of the law and market imperfections.

The effect of trade secrets laws on the mobility of scientists and engineers has an important corollary. To the extent that stronger laws reduce mobility, the stronger laws would also affect earnings and importantly, the incentive to invest in human capital. As scientists and engineers accumulate human capital, employers can pay their employees relatively less. Employers need not pay so much to retain their employees – because the laws impose barriers to the employees switching jobs. However, employers must pay employees relatively more at the beginning of their professional careers. The reason is that employees know that, looking ahead, they would be less able to increase their earnings by switching to other employers. By affecting earnings, trade secrets laws would then affect the returns to human capital, and particularly, education.

4. Empirical Strategy

To study the impact of inevitable disclosure on professional mobility and earnings, we applied an empirical strategy of difference-in-differences similar to that in recent studies of the impact of enforcement of covenants not to compete and the law of wrongful discharge on innovation (Garmaise 2011; Samila and Sorensen 2011; Acharya et al. 2010). We characterize the law on inevitable disclosure through two variables: P_{st} represents the existence of a legal *precedent* on inevitable disclosure (= 1 if courts had ruled, and = 0 otherwise), while L_{st} represents the direction of the *law* (= 1 if courts had ruled in favor of inevitable disclosure, = 0 if they had ruled against or there is no precedent, and = 0.5 in case of mixed rulings).

To analyze mobility, we estimated the model:

$$M_{ist} = \beta_T T_i + \beta X_{ist} + \gamma P_{st} + \gamma_T [P_{st} \cdot T_i] + \eta L_{st} + \eta_T [L_{st} \cdot T_i] + \varepsilon_{ist}, \tag{1}$$

where M_{ist} represents the mobility of person i in state s in month t (= 1 if they changed employer, and = 0 otherwise), T_i is an indicator of a technical occupation (= 1 if person i belonged to a technical occupation, and = 0 otherwise), X_{ist} represents individual, state, and time varying controls, including industry, state, year, and month fixed effects, and ε_{ist} is idiosyncratic error. β_T and β are the coefficients of the technical indicator and the controls, while γ and γ_Q are the coefficients of the precedent and its interaction with the technical indicator, and the η and η_T are the coefficients of the direction of the law and its interaction with the technical indicator.

Model (1) identifies the effect of the doctrine of inevitable disclosure by the difference in its impact on technical workers vis-a-vis all other people within states over time and across states. Within a state, the law could vary in two ways. One is a judgment creating a precedent, which would change P_{st} from 0 to 1. The other is a change in the direction of the law. For instance, the legal precedent in Florida shifted from (clearly) favoring the doctrine in 1960 ($L_{st} = 1$) to a mixed ruling in 2001 ($L_{st} = 0.5$).[4]

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[4] We coded $L_{st} = 0.5$ for Florida from 2001 because of the conflicting precedents – one favoring in 1960 and one against in 2001.

Referring to Model (1), in a state and month without a precedent, $P_{st} = 0$ and $L_{st} = 0$, hence,

$$M_{ist} = \beta_T T_i + \beta X_{ist} + \varepsilon_{ist}, \tag{2}$$

while, in a state and month with a precedent against inevitable disclosure, such as California in 1999 and after, $P_{st} = 1$ and $L_{st} = 0$,

$$M_{ist} = \beta_T T_i + \beta X_{ist} + \gamma + \gamma_T T_i + \varepsilon_{ist}, \tag{3}$$

and, finally, in a state and month with a precedent in favor of inevitable disclosure, such as Illinois in 1995 and after, $P_{st} = 1$ and $L_{st} = 1$,

$$M_{ist} = \beta_T T_i + \beta X_{ist} + \gamma + \gamma_T T_i + \eta + \eta_T T_i + \varepsilon_{ist}. \tag{4}$$

The coefficients γ and γ_T represent the effect of the precedent on all persons and the incremental effect on technical workers, so, the net effect on technical workers is $\gamma + \gamma_T$. Likewise, the coefficients η and η_Q represent the effect of the law on all persons and the incremental effect on technical workers, and so, the net effect on technical workers is $\eta + \eta_T$.

Similarly, to analyze earnings, we estimated the model:

$$E_{ist} = \beta_T T_i + \beta X_{ist} + \gamma P_{st} + \gamma_H [P_{st} \cdot H_i] + \gamma_T [P_{st} \cdot T_i \cdot H_i] + \eta L_{st} + \eta_H [L_{st} \cdot H_i] + \eta_T [L_{st} \cdot T_i \cdot H_i] + \varepsilon_{ist}, \tag{5}$$

where E_{ist} represents earnings and H_i represents the individual's level of human capital as measured by education.

