Tipping Points: The Dynamics of Workplace Segregation by Race and Ethnicity*

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Abstract

Using a regression discontinuity (RD) design, I exploit the variation in base-year minority shares across single-establishment firms to document the dynamics of establishment-level segregation in two five-year intervals: 1995-2000 and 2000-2005. Using the Longitudinal Employer-Household Dynamics (LEHD) infrastructure files, I first show that systematic establishment-level segregation still exists in all industries. Then, I show that the dynamics of segregation among these single-establishment firms are non-linear and exhibit "tipping" patterns in both five-year intervals, although the magnitude is much larger in the earlier time period. The observed tipping pattern is primarily driven by non-Hispanic whites leaving. The effect due to minorities entering is much smaller. Alternative explanations such as non-linear changes in establishment characteristics or omitted variables do not explain the observed changes in minority shares. Finally, I find that, unlike the 1995-2000 period, during which tipping behavior seems to have been driven equally by blacks and Hispanics, Hispanics are the sole driving force in the 2000-2005 period. Taken together, this paper provides the first suggestive evidence that the dynamics of establishment-level segregation are highly nonlinear and exhibit a tipping pattern that is largely consistent with the Schelling (1971) social interaction model.

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1 Introduction

With the rise in minority shares in the U.S., research has demonstrated that racial and ethnic segregation still prevails in residential places (Cutler, Glaeser and Vigdor, 1999; Ananat, 2007; Card, Mas and Rothstein, 2008a), in schools (Caetano and Maheshri, 2013), and in the labor market (Higgs, 1977; Albelda, 1986; Carrington and Troske, 1998; Hellerstein and Neumark, 2003; Hellerstein, Neumark and McInerney, 2008; Gradín, del Río and Alonso-Villar, 2011). Segregation in the labor market is said to exist if members of different groups are more likely to work with coworkers who are more like themselves than would be predicted by a random allocation of workers to firms (Hellerstein and Neumark, 2008).

Labor market segregation by race and ethnicity is an important area of research because, leaving aside the potential social issues, it may account for - at least in a statistical sense - a significant share of wage differentials between whites and various minority groups (Hellerstein, Neumark and McInerney, 2008). To date, most empirical research has documented the magnitude of segregation at the industry-level or at the occupation-level (Higgs, 1977; Albelda, 1986; King, 1992; Gradín, del Río and Alonso-Villar, 2011), and identified some of its possible causes (Carrington and Troske, 1998; Hellerstein and Neumark, 2003, 2008). Segregation at the workplace level, however, has been noticeably under-studied. Data constraints, in particular, the lack of matched employer-employee data, have been a major cause. Nonetheless, research on workplace segregation should be emphasized because it may be much more salient for interactions between racial and ethnic groups than is residential segregation. In fact, Hellerstein, Neumark and McInerney (2008) found that racial and ethnic segregation at the three-digit industry level is usually one-third as large as the establishment-level segregation experienced by minority workers. In this paper, I will first document the extent of racial and ethnic segregation at the workplace level using the Longitudinal Employer-Household Dynamics (LEHD) infrastructure files – a matched employer-employee dataset.

In the literature on residential segregation, Card, Mas and Rothstein (2008a) have shown

that once the base-period minority share in a census tract reaches a certain level, white flight occurs. They define such phenomenon as the evidence of tipping and assert that tipping process can capture the underlying mechanism that leads to residential segregation. Caetano and Maheshri (2013) have demonstrated that a similar tipping effect also exist in school segregation. The dynamic process of labor market segregation, on the other hand, is not as well understood. The dynamics of labor market segregation have crucial implications for understanding its persistence. Better understanding of the dynamics might also facilitate the evaluation of policy measures aimed at promoting racial and ethnic integration in the context of the labor market. The second goal of this paper is to use the LEHD infrastructure files to begin to unravel the dynamics of workplace segregation by race and ethnicity.

Figure 1 illustrates that the sudden percentage changes in net establishment-level white employment, defined as the percentage change in white employment net of the percentage change in minority employment, [1] in all industries pooled, and in the service-producing NAICS supersector [2] appear to be related to a workplace's base-period minority share. Here and throughout the paper, minorities are defined as nonwhites and white Hispanics; whites are defined as non-Hispanic whites only. Each plot depicts the mean percentage changes in net white employment from 1995 to 2000 deviated from the average of the same variable within the NAICS sector, grouping establishments into one-percentage-point wide cells by the minority share in 1995. Figure 1 shows striking evidence of non-linearities in the percentage change in net white employment. Such non-linearities may be a function of base-period minority share. This is suggestive of the existence of a "tipping phenomenon" at the workplace, where workplace minority composition increases rapidly once the the base-year minority share reaches or exceeds a critical threshold. The threshold level at which this rapid change occurs is called a "tipping point (Card, Mas and Rothstein, 2008a; Pan,

[1] The percentage change in establishment-level white employment is expressed as the change in white employment as a percentage of the total employment in a single-establishment firm in the base year. The percentage change in establishment-level minority employment is defined in a similar manner.

[2] Refer to Appendix A. for definitions. In this paper, industries and NAICS sectors are used interchangeably.

2010)."

What theoretical model can explain these non-linear patterns of workplace minority composition changes? I hypothesize that the classic social interaction model posited by Schelling (1971) can account for this empirical finding. A large body of work has focused on theorizing about the causes of segregation, for instance, the statistical discrimination models (Phelps, 1972; Arrow, 1973), the taste-based discrimination theory (Becker, 1971; Blau, Ferber and Winkler, 2010), the "pollution" theory of discrimination (Goldin, 2002), and other models using supply and demand in the labor market (Altonji and Blank, 1999; Kaufman, 2002; Reskin, McBrier and Kmec, 1999; Sørensen, 2004). However, these explanations overlook the possible effect of "post-hiring" dynamics on workplace composition (Sørensen, 2004) and provide little insight on the underlying mechanisms driving the segregation. Schelling (1971), on the other hand, developed the social interaction model to show that substantial segregation can arise from social interactions and weak prejudice against one group (Card, Mas and Rothstein, 2008a; Pan, 2010). Since its development, Schelling's model has been used in many areas of research such as residential segregation (Card, Mas and Rothstein, 2008a) and gender segregation in the labor market (Pan, 2010).

This paper studies the possible effects of "post-hire" dynamics on workplace composition. It attempts to unravel the underlying dynamics of workplace segregation by race and ethnicity. I test whether establishments exhibit "tipping"-like behavior in response to firm-specific shocks in minority labor supply that occur over two five-year intervals: 1995-2000 and 2000-2005. I also analyze the shifting composition of single-establishment firms in the U.S. labor market, which could help explain the persistence of segregation and shed light on the potential effectiveness of policies promoting workplace integration. Only Sørensen (2004) has investigated workplace dynamics and minorities in the paper modeling the relationship between worker turnover and the racial composition of the employing establishment's workforce using a three-year panel data of one multi-unit firm. The author finds that the worker turnover rate is negatively correlated with the minority share in that firm.

This paper uses a Regression Discontinuity (RD)-tipping design as developed by Card, Mas and Rothstein (2008a) and also used by Pan (2010). As depicted in Figure 1, the RD research strategy exploits the cross-sectional variation in base-year minority shares across workplaces to test whether workplaces exhibit tipping patterns as the initial minority share in a workplace exceeds a certain critical threshold. The location of the candidate tipping points is assumed to be sector-specific and is identified by a "fixed-point" procedure that builds on the shape of Figure 2. Figure 2 plots the mean net percentage changes in white employment in the construction sector (NAICS Sector 23) from 1995 to 2000 against the minority share in 1995. The horizontal line depicts the unconditional mean net white employment growth. The vertical line is the estimated tipping point using the "fixed-point" procedure elaborated below. The figure shows clear evidence that, compared to an average single-establishment firm in the construction sector, white employment increases relative to minority employment to the left of the tipping point and decreases substantially to the right of the tipping point. In Appendix Figure 1, I show that similar patterns exist in a broad sample of sectors for both of five-year intervals studied.

Unlike the work of Pan (2010), which is conducted using occupation-state cells and is agnostic about the level at which the tipping mechanism operates, this paper uses establishment-level data from the Census Bureau's LEHD infrastructure files. With these data, I can study employment segregation dynamics at the otherwise hard-to-observe workplace level, where I expect to produce more accurate estimates of the magnitude of segregation and the tipping effect. Moreover, the linked employer-employee data structure enables me to show the shifting racial and ethnic composition of employers at the workplace level. In this way, my study delineates potential mechanisms under which workers respond to changes in the minority composition of their employers.

To motivate my econometric analyses, I first use the Duncan and Duncan index of dis-

similarity [3] to show that segregation exists in the sample of firms used in this study. Because the social interaction model relies on the explicit assumption that workers have perfect information about minority shares, I use only single-establishment firms in the analysis. [4] Thus, most of the firms in my sample are small- to medium-sized. For small firms, indices such as the Duncan and Duncan index and the Gini index, which are widely used to quantify segregation, tend to overestimate its true magnitude (Carrington and Troske, 1997, 1998). This issue was first elaborated by Blau (1977) in the gender segregation literature. The causes of this distortion are two-fold: first, an integer constraint exists in which each worker must be uniquely allocated to one unit; second, the random allocation of workers to units does typically generate some deviation from complete evenness for small firms (Blau, 1977). To address this problem, Blau (1977) develops a random worker-to-firm allocation model. Inspired by Blau's model, I first verify systematic workplace-level segregation by computing the actual and expected Duncan and Duncan indices. Then, I proceed to my tipping-point estimation.

Turning to the employment dynamics, I find that establishment-level segregation is widely evident at the end of both five-year time periods. Using the 2000 and 2005 establishment-level data from the LEHD infrastructure files, I find that, compared to whites, minorities are much more likely to work at firms with at least 50 percent minority employment. I further

[3]The Duncan and Duncan index of dissimilarity is a measure widely used to quantify the degree of segregation. It can be written as

$$D_{i-j}^{K} = \frac{\sum_{k=l}^{K} |X_i^k - X_j^k|}{2}$$

where i and j denote different demographic groups; X_i^k and X_j^k denote the percent distribution of group i and j in occupation/industry/firm k; therefore $\sum_i^k = 100$ and $\sum_j^k = 100$ hold. Basically, the value of the index indicates the percentage of workers in group i who must change occupations/industries/firms to achieve an occupational/industry-wide/firm distribution identical to that of the group j workers. The index takes values between zero and one. When it equals zero, it indicates that groups i and j have the identical occupational distributions, i.e. no segregation; when the index equals 100, it indicates that group i and j workers are never in the same occupation, i.e. complete segregation.

[4]One clarification is necessary before delving into details. In this paper, the definitions of firms and establishments follow Abowd *et al.* (2009) in which establishments are defined as the place where the employees actually perform their work, and firms are defined as the legal entities that employ workers. Thus, firms can either be single-establishment employers or multi-establishment employers. In the following sections, the terms workplace, establishment, and single-establishment firm share the same definition and are used interchangeably in this paper.

confirm the existence of systematic workplace segregation across all sectors in both years. The average estimated candidate tipping points, which are measured in base-year minority shares and are estimated using the fixed-point procedure, are 14.16 percent in 1995-2000 and 15.51 percent in 2000-2005. Heterogeneity in the locations of the candidate tipping points does exist by industry.

In summary, I find strong evidence confirming that tipping exists in both five-year intervals among the single-establishment firms in the sample and it is rather robust to adding flexible controls of establishment-level covariates. I also demonstrate that the observed tipping pattern is mostly driven by non-Hispanic whites leaving. The effect due to minorities entering is small or even trivial. Such findings suggest that tipping patterns are associated with shrinking firms. That raises the concern that rather than social interactions, it may just be that whites are leaving firms that are not performing well. To address this concern, I restrict the analysis to establishments with minimal employment changes over each five-year period. Results show that the same tipping patterns still emerge. Alternative explanations, such as nonlinear changes in establishment characteristics, also fail to explain the observed effects. The tipping patterns described above are primarily found in service-producing sectors rather than in the goods-producing sectors. Finally, I find that, unlike the 1995-2000 period, during which tipping behavior was driven equally by blacks and Hispanics, Hispanics are the sole driving force in the later 2000-2005 period. Taken together, this paper provides some of the first evidence suggesting that the dynamics of establishment-level segregation are highly nonlinear and exhibit a tipping pattern that is largely consistent with the Schelling (1971) social interaction model.

The paper is organized as follows. Section 2 lays out the model and the identification strategy and research design. Section 3 elaborates on the firm-level data from the LEHD infrastructure files, the unit of analysis, and the sample for this paper. In Section 4, a model of the random allocation of workers to firm developed by Blau (1977) is used to baseline the extent of racial and ethnic segregation in the sample. Section 5 shows the

main empirical results on tipping. Robustness checks are also presented. In particular, section 5.4 goes beyond estimating tipping patterns to study the dynamics of the shifting composition of firms. The question is whether the observed tipping pattern is driven by white flight or by minority entry. In section 5.7, I explore various definitions of "minority" and examine whether these distinct racial and ethnic minority groups drive the tipping pattern differentially. Finally, Section 6 summarizes and concludes.

2 Model and Identification Strategy

My goal is to investigate the underlying mechanism that leads to workplace segregation by race and ethnicity. In particular, I want to test whether workplaces exhibit tipping patterns as the initial minority share in a workplace exceeds a certain critical threshold. The main analysis assesses whether social interaction models, as originally outlined by Schelling (1971), can account for the empirical evidence on nonlinear patterns of workplace minority composition changes. A brief review of Schelling's model (originally applied to residential segregation) is presented in Appendix B. Schelling's tipping model has two key features: (1) for tipping to occur, heterogeneity in preferences over neighborhood minority composition must exist; and (2) because the tipping point and the actual tipping are characterized as an unstable equilibrium and a dynamic adjustment process, there must be some friction that ensures that individuals do not always immediately go to the long-run stable equilibrium. In Schelling's model, this friction arises because individuals are myopic decision-makers (Caetano and Maheshri, 2013). Following the standard setup, the theoretical model presented in section 2.1 adopts these two key features as well.

A central insight of Schelling's model is that at any given point, neighborhoods may be observed in the process of tipping, i.e., in disequilibrium, rather than a stable long-run equilibrium. However, most current empirical neighborhood-choice models assume that household choices are observed in equilibrium. Models that are always in equilibrium cannot

be used to implement empirical versions of Schelling's tipping model (Caetano and Maheshri, 2013). Card, Mas and Rothstein (2008a) circumvented this problem using an approach that identifies a tipping point as a bifurcation point or threshold around which the flows of both whites and minorities are quantitatively different (Caetano and Maheshri, 2013; Card, Mas and Rothstein, 2008a,b). In other words, unlike Schelling's model, in which the only stable equilibria are complete segregation and the neighborhood tipping points are characterized as disequilibria, the tipping points in Card, Mas and Rothstein (2008a) represents the maximum minority share at which a neighborhood can maintain a stable integrated equilibrium (Card, Mas and Rothstein, 2008a,b) which permits empirical identification. This paper builds on Card, Mas and Rothstein (2008a). I present in this section a model of firm tipping and an identification strategy to estimate the tipping phenomenon at the workplace level. A direct empirical implementation examines whether evidence of discontinuous changes in workplace minority composition at candidate tipping points exists.

2.1 A Model of Firm Tipping

I present a simple, static, partial equilibrium model in which whites' labor supply to single-establishment firms depends on the share of minority workers in that firm. I assume homogeneity in the job positions. [5] To focus attention on workers' labor supply decisions, I assume that labor demand is constant and that employers are non-discriminating. Based on these assumptions, in a partial equilibrium, workers from different groups will be paid equal wages in the same firm. [6]

Assume that there are two types of workers with distinct racial and ethnic characteristics:

[5] According to Appendix A., NAICS "groups establishments into industries based on the activity in which they are primarily engaged. Establishments using similar raw material inputs, similar capital equipment, and similar labor are classified in the same industry...." (www.bls.gov/bls/naics.htm). Since the analysis is conducted in a sector-specific manner, this assumption is not unreasonable.

[6] The implicit assumption here is that workers from different racial and ethnic groups are perfect substitutes. Though assuming non-discriminating firms is a strong assumption, Becker (1971) developed a model of employee discrimination showing that employees' tastes of discrimination alone can lead to labor market segregation. Additionally, even if an employer has a taste of discrimination, Blau (1977) argues that there are institutional constraints internal to a firm that place limits on the employer's ability to differentiate among individual workers.

non-Hispanic whites (W) and racial/ethnic minorities (M). Workers observe the wage offers posted by all firms. Workers have perfect information about the minority shares in each firm, which are denoted as $R_j = \frac{N_j^M}{N_j^M + N_j^W}$, where j indexes the firm, and N_j^M and N_j^W are the total employment of minorities and whites in firm j. Workers are utility maximizing agents who differ in their tastes and preferences for the minority share at their employers.

Due to the assumption of perfect information on wage offers and minority shares in each firm, i.e., (ω_j, R_j), worker i of type $t \in \{W, M\}$ solves the following problem:

$$\begin{aligned} &\max U_i^t(\omega_j, R_j) \\ &s.t.\ j \in \{1 \cdots J\} \end{aligned}$$

where $U(\cdot, \cdot)$ is continuous and twice differentiable. The following first-order and second-order conditions also hold:

$$\begin{aligned} \frac{\partial U}{\partial \omega} > 0 \quad &\& \quad \frac{\partial^2 U}{\partial \omega^2} < 0, \quad \forall i,\ t \\ \frac{\partial U}{\partial R} < 0 \quad &\& \quad \frac{\partial^2 U}{\partial R^2} > 0, \quad \forall i,\ t \end{aligned}$$

Workers are myopic in the sense that they make decisions based on the wage offers and minority shares they observe without taking into account the simultaneous decisions made by other agents. Let n_j^t denote the number of workers of type t who supply their labor to firm j. Then, n_j^t can be written as:

$$\begin{aligned} n_j^t &= \sum_i \mathbf{1}(i : j = argmax\ U_i^t(\omega_j, R_j), j \in \{1 \cdots J\}) \\ &= n_j^t(\omega_j, R_j) \end{aligned}$$

In this model the labor supply of type W and type M workers to firm j depends on the firm's wage rate ω_j and its share of minority workers, R_j. Given the continuity and monotonicity of the utility function, the inverse labor supply functions exist and are unique. Let $\omega_j^W(n_j^W, R_j)$ and $\omega_j^M(n_j^M, R_j)$ be the inverse labor supply functions. Taking $\omega_j^W(n_j^W, R_j)$

as an example, "n_j^W" whites are willing to work in firm j with minority share R_j and wage ω_j^W. In a partial equilibrium with non-discriminating employers, fixed labor demand, and perfect substitutability, the following condition holds:

$$\omega_j^W(n_j^W, R_j) = \omega_j^M(n_j^M, R_j) \quad \forall\ j \tag{1}$$

To simplify the notation in what follows, the firm index j is dropped, but all the equations are derived at the firm level. Due to the construction of the inverse labor supply functions, $\frac{\partial \omega^W}{\partial n^W}$ and $\frac{\partial \omega^M}{\partial n^M}$ are weakly positive. The cross derivatives of the inverse labor supply function, $\frac{\partial \omega^W}{\partial R}$ and $\frac{\partial \omega^M}{\partial R}$, represent the social interaction effects. These interactions imply that whites require a premium to work with minorities in firms. This premium is assumed to be higher in firms with higher minority shares, i.e., $\frac{\partial \omega^W(n^W, R)}{\partial R} > 0$. and $\frac{\partial^2 \omega^W(n^W, R)}{\partial^2 R} > 0$.

