The Role of Tipping Point- The Dynamics of Workplace Segregation By Race and Ethnicity*

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Abstract

Employing a regression discontinuity (RD) design and making use of the variation in base-year minority shares across single-establishment firms, this paper documents 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 there exist systematic establishment-level segregation in all NAICS sectors.[1] Then I show that the dynamics of segregation among these single-establishment firms are non-linear and exhibit "tipping"-like patterns in both of the two-year intervals, although the magnitude is much larger in the earlier time period. I also demonstrate that the observed tipping pattern is mostly driven by non-Hispanic whites leaving. The effect due to increase in minority entering is much smaller or even trivial. Alternative explanations such as non-linear changes in establishment characteristics or omitted variables fall short in explaining the observed phenomenon. The tipping patterns described above are primarily found in service-producing rather than goods-producing NAICS Supersector.[2] Finally, I find that, unlike 1995-2000 during which tipping behavior seems to have been driven equally by blacks and Hispanics, Hispanics are the sole driving force in 2000-2005. 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 in large consistent with a Schelling (1971) social interaction model.

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[1]Refer to Appendix A. for definitions.

[2]Refer to Appendix A. for definitions

1 Introduction

The United States is often referred to as a country of immigrants and immigration is an important component of the American experience. Since the passage of the 1965 Immigration Act, the U.S. has been in the midst of a new wave of massive immigration unprecedented in its diversity. With the rise in minority immigrants entering the U.S., minority shares in both residential places and workplaces have increased over time. Several papers have demonstrated that racial and ethnic segregation does exist in residential places (Cutler, Glaeser and Vigdor, 1999; Ananat, 2007; Card, Mas and Rothstein, 2008a,b) and workplaces (Higgs, 1977; Albelda, 1986; Carrington and Troske, 1998; Hellerstein, Neumark and McInerney, 2008; Gradín, del Río and Alonso-Villar, 2011).

In particular, 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. However, it is less well understood how workplace segregation as a process operates. As suggestive evidence that the dynamics of workplace segregation has potentially interesting patterns, Figure 1 illustrates that the sudden net percentage changes in establishment-level white employment (defined as the percentage change in white employment net of the percentage change in minority employment)[3] in all NAICS sector pooled and service-producing NAICS Supersector may appear to be related to a workplace's base-period minority share. Here, each plot depicts the mean net percentage changes in white employment from 1995 to 2000 deviated from the mean of this in the NAICS sector, grouping establishments into cells of width 1% by the minority share in 1995. These plots show striking evidence of non-linearities in net percentage change in white employment growth and that 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 level where workplace minority compositions increase rapidly

[3]The net percentage change in establishment-level white employment is expressed the net change in white employment as a fraction of the total employment in a single-establishment firm in 1995. Here and throughout the paper, minorities are defined as nonwhites and white Hispanics; whites are defined as non-Hispanic whites only.

once the the base-year minority share reaches or exceeds a critical threshold. This threshold level at which this rapid change occurs is referred to as a "tipping point".

What theoretical model can be used to explain these non-linear patterns of workplace minority composition changes? I hypothesize that a classic social interaction model posited by Schelling (1971) can account for these empirical evidence. Thus far, a large body of work has focused on theorizing the causes of segregation, for instance, the statistical discrimination models (Phelps, 1972; Arrow, 1973), taste-based discrimination theory (Becker, 1971; Blau, Ferber and Winkler, 2010), the "pollution" theory of discrimination (Goldin, 2002), and other models using the "pre-hire" factors such as 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-hire" dynamics on workplace composition (Sørensen, 2004) and provide little insights on the actual underlying mechanism on how segregation occurs. Schelling (1971), on the other hand, develops 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, 2009). 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, 2009).