Our central identifying assumption is that the legal variation – creation of a precedent and the direction of the ruling – are exogenous to the mobility and earnings of technical workers. Generally, legal precedents in a common law system are plausibly exogenous to economic and business activity. If the common law on a particular issue (such as the right of an employer to obtain an injunction on the basis that an employee would inevitably disclose trade secrets to a competitor) were deterministic, the parties would not take case to trial. They could avoid legal costs by settling their dispute out of court. The very fact that an issue is tried strongly suggests that

the law on the issue is uncertain, and so, exogenous to economic and business activity. Our argument applies even more strongly to cases that are decided by higher (appeal) courts.

Moreover, as discussed above, most state courts were prompted to rule on the doctrine of inevitable disclosure by the landmark decision, in 1995, of the U.S. Court of Appeals for the 7th Circuit applying Illinois law in the PepsiCo case. This would be plausibly exogenous to economic and business activity in other states.

Furthermore, a substantial proportion of trade secrets cases arise from disputes over commercial rather than technical information (Almeling et al. 2010 and 2011). Indeed, in the landmark case on inevitable disclosure, PepsiCo sued Mr Redmond to protect trade secrets regarding business plans, pricing, and distribution systems.[5] Such court rulings on inevitable disclosure are even more plausibly exogenous to the mobility and earnings of technical workers.

5. Data

For data on the mobility and earnings, we followed Fallick et al. (2006) and drew on the Current Population Survey (CPS). The CPS is a monthly survey of a sample of 60,000 households, which provides information on about 120,000 persons. The sample is constructed to be representative of each state. The CPS interviews each household four consecutive months, rests the household for eight months, and then interviews the household again for four consecutive months, making a total of eight interviews over 16 months. The CPS collects personal information including marital status, citizenship, and education, as well as geographic location and employment information.

In its redesign of the CPS in January 1994, the Census Bureau introduced a new question to reduce the burden of collecting information about employment. For respondents who were reported to be employed in the month of interview as well as the previous month, the interviewer asked the respondent whether they worked for the same employer as in the previous month (question PUIODPl). If the respondent answered affirmatively, then the interviewer would carry forward employer information from the previous month's survey, rather than ask for the same information again.

Fallick et al. (2006) used the "same employer" question to identify workers who changed employer between two consecutive months. They assessed the CPS to be a very good source of

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[5] PepsiCo, Inc. v. Redmond, 54 F.3d 1262, 1272 (7th Circuit 1995).

data for analyses of worker mobility. In particular, the information on change of employer was very precise in time, and it could be linked to personal demographic and employment characteristics to control for potentially confounding influences on mobility.

The major limitation of the CPS for analyses of the impact of trade secrets law on professional mobility is that it covers each person just six times in less than 15 months.[6] Hence, the data is essentially a pooled cross-section. The other limitation is that the CPS does not follow people as they move house, and so, the CPS cannot be used to study the effect of trade secrets law on geographical mobility.[7]

The CPS data on change of employer began in 1994, and, so, the study was limited to the period, 1994-2008. Table 2 presents summary statistics of the data. The sample comprised slightly fewer than 7.5 million observations of working age individuals, aged from 16 to 65. The average monthly rate of change of employer among the sample was 2.75%, which is similar to the rate of 2.4% in the sample of workers in the computer industry studied by Fallick et al. (2006). Assuming that the rate is constant over the months, it implies that the probability that a newly hired employee will change employer in a year would be $1 - [1 - 0.0275]^{11} = 26.4\%$. While seemingly high, Fallick et al. (2006: footnote 17) confirmed that such rates align with the data from the Longitudinal Employer-Household Dynamics program, which is based on tax records and should be very accurate.

We identified as technical workers as anyone who was working in science, engineering, or mathematics/computers based on the Census occupation codes. There was a change in the coding from 2002 to 2003 and updated the categories accordingly. The data on hourly earnings including overtime pay comes from Center for Economic and Policy Research (2013) and is originally from the Outgoing Rotation survey of the CPS. The survey data is adjusted for changes in the top-coding,

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[6] In the first month of each four-month interview segment, there is no "previous month", so the interviewer does not pose the "same employer" question. So, although each household is interviewed eight times, they are asked the "same employer" question only six times.

[7] Other researchers have used patent records to track changes of employment, specifically, through differences in assignee between consecutive patents by the same inventor (Almeida and Kogut 1999; Hoisl 2007; Marx et al. 2009; Shalem and Trajtenberg 2009; Agarwal et al. 2009 and 2010; Marx et al. 2010). While patent trails have proved useful in other studies of mobility, they present a particular challenge in analyses of the effect of trade secrets law on mobility. The reason is that changes in trade secrets law might themselves affect patenting. Such an effect is not only intuitive, but has been shown empirically (Png 2012). So, the object of study (trade secrets law) would have a direct first-order effect on the measure of inventor mobility, quite apart from any policy effect. Under such circumstances, statistical inference would be problematic.

by adding tips and overtime, and by trimming outliers. For details of the constructions, we refer to Schmitt (2003).