Under the assumption that labor demand is fixed and that employers are non-discriminating, I normalize the total number of workers in a firm to $\bar{L} = n^W + n^M = 1$. Given this normalization, in an integrated equilibrium with minority share $R \in (0, 1)$, we have the following condition:

$$\omega^W(1 - R, R) = \omega^M(R, R) \tag{2}$$

where $n^M = R$ and $n^W = 1 - R$. The derivative of $\omega^W(1 - R, R)$ with respect to the minority share is:

$$\frac{\partial \omega^W(1 - R, R)}{\partial R} = -\frac{\partial \omega^W}{\partial n^W} + \frac{\partial \omega^W}{\partial R} \tag{3}$$

In equation (3), the first term is negative. With a positive social interaction effects, the white inverse labor supply function is unlikely to be monotonically increasing. If $\frac{\partial \omega^W}{\partial R}$ is small at $R = 0$ and becomes more positive as R increases, the white inverse labor supply function may initially be downward sloping. As the minority share rises, the positive social interaction effect will dominate, which leads to an upward-sloping inverse labor supply curve.

[7] For illustrative purposes, $\omega^M(n^M, R)$ is assumed to be upward-sloping and linear. [8] The two inverse labor supply curves are depicted in Figure 3.

The firm depicted in Figure 3 has three equilibria: two integrated equilibria and one all-minority equilibrium. Point A is a locally stable integrated equilibrium. For instance, for any small perturbation to the right of point A, the marginal minority worker requires a higher wage than the marginal white worker, and the non-discriminating firm will therefore hire the marginal white worker, which will return the system to point A. Using similar reason, point B is not a stable equilibrium. Any positive shock at B will start the system trending toward the all-minority equilibrium C instead of back to B.

An increase in the supply of minority workers pushes the minority inverse labor supply function downward, as shown in Figure 4. Figure 4 illustrates a series of equilibria for this firm due to such a shift, assuming the white inverse labor supply function has the shape illustrated in Figure 3. At the low level of minority labor supply, $R = 0$ is a stable equilibrium (point A_0 in Figure 4). However, as the minority labor supply increases, i.e., ω^M shifts downward, wages begin to fall, and a few minority workers displace whites with the lowest willingness to supply. The firm will be in a stable integrated equilibrium (such as points A_1 and A_2 in Figure 4). Further increase in the supply of minority labor will cause the minority share to increase until ω^M is just tangent to ω^W. The minority share denoted as R^* is a "tipping point," representing the maximum minority share at which a firm can be in a stable integrated equilibrium. Once $R = R^*$, any further increase in minority labor supply will cause the integrated equilibrium to disappear and will lead to a fully segregated equilibrium (all-minority equilibrium, i.e., point D's in Figure 4). The location of the tipping point (R^*) depends on the strength of the social interaction effect.

[7] To ensure the existence of the critical point R^*, the social interaction function needs to be steeper than the function that characterizes the derivative of the own inverse labor supply curve, i.e. the following condition needs to be true: $\frac{\partial^2 \omega^W(n^W, R)}{\partial R^2} > \frac{\partial^2 \omega^W(n^W, R)}{\partial n^{W\,2}}$

[8] The derivative of the minority inverse labor supply function with respect to R is $\frac{\partial \omega^M}{\partial n^M} + \frac{\partial \omega^M}{\partial R}$; this could be downward if minorities have strong distaste towards all-white firms when R is low.

Several points are worth emphasizing. First, notice that this model features a one-sided tipping pattern: firms with minority shares below the tipping point are potentially stable, but those that exceed the critical threshold rapidly converge to 100 percent minority composition. This contrasts with the classic Schelling model, which delivers a two-sided tipping outcome. [9] Second, my model delivers a tipping point even though white preferences for firm-level racial composition are continuous. In addition, wages evolve smoothly through the tipping point, even though employment shares change discontinuously. The smoothness of wages around the tipping point occurs because the upward-sloping minority inverse labor supply curve takes over smoothly from the white inverse labor supply curve at the discontinuity. Wages at the long-run $R = 1$ equilibrium can be higher or lower than at the tipping point depending on the shape of the minority inverse labor supply curves and their movements once tipping is underway.

2.2 Empirical Implementation

Figure 4 assumes steady increases in relative minority labor supply (i.e. $\omega^M(R, R) - \omega^W(1 - R, R)$). On average, this is likely to be true because since the passage of the 1965 Immigration Act, the U.S. has experienced a new wave of immigration. These so-called "new immigrants" are mostly from less industrialized countries in South America and Asia (Xie and Gough, 2009). Due to firms' geographic dispersion and depending on the sectors which the firms belong to, there are likely to be firm-specific shifts in relative labor supply of whites and minorities. The model presented above explains how firm-level minority composition responds to these firm-specific shocks in relative minority labor supply. These insights can be broadly summarized with three scenarios:

(i) For a firm with an initial minority share R_{t-1} somewhat less than R^*, small shifts in relative minority labor supply will produce small changes in the location of the

[9] Using the census tract-level data from 1970 to 2000, Card, Mas and Rothstein (2008b) find evidence that suggests tipping behavior is one-sided, and that minority composition in neighborhoods with initial minority shares below the tipping points stay relatively stable over time.

integrated equilibrium, and the firm will move smoothly toward the new integrated equilibrium, so long as the minority share remains below R^*. Formally, for the set of firms with initial minority share $R_{t-1} \in [0, R^* - s)$ where s represents the maximum relative minority labor supply shock between period $t-1$ and t, $E[\Delta R_t \mid R_{t-1}] = g(R_{t-1})$ for some continuous function $g(\cdot)$.

(ii) Firms with initial minority share above R^* have already begun tipping, the expected change in minority shares for such firms is going to be positive and large. Formally, for the set of firms with initial minority share $R_{t-1} > R^*$, $E[\Delta R_t \mid R_{t-1}] = h(R_{t-1}) > 0$.

(iii) The intermediate range, firms with initial minority share in $[R^* - s, R^*]$, will tip only if they experience sufficiently large shocks, but not otherwise.

Assuming s is very small, then the $E[\Delta R_t \mid R_{t-1}]$ can be written as follows:

$$E[\Delta R_t \mid R_{t-1}] = \mathbf{1}(R_{t-1} < R^*)g(R_{t-1}) + \mathbf{1}(R_{t-1} \geq R^*)h(R_{t-1}) \tag{4}$$

If $\lim_{\epsilon \to 0+} h(R^* + \epsilon) - g(R^* - \epsilon) > 0$, the right-hand side of equation (4) is discontinuous at R^* leading to a "jump." Given the nature of $g(\cdot)$ and $h(\cdot)$, such a jump is likely to be large. As a result, the empirical strategy is to test for a discontinuity in $E[\Delta R_t \mid R_{t-1}]$ at candidate values of R^*. Strictly speaking, a consequence of equation (4) is that for some firms, some time horizons, and some heterogeneity in the location of firm-specific tipping points the function $E[\Delta R_t \mid R_{t-1}]$ might not be strictly discontinuous at R^*. Instead, it will be very steep with a slope in the $[R^* - s, R^*]$ range. In this paper, such a pattern, if any, is also interpreted as evidence of tipping.

2.3 Empirical Strategy & the Identification of the Tipping Point

The empirical analysis uses data for single-establishment firms. I measure changes in their employment composition over a five-year interval. [10] Because the social interaction model relies on the explicit assumption that workers have perfect information about minority shares, I use only single-establishment firms. Let $W_{ijs,t}$, $M_{ijs,t}$ and $P_{ijs,t} = W_{ijs,t} + M_{ijs,t}$ denote the total numbers of whites, minorities, and total employment in firm i, industry j, state s and year t. The main dependent variable, which measures the establishment minority composition changes over a five-year interval, is the percentage change in net white employment,

$$Dw_{ijs,t} = \frac{(W_{ijs,t} - W_{ijs,t-5})}{P_{ijs,t-5}} - \frac{(M_{ijs,t} - M_{ijs,t-5})}{P_{ijs,t-5}} \tag{5}$$

In order to reveal the dynamics of the shifting composition of firms and document whether the observed tipping patterns are driven by white flight or minorities entering, I also examine the analogous measures for whites and minorities, separately,

$$\frac{(W_{ijs,t} - W_{ijs,t-5})}{P_{ijs,t-5}} \; and \; \frac{(M_{ijs,t} - M_{ijs,t-5})}{P_{ijs,t-5}} \tag{6}$$

The key explanatory variable is the base-year minority employment share in a firm,

$$R_{ijs,t-5} = \frac{M_{ijs,t-5}}{P_{ijs,t-5}} \tag{7}$$

Equation (4) from section 2.2 implies that $E[Dw_{ijs,t} \mid R_{ijs,t-5}]$ is a smooth function of $R_{ijs,t-5}$ except, perhaps, at the tipping point R^*. In this paper, the tipping point, if any, is assumed to be industry specific because some industries may be more prone to minority

[10] In previous studies on residential and occupational segregation that employ a similar empirical strategy, 10-year changes calculated from the decennial census of population are usually used (Card, Mas and Rothstein, 2008a,b; Easterly, 2009; Pan, 2010). In this paper, instead of 10-year changes, I use five-year changes because: (1) workplace dynamics are more volatile compared to census tracts and occupations; and (2) data from the LEHD infrastructure files are collected more frequently than the population census data. This eliminates some of the data limitations faced by previous studies.

inflows than others. For instance, in 1995, approximately 17 percent of total employment in the construction sector was black or Hispanic. This share increased to 21 percent in 2000 and to nearly 30 percent in 2005. In comparison, the percentage of blacks and Hispanics employed in finance, insurance, and real estate has remained between 16 to 18 percent since 1995. [11]

Denote $R^*_{j,t-5}$ as the potential tipping point for industry j in year $t-5$, let $\delta_{ijs,t-5} = R_{ijs,t-5} - R^*_{j,t-5}$ be the deviation in minority share of firm i from its industry specific tipping point. The basic empirical specification is:

$$Dw_{ijs,t} = \phi(\delta_{ijs,t-5}) + d\mathbf{1}[\delta_{ijs,t-5} > 0] + X_{ijs,t-5}\beta + \eta_j + \tau_s + \varepsilon_{ijs,t} \tag{8}$$

where $\phi(\cdot)$ is a smooth control function, modeled as a third-order polynomial; η_j is the fixed NAICS sector effect, τ_s measures the fixed state effect; $X_{ijs,t-5}$ is a vector of firm-level control variables. The contols including the share of workers who are at least 57 years old in the base period ($\%RET_{ijs,t-5}$). The age cutoff is set to be 57 years old because people of this age or older are at risk of retiring during the next five-year window. Age 62 is the earliest age that one can claim social security benefits for retirement. Many studies have confirmed the effects of social security benefits on the elderly labor supply. Firms might experience decreases in white employment simply because they have larger shares of workers who are close to retirement age. Firm-level controls also include the share of young workers ($\%YOUNG_{ijs,t-5}$). In this paper, young workers are defined as those who are 24 years old or younger in the base-period. Because young workers tend to change jobs more frequently, firms might experience large changes in minority composition simply because they have larger shares of younger workers. Finally, firm-level log average earnings ($\log \overline{e_{ijs,t-5}}$) are also controlled because workers may leave a firm simply because they find better pay

[11] Due to data limitations, only blacks and Hispanics are discussed here. Data are retrieved from the 1995, 2000, and 2005 Statistical Abstract data collected for the Statistical Compendia program (http://www.census.gov/prod/www/statistical_abstract.html). The data are collected from the section on Labor Force, Employment and Earnings.

elsewhere.

Unlike most research using the conventional RD design, in which the running variable [12] and the cutoff are clearly defined, a critical issue in estimating an empirical model like equation (8) is that the discontinuity point $R^*_{j,t-5}$ is unknown and must be estimated from the data. To elucidate the method used to obtain the candidate tipping point, assume, for the moment, that a tipping point do exists. The method used here, the so-called "fixed-point" procedure, is borrowed from Card, Mas and Rothstein (2008a). This approach uses the shape of smoothed approximation to $E[Dw_{ijs,t} \mid j, R_{ijs,t-5}]$ for industries. Figure 2 reveals that firms that have not hit the industry-specific tipping point tend to experience greater-than-average growth in net non-Hispanic white employment; however, firms that have reached or exceeded the industry-specific tipping point tend to experience relative declines. Formally, this finding implies the following:

$$E[Dw_{ijs,t} \mid j, R_{ijs,t-5} = R^*_{j,t-5} - \xi] > E[Dw_{ijs,t} \mid j] > E[Dw_{ijs,t} \mid j, R_{ijs,t-5} = R^*_{j,t-5} + \xi] \quad (9)$$

for some $\xi > 0$. Thus, the industry-specific tipping point is the minority share at which the white employment of a firm grows at the average rate for the industry. To identify this level, I first obtain a smooth approximation to $E[Dw_{ijs,t} \mid j, R_{ijs,t-5}] - E[Dw_{ijs,t} \mid j]$ and then solve for the root of this function, which is the industry-specific tipping point. [13] If the functional form is correct, this procedure will consistently estimate the location of the tipping points. A result in the structural break literature is that sampling error in the location of a change point (e.g., $R^*_{j,t-5}$) can be ignored when estimating the magnitude of the break (e.g., d) (Card, Mas and Rothstein, 2008a). I borrow this result and do not adjust the standard errors for the estimation of $R^*_{j,t-5}$.

[12] It is also known as the observed "assignment" variable that determines the treatment status in the RD literature (Lee and Lemieux, 2010).

[13] A detailed description on the "fixed-point" procedure can be found in Appendix C. on Tipping Estimation.

2.4 Hypothesis Testing

Because equation (8) is estimated using the candidate tipping points located using the data, the estimates of d, $\widehat{d}$ will have a non-standard distribution under the null hypothesis that there is no discontinuity (Hansen, 2000). Card, Mas and Rothstein (2008a) call this a specification-research bias problem. Conventional test statistics tend to reject the null hypothesis $d = 0$ too often. Hansen (2000) recommends comparing the estimates to a simulated distribution of $\widehat{d}$ under the null hypothesis that there is no discontinuity. Card, Mas and Rothstein (2008a) propose a split-sample technique that uses a randomly selected sub-sample [14] to locate the tipping point and the remainder of the sample to estimate the magnitude of the tipping effect. The authors claim that because the two sub-samples are independent, estimates of $\widehat{d}$ from the second sub-sample will still have a standard distribution and will thus permit conventional hypothesis testing under the null hypothesis. In this paper, the split-sample technique is used to facilitate conventional hypothesis testing. I use a simple random 50 percent subset of my sample for the estimation of the tipping points. The remaining 50 percent is used for further econometric analysis.

3 Data & Sample

3.1 Firm-level Data and Unit of Analysis

The Longitudinal Employer-Household Dynamics (LEHD) infrastructure file system is a job-based longitudinal frame designed to represent the universe of individual-employer pairs covered by the state unemployment insurance system reporting requirement (with federal employees added in 2012). Information about employer characteristics is constructed using the Quarterly Census of Employment and Wages (QCEW). Demographic information about workers comes from two administrative data resources: the Person Characteristics File (PCF)

[14] Two-thirds of the sample was used to locate the tipping points in Card, Mas and Rothstein (2008a) because the "fixed-point" procedure is quite data-intensive.

and the Composite Person Record (CPR), which are sourced from administrative records. The longitudinally linked employer-employee structure of the LEHD data allows researchers to follow both workers and firms over time. Additionally, one can also identify workers who share a common employer in any given quarter. Firms in the LEHD data are defined by their state-level unemployment insurance account number. [15] Basic information about firms includes total payroll, firm size, firm age, geography, and industry. Information on individual demographic characteristics includes race, ethnicity, education, date of birth, sex, and place of birth. A more comprehensive overview and description of the LEHD infrastructure files can be found in Abowd *et al.* (2009).

To explore labor market segregation by race and ethnicity, there is a question of what the appropriate unit of analysis should be (Pan, 2010). Goldin (2002) finds that the "pollution" of occupational prestige by women may occur at the level of firms, occupations, industries, or within some sort of spatial boundaries such as cities, municipalities, or states. Due to the lack of availability and accessibility of firm-level datasets, most studies have focused on racial segregation at the level of occupations or industries. However, Hellerstein, Neumark and McInerney (2008) found that racial and ethnic segregation at the three-digit industry level in the Decennial Employer-Employee Dataset (DEED) is usually one-third as large as the establishment-level segregation they document. They further assert that workplaces, i.e., establishment, should be the units of observation for studying labor market segregation since the essence of social interaction among workers is better captured at the workplace level.

Using the LEHD infrastructure files, this study can be conducted at the level of establishments or workplaces by considering only the single-establishment firms. Since the main dependent variable is the five-year change in non-Hispanic white employment as a fraction of the base-year total employment net of the minority fraction, this paper does not exploit

[15] That is to say, for example, a Target in New York and a Target in New Jersey are considered different firms, but a Target in Ithaca, New York, and a Target in Binghamton, New York, are considered to be part of the same firm.

the full longitudinal structure of the LEHD data but focuses on changes over two five-year windows: 1995 to 2000 and 2000 to 2005. These five-year windows were chosen to be consecutive and to cover a 10-year time span. The base year of the first five-year interval was chosen such that the sample covers a sufficient number of states. Since many states provide data to the LEHD program beginning in the mid-to-late 1990s, [16] I choose 1995-2000 to be the first five-year interval. To avoid any possible confounding impact due to the Great Recession, no further analysis is conducted for 2005-2010.

3.2 Sample

The sampling universe (frame), which is applied to both five-year intervals, is defined as follows: (1) firms must be private, non-farm (no NAICS sector 11) and non-public administration (no NAICS sector 92) firms; (2) firms must remain single-establishment in the base year and in the end year of a five-year interval; and (3) firms' establishment-level employment growth during a five-year interval must lie within 2.5 standard deviations of the state and NAICS sector averages for that time window. The purpose of restricting the sample in this manner is to avoid results driven by extreme values. The samples used for the 1995-2000 and 2000-2005 analyses are 50 percent simple random samples of establishments in each frame. The sampling procedure also selects the worker-level data for all individuals who are employed in their dominant job at the selected single-establishment firms in the base year and in the end year of a five-year interval.

Given the quarterly-based LEHD infrastructure files, there are many ways to construct the main dependent variable. In this paper, I used measures based the beginning-of-quarter employment in the second quarter [17] to construct the variables used in the empirical specification. The rationale is that the April 1 (the beginning of the second quarter) as the base for employment measures in a given year is closest to March 12, the reference date used by

[16] Detailed start dates for each state can be viewed at http://download.vrdc.cornell.edu/qwipu/starting_dates.html.

[17] Again, the definition of beginning-of-quarter employment follows Abowd *et al.* (2009)

the Census Bureau for employment measures contained in its Business Register and in the Economic Censuses and Surveys (Abowd *et al.*, 2009). A second rationale is that measures based on April 1 avoid discontinuities in the Unemployment Insurance wage records that occur at the change of calendar years.

In order to obtain the most economically meaningful results, the following sample restrictions are also applied. These restrictions are necessary because the earnings data in the LEHD infrastructure data are extracted from Unemployment Insurance covered earning records, in which any payment of at least one dollar made to an individual during the quarter will appear in the data. As a consequence, many one-time payments that do not necessarily agree with the general definition of employment between a firm and a worker appear as a "job" that lasts one quarter. Therefore, it is important to define a dominant job for a worker. Once the definition is formed, I consider a worker to be an employee only of her dominant-job firm. In this paper, I define a worker's dominant job in a year as the highest annual earning job for that year. Currently, individuals who have more than one dominant job (a small group who have identical earnings in two jobs over the year) or who indicate two or more races (a larger group) are excluded.

The final sample for 1995-2000 includes 200,000 unique single-establishment firms matched between 1995 and 2000 from 19 states, [18] 6,540,000 individuals in 1995, and 7,280,000 individuals in 2000. The final sample for 2000-2005 includes 341,000 unique single-establishment firms matched between 2000 and 2005 from 42 states, [19] 11,900,000 individuals in 2000, and 12,300,000 individuals in 2005. [20]

The individual characteristics file (ICF) in the LEHD infrastructure files contains all the necessary demographic variables used in this paper, including race, ethnicity, and date of birth. Approximately 3 percent of the individuals found in the unemployment insurance

[18] These 19 states include: CA, CO, FL, ID, IL, KS, LA, MD, MN, MO, MT, NC, NY, OR, PA, RI, TX, WA, and WI.

