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and Firm Survivability

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Abstract: Do firms employing undocumented workers have a competitive advantage? Using administrative data from the state of Georgia, this paper investigates the incidence of undocumented worker employment across firms and how it affects firm survival. Firms are found to engage in herding behavior, being more likely to employ undocumented workers if competitors do. Rivals' undocumented employment harms firms' ability to survive while firms' own undocumented employment strongly enhances their survival prospects. This finding suggests that firms enjoy cost savings from employing lower-paid undocumented at workers wages less than their marginal revenue product. The herding behavior and competitive effects are found to be much weaker in geographically broad product markets, where firms have the option to shift labor-intensive production out of state or abroad.

JEL classification: L1, J23, J61

Key words: undocumented workers, firm dynamics, monopsony, immigration policy

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Undocumented Worker Employment and Firm Survival

1. Introduction

Firms may inherently wish to obey the law. But if breaking the law can give firms a competitive advantage, some may be tempted to do so. Using administrative data from the state of Georgia, Hotchkiss and Quispe-Agnoli (2008) find a significant wage differential between documented and undocumented workers. If this wage gap reflects more than productivity differences and costs from breaking the law, the employment of undocumented workers could reduce firm costs. We employ the same Georgia administrative data to test whether employing undocumented workers actually gives firms a competitive advantage.¹

The answer to this question has implications for immigration policy. If undocumented worker employment is found to provide a competitive advantage, then a reduction in the supply of undocumented workers (e.g., via tougher border and worksite enforcement) will raise production costs. The answer also has political implications. Understanding the mechanism driving the firm's decision process to employ undocumented workers will inform policy makers about potential opposition to successfully implementing proposed reforms and how those reforms might be structured to address concerns of employers.

There is a large literature on undocumented workers (see Hanson 2006 for a review), but almost no prior studies have investigated undocumented worker employment at the firm level. One exception is Morales (1983-1984), who conducts eight case studies of Los Angeles auto parts manufacturers. She finds that firms adapt to growing competition by employing undocumented workers, who are in plentiful supply in that area. The firms employing

¹ It has often been claimed in the immigration debate that firms employing undocumented workers have an advantage over their competitors, but this has never been empirically tested. See, for example, Subcommittee on Workforce Protections (2006, pp. 25-26) or Cave (2008).

undocumented workers tend to be the ones that are more labor intensive and face more variable demand (necessitating easily released labor). There is no previous work on the firm performance effects of employing undocumented workers. However, Champlin and Hake (2006) examine the increased need for short-term, low-skilled workers during the industrialization of the meatpacking industry from 1970-2002. They find that the presence of illegal immigrants within the factories reduced the bargaining power of shop workers and increased employer control.

The purpose of this paper is to determine whether there is any evidence of competitive advantage among firms that employ undocumented workers. If a competitive advantage is identified, this would be suggestive of monopsonistic discrimination; an absence of competitive advantage would suggest that the undocumented worker pay gap merely reflects productivity differences and costs of firms breaking the law. Results from the analysis in this paper will have implications for the impact of stricter immigration policies on product and labor markets, how effective those policies might be in modifying firm employment behavior, and from where opposition to or support for stricter policies might come.

2. Theoretical Framework

This section discusses how a wage gap could arise between documented and undocumented workers from a theoretical perspective.² Depending on the source of the wage gap, firms employing undocumented workers may or may not receive a competitive advantage. The wage gap could simply reflect lower undocumented worker productivity. Undocumented workers may be systematically less well educated, have less work experience, and they may have

² We implicitly assume firms know whether a worker is documented or not, though in reality firms must conduct costly background checks to be sure. Among firms not wishing to employ undocumented workers, rather than go to the trouble of doing a background check, it is common practice to avoid workers with characteristics associated with undocumented status, such as English language ability and ethnicity. It may thus be more accurate to label the two groups “suspected documented workers” and “suspected undocumented workers”.

poor English language skills.³ Firms may also incur additional expenses from employing undocumented workers, such as fines, a loss of reputation, and costs of avoiding prosecution, so they may be willing to employ undocumented workers only if the wage is lower so as to compensate for such costs. Thus, a wage gap is not necessarily inconsistent with workers being paid their marginal products, and in such a scenario firms employing undocumented workers should receive no competitive advantage.

Discrimination against undocumented workers within firms that employ them could decrease productivity. If this isn't reflected in the wages paid to undocumented workers, firms employing them could have a competitive disadvantage. Perotin et al. (2003), for example, suggest that discriminated workers could be passed over for promotions and receive lower performance bonuses, not only reducing the workers' own productivity, but also generating negative spillovers for the firm as a whole (e.g., candidates for senior positions would be drawn from a smaller pool of workers). Undocumented workers may be expected to have lower future tenure in the firm either because they intend to return to their home country or because they may be deported. If expected tenure is low, the firm and the workers will have less of an incentive to invest in the match, also depressing productivity. Below we refer to the scenarios in this and the previous paragraph as productivity gap theories, as they assume that the wage gap can be explained by a productivity gap.

If, however, undocumented workers are just as productive as documented workers, and if firms are able to exercise monopsony power over undocumented workers as a result of low labor supply elasticities among these workers, then firms could pay these workers less than their

³ Borjas and Katz (2005) find that Mexican immigrants to the U.S. are much less educated than U.S. natives. Unfortunately, the Georgia administrative data do not contain proxies for worker productivity such as age, education, or work experience, so at least some of the wage gap they measure is likely to be due to productivity differences.

marginal product and gain a competitive advantage. Undocumented workers need not even be as productive as documented workers for firms to gain an advantage; they only need to be willing to accept a wage that is lower than their marginal revenue product. The model of monopsonistic discrimination was developed by Robinson (1933) to describe a labor market in which two groups of equally productive workers (men and women) are paid different wages because they differ in their elasticities of labor supply. Robinson theorized that women were paid less than men because they were limited in their alternative employment options as a result of their husbands' employment situations.⁴ The source of the firm's monopsonistic power in the labor market derives from the behavior of workers, not from the degree of competition in the firm's product market. In other words, the presence of a large number of competitive firms does not preclude monopsonistic discrimination. In fact, a greater degree of product market competition will put additional pressures on an employer to take advantage of differential labor supply elasticities across workers.

Using the same data employed in this study, Hotchkiss and Quispe-Agnoli (2008) present empirical evidence that the labor supply elasticity among undocumented workers is about half of that estimated for documented workers. Fear of deportation and limited employment opportunities could help account for the lower elasticity. In addition, Stark (2007) presents a compelling theoretical mechanism through which the work effort of undocumented workers is increased as their probability of deportation increases, which, in turn expands the wedge between undocumented worker productivity and their wage. Undocumented workers fearing deportation

⁴ Evidence of potential monopsonistic discrimination against women as a result of lower labor supply elasticities (relative to men) is provided by Hirsch et al. (2006) and Barth and Dale-Olsen (1999). Also see Bhaskar et al. (2002) for a review of evidence of monopsonistic competition more generally.

are unlikely to complain about low wages or poor employment environments.⁵ It is also not unreasonable to expect that the more employers to which undocumented workers expose themselves, the higher the risk of deportation.⁶ And it is likely that there are many firms who will simply refuse to hire undocumented workers and that undocumented workers are geographically constrained by the support (or lack) of social networks. All of these conditions reduce the employment opportunities of undocumented workers, *ceteris paribus*.

In sum, the productivity gap theories do not predict any systematic patterns of undocumented worker employment across firms, and they imply that firms without undocumented workers will perform at least as well as those with them. The monopsonistic discrimination theory suggests that firms will enjoy a competitive advantage from employing undocumented workers at a below-marginal-product wage.

3. Data

The primary data used for the analyses in this paper are the Employer File and the Individual Wage File, compiled by the Georgia Department of Labor for the purposes of administering the state's Unemployment Insurance (UI) program. These data are highly confidential and strictly limited in their distribution. The data are available from the first quarter of 1990 through the fourth quarter of 2006. The Employer File provides an almost complete census of firms in non-farm sectors, covering approximately 97 percent of non-farm workers. The establishment-level information includes the number of employees, the total wage bill, and the NAICS classification of each establishment. The Individual Wage File is used to construct

⁵ Semple (2008) offers anecdotal evidence that undocumented workers are at the mercy of their employers. An undocumented worker reported to Semple that an employer refused to pay him about \$1,000 he was owed for work performed, but that, "fear [of being deported] kept my mouth shut."

⁶ For example, Gibbons (2008) reports that a Pennsylvania firm assisted federal immigration agents in apprehending employees suspected of being undocumented.

work force characteristics at the firm level. We take advantage of the longitudinal nature of the data to calculate the firm's age, employment variability, turnover rates, worker tenure, and most importantly, determination of when the firm ceases operation. The data also contain a 6-digit NAICS industry code and the county of location, allowing us to construct or merge in various industry- and county-level indicators.

Regrettably, the data set contains no information about workers' demographics or, more importantly, immigration status. In addition, one seeming disadvantage to using UI records data to identify undocumented workers is the lack of coverage in the agriculture industry where one might expect to find a significant number of undocumented workers. However, Card and Lewis (2007) report that between 1990 and 2000, among Mexican migrants who have been in the U.S. 0-5 years, the share working in agriculture fell from 23 percent to 15 percent among men and from 13 percent to seven percent among women.

The specific variables used for the analyses will be described in the empirical specification section below.

