The Impact of the Americans with Disabilities Act on the Entry and Exit of Retail Firms[1]

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Abstract

Congress enacted The Americans with Disabilities Act of 1990 over the protests of small business advocates who claimed that the ADA would trigger a wave of bankruptcies. Although the profitability of firms may suffer from the costs of ADA compliance, no systematic review of the evidence has been done. This paper seeks to determine if the ADA had a measurable impact on both the entry of new firms and the failure rate (exit) of existing firms.

The empirical results are consistent with the hypothesis that the ADA negatively impacted the retail industry. There were fewer food stores (the primary retail category examined) after the ADA was passed, and the drop was larger in states in which the ADA was more of a legal innovation, and in states that had more disabled people, more ADA-related lawsuits, and more ADA-related labor complaints. There is also evidence that employment and access discrimination suits imposed real costs on stores, encouraging exit. However, the exit of incumbents was partially offset by new entry. Overall, the number of food stores decreased an average of 4–9% after the ADA came into effect, and at least a 1.4–2.3% decrease in the number of smaller stores may be attributed directly to the ADA, net of trends affecting larger firms. Similar patterns are found for firms in many of the other retail categories.

Two subsidiary contributions of the paper are an inquiry into the response of industry dynamics to increases in costs, and an econometric model to back out entry and exit rates from establishment count data. The theoretical model of industry dynamics shows that increases in marginal and fixed costs may have interesting and non-obvious effects on entry and exit. The econometric model enables maximum likelihood estimation of unobserved entry and exit processes based on the observed establishment count data. Both models show promise for application to other questions in economics.

1 Introduction

The Americans with Disabilities Act (ADA) of 1990 is the most recent major federal antidiscrimination law. The ADA seeks to prevent employment and wage discrimination against disabled workers, and to ensure the physical accessibility of businesses to disabled customers. Congress enacted the ADA over the protests of small business advocates who claimed that the ADA would trigger a wave of bankruptcies. Despite allegations, no systematic review of the evidence has been presented to substantiate or refute this claim. The profitability of smaller firms may be vulnerable to the cost of complying with the ADA. Compliance costs stem from provisions mandating accommodation of disabled workers and customers, and from the civil lawsuits and penalties to which the ADA exposes firms.

In this paper we seek to determine if the ADA had a measurable impact on the number of firms, the entry of new firms, and the failure rates of existing firms in the retail sector. We focus on retailers because they are subject to both the employment and customer accessibility provisions of the ADA. The empirical results are consistent with the hypothesis that the ADA indeed decreased the number of retail firms. There were fewer retail firms after the ADA was passed, and the drop was larger in states in which the ADA was more of a legal innovation, and in states that had more disabled people, more ADA-related lawsuits, and more ADA-related labor complaints. The same conclusions hold when baseline trends for larger establishments, which are least vulnerable to the costs imposed by the ADA, are differenced out. There is also evidence that employment and access discrimination suits imposed real costs on retail stores, encouraging exit. However, the exit of incumbents was partially offset by new entrants, which may imply that stores less able to adapt to the new requirements made room for the entry of stores better able to adapt. So, while the prediction by the pessimists that the ADA would cause firms to fail may be correct, the decline in the number of firms was partially offset by new entry. Overall, the ADA is associated with 1.4 to 2.3% fewer small and medium firms, net of trends affecting large firms.

The investigation also makes two subsidiary contributions. The first is an inquiry into the response of industry dynamics to increases in costs. In the theoretical model developed in section 4, we show that increases in marginal and fixed costs may have interesting and non-obvious effects on entry and exit. Before costs change, the model exhibits behavior that matches the retail sector examined here: fewer but larger firms over time and significant entry and exit. When costs rise, the market quantity supplied falls, but the number of firms may rise or fall due to composition effects as the size distribution of firms changes. In addition, no matter how the number of firms changes, entry and exit of firms may each increase or decrease. The potential outcomes from a cost increase are the *competitor neutral* case, in which entry decreases and exit increases, the *entrant favoring* case, in which entry and exit both increase, and the *incumbent favoring* case, in which entry and exit both decrease. The model places restrictions on which outcomes are possible given which costs rise (marginal or fixed). The entrant favoring case can arise only from an increase in marginal cost (when demand is inelastic), which favors small entering firms relative to larger incumbents. The incumbent favoring case can come about only from an increase in fixed cost, which favors incumbents with their larger market share relative to small entrants. These restrictions allow us to infer the nature of the cost increases caused by the various components of the ADA. The same model could easily be adapted to examine the impacts of other forms of cost-increasing regulation or exogenous process innovation on industry dynamics.

The second subsidiary contribution of the paper is an econometric model that allows entry and exit rates to be estimated from counts of currently operating firms. Given that the impacts of the ADA on firms may be subtle, a large data set is required to assess the evidence with any degree of precision. The data used in the study are the comprehensive Census Bureau counts of business establishments by county and type of business. Thus, the data are counts of the number of businesses currently operating in a year, and do not directly give entry and exit rates. There is no publicly available data set as disaggregated and as large that gives direct information on entry and exit.[1] While standard models for count data can be used to investigate changes in the number of firms in the market, backing out the entry and exit rates from the establishment count data is the major econometric contribution of the paper. Borrowing techniques from queuing theory, we develop the maximum likelihood estimator for a latent entry and exit model based on the available count data. The model incorporates unobserved heterogeneity in and correlation between the entry and exit rates. Identification of the entry and exit rates is secured through the assumption that entry and exit are Poisson stochastic processes, conditional on time-varying covariates and correlated, gamma-distributed mixing terms (i.e., random effects that relax the Markovian assumptions in the model). Although we use techniques drawn from the existing queuing theory literature, the likelihood for the count data is non-trivial to derive and we have not seen the likelihood for this model presented elsewhere. We denote the model a $CM_t/CM_t/\infty$ queuing system, for reasons explained in section 5. We develop the $CM_t/CM_t/\infty$ model here out of necessity, due to the particular limitations of the available data; however, there are many other potential applications for the econometric model. We return to these possibilities in the final section of the paper.

The plan of the paper is as follows. In the next section we discuss the costs that the ADA creates for firms. Section 3 reviews the relevant literature. Section 4 introduces the theoretical model of firm dynamics and response to the ADA. In Section 5, we formalize the $CM_t/CM_t/\infty$ econometric model and present the likelihood of the data. Section 6 discusses empirical strategies to identify impacts of the ADA on the number, entry, and exit of retail firms, and includes the results of the estimations. A final section concludes and discusses the broader applicability of the theoretical and econometric models in the paper. Proofs and the detailed derivation of the $CM_t/CM_t/\infty$ likelihood are in an appendix.

[1] Other researchers have exploited the *Longitudinal Research Database* (LRD) from the U.S. Census Bureau to study entry and exit. The LRD, however, covers only the manufacturing sector, which is not likely to be affected by Title III of the ADA, as explained below. The new *Longitudinal Business Database*, also from Census, covers the retail sector and is a promising resource; it was not yet available when the present study was begun and is still not publicly available.

2 The Costs of the ADA for Firms

The ADA was passed in July 1990. Most likely to affect private firms are Title I, which prohibits discrimination by employers against disabled individuals, and Title III, which (among other things) bans discrimination in access to private commercial facilities. Title I protects disabled individuals who can perform the "essential functions" of a position, both in applying for a job and once on payroll. The employer is not allowed to discriminate against disabled workers in hiring, firing, or wages. The employer is required to make "reasonable accommodations" for disabled workers, as long as accommodation does not create "undue hardship" (which is not defined) for the employer. The employment provisions took effect July 1992 for employers with 25 or more employees, and two years later for businesses with 15-24 employees. Smaller firms remain exempt.

Title III of the ADA requires businesses to make accessible all areas of stores where customers might go. In addition, it instituted a national building code for accessibility for new construction. Accessibility-related costs are limited to 20% of total construction or remodeling costs. Title III took effect January 26, 1992 for businesses with more than 25 employees, six months later for firms with 11-25 employees, and one year later for smaller firms.[2]

What then are the costs of the ADA to firms?[3] The non-discrimination clause means that employers cannot base hiring, firing, and wage decision solely on the marginal product of the individual worker, which may lead to higher operating costs. Other costs stem from real or perceived violation of the law. Enforcement of Title I is delegated to the Equal Employment Opportunity Commission (EEOC). From July 1992 to September 2001, 158,280 discrimination charges were filed with the EEOC.[4] When a worker files a charge, the EEOC investigates, attempts to settle, and in some cases sues the firm (or gives permission to the worker to privately sue the firm). Of the 11% of charges leading to non-litigated compensation, the average benefit paid to the worker was

[2] In addition to the employee count, the businesses with 11-25 employees also had to have gross receipts of less than $1,000,000, and the businesses with 0-10 employees had to have gross receipts of less than $500,000.

[3] This section draws on the similar discussion in Acemoglu and Angrist (2001).

[4] These data are from the EEOC, available from <http://www.eeoc.gov/stats/ada-charges.html>.

$19,226.[5] If the case is litigated and the plaintiff prevails, the ADA requires firms to pay remedies, such as back pay and all court costs.[6] A related law, the Civil Rights Act of 1991, also makes the firm liable for damages ranging from $50,000 to $300,000.[7] Thus costs come from three sources. The first two are the direct accommodation costs for disabled workers[8] and the litigation, remedy, and penalty costs. The third is the cost of a new kind of insurance that has arisen in response to such lawsuits. In the past decade, more firms have begun to purchase Employment Practice Liability Insurance (EPLI), with basic premiums ranging from $5,000 to $20,000 per year.

The costs of Title III stem from similar sources. One estimate places access accommodation costs at $500–$3000 on average (Chebium, 2000).[9] Enforcement of Title III is up to the Justice Department; civil penalties can be as high as $100,000 per violation, and remedies such as repayment of court costs and construction costs can make losing a Title III case even more expensive for a firm.[10]

These actual and expected costs prompted small business advocates to lobby hard against the ADA, claiming that it would trigger a wave of bankruptcies (Teltsch, 1993). While no such wave of bankruptcies has been reported in the press, there certainly have been thousands of lawsuits, and the law may have had subtle effects on the decisions of firms to enter or exit markets. For example, if there are differences in the organizational adaptability of firms, then the changed legal environment may have induced the exit of those firms that found it costliest to adapt, making

[5] *Ibid.*

[6] Court costs in employment practices suits average $50,000 to $100,000 per claimant (Dertouzos, 1988; Chanzit, 2001).

[7] Compensatory damages averaged $395,197 in the 101 successful suits for wrongful termination due to discrimination (of which ADA suits are a subset) in California during 1992-1996.(Jung, 1997) Plaintiffs prevailed (through verdict or settlement) in about 38.1% of such cases. Punitive damages averaged another $895,863 in the 25 cases with punitive damage awards. These figures do not include out-of-court settlements.

[8] There are no good estimates of the magnitude of accommodation costs. A non-random survey cited in Acemoglu and Angrist (2001) finds average costs of $930 per accommodation through 1997, but this figure does not include involuntary accommodations, the value of time spent on compliance, or reduced efficiency of the firm due to compliance.

[9] The estimate is from the National Federation of Independent Businesses. The most common accommodation is ensuring wheelchair access.

[10] It is difficult to estimate the number of lawsuits filed under Title III. The DOJ files suit itself relatively rarely and only for high-profile cases; the DOJ does not track private suits. In section 6 I use a measure of Title III suits brought to judgment in the federal court system.

room for the entry of new firms that find it less costly to adapt. The evidence presented in section 6 shows there was indeed increased exit and entry in response to the ADA. In this case, changes in the number of firms in a market may mask larger structural changes caused by an increased turnover rate of firms during the period of adaptation and transition. This example highlights why entry and exit rates are interesting in their own right, instead of looking only at the number of firms in the market.

3 Relevant Literature

Three strands of literature come together in this paper: empirical studies evaluating the effects of the ADA, the industrial organization literature on firm entry and industry dynamics, and applications of queuing theory in economics.

Empirical studies of the ADA all focus on the employment of disabled individuals. Acemoglu and Angrist (2001) find that the ADA appears to have reduced the employment of disabled men of all ages and of women under age 40. More recently, Jolls (2004) presents evidence suggesting that disemployment of the disabled is partially explained by their increased educational participation. In this argument, the disabled believe that better employment opportunities for them under the ADA increased the returns to human capital investment, and choose further education in the short run instead of joining the labor force.[11] This paper extends the empirical literature on the ADA to the impacts on the firm's profitability and industry dynamics.

There are numerous empirical studies in industrial organization examining the entry or exit of firms.[12] A few empirical regularities emerge from the many studies based on reduced-form models (see Geroski (1995) for a review). First, within an industry, high entry rates are correlated with low

[11] See also Jolls and Prescott (2004), and Jolls (2004) for citations to the other empirical papers examining the employment effects of the ADA.