This paper is among the first few attempts to study the possible effect of "post-hire" dynamics on workplace composition and to unravel the underlying dynamics of workplace segregation by race and ethnicity. In particular, it tests whether establishments exhibit tipping-like behavior in respond to firm specific shocks in minority labor supply that occurs over two five-year intervals: 1995-2000 and 2000-2005. I also analyze the shifting composition of firms in the U.S. labor market. By doing so, it could help explain the persistence of such labor market feature and shed some light on how to promote workplace integration. So far, to my knowledge, only Sørensen (2004) has elaborated on a similar research question by examining the relationship between worker turnover rate and racial composition of the

employing establishment workforce using a three-year panel data of one multi-unit firm. The author finds negative correlation between the two.

The main empirical strategy of this paper draws on the Regression Discontinuity (RD)-tipping design developed by Card, Mas and Rothstein (2008a) and utilized by Pan (2009). As depicted in Figure 1, this research strategy exploits the cross-sectional variation in base-year minority shares across workplaces to test whether workplaces exhibit tipping-like pattern as the minority share in a workplace exceeds a certain critical threshold. The location of the candidate tipping points is assumed to be NAICS sector specific and is identified by a fixed point procedure which builds upon the shape of Figure 2. Figure 2 plots mean net percentage changes in the white employment of NAICS Sector 23, i.e. Construction from 1995 to 2000 against the minority share in 1995. The horizontal line depicts the unconditional mean. The vertical line is estimated using the fixed point procedure and 50% subsample of single-establishment firms in the Construction sector. The figure shows clear evidence that white employment gains relative to minority employment to the left of the tipping point and substantial loss to the right of the tipping point. I find similar patterns for a broad sample of NAICS sectors across the two five-year intervals.

Unlike the paper by Pan (2009) which is conducted at the level of occupation-state and remains agnostic about the level that the tipping mechanism operates at, this paper uses establishment-level data from the LEHD infrastructure files,[4] which contains approximately 98 percent of all private-sector non-farm jobs in the U.S. Thereby, this paper can investigate the employment segregation pattern and its dynamics at the hard-to-observe firm or workplace level and is expected to yield more accurate estimates of the magnitude of segregation and the "tipping" effect.[5] Meanwhile, the linked employer-employee infrastructure data structure also enables this paper to reveal the shifting racial and ethnic composition

[4]It also appears to be the first paper using the LEHD data to study the dynamics of labor market segregation by race and ethnicity.

[5]Hellerstein, Neumark and McInerney (2008) discover that the 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.

of firms. By doing so, this study attempts to delineate the mechanism under which workers respond to changes in minority compositions of their hiring firms.

Before conducting the formal econometric analysis, I intend to use the Duncan and Duncan index[6] to show that there exists segregation in the sample of firms used in this study. Since the social interaction model replies on the explicit assumption that workers have perfect information about minority shares, I only use single-establishment firms in the analysis.[7] In other words, most of the firms in the sample are small to medium size firms. When the sizes of firms are small, the widely implemented indexes such as Duncan and Duncan index and the Gini index to quantify segregation tend to conflate its true magnitude (Carrington and Troske, 1997, 1998). This issue was in fact first elaborated by Blau (1977) in the gender segregation literature. The reasons are two-fold: first, an integer constraint in which each worker must be uniquely allocated to one unit; secondly, the random allocation of workers to units do typically generate some deviation from complete evenness when the firm sizes are small (Blau, 1977). In an effort to address this concern, Blau (1977) develops a random worker to firm allocation model. Inspired by Blau's model, I first verify there is indeed systematic workplace-level segregation by computing the actual and expected Duncan and Duncan indexes.

Overall, establishment-level segregation still widely prevails at the end of both five-year

[6]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 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 in order to achieve an occupational distribution identical to that of the group j workers. The index takes values between zero and one. When it equals zero, it indicates that group 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.