A. Identifying Undocumented Workers using Invalid Social Security Numbers

Every quarter employers must file a report with their state's Department of Labor detailing all wages paid to workers who are covered under the Fair Labor Standards Act (FLSA).⁷ Each worker on this report is identified by his/her social security number (SSN). There are a number of ways in which one can establish that a reported social security number is invalid. The Social Security Administration provides a service by which an employer can upload a file of SSNs for checking, but one must register as an employer to obtain this service.⁸ In addition, there are several known limitations on what can be considered a valid social security

⁷ For information about which workers are covered, see U.S. Department of Labor (2007).

⁸ See Social Security Number Verification Service <<http://www.ssa.gov/employer/ssnv.htm>> (accessed 20 September 2007).

number, so a simple algorithm is used to check whether each number conforms to the valid parameters.

There are three pieces to a SSN.⁹ The first three numbers are referred to as the Area Number. This number is assigned based on the state in which the application for a SSN was made; it does not necessarily reflect the state of residence. The lowest Area Number possible is 001 and the highest Area Number ever issued, as of December 2006, is 772. Using information provided by the SSA, the dates at which area numbers between 691 and 772 are first assigned can be determined.¹⁰ Any SSN with an Area Number equal to 000, greater than 772, or which shows up before the officially assigned date, will be considered invalid.

The second piece of a SSN consists of the two-digit Group Number. The lowest group number is 01, and they are assigned in non-consecutive order based on whether the Area Number is odd or even. Any SSN with a Group Number equal to 00 or with a Group Number that appears in the data out of sequence with the Area Number will be considered invalid.¹¹

The last four digits of a SSN are referred to as the Serial Number. These are assigned consecutively from 0001 to 9999. Any SSN with a Serial Number equal to 0000 will be considered invalid.

In 1996 the Internal Revenue Service (IRS) introduced the Individual Tax Identification Number (ITIN) to allow individuals who had income from the U.S. to file a tax return. It is simply a "tax processing number," and does not authorize an individual to work in the U.S. Employers are instructed by the IRS to "not accept an ITIN in place of a SSN for employee

⁹ Historical information and information about valid SSNs can be found at the Social Security Administration's web sites: <<http://www.ssa.gov/history/ssn/geocard.html>> <<http://www.socialsecurity.gov/employer/stateweb.htm>> (accessed 20 September 2007).

¹⁰ See <<http://www.ssa.gov/employer/ssnvhighgroup.htm>>.

¹¹ The Social Security Administration publishes the maximum Group Number issued for every Area Number as of certain dates (<http://www.socialsecurity.gov/employer/ssnvhighgroup.htm>).

identification for work. An ITIN is only available to resident and nonresident aliens who are not eligible for U.S. employment and need identification for other tax purposes."¹² ITIN numbers have a "9" in the first digit of the Area Number and a "7" or "8" in the first digit of the Group Number. Anyone with this numbering scheme will be identified as having an invalid Area Number, as they are not authorized to work. The percent of SSN with high area numbers that also match the ITIN numbering scheme has risen from about one percent in 1996 to over 60 percent by the end of 2006.

A series of SSNs were de-commissioned by the Social Security Administration because they had been put on fake Social Security Cards used as props to sell wallets.¹³ Apparently, some people who purchased the wallets thought the fake Social Security Cards were real and started using them as their own. If any of these 21 "pocketbook" SSNs appear in the data, they are considered invalid, although their frequency is so low as to be inconsequential. In addition, a number of SSNs are exactly equal to the employer identification number. These are considered invalid. In any instance where a SSN is used for more than one person on a firm's UI wage report or does not have the required number of digits (including zeros), the SSN will also be considered invalid.

The possibility that someone fraudulently uses a valid SSN assigned to someone else poses a special problem. First of all, the SSN will show up multiple times across firms in one quarter for workers with different surnames (the wage report includes the first three characters of the workers' surnames). With this information alone, it is not possible to know which worker is using the SSN fraudulently and which is the valid owner of the number. If one of the

¹² "Hiring Employees," <<http://www.irs.gov/businesses/small/article/0,,id=98164,00.html>> (accessed 9 May 2008). Also see, "Individual Taxpayer Identification Number (ITIN)," <<http://www.irs.gov/individuals/article/0,,id=96287,00.html>> (accessed 8 May 2008).

¹³ See U.S. Department of Housing and Urban Development (1990).

SSN/surname pairs shows up in the data initially in a quarter by itself, this is the pair that is considered valid and all other duplicates (with different surnames) are considered invalid.

B. Does "Invalid" mean "Undocumented?"

Examining the patterns of incidence of different types of invalid SSNs suggests that some types are firm generated rather than worker generated. Figure 1 illustrates the incidence patterns across types of invalid SSNs in construction. This pattern is consistently found in the other sectors as well. The percent of workers with SSNs having a high area number or out-of-sequence group number displays the expected growth in undocumented workers (see Hoefler 2007), whereas the incidence of SSNs for other reasons exhibits a flat to declining, highly seasonal pattern. The strong seasonal nature of the other invalid reasons suggests that firms are temporarily assigning invalid SSN numbers to workers before having time to gather the information for the purpose of record keeping/reporting. Or, firms may decide to not bother obtaining a SSN for workers who will only be employed a very short time.¹⁴ The high degree of churning observed among workers with invalid SSNs for these other reasons is consistent with either of these practices.¹⁵

[Figure 1 here]

Since there is no way to know whether a temporary assignment by the firm of an invalid SSN is to merely cover for temporary employment of an undocumented worker or to allow the firm to file its wage report before having had a chance to record the worker's valid SSN, the analysis below takes the conservative tack by considering as undocumented only those workers whose SSNs are classified as invalid because the area number is too high or the group number is

¹⁴ Indeed, a worker has 90 days to resolve a discrepancy that results in the receipt of a "no-match" letter from the Social Security Administration. The employee may be long gone before such a letter is even received.

¹⁵ The average churning rates for SSNs with invalid area numbers, invalid group numbers, duplicate SSNs with different surnames, and invalid for other reasons are 26.9%, 55.7%, 188.3%, and 215.6%, respectively.

assigned out of sequence. This will clearly undercount the actual number of undocumented workers, so that any effect identified in the analysis will also likely under-estimate the true effect of the presence of undocumented workers on firm exit.¹⁶ We take pains, however, to not include workers with invalid SSNs for these other reasons in the construction of a firm's worker characteristics (such as average worker tenure). However, they are included in counts of aggregate firm employment.

Figure 2 plots the prevalence of undocumented workers in the six broadly defined sectors with the highest incidences. The concentration of workers in these sectors was also identified nationally by Fortuny et al. (2007).¹⁷ The pattern of growth, with recent exponential increases, is also consistent with Fortuny et al. who estimate that 72 percent of unauthorized immigrants in Georgia arrived in the last 10 years. Figure 3, showing the share of firms employing undocumented workers reflects the same pattern of growth.

[Figures 2 and 3 here]

Fortuny et al. (2007) estimate that 4.5 percent of the workforce in Georgia was undocumented in 2004. In our sample 1.6 percent of workers are classified as undocumented in 2004. The implication is that the sample used for the analysis in this paper is capturing at least 36 percent of all undocumented workers in the state of Georgia.¹⁸ This is a respectable representation, given that to be included in the sample an undocumented worker must be reported by the employer to the Department of Labor in the first place, and that we are being very conservative in the identification of workers as undocumented.

¹⁶ All analyses were repeated for workers with employer-generated invalid SSNs, yielding similar results; these will be discussed further below.

¹⁷ Fortuny et al. (2007) estimate that nationally in 2004 the percent of workers in leisure and hospitality and construction that was undocumented was 10 percent each and six percent each in manufacturing, professional and business services, and other services.

¹⁸ Fortuny et al.'s (2007) estimate includes workers in agriculture, which is excluded from our study, so our number of undocumented workers actually captures an even greater percentage of *non-agricultural* workers in the state.

C. Are Undocumented Workers Correctly Identified?

It is crucial to establish confidence in the mechanism employed to identify undocumented workers. The best information at hand for doing this is to compare the geographic distribution or concentration of undocumented workers (and firms that employ them) with some external source of information about the distribution or concentration of unauthorized immigrants. The Department of Homeland Security estimates for January 2006 that 57 percent of unauthorized immigrants come from Mexico (Hoefer et al. 2007). Clearly not all Hispanic individuals are unauthorized immigrants, but a first test of the accuracy of identifying undocumented workers might be to compare the geographic distribution of those identified as undocumented for the purposes of analysis in this paper and the geographic distribution of various ethnic and racial groups across counties in the state. Table 1 presents these correlation coefficients for 2005.

[Table 1 here]

The correlation between the percent of the county population that is Hispanic and the percent of workers in the county identified as undocumented is 0.18 (of course, some individuals may live and work in different counties). The correlations with the percent that is Asian and the percent that is African American in the counties are both negative. The correlation of the percent of firms in the county employing undocumented workers with ethnicity is also positive and highest as it relates the percent of the county population that is Hispanic (0.38). The correlation of the presence of these firms with percent of the county population that is Asian is also positive, but smaller at 0.27; the correlation with the percent of the population that is African American is again negative. This provides some confidence that the mechanism employed in this paper to identify undocumented workers is accurate.

D. Sample Means

Table 2 presents some sample means for all firms, firms that do not employ any undocumented workers, and firms that employ at least one undocumented worker. Means from 1995 and 2005 are presented separately; they correspond to the actual estimating sample (the reason for limiting the estimation to the years 1995-2005 is explained below).