[19] These 42 states include: AK, CA, CO, CT, DE, FL, GA, HI, IA, ID, IL, IN, KS, LA, MD, ME, MI, MN, MO, MT, NC, ND, NE, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, and WV.

[20] These numbers are rounded to three significant digits for disclosure avoidance review purposes.

wage records do not link to the PCF [21](Abowd *et al.*, 2009). To use effectively, the LEHD infrastructure files have undergone sophisticated multiple imputations using general Bayesian methods. [22] Ten independent missing data implicates are created to impute missing demographic variables for these individuals (Abowd *et al.*, 2009). Each missing data implicate, combined with the observations with non-missing demographic information is referred to as an implicate file. To ensure the inference validity using the multiple imputation data, all the statistics and estimation are computed following Chapter 5 in Little and Rubin (2002). Each statistics or estimate is first computed 10 times using the 10 implicate files, individually. The final result is the mean estimand obtained by averaging across the results from the 10 implicate files. Standard errors are further corrected to account for missing data contribution to variance. [23]

4 Evidence on Systematic Firm-Level Segregation By Race and Ethnicity

4.1 Suggestive Evidence on Establishment-Level Segregation

Hellerstein, Neumark and McInerney (2008) verify the existence of establishment-level segregation by race, ethnicity, and skills, using the Decennial Employer-Employee Dataset (DEED) in 1990 and 2000. This section shows that establishment-level segregation is still widespread at the end of each five-year window in the sample of firms used in this paper. Figure 5 is constructed to present the distributions of white and minority workers across single-establishment firms grouped by minority composition categories. This is done for all sectors pooled and for the goods-producing and service-producing NAICS supersectors,

[21] As described in section 3.1, demographic information about workers comes from two administrative data resources: the Person Characteristics File (PCF) and the Composite Person Record (CPR).

[22] Refer to Little and Rubin (2002) for a detailed description of the general Bayesian methods for multiple imputation.

[23] Detailed computation formulas used in this paper are presented in Appendix D.

separately.

Overall, Figure 5 presents evidence suggesting that substantial establishment-level segregation is pervasive in 2000 and 2005. In particular, a comparison between the distributions of whites and minorities across various firm minority composition categories reveals a striking pattern: compared to non-Hispanic whites, minorities are much more likely to be employed in firms with higher minority shares. For instance, the top left figure, constructed for all sectors pooled in 2000, shows that approximately 3 percent of all minority workers work in firms where minorities account for less than 10 percent of the employment. Nonetheless, these firms account for close to 30 percent of all non-Hispanic white workers. In comparison, more than 30 percent of all minority workers work in firms where minorities account for 50 percent to 75 percent of the employment. This share remains high even when considering firms where more than 75 percent of the employment is minorities. On the other hand, these two groups of firms account for approximately 12 percent of all non-Hispanic white workers - approximately 10 percent in firms where minorities account for 50 percent to 75 percent of the employment and only about 2 percent in firms where minorities account for more than 75 percent of the employment. The all-sector pooled sample in 2005, which is depicted in the lower left figure in Figure 5, shows similar patterns.

Figure 5 also shows that the goods-producing and the service-producing supersectors in 2000 and 2005 exhibit patterns nearly identical to the one discussed above. A close comparison between the top and the bottom panels in Figure 5 indicates very minimal changes in the uneven distributions of whites and minorities between 2000 and 2005. To further illustrate that these trends and findings also exist in each NAICS sector, Appendix Figure 2 is constructed using NAICS sector 23 (construction) and NAICS sector 62 (health care and social assistance), separately, as examples.

To examine whether various racial and ethnic minority groups exhibit different segregation patterns, I replicate Figure 5 for Asians, blacks, and Hispanics, separately. The results are presented in Appendix Figure 3. Although all three minority groups experience

establishment-level segregation, blacks (represented by the red bars in Appendix Figure 3) seem to face the least. For instance, in 2000 and 2005, less than 50 percent of all black workers were employed in firms with 50 percent or higher minority shares in all sectors pooled. In both years, however, more than half of all Asian workers (represented by the blue bars in Appendix Figure 3) and Hispanic workers (represented by the green bars in Appendix Figure 3) were employed in these firms. Additionally, blacks have the highest proportion of workers at firms with less than 25 percent minorities in all sectors. By contrast, Hispanic workers have the lowest proportion. These findings also hold for the goods-producing and service-producing supersectors. Because Asians and Hispanics are the main immigrant groups in recent decades and, compared to blacks, have a much shorter history in the U.S., the results seem to suggest that these two minority groups might face more prejudice. [24]

4.2 Evidence on Systematic Firm-Level Segregation

A conventional way to document segregation is to compute the Duncan and Duncan index. As discussed in Section 1, when firm sizes are relatively small, the Duncan and Duncan index tends to distort the true magnitude of segregation (Blau, 1977; Carrington and Troske, 1997, 1998). The main cause of this distortion is that the conventional Duncan and Duncan index characterizes "no segregation" with an absolute zero value. However, research has shown that the segregation indices can be positive when workers are allocated randomly across units (Carrington and Troske, 1997, 1998). In an effort to address this concern, Blau (1977) developed a random worker-to-firm allocation model to adjust and allow complete randomness to be characterized by a non-zero benchmark Duncan and Duncan index.

Though Figure 5 provides suggestive evidence, it does not present any information on whether the observed pattern is systematically different from what would have been randomly observed by chance. To provide this information, I apply the random worker-to-firm allocation model developed by Blau (1977) to the same set of firms used in the previous

[24] Although it is entirely possible that these newer immigrant groups have not assimilated and therefore distribute more unevenly.

section. [25] This model enables me to compute the distribution of firms that would have been observed by chance under the conditions of random worker-to-firm allocation, taking into account the minority composition of the labor pool for a state-NAICS sector. Then, this theoretical distribution of firms and the actual distribution can be used to compute the expected and the actual Duncan and Duncan index for each state-sector. Next, weighted averages of these two indices across all available states within each sector are computed. These sector-specific Duncan and Duncan indices for 2000 and 2005 are in Table 1. The expected Duncan and Duncan index defines the "evenness," and the difference between the expected and the actual Duncan and Duncan index measures the magnitude of systematic segregation. It is important to note that although I do not expect an absolute zero value in the Duncan and Duncan index to indicate evenness, as shown in Table 1, the expected Duncan and Duncan index is considerably less than the actual one.

As Table 1 demonstrates, a sizable proportion of minorities would have to reallocate among firms such that the actual distribution could be considered as indistinguishable from random worker-to-firm allocation. This statement holds for every sector. For instance, in 2000, close to 20 percent of minority workers in construction (NAICS 23) would have to reallocate among firms to approximate a situation of random allocations. In 2005, this index still remains higher than 18 percent. In both years, the sector that showed the most severe systematic segregation was health care and social assistance (NAICS 62). The Duncan and Duncan indices for this sector in both years are higher than 30 percent and have remained fairly constant between 2000 and 2005. Among all sectors listed, utilities (NAICS 22) has the smallest difference between the actual and expected Duncan and Duncan index for 2000 and 2005. Even then, for utilities to be considered a sector without systematic segregation, approximately 12 percent of minorities in 2000 and 14 percent in 2005 would have to be reallocated among firms. [26] Thus, Table 1 indicates that systematic segregation does exist

[25] The details of the random worker-to-firm allocation model are provided in E.

[26] I have also applied the chi-square "goodness of fit" test developed by Blau (1977) to test whether the theoretical distribution of firms is systematically different from the actual distribution. Most state-sectors reject the hypothesis of random worker-to-firm allocation and thus confirm systematic segregation.

at the establishment level in 2000 and 2005, although its extent appears to vary by industry. Nonetheless, the magnitude seems to vary minimally between 2000 and 2005.

5 Do Firms Exhibit "Tipping-like" Patterns?

5.1 Descriptive Statistics

Table 2 presents descriptive statistics for the establishment-level data in all sectors pooled. The same descriptive statistics are also computed for establishments in the goods-producing supersector as well as in the service-producing supersector. The mean establishment-level minority shares in these two five-year intervals across sectors are very similar and are between 33% and 34%. In particular, Hispanics always comprise the largest minority group.

Overall, there is rapid employment growth in the period 1995-2000, which reflects the economic boom in the mid-to-late 1990s. As shown in Table 2, the goods-producing supersector and the service-producing supersector are equally affected by the economic boom. Although between 1995-2000, non-Hispanic white employment grows by more than 4 percent, over 60 percent of the total employment growth is driven by growth in minority employment. This is true for all sectors pooled, the goods-producing supersector, and the service-producing supersector. Hispanic employment experiences the largest growth compared to the other racial and ethnic minority groups. In comparison, total employment growth between 2000 and 2005 is considerably slower. The goods-producing supersector even experienced contraction, which reflects the economic recession that occurred in early 2000 and the loss of manufacturing jobs in the U.S. In all sectors pooled, almost all employment growth can be attributed to minority employment growth. Specifically, between 2000-2005, total employment grows by 3.49 percentage points, and 3.10 percentage points are due to growth in minority employment. Interestingly, only non-Hispanic whites and blacks experience employment contraction in the goods-producing supersector, with the former being close to -3.8 percentage points. As in 1995-2000, Hispanics undergo the largest employment growth in 2000-2005 compared

to the other minority groups.

Table 3 compares five subgroups of establishments defined by the fraction of minority shares in the base year, i.e., 1995 or 2000. Table 3 shows how the growth in non-Hispanic white employment is affected by the base-year minority share. Taking all sectors pooled in 1995 as an example, one can see clearly from Table 3 that in establishments that have minority shares from 0 to 5 percent, more than 70 percent of the growth in total employment is driven by the growth in white employment. Establishments that were 5 to 20 percent minority saw relatively slower growth in white employment. Nonetheless, growth in non-Hispanic white employment accounts for approximately one half of total employment growth. In contrast, establishments that were 20 to 50 percent minority experienced much slower growth in white employment, although the magnitudes of total employment growth are not dramatically different compared to establishments with lower minority shares. When base-year minority shares further increase, growth in white employment remains low.

The findings here suggest that once the establishment-level minority share reaches a certain level in the base year, non-Hispanic white employment growth over the five-year window tends to dramatically slow down. Because there is no such indication on total employment growth, the summary statistics presented in Table 3 imply that once the base-year minority share reaches a threshold level, minority composition increases dramatically, i.e., the tipping phenomenon occurs. It can be seen that the described pattern and trends hold true for all sectors listed in Table 3 except for the goods-producing supersector in 2000-2005. The nonconformity of the goods supersector may be due to the loss of manufacturing jobs during the recession in the early 2000s. Additionally, these trends generally remain true for all sectors, individually. To illustrate this finding, Appendix Table 1 reproduces Table 3 for the construction and health care and social assistance sectors separately.

5.2 Pooled Analysis of Changes in Net Non-Hispanic White Employment Growth

In order to implement the RD-tipping design and estimate the empirical specifications developed in section 2.3, I use the fixed-point procedure first to obtain the candidate tipping points. The estimated sector-specific tipping points for 1995-2000 and 2000-2005 are presented in Table 4. These candidate tipping points range from 5.26 to close to 40 percent in 1995 and 2.44 to 38.6 percent in 2005. The mean tipping point across 18 sectors is 14.16 percent in 1995 and 15.51 percent in 2000. The increase in the average tipping point from 1995 to 2000 suggests an increasing level of tolerance for working with minorities in the same firm, although the increase is quite small.

I now turn to specifications that pool the data in all sectors but estimated separately for the 1995-2000 and 2000-2005 periods. Figure 6 depicts the relationship between the base-year minority share in a single-establishment firm, deviated from the sector-specific candidate tipping point, and the percentage change in the net non-Hispanic white employment in the establishment, deviated from its sector-specific mean. The dots in the figure represent mean changes in one-percentage bins of $\delta_{ijs,t-5} = R_{ijs,t-5} - R^*_{j,t-5}$. The solid green line is a local linear regression fitted separately on each side of the candidate tipping point with an Epanechnikov kernel and a bandwidth of 5. Finally, the solid blue line shows fitted values from a global third-order polynomial in $\delta_{ijs,t-5}$, allowing an intercept shift at $\delta_{ijs,t-5} = 0$. I limit attention to $\delta_{ijs,t-5} \in [-20, 20]$.

Figure 6 suggests establishment-level tipping. In particular, the Figure presents clear evidence of a discontinuous change in the minority composition when comparing establishments just below and just above the tipping point. Although visually telling, Figure 6 does not permit formal hypothesis tests and does not control for other establishment-level characteristics that might affect worker mobility, making it hard to determine whether the observed tipping behavior is due to differences in other covariates close to the candidate tipping points.

5.3 Formal Econometric Evidence on Establishment-level Tipping

Table 5 presents estimates of $\widehat{d}$ from equation (8) pooling all sectors pooled in 1995-2000 and 2000-2005. The regression analysis assesses the magnitude of tipping for establishments with an initial minority share just above the sector-specific candidate tipping points, compared to establishments with an initial minority share just below the tipping points. The main dependent variable is the change in net non-Hispanic white employment over a five-year window as a percentage of the establishment total employment in the base year (columns (1) and (2)). To reveal the dynamics of the shifting composition of firms and to document whether the observed tipping pattern is driven by white flight or by minority entry, I also examine analogous measures for whites and minorities, separately (columns (4) and (5) for non-Hispanic whites; columns (6) and (7) for minorities; the results are discussed in detail in section 5.4).

The estimation controls for a flexible control function in a form of third-order polynomial in $\delta_{ijs,t-5}$, establishment-level covariates as described in section 2.3, fixed state effects, and fixed sector effects. Standard errors are clustered on the state-sector level. All estimates are computed and averaged across the 10 implicate files. The variance-covariance matrices of the estimates are corrected by taking into consideration of the variance contribution of the missing data and multiple imputation. [27] The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

The estimated coefficients for the models in columns (1) and (2) confirm that the change in net non-Hispanic employment as a percentage of the establishment total employment is discontinuous in the initial minority share around the candidate tipping points. When I estimate the model without any establishment controls (column (1)), the estimated, statistically significant, discontinuities are approximately -6 and -3 percentage points in 1995-2000, and 2000-2005, respectively. In 1995-2000, other things equal, the growth in net non-Hispanic white employment in establishments with an initial minority share just above the sector-

[27] The computation formulas can be found in Appendix D.

specific candidate tipping points is 6 percentage points less than in establishments with initial minority shares just below the tipping points. In 2000-2005, the discontinuity is also statistically significant, although the magnitude decreases to −3 percentage points. When establishment controls are included (column (2)), the estimated discontinuities in both five-year intervals remain largely unchanged.

Column (3) in Table 5 presents estimates where the dependent variable is the change in the establishment's minority share, i.e., $R_{ijs,t} - R_{ijs,t-5}$. The estimated tipping effect on this variable, which is the traditional focus of tipping models (Card, Mas and Rothstein, 2008a; Easterly, 2009; Pan, 2010), is significant in both five-year intervals, although it is larger in 1995-2000. For instance, the estimate obtained for 1995-2000 implies that, compared to the establishments with initial minority shares just below the candidate tipping points, there is a significant increase in minority share of more than 2 percentage points in establishments with initial minority shares just above the tipping points.

One possible reason that the estimated tipping effect decreased between 1995-2000 and 2000-2005 might be the effect of changes in the state composition of my main estimation sample. The 1995-2000 sample includes single-establishment firms from only 19 states compared to 42 states covered in the 2000-2005 sample. To verify that my results are not due to the change in the number of states covered in the second five-year interval, I replicate columns (2), (3), (5), and (7) in Table 5 for all 19 states from the 1995-2000 sample in 2000-2005. Table 6 presents these results. Table 6 shows that the magnitude of the observed discontinuity is indeed smaller compared to 1995-2000, even when using the same 19 states in 1995-2000 and 2000-2005.

Another possible explanation for the estimated decrease might be the recession that occurred in 2001 and the associated drops in quits and total separations. [28] Research has shown that worker churning and job-to-job mobility during recent recessions have declined considerably (Kahn and McEntarfer, 2013). In Appendix Figure 4, I plot the seasonally ad-

[28] For the accurate start and end date of this recession, refer to http://www.nber.org/cycles.html

justed time-series data on quits and total separations of private establishments from the Job Openings and Labor Turnover Survey (JOLTS) produced by the Bureau of Labor Statistics (BLS). The Appendix Figure 4 confirms that significant decreases in quits and total separations did occur in the 2001 recession (marked as the first shaded area in Appendix Table 4). The levels of quits and total separations remained fairly low until late 2003 and early 2004. In a different paper, Kahn (2010) finds that the cohorts who graduate from college in a bad economy also tend to have slightly higher tenure.

Thus far, all the analyses have been conducted using the pooled sector samples. Heterogeneity in the tipping effect almost surely exists across different sectors. To explore this issue, Table 7 presents the results of applying the RD models to the goods-producing and services-producing NAICS supersectors, separately. The specifications are otherwise identical to those in columns (2), (5), and (7) in Table 5. It is clear that the observed tipping phenomena seems to exist only in the services-producing supersector. Discontinuity in the goods-producing supersector does not seem to exist in either five-year window. To further confirm this finding, Figure 7 plots the change in the net non-Hispanic white employment in the establishment, deviated from the sector-specific mean in the services-producing supersector in 1995-2000 and 2000-2005. These figures are identical in structure to Figure 6. In comparison, the pattern in Figure 6 is almost indistinguishable from that in Figure 7 for both five-year intervals, reinforcing the finding that the observed discontinuity exists only in the service-producing NAICS supersector.

5.4 Whites Leaving or Minority Entering?

The evidence presented thus far is consistent with the social interaction model and the tipping argument. However, there are alternative mechanisms that could also lead to a tipping phenomenon, such as changes in production technology or learning dynamics (Pan, 2010). For instance, the production technology argument suggests that the increase in minority labor supply into the labor market might lead firms to switch to a minority-intensive pro-

duction technology, which could result in a sharp increase in minority employment growth over some range of initial minority share. Alternatively, a learning-dynamics model implies that at low minority shares, little information about a particular job is available, hence minority employment growth is slow. As the minority share rises, information accumulates and learning accelerates, which could lead to a rapid increase in minority employment (Pan, 2010).

A common way to try to distinguish these models from the social interaction model is to consider whether establishment-level tipping is driven by white flight or by minorities entering. Schelling's mechanism suggests that tipping should be driven primarily by a sharp decline in non-Hispanic white employment, although it is entirely possible that minority employment might increase substantially in response to white flight. Nonetheless, if we observe a sharp decline in non-Hispanic white employment that is not accompanied by a sharp increase in minority employment, this would suggest that tipping is driven mostly by the social interaction model.

To examine the shifting composition of firms and, in particular, to examine whether establishment-level tipping is driven by white flight or minority entry, columns (4)-(7) in Table 5 present models for the changes in white and minority employment as a percentage of base-year total establishment employment for 1995-2000 and 2000-2005. The specifications are otherwise identical to those in columns (1) and (2) in Table 5. Columns (4)-(7) show that in 1995-2000, there was a significant decline in white employment growth and an upward jump in minority inflows at the sector-specific tipping points. In other words, the observed discontinuity in minority composition during this five-year window is driven almost equally by whites leaving and minorities entering, although the magnitude of the former is slightly larger. In comparison, in 2000-2005 the observed tipping effect is driven solely by whites leaving, and the upward jump in minority employment at the candidate tipping points is negligible. These results indicate that although tipping is confirmed to be a mechanism leading to establishment-level segregation in the sample of firms used in this paper, I cannot

rule out that multiple explanations might explain the observed tipping phenomenon. For instance, while both the production-technology and learning-dynamics models would have trouble explaining the negligible effect due to minority entry in 2000-2005, I cannot reject a possible role for these hypotheses in the earlier five-year window (1995-2000). Therefore, it is entirely possible, and even likely, that more than one underlying process is operating. The purpose of this paper is to document the tipping patterns and to demonstrate that at least some of these observed patterns are broadly consistent with predictions from a simple Schelling-type social interaction model.