[12] There is also a large related literature in the fields of corporate demography and organizational ecology. See Carroll and Hannan (2000) for an overview. Of this literature, the closest application to the present study (although using different methodology) is Barnett and Carroll's (1993) examination of early telecommunications regulation on the number of firms within size categories.

exit rates (Dunne, Roberts and Samuelson, 1988). This fits the usual intuition that when conditions are profitable in a market, not only are new entrants attracted to the market but existing firms are unlikely to exit. Second, there are large cross-sectional variations in the entry and exit rates of industries (Dunne et al., 1988; Geroski, 1995). Third, across industries in the cross section, high entry rates are correlated with high exit rates (Dunne et al., 1988; Honjo, 2000). Fourth, the hazard rates (exit rates) estimated from panel data typically decline with the age and the size of firm (Hall, 1987; Evans, 1987).[13] In the age dimension, therefore, there is negative duration dependence.[14] We view these four stylized facts as necessary possible outcomes for any econometric model; the $CM_t/CM_t/\infty$ model we develop can accommodate them all. All of these studies use longitudinal data on individual firms in the manufacturing sector. Shonkwiler and Harris (1993) and Geroski and Mazzucato (2001) are two of the few studies that model the number of firms in the industry directly, in a dynamic setting. Unlike the present work, they do not attempt to back out the entry and exit rates from the data. There are also an increasing number of empirical studies of entry and exit using structural econometric models, mostly in static or two-period settings (Bresnahan and Reiss, 1987; Berry, 1992; Mazzeo, 2002; Seim, 2004), although Pakes, Ostrovsky and Berry (2004) present a fully dynamic model. We do not adopt a structural model based on optimizing entry and exit behavior for the empirical work, because positing simpler reduced forms for the entry and exit rates allow us to estimate these rates from panel data on the count of establishments in each market. In contrast, Pakes et al.'s (2004) model requires observations on entry and exit, and the static models focus on estimating parameters of the profit function and not entry and exit rates themselves.

There are several theoretical studies of industry dynamics. Three prominent models with atomistic firms are Jovanovic (1982), Hopenhayn (1992), and Klepper (1996); Ericson and Pakes (1995)

[13]It is well known that estimated negative duration dependence may be a spurious result of estimating a common hazard rate for firms that actually have constant but differing rates. I account for this explicitly in my econometric model.

[14]A notable exception is Holmes and Schmitz (1995), who find that the hazard rate may be ∪-shaped for small firms run by their founders.

extend the literature to imperfect competition. The model in section 4 is based on Klepper (1996),[15] which is a more convenient model to work with than the complex dynamical system in Jovanovic (1982) and admits non-steady state analysis more easily than do the models in Hopenhayn (1992) and Ericson and Pakes (1995). By ignoring the strategic interactions among firms built into Ericson and Pakes's (1995) model, we are able to characterize how entry and exit change in response to structural cost changes. We do not consider our model's price-taking assumption as significantly detrimental in our application to the retail sector, with its great preponderance of small establishments in the period we study.[16] However, our model would be less suited to study of industries with few firms such as telecommunications or automobile manufacturing. Our theoretical model simplifies Klepper (1996) by abstracting away from innovation (which may not be as important in our retailing context as in Klepper's (1996) manufacturing setting) and adds a microstructure for costs for the sake of exploring the various channels through which the ADA might increase firms' costs. Hopenhayn (1992) is the only one of these studies that investigates the effect of cost changes on entry and exit, and focuses on the limiting distribution instead of the short-run impact we consider.

The econometric model developed in section 5 is based on queuing theory. There are many applications of queuing theory in economic literature, but empirical applications (e.g., De Vany and Frey (1982); Daniel (1995); Prieger (2001; 2002*a*; 2002*b*)) are scarcer than theoretical studies. None of these empirical queuing studies attempts to infer arrivals and departures from the number of units currently in the system, as we do here.

[15] See also Klepper (2002).

[16] There is, however, some evidence that supermarkets erect strategic barriers to entry in the grocery store subcategory of food stores, the main category we explore (Cotterill and Haller, 1992). Extending our model to incorporate strategic action awaits future research.

4 The Theoretical Model

In a companion paper (Prieger, 2004a), we construct a general model to investigate the response of industry dynamics to increases in costs. For the sake of brevity, here we will only describe the impacts that the ADA is assumed to have on costs and the main results from the theoretical model; additional details of the model and proofs are presented in Prieger (2004a). The model draws on elements of Klepper (1996) for industry dynamics and Acemoglu and Angrist (2001) for the ADA-specific components.

In each period $t = 1, 2, \ldots$, there is a continuum of atomistic potential entrant firms indexed by their fixed cost F, which is uniformly distributed on $[\underline{F}, \bar{F}] \equiv \mathcal{F}, 0 < \underline{F} < \bar{F}$, with total mass M. The fixed costs are paid each period, and are avoidable if a firm decides to exit (or not enter) the market.[17] Firms have no costs if they do not enter: outside opportunities are normalized to zero. The variable inputs of a firm are capital K, with price r, and workers. Workers are either disabled (D, with wage w_D), or not (L, with wage w_L). The production technology of each firm is identical, and is described by the constant returns to scale production function $q = G(L, D, K) = \gamma(L + eD)^{\alpha} K^{1-\alpha}$, $\gamma > 0$, $\alpha \in (0, 1)$, where $e \in (0, 1)$ is the relative efficiency of disabled workers. Note that disabled and nondisabled workers are perfect substitutes at rate e nondisabled workers for one disabled worker.

Each unit of disabled labor requires an accommodation cost $a > 0$; assume that e would be zero in the absence of accommodation of disabled workers. It is assumed that both disabled and nondisabled workers are active in the labor force, which in a competitive labor market requires that $w_D = ew_L - a$.[18] The substitutability of labor implies that firms are indifferent between disabled and nondisabled workers at those wages. Labor supply of both types is assumed to be completely elastic at the given wages. Under these assumptions, the marginal cost of production is constant

[17] The fixed costs may represent the costs of business licenses, complying with local regulations, or lumpy investments that fully depreciate each period.

[18] In contrast, Acemoglu and Angrist (2001) do not assume that both types of workers are active but instead derive it as a result of their model.

at βw_L^α, where β is a function of (α, γ, r).[19]

After the passage of the ADA, costs change for several reasons. First, the equal-pay provision of the ADA mandates that w_D rise to w_L.[20] It is assumed that to minimize the risk of lawsuits, labor employed by each firm is now composed of D and L in the same proportion as in the labor force at large. Let x be the fraction of workers that are disabled in the labor force. Second, under the ADA firms that have entered the market are exposed to potential litigation costs. Litigation is of two types: employment discrimination suits, as authorized under Title I of the ADA, and accessibility suits, as authorized under Title III.

Employment suits may stem from (perceived) hiring discrimination and wrongful termination of disabled workers. Assume that firms lay off and replace fraction θ of their work force each period,[21] that the size of the pool of potential hires is H, and that each worker composing H applies for only one of the positions open in the current period at each firm, and that H is large compared to any one firm's labor demand. A disabled applicant that is not hired for a position sues with probability ℓ_H; the firm (assumed to be risk neutral) has expected costs of A_H from each suit, inclusive of litigation, settlement, and damages awarded. Then the expected cost from hiring discrimination suits is $xH\ell_H A_H \equiv \Lambda_H$. A disabled worker that is fired sues with probability ℓ_T and expected cost A_T. The expected termination costs are therefore $\theta D \ell_T A_T \equiv \Lambda_T D$. This formulation implies that hiring suits raise fixed costs and that termination suits raise marginal costs.[22]

Accessibility suits may also raise both fixed and variable costs. The expected number of accessibility suits is $s_F(y) + s_V(y)q$, where y is the fraction of the population that is disabled; s_F and s_V are assumed to increase with y. Here s_F may represent the suits filed by activists or otherwise oc-

[19] In particular, $\beta \equiv (\delta^{1-\alpha} + \delta^{-\alpha})r^{1-\alpha}/\gamma$, where $\delta \equiv \alpha/(1-\alpha)$.

[20] In a general equilibrium model, w_L would fall because (as will be shown) output and labor demanded drop. In this partial equilibrium setup, the elastic supply of labor ensures that w_L does not change.

[21] Turnover may be prompted by workers receiving random shocks with probability θ that cause their productivity with their current employer to fall to zero, as in Acemoglu and Angrist (2001).

[22] That hiring suit costs are not related to output stems from the assumption that each searcher applies for one job at each hiring firm, so that the number of applicants at each firm is the same. While such a sharp distinction between hiring and firing suits may be unrealistic, the only assumption needed for the empirical work is that a firm receives a certain number of job applications whatever its output level.

curring without respect to the size of the firm.[23] The term $s_V q$ represents suits filed by customers, and is therefore assumed to be proportional to output. The expected cost of each Title III suit to the firm is A_{III}. Letting $\Lambda_F \equiv s_F A_{III}$ and $\Lambda_V \equiv s_V A_{III}$, the total expected cost of accessibility suits is $\Lambda_F + q\Lambda_V$.

These assumptions imply that after the ADA costs rise to

$$C(q) = \left(\beta \left[\frac{w_L + (a + \Lambda_T)x}{1 - x(1 - e)}\right]^{\alpha} + \Lambda_V\right) q + F + \Lambda_H + \Lambda_F \quad (1)$$

$$\equiv c(x, \Lambda_T, \Lambda_V)q + \phi(\Lambda_H + \Lambda_F) + F \quad (2)$$

where the other arguments of marginal cost c are suppressed. With this notation, pre-ADA costs are marginal cost $c(0, 0, 0)$ and fixed cost $\phi(0) + F$. Equation (1) is derived in the appendix.

Entry, production, and exit in the model are similar to the model of Klepper (1996), and are described only in broad outlines here. Consumers view firms' products as homogeneous. Market demand is a function of the current market price only, and increases (for given p) over time. If a firm stays in the market it keeps all previous customers and attracts a share of new buyers (and those whose previous supplier exited) in proportion to last period's market share. The firm can also sell more product by incurring a marketing cost.

Since firms are atomistic, they are assumed to be price takers. Firms can project the current period's market-clearing price, but are myopic in that they base entry, exit, and production decisions only on current period's profits, and do not anticipate the passage of the ADA before it happens. Given an expectation of the market-clearing price, each firm decides by how much to expand output should the firm decide to be in the market. Firms will enter (or stay in the market) if their optimized profit is positive, and will not enter (or will exit) if it is negative. This behavior creates a threshold value F_t^k for fixed costs (differing for period t each cohort that entered at $k \leq t$) that characterizes the marginal entrant (or exiting firm), which defines the measure of firms in the

[23] There are numerous cases reported in the press of litigants actively seeking out firms to sue under the ADA. A Florida lawyer has sued over 740 businesses, mostly on behalf of a single disabled activist group (Voris, 2001). Two individuals in California have filed 1,500 ADA suits between them (Krasnowski, 2004). Such litigants appear to be "equal opportunity suers", filing against firms of all sizes.

market. The equilibrium price is determined by supply equaling demand under the optimal entry, exit, and output expansion decisions.

In equilibrium in the model, in the absence of the ADA, market price declines and the market quantity increases over time in equilibrium, and therefore the quantity for any firm staying in the market increases over time. Exit occurs each period, but entry eventually ceases. The number of firms in the market may increase at first, but eventually declines monotonically.[24] The model thus exhibits behavior that matches many of the retail subsectors during the relevant time period: fewer but larger firms over time,[25] with significant entry and exit.[26]

Against this backdrop we can now examine the impact of the ADA. In the period the ADA comes into effect, it is assumed that the firms know that costs have changed before they make their entry, exit, and output decisions.

Proposition 1 (Impact of Cost Increases) *In the period in which cost increases, the following hold, compared to the same period were cost not to increase:*

1. *Equilibrium price rises and equilibrium market quantity falls.*
2. *The number of entering firms can increase or decrease.*
3. *The number of incumbent firms can increase or decrease.*

The first point follows naturally from the fact that while cost rises for all firms, the demand function is unchanged. The second and third results may be shown numerically. In these statements "number of firms" is to be read as mass of firms, which is $(F_t^t - \underline{F})M/(\bar{F} - \underline{F})$ for entrants and $\sum_{k=1}^{t-1}(F_t^k - \underline{F})M/(\bar{F} - \underline{F})$ for incumbents. Given that market quantity falls, when the number of firms increases it must be that each firm produces less or smaller entrants replace larger incumbents

[24] See Proposition 1 of Prieger (2004a) for a formal statement of these results.

[25] In SIC 54, food stores, the main subsector examined in the empirical work, the average number of firms was 59.2 in 1988, rose to 61.4 in 1992, and then fell to 56.9 by 1997. The percentage of firms with fewer than 20 employees fell from 82.4% in 1988 to 80.0% in 1997.

[26] For example, from 1995 to 1996 there was an 11.1% birth rate and 10.5% death rate in the retail sector (source: Statistics of U.S. Businesses, Census Bureau).

(a composition effect), or both. In static entry models such as Bresnahan and Reiss (1987), entry can only decrease when costs rise.

Thus, this relatively simple model generates interesting, varied, and non-obvious responses to the cost changes. The possibilities for entry and exit are listed in Table 1. The most intuitive case is the *competitor neutral* case, in which entry decreases and exit increases in response to the cost changes. When entry increases, it can be shown that the scale of entry also increases. Thus, since total market quantity falls by Proposition 1.1, entry can increase only at the expense of the number of incumbents, the quantity each incumbent produces, or both. When entry declines and the resulting lessening of competitive pressure allows more incumbents to stay in the market, so that exit also declines, we have the *incumbent favoring* case. Finally, we term the case in which entry increases and the number of incumbents falls *entrant favoring.* Note that all changes in Table 1 are with reference to the same period in the baseline in which no costs changes, not with reference to changes in entry and exit over time.

Examining when the various cases occur allows us to link changes in entry and exit with the unobserved (in the data) changes in cost. Recall that the effect of the ADA is to raise marginal cost c and fixed cost ϕ. The following proposition characterizes the impacts that the changes in cost have on entry and exit.