[Table 2 here]

The employment of undocumented workers has increased over time. The share of firms in Georgia employing undocumented workers doubled from four percent in 1995 to eight percent in 2005. Among firms employing at least one undocumented worker, these workers made up about seven percent of a firm's work force, on average, in 1995, but over 11 percent in 2005. Larger, multi-establishment, and slightly older firms are more likely to employ undocumented workers. The average firm size among firms employing undocumented workers has come down significantly over time, indicating that more small (and more single-establishment) firms employ them in 2005 than in 1995. In addition, average worker tenure is lower among firms employing undocumented workers. These characteristics of firms employing undocumented workers are consistent with those identified by Morales (1983-1984).

4. Empirical Specifications

The goal of the empirical analysis is to determine whether the practice of employing undocumented workers gives firms a competitive advantage. As the data allow us to identify when a firm ceases to operate, but they do not contain profit, value added, or sales, we have chosen to use survivability as our proxy for competitive advantage. A firm is considered to have exited when a quarter of positive employment is followed by four quarters of zero employment. The basic exit equation is specified as follows:

$$(1) \quad P[\text{Exit}_{jtsct}] = \beta_0 + \beta_1' X_{jt} + \beta_2' Y_{it} + \beta_3' W_{st} + \beta_4' G_{ct} + \delta * \text{UNDOC}_{jt} + \varepsilon_{jtsct}$$

where firm j 's probability of exit in time t is determined by firm-specific characteristics in t , X_{jt} ; the firm's industry-specific characteristics at time t , Y_{it} ; the firm's sector-specific characteristics at time t , W_{st} ; the firm's geographic county-specific characteristics, G_{ct} ; and whether or not the firm employs undocumented workers in time t , $\text{UNDOC}_{jt} = 0,1$.¹⁹ The firm's industry reflects the 1997 6-digit NAICS classification. The firm's sector is an aggregated grouping based on the NAICS. Appendix A contains a table of sector definitions. In addition to the regressors of interest, year-quarter fixed effects and 3-digit industry fixed effects are included in all estimations to control for quarterly aggregate variation in exit rates and for time-invariant industry-specific influences on firm performance, such as technologically-intensive or labor-intensive production processes (see Cortes 2008).²⁰ Standard errors are adjusted for clustering at the firm level. Parameter estimates are obtained through maximum likelihood probit estimation.

A. Firm-Specific Characteristics

Characteristics of the firm include log age; log age squared; employment size dummies equal to one if the firm has only one employee or only two employees--employing more than two workers is the excluded category; a dummy equal to one if the establishment is part of a multi-establishment firm; the establishment's rate of worker churning among its documented work force; average tenure among documented workers; and average cumulative employment

¹⁹ We measure undocumented employment as a (0,1) dummy variable rather than as the number or share of undocumented workers employed by the firm, because the data appear to do a much better job of identifying the firms that employ undocumented workers than the numbers of undocumented workers they employ. To give just one example, Table 1 shows a significantly higher correlation between a county's Hispanic population share and the percent of firms employing undocumented workers (38%) than with percent of workers (18%). This will be discussed further below.

²⁰ The transport and utility sector regressions include fixed effects at a more aggregated 2-digit level, because insignificant 3-digit industry dummies prevented the regressions from achieving convergence.

variability, which is calculated as the variance in total employment levels from the first quarter in the data set to the current time period.

Dummy variables for employment size are used instead of a continuous employment (or log employment) variable because there are large discontinuities between firm size and exit events and between firm size and employing undocumented workers. Discontinuities at such low levels of employment reflect the prevalence of small firms in the U.S. economy; median firm sizes ranged from two workers in the other services sector to nine workers in manufacturing. In the estimation procedure described below, using a continuous employment variable instead of size dummies yields similar conclusions but slightly weaker results.²¹

Older firms should be less likely to exit, as they tend to have high productivity – otherwise they would have already exited. In addition, large firms tend to be more productive, so they should also have a lower exit propensity.²² A multi-establishment firm may be less likely to shut down since it can close individual establishments if necessary without shutting down completely. High worker churning is likely to add to the firm's labor costs, thus positively affecting *EXIT*.²³ Having a work force with higher human capital would also make a firm more productive, thus reduce exit propensity. Higher average worker tenure reflects a higher level of firm-specific human capital. High employment variability may reflect a degree of instability, thus a higher propensity to exit, or that a firm that is nimble in adjusting to product demand, thus reducing the propensity to exit.

²¹ A specification that included the wage bill instead of measures of employment also yielded similar results to those presented in the paper.

²² These relationships between firm age, size, and exit are predicted by the Jovanovic (1982) and Ericson and Pakes (1995) models of firm selection.

²³ Including this variable at least partially controls for the possibility that not all firms report their undocumented workers to the Department of Labor. As mentioned above, firms may be less likely to include undocumented workers on their UI wage report if the firm's separation experience has resulted in a higher UI tax rate..

B. Industry-, Sector-, and County-Specific Characteristics

Growth of the firm's industry over the previous year and growth of the firm's sector in the firm's county, as measured by employment growth (calculated using the Davis and Haltiwanger, 1992, method), are included as measures of the strength in the firm's industry overall and in the firm's broader sector more geographically specific to the firm's location. Expansion in the sector and locality should support a larger number of firms and hence less exit. Additional regressors are added to account for overall economic demand and consumption that the firm might face in its locality: county population growth; log county per-capita income (measured in \$1,000s); and the proportion of total public school enrollment in the county that is eligible for free and reduced price school lunch, as a poverty-level proxy. The free and reduced lunch variable is measured only in October in each year and is assigned to all quarters in the following calendar year. This regressor is available only starting in 1995 and thus limits the final analyses to the years 1995 through 2005.

All analyses will be estimated separately by sector, allowing the impact of employing undocumented workers (and the other regressors) on exit probability to fully vary by sector. Figure 3 shows that the incidence of undocumented employment is quite uneven across sectors (and there are five other sectors not shown in the figure with even lower incidences of undocumented employment). Among other things, the estimation of separate sector-level results will allow us to explore whether the competitive advantage from employing undocumented workers is associated with the prevalence of the practice.

One industry-specific measure deserves special consideration. Just as a firm's own employment of undocumented workers could give it a comparative advantage, undocumented employment by competitors could place the firm at a disadvantage. To test this, we include a

variable measuring the proportion of *other* firms in the firm's 6-digit NAICS industry that employ undocumented workers: *IndUNDOC*.

The influence of competitors' undocumented employment behavior may vary with the geographic size of the product market. In markets where firms supply a geographically broad product market, they may shift labor-intensive parts of their business to developing countries, where low-cost labor is both legal and plentiful (for example see Preston 2007). In such cases, local competitors' undocumented employment behavior is unlikely to affect the firm. But in geographically segmented markets, where each firm supplies their product to a smaller geographic area, firms do not have the option to conduct low-skilled labor production offshore, making the use of undocumented employment in the local market a more important tool for gaining a competitive advantage. To measure geographic market size, we calculate

BroadMarket, which is a modified Duncan index of dissimilarity (Duncan and Duncan 1955):

$$(2) \quad D_i = \frac{1}{2} \sum_{c=1}^{N_c} \left| \frac{e_{ic}}{E_i} - \frac{1}{N_c} \right|$$

where N_c is the number of counties (159), e_{ic} is the number of workers in industry i that are in county c , E_i is the total employment in industry i , $1/N_c$ is the share of workers that would need to be employed in each county for there to be an equal distribution of workers in the industry across counties. The closer D_i gets to 0 (more equally distributed workers), the more diversified the industry and the more local the market. The closer D gets to 1, the more concentrated is employment in that industry and thus serving a broader market. "Broad," in this case, of course, means extending outside of Georgia. *BroadMarket* is interacted with *IndUNDOC* to test the hypothesis that other firms' undocumented employment behavior matters more in geographically segmented markets.

C. Issues of Endogeneity

It is likely that several of the regressors in equation (1) are endogenous to the determination of a firm's exit outcome. More specifically, some regressors may be correlated with the error term, or their observed values in time t may be affected by the firm's process of exiting. For example, if a firm is not doing well and showing signs of distress (likely to exit), the workers might become anxious or dissatisfied, resulting in a high turnover rate, measured by the degree of worker churning. In addition, a firm anticipating shutting down may adjust its employment level or employment mix (documented vs. undocumented) a couple of quarters prior to shutting down. Given the limited nature of the data, and since there is no hope of instrumenting all these regressors, we take a mixed approach.

For most of the regressors, lagged values are used to move them further from the time of exit itself. *IndUNDOC*, the employment dummies, employee churning, log tenure, and log employment variability are all lagged one year (four quarters); industry growth and county sector growth correspond to the growth experienced in the previous year (lagged one quarter). We account for the potential endogeneity of *UNDOC*, a regressor of particular interest, in an alternative way. The measured impact of employing undocumented workers on performance is likely intimately related to the firm's decision to employ undocumented workers in the first place. Accounting for unobserved factors that simultaneously influence the employment and reporting decision as well as the exit outcome is best handled through estimation of a recursive bivariate probit model (Greene 1996, 1998; Baslevent et al., unknown date).