5.5 Does Tipping Only Exist in Shrinking Firms?

The specifications in Table 5 show that tipping is associated with a discontinuous drop in non-Hispanic white employment growth but a smaller or negligible jump in minority employment growth. Such findings suggest that tipping patterns are associated with shrinking firms. That raises the concern that rather than social interactions, it may just be that whites are leaving firms that are not performing well. Similarly, in Table 3 I find that establishments with initial minority shares below 20 percent experienced faster employment growth over the next five years compared to those with higher initial shares. These observations call attention to an important element that is missing from the model: labor demand.

With fixed labor demand, as in the model in Section 2, any decline in white labor supply is mechanically offset by minority labor inflows. To approximate an environment of fixed labor demand, I identify a subset of establishments where total employment has changed by less than 10 percentage points over a five-year interval. The model specification is otherwise identical to Table 5. The results are presented in Table 8.

In the establishments with fixed labor demand, the estimated discontinuity in net non-Hispanic white employment growth at the tipping point is -4.24 percent in 1995-2000 and -1.87 percent in 2000-2005. This is somewhat smaller than the corresponding estimate from the full sample (Column (2) in Table 5) but is still large and statistically significant. In these

establishments with fixed labor demand, total employment growth shows no discontinuity at the tipping point, while the estimated discontinuity in white employment growth is approximately equal and opposite to the jump in minority employment growth. This observation is true for both 1995-2000 and 2000-2005. Column (2) of Table 8 presents estimates where the dependent variable is the change in establishment's minority share. The estimated tipping effect on this variable is apparent, although it is rather small in 2000-2005. Thus, Table 8 demonstrates that mobility patterns in these establishments with fixed labor demand closely match the predictions from the model with fixed labor demand.

5.6 Omitted Variables and Effect on Establishment Covariates

An additional concern with the RD model used in the previous sections is that the discontinuous relationship between net white mobility flows and the initial minority share might be due to omitted establishment characteristics that happen to be discontinuously related to the minority share. Although the main specifications (columns (2), (5), and (7) in Table 5) include a vector of establishment controls, these linear controls might not be flexible enough to absorb the nonlinear effects. To assess this possibility and to test whether the results presented in Table 5 are sensitive to flexible controls for the pre-period establishment characteristics, Table 9 presents a series of extended specifications that add a third-order polynomial in these establishment-level covariates. Table 9 shows that the estimates of $\widehat{d}$ are rather robust to such inclusions, suggesting that omitted variables of this kind are unlikely to account for the observed discontinuities.

The empirical analysis thus far has focused on changes in minority composition due to non-Hispanic white or minority employment growth. In other words, the analysis has primarily looked at changes in quantities. Nonetheless, apart from quantities, there are other outcomes worth examining. These include whether earnings, the share of retiring workers, or the share of young workers are affected by tipping. This part of the analysis therefore looks at how these establishment-level characteristics behave around the sector-specific candidate

tipping points.

Table 10 reports results from regressions in which the dependent variable is replaced by changes over a five-year window in log average earnings for all workers, in the share of retiring workers, and in the share of young workers. In each regression, a flexible third-order polynomial in $\delta_{ijs,t-5}$, fixed state effects, and fixed sector effects are controlled. Similarly, standard errors are clustered on the state-sector. According to Table 10, there is little evidence of significant changes in the establishment-level covariates around the candidate tipping points. Thus, from Table 10 I conclude that the observed discontinuity is not driven by abrupt changes in establishment-level characteristics around the tipping points.

5.7 Minority Definition

Thus far, I have defined minorities as nonwhites and white Hispanics. Nonetheless, it is entirely possible that whites might react to inflows of different minority workers differently. Specifically, evidence presented in Appendix Figure 3 suggests that different racial and ethnic minority groups seem to face different degrees of segregation and Table 2 shows clear heterogeneity in employment trends across Asians, blacks, and Hispanics. In this section, I present a series of models in which I vary the definition of minority to explore this issue.

Tables 11 and 12 present estimates that explore alternatives that count only blacks or only Hispanics as minorities for 1995-2000 and 2000-2005, separately. I also present a composite model that includes indicators for being beyond the tipping point for all three minority definitions. As in earlier tables, the dependent variable in each specification is the change in net non-Hispanic white employment, the change in white employment, or the change in minority (all nonwhites and white Hispanics) employment, as a percentage of total establishment employment. Candidate tipping points are estimated separately for each definition of minorities, using the fixed-point procedure discussed in section 2.3 and Appendix C. Each model also includes a third-order polynomial in the deviation of the establishment's minority share from the candidate tipping point. The composite model includes all three third-order

polynomials. The establishment controls are identical to those in Table 5. Fixed State and sector effects are included. Standard errors are clustered on the state-sector.

The estimates in columns (1)-(4) in Table 11 suggest that in 1995-2000, tipping behavior was driven slightly more by the black shares than by the presence of other minority groups, although the effect of the Hispanic shares is quite strong as well. When I decompose the observed discontinuity in net non-Hispanic white employment change into changes in white employment and minority employment and examine them separately, Table 11 (columns (5)-(8)) shows that changes in non-Hispanic white employment alone exhibit even stronger tipping beyond the black-share fixed point and the Hispanic-share fixed point. Interestingly, the results in Table 11 (columns (9)-(12)) seem to show that even minority workers leave establishments once its black share or Hispanic share reaches the candidate tipping points, with both measured the same way. However, the latter discontinuity is much smaller compared to the former.

In comparison, the results presented in Table 12 imply that in 2000-2005, almost all observed tipping behavior is driven solely by the Hispanic share. When I look at the white employment change and the minority employment change individually, the Hispanic shares seem to be the only driving force again. In particular, non-Hispanic white employment in establishments with initial Hispanic share just above the sector-specific candidate tipping points, measured in Hispanic share in 2000, experience a 7 percentage point decrease (column (7) in Table 12) compared to establishments with shares just below the tipping points. The discontinuity observed in minority employment change is much smaller, although it is statistically significant and of approximately -2.5 percentage points in magnitude (column (11) in Table 12). In all, estimates presented in Table 11 and 12 suggest that as Hispanics become the largest minority group in the U.S., they might face stronger distaste from non-Hispanic whites, and such distaste might even exist among other ethnic minority groups.

6 Conclusion

In summary, using the establishment-level data from the LEHD infrastructure files and the random worker-to-firm allocation model developed by Blau (1977), this study first confirms that systematic racial and ethnic workplace segregation exists in 2000 and 2005. Then, the paper makes use of a Regression Discontinuity design developed by Card, Mas and Rothstein (2008a) and demonstrates the importance of tipping. My approach uses the cross-sectional variation in base-year minority shares across establishments to test whether establishments exhibit tipping-like behavior in response to firm-specific shocks in minority labor supply that occur over two five-year intervals: 1995-2000 and 2000-2005.

The average NAICS sector-specific candidate tipping point, estimated using the fixed-point procedure, is 14.16 percent in 1995 and 15.51 percent in 2000. The increase in the average tipping point from 1995 to 2000 suggests an increasing tolerance level for working with minorities in the same firm, although this increase is quite small.

Overall, I find clear evidence that tipping is a feature of the dynamic process of establishment-level segregation in the sample of firms used in this paper. The estimated, statistically significant, discontinuities are close to -6, and -3 percentage points in 1995-2000, and 2000-2005, respectively. One possible reason for the decrease in the observed tipping effect between 1995-2000 and 2000-2005 is the recession that occurred in 2001. To examine the shifting composition of firms, and in particular, to explain whether establishment-level tipping is driven by white flight or minorities entering, I find that tipping in 1995-2000 is driven by whites leaving and minorities entering together. In comparison, in 2000-2005, the observed tipping effect is solely driven by white leaving, the upward jump in minority employment at the candidate tipping points is quite negligible. By using a subset of establishments that have undergone minimal employment growth over a five-year window to approximate an environment with fixed labor demand, I demonstrate that mobility patterns in these establishments closely match the predictions from the social interaction model with fixed labor demand presented in this paper. Taken together, the analysis in this paper provides some of

the first evidence suggesting that the dynamics of establishment-level segregation are noticeably nonlinear and exhibit a tipping pattern. This observation is largely consistent with the Schelling (1971) social interaction model, although at this point, I cannot completely rule out alternative explanations for the observed discontinuity. It is possible, and even likely, that more than one underlying process is operating here. Future work should assess how social interactions interact with other underlying mechanisms, which will provide a far richer picture of the dynamics of workplace segregation.

As part of robustness checks, I present evidence confirming that the tipping effects for both five-year windows are robust to adding flexible controls of establishment-level covariates. I also demonstrate that the observed tipping patterns are not driven by nonlinear changes in establishment characteristics. Finally, I present composite model estimates in which I explore alternative definitions of minority. In particular, I find that in 1995-2000, tipping behavior seems to have been driven slightly more by the black shares than by the presence of other minority groups, although the effect of the Hispanic shares is quite strong as well. In comparison, in 2000-2005, the observed tipping behavior seems to be driven solely by Hispanic shares. This change seems to suggest that as Hispanics become the largest minority group in the U.S., they might face stronger distaste from non-Hispanic whites. As the minority composition in the U.S. changes, this finding has implications for understanding the persistence of current labor market segregation.

Appendix

A. NAICS Sectors and NAICS Supersectors

NAICS stands for the North American Industry Classification System. Developed using a production-oriented conceptual framework, NAICS "groups establishments into industries based on the activity in which they are primarily engaged. Establishments using similar raw material inputs, similar capital equipment, and similar labor are classified in the same industry. In other words, establishments that do similar things in similar ways are classified together" (www.bls.gov/bls/naics.htm). Revisions implemented for every Economic Census (years ending in 2 and 7). In this paper, the 2007 NAICS classification is utilized. Overall, there are 20 NAICS sectors (www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007).

For purposes of aggregate analysis, the U.S. Economic Classification Policy Committee aggregated NAICS sectors into "Supersectors." The goods-producing NAICS supersector includes natural resources and mining (NAICS 1133, i.e., logging; NAICS 21, i.e., mining), construction (NAICS 23) and manufacturing (NAICS 31-33) (www.bls.gov/ces/cessuper.htm). Because the sample in this paper does not include NAICS sector 11 (agriculture, forestry, fishing, and hunting), the goods-producing NAICS supersector only includes NAICS sectors 21, 23 and 31-33. The service-producing NAICS supersector includes trade, transportation, and utilities (NAICS 42, i.e., wholesale trade; NAICS 44-45, i.e., retail trade; NAICS 48-49, i.e., transportation and warehousing; NAICS 22, i.e., utilities), information (NAICS 51), financial activities (NAICS 52, i.e., finance and insurance; NAICS 53, i.e., real estate and rental and leasing), professional and business services (NAICS 54, i.e., professional, scientific, and technical services; NAICS 55, i.e., management of companies and enterprises; NAICS 56, i.e., administrative and waste services), education and health services (NAICS 61, i.e., educational services; NAICS 62, i.e., health care and social assistance), leisure and hospitality (NAICS 71, i.e., arts, entertainment, and recreation; NAICS 72, i.e., accommodations and food services), other services (NAICS 81), and government (www.bls.gov/ces/cessuper.htm). Because the sample in this paper does not include any governmental establishments, the service-producing NAICS supersector in this paper does not include government.

B. Schelling's Bounded-neighborhood Model

Schelling's Bounded-neighborhood model and its extension into the tipping model use the preference interaction perspective to analyze (residential) segregation by race (Schelling, 1971). Preference interaction occurs when an agent's preference ordering on the alternatives within her choice set depends on actions chosen by other agents (Manski, 2000).

In this model, there is a well-defined "neighborhood" with clear boundaries. People are either in or out of this common neighborhood. Everybody in this neighborhood is concerned with the minority share. This concern is characterized by a upper limit or tolerance for the minority share. An individual will reside in the neighborhood only if the minority share in the neighborhood has not reached his own limit. If an individual's limit is exceeded, he will leave and choose somewhere else that meets his tolerance level. This model assumes heterogeneity in individual preferences over the neighborhood-level minority share, ranging from complete integrationist to complete segregationist. Agents are assumed to have perfect information about the minority share within the neighborhood when they decide whether to leave or to enter a neighborhood. However, agents are myopic about other agents' intentions and their future moves. Zero mobility costs are also assumed. There are no neighborhood capacity constraints and adding-up constraints in the neighborhood to enforce that the population-weighted average of neighborhoods' minority shares be equal to the system-wide share of minorities in the population (Easterly, 2009; Schelling, 1971; Zhang, 2011). Therefore, Schelling's model cannot be viewed as a general equilibrium model.

Given this model setup, Schelling (1971) shows how only a modest preference of whites to live next to other whites can lead to nearly complete residential segregation. In this model, even a relatively small fraction of minorities could cause the neighborhood to tip from completely white to completely minority. The fraction at which this happens is called the "tipping point." The tipping point in Schelling's model represents an unstable equilibrium, since even a slight perturbation in the level of minority shares around the point can lead to complete segregation (Caetano and Maheshri, 2013). As a result, Schelling's model has the feature that the only stable equilibria are fully segregated equilibria. A neighborhood with a mixed minority composition is inherently unstable. The triggered dynamic process can lead to either 0 percent or 100 percent minority share, i.e., two-sided tipping (Card, Mas and Rothstein, 2008b). A more detailed description of Schelling's Tipping model can be found in Schelling (1971).

C. Tipping Estimation

I use the fixed-point procedure discussed in section 2.3 to identify NAICS sector-specific tipping points in the 50 percent simple random subsample of establishments. I identify the roots of

$$E[Dw_{ijs,t} \mid j, R_{ijs,t-5}] - E[Dw_{ijs,t} \mid j] \tag{10}$$

as the estimated tipping point. I fit $Dw_{ijs,t} - E[Dw_{ijs,t} \mid j]$ to a third-order polynomial in $R_{ijs,t-5}$. Following Card, Mas and Rothstein (2008a), I use only firms with minority shares below 60 percent. This polynomial is fitted separately for each NAICS sector. For each NAICS sector, I identify a root of this polynomial, taking into consideration the range of the minority shares in the remainder 50 percent subsample used for model estimation. In particular, I first exclude those roots above 50 percent minority share. The reason for restricting observations and the identified roots to this range is that this paper focuses on how establishments with lower shares of minorities in the base year respond to minority entry. Second, for each NAICS sector, I select roots that are strictly greater than the minimum value of base-year minority shares in establishments reserved for estimation. Finally, when there are multiple roots, the one that yields the most negative slope of the polynomial function is selected. The estimated sector-specific tipping point is presented in Table 4.

D. Computation Formulas for Multiple Imputation Statistics

This section follows Chapter 5 in Little and Rubin (2002). Let Y denote the data, which can be further partitioned into the observed and unobserved parts, if needed.

$$Y = (Y_{obs}, Y_{mis})$$

Let $Q(Y)$ denote the statistics of interest to be estimated. Let

$$Q_m(Y^m) = estimand\ from\ the\ m^{th}\ implicate$$

Let M denote the total number of implicates. Then, the average estimand over all implicates, $\overline{Q}$ can be written as

$$\overline{Q} = \frac{\sum_{m=1}^{M} Q_m(Y^m)}{M}$$

Let

$$V_m(Y^m) = covariance\ matrix\ of\ Q_m(Y^m)\ from\ the\ m^{th}\ implicate$$

Then, the average within-implicate covariance matrix, $\overline{V}$, can be written as

$$\overline{V} = \frac{\sum_{m=1}^{M} V_m(Y^m)}{M}$$

Let B denote the between-implicate variation of $Q_m(Y^m)$; then, B can be written as

$$B = \frac{[\sum_{m=1}^{M}(Q_m(Y^m) - \overline{Q})(Q_m(Y^m) - \overline{Q})^T]}{M}$$

The corrected covariance matrix, T, of $Q(Y)$, which accounts for the missing data contribution to variance, is defined as

$$T = \overline{V} + (1 + \frac{1}{M})B$$

The Rubin missingness ratio is defined as

$$Missingness\ Ratio = (1 + \frac{1}{M}) * \frac{b_{ii}}{t_{ii}}$$

where b_{ii} and t_{ii} are the diagonal elements of B and T. The Rubin missingness ratio essentially measures the proportion of the total variance that is due to between implicate variance. $\overline{Q}$, $\sqrt{t_{ii}}$, and the Rubin missingness ratio are the final results presented in all tables.

Within-implicate variance, i.e., V_m, for each estimate in Tables 1, 2, 3, Appendix Table 1, Figures 5, Appendix Figures 2, and 3 is computed using the bootstrap method. The bootstrap samples for each implicate file m are generated by a simple random sampling with replacement, holding the sample size of that implicate file constant. The number of repetition is set to equal 1000. To compute the within-implicate variance for implicate file m, I first compute an estimand of interest, Q, for each bootstrap sample. Upon completion, the within-implicate variance of the estimand Q for implicate file m can be computed.

E. Random Worker to Firm Allocation Model

This paper adopts the random worker-to-firm allocation model developed by Blau (1977) and computes the expected and actual Duncan and Duncan indices for each NAICS sector presented in Table 1.

For each state and NAICS sector, let

p = the proportion of the individuals with the requisite industry-specific skills that is minority;

$q = 1 - p$ = the proportion of the labor pool that is non-Hispanic white;

x_i = the number of minorities employed in firm i in the given state and NAICS sector;

n_i = the total number of employees in firm i in the given state and NAICS sector;

$p_i = 100 * \frac{x_i}{n_i}$ = the share that minorities account for all workers in firm i in the given state and NAICS sector.

Under the random worker-to-firm allocation, x_i can be viewed as the outcome of n_i trials of an experiment in which each trial consists of selecting an individual at random from the labor pool, where the likelihood of getting a minority is p, and the likelihood of getting a non-Hispanic white is $q = 1-p$. Therefore, x_i can be characterized by a binomial probability distribution as:

$$f_i(x = x_i) = \binom{n_i}{x_i} p^{x_i} q^{n_i - x_i}$$

Then, firms are grouped according to size. Each size category contains firms with the same values of n_i. The possible outcomes, x_i, are grouped into ten categories according to the value of p_i: 0 $\leq$p$_i <$ 10, 10 $\leq$p$_i <$ 20, 20 $\leq$p$_i <$ 30, 30 $\leq$p$_i <$ 40, 40 $\leq$p$_i <$ 50, 50 $\leq$p$_i <$ 60, 60 $\leq$p$_i <$ 70, 70 $\leq$p$_i <$ 80, 80 $\leq$p$_i$ ¡ 90, 90 $\leq$p$_i \leq$ 100.

Further, let:

n_j = the number of firms in the jth size category;

p_{jk} = the probability that a firm selected at random from the jth size class has a value of p_i that falls in the kth minority composition category;

e_{jk} = the expected number of firms in the j size class and kth minority composition category;

E_k = the total expected number of firms in the kth minority composition category;

P_k = the probability of obtaining a firm in the kth minority composition category, given the size distribution of firms.

Then, given the binomial probability distribution described earlier, p_{jk} can be written as:

$$p_{jk} = f(x_a \leq x \leq x_b) = \sum_{a}^{b} f_i(x = x_i)$$

Therefore, to find the theoretical distribution of firms with N firms in the state-two digit NAICS sector cell, e_{jk}, E_k, and P_k can be written as:

$$e_{jk} = p_{jk} \cdot n_j$$
$$E_k = \sum_{j} e_{jk}$$
$$P_k = E_k / N$$

The distribution of non-Hispanic white and minority workers among establishments that would prevail under the condition of random worker-to-firm allocation can be derived directly from the theoretical distribution of firms. Again, for each state and NAICS sector, let:

n_{ij} = the number of workers in firms included in the jth size class;

$\overline{p}_{ik}$ = the simple average of the p_i included in the kth minority composition category divided by 100;

m_{jk} and w_{jk} = the expected number of minorities and whites, respectively, employed in firms that fall into the jth size class and kth minority composition category;

M_k and W_k = the total expected number of minorities and whites, respectively, employed in firms included in the kth minority composition group.