Proposition 2 (Restrictions on Observed Outcomes) *Using the definitions from Table 1, the following hold:*

1. *When marginal cost increases, the incumbent favoring case is not possible.*

2. *When fixed cost increases, if demand is inelastic at the equilibrium price the entrant favoring case is not possible.*

The proof of the proposition is in Prieger (2004a), but the insight is presented here. For any cohort k, the change in the number of firms in the market due to an increase in cost can be decomposed into a negative direct effect and a positive price effect. The direct effect reflects that because production is more expensive when costs rise, the threshold fixed cost decreases and fewer firms remain in the market (or enter). There is a countervailing price effect, however. The cost increase leads to an increase in equilibrium price, which increases profit for each firm. With higher profit, more firms remain in the market (or enter). The direct and price effects thus move in opposite directions, and either can predominate in general. However, in particular cases more can be said.

Consider increases in marginal cost. If the number of firms increases for any cohort, it can be shown that it increases for the entering cohort, so the incumbent favoring outcome cannot happen (Proposition 2.1). When entry increases (the entrant favoring case) an increase in marginal cost hurts the profit of incumbents more than of entrants because existing firms sell more, and thus suffer greater inframarginal loss. The greater exit of incumbents results in a price increase that exceeds the marginal cost increase, spurring entry by new firms. On the other hand, when fixed cost rises and demand is inelastic, then if the number of firms rises for any cohort it rises for the oldest cohorts. Thus entrant favoring is not possible (Proposition 2.2).[27] The other two cases, competitor neutrality and incumbent favoring, are both possible when fixed cost rises. If exit decreases enough from the oldest cohorts, the incumbent favoring case can result. In this case the increase in cost disproportionately hurts the small firms (including entrants), because their smaller scale leaves them more vulnerable to increases in fixed costs. In Prieger (2004*a*) we explore why entrant and incumbent favoring happen in greater detail.

The implications of the model useful for empirical work are thus as follows. When demand is inelastic (as it is in the empirical application to food stores), an entrant favoring outcome from the ADA can come only from increases in x, or through Λ_T and Λ_V, which increase marginal cost. Furthermore, an incumbent favoring outcome can come only through Λ_H and Λ_F, which

[27] Inelastic demand is in fact sufficient but not necessary for Proposition 2.2. The much weaker necessary condition is that $\varepsilon(p-c)/p < 1$ in equilibrium, where ε is the elasticity of demand.

increase fixed cost. The competitor-neutral outcome implies no restrictions on the nature of the cost increase. In section 6, we use these two implications of the model to infer which elements of the ADA raised which costs.

5 Data and Empirical Models

One would expect that if the ADA impacted any firms, it would be those in the retail sector. Retail firms are exposed to costs under both Title I through employment and Title III through access by customers to their premises. The retail sector has many small firms operating on thin margins,[28] and is also involved in many of the ADA lawsuits. The dependent variable in the estimations here is therefore the number of retail establishments by major SIC group within a county; the data cover the whole U.S. except Alaska.[29] Summary statistics of the data are presented in Table 2.

To get a sense of the overall trends in the data, consider Figure 1, which shows the percentage changes in the total number of retail establishments by two-digit SIC code. Some subsectors are growing and some are shrinking, but (with several exceptions) each line in the graph generally trends down. Except for SIC 52 (building materials and garden supplies) and 53 (general merchandise stores), every group saw decreased growth rates in 1993, the first full year the ADA was in effect, compared to the previous year. In all but one of these cases (SIC 58, eating and drinking places), growth was negative in 1993. Given that the ADA may be a relatively minor determinant of the number of firms, however, compared to changes in demand and other costs, and given the dynamic industry behavior predicted by the model in section 4 even in the absence of the ADA, Figure 1 should not be read as strong evidence by itself for impacts of the ADA. Instead, it may mainly show the trends that we will have to difference out in the analysis.

Although results from all retail subsectors are summarized below, we focus on SIC 54, food

[28] By 1980, 93.4% of the sector was effectively competitive, based on concentration ratios (Shepherd, 1982).

[29] The data are from the U.S. Census Bureau, *County Business Patterns CD-ROM*, years 1987-1997. Although establishments are not the same as firms, an establishment may be judged an "employer" under the ADA even if it is not a distinct legal entity (EEOC v. St. Francis Xavier Parochial School, 326 U.S. App. D.C. 67).

stores (the heavy line in Figure 1).[30] Food stores were chosen for several reasons. They appear to be among the most vulnerable to cost changes within the retail sector.[31] Food stores also have relatively small, local markets, for which counties may be an adequate approximation. Establishments in other retail groups, such as SIC 53 (which includes department stores) and 55 (which includes automotive dealers) are more likely to have market areas that span multiple counties. Furthermore, in comparison to restaurants (SIC 58), the other natural choice by the first two criteria, the relatively smaller number of food stores per county makes the estimation of the heterogeneous models more feasible.[32] Finally, demand for food consumed at home, which these stores sell, is consistently estimated in the literature to be inelastic (e.g., Barnes and Gillingham, 1984). Restricting investigation to a good with inelastic demand allows part 2 of Proposition 2 to be applied.[33]

In the rest of this section we present the econometric models used in the investigation. The data are a panel of establishment counts by county and year. The first question to investigate is the effect of the ADA on the number of firms. To answer this question, we use standard count data models. The first is a Poisson regression model estimated on the pooled data, which yields consistent estimates even if there are county-specific or county-year-specific random effects leading to clustering and overdispersion (Cameron and Trivedi, 1998, sec. 3.2.3). All standard errors are calculated with the Huber-White sandwich estimator, which is robust to county-level clustering and overdispersion in the Poisson model. If the regressors are correlated with the county-specific fixed effects, however, the Poisson model is not consistent. To address this possibility, we also

[30] SIC major group 54 includes retail stores primarily engaged in selling food for home preparation and consumption (grocery stores). It excludes restaurants and liquor stores. The other major retail groups are 52 (building materials & garden supplies), 53 (general merchandise stores), 55 (automotove dealers & service stations), 56 (apparel and accessory stores), 57 (furniture and homefurnishings stores), 58 (eating and drinking places), and 59 (miscellaneous retail).

[31] Food stores have a lower gross margin (as percent of sales) than any other two-digit retail segment except automotive dealers (U.S. Census Bureau, 1999). The sector also was relatively unconcentrated during the study period; the four largest firms accounted for only 15% of sales in 1992 (U.S. Census Bureau, 1995). There is evidence, however, that the grocery store subcategory is considerably more concentrated in local markets (Cotterill, 1993).

[32] Estimation time for the $CM_t/CM_t/\infty$ model is proportional to the sum of the dependent variable, not the number of observations.

[33] This is another reason not to use SIC 58. Food consumed away from home is often estimated to have price elastic demand (Barnes and Gillingham, 1984).

estimate a fixed effects Poisson model (Hausman, Hall and Griliches, 1984), which is analogous to the familiar "within" estimator for linear panel models.[34]

The other question of interest is the effect of the ADA on entry and exit. Pursuing structural estimation based on the theoretical model in the previous section is impractical, given that data on entry and exit are not available. Instead, we take a simpler approach and posit reduced-form entry and exit processes. Because entry and exit are not observed, we derive the likelihood for the number of currently operating firms. The model adopted to recover entry and exit rates is an extension of a simple $M/M/\infty$ queuing system.[35] In a $M/M/\infty$ system the number of entering firms each period follows the Poisson distribution and survival after entry follows the exponential distribution. Our first extension is to introduce dependence in the entry and exit rates on covariates that evolve period to period. We also add correlated random effects in the entry and exit rates. Conditional on these random effects, entry and exit are Markovian; unconditionally, overdispersion and duration dependence is allowed in the processes. We denote the model a $CM_t/CM_t/\infty$ queuing system, where the CM is for "conditionally Markovian" and the subscript denotes rates that vary each period. In this queuing system, each period nature first draws a pair of heterogeneity terms that enter the specification of the rates for the entry and exit processes. The random effects[36] and the period-specific rates determine the distribution for the number of entering firms and a firm's lifetime distribution. The latent entry and exit processes generate an observed number of firms in the market in each period.

With this overview of the model in hand, we now describe in detail how we construct the ML estimator for the parameters of the $CM_t/CM_t/\infty$ system. The entry of firms is a nonhomogeneous Poisson process with gamma mixing. In particular, the interarrival times (the epochs between the

[34] Standard errors for the fixed-effects Poisson model are calculated via bootstrapping to account for clustering.

[35] Kendall notation provides a compact description of a queuing system: an $A/B/c$ system has interarrival time distribution A, service time distribution B, and c servers. A and B are chosen from a few traditional symbols such as M for the exponential distribution (for its Markovian property). Systems with infinite servers never experience waiting time before service begins.

[36] Such heterogeneity terms are also known as *mixing terms*.

times at which entry occurs), conditional on a gamma-distributed heterogeneity random variable u, are exponentially distributed with instantaneous rate $\lambda(t)$ at time t. The lifetime of each entrant, conditional on another gamma-distributed heterogeneity random variable v, is exponentially distributed with instantaneous rate $\mu(t)$. Conditional on (u, v), the entry and exit processes are independent; dependence is introduced by means of correlation between u and v. The random effects capture the effect of unobserved factors in the market on entry and exit.

In our data the number of establishments is observable, but not the entry and exit times. We derive the likelihood function for the number of firms using techniques from queuing theory (Srivastava and Kashyap, 1982).[37] For the substantially easier problem where the arrival and exit times are observable, see Prieger (2001; 2002*a*; 2002*b*) for models and applications. To economize on notation, the model will be explicated for a single time series of firm counts; the cross-sectional dimension will be introduced later. Let $N(s)$ be the random variable generating the number of firms (i.e., firms that have entered but not exited) at time $s \in [0, T]$, $n(s)$ be a realization of $N(s)$, and n_t be the number of units in the system at the end of period $t \in \{1, \ldots, T\}$. For simplicity each period is of unit length (one year, in the application), so that $n_t = n(t)$.

The entry rate $\lambda(s)$ and the failure rate $\mu(s)$ are taken to be constant within a period, so that $\lambda(s) = \lambda_t$ and $\mu(s) = \mu_t$ for $s \in [t-1, t)$. The rates are modeled as:

$$\lambda_t = \exp\left(\mathbf{X}_t' \boldsymbol{\alpha}\right) u_t = \lambda_{0t} u_t \tag{3}$$

$$\mu_t = \exp\left(\mathbf{Z}_t' \boldsymbol{\beta}\right) v_t = \mu_{0t} v_t, \tag{4}$$

where $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$ are vectors of parameters, $\mathbf{X}_t$ and $\mathbf{Z}_t$ are vectors of observed explanatory variables, and u_t and v_t are unobserved i.i.d. heterogeneity terms with distribution[38]

$$f(u, v) = \mathcal{G}(\gamma, \sigma_u^2 v^\tau; u) \mathcal{G}(\delta, \sigma_v^2; v), \quad \gamma, \delta, \sigma_u^2, \sigma_v^2 > 0 \tag{5}$$

[37] For a more advanced theoretical treatment of queues with time-varying parameters, refer to Brémaud (1981, section VI.2).

[38] This distribution is from Gran (1992, sec.2.7.5).

where $\mathcal{G}$ is the gamma pdf

$$\mathcal{G}(a,b;x) = \frac{x^{a-1}e^{-x/b}}{b^a\Gamma(a)}. \tag{6}$$

The parameters σ_u^2 and σ_v^2 govern the variance of u and v, respectively (see appendix). In addition to the restrictions on the parameters in (5), it is also necessary that $\tau > -(2\sigma_v^2)^{-1}$ for the variance of u to be finite. The shape parameters γ and δ are normalized so that $E(u) = E(v) = 1$, which is required for identification of the intercept terms in $\boldsymbol{\alpha}$ and $\boldsymbol{\beta}$. With these restrictions, $Var(v) = \sigma_v^2$, $Var(u|v)$ is linear in σ_u^2, and $Var(u)$ is affine in σ_u^2 (see appendix). Correlation between u and v, ρ, is a function of τ. The correlation has the same sign as τ, can take the full range of values on $[-1,1]$, is zero if and only if $\tau = 0$, but is not in general monotonic in τ.

From (5) it can be seen that v has a marginal Gamma distribution and u has a Gamma distribution conditional on v.[39] We choose a conditional Gamma distribution for u purely for convenience; it allows analytic integration of the unobserved heterogeneity in the entry process. Numerical integration is required to integrate out v.[40]

Gamma mixing in Poisson and exponential distributions has well-known properties and is commonly used, because it leads to closed-form likelihoods. The Gamma-Poisson mixture for entry results in a negative binomial random variable that allows for overdispersion (for which the Poisson distribution alone cannot account). A Gamma-exponential mixture for the firms' lifetimes results in a Pareto distribution, and relaxes the exponential's imposition of a constant hazard rate (Johnson, Kotz and Balakrishnan, 1995, p.574). As is true with any mixture of exponentials, the hazard rate for a Gamma-exponential mixture is decreasing, which implies that there is negative duration dependence and overdispersion.[41] Dubey (1966) also uses Gamma-exponential mixtures for firm lifetime data.

The heterogeneity in the model thus exhibits properties that fit the stylized facts of firm entry

[39] No structural interpretation is assigned to this formulation (i.e., that entry depends on exit but not vice versa). Of course v also has a distribution conditional on u.

[40] There is no bivariate distribution with correlation for which both the marginal and conditional distributions are Gamma (Arnold, Castillo and Sarabia, 1999, sec.4.6).

[41] In particular, one can show that mean time remaining to exit, conditional on survival to t, increases linearly in t.

and exit mentioned in section 3: overdispersion to account for the large variance in entry and exit rates across industry groups, correlation between the entry and exit rates, and duration dependence in the life of the firm. The $CM_t/CM_t/\infty$ model thus combines flexibility through the random effects to account for these features, with the analytical convenience of a Markovian queuing system. The former is desirable to fit the stylized facts; the latter is necessary to find a (near) closed form for the likelihood.