In a study of the impact of the doctrine of inevitable disclosure, it is important to control for differences between the states in their trade secrets statutes and case law other than the doctrine of inevitable disclosure. We use Png's (2012) index of trade secrets law, which is constructed from six items that represent three dimensions of the law – substantive law, procedure, and remedies – to control for these background differences. The index is designed so that a higher value represents stronger legal protection of trade secrets. In most states, the index has trended upward over time (Png 2012).

6. Results

Inevitable disclosure is a matter of state law. Hence, in estimating its effect on individual behavior, it is important to cluster the estimated standard errors by state (Bertrand et al. 2004). We estimated mobility using the linear probability model, for ease of interpretation and ready implementation of clustered standard errors. Following Fallick et al. (2006), in all estimates, the controls included seven personal characteristics –citizenship, marital status, full-time work status, bachelor degree, postgraduate degree, and age (in ten-year brackets), as well as year and month fixed effects. The year and month fixed effects control for changes in mobility due to the general macro economy.

In addition, we included three other sets of controls – occupational status as an engineer or scientist (defined as persons with bachelor or higher degrees in engineering, science, and mathematical/computing occupations), the index of trade secrets law, and industry and state fixed effects.[8] As described above, the index of trade secrets law controls for differences between the states in their trade secrets statutes and case law other than the doctrine of inevitable disclosure. The state fixed effects control for non-time-varying state-level laws and institutions that influence mobility. In particular, they control for state laws on wrongful discharge and covenants not to compete, which were mostly fixed during the period of study (Autor et al. 2006; Garmaise 2011).

Table 3, column (1), reports the estimate of a background specification that included only the personal controls. Mobility was lower among citizens, married people, and those with full-time

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[8] Fallick et al. (2006) focused on employees in the computer industry in 20 metropolitan statistical areas. Since we include all persons, regardless of industry, in all states, it seemed reasonable to add controls for industry and state to account for any systematic differences between industries and states in labor mobility.

jobs. Further, mobility was lower people with bachelor degrees and of degree holders in technical occupations.

Table 3, column (2), reports an estimate including the index of trade secrets law as a control for the background law of trade secrets, as well as the measures – precedent and ruling – of the doctrine of inevitable disclosure.   Interestingly, the coefficient of the index of trade secrets law was positive and significant, suggesting that stronger trade secrets protection in general was associated with higher mobility. (However, this relation was insignificant when state-level trends were added as controls.) The coefficients of inevitable disclosure precedent and ruling were not significant.

Table 3, column (3), reports an estimate that distinguished the impact of inevitable disclosure on technical workers as compared with other people.   The coefficient of the inevitable disclosure precedent for all people, -0.000621 (±0.000430), was not significant, while the coefficient for technical workers, 0.00442 (± 0.000679), was positive and significant. The mobility of technical workers was thus 0.00442 – 0.00062 = 0.00380 ($p < 0.01$) or about 0.4%-points higher with a legal precedent on inevitable disclosure than without.

If a precedent is established with the ruling against inevitable disclosure, then, referring to equation (3), $P_{st} = 1$ and $L_{st} = 0$, and so, the associated mobility is just that with $P_{st} = 1$. Hence, our discussion above also applies when courts in a state establish a precedent that rules against inevitable disclosure, such as California in 1999. Our results suggest that, with a legal precedent against inevitable disclosure as compared with no precedent, the mobility of technical workers was about 0.4%-points higher and not significantly different among other people.

By contrast, if a precedent is established with the ruling in favor of inevitable disclosure, then, referring to equation (3), $P_{st} = 1$ and $L_{st} = 1$. By Table 3, column (3), the coefficient of the ruling in favor of inevitable disclosure for all people, 0.00120 (±0.00110), was not significant, while the coefficient for technical workers, – 0.00362 (± 0.00109), was negative and significant. These results suggest that, given that courts had established a precedent, the effect of a ruling in favor of the doctrine of inevitable disclosure was to reduce the mobility of technical workers roughly 0.36%-points relative to all other people. The total effect on the mobility of engineers and scientists was – 0.00362 + 0.00120 = – 0.00242 (n.s.) or a decline of about 0.24%-points with a legal precedent in favor of inevitable disclosure than with a legal precedent against. Hence, in toto, the establishment of a precedent in favor of the doctrine of inevitable disclosure was associated

with a change of mobility among technical workers of – 0.000621 + 0.00120 + 0.00442 – 0.00362 = 0.001379 (n.s.), or an increase of about 0.14%-point.