Therefore, m_{jk} and w_{jk} can be approximated by

$$m_{jk} = e_{jk} \cdot n_{ij} \cdot \overline{p}_{ik}$$

$$w_{jk} = (e_{jk} \cdot n_{ij}) - (m_{jk})$$

And M_k and W_k can by calculated by the following:

$$M_k = \sum_{j} m_{jk}$$
$$W_k = \sum_{j} w_{jk}$$

Then, the state-sector-specific expected and actual Duncan and Duncan indices are calculated using the following formula:

Within each state and NAICS sector cell

Let p_i = the percentage that minority workers comprise the labor force in firm i. Then, firms are grouped into ten categories according to the value of p_i: 0 $\leq$p$_i$ $<$ 10, 10 $\leq$p$_i$ $<$ 20, 20 $\leq$p$_i$ $<$ 30, 30 $\leq$p$_i$ $<$ 40, 40 $\leq$p$_i$ $<$ 50, 50 $\leq$p$_i$ $<$ 60, 60 $\leq$p$_i$ $<$ 70, 70 $\leq$p$_i$ $<$ 80, 80 $\leq$p$_i$ ¡ 90, 90 $\leq$p$_i$ $\leq$ 100.Letm$_k$ and w_k equal the percentages of all minority workers and all non-Hispanic white workers who are employed in firms included in the kth minority composition category. The Duncan and Duncan index of segregation for a given state and sector cell is defined as:

$$D = \frac{\sum_{k=1}^{10} |m_k - w_k|}{2}$$

The actual Duncan and Duncan index of segregation is computed using the employment distribution of whites and minorities observed in the sample. The expected Duncan and Duncan index is computed using the theoretical distribution derived. Once the state and sector-specific indices are calculated, the NAICS sector-specific actual and expected indices are simply the weighted averages among all the available states. The weight used is the total number of firms in a given state-sector cell.

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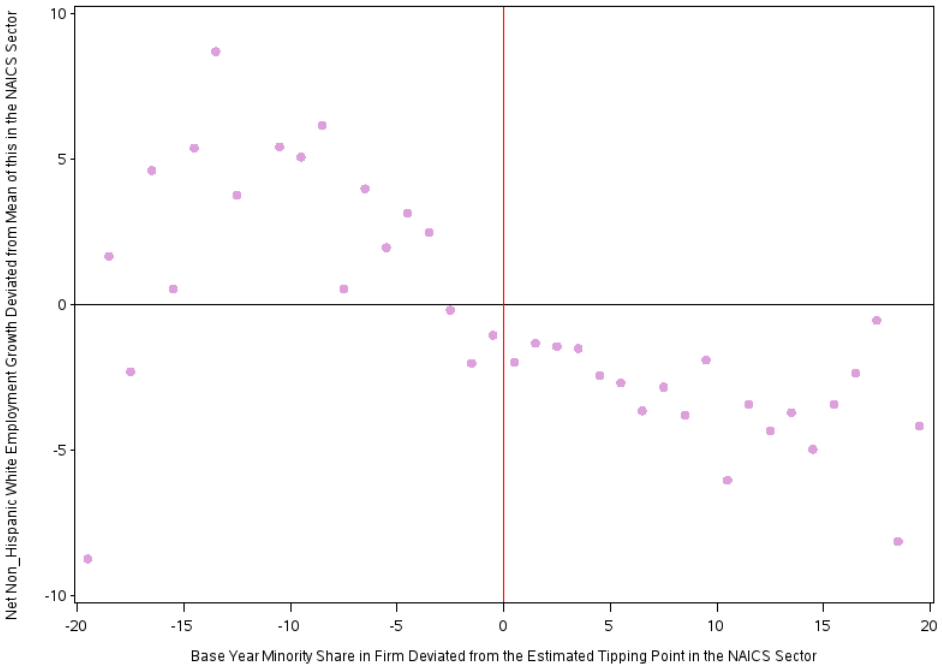
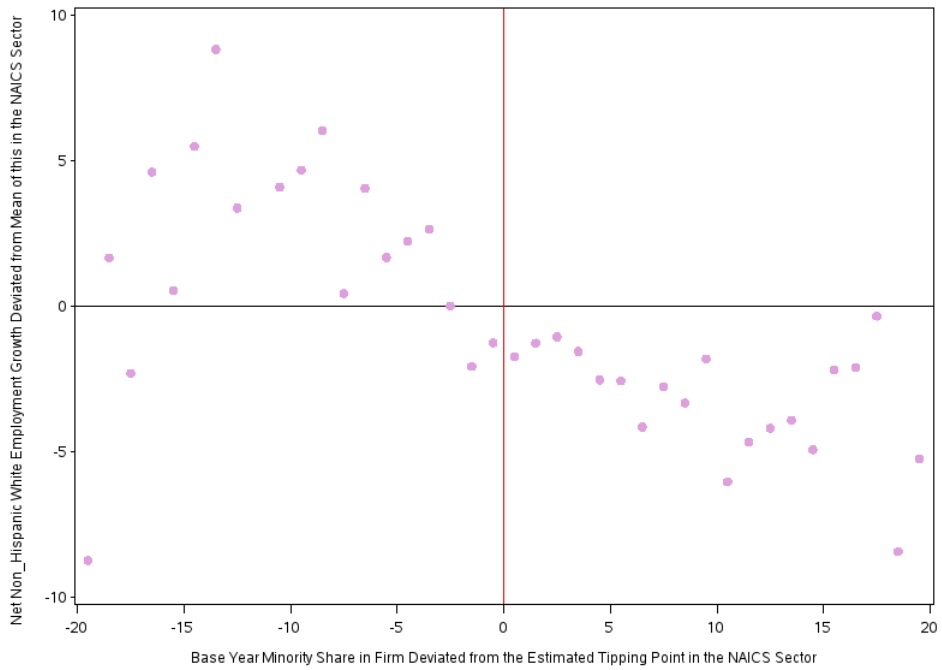
Figure 1. Change in a Pooled Sample of Firm-level Minority Composition, by Relationship to Candidate Tipping Points 1995-2000

All NAICS Sectors Pooled

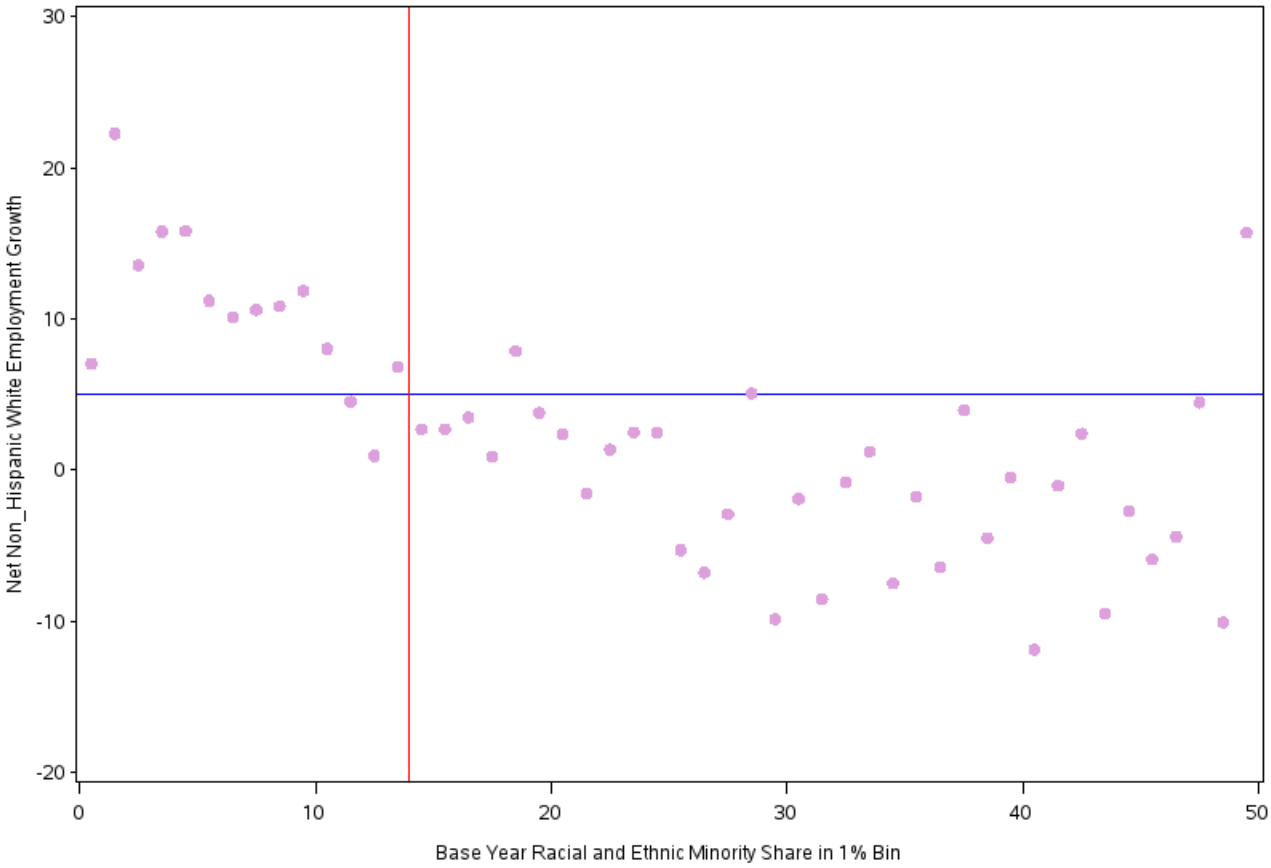


Service-producing NAICS Supersector



Notes: the X axis is minority share in establishment minus the estimated tipping point in a NAICS sector. The tipping point is estimated using the fixed-point procedure described in subsection 2.3. The Y axis is the percentage change in net white employment between 1995 and 2000, expressed as a percentage of the total establishment-level employment in 1995 and deviated from the mean in the NAICS sector. Dots depict averages in 1-percentage-point bins of the 1995 minority share. All series use only the 50% of establishments not used to identify the tipping points.

Figure 2. Firm-level Minority Composition Change in NAICS Sector 23 - Construction, 1995-2000



Notes: Dots show the mean of the change in the net establishment-level white employment between 1995 and 2000 as a percentage of the total employment in 1995, grouping establishments into cells of width 1% by the 1995 minority share. The horizontal line depicts the unconditional mean. The vertical line depicts the estimated tipping point using the fixed-point procedure described in subsection 2.3 and a 50 percent sample of single-establishment firms in NAICS sector 23.

Figure 3. Three Equilibria, With Social Interaction Effects

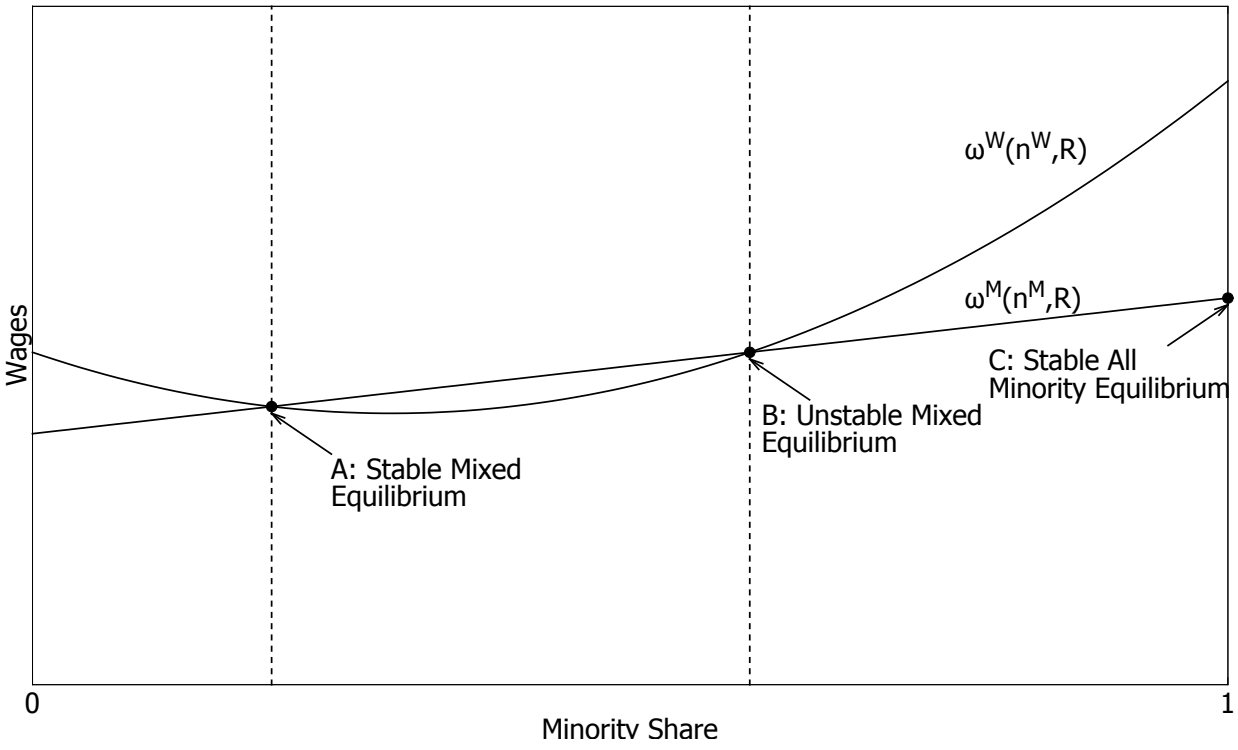


Figure 4. Rising Minority Labor Supply Leads to a Tipping Point

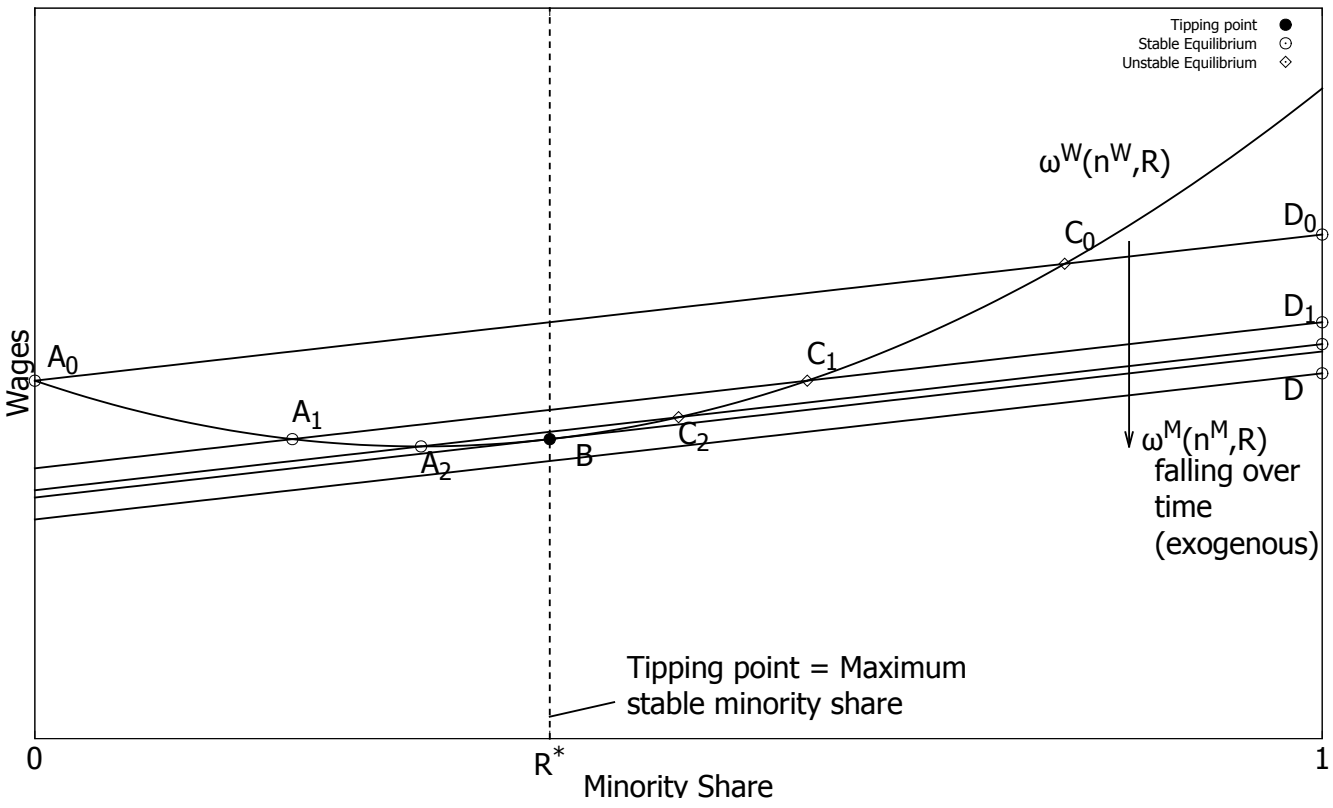
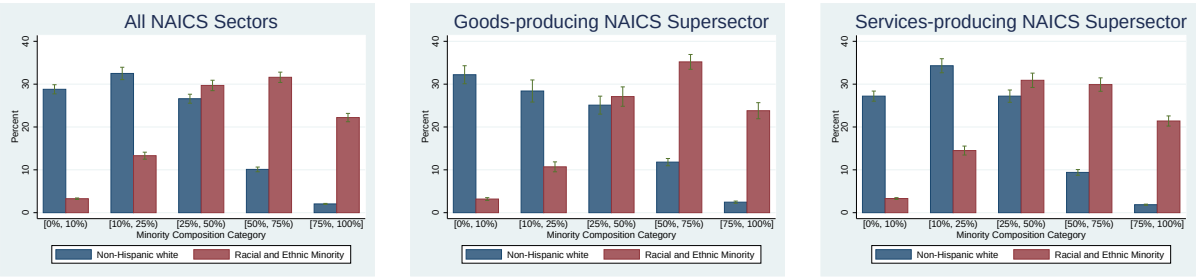
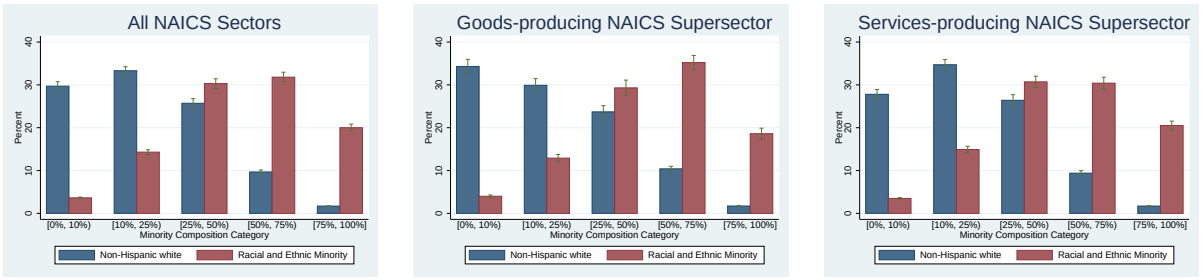


Figure 5. White and Minority Workers in Firms Grouped by Minority Composition Category

(a) 2000

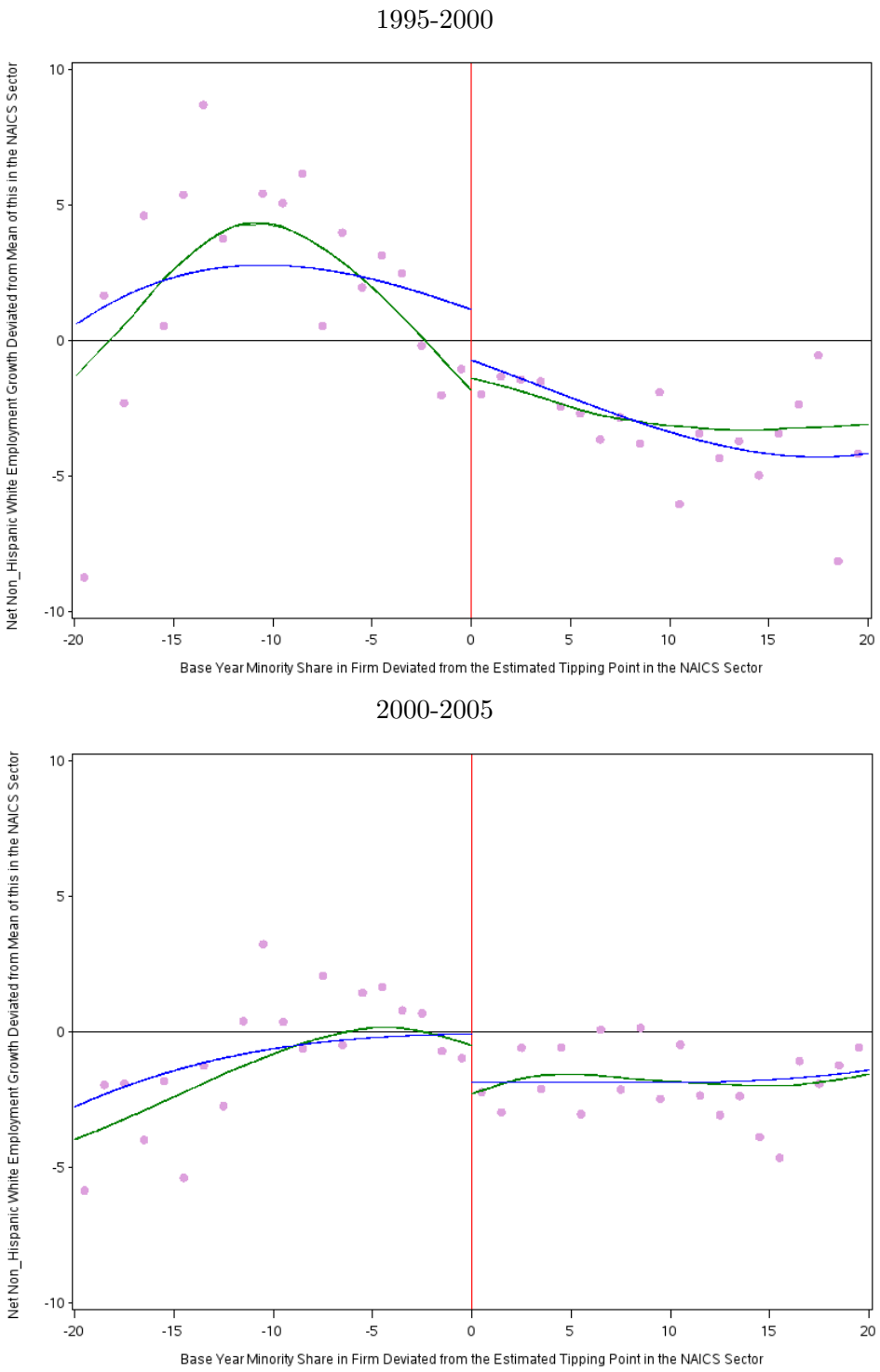


(b) 2005



Notes: Blue bars represent non-Hispanic whites and red bars represents racial and ethnic minorities. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. The standard errors of the estimates are corrected taking into consideration of the variance contribution of multiple imputation. Standard error bars are included. The Rubin missingness ratios of these estimates can be found in Appendix Table 2.