From the model specified above, the likelihood of the data can be obtained (see appendix). Finding the pdf of n_t given n_{t-1}, denoted $f(n_t|n_{t-1})$, requires taking expectation over u_t and v_t, a bivariate integral. The expectation can be solved analytically over u_t but not over v_t, leaving a unidimensional integral in the expression for $f(n_t|n_{t-1})$. In the application, we use Gauss-Laguerre quadrature to numerically integrate this expression. To find the joint likelihood of the data $(n_t)_{t=1}^{T}$, note that $N(t)$ is a Markov process. Therefore $f(n_1,\ldots,n_T|n_0) = \prod_{t=1}^{T} f(n_t|n_{t-1})$. Now we may introduce the cross-sectional dimension of the panel, and write n_t as n_{kt}, the number of firms in county k in year t. Assuming that (u_{kt}, v_{kt}) are independent across time and county, the log likelihood function for the parameter vector $\boldsymbol{\theta} = (\boldsymbol{\alpha}, \boldsymbol{\beta}, \sigma_u^2, \sigma_v^2, \tau)$ is determined from (3), (4), and

$$l_{\boldsymbol{\theta}}\left(\boldsymbol{\theta}|n_{k0}, ((n_{kt}, \mathbf{X}_{kt}, \mathbf{Z}_{kt})_{t=1}^{T})_{k=1}^{K}\right) = \sum_{k=1}^{K}\sum_{t=1}^{T}\log f\left(n_{kt}|n_{kt-1}\right) \tag{7}$$

where $f(n_{kt}|n_{kt-1})$ is given in (30).

Let $\hat{\boldsymbol{\theta}}$ be the estimate obtained from maximizing $l_{\boldsymbol{\theta}}$. If the heterogeneity terms (u_{kt}, v_{kt}) are independent over time then $\hat{\boldsymbol{\theta}}$ is a fully-efficient ML estimate. If the heterogeneity terms are not independent over time within the same county (i.e., if there is county-level clustering), then $\hat{\boldsymbol{\theta}}$ is an inefficient but consistent partial ML estimate.[42] Because the Hessian is complicated and expensive to calculate, maximization techniques and variance estimators that require only the gradient are an appealing choice here. We use the BFGS variant of the DFP algorithm in the application. All standard errors are calculated with the Huber-White sandwich estimator using the BHHH estimated

[42] The asymptotics require fixed T and $K \to \infty$. See Wooldridge (2001), sec. 13.8 on the partial MLE.

variance matrix, which is robust to county-level clustering. The gradient of $l_{\boldsymbol{\theta}}$ is straightforward to calculate (although it also requires numerical integration). Prieger (2004*b*) contains more details on estimating the model.

6 Empirical Results

In this section we apply the econometric models from the previous section to the retail establishment data to look for effects of the ADA on the number, entry rate, and exit rate of firms. We also apply the insight gained from the theoretical model of section 4 to discern which aspects of the ADA are most important in creating additional costs for firms. We use three empirical specifications, moving from differences in means pre- and post-ADA to differences-in-differences specifications. The specifications provide increasingly stringent tests of whether the link we find between the ADA and negative industry effects is causal.

6.1 Specification A: differences in means

The simplest specification, A, uses the number of firms of all sizes per county in a year and focuses on differences in mean establishment counts, entry, and exit before and after the ADA. In the standard count data models, the mean number of firms in county k and year t is specified as an exponential function of a linear index $\mathbf{X}'_{kt}\boldsymbol{\beta}$, with

$$\mathbf{X}'_{kt}\boldsymbol{\beta} = \beta_0 + \upsilon_s + \varphi_t + \boldsymbol{\pi}'\mathbf{W}_{kt} \tag{8}$$

where υ_s is a state fixed effect and φ_t is a year fixed effect with φ_{1988} normalized to zero. Covariates $\mathbf{W}$ include county land area, population, per capita real income, and labor cost (average real wage and salary disbursements per job), all in logs. In specification A, the only evidence for the ADA's effect comes from φ_t for the ADA years, which capture changes in the number of firms after the act was in effect. Such evidence can only be suggestive, since the year indicators may merely pick up trends unrelated to the ADA.

The first results are from the Poisson models for the number of establishments (Table 3). The three estimations reported are Poisson regressions with and without state dummy variables and a fixed-effects Poisson estimation. Proposition 1 by itself does not rule out that the number of firms may rise from the ADA, given that smaller entrants can replace larger incumbents when costs rise. Thus we have no *a priori* expectation for the signs of the ADA-related variables in these estimations, although the most natural expectation is that if the ADA increased costs then the number of firms should fall. The coefficients are elasticities when the variable is in logs (all except indicator variables). The negative and significant $\hat{\varphi}_t$ for the ADA period 1993-1997 in all models implies that the number of firms decreased in the ADA periods, even after controlling for changes in the economic variables. The decreases range from 6% to 13% in the Poisson estimations, with the larger decreases coming in the later years, for an average decrease in the ADA years of 8.7% for regression 1 and 8.9% for regression 2. For the fixed-effects estimation, the decreases range from 2% to 6%, with an average of 3.6%.[43] The economic covariates have intuitive signs. Greater population, population density ($\pi_{pop} - \pi_{area}$), and income and lower labor costs are correlated with a higher number of firms in the county. Although the magnitudes are generally smaller in the fixed-effects estimation (the right-most set of columns in Table 3) than the pooled Poisson estimations, the qualitative results are similar in all three estimations. Results (not reported) from alternative random-effects Poisson and negative binomial models are also similar. The results from six of the seven other two-digit SIC retail categories are qualitatively very similar with these results from food stores.[44]

The theoretical model in section 4 shows that examining entry and exit in addition to the number of firms can provide insight into how the ADA changed firms' costs. We turn now to the $CM_t/CM_t/\infty$ model for entry and exit from section 5. The mean entry and exit rates λ and μ for the $CM_t/CM_t/\infty$ model are also exponential functions of indices specified as in (8) (i.e., $\mathbf{X}'_{kt}\boldsymbol{\beta}$

[43] The percentage change in the mean dependent variable from a binary variable like φ_t is $\exp(\varphi_t) - 1$.

[44] The exception is SIC 58, for which φ_t is positive during the ADA periods and larger than before the ADA.

also stands in for the indices $\mathbf{X}_t'\boldsymbol{\alpha}$ and $\mathbf{Z}_t'\boldsymbol{\beta}$ in the notation of section 5). A few changes are made to reduce the number of parameters to be estimated. The year indicators are grouped into three periods: the pre-ADA period 1988-1992 ($\varphi_1 = 0$, the omitted variable), the initial ADA period 1993-1994 (φ_2), and the subsequent ADA period, 1995-1997 (φ_3). Period 2 spans the first full year that the ADA was fully in effect for any size firm (1993) and the end of the phase-in period (1994; refer to section 2). The state fixed effects are replaced with Census region indicators. Added to $\mathbf{W}$ is log capital cost, proxied by the Moody's Baa bond rate (capital cost is absorbed into the year fixed effects in (8)). The specifications of the entry and exit rates are identical (in this and all specifications). There is no exclusion restriction required for identification, and none could be defended on economic grounds, given that any variable affecting profitability affects both entry and exit decisions.

The results from specification A for the $CM_t/CM_t/\infty$ model are in Table 4, both with and without random effects (heterogeneity). Several results stand out from these estimations. Entry rates were significantly lower and failure rates were significantly higher in the ADA periods than the pre-ADA period in both specifications. If all such changes can be ascribed to the ADA, this is the *competitor neutral* case. The estimates from other retail SIC groups, with some exceptions, display the same pattern as these results for food stores.[45] The economic coefficients have the expected signs in the entry rate (larger area, more population and higher per capita income all increase the arrival rate; higher labor costs decrease the entry rate) except for capital costs in the homogeneous specification.[46]

In the failure rate part of the homogeneous specification, the population coefficient has an unexpected sign: more populous counties have *higher* failure rates. The heterogeneous specification

[45] The exceptions: for entry, 4 out of the 14 ADA period indicators from all other SIC groups are significant and positive (homogeneous specification); for exit, 3 out of the 14 ADA period indicators are significant and negative. The unlikely case (positive for entry and negative for exit) never occurs.

[46] In many estimations in other SIC groups, capital costs also had the wrong sign. This is probably because the variable is a poor proxy for the true opportunity cost of capital or that it is acting as a peculiar type of time trend (recall the capital cost variable varies only over time, not in the cross section).

reverses the sign on the population failure rate coefficient. The homogeneous specification is soundly rejected in favor of the random effects version, whether by significance tests on σ_u^2, σ_v^2, and τ, or by likelihood ratio tests. The evidence thus indicates that the random effects are an important addition to the model and may be required to get sensible estimates from the $CM_t/CM_t/\infty$ model. Correlation between the arrival and exit rates is estimated to be negative, possibly due to omitted variables that affect the profitability of the market. Correlation is estimated to be negative in every estimate for all retail SIC groups.

6.2 Specification B: ADA-specific covariates

To investigate whether the ADA had anything to do with the decline in the number of firms and the changes in firm dynamics shown in specification A, in specification B we add ADA-specific covariates. The dependent variable remains total firms of all sizes. Using the results and notation of section 4, we know that marginal cost increases with x, Λ_T, and Λ_V, that fixed cost increases with Λ_H and Λ_F, and that Λ_F and Λ_V increase with y. Since the litigation variables Λ_T, Λ_V, Λ_H, and Λ_F are not directly observed, we proxy them with related observables. The index is specified as

$$\mathbf{X}'_{kt}\boldsymbol{\beta} = \beta_0 + \upsilon_s + \varphi_t + \eta_p e_{st-1} + \zeta_p c_{st-1} + \omega_p d_{st-1} + \xi_p f_s + \boldsymbol{\pi}'\mathbf{W}_{kt} \tag{9}$$

where $\mathbf{W}$ includes all the variables from specification A. Parameters $(\beta_0, \upsilon_s, \varphi_t)$ are as in (8). The employment litigation costs Λ_H and Λ_T increase with the probabilities of litigation (ℓ_H and ℓ_T). We proxy these probabilities by the EEOC charge rate in state s, lagged one year. The charge rate variable e_{st-1} is the number of EEOC ADA Title I charges in the state, as a fraction of prime working age disabled population (aged 21-58), times 1,000.[47] Hiring and termination charges are not distinguished in the EEOC data; evidence on which places greater costs on firms will come from application of Proposition 2. The charge rate (and the Title III case rate described below)

[47] The EEOC data were obtained as summary counts per state through a Freedom of Information Act request. The disability data are from the U.S. Census' Current Population Survey, following Acemoglu and Angrist (2001).

is lagged to avoid reverse causation between current firm dynamics and worker complaints. For example, when many firms are exiting, employees may file fewer labor complaints because they are in transition to new jobs anyway. The coefficient on e_{st-1} is η_p, where $p = 2, 3$ indexes the two ADA periods.

Similarly, the accessibility litigation costs Λ_F and Λ_V increase with the number of suits (s_F and s_V). Instead of proxying the number of suits (which is highly correlated with population), we proxy the probability of accommodation suit-filing. The case rate variable c_{st-1} (with coefficient ζ_p) is the number of Title III-related federal court cases in state s in year $t-1$, as a fraction of disabled adult population (aged 15+ years), times 1,000.[48] As with the EEOC charges, we will use Proposition 2 to infer whether the Title III cases increase marginal or fixed costs more. The coefficients for the charge and case rate variables are semi-elasticities.

Finally, because of the high correlation between the fractions of the labor force (x) and population (y) that are disabled, we include a single variable d_{st-1} to proxy both. This variable (with coefficient ω_p) is the log fraction of adult population (aged 15+ years) in the state that is disabled in year t (times 100), lagged one year.

Although every state had some sort of Fair Employment Practice (FEP) law before the ADA, and all but three prohibited disability-based discrimination in hiring and firing, not all of these laws had teeth. The variable f_s is an indicator for states that had a "strong" FEP law with sanctions before the ADA ($f_s = 1$ if the state had a strong pre-ADA FEP law, 0 if not).[49] Sanctions include misdemeanor charges and civil penalties; these are in addition to the monetary damages available under all states' FEP laws . Title I of the ADA was less of an innovation in states with strong FEP laws, and the ADA should have had less of an impact. If there is less entry in the weaker

[48] The case data were obtained from a search of the Lexis database (all federal trial, appellate, and Supreme Court cases) for cases matching keywords "ADA" and "public accommodation" or "Title III". Although this is not as accurate a means of classification as reviewing each of the numerous cases individually, a check of the cases matched showed this method to be fairly accurate.

[49] These data are from Percy (1989). Jolls and Prescott (2004) and Jolls (2004) categorize states' pre-ADA FEP laws differently; see section 6.5 for discussion.

FEP states after the ADA, for example, then $\hat{\xi}_2$ and $\hat{\xi}_3$ will be positive in the entry index.

All the ADA-related coefficients are allowed to vary between periods; since the Title I and Title III variables are not observed in period 1, we normalize $\zeta_1 = \eta_1 = 0$. In the results, we report differenced estimates (i.e., increments over the period 1 effect) where applicable; for ω_p we report $\hat{\omega}_1$, $\hat{\omega}_2 - \hat{\omega}_1$, and $\hat{\omega}_3 - \hat{\omega}_1$, for example. The coefficients on f_s are reported as difference-in-differences (D-D) estimates: $\hat{\xi}_2 - \hat{\xi}_1$ and $\hat{\xi}_3 - \hat{\xi}_1$, the difference (between strong FEP and other states) in the difference in $\mathbf{X}'_{kt}\boldsymbol{\beta}$ before and after the ADA.