[7]One clarification is called upon before delving into details: in this paper, the definition of firms and establishments will 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, workplace and establishment, as well as single-establishment firm share the same definition and are used interchangeably in this paper.

time periods. Using the 2000 and 2005 establishment-level data from the LEHD infrastructure files, this paper first finds that minorities, compared to whites, are much more likely to work at firms with at least 50% minorities. Then it further confirms that systematic workplace segregation still widely prevail across all sectors in both years. The NAICS sector specific candidate tipping points, which are measured in base-year minority shares and are estimated using the fixed-point procedure, range from 5.26% to over 39% in 1995-2000 and range from 2.44% to over 38% in 2000-2005. In summary, I find strong evidence confirming that tipping does exist 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 increase in minority entering is relatively smaller in earlier time period or even trivial in later time period. Alternative explanations such as non-linear changes in establishment characteristics fall short in explaining the observed phenonmenon. The tipping patterns described above are primarily found in service-producing NAICS Supersector, instead of goods-producing NAICS Supersector. Finally, I find that unlike 1995-2000 during which tipping behavior seems to have been driven equally by blacks and Hispanics, Hispanics seems to be the sole driving force in 2000-2005. Taken together, the analysis in 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 in large consistent with a Schelling (1971) social interaction model.

The paper unfolds as the following: Section 2 lays out the model and identification strategy under the guidance of the research design developed by Card, Mas and Rothstein (2008a) and Pan (2009). Section 3 expands on the firm level data from the LEHD infrastructure files, unit of analysis and the sample for this paper. A model of random allocation of workers to firm developed by Blau (1977) is applied to examine whether there is indeed systematic racial segregation in the sample in Section 4. Section 5 shows the empirical results. Robustness checks are also presented. In particular, section 5.3 goes beyond the observed tipping

pattern and reveals the dynamics of the shifting composition of firms. The question to be answered is whether the observed tipping pattern is driven by white flights or minority entering. In section 5.6 I explore various definitions of "minority" and examine whether these distinct racial and ethnicity minority groups drive the tipping pattern differentially. Finally, section 6 summarizes and concludes.

2 Model and Identification Strategy

As described at the outset, the aim of this paper is to investigate the underlying mechanism that leads to workplace segregation by race and ethnicity. The main analysis will assess whether the empirical evidence of non-linear patterns of workplace minority composition changes can be accounted by social interaction models, as originally outlined by Schelling (1971). A brief review of Schelling's model is presented in Appendix B. Schelling's model has two key features that have important theoretical and empirical implication for tipping behavior: (1) for tipping to occur, heterogeneity in preferences over the neighborhood minority composition must exist; (2) since the tipping point and the actual tipping are characterized as an unstable equilibrium and a dynamic adjustment process, there must exist some friction that ensures individuals do not always immediately take long run stable equilibrium. In the Schelling's model this friction arises because individuals are cast as myopic decision-makers (Caetano and Maheshri, 2013). Following the standard setup, the theoretical model presented in section 2.1 inherits these two key features as well.

A crucial 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 already reaching a stable equilibrium. Such insight results in relatively few empirical developments in implementing Schelling's model to identify tipping behavior (Caetano and Maheshri, 2013). Card, Mas and Rothstein (2008a) have circumvented this issue with an approach under which a tipping point is identified as bifurcation point or threshold around which flows of both whites and

minorities are quantitatively different (Caetano and Maheshri, 2013; Card, Mas and Rothstein, 2008a,b). Therefore, unlike Schelling's model in which the only stable equilibria are completely segregated, minority share below a critical threshold can be potentially stable in Card *et al*'s approach. Tipping point in Card, Mas and Rothstein (2008a) represents the maximum minority share at which a neighborhood can be in a stable integrated equilibrium (Card, Mas and Rothstein, 2008a,b).

This paper will mostly follow the work by Card, Mas and Rothstein (2008a). Under the theorical and empirical guidance of Card, Mas and Rothstein (2008a), in this section I will present a model of firm tipping and identification strategy used to identify the tipping phenomenon at the workplace level. A direct empirical implementation is to examine whether there exist evidence of discontinuous changes in workplace minority composition at candidate tipping points.