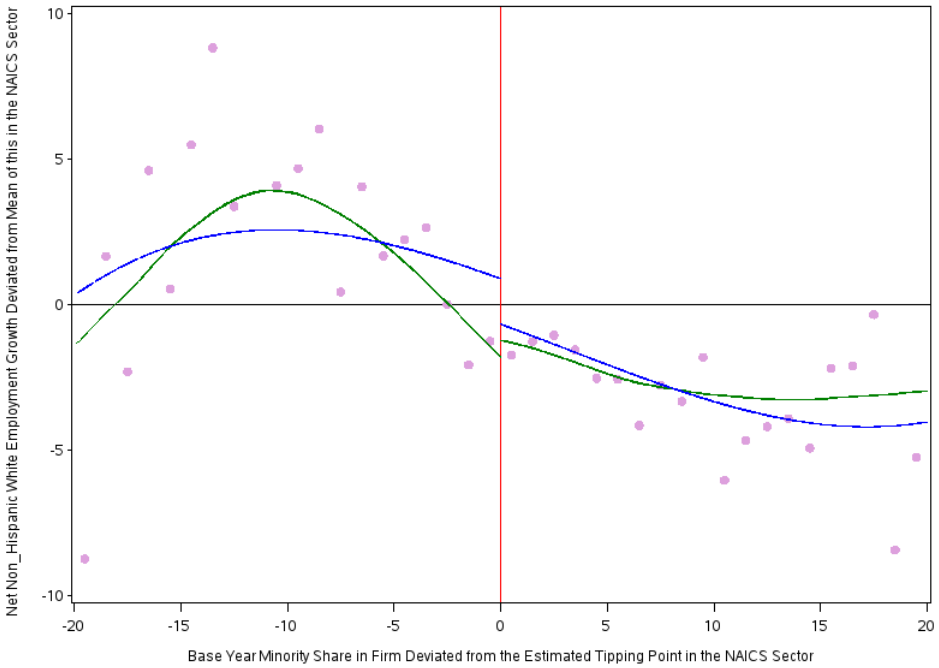
Figure 6. Minority Composition Change in All NAICS Sectors Pooled Sample, by Relationship to Candidate Tipping Point



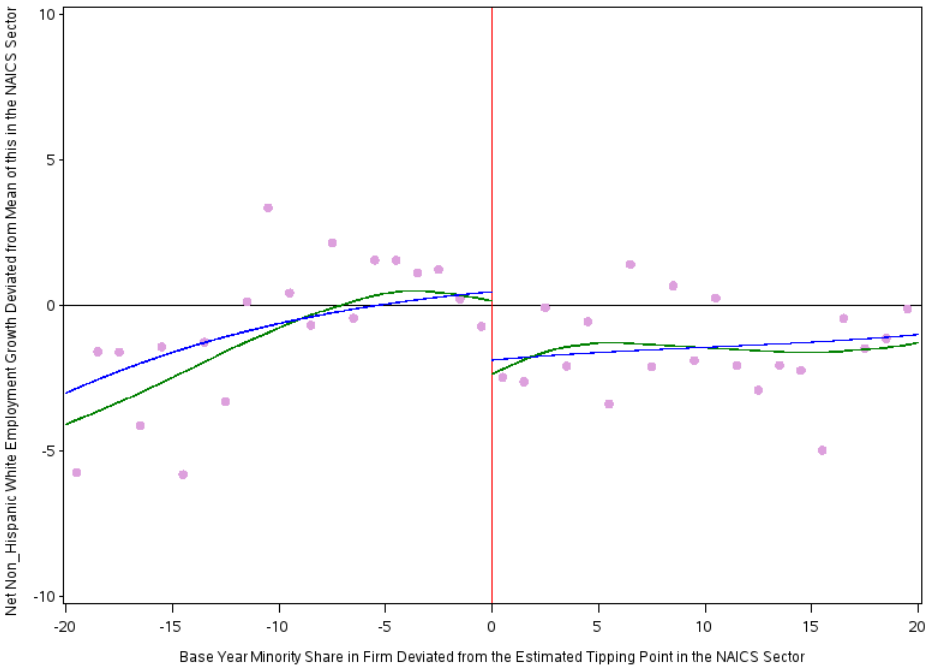
Notes: the X axis is minority share in establishment deviated from the estimated sector-specific tipping point. The Y axis is the change in net white employment in a five-year interval as a fraction of the total base year employment and deviated from the mean in the NAICS sector. Dots depict means in 1-percentage-point bins. The green line is a local linear regression fit separately on either side of zero using an Epanechnikov kernel and a bandwidth of 5. The blue line is a global third-order polynomial with an intercept shift at zero. All series use only the 50% of establishments not used to identify the tipping points.

Figure 7. Minority Composition Change in Service-producing NAICS Supersector Pooled Sample, by Relationship to Candidate Tipping Point

1995-2000



2000-2005



Notes: the X axis is minority share in establishment deviated from the estimated sector-specific tipping point. The Y axis is the change in net white employment in a five-year interval as a fraction of the total base year employment and deviated from the mean of this in the NAICS sector. Dots depict means in 1-percentage-point bins. The green line is a local linear regression fit separately on either side of zero using an Epanechnikov kernel and a bandwidth of 5. The blue line is a global 3^{rd} order polynomial with an intercept shift at zero. All series use only the 50% of establishments not used to identify the tipping points.

Table 1. Actual and Expected Duncan & Duncan Index by NAICS Sector

NAICS Sector	Duncan & Duncan (DD) Index		
	Actual	Expected	Difference
	Year 2000		
21 Mining, Quarrying, and Oil and Gas Extraction	36.8	13.4	23.3
22 Utilities	29.1	17.3	11.8
23 Construction	36.2	16.4	19.9
31-33 Manufacturing	41.1	11.1	30.0
42 Wholesale Trade	40.0	16.0	24.1
44-45 Retail Trade	40.2	17.0	23.2
48-49 Transportation and Warehousing	38.9	13.0	25.9
51 Information	31.8	10.7	21.1
52 Finance and Insurance	34.2	12.5	21.7
53 Real Estate and Rental and Leasing	37.9	17.4	20.5
54 Professional, Scientific, and Technical Services	31.7	15.1	16.6
55 Management of Companies and Enterprises	28.6	15.0	13.6
56 Administrative & Support and Waste Management & Remediation	40.5	11.2	29.3
61 Educational Services	35.3	11.3	24.0
62 Health Care and Social Assistance	42.7	12.1	30.6
71 Arts, Entertainment, and Recreation	35.2	12.4	22.8
72 Accommodation and Food Services	41.7	16.4	25.3
81 Other Services (except Public Administration)	42.7	18.4	24.3
	Year 2005		
21 Mining, Quarrying, and Oil and Gas Extraction	36.1	14.6	21.5
22 Utilities	31.6	17.6	13.9
23 Construction	35.9	17.6	18.3
31-33 Manufacturing	39.9	11.2	28.7
42 Wholesale Trade	38.3	16.1	22.3
44-45 Retail Trade	39.2	17.3	21.9
48-49 Transportation and Warehousing	38.4	13.1	25.3
51 Information	29.6	11.7	17.9
52 Finance and Insurance	32.9	13.1	19.8
53 Real Estate and Rental and Leasing	36.8	17.1	19.7
54 Professional, Scientific, and Technical Services	33.3	16.9	16.4
55 Management of Companies and Enterprises	28.8	12.3	16.5
56 Administrative & Support and Waste Management & Remediation	40.3	11.8	28.5
61 Educational Services	35.2	10.8	24.4
62 Health Care and Social Assistance	42.0	11.3	30.7
71 Arts, Entertainment, and Recreation	35.4	12.9	22.6
72 Accommodation and Food Services	40.5	16.0	24.5
81 Other Services (except Public Administration)	41.4	19.1	22.3

Notes: The sector-specific actual and expected DD indices are computed by averaging the state-specific actual and expected DD indices, weighted by the numbers of firms in the sector and state cell. Each statistic is computed and averaged across the results obtained using the 10 implicate files. The corrected standard errors and Rubin missingness ratios are presented in Appendix Tables 4 and 5.

Table 2. Summary Statistics for Establishments

	1995			2000		
	All	**Goods-producing**	**Services-producing**	**All**	**Goods-producing**	**Services-producing**
Total # of Firms	200,000	48,500	151,000	341,000	78,300	263,000
Mean % Minority	33.60	34.40	33.40	33.20	32.90	33.30
Std. Dev.	(23.2)	(24.1)	(22.9)	(23.1)	(23.3)	(23.0)
Mean % Asians	5.88	4.83	6.21	5.95	4.51	6.38
Std. Dev.	(13.0)	(11.2)	(13.5)	(13.3)	(10.8)	(13.9)
Mean % Blacks	9.02	7.64	9.46	10.20	8.68	10.60
Std. Dev.	(14.9)	(12.7)	(15.5)	(15.7)	(13.5)	(16.3)
Mean % Hispanics	18.70	21.90	17.70	16.90	19.50	16.10
Std. Dev.	(21.4)	(23.1)	(20.7)	(20.5)	(21.9)	(20.0)
Growth in:						
White Employment	4.14	4.05	4.18	0.39	−3.77	2.17
Minority Employment	7.23	7.97	6.89	3.10	1.16	3.93
Asians	1.49	1.80	1.35	0.85	0.43	1.03
Blacks	1.73	1.00	2.05	0.46	−0.61	0.92
Hispanics	4.15	5.31	3.63	1.90	1.44	2.09
Total Employment	11.40	12.00	11.10	3.49	−2.60	6.10

Notes: Year at top of column is the base year. The numbers of firms do not sum up due to rounding for disclosure avoidance purposes. Each statistic is computed and averaged across the results obtained using the 10 implicate files. The corrected standard errors and Rubin missingness ratios are presented in Appendix Tables 6 and 7.

Table 3. Summary Statistics for Establishments by Base-year Minority Shares

	1995			2000		
	All	**Goods-producing**	**Services-producing**	**All**	**Goods-producing**	**Services-producing**
Total # of Firms	200,000	48,500	151,000	341,000	78,300	263,000
0 to 5% Minority in BY:						
# of Firms	10,800	3,470	7,380	18,600	5,590	13,000
as % of Total # of Firms	5.40	7.15	4.89	5.45	7.14	4.94
Growth in:						
Total Employment	12.30	11.10	13.00	4.16	−3.75	9.07
White Employment	8.86	7.88	9.48	1.82	−5.29	6.23
5 to 20% Minority in BY:						
# of Firms	65,800	14,900	50,900	114,000	25,400	89,000
as % of Total # of Firms	32.90	30.72	33.71	33.43	32.44	33.84
Growth in:						
Total Employment	13.10	12.40	13.40	4.98	−1.88	7.76
White Employment	6.08	5.28	6.39	0.97	−4.70	3.26
20 to 50% Minority in BY:						
# of Firms	81,900	18,500	63,400	139,000	30,300	108,000
as % of Total # of Firms	40.95	38.14	41.99	40.76	38.70	41.06
Growth in:						
Total Employment	10.50	13.90	9.22	3.15	−1.80	5.02
White Employment	1.57	2.37	1.26	−0.92	−4.28	0.36
50 to 80% Minority in BY:						
# of Firms	33,200	9,520	23,700	55,600	14,200	41,400
as % of Total # of Firms	16.60	19.63	15.70	16.30	18.14	15.74
Growth in:						
Total Employment	9.65	11.70	8.48	1.01	−3.22	3.09
White Employment	1.85	1.91	1.81	0.24	−1.11	0.91
80 to 100% Minority in BY:						
# of Firms	8,170	2,160	6,010	13,500	2,850	10,700
as % of Total # of Firms	4.09	4.45	3.98	3.96	3.64	4.07
Growth in:						
Total Employment	7.90	3.49	10.20	1.68	−7.56	5.26
White Employment	3.36	2.69	3.70	2.64	1.63	3.03

Notes: "BY" stands for "Base Year." Year at the top of the column is the base year. The numbers of firms do not sum up due to rounding for disclosure avoidance purposes. Each statistic, except the number of firms as a percentage of the total number of firms, is computed and averaged across the results obtained using the 10 implicate files. The corrected standard errors and Rubin missingness ratios are presented in Appendix Table 8.

Table 4. NAICS Sector-Specific Candidate Tipping Points Using the Fixed-point Procedure

NAICS Sector	**Estimated Tipping Point**	
	$1995-2000$	$2000-2005$
21 Mining, Quarrying, and Oil and Gas Extraction	15.10	23.30
22 Utilities	10.90	18.60
23 Construction	14.20	9.74
31-33 Manufacturing	16.00	38.60
42 Wholesale Trade	13.20	7.18
44-45 Retail Trade	7.55	2.44
48-49 Transportation and Warehousing	19.20	9.90
51 Information	14.70	19.50
52 Finance and Insurance	12.50	13.00
53 Real Estate and Rental and Leasing	8.05	5.56
54 Professional, Scientific, and Technical Services	6.47	8.88
55 Management of Companies and Enterprises	15.80	16.80
56 Administrative & Support and Waste Management & Remediation	15.00	7.81
61 Educational Services	11.10	17.50
62 Health Care and Social Assistance	11.60	12.80
71 Arts, Entertainment, and Recreation	18.60	27.30
72 Accommodation and Food Services	39.70	26.20
81 Other Services (except Public Administration)	5.26	14.10
All NAICS Sector Average	14.16	15.51
Standard Deviation	7.49	9.08

Notes: Observations used to conduct the fixed-point procedure are the 50 percent simple random subsample of the establishments for each five-year interval. The tipping point is measured in base-year minority shares in each sector. Each estimate is computed and averaged across the results obtained using the 10 implicate files.

Table 5. Basic Regression Discontinuity Models for Changes in Employment Around the Tipping Point

	All NAICS						
	Net Change in white employment		Change in minority share	Change in white employment		Change in minority employment	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1995-2000							
Beyond candidate tipping point in 1995	−6.06	−5.83	2.32	−3.36	−3.15	2.70	2.68
	(1.14)	(1.16)	(0.33)	(1.02)	(1.04)	(0.54)	(0.52)
	[0.60]	[0.61]	[0.56]	[0.51]	[0.54]	[0.48]	[0.46]
Establishment controls	n	y	y	n	y	n	y
N	99,900	99,900	99,900	99,900	99,900	99,900	99,900
2000-2005							
Beyond candidate tipping point in 2000	−3.07	−3.25	0.96	−2.50	−2.70	0.57	0.56
	(1.06)	(1.06)	(0.45)	(1.01)	(1.03)	(0.59)	(0.59)
	[0.50]	[0.50]	[0.69]	[0.60]	[0.61]	[0.48]	[0.49]
Establishment controls	n	y	y	n	y	n	y
N	170,000	170,000	170,000	170,000	170,000	170,000	170,000

Note: The unit of analysis is an establishment in the indicated five-year window. Dependent variables are the change in the relevant employment - net non-Hispanic white in columns (1) and (2), non-Hispanic white in columns (4) and (5), and minority in columns (6) and (7)) as a percentage (0-100) of the establishment's total base-year employment. Column (3) takes as the dependent variable the minority share in an end year minus the minority share in a base year but is otherwise identical. All specifications are estimated using only the 50% of single-establishment firms not used to identify the candidate tipping points. The specifications include fixed state effects, fixed NAICS sector effects, a cubic polynomial in the deviation in the establishment's minority share from the candidate tipping point, the share of workers approaching retirement, the share of workers who are 24 years old or younger, and log average earnings. All are measured in the base year at the establishment-level. Standard errors are clustered on the state-sector level. All estimates are computed and averaged across the results obtained using the 10 implicate files. The variance-covariance matrices of the estimates are corrected, taking into consideration the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 6. Basic Regression Discontinuity Models for Changes in Employment Around the Tipping Point Using the 19 States Contained in 1995-2000 Sample, 2000-2005

	All NAICS			
	Net Change in white employment	Change in minority share	Change in white employment	Change in minority employment
	(1)	(2)	(3)	(4)
2000-2005				
Beyond candidate tipping point in 2000	−2.75	0.86	−2.29	0.46
	(1.20)	(0.54)	(1.08)	(0.73)
	[0.34]	[0.59]	[0.46]	[0.42]
Establishment controls	y	y	y	y
N	119,000	119,000	119,000	119,000

Note: The unit of analysis is an establishment in 2000-2005 from the following 19 states: CA, CO, FL, ID, IL, KS, LA, MD, MN, MO, MT, NC, NY, OR, PA, RI, TX, WA, and WI. See Table 5 footnote (columns(2), (3), (5), and (7)) for details on specifications. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 7. Basic Regression Discontinuity Models for Net Non-Hispanic White Employment Changes Around the Tipping Point: Goods-producing vs. Services-producing NAICS Supersectors