Although all the variables in specification A are included in specification B, only the ADA-specific coefficients are reported in Tables 5 and 6. Of interest here are the difference and D-D estimates. For the count models in Table 5, with the exception of the Title III case rate, all of these estimates have signs unambiguously associating the ADA with a decreased number of firms. In particular, the coefficients for the percentage of disabled adults and the EEOC charge rate are negative in the ADA periods. The coefficient for states with strong FEP laws is positive, which is also consistent with the ADA causing the number of firms to fall. These signs are robust across models, and with a few exceptions are stastically significant. Due to the presence of nonlinearity in the effect of Title III case rates during 1993-1994 in preliminary estimations, a squared term is added for those years (no significant nonlinearity was found for 1995-1997). The Title III case rate coefficient for 1993-1994 displays a U-shaped effect in all specifications, with 99% of the observations occurring in the downward sloping (and thus negative) part of the effect. The Title III coefficient for 1995-1997 is not significant. We defer interpreting the magnitudes of the estimates until section 6.6. The results from the other retail groups are generally in accord with these results from SIC 54.[50]

Table 6 has the results from specification B for the $CM_t/CM_t/\infty$ model. The versions with and without heterogeneity are generally in agreement; there are no (statistically significant) sign

[50]The main exceptions are the FEP coefficients, which have mixed signs, and the disability coefficients for the latter ADA period, which are more often positive than negative.

changes of the estimates between versions. Of the significant estimates, the EEOC charge rates and the percentage of adults disabled in both ADA periods show incumbent favoring behavior.[51] From Proposition 2, this implies that these variables (on net) raise fixed costs.[52] The result for the charge rates implies that the ADA raised hiring costs (through ℓ_H and Λ_H from section 4) more than termination costs (through ℓ_T and Λ_T). This seems unlikely; Moss *et al.* (1999) report that fewer than 10 percent of the ADA charges filed with the EEOC concern hiring discrimination. We return to this issue in the next specification.

Recall that the disability variable d_{st} stands in for the fraction of the labor force and population that is disabled (x and y of section 4, resp.). The disability variables raise fixed costs by increasing Λ_H, the cost of hiring discrimination suits (through x) and by increasing Λ_F, a component of the cost of accessibility suits (through y). Setting aside the possibility of significant impacts through hiring-related suits, the incumbent favoring impact of the disability variable may imply that "serial suers" or other litigants have significant impacts on entry by raising the expected cost of accessibility lawsuits (or other such suits not related to the scale of the businesses), Λ_F. Another explanation for the incumbent favoring, apart from the implications of Proposition 2, may be that negative impacts from the disability variable show up on entry and not exit if potential entrants perceive the costs from ADA suits to be larger than incumbents actually find them to be.

The other significant estimates are the Title III case rates and the strong FEP law D-D estimates (first ADA period only for the latter). The Title III coefficients for the second ADA period and the strong FEP law coefficients for the first ADA period show entrant favoring behavior. Proposition 2 therefore implies that these variables raise marginal costs. For the case rate variable, this result is consistent with the ADA imposing real litigation costs Λ_V from accessibility suits from customers. However, we show in the next section that this result does not persist when trends common to

[51] The estimates discussed here are those for which either the entry or failure coefficient was significant in one or both specifications. All of these are pairwise jointly significant.

[52] The results of Proposition 2 apply to small univariate increases in marginal cost c or fixed cost ϕ. Given that both may have actually increased, "incumbent favoring" here means that the effects of the increase in ϕ outweigh the effects of any increase in c.

all sizes of firms are removed. Also, the Title III entry coefficient for the first ADA period is negative. We return to the Title III estimates in the next section. The results for the strong FEP laws imply that marginal costs increased more in states for which the ADA was more of an legal innovation (at least during the first ADA period). This latter result may indicate that overall, the ADA helped entrants at the expense of incumbents. The estimates from other retail SIC groups, with few exceptions, are in accord with these results for food stores.[53] Therefore, combining all results from this section, there is much evidence that the ADA had real impacts on the number, entry, and exit of stores in the retail sector. Specification B does not, however, take advantage of the fact that small firms are likely to be more vulnerable to costs imposed by the ADA than larger firms. In the next section we use large firms as a control group to strengthen the conclusions of this section.

6.3 Concerns about endogeneity (preliminary)

One may suspect that some of the variables treated as exogenous in Specification B are in fact endogenous. For example, self-reported disability status may respond to economic conditions, and thus be artificially high when industry is declining. However, recent evidence in the literature suggests accepting disability status as reported in anonymous surveys as exogenous (Benitez-Silva, Buchinsky, Chan, Cheidvasser and Rust, 2000).[54] Nonetheless, we explore its potential endogeneity here. There is stronger evidence that EEOC charge rates in general (not specific to the ADA) may also increase when joblessness, perhaps due to turnover of firms, increases (III and Siegelman, 1991). In this section we therefore explore instrumental variable regressions in which the disabled and EEOC variables are treated as endogenous.

Instrumenting for the CPS disability variable requires finding measures of disabled persons less

[53] The significant exceptions (homogeneous specification) are: in SIC 56 (apparel stores), EEOC charge rates favor entry in period 3 and non-FEP status favors incumbents period 2; in SIC 59 (miscellaneous retail), disabled adults favor entry in period 3. The unlikely case never appears in any SIC group for any variable.

[54] In an earlier investigation, Stern (1989) found only weak evidence of endogeneity self-reported disability status in a labor force participation estimation.

susceptible to self-reporting bias. Here we use some variables from the SIPP as instruments for the disability measure used above constructed from the rather general CPS question regarding ability to work.[55] The three SIPP variables used were chosen for their specificity: whether the respondent is blind, deaf, and needs help taking a bath. From these variables, state-level fractions of blind, deaf, and limited-ability adults were constructed. Unfortunately, the SIPP data are available only after 1990, which necessitates dropping the early years of the sample. To instrument for the EEOC case rates, I follow Acemoglu and Angrist (2001) and drop the FEP variables from the main estimation, using them as instruments instead.

To allow use of standard IV techniques, the dependent variable was transformed by square root,[56] so the coefficients (reported in Table 6b) are not comparable to those in previous tables. OLS coefficients for comparison are reported in the first column, and show the same direction of effects for all ADA-related variables (in particular, the signs of the disability, EEOC, and Title III coefficients match those of the analogous Poisson Regression 2 in Table 5). When disability and EEOC cases are treated as endogenous, in columns 2 (without state dummies) and 3 (with state dummies), the results show that the sign and significance of the coefficients generally persist, particularly in IV Regression 2 with the state dummies. An overidentification test rejects the null that the suspect variables are exogenous for IV Regression 1. However, this is likely due to the omitted state dummies. When they are added, the overidentification test for IV REgression 2 does not reject the hypothesis that the disability and EEOC variables are exogenous. Therefore in the rest of the paper we treat these as exogenous.

[55] The CPS question is "Does [respondent] have a health problem or disability which prevents him/her from working or which limits the kind or amount of work he/she can do"?

[56] As discussed in section 3.7.2 of Cameron and Trivedi (1998), the more usual log transformation for count data often performs poorly. The square-root transformation is suggested as an alternative by McCullough and Nelder (year??).

6.4 Specification C: difference-in-differences

In specification C, we split the dependent variable into size groups. Here the dependent variable is the number of firms within each size group: small (1-19 employees), medium (20-49 employees), and large (50+ employees), and the independent variables are as in specification B. Estimations for the different size firms are run separately, which effectively adds a size subscript $j = S, M, L$ to all the variables in (9). This allows all the ADA-related variables to be differenced over firm sizes as well as over time, and is the most demanding test that the ADA had a causal impact on firms. In specification C, we require not only that the ADA-related variables affect the number of firms, entry, or exit, but that the impacts be greater on the small firms that are most vulnerable to the ADA. By looking for impacts on small firms, net of trends for large firms, potentially spurious trends affecting all sizes of firms are differenced out. Recall from section 2 that the smallest firms (those with fewer than 15 employees) are exempt from Title I employment discrimination obligations. Therefore for the Title I variable e_{st} we will also look at differences of medium size firms from large firms. The strong FEP law coefficient is triple differenced (D-D-D) in this specification, with differencing over states with strong and weak laws, over small and large firms, and over time. This allows the D-D estimate for large firms to be a baseline, against which the incremental effects for small firms can be compared.

The results are reported as D-D or D-D-D estimates. The D-D estimate labeled *% adult disabled, 1993-94* in the first row of Table 7, for example, is $(\hat{\omega}_{2S} - \hat{\omega}_{1S}) - (\hat{\omega}_{2L} - \hat{\omega}_{1L})$: the difference (between small and large firms) in the difference in $\mathbf{X}'_{kt}\boldsymbol{\beta}$ from a unit change in d_{st} before and after the ADA. Similarly, the D-D-D strong FEP state estimate labeled *strong FEP state, 1993-94* is $(\hat{\xi}_{2S} - \hat{\xi}_{1S}) - (\hat{\xi}_{2L} - \hat{\xi}_{1L})$: the difference (between small and large firms) in the difference (between strong FEP and other states) in the difference in $\mathbf{X}'_{kt}\boldsymbol{\beta}$ before and after the ADA.

Table 7 presents the results from specification C for the standard count models. The table reports only the D-D and D-D-D calculations; each is the set of small or medium firm estimates net of the large firm estimates. Of the significant estimates for small firms, all have signs consistent with the ADA decreasing the number of firms. The Title III case rate coefficient for the initial ADA period again stands out; it is insignificant in all regressions. The D-D-D coefficients for the strong FEP state variables are positive in Table 7. These D-D-D estimates imply that not only did the number of firms fall in weaker FEP states after the ADA (from the D-D estimates in Specification B) but that the trend is more marked for the ADA-vulnerable small firms than for large firms. The lower part of Table 7 has the D-D estimates of the EEOC charge rate coefficients for medium firms. These estimates are all negative, and most of them are significant at the 1% level. Taken altogether, the evidence is consistent with the ADA reducing the number of establishments in each market. While causality can not directly proven here, in the D-D and D-D-D settings any alternative explanations become increasingly complicated. The results from the other retail groups are generally in accord with their results from specification B.[57]

Table 8 contains the estimates of interest from the $CM_t/CM_t/\infty$ model. With the exception of the Title III case rates, all of the incumbent favoring or entrant favoring behavior found in specification B carries through to the small firm D-D and D-D-D estimates.[58] Thus not only are effects from the ADA-related variables significant, they generally show up strongest for the small firms likely to be most susceptible to the costs of the ADA. For the accessibility estimates, the first ADA period Title III estimates show strong incumbent favoring, and the entry-favoring previously found for the second period Title III estimates in specification B disappears. The Title III results are thus brought into line with the results for the disability variable d_{st}; the evidence from both suggests that fixed costs rose, which is consistent with accessibility suits by activists raising costs

[57] The exceptions are SIC 52 and 58, which had positive, significant coefficients for the disabled adult variables in specification B but negative, significant coefficients in specification C. Differencing in these cases brings the results closer in line with the results from SIC 54.

[58] The entry and exit coefficients are jointly significant for all the variables discussed in specification B. The entry and exit coefficients for disabled population rate in ADA period 2 are individually insignificant in specification C but retain joint significance.

through s_F and Λ_F.

The suspect finding from specification B that EEOC charge rates appear to increase fixed costs is still present for the first ADA period when looking at small firms. However, because of the Title I exemption for most small firms, medium size firms provide a better test of the effect of the EEOC charges. The bottom part of Table 8 has the results for the EEOC charge rate D-D estimates for medium firms (net of large firms). Here, the Title I variable exhibits entrant favoring effects in both ADA periods, which implies from the theoretical model that the costs of termination suits (and possibly other suits from employees regarding accommodation[59]) have more of an impact than hiring suits. Given that over 81 percent of charges filed with the EEOC concern termination or accommodation of employees, this is a plausible finding.

A caveat applies to specification C when estimating the entry and exit model. Given the anonymous nature of individual firms in the establishment counts, true exits cannot be distinguished from size group switching. E.g., if a firm grows from 10 to 40 employees one year to the next, the econometric model treats it as an exit of a small firm and *de novo* entry of a medium firm. Thus, entry and exit may be over counted in specification C and the magnitudes of the coefficients must be interpreted with caution. By comparing entry rate $\hat{\lambda}$ from specification B with the sum of the $\hat{\lambda}_j$ for all size groups from specification C, one can estimate the extent of the overcounting. Arrival rates are over counted 22–25% in the ADA periods in specification C; similar calculation for the failure rate shows over counting of 19–23% in the ADA periods. These figures provide rough upper bounds on the mismeasurement of the ADA-related coefficients; in a best-case scenario the category switching is not related to the variables of interest, the estimate of the constant absorbs the mismeasurement, and the other coefficients are correctly estimated.

[59] Although not included in the model, suits from non-terminated employees would increase marginal costs similarly to termination suits.