The probability that a firm employs undocumented workers is specified as follows:

$$(3) \quad P[UNDOC_{jst}] = \alpha_0 + \alpha_1 X_{jt} + \alpha_2 Y_{it} + \alpha_3 W_{st} + \alpha_4 G_{ct} + \alpha_4 POPDEN_{ct} + \alpha_5 HISPENROL_{ct} + \alpha_6 CS_UNDOC_{ct-4} + U_{jst}$$

where X_{jt} , Y_{it} , W_{st} , and G_{ct} are all as described above. $POPDEN_{ct}$ is the log of population density (measured in 1,000s of persons per square mile) in the firm's county at time t ;

$HISPENROL_{ct}$ is the proportion of public school enrollment in the firm's county at time t that is Hispanic;²⁴ and CS_UNDOC_{ct-4} is the proportion of the firm's sector, in the firm's county, that employed undocumented workers four quarters previously. These last three regressors are included to improve model identification, and they all (or a subset of them, depending on the sector) contribute significant explanatory power to the firm's employment decision.²⁵

Technically, what equation (3) is describing is the probability of the joint decision by the firm to employ *and report* the employment of undocumented workers. It is likely there are firms that employ undocumented workers, but do not report them on formal wage reports to the Department of Labor. There is no way to distinguish these firms from those not employing undocumented workers. Informal conversations with employers and immigration lawyers have led us to believe that a firm is more concerned with penalties associated with not paying employment taxes (e.g., unemployment insurance, workman's compensation, Medicaid) than they are about immigration enforcement.²⁶ In other words, we expect that if a firm employs undocumented workers, it is likely to report those workers, or at least some of them, on the UI wage report.

²⁴ Proportion of the county population that is Hispanic is only available on an annual basis since 2000.

²⁵ Wilde (2000) shows that exclusion restrictions are not necessary for identification with a bivariate probit model, but Monfardini and Radice (2008) provide evidence suggesting that exclusion restrictions improve the reliability of exogeneity tests.

²⁶ U.S. Immigration and Customs Enforcement (ICE) describe their priorities in undertaking raids on firms suspected of employing undocumented workers (<http://www.ice.gov/pi/worksites/index.htm>). The first priority includes work sites critical to infrastructure and national security. Secondly, "Worksite Enforcement investigations focus on egregious employers involved in criminal activity or worker exploitation." Employers who continually report a large number of workers whose names and SSNs do not match (as determined by the SSA) are the most likely targets. This is an additional reason why we have more confidence in our identification of firms employing and reporting behavior than in the actual number of undocumented workers employed.

An additional identification problem arises in the specification and estimation of equation (3), namely, the "reflection problem" identified by Manski (1993). The problem arises because the dependent variable ($\text{Prob}[UNDOC]=1$) is a function of the outcomes observed for other members of the firm's "group," which in this case is firms in the same industry (*IndUNDOC*) and the same county-sector (*CS_UNDOC*). The *IndUNDOC* and *CS_UNDOC* effects could be positive not because a firm's behavior varies with the behavior of its group (endogenous effects), but instead because of contextual or correlated effects. Some uncontrolled factor in common to each of the firms in the group could affect the undocumented employment decision. Unfortunately, data limitations preclude us from instrumenting the social effect of interest (*IndUNDOC*). However, Manski points out that in the case of dynamic models like equation (3), the social effect is identified if the dynamic structure imposed is correct. We are assuming that a firm's decision to employ undocumented workers at time t is related to other firms' decisions made in time $t-4$ (one year ago). This assumption is not entirely unreasonable, as the groups are based on loose connections (industry and county location) rather than on daily contact (as might be the case when defining a group for members of the same family, for example).

5. Results

Table 3 contains parameter estimates and marginal effects from estimation of equations (1) and (3) via maximum likelihood bivariate probit.²⁷ As suggested by Greene (1998), results corresponding to fixing the correlation coefficient to zero are reported for sectors where the likelihood ratio test of $\rho=0$ is insignificant at the 90 percent confidence level.²⁸

[Table 3 here]

²⁷ The marginal effects are evaluated at each observation, then averaged over the sample (see Greene 1996). Standard errors are bootstrapped using 500 repetitions.

²⁸ Monfardini and Radice (2008) show that the likelihood ratio test is the preferred test in this case.

A. The Firm's Undocumented Employment Decision

Older and larger firms are more likely to employ undocumented workers. This is consistent with older firms having better developed access to undocumented worker supplies and larger firms having more sophisticated record keeping that increases the likelihood that any undocumented worker that is employed is also reported. Except in construction and manufacturing, multi-establishment firms are more likely to employ undocumented workers, as are firms with greater churning and employment variability (across all sectors). These results are consistent with Morales (1983-1984), who concludes from her case study of automobile manufacturers in Los Angeles that subsidiaries (part of a multi-establishment firm) and firms with high turnover and employment variability are more likely to employ undocumented workers. She argues that subsidiaries might have extra pressure from a parent company to show a profit and are thus more motivated to cut costs by employing undocumented workers. In addition, firms with high employment variability (and churning) are likely to need a very flexible work force, and it is thought that undocumented workers are easy to hire and fire as demand conditions dictate.

The three regressors unique to the employment equation are *POPDEN*, *HISPENROL*, and *CS_UNDOC*. All these regressors are important in explaining a firm's probability of employing undocumented workers, but they do not help explain firm exit propensity.²⁹ The coefficient estimates indicate that a firm located in a more densely populated county (most sectors) and in a county with a greater share of public school enrollment that is Hispanic is more likely to employ undocumented workers. These regressors appear to do a good job as proxies for the supply of undocumented worker labor available to the firm.

²⁹ *POPDEN* is excluded from the retail trade and financial services sector estimations; that regressor shows some explanatory power in determining exits in those sectors. *HISPENROL* is excluded from the estimations for the transportation & utilities and education & health sectors for the same reason.

The industry, county-sector, and county population growth coefficients are positive coefficients in most cases. This is consistent with firms using undocumented labor during times of peak demand rather than as a desperation measure when distressed. The estimated positive and significant coefficient on *CS_UNDOC* is consistent with a herding mentality found by others at the firm level regarding illegal behaviors (see Earle and Peter, forthcoming); a culture of acceptable behavior develops as more employers hire undocumented workers. It could also be the case that observed success in getting away with the behavior encourages more risk averse firms to jump on the bandwagon. This regressor's coefficient is negative only in the information sector. The positive and significant coefficient on *IndUNDOC* provides additional support for herding behavior

Firms in broad product markets are found to be significantly less likely to employ undocumented workers, as expected given that only such firms have the opportunity to conduct labor-intensive parts of their business abroad. A negative and (mostly) significant coefficient on the interaction of *IndUNDOC* with *BroadMarket* suggests that herding behavior is also less strong in such sectors.

B. Firm Survival

The parameter estimates in the exit equation conform to well-established relationships between firm characteristics and firm survival.³⁰ Young firms, small firms, those with a high degree of employment variability, and ones with low worker tenure are more likely to exit. Multi-establishment firms and firms in an industry experiencing faster employment growth have a reduced probability of exiting. The importance and directional effect of churning varies across sectors. The county-level regressors perform at different significance levels and in different

³⁰ For example, see Disney et al. 2003 and Dunne et al. 1989.

directions across sectors; these are likely correlated with other regressors in different ways across sectors.

The coefficients on the *UNDOC* regressor are significantly negative for all sectors. The marginal effects indicate that employing undocumented workers reduces the probability of a firm exiting between 0.2 of a percentage point (in education and health) to two percentage points (in transportation and utilities). Employing undocumented workers reduces a firm's probability of exiting by 1.4 percentage points in construction and by about 0.6 of a percentage point in both manufacturing and leisure and hospitality. Given that the predicted probability of a firm exiting in any sector is roughly two percent, employing undocumented workers could double a firm's probability of survival.

In addition, a firm's exit probability is almost uniformly increased across sectors when other firms in the industry employ undocumented workers. This makes sense if doing so also gives other firms a competitive advantage, and it is consistent with anecdotal evidence obtained from interviews with firms and from Congressional testimony, in which employers report that they feel a need to hire undocumented workers to stay competitive, because everybody else is doing it.³¹ The implication is that firms would be better off if they could all commit to not employing undocumented workers. It also implies that profit margins are pushed lower as more firms employ undocumented workers, suggesting that consumer prices are lower in these sectors as well. This is consistent with the work by Cortes (2008) that finds that the price of immigrant-intensive services are pushed lower in areas experiencing increases in the share of low-skilled immigrants.

³¹ For example, see the testimony of Charles Shafer, carpenter from Lawrenceville, GA (Subcommittee on Workforce Protections of the Committee on Education and the Workforce, 2006, pp. 25-6).

The negative (when significantly different from zero) coefficient on the interaction of *IndUNDOC* with *BroadMarket* indicates that undocumented employment is less of a competitive factor when firms have the option to move labor-intensive parts of their business out of state (or offshore). Notably, this coefficient is significant in sectors where some industries are global (e.g., in manufacturing, financial services, and professional and business services).