	Services-producing			**Goods-producing**		
	Net Change in white employment	Change in white employment	Change in minority employment	Net Change in white employment	Change in white employment	Change in minority employment
	(1)	(2)	(3)	(4)	(5)	(6)
1995-2000						
Beyond candidate tipping	−5.78	−3.32	2.46	−0.14	−0.067	0.068
point in 1995	(1.18)	(1.05)	(0.51)	(3.34)	(3.09)	(1.99)
	[0.59]	[0.50]	[0.42]	[0.49]	[0.28]	[0.55]
Establishment controls	y	y	y	y	y	y
N	90,100	90,100	90,100	9,800	9,800	9,800
2000-2005						
Beyond candidate tipping	−3.34	−2.45	0.89	−0.16	−0.23	−0.067
point in 2000	(1.11)	(1.07)	(0.59)	(4.52)	(4.32)	(2.32)
	[0.50]	[0.63]	[0.53]	[0.51]	[0.45]	[0.66]
Establishment controls	y	y	y	y	y	y
N	152,000	152,000	152,000	18,000	18,000	18,000

Note: See Table 5 footnote for a description on specifications. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 8. Tipping in Firms Which Have Undergone Small Changes in Employment

	All NAICS				
	Net Change in white employment	Change in minority share	Change in white employment	Change in minority employment	Change in total employment
	(1)	(2)	(3)	(4)	(5)
1995-2000					
Beyond candidate tipping point in 1995	−4.24	2.05	−2.18	2.06	−0.11
	(0.82)	(0.41)	(0.43)	(0.41)	(0.19)
	[0.44]	[0.45]	[0.42]	[0.46]	[0.50]
Establishment controls	y	y	y	y	y
N	21,500	21,500	21,500	21,500	21,500
2000-2005					
Beyond candidate tipping point in 2000	−1.87	0.85	−1.01	0.86	−0.16
	(0.92)	(0.45)	(0.47)	(0.45)	(0.14)
	[0.54]	[0.56]	[0.52]	[0.55]	[0.35]
Establishment controls	y	y	y	y	y
N	39,100	39,100	39,100	39,100	39,100

Note: The unit of analysis is an establishment in a five-year interval that has undergone less than 10 percentage point change in establishment-level employment. See Table 5 footnote (columns(2), (3), (5), and (7)) for details on specifications. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 9. Sensitivity to Flexible Controls For Establishment Covariates

	(1)	(2)	(3)	(4)	(5)
1995-2000	−5.83	−5.85	−6.02	−5.99	−6.11
	(1.16)	(1.17)	(1.18)	(1.18)	(1.20)
	[0.61]	[0.62]	[0.63]	[0.63]	[0.64]
3^{rd}-order polynomial in:					
log average earnings		y			y
share of retiring workers			y		y
share of young workers				y	y
2000-2005	−3.25	−3.26	−3.22	−3.17	−3.17
	(1.06)	(1.07)	(1.08)	(1.08)	(1.10)
	[0.50]	[0.50]	[0.49]	[0.50]	[0.50]

Notes: The specification in column (1) is that from column (2) of Table 5. The dependent variable is the change in net non-Hispanic white employment as a percentage of base-year total establishment employment. The remaining specifications add third-order polynomials in the listed control variables. All specifications are estimated using only the 50% of establishments not used to identify the tipping points. Standard errors are clustered on the state-sector level. All estimates are computed and averaged across the results obtained using the 10 implicate files. The variance-covariance matrices of the estimates are corrected, taking into consideration the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 10. Changes in Covariates Around the Candidate Tipping Point

Dependent Variable: Change in	**Log Average Earnings** (1)	**% of Retiring Workers** (2)	**% of Young Workers** (3)
1995-2000			
Beyond candidate tipping point in 1995	0.0019	0.049	−0.032
	(0.0057)	(0.21)	(0.26)
	[0.38]	[0.57]	[0.53]
2000-2005			
Beyond candidate tipping point in 2000	−0.00052	−0.052	−0.19
	(0.0048)	(0.15)	(0.21)
	[0.27]	[0.30]	[0.49]

Notes: All specifications are estimated using only the 50% of single-establishment firms not used to identify the candidate tipping points. All specifications include fixed state effects, fixed sector effects, and a cubic polynomial in the deviation in the establishment's minority share from the candidate tipping point. Standard errors are clustered on the state-NAICS sector. All estimates are computed and averaged across the results obtained using the 10 implicate files. The variance-covariance matrices of the estimates are corrected, taking into consideration the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 11. Tipping in Minority Share, Black Share, and Hispanic Share, 1995-2000

	Percentage change in net white employment				Percentage change in white employment				Percentage change in minority employment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Beyond minority share fixed point	−5.83			−4.95	−3.15			−2.03	2.68			2.91
	(1.16)			(1.14)	(1.04)			(1.10)	(0.52)			(0.55)
	[0.61]			[0.60]	[0.54]			[0.56]	[0.46]			[0.42]
Beyond black share fixed point		−4.68		−4.20		−7.71		−7.18		−3.03		−2.98
		(1.10)		(1.16)		(1.71)		(1.79)		(1.46)		(1.43)
		[0.55]		[0.60]		[0.60]		[0.62]		[0.63]		[0.66]
Beyond Hispanic share fixed point			−4.71	−3.15			−6.56	−5.54			−1.84	−2.39
			(0.79)	(0.73)			(1.01)	(0.95)			(0.78)	(0.75)
			[0.27]	[0.22]			[0.16]	[0.24]			[0.23]	[0.24]
Cubic in min. share minus TP	y			y	y			y	y			y
Cubic in bl. share minus TP		y		y		y		y		y		y
Cubic in hi. share minus TP			y	y			y	y			y	y
Establishment controls	y	y	y	y	y	y	y	y	y	y	y	y

Notes: See Table 5 footnote for a description of establishment-level controls. Specification in columns (1), (5), and (9) are identical to those in Table 5. Other columns explore candidate tipping points in the establishment black share or Hispanic share. All specifications include fixed state effects and fixed sector effects. All specifications are estimated using only the 50% of establishments not used to identify the tipping points. Standard errors are clustered on the state-sector level. All estimates are computed and averaged across the results obtained using the 10 implicate files. The variance-covariance matrices of the estimates are corrected, taking into consideration the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Table 12. Tipping in Minority Share, Black Share, and Hispanic Share, 2000-2005

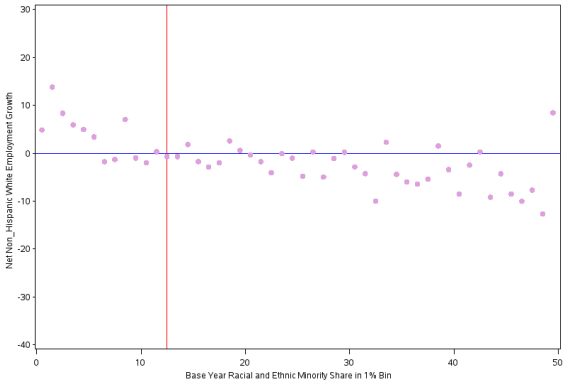
	net white employment				**Percentage change in white employment**				**minority employment**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Beyond minority share fixed point	−3.25			−2.39	−2.70			−1.66	0.56			0.72
	(1.06)			(1.00)	(1.03)			(1.02)	(0.59)			(0.66)
	[0.50]			[0.46]	[0.61]			[0.61]	[0.49]			[0.57]
Beyond black share fixed point		0.29		0.039		0.84		0.52		0.55		0.48
		(1.18)		(0.95)		(2.00)		(1.76)		(1.12)		(1.21)
		[0.69]		[0.53]		[0.85]		[0.82]		[0.75]		[0.79]
Beyond Hispanic share fixed point			−4.54	−2.89			−7.01	−5.84			−2.47	−2.94
			(0.74)	(0.71)			(1.24)	(1.18)			(0.98)	(0.99)
			[0.39]	[0.42]			[0.69]	[0.72]			[0.75]	[0.75]
Cubic in min. share minus TP	y			y	y			y	y			y
Cubic in bl. share minus TP		y		y		y		y		y		y
Cubic in hi. share minus TP			y	y			y	y			y	y
Establishment controls	y	y	y	y	y	y	y	y	y	y	y	y

Notes: See Table 5 footnote for a description of establishment-level controls. Specification in columns (1), (5) and (9) are identical to those in Table 5. Other columns explore candidate tipping points in the establishment black share or Hispanic share. All specifications include fixed state effects and fixed sector effects. All specifications are estimated using only the 50% of establishments not used to identify the tipping points. Standard errors are clustered on the state-sector level. All estimates are computed and averaged across the results obtained using the 10 implicate files. The variance-covariance matrices of the estimates are corrected, taking into consideration the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

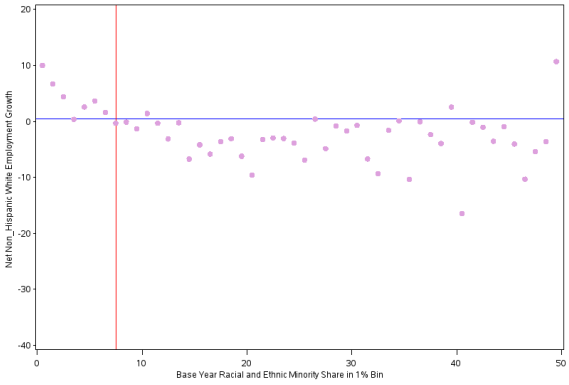
Appendix Figure 1. Firm-level Minority Composition Change in Selected NAICS Sectors

(a) 1995-2000

NAICS 42: Wholesale Trade

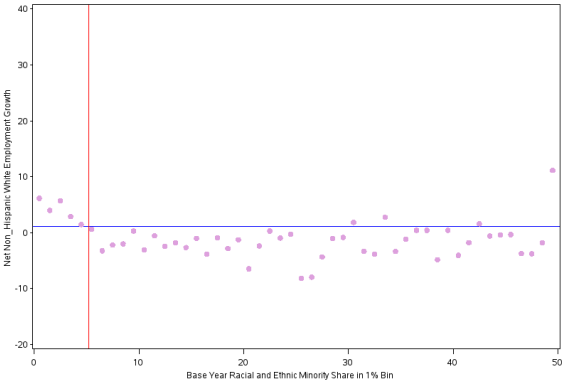


NAICS 44-45: Retail Trade

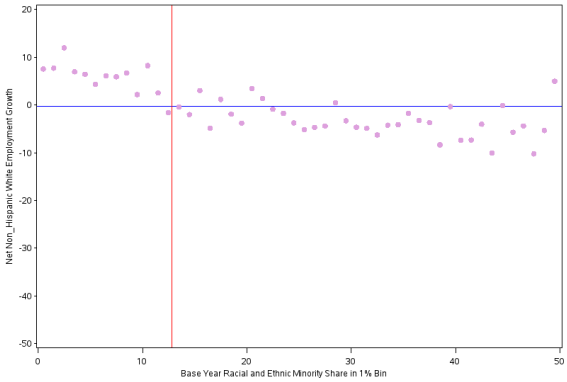


(b) 2000-2005

NAICS 42: Wholesale Trade



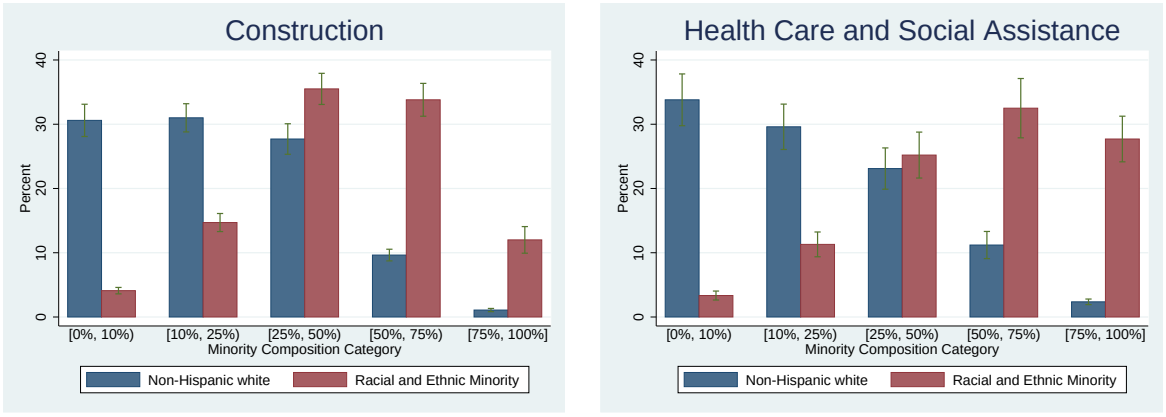
NAICS 62: Health Care and Social Assistance



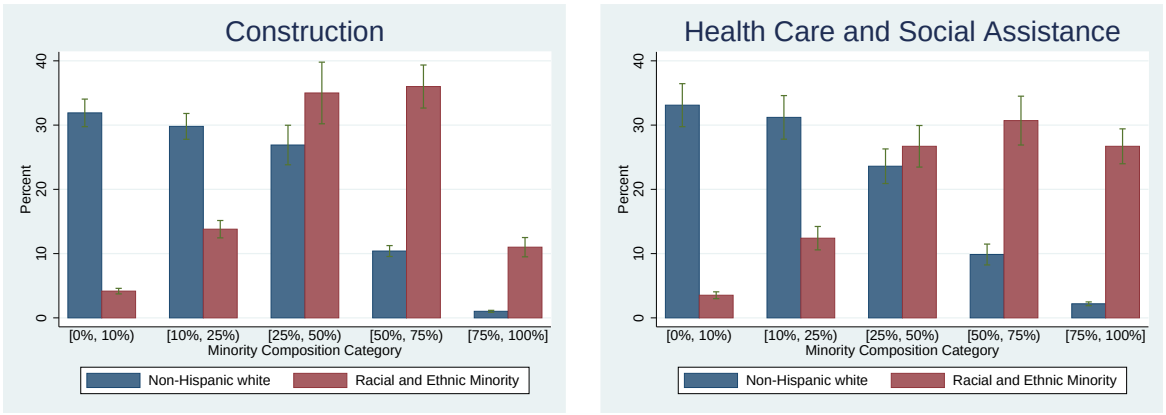
Notes: Dots show mean of the change in the net establishment-level white employment in a five-year window as a percentage of the total employment in the base year, grouping establishments into cells of width 1 percentage point by the base-year minority share. The horizontal line depicts the unconditional mean. The vertical line depicts the estimated tipping point using the fixed-point procedure described in subsection 2.3 and a 50 percent sample of single-establishment firms in a NAICS sector.

Appendix Figure 2. White and Minority Workers in Firms Grouped by Minority Composition Category in Selected NAICS Sectors

(a) 2000



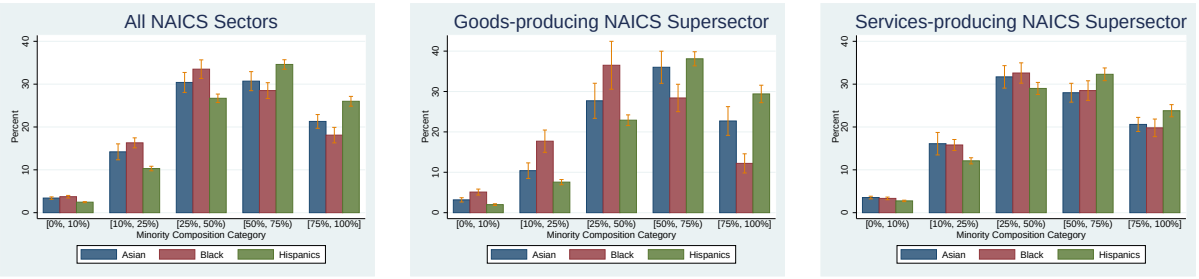
(b) 2005



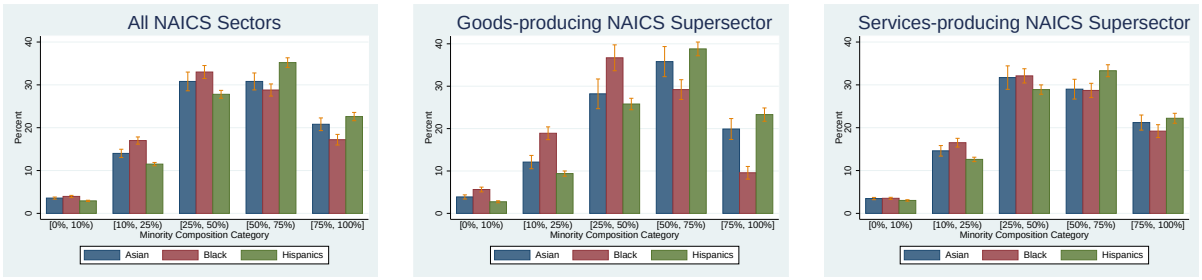
Notes: Blue bars represent non-Hispanic whites and red bars represents racial and ethnic minorities. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. The standard errors of the estimates are corrected taking into consideration of the variance contribution of multiple imputation. Standard error bars are included. The Rubin missingness ratios of these estimates can be found in Appendix Table 3.

Appendix Figure 3. Various Groups of Minority Workers in Firms Grouped by Minority Composition Category

(a) 2000

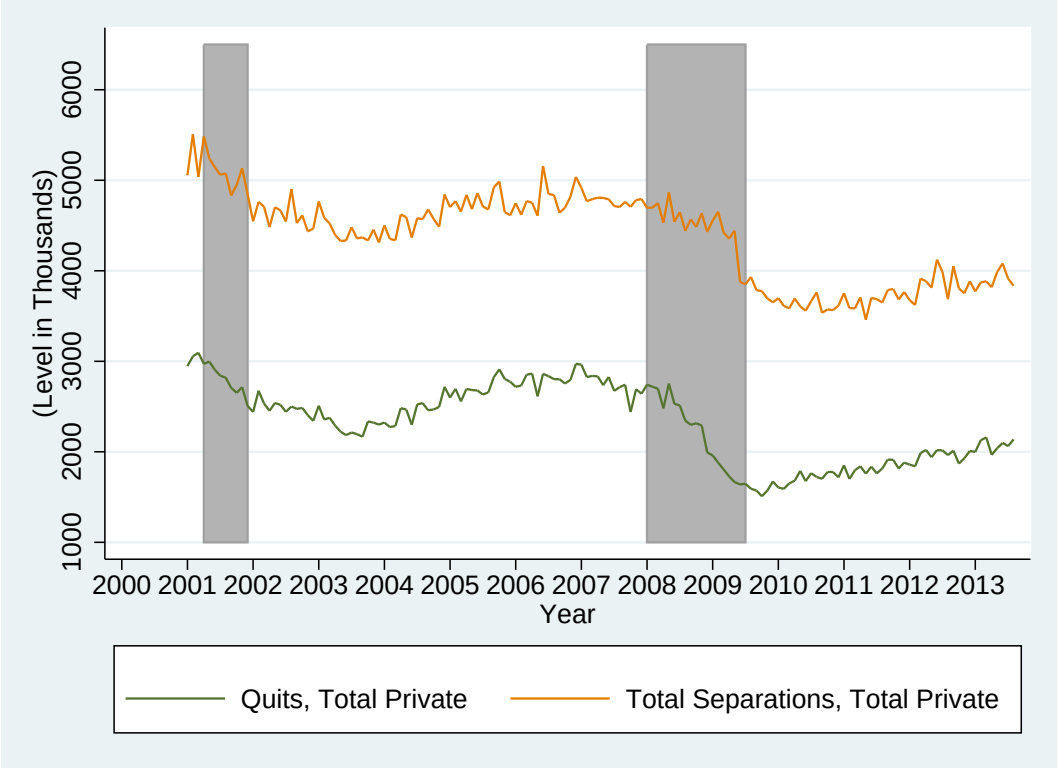


(b) 2005



Notes: Blue bars represent Asians, red bars represent blacks, and green bars represent Hispanics. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. The standard errors of the estimates are corrected taking into consideration of the variance contribution of multiple imputation. Standard error bars are included. The Rubin missingness ratios of these estimates can be found in Appendix Table 2.