Apparently, a state court ruling against the doctrine of inevitable disclosure was associated with the mobility of technical workers being significantly lower. However, a ruling in favor of inevitable disclosure had no significant effect. One interpretation is that, the PepsiCo decision in 1995 provided a very influential interpretation of the UTSA. So, in other states that had also enacted the UTSA, lawyers may have formed expectations that their state courts would also rule in favor of inevitable disclosure and advised their clients accordingly. Hence, such state rulings had no effect on the mobility of technical workers, while only rulings against had an effect (in the negative direction).

Table 3, columns (4) and (5), report two robustness checks. One excluded California, a state known for a culture of job-hopping (Saxenian 1994), which famously does not enforce covenants not to compete (Gilson 1999; Hyde 2001). As discussed above, the state fixed effects would absorb differences in state law on covenants not to compete for all but the four states whose law did not vary during the sample period (Garmaise 2011). Nevertheless, it was worth checking for the robustness of the results to the exclusion of California. As Table 3, column (4) reports, the results were quite similar with just several coefficients less precisely estimated.

The other robustness check included state-specific year trends to check that the inevitable disclosure variables were not reflecting unobserved differences in trends among states in the mobility of technical workers. As Table 3, column (5) reports, the only effect was to reduce the precision of the coefficient of the index of trade secrets law, which, as noted above, tended to increase over time in most states. There was little effect on the coefficients of the inevitable disclosure precedent or ruling.

Our next set of estimates applies model (5) to investigate the relation between the precedent rulings on the doctrine of inevitable disclosure and earnings and the returns to investment in education.   Table 4, column (1), reports the estimate of a specification including individual characteristics as well as the general background law of trade secrets and state court rulings on inevitable disclosure.   As intuitively expected, earnings were higher among citizens and full-time employed people, and earnings increased with the level of education (associate lower than bachelor, which was lower than postgraduate-qualified persons). Regarding the law, neither the general

background law of trade secrets nor state court rulings on inevitable disclosure had any general relation to earnings.

For a more fine-grained understanding, the next specification, as reported in Table 4, column (2), distinguishes the effect of the precedent and direction of ruling on inevitable disclosure by level of education among technical workers. A state court precedent on inevitable disclosure (equivalently, a state court ruling against inevitable disclosure) was associated with higher earnings for bachelor-qualified technical workers, 0.0484 (±0.00902) and even higher earnings for postgraduate-qualified technical workers, 0.0612 (±0.0154), relative to high-school-qualified technical workers.

We interpret this result as suggesting that rulings against inevitable disclosure are associated with higher returns to human capital among technical workers. The result with respect to bachelor-level education is robust to the exclusion of California (Table 4, column (3)) and the inclusion of state-specific year trends (Table 4, column (4)).[9]

7. Discussion

By combining analyses of state-level trade secrets law on the doctrine of inevitable disclosure with records of changes of employers from the Current Population Survey, we investigated the effect of inevitable disclosure on the mobility of engineers and scientists. We found that a precedent ruling against the doctrine of inevitable disclosure was associated with a 0.4%-point or 20% increase in the mobility of engineers and scientists. By contrast, a precedent ruling in favor of the doctrine was not associated with any significant effect. We also found that a precedent ruling against inevitable disclosure was associated with higher returns to education.

An obvious implication of the effect of trade secrets law on professional mobility could be slower diffusion of technical knowledge. Technical knowledge that is explicit can be shared through joint ownership and licensing. However, the spread of technical knowledge of a tacit nature depends relatively more on the movement of scientists and engineers. With less mobility, communication and spillovers of knowledge among innovative businesses would be reduced.

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[9] The result with respect to postgraduate-level education was not robust to the exclusion of California, so, we must interpret that implication with caution.

Another implication would be fewer spin-offs and start-ups. A key advantage for employees leaving established organizations to start new businesses is the knowledge that they acquired in their previous employment. To the extent that they are more constrained in using such knowledge, their expected profit from starting a new businesses would be lower. So, trade secrets law would result in fewer spin-offs and start-ups.[10]

The effect of reduced mobility on productivity and economic growth would be amplified to the extent that technical workers increase productivity when they change employers (Hoisl 2007; Trajtenberg 2005; Shalem and Trajtenberg 2009). By impeding the movement of workers to better matches where they can achieve higher productivity, whether with other established businesses or start-ups, the law of trade secrets would reduce welfare and growth.

These implications should be balanced against the effect on the incentives of employers. If employees are less likely to quit for other opportunities, employers would realize a greater return on investment in overall R&D and, specifically, the development of their employees. So, stronger trade secrets protection might foster more employer investment in R&D (as found by Png (2012)) and their employees' human capital (Motta and Ronde 2001).