When comparing the effects of *UNDOC* and *IndUNDOC* across sectors, one can see a clear tendency for the magnitudes to be larger in sectors with less undocumented employment.³² This suggests the competitive advantage dissipates when the practice becomes more widespread, perhaps because documented worker wages adjust downwards.³³

C. Results for Workers with Invalid SSNs for Any Reason

The results reported in this paper correspond to the impact of employing workers for whom we are most confident of the "undocumented" designation. As mentioned earlier, it is not at all clear whether workers with invalid reasons other than having a high area number or out-of-sequence group number are documented or not. Some of the other reasons appear to be record-keeping short-cuts allowing firms to complete their paperwork for workers who may only be employed one quarter, or for whom the employer has yet to obtain valid SSNs. In these cases, the employer may just record zeros, their own employer ID, or repeat the same number for multiple workers. In the case of the same valid SSN appearing for workers with different surname initials at different employers, it is not known to which worker the valid SSN truly

³² The correlations between the *UNDOC* share in the sector and the exit marginal effects for *UNDOC* and *IndUNDOC* are 0.372 and -0.296, respectively.

³³ Hotchkiss and Quispe-Agnoli (2008) find that documented worker wages adjust downwards to a greater extent the larger the share of undocumented employment in the industry. To further investigate this, in a separate set of regressions not reported here we have added an *IndUNDOC* squared term. *IndUNDOC* is positive and significant, and the squared coefficient is negative and significant in manufacturing, financial services, professional and business services, and education and healthcare.

belongs; informal conversations with immigration lawyers and members of the undocumented community confirm that selling valid SSNs is a common practice.

In cases where employers assign an invalid SSN to workers employed on a very short-term basis, or where there are repeated valid SSNs across workers with different surnames, it is likely that a significant number of these workers are actually undocumented. As a limited test of this assertion, the full analysis has been repeated to determine whether employing workers with invalid SSNs for reasons other than a high area number or out-of-sequence group number have a similar impact on firm performance as employing workers that are more confidently in the "undocumented" category.

The directional impact and significance levels of the regressors from the bivariate probit estimation when an indicator for workers with invalid SSNs for reasons other than high area number or out-of-sequence group number replaces *UNDOC* generally match those presented in Table 3.³⁴ However, the impact on a firm's exit probability of employing workers with these other invalid SSNs, or being in an industry that employs more of these workers, is weaker than when considering those we classify as undocumented. This is to be expected if some workers have invalid SSNs merely as a short-term convenience for the firm, but are indeed documented workers.

6. Conclusion

The results of the analysis in this paper indicate that firms employing undocumented workers enjoy a competitive advantage over firms that do not employ undocumented workers. Others have identified a sizeable wage gap between documented and undocumented workers, with undocumented workers being paid about 30 percent less than documented workers

³⁴ The full set of estimation results is available on request.

(Hotchkiss and Quispe-Agnoli 2008). Whether this wage gap results in cost savings for employers, thus improving their competitiveness, depends on its source. If the wage gap compensates for lower productivity among, or higher risk of employing undocumented workers, then firms employing undocumented workers should experience no competitive advantage. If, on the other hand, firms are able to distinguish between groups of workers and one group has a lower labor supply elasticity, the firm can gain a competitive advantage by paying those workers a wage below their marginal revenue product. This wage-setting practice is referred to as monopsonistic discrimination. The analysis in this paper provides evidence consistent with employers' ability to sustain monopsony power over undocumented workers.

There are both economic and political implications from finding that firms experience a competitive advantage from employing undocumented workers. From an economic perspective, any reduction in the supply of undocumented workers (e.g., through tougher border and worksite enforcement) will raise firms' production costs and, likely, prices paid by consumers in those sectors employing larger shares of undocumented workers.

From a political perspective, the results of this paper provide strong predictions about the sources of lobbying about and potential effectiveness of immigration policies designed to reduce the supply of undocumented workers. Resistance to tougher enforcement is likely to come from employers in industries where undocumented employment is pervasive, such as construction, leisure and hospitality, and industries in other sectors where markets are geographically segmented. Groups representing documented workers in those same sectors are likely to call for tougher enforcement due to their depressed wages resulting from undocumented employment. In sectors where undocumented employment is uncommon, but the competitive effects are strong (e.g., in transport and utilities and wholesale trade) individual firms employing undocumented

workers may wish to quietly lobby against tougher enforcement, but industry-wide employer resistance and documented employee calls for enforcement are unlikely.³⁵

In addition, local initiatives to enforce immigration law are likely to be more effective at curbing employment of undocumented workers within geographically segmented industries, as firms in these industries don't have an option to move production elsewhere while continuing to serve the local market. In contrast, firms facing product markets that extend beyond the county or state borders can respond to stricter immigration enforcement by shifting production to counties or states with more lax immigration enforcement. If immigration is enforced more strictly nationally, companies may shift production abroad.

The identification of a competitive advantage accruing to firms that employ undocumented workers suggests that they are exercising some monopsony power in the labor market for these workers. Consequently, if immigration policies predicated on workers' rights and moral obligation (see Gibbons 2008 and Greenhouse 1999) are successful in forcing firms to treat undocumented workers in the same way as documented workers, their competitive advantage may disappear, lowering demand for undocumented workers.

³⁵ Immigration lawyers have informed us that firms lobbying for softer immigration enforcement keep a low profile in order not to draw attention to their violation of the law.

Figure 1.

Percent of workers with invalid SSN, by reason, construction, 1990:1 - 2006:4

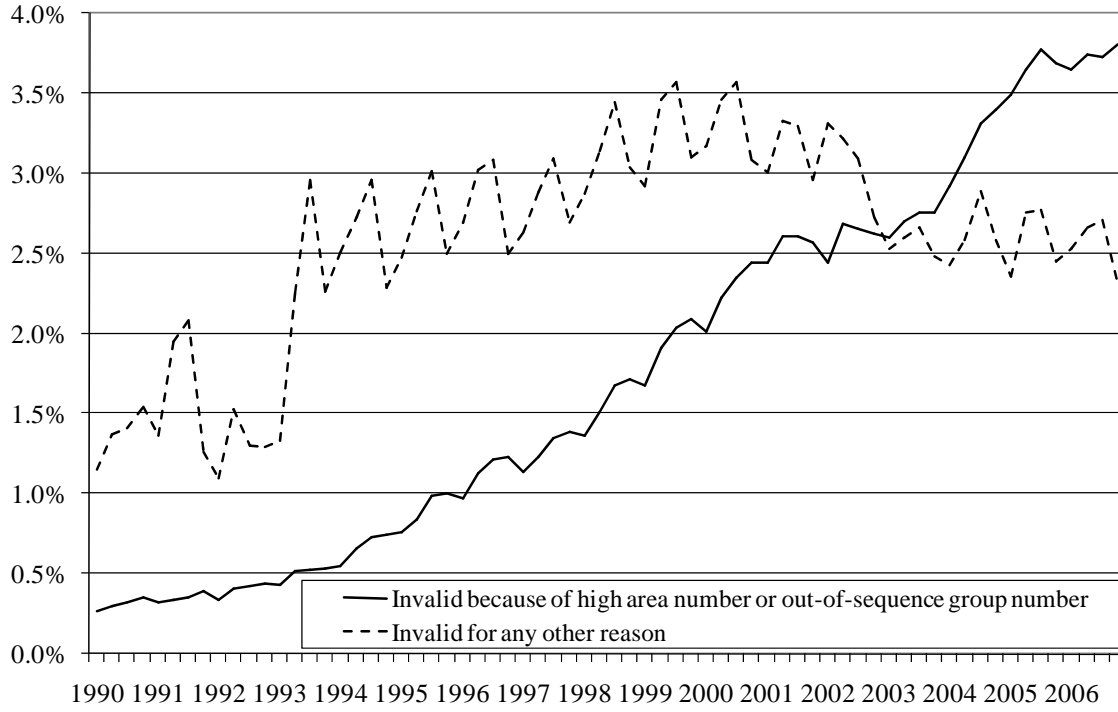


Figure 2.

Percent of workers that is undocumented by broad industry, 1990:1 - 2006:4

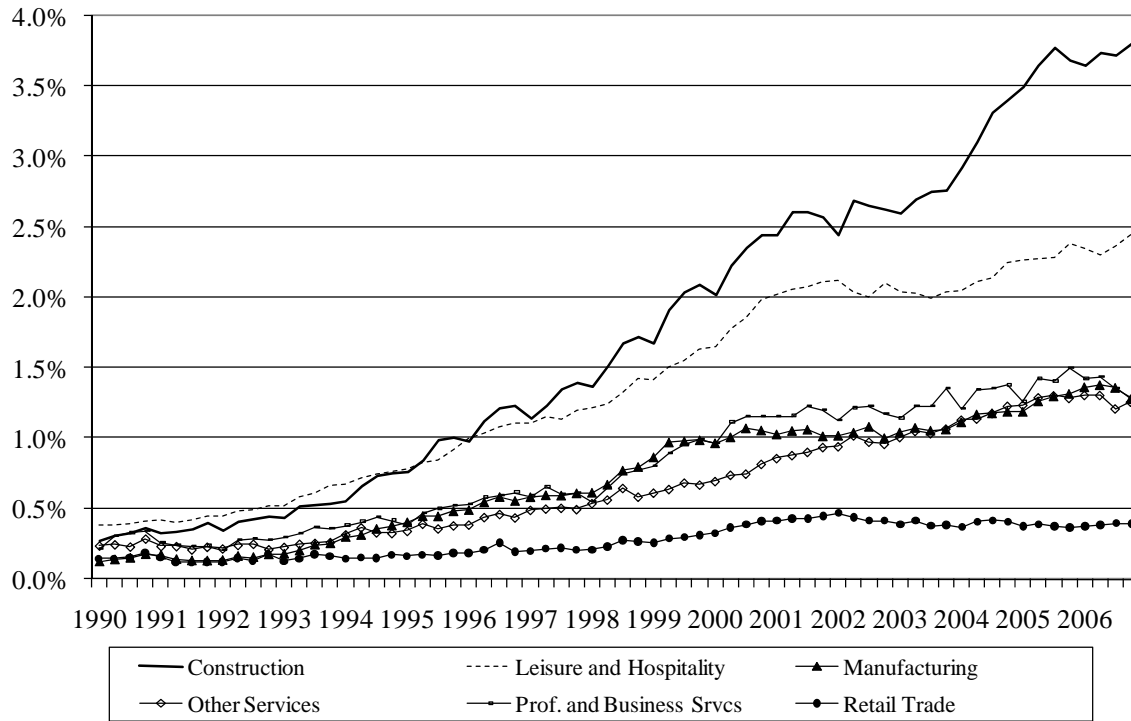


Figure 3.