6.5 Specification checks

We now consider various specification checks of the models. Since identification of the entry and failure rate parameters comes from the functional forms assumed for the $CM_t/CM_t/\infty$ model, it would be reassuring if the model passed econometric specification tests. However, there is no test of parametric dynamic, discrete models of which we are aware that is consistent against non-parametric alternatives and is feasible for our case.[60] Instead we compare the $CM_t/CM_t/\infty$ estimates with those from simpler regressions using observed establishment births and deaths as the dependent variables. As discussed above, such data are not publicly available at the detailed SIC and county level. However, if one is willing to lump all retail subsectors together and to aggregate to the state level, then the joint Census/Small Business Administration Statistics of U.S. Businesses (SUSB) dynamic data on establishment births and deaths are available.[61] In Poisson regressions not reported here, we estimated specification A separately for overall entry and exit in the retail sector using the SUSB data. Even though the level of aggregation and the businesses covered differed, the qualitative results from the SUSB data for the determinants of retail entry were close to those reported in Table 4 (heterogeneous model): the signs of each coefficient matched (or in one case differed but were both insignificant). The coefficients for the determinants of retail exit from the SUSB data were not as close to the analogous estimates in Table 4, but seven out of ten of them matched sign or were both insignificant. While the similarities between the estimations performed on observed firm dynamics and the establishment counts do not provide a complete specification check, they do lend credence to the results from the $CM_t/CM_t/\infty$ model.

Our second specification check concerns the static specification used in the standard count data models for the number of firms. It is clear from (30)–(28) that the lagged dependent variable enters the likelihood for the firm counts, suggesting that dynamic specifications be explored. In addition to the count models mentioned above, we estimated fixed effects dynamic panel models

[60] Tests we considered are either not suited to discrete data, not suited to dynamic models, or require bootstrapping (e.g., Andrews (1997), Corradi and Swanson (2003)), which is far too computationally onerous to be practical here.

[61] See http://www.census.gov/csd/susb/susbdyn.htm for a description of the data.

for count data with n_{jkt-1} appearing in the specification for mean counts, $E(n_{jkt}|n_{jkt-1}, \mathbf{X}_{jkt})$, following the quasi-differencing GMM approach of Chamberlain (1992). The magnitudes of these GMM estimates proved to be quite sensitive to the choice of weighting matrix used in the GMM criterion function and we do not include the results here. However, the signs of the coefficients generally matched those of the static fixed effects model in the third pair of columns in Tables 3, 5, and 7 (for the analogous specifications) and none of the qualitative conclusions change.[62]

Finally, some other studies classify states' pre-ADA laws differently than we do. Instead of categorizing state laws on the basis of sanctions (which follows Acemoglu and Angrist (2001)), Jolls (2004) and Jolls and Prescott (2004) classify states as full-protection (FP), limited protection (LP), or no-protection (NP) states. FP states had pre-ADA laws requiring employers to avoid disability-based discrimination in hiring and firing and to provide reasonable accommodations to disabled workers. LP states had laws lacking the reasonable accommodation provision, and the three NP states had no disability discrimination laws. To investigate this alternative approach, we re-estimated the Poisson regressions for specification B including as the only ADA-related variables a full set of FEP categories, interacting our "strong law" categorization with the alternative FP/LP/NP classification, leading to five groups: FP/strong, LP/strong, FP/not strong, LP/not strong, and NP. The results (not reported) show that the only category significantly different from the others is LP/strong, which has a coefficient positive and larger than those for any other group in both ADA periods. If the states in this group are different due mainly to the extent of protection afforded by the state law, then the unintuitive interpretation is that where the ADA created new requirements, there was an increase in the number of firms. If the difference is due mainly to whether the state law had teeth, however, then the more natural interpretation follows that states

[62]In particular: in specification A the ADA year dummies are all significantly negative; in specification B the significant coefficients (percentage of disabled adults in the second ADA period and the FEP D-D estimates in both ADA periods) all have signs associating the ADA with a decreased number of firms; in specification C all eight ADA-specific coefficients in Table 7 except one are significant and have signs consistent with the ADA decreasing the number of firms. The exception is the differenced Title III case rate coefficient for the first ADA period, which is positive.

in which the ADA created new penalties saw the number of firms decrease.

6.6 The overall impact of the ADA

To gauge the overall impact of the ADA on the firms, in Table 9 we show the magnitudes of the effects of the ADA variables. In the table we calculate the number of small and medium size firms "lost" when the ADA is implemented by subtracting the number of establishments in a "no ADA" counterfactual from the actual figures. In the counterfactual, we assume there are no EEOC charges or Title III cases, since without the ADA neither would have been possible (medium firms only for the former, due to the inapplicability of Title I to most of the small firms). We also assume in the counterfactual that there were no incremental effects in states with weak FEP laws compared to those with strong FEP laws in the ADA periods, on the logic that any such effects were due to the legal innovation of the ADA. To be conservative, we do not assume that the impact of disabled workers changes in the counterfactual, given that their impact on firms may have changed over time due to factors other than the ADA (for example, through changes in state law). All figures are calculated using coefficients from specification C, and thus are to be interpreted as net of trends for large firms.

The first three columns of Table 9 show the total impact of the ADA (defined as the difference between the actual number of firms and the estimated number of firms in the counterfactual) on the number of small and medium firms, with one column for each standard count data model in Table 7. The estimates range from 2,279 to 2,644 fewer small and medium firms nationally (1.4–1.6% of actual firms) during the initial ADA period and from 2,572 to 3,684 (1.6–2.3%) fewer small and medium firms during the later ADA period, depending on the estimation.[63] The large majority of these losses come from small firms. The other columns in Table 9 show the ADA impacts using the $CM_t/CM_t/\infty$ model estimates from Table 8. The $CM_t/CM_t/\infty$ estimations imply that overall,

[63] If the disabled variables for the ADA periods are also changed to zero in the counterfactual, the estimates increase by an order of magnitude.

entry and exit increase due to the ADA, with the latter outweighing the former so that the number of firms falls.[64] The implied changes in the number of firms from the $CM_t/CM_t/\infty$ estimates are smaller than those from the standard count data models, but in all cases the number of firms is estimated to decrease due to the ADA.

These estimates are not meant to be a precise comparison to a world without the ADA. State disability law and enforcement of existing law might have changed in the absence of the ADA. The ADA might also have crowded out some legal action pursued under state disability law. Furthermore, there is no way to tell how the impact of disabled workers (either to the benefit or the detriment of firms) may have changed over time without the ADA, which is why this variable was not included in the counterfactual. With these qualifications, and given the potential overcounting of entry and exit discussed at the end of section 6.4, the estimates are perhaps best viewed as merely illustrative of the magnitudes of the coefficients in Tables 8 and 9.

7 Concluding Remarks

There is convincing evidence that the ADA had real impacts on the number, entry, and exit of food stores. Although the evidence is not consistent in every specification and in every SIC group, the empirical results for other retail segments generally mirror those for food stores. In the ADA period, there were an average of 4–9% fewer retail establishments than before, and the drop was larger in states in which the ADA was more of a legal innovation, and in states that had more disabled people and more ADA-related labor complaints. The same conclusions hold when baseline trends for larger establishments (those least vulnerable to the costs imposed by the ADA) are differenced out, and in addition ADA-related accessibility lawsuits are associated with declines in firm counts. There is also evidence that labor complaints (and to a lesser extent, access discrimination suits) raised the marginal costs of retail stores, encouraging exit. At the same time that the ADA spurred

[64] The number of exiting firms is calculated by applying the per-firm exit rate μ to the number of firms in the county at the end of the previous period.

exit, however, it apparently increased entry, perhaps because stores less able to adapt to the new requirements failed and made room for new stores in the local market. So, while predictions that the ADA would cause firms to fail may have proven correct, the decline in the number of firms was partially offset by new entry. A conservative estimate, based only on factors directly related to the ADA and net of trends for large firms, is that there were 1.4–2.3% fewer small and medium firms during the ADA periods than before. These percentages translate to 2,300–3,700 firms nationally.

To say that the ADA was bad for businesses overall is not to conclude that the ADA fails a cost-benefits test. However, given the evidence of Acemoglu and Angrist (2001) that the ADA did not improve employment prospects for the disabled, the only remaining benefit of the law may be the greater physical accessibility requirements it mandates for businesses. Quantifying the benefits of accessibility for disabled customers would be difficult, and is beyond the scope of this work.

More generally, this paper develops theoretical and econometric models that may be useful for many economic questions. The model of the effect of cost changes on industry dynamics could easily be adapted to examine the impacts of other forms of cost-increasing regulation or exogenous process innovation on industry dynamics. Furthermore, the econometric $CM_t/CM_t/\infty$ model may apply to any example where a quantity of interest is a count of events in progress at a given time. For example, consider the number of ongoing strikes, or the number of people receiving unemployment compensation, or visiting an attraction. When only the count of pending spells is observed, the $CM_t/CM_t/\infty$ model allows estimation of the unobserved arrival and duration parameters. Such data arise whenever census methods report stock levels (e.g., population, pending stock trades, monetary aggregates, number of patients on a waiting list) and not flows.

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A Appendix

A.1 Proofs of results from the theoretical model.

Proof of equation (1): after the ADA, marginal production cost is still constant given the assumptions, of form βw^{α}, where w is the price of effective labor $L + eD$, inclusive of accommodation costs. Adding in the accommodation cost of a and the termination cost of Λ_T per disabled worker leads to total labor expenses of $w_L L + (w_D + a + \Lambda_T) D$. Since disabled workers are hired in proportion x and receive wage w_L after the ADA, total labor expenses are $w_L L + (w_L + a + \Lambda_T) Lx/(1-x) = [w_L + (a + \Lambda_T) x] L/(1-x)$. The total amount of effective labor is $L + eD = L + eLx/(1-x) = (1 - x(1-e)) L/(1-x)$, so that the factor price of effective labor is $[w_L + (a + \Lambda_T) x] / [1 - x(1-e)]$, found as the ratio of the total labor expense to total effective labor. Adding in the hiring and accessibility litigation costs results in (1). All other proofs for the theoretical model are found in Prieger (2004*a*).

A.2 Variance and correlation of entry and exit

The variance of v is σ_v^2 and the variance of $u|v$ is $\sigma_u^2 v^{\tau}$. To ensure that $E(u) = E(v) = 1$, δ and γ are normalized

$$\delta = \sigma_v^{-2} \tag{10}$$

$$\gamma = \frac{\Gamma(\delta)}{\sigma_u^2 \sigma_v^{2\tau} \Gamma(\tau + \delta)} \tag{11}$$

With these restrictions, $Var(u|v) = \sigma_u^2 \sigma_v^{-2\tau} v^{2\tau} g(0)/g(1)$ is linear in σ_u^2, and $Var(u) = g(2) \cdot \left[g(0)/g(1) + \sigma_u^2 \sigma_v^{2\tau}\right] / g(1) - 1$ is affine in σ_u^2, where $g(a) = \Gamma\left(a\tau + \sigma_v^{-2}\right)$. Correlation between u and v, ρ, is:

$$\rho = \tau \sigma_v \left(\frac{g(2)}{g(1)} \left[\frac{g(0)}{g(1)} + \sigma_u^2 \sigma_v^{2\tau} \right] - 1 \right)^{-1/2} \tag{12}$$

The correlation has the same sign as τ and can take the full range of values on $[-1, 1]$. For example, when $\tau = 1$, $\rho \to 1$ as $\sigma_u^2 \to 0$. If $\sigma_u^2 = \tau^2 \sigma_v^2$, then $\rho \to -1$ as $\tau \to 0$ from below and $\sigma_v^2 \to 0$.

Correlation is zero if and only if $\tau = 0$, but is not in general monotonic in τ.

A.3 Derivation of the likelihood of the $CM_t/CM_t/\infty$ queuing system.

From the properties of Poisson and exponential processes, when $(s, s + \Delta s)$ is strictly within a period we have the following (where $o(x)$ denotes order smaller than x):

$$\Pr\{1 \text{ arrival in interval } (s, s + \Delta s)\} = \lambda_t \Delta s + o(\Delta s) \tag{13}$$

$$\Pr\{0 \text{ arrivals in interval } (s, s + \Delta s)\} = 1 - \lambda_t \Delta s + o(\Delta s). \tag{14}$$

where $s \in [t-1, t)$. For any particular server we have:

$$\Pr\{1 \text{ exit in interval } (s, s + \Delta s)\} = \mu_t \Delta s + o(\Delta s) \tag{15}$$

$$\Pr\{0 \text{ exits in interval } (s, s + \Delta s)\} = 1 - \mu_t \Delta s + o(\Delta s). \tag{16}$$

The probability of any compound event (e.g., an arrival and an exit) is $o(\Delta s)$. For now we treat all expressions as conditional on (u, v).

From (13)–(16) one can derive the probability of the number of units in service at time t. Most queuing studies focus on the limiting behavior of the system, but here we are interested in the transient behavior; in application there is no reason to assume that the system is in steady state (or even that the system is ergodic). We begin by deriving the likelihood for n_{t+1} given that $N(t) = n_t$.

Restrict attention for the moment to behavior within a period t, during which λ and μ are constant, and suppress the dependence on t in the notation for λ, μ, and n. Let $P_n(s)$ be the probability that $N(s) = n$. Then from (13)–(16) one can derive a recursive equation for the probability that there are n units in the system at time s:

$$\frac{d}{dt} P_n(s) = -P_n(s)(\lambda + n\mu) + P_{n+1}(s)(n+1)\mu + P_{n-1}(s)\lambda, \quad n \geq 0; \tag{17}$$

see (Kalashnikov, 1994, p.276). Add the initial condition

$$P_n(t-1) = \delta_{n_{t-1}n} \tag{18}$$

where $\delta_{n_{t-1}n}$ is the Kronecker delta (δ_{xy} equals 1 if $x = y$ and 0 otherwise). Equations (17)–(18) form a differential difference equation known as the *forward Kolmogorov equation*, which admits a solution, after employing a generating function that reduces the problem to a linear partial differential equation.