An interesting related question is how trade secrets protection would affect workers' investment in their own human capital. We have found that rulings against inevitable disclosure are associated with higher earnings among more educated technical workers. To that extent, people in technical occupations would have more incentive to invest in their human capital.

Trade secrets law might also affect the profile of employee compensation within the job. With strong trade secrets protection, employers must give higher pay to new employees, as they would be locked in and less able to move over time. Further, the profile of compensation would be relatively flatter with experience, since employers need pay so much to retain talent. By contrast, with weak trade secrets protection, engineers and scientists might be willing to trade off lower initial salaries for the opportunity to acquire knowledge and then leave to competitors or start their own businesses. And employers must raise compensation relatively faster to keep their employees

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[10] Applying the Garmaise (2011) index, Samila and Sorensen (2011) found a lower rate of startups in states that enforced CNCs.

from jumping ship, so, the profile of compensation would be relatively steeper.[11] The profile of compensation would obviously affect the employee's incentive to accumulate human capital within the job.

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[11] Among technicians in the Norwegian machinery and equipment industries between 1986-95, starting pay was low while the workers accumulated knowledge, but then, in later years, pay increased to compensate the workers for their earlier investment in human capital (Moen 2005).

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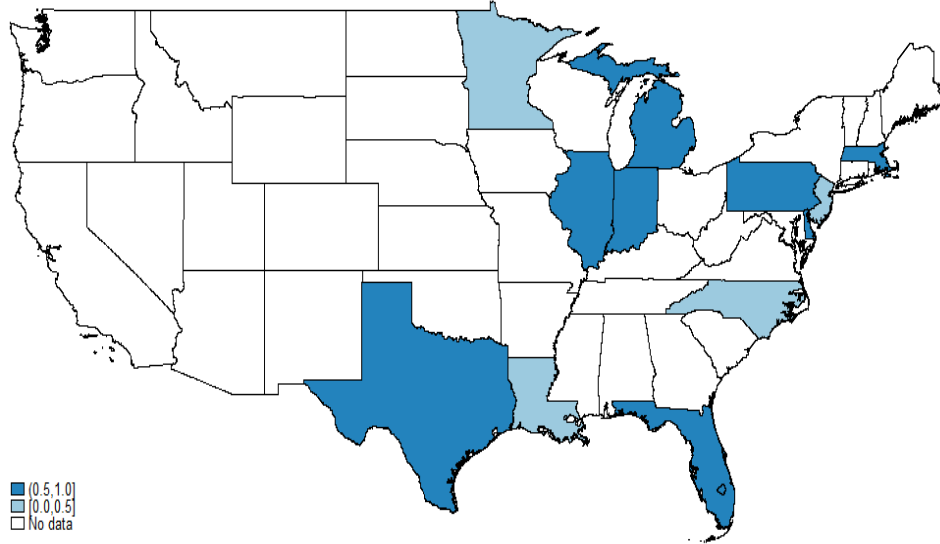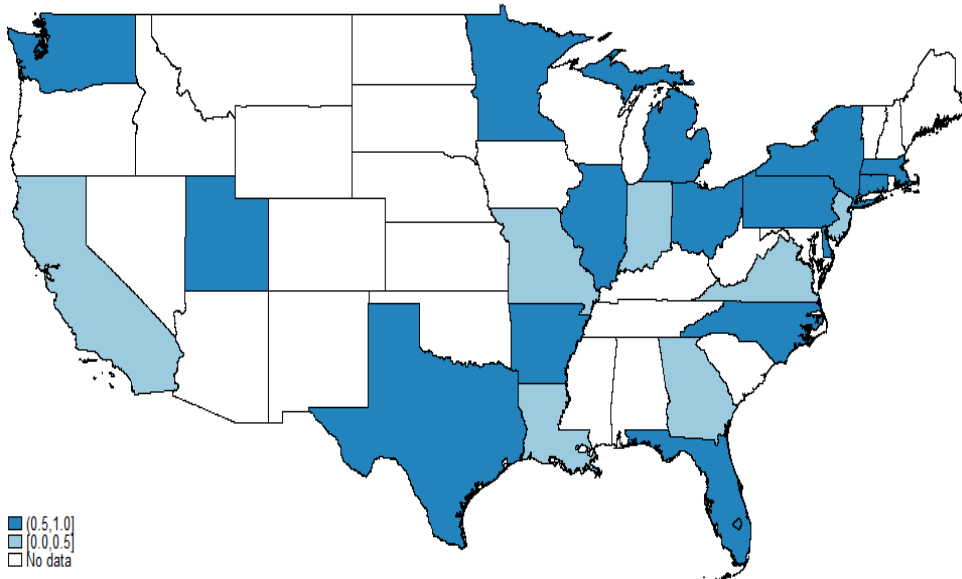
Figure 1(a). Inevitable disclosure, 1995