Percent of firms employing undocumented workers by broad sector, 1990:1-2006:4

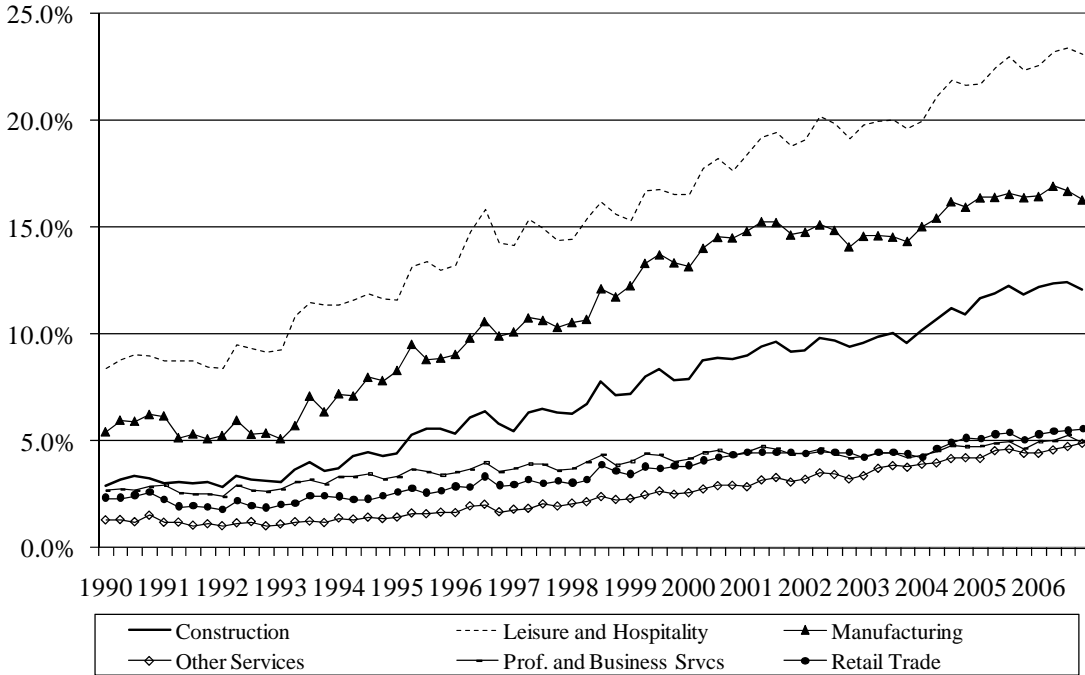


Table 1. Correlation between percent of workers identified as undocumented by county and the percent of firms that employ them, with the percent of the population in each county that is Hispanic, African American, and Asian, 2005.

Percent of Population that is:	Percent of Undocumented Workers in County	Percent of Firms Employing Undocumented Workers in County
Hispanic	0.18	0.38
Asian	-0.02	0.27
African American	-0.19	-0.13

Table 2. Select sample means.

	1995			2005		
	All firms	Firms with no undoc. worker	Firms with at least one undoc. worker	All firms	Firms with no undoc. worker	Firms with at least one undoc. worker
Percent of firms employing undocumented workers	4.20% (20.05)	--	100%	8.31% (27.60)	--	100%
Percent of workers that is undocumented	0.28% (2.42)	--	6.74% (9.78)	0.95% (4.83)	--	11.45% (12.68)
Total Employment	23.12 (208)	14.98 (93)	209.07 (896)	24.74 (254)	16.31 (111)	117.79 (796)
Number of establishments in firm	1.22 (3.52)	1.13 (2.37)	3.41 (12.75)	1.32 (6.12)	1.19 (4.42)	2.75 (15.27)
Percent of firms exiting	1.78% (13.21)	1.81% (13.32)	1.09% (10.04)	2.13% (14.44)	2.22% (14.72)	1.20% (10.88)
Number of firms in industry	1,252 (1,599)	1,267 (1,615)	915 (1,113)	1,493 (1,863)	1,501 (1,880)	1,413 (1,651)
Broad market	0.662 (0.137)	0.662 (0.136)	0.666 (0.147)	0.654 (0.126)	0.656 (0.126)	0.638 (0.129)
Age of firm (number of quarters)	19.12 (5.31)	19.10 (5.32)	19.60 (5.06)	38.57 (20.59)	38.45 (20.61)	39.95 (20.44)
Average worker tenure among documented (number of quarters)	10.29 (5.60)	10.43 (5.62)	7.21 (3.98)	17.38 (12.98)	17.90 (13.21)	11.63 (8.15)
Average worker tenure among undocumented (num. of quarters)	3.54 (4.48)	--	3.54 (4.48)	5.59 (5.71)	--	5.59 (5.71)
Percent of county population that is Hispanic ^a	--	--	--	7.54% (4.91)	7.46% (4.90)	8.45% (4.94)
Percent of county school enrollment that is Hispanic	2.01% (1.44)	2.00% (1.44)	2.19% (1.48)	8.01% (5.98)	7.92% (5.97)	9.01% (6.04)
Employment variability ^b	889.35 (45,860)	224.92 (12,465)	16,060 (215,269)	3,886 (381,926)	1,137 (73,555)	34,226 (1,301,957)
Number of firm-quarter obs.	377,019	361,200	15,819	432,336	396,418	35,918

Notes. Standard deviations are in parentheses. Undocumented workers are identified as those whose SSN has an area number that is too high to be valid or a group number that appears out of sequence. Note in comparing values between 1995 and 2005 that 1990 is the first year in which any firm is observed in the data.

^aStatistic not available in 1995.

^bMeasured as the cumulative variance in total employment.

Table 3. Bivariate probit estimation results and marginal effects.

Panel (a): Construction, Manufacturing, Transportation & Utilities

Regressors	Construction		Manufacturing		Transportation & Utilities	
	P(UNDOC=1)	P(Exit=1)	P(UNDOC=1)	P(Exit=1)	P(UNDOC=1)	P(Exit=1)
<i>UNDOC</i>		-0.463* (0.062) [-0.01401]*		-0.183* (0.024) [-0.00548]*		-0.633* (0.256) [-0.02008]*
<i>IndUNDOC</i>	6.952* (0.882) [0.49876]*	0.926+ (0.523) [0.02875]*	8.354* (0.747) [0.28223]*	1.470* (0.456) [0.01610]*	15.736* (3.084) [0.46431]*	-0.037 (1.649) [0.02799]*
<i>BroadMarket</i>	0.335+ (0.201) [-0.03065]*	0.272* (0.095) [0.00748]*	0.991* (0.183) [-0.05781]*	0.194* (0.077) [-0.00075]	0.342^ (0.177) [-0.04169]*	-0.086 (0.072) [-0.00575]*
<i>Broad*INDUNDOC</i>	-5.036* (1.404)	-0.964 (0.828)	-8.044* (0.806)	-1.443* (0.497)	-14.502* (3.430)	0.116 (1.854)
One Employee	-0.722* (0.026) [-0.06736]*	0.305* (0.012) [0.01650]*	-0.984* (0.058) [-0.10583]*	0.446* (0.022) [0.02302]*	-0.682* (0.057) [-0.03560]*	0.305* (0.023) [0.02003]*
Two Employees	-0.464* (0.024) [-0.04900]*	0.214* (0.013) [0.01106]*	-0.739* (0.057) [-0.08993]*	0.268* (0.022) [0.01173]*	-0.460* (0.063) [-0.02754]*	0.164* (0.025) [0.01010]*
Log Age	0.228^ (0.098) [0.00131]*	0.110+ (0.063) [-0.00021]*	0.767* (0.160) [0.00279]*	0.267^ (0.112) [-0.00009]*	0.580* (0.230) [0.00090]*	0.161 (0.115) [-0.00006]
Log Age Squared	-0.001 (0.017)	-0.041* (0.011)	-0.051+ (0.027)	-0.066* (0.018)	-0.057 (0.040)	-0.039^ (0.019)
Multi-establishment	-0.191 (0.138) [-0.02211]*	-0.149 (0.098) [-0.00570]*	-0.037 (0.056) [-0.00600]*	-0.209* (0.043) [-0.00588]*	0.006 (0.086) [0.00048]*	-0.254* (0.073) [-0.01110]*
Employment Churning	0.010* (0.003) [0.00123]*	0.003* (0.001) [0.00016]*	0.001 (0.001) [0.00015]*	-0.004+ (0.002) [-0.00014]*	-0.001 (0.001) [-0.00005]	-0.002 (0.002) [-0.00013]*
Log Tenure	-0.359* (0.016) [-0.00774]*	-0.112* (0.008) [-0.00123]*	-0.506* (0.022) [-0.01066]*	-0.073* (0.013) [-0.00064]*	-0.374* (0.034) [-0.00528]	-0.156* (0.016) [-0.00211]*
Log Employment Variability	0.266* (0.006) [0.00672]*	0.039* (0.006) [0.00109]*	0.167* (0.006) [0.00359]*	0.020* (0.003) [0.00032]*	0.165* (0.009) [0.00203]*	0.020+ (0.011) [0.00071]*
Industry Growth	0.243* (0.053) [0.03093]*	-0.119^ (0.054) [-0.00398]*	0.056^ (0.026) [0.00935]*	-0.119* (0.034) [-0.00375]*	0.173^ (0.080) [0.01363]*	-0.081 (0.062) [-0.00347]*
County Sector Growth	0.197* (0.033) [0.02503]*	-0.073^ (0.034) [-0.00226]*	-0.002 (0.027) [-0.00029]*	-0.038 (0.035) [-0.00125]*	0.056 (0.035) [0.00437]*	-0.005 (0.030) [-0.00002]*
County Population Growth	3.328* (0.551) [0.42291]*	0.251 (0.282) [0.02259]*	3.045* (0.783) [0.50796]*	0.319 (0.475) [0.02110]*	1.884 (1.232) [0.14828]*	-0.510 (0.540) [-0.01856]*
Log Per Capita Income	0.097 (0.063) [0.00045]*	0.006 (0.020) [0.00002]*	0.189^ (0.083) [0.00123]*	0.028 (0.029) [0.00006]*	0.065 (0.098) [0.00019]*	-0.031 (0.033) [-0.00005]*
Free & Reduced Lunch	-0.217* (0.071) [-0.02757]*	0.145* (0.034) [0.00517]*	-0.063 (0.096) [-0.01052]*	0.051 (0.054) [0.00147]*	-0.138 (0.156) [-0.01086]*	0.034 (0.060) [0.00117]*