Define the generating function of the sequence $\{P_n(s)\}_{n=0}^{\infty}$ as[65]

$$P(z,s) \equiv \sum_{n=0}^{\infty} P_n(s) z^n, \tag{19}$$

where $z \in \mathbb{C}$, $\|z\| < 1$. $P(z,s)$ allows us to restate (17)–(18) as an initial value partial differential equation:

$$P(z,0) = z^{n_{t-1}} \tag{20}$$

$$\frac{\partial P}{\partial s} = (1-z)\left[\mu \frac{\partial P}{\partial z} - \lambda P(z,s)\right]. \tag{21}$$

The solution to this partial differential equation is

$$P(z,s) = c \exp\left[-\kappa (1-z)\right] \tag{22}$$

where c is an arbitrary function ϕ of $(z-1)\, e^{-\mu s}$ and $\kappa \equiv \lambda/\mu$ is the *traffic intensity*. To determine c, use (20) to find that

$$\phi (z-1) \exp\left[-\kappa (1-z)\right] = z^{n_{t-1}} \Rightarrow \tag{23}$$

$$\phi(w)\, e^{\kappa w} = (w+1)^{n_{t-1}} \Rightarrow \tag{24}$$

$$\phi\left((z-1)\, e^{-\mu s}\right) = \exp\left[\kappa (1-z) e^{-\mu s}\right] \left[1 - (1-z)\, e^{-\mu s}\right]^{n_{t-1}} = c \tag{25}$$

Thus the particular solution of (22) that matches the boundary condition (25) is given by

$$P(z,s) = \left[1 - e^{-\mu s}(1-z)\right]^{n_{t-1}} \exp\left[-\kappa A(s)(1-z)\right], \tag{26}$$

[65] In the rest of this section, s should, strictly speaking, be Δs, the time elapsed in the current period.

where $A(s) = 1 - e^{-\mu s}$. Now expand the first term and use the power series expansion of the exponential term to rewrite (26) as

$$P(z,s) = \exp\left[-\kappa A(s)\right] \left[\sum_{m=0}^{n_{t-1}} \binom{n_{t-1}}{m} \left(e^{-\mu s} z\right)^m A(s)^{n_{t-1}-m}\right] \left[\sum_{n=0}^{\infty} \frac{z^n \left[\kappa A(s)\right]^n}{n!}\right]$$

$P_n(s)$ is equal to the coefficient on z^n in $P(z,s)$. When s has run to the end of the period, this coefficient gives us the probability of observing n_t units in service at the end of period t. It is therefore the density for n_t, conditional on its lagged value n_{t-1} and on (u_t, v_t), which enter only through λ and μ. Denote this pdf $f(n_t|n_{t-1}, u_t, v_t)$. It is

$$f(n_t|n_{t-1}, u_t, v_t) = \exp\left[-\kappa_t\left(1 - e^{-\mu_t}\right)\right] \sum_{m=0}^{M_t} B_{mt}, \tag{27}$$

where $M_t \equiv \min\{n_{t-1}, n_t\}$ and B_{mt} is defined as

$$B_{mt} \equiv \binom{n_{t-1}}{m} \frac{\kappa_t^{n_t - m}}{(n_t - m)!} e^{-\mu_t m} \left(1 - e^{-\mu_t}\right)^{n_t + n_{t-1} - 2m} \tag{28}$$

Finding $f(n_t|n_{t-1})$ requires integrating out the unobserved heterogeneity:

$$f(n_t|n_{t-1}) = E_{u,v}\left[f(n_t|n_{t-1}, u_t, v_t)\right] = E_v\left\{E_{u|v}\left[f(n_t|n_{t-1}, u_t, v_t)\right]\right\} \tag{29}$$

Begin with the inner expectation and integrate out u (which enters through λ). Due to the assumption that u has a gamma distribution, conditional on v, the inner expectation may be found in closed form, leading to

$$f(n_t|n_{t-1}) = \int_0^\infty f(n_t|n_{t-1}, v_t) \mathcal{G}(\delta, \sigma_v^2; v) dv_t, \tag{30}$$

where

$$\begin{aligned} f(n_t|n_{t-1}, v_t) \quad = \quad & \left[\kappa_{0t} \sigma_u^2 v_t^{\tau-1}\left(1 - e^{-\mu_t}\right) + 1\right]^{-\gamma} \cdot \\ & \sum_{m=0}^{M_t} \tilde{B}_{mt} \left[\frac{\Gamma(n_t - m + \gamma)}{\Gamma(\gamma)} \left(\frac{\sigma_u^2 v_t^{\tau-1}}{\kappa_{0t} \sigma_u^2 v_t^{\tau-1}(1 - e^{-\mu_t}) + 1}\right)^{n_t - m}\right], \end{aligned} \tag{31}$$

$\tilde{B}_{mt}$ is as in (28) but with $\kappa_{0t} = \lambda_0/\mu_0$ replacing κ_t, $\mathcal{G}$ is as in (6), $M_t \equiv \min\{n_{t-1}, n_t\}$, and restrictions (10)–(11) are imposed. The remaining integral in (30) cannot be solved analytically, and so numerical integration is used to evaluate the density (30); see Prieger (2004*b*) for details.

Table 1: Changes in Entry and Exit in Response to Cost Increases

Entry of New Firms	Exit of Incumbents	Nomenclature
decreases	increases	competitor neutral
decreases	decreases	incumbent favoring
increases	increases	entrant favoring

Table 2: Description of Data

Variable	mean	s.d.
Adult population disabled (percentage, log)	2.36	0.22
Area (log sq. miles)	6.51	0.76
Capital cost (real, x 100, log)	1.71	0.09
EEOC charge rate (x 1000), 1992-1993	0.18	0.59
EEOC charge rate (x 1000), 1994-1996	0.60	1.12
FEP (state had strong pre-ADA disability law, 1=yes, 0=no)	0.32	0.47
Labor cost (real, in thousands, log)	2.58	0.20
Per capital income (real, in thousands, log)	2.46	0.22
Population (log)	10.17	1.38
Region: Midwest (1=yes, 0=no)	0.34	0.48
Region: South (1=yes, 0=no)	0.45	0.50
Region: West (1=yes, 0=no)	0.14	0.34
SIC 54 establishments, large, 1988-1997	5.62	17.68
SIC 54 establishments, large, 1988-1991	5.46	17.67
SIC 54 establishments, large, 1992-1993	5.65	17.52
SIC 54 establishments, large, 1994-1997	5.85	17.78
SIC 54 establishments, medium, 1988-1997	5.09	12.81
SIC 54 establishments, medium, 1988-1991	5.33	13.47
SIC 54 establishments, medium, 1992-1993	4.91	12.14
SIC 54 establishments, medium, 1994-1997	4.81	12.08
SIC 54 establishments, small, 1988-1997	48.46	149.09
SIC 54 establishments, small, 1988-1991	49.33	149.30
SIC 54 establishments, small, 1992-1993	48.23	150.33
SIC 54 establishments, small, 1994-1997	47.17	147.90
SIC 54 establishments, total, 1988-1997	59.17	177.33
SIC 54 establishments, total, 1988-1991	60.13	178.52
SIC 54 establishments, total, 1992-1993	58.79	177.67
SIC 54 establishments, total, 1994-1997	57.83	175.10
Title III case rate (x 100,000), 1992-1993	0.01	0.08
Title III case rate (x 100,000), 1994-1996	0.12	0.35

Note: unit of observation is a U.S. county, over years 1988-1997.

Table 3: Estimation Results for the Number of Firms from Standard Count Models—Specification A (Differences in Means Before and After the ADA)

	Poisson Regression 1		Poisson Regression 2		Fixed Effects Poisson Regression	
	estimate	s.e.	estimate	s.e.	estimate	s.e.
Difference-in-mean estimates						
1989	-0.010 **	(0.002)	-0.011 **	(0.002)	0.002	(0.003)
1990	-0.008 *	(0.003)	-0.010 **	(0.003)	0.011**	(0.004)
1991	-0.007	(0.004)	-0.008	(0.004)	0.016**	(0.005)
1992	-0.004	(0.004)	-0.005	(0.004)	0.025**	(0.006)
1993	-0.062 **	(0.006)	-0.063 **	(0.006)	-0.023**	(0.008)
1994	-0.069 **	(0.007)	-0.071 **	(0.007)	-0.022*	(0.009)
1995	-0.084 **	(0.008)	-0.086 **	(0.007)	-0.029**	(0.010)
1996	-0.108 **	(0.009)	-0.111 **	(0.008)	-0.045**	(0.011)
1997	-0.133 **	(0.011)	-0.137 **	(0.010)	-0.065**	(0.012)
Other variables						
area	-0.040 *	(0.019)	-0.049 **	(0.018)		
population	0.942 **	(0.012)	0.932 **	(0.012)	0.354**	(0.065)
per cap income	0.161	(0.089)	0.225 **	(0.073)	-0.048	(0.054)
labor cost	-0.139	(0.083)	-0.180 *	(0.081)	0.094	(0.079)
constant	-6.102 **	(0.224)	-6.107 **	(0.240)		
state dummies	no		yes		n.a.	
Log likelihood	-129,898		-119,961		-70,139	
Pseudo R^2	0.942		0.947		0.969	

* = 5% significance level; ** = 1% significance level.

Notes: Dependent variable is total number of food stores (SIC 5400) in county in year. N = 30,578 in all estimations. Each standard error (s.e.) is robust to clustering within each county; s.e.'s for the fixed effects regression are calculated via bootstrap with 400 repetitions. The excluded year dummy is 1988. The fixed effects regression is a "within county" specification and is estimated by conditional MLE (assuming the effects are gamma distributed).

Table 4: Estimation Results for Entry and Exit from $CM_t/CM_t/\infty$ Model—Specification A (Differences in Means Before and After the ADA)

	No Heterogeneity		Heterogeneity	
	estimate	s.e.	estimate	s.e.
Entry rate parameters				
Difference-in-mean estimates				
Years 93-94	-0.049 **	(0.016)	-0.149 **	(0.023)
Years 95-97	-0.088 **	(0.014)	-0.084 **	(0.019)
Other variables				
Area	0.044 **	(0.009)	0.015	(0.015)
Population	1.025 **	(0.007)	0.708 **	(0.010)
Per cap income	0.010	(0.044)	0.233 **	(0.058)
Capital cost	0.676 **	(0.061)	-0.102	(0.103)
Labor cost	-0.154 *	(0.062)	-0.224 **	(0.066)
Midwest	-0.243 **	(0.023)	-0.226 **	(0.037)
South	0.152 **	(0.021)	0.129 **	(0.036)
West	-0.233 **	(0.033)	-0.074	(0.044)
Constant	1.298 **	(0.021)	0.765 **	(0.036)
Failure rate parameters				
Difference-in-mean estimates				
Years 93-94	0.102 **	(0.015)	0.209 **	(0.021)
Years 95-97	0.068 **	(0.014)	0.131 **	(0.019)
Other variables				
Area	0.081 **	(0.008)	-0.006	(0.011)
Population	0.065 **	(0.006)	-0.153 **	(0.009)
Per cap income	-0.095 *	(0.040)	-0.048	(0.047)
Capital cost	1.148 **	(0.054)	1.273 **	(0.078)
Labor cost	0.009	(0.056)	0.088	(0.060)
Midwest	0.056 **	(0.020)	0.167 **	(0.025)
South	0.255 **	(0.018)	0.205 **	(0.025)
West	-0.022	(0.029)	0.145 **	(0.033)
Constant	-1.910 **	(0.019)	-2.530 **	(0.026)
Nuisance parameters				
σ_U^2			0.041 *	(0.017)
σ_V^2			0.274 **	(0.007)
τ			-0.542 **	(0.146)
ρ (correlation)			-0.688	
Log likelihood	-77836.5		-73989.15	
Pseudo R^2	0.446		0.090	
N	30,578		30,578	

* = 5% significance; ** = 1% significance.

Note: Dependent variable: total number of food stores (SIC 5400) in county in year. The excluded period dummy is the pre-ADA period 1988-1992. Standard errors are robust to clustering within county. Heterogeneous likelihood evaluated by 20 point Gauss-Laguerre quadrature. Pseudo R^2 is $1-L1/L0$, where L0 is an intercepts (plus σ_u^2, σ_v^2, and ρ in the heterogeneous model) only model and L1 is the full model.

Table 5: Estimation Results for the Number of Firms from Standard Count Models—Specification B (ADA-Specific Variables)

	Poisson Regression 1		Poisson Regression 2		Fixed Effects Poisson Regression	
	estimate	s.e.	estimate	s.e.	estimate	s.e.
Difference estimates						
% adults disabled, 1993-94	-0.056 *	(0.027)	-0.070 **	(0.018)	-0.050**	(0.011)
% adults disabled, 1995-97	-0.001	(0.035)	-0.052 *	(0.023)	-0.039**	(0.010)
EEOC charge rate, 1993-94	-0.075 **	(0.011)	-0.018 **	(0.004)	-0.010**	(0.003)
EEOC charge rate, 1995-97	-0.058 **	(0.009)	-0.014 **	(0.004)	-0.006**	(0.002)
Title III case rate, 1993-1994	-0.161 **	(0.058)	-0.008	(0.013)	-0.011	(0.014)
Title III case rate, sqrd, 1993-1994	0.033 **	(0.009)	0.005 *	(0.002)	0.005	(0.003)
Title III case rate, 1995-1997	0.005	(0.010)	0.003	(0.004)	0.000	(0.003)
Difference-in-difference estimates						
Strong FEP state, 1993-94	0.010	(0.008)	0.027 **	(0.008)	0.022**	(0.004)
Strong FEP state, 1995-97	0.012	(0.012)	0.025 *	(0.011)	0.015**	(0.004)
Main effects (apply to all years)						
% adults disabled	0.171 **	(0.040)	0.058 **	(0.016)	0.029**	(0.009)
FEP state	0.091 **	(0.019)	0.173 **	(0.067)	n.a.	
State dummies	no		yes		n.a.	
Log likelihood	-133,726		-119,791		-70,085	
Pseudo R^2	0.941		0.947		0.969	

* = 5% significance level; ** = 1% significance level.