Appendix Figure 4. Quits and Total Separations: Total Private, Monthly, Seasonally Adjusted, 2000-12-01 to 2013-07-01



Data Source: Bureau of Labor Statistics, Job Openings and Labor Turnover Survey, JTS1000QUL and JTS1000TSL. Shaded areas indicate U.S. recessions. The start and end dates of the recessions are obtained from the National Bureau of Economic Research, (http://www.nber.org/cycles.html)

Appendix Table 1. Summary Statistics for Establishments by Base-year Minority Shares of Selected NAICS Sectors

	1995		2000	
	23 Construction	**62 Health Care & Social Asst**	**23 Construction**	**62 Health Care & Social Asst**
Total # of Firms	19,000	22,500	35,400	42,000
Mean % Minority	31.30	34.90	31.20	34.30
Std. Dev.	(21.9)	(23.3)	(21.6)	(23.7)
Growth in:				
White Employment	14.60	2.53	2.16	5.93
Minority Employment	11.80	5.42	5.52	6.93
Total Employment	26.40	7.95	7.68	12.90
0 to 5% Minority in BY:				
# of Firms	1,140	1,110	2,070	2,170
as % of Total # of Firms	6.00	4.93	5.85	5.17
Growth in:				
Total Employment	27.10	10.30	3.81	14.20
White Employment	22.10	8.18	1.17	12.00
5 to 20% Minority in BY:				
# of Firms	6,750	6,970	12,400	13,700
as % of Total # of Firms	35.53	30.98	35.03	32.62
Growth in:				
Total Employment	27.90	9.57	5.81	14.30
White Employment	17.10	3.96	0.63	9.11
20 to 50% Minority in BY:				
# of Firms	7,880	9,710	14,800	17,200
as % of Total # of Firms	41.47	43.16	41.81	40.95
Growth in:				
Total Employment	25.40	7.64	9.06	10.90
White Employment	10.40	−0.20	2.15	2.99
50 to 80% Minority in BY:				
# of Firms	2,750	3,720	5,320	6,860
as % of Total # of Firms	14.47	16.53	15.03	16.33
Growth in:				
Total Employment	24.90	4.49	11.50	11.30
White Employment	10.90	0.33	6.03	1.40
80 to 100% Minority in BY:				
# of Firms	500	1,030	810	2,020
as % of Total # of Firms	2.63	4.58	2.29	4.81
Growth in:				
Total Employment	21.80	6.03	14.50	15.90
White Employment	10.50	1.33	9.14	2.27

Notes: See Table 3 footnote for a description of the table structure. The corrected standard errors and Rubin missingness ratios are presented in Appendix Tables 9 and 10.

Appendix Table 2. Rubin Missingness Ratios Computed for Estimates Used in Figure 5 and Appendix Figures 3

NAICS Sector	Minority Composition	Percent of Whites	Minorities	Asians	Blacks	Hispanics
		Year 2000				
ALL	[0, 10%)	0.25	0.25	0.29	0.34	0.26
	[10%, 25%)	0.37	0.38	0.26	0.32	0.47
	[25%, 50%)	0.18	0.26	0.36	0.34	0.28
	[50%, 75%)	0.35	0.34	0.48	0.26	0.24
	[75%, 100%]	0.28	0.29	0.22	0.56	0.31
Goods-producing Super-sector	[0, 10%)	0.27	0.49	0.46	0.39	0.50
	[10%, 25%)	0.27	0.39	0.49	0.31	0.42
	[25%, 50%)	0.24	0.28	0.23	0.30	0.31
	[50%, 75%)	0.16	0.073	0.36	0.23	0.20
	[75%, 100%]	0.21	0.29	0.23	0.31	0.37
Services-producing Super-sector	[0, 10%)	0.19	0.20	0.12	0.29	0.33
	[10%, 25%)	0.33	0.33	0.26	0.32	0.40
	[25%, 50%)	0.40	0.44	0.46	0.52	0.31
	[50%, 75%)	0.30	0.32	0.32	0.31	0.30
	[75%, 100%]	0.26	0.31	0.24	0.50	0.40
		Year 2005				
ALL	[0, 10%)	0.61	0.63	0.40	0.60	0.62
	[10%, 25%)	0.35	0.35	0.45	0.28	0.30
	[25%, 50%)	0.51	0.41	0.25	0.43	0.38
	[50%, 75%)	0.32	0.37	0.34	0.26	0.37
	[75%, 100%]	0.29	0.35	0.40	0.35	0.29
Goods-producing Super-sector	[0, 10%)	0.47	0.52	0.40	0.52	0.51
	[10%, 25%)	0.30	0.24	0.29	0.20	0.34
	[25%, 50%)	0.33	0.20	0.26	0.24	0.22
	[50%, 75%)	0.25	0.30	0.44	0.25	0.28
	[75%, 100%]	0.33	0.25	0.17	0.29	0.23
Services-producing Super-sector	[0, 10%)	0.52	0.51	0.32	0.46	0.54
	[10%, 25%)	0.41	0.44	0.51	0.36	0.32
	[25%, 50%)	0.44	0.41	0.24	0.45	0.33
	[50%, 75%)	0.30	0.35	0.26	0.25	0.37
	[75%, 100%]	0.32	0.35	0.43	0.34	0.30

Notes: The variable "percent of whites" is used to create the blue bars in Figure 5; the variable "percent of minorities" is used to create the red bars in Figure 5; the variable "percent of Asians" is used to create the blue bars in Appendix Figure 3; the variable "percent of blacks" is used to create the red bars in Appendix Figure 3; the variable "percent of Hispanics" is used to create the green bars in Appendix Table 3. The Rubin missingness ratios are computed following the computational formulas presented in Appendix D.

Appendix Table 3. Rubin Missingness Ratios Computed for Estimates Used in Appendix Figures 2

NAICS Sector	Minority Composition	Percent of Whites	Percent of Minorities
		Year 2000	
23 Construction	[0, 10%)	0.47	0.46
	[10%, 25%)	0.30	0.38
	[25%, 50%)	0.33	0.19
	[50%, 75%)	0.17	0.25
	[75%, 100%]	0.25	0.28
62 Health Care & Social Assistance	[0, 10%)	0.28	0.35
	[10%, 25%)	0.12	0.20
	[25%, 50%)	0.46	0.53
	[50%, 75%)	0.17	0.30
	[75%, 100%]	0.24	0.29
		Year 2005	
23 Construction	[0, 10%)	0.44	0.39
	[10%, 25%)	0.37	0.25
	[25%, 50%)	0.23	0.21
	[50%, 75%)	0.28	0.33
	[75%, 100%]	0.15	0.19
62 Health Care & Social Assistance	[0, 10%)	0.50	0.48
	[10%, 25%)	0.43	0.35
	[25%, 50%)	0.48	0.53
	[50%, 75%)	0.31	0.39
	[75%, 100%]	0.14	0.24

Notes: The variable "percent of whites" is used to create the blue bars in Appendix Figure 2; the variable "percent of minorities" is used to create the red bars in Figure 2. The Rubin missingness ratios are computed following the computational formulas presented in Appendix D.

Appendix Table 4. The Corrected Standard Errors and Rubin Missingness Ratios Computed for the Actual and Expected Duncan & Duncan Index in Table 1, Year 2000

NAICS Sector	Duncan & Duncan Index		
	Actual	Expected	Difference
21 Mining, Quarrying, and Oil and Gas Extraction	(3.36) [0.23]	(2.66) [0.21]	(3.39) [0.33]
22 Utilities	(5.13) [0.23]	(2.11) [0.19]	(4.45) [0.15]
23 Construction	(0.47) [0.19]	(0.42) [0.15]	(0.60) [0.21]
31-33 Manufacturing	(0.55) [0.21]	(0.38) [0.22]	(0.64) [0.23]
42 Wholesale Trade	(0.59) [0.21]	(0.33) [0.51]	(0.67) [0.38]
44-45 Retail Trade	(0.53) [0.18]	(0.55) [0.36]	(0.80) [0.16]
48-49 Transportation and Warehousing	(1.28) [0.44]	(0.79) [0.39]	(1.08) [0.35]
51 Information	(1.71) [0.16]	(1.54) [0.13]	(2.37) [0.15]
52 Finance and Insurance	(1.27) [0.26]	(0.86) [0.19]	(1.44) [0.29]
53 Real Estate and Rental and Leasing	(0.92) [0.17]	(0.68) [0.32]	(0.97) [0.25]
54 Professional, Scientific, and Technical Services	(0.75) [0.17]	(0.51) [0.36]	(0.73) [0.22]
55 Management of Companies and Enterprises	(3.15) [0.20]	(1.81) [0.35]	(3.47) [0.25]
56 Administrative & Support and Waste Management & Remediation	(0.97) [0.29]	(0.85) [0.36]	(1.09) [0.27]
61 Educational Services	(1.96) [0.20]	(1.93) [0.21]	(2.32) [0.20]
62 Health Care and Social Assistance	(1.05) [0.19]	(0.84) [0.28]	(1.09) [0.18]
71 Arts, Entertainment, and Recreation	(1.68) [0.26]	(1.53) [0.37]	(2.46) [0.38]
72 Accommodation and Food Services	(0.57) [0.11]	(0.44) [0.55]	(0.68) [0.22]
81 Other Services (except Public Administration)	(0.72) [0.18]	(0.54) [0.37]	(0.86) [0.30]

Notes: The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 5. The Corrected Standard Errors and Rubin Missingness Ratios Computed for the Actual and Expected Duncan & Duncan Index in Table 1, Year 2005

NAICS Sector	Duncan & Duncan Index		
	Actual	**Expected**	**Difference**
21 Mining, Quarrying, and Oil and Gas Extraction	(2.05) [0.09]	(1.52) [0.15]	(2.37) [0.14]
22 Utilities	(3.55) [0.12]	(1.85) [0.53]	(4.03) [0.21]
23 Construction	(0.40) [0.17]	(0.39) [0.40]	(0.53) [0.46]
31-33 Manufacturing	(0.48) [0.19]	(0.54) [0.34]	(0.67) [0.38]
42 Wholesale Trade	(0.48) [0.29]	(0.36) [0.18]	(0.52) [0.11]
44-45 Retail Trade	(0.59) [0.22]	(0.40) [0.53]	(0.50) [0.23]
48-49 Transportation and Warehousing	(1.22) [0.44]	(0.63) [0.19]	(1.26) [0.30]
51 Information	(1.78) [0.14]	(1.35) [0.21]	(2.25) [0.23]
52 Finance and Insurance	(1.09) [0.36]	(0.77) [0.27]	(1.23) [0.23]
53 Real Estate and Rental and Leasing	(0.89) [0.20]	(0.57) [0.10]	(0.80) [0.21]
54 Professional, Scientific, and Technical Services	(0.74) [0.31]	(0.39) [0.33]	(0.75) [0.22]
55 Management of Companies and Enterprises	(2.59) [0.40]	(1.25) [0.33]	(2.62) [0.33]
56 Administrative & Support and Waste Management & Remediation	(0.76) [0.23]	(0.60) [0.29]	(0.80) [0.28]
61 Educational Services	(1.60) [0.31]	(1.29) [0.12]	(2.03) [0.23]
62 Health Care and Social Assistance	(0.88) [0.14]	(0.78) [0.11]	(0.93) [0.23]
71 Arts, Entertainment, and Recreation	(1.71) [0.078]	(1.21) [0.26]	(2.17) [0.17]
72 Accommodation and Food Services	(0.61) [0.43]	(0.40) [0.16]	(0.70) [0.38]
81 Other Services (except Public Administration)	(0.72) [0.23]	(0.40) [0.18]	(0.79) [0.27]

Notes: The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 6. The Corrected Standard Errors and Rubin Missingness Ratios for Summary Statistics in Table 2, Part 1

	1995			2000		
	All	**Goods-producing**	**Services-producing**	**All**	**Goods-producing**	**Services-producing**
Mean % Minority	(0.065)	(0.12)	(0.081)	(0.050)	(0.096)	(0.060)
	[0.37]	[0.22]	[0.48]	[0.36]	[0.22]	[0.44]
Std. Dev.	(0.040)	(0.074)	(0.053)	(0.031)	(0.060)	(0.039)
	[0.39]	[0.29]	[0.52]	[0.33]	[0.31]	[0.45]
Mean % Asians	(0.035)	(0.060)	(0.043)	(0.029)	(0.046)	(0.035)
	[0.32]	[0.27]	[0.35]	[0.40]	[0.28]	[0.40]
Std. Dev.	(0.063)	(0.13)	(0.07)	(0.060)	(0.11)	(0.069)
	[0.23]	[0.28]	[0.22]	[0.50]	[0.29]	[0.50]
Mean % Blacks	(0.036)	(0.064)	(0.045)	(0.032)	(0.052)	0.038
	[0.17]	[0.18]	[0.25]	[0.29]	[0.14]	[0.29]
Std. Dev.	(0.055)	(0.10)	(0.066)	(0.050)	(0.083)	(0.058)
	[0.25]	[0.23]	[0.28]	[0.48]	[0.30]	[0.48]
Mean % Hispanics	(0.059)	(0.12)	(0.069)	(0.039)	(0.090)	(0.048)
	[0.35]	[0.17]	[0.41]	[0.16]	[0.23]	[0.33]
Std. Dev.	(0.052)	(0.091)	(0.066)	(0.037)	(0.075)	(0.045)
	[0.42]	[0.30]	[0.49]	[0.23]	[0.30]	[0.31]

Notes: The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 7. The Corrected Standard Errors and Rubin Missingness Ratios for Summary Statistics in Table 2, Part 2

	1995			2000		
	All	**Goods-producing**	**Services-producing**	**All**	**Goods-producing**	**Services-producing**
Growth in:						
White Employment	(0.31)	(0.46)	(0.41)	(0.20)	(0.31)	(0.23)
	[0.28]	[0.25]	[0.31]	[0.27]	[0.24]	[0.22]
Minority Employment	(0.19)	(0.33)	(0.23)	(0.12)	(0.23)	(0.15)
	[0.28]	[0.26]	[0.22]	[0.23]	[0.41]	[0.27]
Asians	(0.069)	(0.14)	(0.074)	(0.043)	(0.089)	(0.052)
	[0.34]	[0.26]	[0.33]	[0.24]	[0.47]	[0.28]
Blacks	(0.096)	(0.13)	(0.12)	(0.059)	(0.098)	(0.078)
	[0.23]	[0.38]	[0.13]	[0.15]	[0.41]	[0.18]
Hispanics	(0.098)	(0.21)	(0.12)	(0.069)	(0.14)	(0.080)
	[0.28]	[0.24]	[0.42]	[0.42]	[0.42]	[0.41]
Total Employment	(0.46)	(0.67)	(0.58)	(0.28)	(0.46)	(0.33)
	[0.28]	[0.20]	[0.28]	[0.21]	[0.29]	[0.17]

Notes: The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 8. The Corrected Standard Errors and Rubin Missingness Ratios for Summary Statistics in Table 3

	1995			2000		
	All	**Goods-producing**	**Services-producing**	**All**	**Goods-producing**	**Services-producing**
0 to 5% Minority in BY:						
Growth in:						
Total Employment	(0.83)	(1.34)	(1.15)	(0.57)	(0.99)	(0.74)
	[0.35]	[0.35]	[0.46]	[0.28]	[0.32]	[0.42]
White Employment	(0.78)	(1.23)	(1.09)	(0.53)	(0.94)	(0.69)
	[0.37]	[0.33]	[0.47]	[0.26]	[0.33]	[0.41]
5 to 20% Minority in BY:						
Growth in:						
Total Employment	(0.82)	(1.39)	(0.99)	(0.51)	(0.90)	(0.59)
	[0.29]	[0.26]	[0.28]	[0.43]	[0.35]	[0.46]
White Employment	(0.66)	(1.11)	(0.81)	(0.42)	(0.73)	(0.49)
	[0.30]	[0.27]	[0.32]	[0.42]	[0.34]	[0.47]
20 to 50% Minority in BY:						
Growth in:						
Total Employment	(0.77)	(1.38)	(0.97)	(0.53)	(0.81)	(0.66)
	[0.10]	[0.25]	[0.15]	[0.19]	[0.21]	[0.18]
White Employment	(0.49)	(0.83)	(0.62)	(0.33)	(0.46)	(0.42)
	[0.11]	[0.27]	[0.15]	[0.13]	[0.12]	[0.13]
50 to 80% Minority in BY:						
Growth in:						
Total Employment	(1.26)	(1.67)	(1.72)	(0.73)	(1.13)	(1.01)
	[0.36]	[0.40]	[0.33]	[0.23]	[0.35]	[0.31]
White Employment	(0.52)	(0.59)	(0.72)	(0.29)	(0.41)	(0.40)
	[0.39]	[0.46]	[0.34]	[0.22]	[0.30]	[0.24]
80 to 100% Minority in BY:						
Growth in:						
Total Employment	(1.44)	(2.55)	(1.72)	(1.13)	(2.14)	(1.37)
	[0.27]	[0.25]	[0.28]	[0.27]	[0.35]	[0.28]
White Employment	(0.31)	(0.48)	(0.39)	(0.24)	(0.36)	(0.30)
	[0.35]	[0.32]	[0.32]	[0.36]	[0.16]	[0.39]

Notes: "BY" stands for "Base Year." Year at the top of the column is the base year. The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 9. The Corrected Standard Errors and Rubin Missingness Ratios for Summary Statistics in Appendix Table 1, Part 1

	1995		2000	
	23 Construction	**62 Health Care & Social Asst**	**23 Construction**	**62 Health Care & Social Asst**
Mean % Minority	(0.17)	(0.22)	(0.14)	(0.14)
	[0.16]	[0.47]	[0.28]	[0.28]
Std. Dev.	(0.12)	(0.12)	(0.097)	(0.077)
	[0.30]	[0.33]	[0.40]	[0.17]
Growth in:				
White Employment	(0.84)	(0.76)	(0.48)	(0.46)
	[0.11]	[0.27]	[0.35]	[0.26]
Minority Employment	(0.52)	(0.63)	(0.34)	(0.31)
	[0.25]	[0.25]	[0.39]	[0.26]
Total Employment	(1.21)	(1.23)	(0.73)	(0.66)
	[0.12]	[0.27]	[0.39]	[0.25]

Notes: Year at the top of the column is the base year. The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.

Appendix Table 10. The Corrected Standard Errors and Rubin Missingness Ratios for Summary Statistics in Appendix Table 1, Part 2

	1995		2000	
	23 Construction	**62 Health Care & Social Asst**	**23 Construction**	**62 Health Care & Social Asst**
0 to 5% Minority in BY:				
Growth in:				
Total Employment	(2.83)	(2.35)	(1.80)	(1.66)
	[0.21]	[0.37]	[0.42]	[0.40]
White Employment	(2.61)	(2.21)	(1.66)	(1.54)
	[0.21]	[0.36]	[0.41]	[0.39]
5 to 20% Minority in BY:				
Growth in:				
Total Employment	(2.00)	(1.72)	(1.12)	(1.15)
	[0.34]	[0.18]	[0.40]	[0.47]
White Employment	(1.58)	(1.51)	(0.90)	(0.98)
	[0.32]	[0.22]	[0.40]	[0.45]
20 to 50% Minority in BY:				
Growth in:				
Total Employment	(2.50)	(1.72)	(1.16)	(1.23)
	[0.16]	[0.35]	[0.26]	[0.25]
White Employment	(1.54)	(1.07)	(0.68)	(0.79)
	[0.16]	[0.33]	[0.18]	[0.26]
50 to 80% Minority in BY:				
Growth in:				
Total Employment	(3.84)	(5.13)	(2.49)	(2.00)
	[0.34]	[0.35]	[0.38]	[0.27]
White Employment	(1.58)	(2.16)	(1.00)	(0.87)
	[0.39]	[0.32]	[0.42]	[0.35]
80 to 100% Minority in BY:				
Growth in:				
Total Employment	(4.96)	(3.43)	(4.20)	(2.96)
	[0.13]	[0.20]	[0.28]	[0.44]
White Employment	(1.80)	(0.77)	(0.98)	(0.66)
	[0.35]	[0.28]	[0.21]	[0.57]

Notes: "BY" stands for base year. Year at the top of the column is the base year. The corrected standard errors and Rubin missingness ratios are computed following Appendix D. The corrected standard errors are presented in parentheses. The Rubin missingness ratios are presented in brackets.