(0.5,1.0]
[0.0,0.5]
No data

Figure 1(b). Inevitable disclosure, 2000

(0.5,1.0]
[0.0,0.5]
No data

Table 1. Inevitable disclosure

State	Year	Case	Status	Score
Arkansas	1997	Southwestern Energy v. Eickenhorst, 955 F. Supp. 1078 (1997).	Yes	1
California	1999	Bayer Corp. v. Roche Molecular Systems, Inc, 72 F. Supp. 2d 1111, 1112 (N.D. Cal 1999).	No	0
		Electro Optical Indus., Inc. v. Stephen White, 90 Cal.Rptr.2d 680 (1999), 76 Cal.App. 4th 653	Yes, then over-ruled by Supreme Court.	
Connecticut	1996	Branson Ultrasonics Corp. v. Stratman, 921 F. Supp. 909 (D. Conn. 1996)	Yes where employee bound by covenant not to compete; Not clear otherwise.	0.5
Delaware	1964	E.I. DuPont de Nemours & co v. American Potash and Chemical Corp, 200 A. 2d 428 (Del Ch. 1964)	Yes	1
Florida	1960	Fountain v. Hudson Cush-N-Foam Corp., 122 So. 2d 232, 234 (Fla. Dist. Ct. App. 1960)	Yes	1
	2001	Del Monte Fresh Produce Co. v. Dole Food Co., 148 F. Supp. 2d 1326 (S.D. Fla. 2001)	No	0.5
Illinois	1995	PepsiCo, Inc. v. Redmond, 54 F.3d 1262, 1272 (7th Cir. 1995)	Yes	1
Indiana	1995	Ackerman v. Kimball Int'l, Inc., 652 N.E.2d 507, 510-11 (Ind. 1995).	Yes	1
	1998	Bridgestone/Firestone, Inc. v. Lockhart, 5 F. Supp. 2d 667 (S.D. Ind. 1998)	No	0.5
Iowa	2002	Barilla Am., Inc. v. Wright, No. 4-02-CV-90267, 2002 U.S. Dist. Lexis 12773 (S.D. Iowa 2002)	Yes	1
Kansas	2006	Bradbury Co. v. Teissier-Ducros, 413 F. Supp. 2d 1203, 1209 (D. Kan. 2006)	Court acknowledged doctrine but did not apply because time limit had expired.	0.5
Louisiana	1967	Standard Brands, Inc. V. Zumpe, 264 F. Supp. 254 (E.D. La. 1967).	No	0
Maryland	2004	LeJeune v. Coin Acceptors, Inc., 849 A.2d 451, 471 (Md. 2004)	No	0
Massachusetts	1995	Campbell Soup Co. v. Giles 47 F.3d 467, 472 (1st Cir. 1995)	No	0.5

State	Year	Case		Score
		Marcam Corp. v. Orchard, 885 F. Supp. 294, 298-300 (D. Mass. 1995)	Yes	
Michigan	1966	Allis-Chalmers Manufacturing Co. v. Continental Aviation & Engineering Corp., 255 F. Supp. 645, 654 (E.D. Mich. 1966)	Yes	1
	2002	CMI International Inc. v. Intermet Inter. Corp., 649 N.W.2d 808 (Mich. Ct. App. 2002)	No	0.5
Minnesota	1986	Surgidev Corp. v. Eye Tech., Inc., 648 F. Supp. 661 (D. Minn. 1986)	Yes	1
	1992	IBM Corp. v. Seagate Tech., Inc., 941 F. Supp. 98 (D. Minn. 1992)	No	0.5
	1996	La Calhene, Inc. v. Spolyar, 938 F. Supp. 523 (W.D. Wis. 1996)	Yes	1
Missouri	2000	Conseco Finance Servicing Corp. v. North American Mortgage Co., No. 00CV1776, 2000 WL 33739340 (E.D. Mo.	No	0.5
	2000	Dec. 6, 2000). H&R Block Eastern Tax Services, Inc. v. Enchura, 122 F.Supp. 2d 1067 (W.D. Mo. 2000).	Court acknowledged doctrine but did not apply it.	
New Jersey	1980	Continental Group, Inc. v. Amoco Chem. Corp., 614 F.2d 351, 359 (3d Cir. 1980). National Starch & Chemical Corp. v.	No	0
	1987	Parker Chemical Corp., 530 A.2d 31 (N.J. Super. Ct. App. Div. 1987)	Yes	0.5
New York	1997	DoubleClick, Inc. v. Henderson, No. 116914/97, 1997 N.Y. Misc. Lexis 577 (Sup. Ct. N.Y. Co. Nov. 7, 1997)	Yes	1
	2003	Marietta Corp. v. Fairhurst, 301 A.D.2d 734 (N.Y. App. Div. 2003)	Court cautioned against applying inevitable disclosure.	0.5
	2006	Estee Lauder Co. v. Batra, No. 06 Civ.2035 (RWS), 2006 WL 1188183 (S.D.N.Y. May 4, 2006)	Yes	1
North Carolina	1976	Travenol Labs., Inc. v. Turner, 228 S.E.2d 478, 483 (N.C. Ct. App. 1976)	Court acknowledged doctrine but did not apply it.	0.5
	1996	Merck & Co. v. Lyon, 941 F. Supp. 1443 (M.D.N.C. 1996)	Yes	1
Ohio	2000	Procter & Gamble Co., v. Stoneham, 747	Yes	1