Log Population Density (<i>POPDEN</i>)	0.011 (0.012) [0.00626]*		0.052* (0.016) [0.05345]*		-0.011 (0.020) [-0.00505]*	
Hispanic Enrollment (<i>HISPENROL</i>)	1.081* (0.214) [0.13740]*		0.775* (0.312) [0.12922]*			
County UNDOC (<i>CS_UNDOC</i>)	2.454* (0.258) [0.31184]*		2.058* (0.165) [0.34335]*		1.030* (0.324) [0.08105]*	
ρ	0.133* (0.035)		0.000		0.259 ⁺ (0.142)	
Firms	29,378		11,665		8,224	
Observations	530,768		271,434		139,751	

Panel (b): Wholesale Trade, Retail Trade, Financial Services

Regressors	Wholesale Trade		Retail Trade		Financial Services	
	P(<i>UNDOC</i> =1)	P(Exit=1)	P(<i>UNDOC</i> =1)	P(Exit=1)	P(<i>UNDOC</i> =1)	P(Exit=1)
<i>UNDOC</i>		-0.755* (0.162) [-0.01744]*		-0.172* (0.025) [-0.00645]*		-0.533* (0.152) [-0.01398]*
<i>IndUNDOC</i>	7.422* (2.247) [0.34958]*	2.454 ⁺ (1.299) [0.04251]*	5.536* (0.865) [0.20125]*	-0.496 (0.447) [-0.00206]*	16.653* (3.130) [0.25530]*	12.186* (1.776) [0.11851]*
<i>BroadMarket</i>	-0.133 (0.207) [-0.01803]*	0.435* (0.085) [0.01528]*	-0.046 (0.121) [-0.02143]*	0.090 ⁺ (0.048) [0.00430]*	0.292 [^] (0.143) [-0.00423]*	0.350* (0.073) [0.00362]*
<i>Broad*INDUNDOC</i>	-2.739 (2.962)	-2.389 (1.664)	-5.005* (1.057)	0.591 (0.578)	-15.050* (3.570)	-14.066* (2.322)
One Employee	-0.845* (0.042) [-0.03321]*	0.411* (0.016) [0.02316]*	-0.559* (0.028) [-0.02872]*	0.370* (0.011) [0.02105]*	-0.723* (0.038) [-0.01840]*	0.328* (0.014) [0.01697]*
Two Employees	-0.506* (0.055) [-0.02435]*	0.228* (0.017) [0.01230]*	-0.329* (0.027) [-0.01973]*	0.181* (0.011) [0.00903]*	-0.384* (0.039) [-0.01229]*	0.160* (0.015) [0.00774]*
Log Age	0.841* (0.169) [0.00057]*	0.228* (0.076) [-0.00009]*	0.423* (0.121) [0.00021]*	-0.007 (0.062) [-0.00018]*	0.380 [^] (0.179) [0.00022*]	0.028 (0.074) [-0.00021]*
Log Age Squared	-0.103* (0.028)	-0.053* (0.012)	-0.060* (0.021)	-0.014 (0.010)	-0.045 (0.030)	-0.022 ⁺ (0.012)
Multi-establishment	0.063 (0.078) [0.00429]*	-0.198* (0.059) [-0.00748]*	0.150* (0.043) [0.01204]*	-0.110* (0.033) [-0.00434]*	0.027 (0.064) [0.00113]*	-0.111* (0.038) [-0.00436]*
Employment Churning	0.020* (0.004) [0.00131]*	-0.000 (0.003) [0.00004]*	0.007* (0.003) [0.00051]*	0.001 (0.002) [0.00004]*	0.015* (0.003) [0.00062]*	0.000 (0.003) [0.00003] ⁺
Log Tenure	-0.366* (0.024) [-0.00332]*	-0.110* (0.010) [-0.00095]*	-0.207* (0.016) [-0.00253]*	-0.093* (0.006) [-0.00086]*	-0.209* (0.027) [-0.00143]*	-0.090* (0.008) [-0.00079]*
Log Employment Variability	0.178* (0.007) [0.00240]*	0.038* (0.008) [0.00112]*	0.206* (0.006) [0.00336]*	-0.002 (0.004) [0.00006]*	0.140* (0.007) [0.00151]*	0.025* (0.005) [0.00071]*
Industry Growth	0.124 [^] (0.053) [0.00813]*	-0.113 [^] (0.049) [-0.00450]*	0.061 (0.052) [0.00442]*	-0.139* (0.041) [-0.00594]*	0.023 (0.071) [0.00097]*	-0.111* (0.041) [-0.00467]*

County Sector Growth	-0.018 (0.037) [-0.00121]*	-0.051 (0.032) [-0.00222]*	0.005 (0.018) [0.00038]*	-0.020 (0.017) [-0.00087]*	-0.043 (0.047) [-0.00177]*	-0.031 (0.030) [-0.00141]*
County Population Growth	2.229 [^] (0.980) [0.14589]*	-0.336 (0.381) [-0.00800]*	1.012 (0.650) [0.07308]*	0.091 (0.302) [0.00576]*	1.168 (1.161) [0.04809]*	0.141 (0.378) [0.00799]*
Log Per Capita Income	-0.024 (0.081) [-0.00006]*	0.027 (0.021) [0.00004]*	0.264* (0.043) [0.00070]*	0.019 (0.017) [0.00005]*	0.207* (0.067) [0.00029]*	0.129* (0.020) [0.00021]*
Free & Reduced Lunch	0.072 (0.114) [0.00472]*	0.057 (0.037) [0.00264]*	-0.042 (0.073) [-0.00307]*	-0.016 (0.033) [-0.00078]*	0.267 ⁺ (0.139) [0.01098]*	0.041 (0.039) [0.00222]*
Log Population Density (<i>POPDEN</i>)	-0.010 (0.018) [-0.00262]*					
Hispanic Enrollment (<i>HISPENROL</i>)	1.241* (0.323) [0.08125]*		1.667* (0.226) [0.12057]*		2.046* (0.406) [0.08429]*	
County UNDOC (<i>CS_UNDOC</i>)	0.874* (0.302) [0.05722]*		2.675* (0.415) [0.19349]*		1.395 [^] (0.633) [0.05746]*	
ρ		0.307* (0.091)		0.000		0.163 [^] (0.073)
Firms		22,439		31,034		22,048
Observations		435,685		620,336		417,437