Notes: Dependent variable is total number of food stores (SIC 5400) in county in year. N = 30,578 in regressions 1 and 2; N = 30,528 in regression 3. Each standard error (s.e.) is robust to clustering within each county; s.e.'s for the fixed effects regression are [will eventually be…] calculated via bootstrap with 400 repetitions. All estimations include all controls from Specification A (Table 3), including year dummies. All *Difference* estimates are differences from the pre-ADA period. The fixed effects regression is estimated by conditional MLE and exploits variation within each county only to identify the coefficients.

Table 6: Estimation Results for Entry and Exit from $CM_t/CM_t/\infty$ Model—Specification B (ADA-Specific Variables)

	No Heterogeneity		Heterogeneity	
	estimate	*s.e.*	*estimate*	*s.e.*
Entry rate parameters				
Difference estimates				
% adults disabled, 1993-94	-0.692 **	(0.066)	-0.357**	(0.106)
% adults disabled, 1995-97	-0.076	(0.073)	-0.046	(0.092)
EEOC charge rate, 1993-94	-0.331 **	(0.013)	-0.089**	(0.020)
EEOC charge rate, 1995-97	-0.040 **	(0.010)	-0.017	(0.014)
Title III case rate, 1993-1994	-0.084 *	(0.036)	-0.062	(0.068)
Title III case rate, 1995-1997	0.134 **	(0.021)	0.114**	(0.032)
Difference-in-difference estimates				
Strong FEP state, 1993-94	-0.101 **	(0.031)	-0.056	(0.049)
Strong FEP state, 1995-97	-0.043	(0.026)	-0.071	(0.038)
Main effects (apply to all years)				
% adults disabled	0.154 **	(0.043)	0.125*	(0.055)
Strong FEP state	-0.002	(0.020)	0.006	(0.025)
Failure rate parameters				
Difference estimates				
% adults disabled, 1993-94	-0.489 **	(0.059)	-0.462**	(0.088)
% adults disabled, 1995-97	-0.151 *	(0.068)	-0.212**	(0.082)
EEOC charge rate, 1993-94	-0.528 **	(0.013)	-0.476**	(0.017)
EEOC charge rate, 1995-97	-0.022 *	(0.009)	-0.001	(0.012)
Title III case rate, 1993-1994	0.013	(0.046)	-0.125	(0.115)
Title III case rate, 1995-1997	0.131 **	(0.018)	0.140**	(0.026)
Difference-in-difference estimates				
Strong FEP state, 1993-94	-0.163 **	(0.028)	-0.100**	(0.037)
Strong FEP state, 1995-97	-0.017	(0.024)	0.031	(0.034)
Main effects (apply to all years)				
% adults disabled	0.035	(0.042)	0.121*	(0.051)
Strong FEP state	-0.032	(0.019)	-0.046*	(0.023)
Includes Controls from Model A	Yes		Yes	
Pseudo R^2	0.451		0.073	
Log likelihood	-77077.1		-73,548.5	

* = 5% significance; ** = 1% significance. N = 30,578. Dependent variable: total number of food stores (SIC 5400) in county in year. The excluded period dummy is the pre-ADA period 1988-1992. Specification also includes all variables in specification A, previous table.

Table 6b: Instrumental Variables Estimations for Specification B (ADA-Specific Variables)

	OLS		IV Regression 1		IV Regression 2	
	estimate	s.e.	estimate	s.e.	estimate	s.e.
Difference estimates						
% adults disabled, 1993-94	-0.101 *	(0.041)	-1.509 **	(0.506)	-0.190*	(0.087)
% adults disabled, 1995-97	-0.069	(0.047)	-2.544 **	(0.630)	-0.356**	(0.126)
EEOC charge rate, 1993-94	-0.037 **	(0.007)	-0.358	(0.262)	-0.049*	(0.025)
EEOC charge rate, 1995-97	-0.040 **	(0.006)	0.592 *	(0.249)	-0.089**	(0.023)
Title III case rate, 1993-1994	-0.014	(0.026)	-1.651 **	(0.327)	-0.010	(0.038)
Title III case rate, sqrd, 1993-1994	0.013 **	(0.004)	0.443 **	(0.057)	0.011*	(0.005)
Title III case rate, 1995-1997	0.044 **	(0.011)	0.368 **	(0.107)	0.018	(0.012)
Main effects (apply to all years)						
% adults disabled	0.046	(0.046)	0.010	(0.431)	0.190	(0.174)
State dummies	yes		no		yes	
Hansen J Statistic (OverID test)	n.a.		50.643		3.469	
p-value of Hansen J Statistic	n.a.		0.000		0.628	

* = 5% significance level; ** = 1% significance level.

Notes: Dependent variable is squared root of total number of food stores (SIC 5400) in county in year. Sample is restricted to years 1991-1997. N = 21,406. Each standard error (s.e.) is robust to clustering within each county. All estimations include all controls from Specification A (Table 3), including year dummies. All *Difference* estimates are differences from the pre-ADA period. The fixed effects regression is estimated by conditional MLE and exploits variation within each county only to identify the coefficients.

Table 7: Estimation Results for the Number of Firms from Standard Count Models—Specification C (ADA-Specific Variables, Differenced over Firm Sizes)

	Poisson Regression 1		Poisson Regression 2		Fixed Effects Poisson Regression	
	estimate	s.e.	estimate	s.e.	estimate	s.e.
Small firms differenced off large firms						
Difference-in-difference estimates						
% adults disabled, 1993-94	-0.079	(0.050)	-0.125**	(0.033)	-0.123**	(0.030)
% adults disabled, 1995-97	-0.180**	(0.052)	-0.158**	(0.039)	-0.163**	(0.037)
EEOC charge rate, 1993-94	-0.062**	(0.015)	-0.019**	(0.006)	-0.014**	(0.005)
EEOC charge rate, 1995-97	-0.027*	(0.012)	-0.010	(0.007)	-0.004	(0.006)
Title III case rate, 1993-94	0.029	(0.168)	0.030	(0.027)	0.020	(0.020)
Title III case rate, 1995-97	0.009	(0.015)	-0.017*	(0.007)	-0.018**	(0.007)
Difference-in-difference-in-differences						
Strong FEP state, 1993-94	0.022	(0.016)	0.029	(0.016)	0.029*	(0.013)
Strong FEP state, 1995-97	0.034	(0.021)	0.044*	(0.021)	0.040*	(0.018)
Medium firms differenced off large firms						
EEOC charge rate, 1993-94	-0.083**	(0.020)	-0.018	(0.011)	-0.016	(0.013)
EEOC charge rate, 1995-97	-0.041**	(0.015)	-0.025**	(0.008)	-0.022**	(0.010)
State dummies	no		yes		n.a.	

* = 5% significance level; ** = 1% significance level.

Notes: N = 30,578 in each estimation, using SIC 54 data. Estimates are differences across sizes of firms (as noted in first column) in differences over time (as noted in row headings; compared to the pre-ADA period). For each specification there are three separate underlying estimations (one for each of small, medium, and large firms). All variables from Specification B are included in each estimation; only the estimates of interest are reported in the table. Each standard error (s.e.) is robust to clustering within each county, and is calculated via bootstrap with 400 repetitions to account for covariance between coefficients to be differenced.

Table 8: Estimation Results for Entry and Exit from $CM_t/CM_t/\infty$ Model—Specification C (ADA-Specific Variables, Differenced over Firm Sizes)

	No Heterogeneity		Heterogeneity	
	estimate	*s.e.*	*estimate*	*s.e.*
Small firms differenced off large firms				
Entry rate parameters				
Difference-in-difference estimates				
% adults disabled, 1993-94	-0.999**	(0.171)	-0.643**	(0.205)
% adults disabled, 1995-97	-0.023	(0.162)	0.001	(0.185)
EEOC charge rate, 1993-94	-0.234**	(0.033)	-0.020	(0.038)
EEOC charge rate, 1995-97	0.009	(0.024)	0.024	(0.027)
Title III case rate, 1993-94	-0.460*	(0.193)	-0.301	(0.213)
Title III case rate, 1995-97	0.059	(0.048)	0.046	(0.057)
Difference-in-difference-in-differences				
Strong FEP state, 1993-94	-0.203**	(0.075)	-0.153	(0.090)
Strong FEP state, 1995-97	0.056	(0.065)	0.016	(0.076)
Failure rate parameters				
Difference-in-difference estimates				
% adults disabled, 1993-94	-0.838**	(0.181)	-0.784**	(0.212)
% adults disabled, 1995-97	-0.270	(0.163)	-0.338	(0.186)
EEOC charge rate, 1993-94	-0.370**	(0.034)	-0.318**	(0.040)
EEOC charge rate, 1995-97	0.002	(0.027)	0.008	(0.031)
Title III case rate, 1993-94	-0.390*	(0.193)	-0.322	(0.232)
Title III case rate, 1995-97	0.022	(0.051)	0.034	(0.060)
Difference-in-difference-in-differences				
Strong FEP state, 1993-94	-0.372**	(0.078)	-0.337**	(0.091)
Strong FEP state, 1995-97	0.064	(0.069)	0.081	(0.081)
Medium firms differenced off large firms				
Entry rate parameters				
EEOC charge rate, 1993-94	0.049	(0.037)	0.068	(0.039)
EEOC charge rate, 1995-97	0.028	(0.029)	0.032	(0.030)
Failure rate parameters				
EEOC charge rate, 1993-94	0.088*	(0.039)	0.123**	(0.045)
EEOC charge rate, 1995-97	0.086**	(0.031)	0.071*	(0.034)

* = 5% significance; ** = 1% significance. N = 30,578. Dependent variable: total number of food stores (SIC 5400) in county in year. The excluded period dummy is the pre-ADA period 1988-1992. Specification also includes all variables in specification A, Table 5.

Table 9: Effect of the ADA on the Number, Entry, and Exit of Food Stores (Based on Specification C)

	Direct Estimates from Standard Count Data Models			Indirect Estimates from $CM_t/CM_t/\infty$ Model					
	Poisson Regression 1	Poisson Regression 2	Fixed Effects Poisson Regression	No Heterogeneity			Heterogeneity		
	Δ(Number of Firms)	*Δ(Number of Firms)*	*Δ(Number of Firms)*	*ΔEntry*	*ΔExit*	*Implied Δ((Number of Firms)*	*ΔEntry*	*ΔExit*	*Implied Δ((Number of Firms)*
Initial ADA Period: 1993-1994									
Small Firms	-1,578	-2,259	-1,928	1,600	3,057	-1,457	486	1,141	-655
%Δ in small firms	-1.1%	-1.5%	-1.3%	17.1%	21.5%	-1.0%	5.2%	8.0%	-0.4%
Medium Firms	-1,066	-343	-352	62	410	-348	161	554	-393
%Δ in medium firms	-7.1%	-2.3%	-2.3%	1.7%	9.1%	-2.3%	4.4%	12.3%	-2.6%
Total	*-2,644*	*-2,601*	*-2,279*	*1,662*	*3,467*	*-1,804*	*647*	*1,695*	*-1,048*
%Δ in small & medium firms	*-1.6%*	*-1.6%*	*-1.4%*	*12.8%*	*18.5%*	*-1.1%*	*5.0%*	*9.1%*	*-0.6%*
Later ADA Period: 1995-1997									
Small Firms	-1,623	-2,659	-2,053	2,130	1,996	134	763	504	259
%Δ in small firms	-1.1%	-1.8%	-1.4%	20.3%	15.2%	0.1%	7.3%	3.8%	0.2%
Medium Firms	-949	-1,025	-922	-48	350	-399	30	319	-289
%Δ in medium firms	-6.5%	-7.0%	-6.3%	-1.1%	7.5%	-2.7%	0.7%	6.8%	-2.0%
Total	*-2,572*	*-3,684*	*-2,975*	*2,082*	*2,346*	*-264*	*793*	*823*	*-30*
%Δ in small & medium firms	*-1.6%*	*-2.3%*	*-1.9%*	*14.1%*	*13.2%*	*-0.2%*	*5.4%*	*4.6%*	*-0.02%*

Notes: All figures are difference-in-difference estimates (net of trends for large firms) and are relative to a counterfactual "no ADA" regime. For the small firms, in the counterfactual *Title III case rate* is set to zero and *Strong FEP state* for the ADA periods is set to one. For the medium firms, in the counterfactual *Title III case rate* and *EEOC charge rate* are set to zero and *Strong FEP state* for the ADA periods is set to one. *Δ(Number of Firms)* for the direct estimates is based on coefficients from the estimations from Table 7. *ΔEntry* is calculated as the difference in $\hat{\lambda}$ [equation (9 CHECK THIS)] and *ΔExit* as the difference in $N_{t-1}\hat{\mu}$ [equation (10 CHECK THIS)] relative to the counterfactual, based on coefficients from the estimations from Table 8. *Implied Δ(Number of Firms)* is calculated as *ΔEntry* minus *ΔExit*. All figures are calculated at the county level and aggregated to the national level.

Figure 1:
Percentage Changes in the Number of Retail Establishments by SIC