		N.E.2d 268 (Ohio Ct. App. 2000)		
Penn-sylvania	1982	Air Products & Chemical, Inc. v. Johnson, 442 A.2d 1114 (Pennsylvania Superior Ct. 1982)	Yes	1
Texas	1993	Rugen v. Interactive Bus. Sys., Inc., 864 S.W.2d 548, 551 (Tex. App. 1993)	Yes	1
	2003	Fox v. Tropical Warehouses Inc, 121 S.W. 3d 853, 861 (Tex Ct App, Ft Worth 2003) Cardinal Health Staffing Network, Inc. v. Bowen, 106 S.W.3d 230, 242 (Tex. App. 2003)	Court acknowledged doctrine but did not apply it.	0.5
Utah	1998	Novell, Inc. v. Timpanogos Research Group, Inc., 46 U.S.P.Q.2d 1197 (Utah Dist. Ct. 1998).	Yes	1
Virginia	1999	Government Technology Services, Inc. v. Intellisys Technology Corp., 51 Va. Cir. 55 (Va. Cir. Ct. Oct. 20, 1999).	No	0
Washington	1997	Solutec Corp, Inc. v. Agnew, 1997 WL 794496, 8 (Wash. Ct. App.)	Yes	1

Notes: Score = 1 if courts ruled in favor of inevitable disclosure, = 0 if they had ruled against or there is no precedent, and = 0.5 in case of mixed rulings. Although trade secrets law is a state matter, federal courts have jurisdiction in cases involving parties in different states, and in cases that involve some federal cause of action such as patent, trademark, copyright, bankruptcy, or tax.

Table 2. Summary statistics

	Mean	S.D.	Min	Max	N
Employer change	0.03	0.16	0	1	7177661
Citizen	0.93	0.25	0	1	7177661
Married	0.58	0.49	0	1	7177661
Full-time	0.76	0.43	0	1	7177661
Age	39.36	12.28	16	65	7177661
Age30	0.23	0.42	0	1	7177661
Age40	0.27	0.44	0	1	7177661
Age50	0.23	0.42	0	1	7177661
Age60	0.11	0.31	0	1	7177661
Associate diploma	0.09	0.29	0	1	7177661
Bachelor degree	0.19	0.39	0	1	7177661
Postgraduate degree	0.09	0.29	0	1	7177661
Technical degree-qualified	0.03	0.17	0	1	7177661
Technical associate-qualified	0	0.07	0	1	7177661
Technical bachelor-qualified	0.02	0.14	0	1	7177661
Technical postgraduate-qualified	0.01	0.10	0	1	7177661
Hourly earnings (including overtime)	20.95	14.73	1.79	356.79	2368883
Index of trade secrets background law	1.23	0.50	0	2.83	765
Inevitable disclosure precedent	0.54	0.50	0	1	765
Inevitable disclosure ruling (1 = in favor; 0 = against)	0.39	0.45	0	1	765

Table 3. Job mobility

VARIABLES	(1) Back-ground	(2) Trade secrets law	(3) Engineer/ scientist	(4) Excluding California	(5) State trends
Citizen	-3.33***	-3.33***	-3.33***	-3.16***	-3.32***
	(0.305)	(0.303)	(0.304)	(0.376)	(0.304)
Married	-5.06***	-5.06***	-5.06***	-4.91***	-5.06***
	(0. 186)	(0. 186)	(0. 185)	(0. 144)	(0. 185)
Full-time	-8.66***	-8.65***	-8.65***	-8.57***	-8.66***
	(0.362)	(0.362)	(0.362)	(0.406)	(0.360)
Bachelor degree	-0.727***	-0.728**	-0.720**	-0.951***	-0.724***
	(0.269)	(0.269)	(0.270)	(0.211)	(0.270)
Postgraduate degree	0.392	0.391	0.384	0.195	0.376
	(0.339)	(0.339)	(0.339)	(0.340)	(0.339)
Technical degree- qualified	-4.45***	-4.45***	-5.87***	-5.41***	-5.84***
	(0.473)	(0.473)	(0.746)	(0.723)	(0.763)
Trade secrets background law		0.935***	0.936***	0.952***	0.706
		(0.251)	(0.249)	(0.263)	(0.795)
ID precedent		-0.447	-0.621	-0.847	-1.39**
		(0.427)	(0.430)	(0.826)	(0.689)
ID ruling		1.06	1.20	1.33	1.69
		(1.11)	(1.10)	(1.33)	(1.16)
ID precedent x technical degree			4.42***	4.33***	4.26***
			(0.679)	(0.893)	(0.712)
ID ruling x technical degree			-3.62***	-3.56**	-3.42***
			(1.09)	(1.42)	(1.07)
Age bracket fixed effects	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
States	51	51	51	50	51
N	7177661	7177661	7177661	6644337	7177661
R^2	0.008	0.008	0.008	0.009	0.008