Panel (c): Information, Profession & Business Services, and Education & Health

	Information		Professional & Business Svcs		Education & Healthcare	
Regressors	P(<i>UNDOC</i> =1)	P(Exit=1)	P(<i>UNDOC</i> =1)	P(Exit=1)	P(<i>UNDOC</i> =1)	P(Exit=1)
<i>UNDOC</i>		-0.244* (0.076) [-0.01036]*		-0.400* (0.055) [-0.01264]*		-0.076 [^] (0.033) [-0.00228]*
<i>IndUNDOC</i>	-1.593 (4.468) [0.06464]*	2.445 (3.412) [-0.00200]	23.486* (0.885) [0.26715]*	2.513* (0.460) [0.02430]*	1.503 (1.092) [0.10886]*	3.862* (0.778) [0.03143]*
<i>BroadMarket</i>	-0.965 [^] (0.400) [-0.05242]*	0.167 (0.204) [0.00188]*	-0.067 (0.114) [-0.20146]*	0.856* (0.044) [0.02586]*	-0.480* (0.144) [-0.02385]*	0.427* (0.077) [0.00917]*
<i>Broad*INDUNDOC</i>	3.508 (5.110)	-3.271 (4.034)	-27.863* (1.259)	-2.871* (0.639)	0.773 (1.419)	-4.515* (1.030)
One Employee	-0.676* (0.107) [-0.02764]*	0.313* (0.032) [0.02017]*	-0.750* (0.026) [-0.03590]*	0.338* (0.009) [0.01801]*	-0.516* (0.035) [-0.01947]*	0.369* (0.015) [0.01584]*
Two Employees	-0.446* (0.078) [-0.02125]*	0.204* (0.035) [0.01251]*	-0.475* (0.028) [-0.02577]*	0.192* (0.010) [0.00988]*	-0.206* (0.054) [-0.00974]*	0.249* (0.016) [0.00993]*
Log Age	0.493 (0.344) [0.00088]*	0.340 [^] (0.166) [-0.00007]*	0.158 (0.100) [0.00052]*	0.032 (0.051) [-0.00034]*	0.482* (0.131) [0.00035]*	0.078 (0.080) [-0.00016]*
Log Age Squared	-0.036 (0.060)	-0.073* (0.028)	-0.000 (0.017)	-0.031* (0.009)	-0.057* (0.022)	-0.033* (0.013)
Multi-establishment	0.180 (0.114) [0.01306]*	-0.030 (0.069) [-0.00157]*	0.209* (0.052) [0.01573]*	-0.159* (0.040) [-0.00615]*	0.196* (0.053) [0.01243]*	-0.032 (0.046) [-0.00099]*

Employment Churning	0.004 (0.004) [0.00026]*	-0.000 (0.003) [-0.00001]*	0.009* (0.003) [0.00058]*	0.003 [^] (0.001) [0.00014]*	0.004* (0.001) [0.00020]*	-0.002 (0.002) [-0.00005]*
Log Tenure	-0.402* (0.052) [-0.00464]*	-0.118* (0.021) [-0.00140]*	-0.309* (0.015) [-0.00437]*	-0.066* (0.006) [-0.00074]*	-0.215* (0.020) [-0.00187]*	-0.048* (0.009) [-0.00032]*
Log Employment Variability	0.133* (0.013) [0.00115]*	0.009 (0.006) [0.00024]*	0.193* (0.004) [0.00267]*	0.024* (0.003) [0.00071]*	0.161* (0.006) [0.00173]*	-0.000 (0.004) [0.00004]*
Industry Growth	-0.027 (0.097) [-0.00176]*	-0.007 (0.066) [-0.00044]*	0.029 (0.037) [0.00195]*	-0.048 ⁺ (0.026) [-0.00202]*	-0.034 (0.065) [-0.00183]*	0.003 (0.060) [0.00004] [^]
County Sector Growth	0.021 (0.043) [0.00137]*	-0.067 ⁺ (0.037) [-0.00346]*	0.025 (0.019) [0.00165]*	0.004 (0.018) [0.00024]*	-0.023 (0.036) [-0.00127]*	-0.060 ⁺ (0.034) [-0.00195]*
County Population Growth	3.241 (2.289) [0.20815]*	-1.265 (0.961) [-0.05927]*	2.419* (0.643) [0.16227]*	0.439 (0.271) [0.02429]*	2.773* (0.746) [0.15127]*	-1.107* (0.385) [-0.03233]*
Log Per Capita Income	-0.259 ⁺ (0.159) [-0.00055]*	0.194* (0.046) [0.00031]*	0.033 (0.054) [0.00007]*	0.014 (0.014) [0.00002]*	-0.037 (0.059) [-0.00007]*	0.013 (0.020) [0.00001]*
Free & Reduced Lunch	-0.019 (0.241) [-0.00124]*	-0.101 (0.091) [-0.00532]*	-0.173 [^] (0.072) [-0.01159]*	0.030 (0.027) [0.00096]*	0.046 (0.080) [0.00251]*	0.024 (0.041) [0.00084]*
Log Population Density (POPDEN)	0.098 [^] (0.041) [0.01747]*		0.056* (0.013) [0.01018]*		0.101* (0.013) [0.02157]*	
Hispanic Enrollment (HISPENROL)	0.922 (1.268) [0.05921]*		0.817* (0.246) [0.05481]*			
County UNDOC (CS_UNDOC)	-1.594* (0.568) [-0.10237]*		1.694* (0.370) [0.11361]*		0.186 (0.477) [0.01014]*	
ρ	0.000		0.099* (0.030)		0.000	
Firms	4,083		46,853		22,686	
Observations	69,569		805,570		495,700	

Panel (d): Leisure & Hospitality, Other Services

Regressors	Leisure & Hospitality		Other Services	
	P(UNDOC=1)	P(Exit=1)	P(UNDOC=1)	P(Exit=1)
<i>UNDOC</i>		-0.151* (0.017) [-0.00636]*		-0.488* (0.104) [-0.01685]*
<i>IndUNDOC</i>	7.739* (0.770) [0.71273]*	-0.229 (0.492) [0.01980]*	13.555* (1.429) [0.29115]*	2.120 [^] (0.906) [0.03858]*
<i>BroadMarket</i>	0.381 (0.243) [-0.21777]*	0.165 (0.129) [0.00301]*	-0.171 (0.163) [-0.05068]*	0.413* (0.057) [0.01689]*
<i>Broad*INDUNDOC</i>	-7.398* (1.202)	0.308 (0.775)	-12.529* (2.075)	-2.505 [^] (1.297)
One Employee	-0.847* (0.037)	0.320* (0.018)	-0.728* (0.034)	0.303* (0.013)

	[-0.12892]*	[0.01938]*	[-0.02702]*	[0.01703]*
Two Employees	-0.654* (0.032) [-0.10834]*	0.223* (0.018) [0.01243]*	-0.334* (0.036) [-0.01475]*	0.161* (0.014) [0.00957]*
Log Age	0.911* (0.098) [0.00106]*	-0.063 (0.079) [-0.00028]*	0.191 (0.146) [0.00023]*	-0.083 (0.063) [-0.00037]*
Log Age Squared	-0.149* (0.017)	-0.012 (0.013)	-0.017 (0.025)	-0.008 (0.011)
Multi-establishment	0.336* (0.045) [0.07648]*	-0.129* (0.037) [-0.00533]*	0.024 (0.089) [0.00129]*	-0.288* (0.092) [-0.01176]*
Employment Churning	0.009* (0.003) [0.00187]*	-0.002 (0.002) [-0.00004]*	0.019* (0.005) [0.00099]*	0.003 ⁺ (0.002) [0.00019]*
Log Tenure	-0.186* (0.017) [-0.00854]*	-0.097* (0.010) [-0.00141]*	-0.256* (0.019) [-0.00248]*	-0.071* (0.006) [-0.00081]*
Log Employment Variability	0.245* (0.006) [0.00792]*	0.005 (0.004) [0.00035]*	0.220* (0.009) [0.00363]*	0.028* (0.008) [0.00129]*
Industry Growth	0.002 (0.063) [0.00033]	-0.016 (0.059) [-0.00072]*	-0.215* (0.055) [-0.01126]*	-0.164* (0.044) [-0.00899]*
County Sector Growth	0.042 [^] (0.020) [0.00854]*	-0.018 (0.029) [-0.00053]*	0.071 (0.054) [0.00370]*	-0.048 (0.037) [-0.00235]*
County Population Growth	4.050* (0.657) [0.82893]*	0.070 (0.399) [0.02849]*	1.238 (0.877) [0.06489]*	0.469 (0.320) [0.02713]*
Log Per Capita Income	0.526* (0.061) [0.00380]*	0.089* (0.021) [0.00026]*	0.297* (0.074) [0.00053]*	-0.090* (0.017) [-0.00015]*
Free & Reduced Lunch	-0.098 (0.076) [-0.02011]*	0.012 (0.043) [-0.00010]	0.034 (0.109) [0.00178]*	-0.062 ⁺ (0.034) [-0.00318]*
Log Population Density (<i>POPDEN</i>)	0.084* (0.012) [0.06243]*		0.066* (0.018) [0.00926]*	
Hispanic Enrollment (<i>HISPENROL</i>)	1.844* (0.257) [0.37739]*		0.715 [^] (0.323) [0.03745]*	
County UNDOC (<i>CS_UNDOC</i>)	0.849* (0.156) [0.17374]*		3.533* (0.642) [0.18517]*	
ρ	0.000		0.191* (0.054)	
Firms	18,789		27,028	
Observations	327,457		490,540	

Notes: Standard errors (corrected for firm clustering) are shown in parentheses. Marginal effects are in brackets. Significance level of marginal effects are derived from bootstrapped standard errors, 500 repetitions. ⁺ = significant at 10-percent level. [^] = significant at 5-percent level. * = significant at 1-percent level.

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Appendix A: Definitions of sectors based on NAICS classifications.

Table A1: Definitions of sectors based on 2-digit NAICS classifications.

Sector	Included 2-digit NAICS
Construction	23
Manufacturing	31-33
Transportation and Utilities	22, 48-49
Wholesale Trade	42
Retail Trade	44-45
Financial Activities	52-53
Information	51
Professional and Business Services (includes temporary services)	54-56
Education and Health Services	61-62
Leisure and Hospitality	71-72
Other Services (includes private household, laundry, and repair and maintenance services)	81