Notes: Estimated by linear probability model, with the dependent variable being change of employer in the previous month. All coefficients and standard errors inflated by a factor of 1000. ID = inevitable disclosure. (1) Regression on background factors; (2) Regression including index of trade secrets law and indicators of inevitable disclosure precedent and direction of ruling; (3) Regression including interaction of indicators of inevitable disclosure with technical degree; (4) Excluding California; (5) Including state year trends. Standard errors clustered by state in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).

Table 4. Earnings

VARIABLES	(1) Trade secrets law	(2) Engineer/ scientist	(3) Excluding California	(4) State trends
Citizen	0.205***	0.205***	0.181***	0.205***
	(0.0183)	(0.0182)	(0.00811)	(0.0181)
Married	0.0951***	0.0951***	0.0970***	0.0951***
	(0.00239)	(0.00238)	(0.00210)	(0.00241)
Full-time	0.145***	0.145***	0.146***	0.145***
	(0.00286)	(0.00287)	(0.00282)	(0.00285)
Associate diploma	0.139***	0.139***	0.137***	0.139***
	(0.00388)	(0.00389)	(0.00398)	(0.00391)
Bachelor degree	0.384***	0.384***	0.383***	0.384***
	(0.00668)	(0.00668)	(0.00761)	(0.00668)
Postgraduate degree	0.604***	0.604***	0.602***	0.604***
	(0.00688)	(0.00689)	(0.00767)	(0.00690)
Technical x associate	0.183***	0.199***	0.200***	0.199***
	(0.00508)	(0.00791)	(0.00907)	(0.00789)
Technical x bachelor	0.136***	0.122***	0.117***	0.122***
	(0.00586)	(0.00959)	(0.0100)	(0.00955)
Technical x postgrad	0.0296***	0.00528	-0.00300	0.00555
	(0.0104)	(0.0144)	(0.0152)	(0.0143)
Trade secrets	0.00183	0.00185	0.00144	0.00501
background law	(0.00513)	(0.00514)	(0.00498)	(0.00440)
ID precedent	0.000513	-0.00144	-0.000893	-0.0162***
	(0.00518)	(0.00523)	(0.00928)	(0.00526)
ID ruling	-0.00292	-0.00129	-0.00286	0.0130**
	(0.00770)	(0.00766)	(0.00989)	(0.00623)
ID precedent		-0.0387***	-0.0459**	-0.0384***
x technical associate		(0.0126)	(0.0228)	(0.0126)
ID precedent		0.0484***	0.0429***	0.0481***
x technical bachelor		(0.00902)	(0.0144)	(0.00895)
ID precedent		0.0612***	0.0399	0.0606***
x technical postgrad		(0.0154)	(0.0282)	(0.0152)
ID ruling		0.0204	0.0296	0.0203
x technical associate		(0.0148)	(0.0244)	(0.0148)
ID ruling		-0.0421***	-0.0308**	-0.0422***
x technical bachelor		(0.0101)	(0.0130)	(0.0101)
ID ruling		-0.0425**	-0.0128	-0.0420**
x technical postgrad		(0.0170)	(0.0270)	(0.0171)
Age bracket fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Month fixed effects	Yes	Yes	Yes	Yes

	(1)	(2)	(3)	(4)
Year fixed effects	Yes	Yes	Yes	Yes
States	51	51	50	51
N	2368883	2368883	2190747	2368883
R^2	0.416	0.416	0.414	0.417

Notes: Estimated by ordinary least squares, with the dependent variable being logarithm of hourly earnings including overtime. ID = inevitable disclosure. (1) Regression including index of trade secrets law and indicators of inevitable disclosure precedent and direction of ruling; (2) Regression including interaction of indicators of inevitable disclosure with technical degree; (3) Excluding California; (4) Including state year trends. Standard errors clustered by state in parentheses (*** $p<0.01$, ** $p<0.05$, * $p<0.1$).