2.1 A Model of Firm Tipping

I present a simple static partial equilibrium model in which whites' labor supply to a single-establishment firm depends on the share of minority workers in that firm. Without loss of generality, homogeneity in the job positions to be filled by whites and minorities is assumed.[8] In order to focus the attention on workers' decision of labor supply, I inherit the assumptions used in Pan (2009) which basically assume that the labor demand is fixed and that employers are non-discriminating. Due to the above assumptions, in a partial equilibrium, workers from different groups will be paid at equal wages in the same firm.[9,10]

In this model, there are two types of workers with distinct racial and ethnic characteristics: non-Hispanic white (W) and racial and ethnic minority (M). Workers observe the wage

[8]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 NAICS sector specific manner, this assumption is not completely unreasonable.

[9]The implicit assumption here is that workers from different groups are perfect substitute.

[10]Even if employer has a taste of discrimination, Blau (1977) argues that there are institutional constraints internal to a firm which place limits on the employer's ability to differentiate among individual workers.

offers posted by all firms. Workers are also assumed to have perfect information about the minority shares in each firm, which is denoted as $R_j = \frac{N_j^M}{N_j^M + N_j^W}$ where j indexes the firm, N_j^M and N_j^W are the total employment of minorities and whites in firm j. All workers are utility maximizing agents. Workers differ in their tastes and preferences of firms' minority shares. Assuming 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:

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

$U(\cdot, \cdot)$ is assumed to be continuous and twice differentiable. The following first-order and second-order conditions are also assumed:

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

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. Based on the set-up, 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 a firm j depends on the firm's wage rate ω_j and the share of minority workers, R_j. Given the continuity and monotonicity assumption 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, this function basically means that "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 given the assumption of non-discriminating employers, fixed labor demand and perfect substitutability, the following condition can be obtained:

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

To simplify the notation the firm index j will be dropped, but all the conditions 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. Basically it implies that whites require a premium to work with minorities in firms. Such 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 such 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 effect, the whites 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 whites inverse labor supply

function may be initially downward sloping. As the minority share rises, the positive social interaction effect will dominate which essentially leads to a upward-sloping inverse labor supply curve.[11] For illustrative purposes, $\omega^M(n^M, R)$ is assumed to be upward-sloping and linear.[12] The two inverse labor supply curves are depicted in Figure 3.

In the firm depicted in Figure 3, there are three equilibria: two mixed equilibria and one all minority equilibrium. Point A is a locally stable mixed equilibrium. For instance, any small perturbation to the right of point A, the marginal minority worker requires a higher wage than the marginal white worker, the non-discriminating firm will therefore hire the marginal white worker which will return the system to point A. By the same analogy, it can be inferred that point B is not a stable equilibrium. Any positive shock will render the system trending toward the all minority equilibrium C.

An increase in the supply of minority workers will push 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 shift, assuming the whites inverse labor supply function has the shapes 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 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 mixed equilibrium (such as points A_1 and A_2 in Figure 4). Further increase in the supply of minority labors 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 lead to a fully segregated equilibrium(all minority equilibrium, i.e. point

[11] To ensure the existence of such 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: $\frac{\partial^2 \omega^W(n^W, R)}{\partial R^2} > \frac{\partial^2 \omega^W(n^W, R)}{\partial n^{W\,2}}$

[12] 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 distastes towards all-whites firms when R is low.

D's in Figure 4). The location of the tipping point (R^*) depends on the strength of the social interaction effect.

Several points worth emphasizing. First , notice that this model features an one-side tipping pattern: firms with minority shares below the tipping point are potentially stable but those that exceed the critical threshold rapidly converge to 100% minority composition. This is in contrast to standard Schelling's model which delivers a two-sided tipping story.[13] Secondly, this model delivers a tipping point even though whites preference towards firm level racial composition does not exhibit a discontinuity. In addition, wages evolve smoothly through the tipping point, even though employment changes discontinuously. The main reason for the smoothness of wages around the tipping point is because the upward-sloping minority inverse labor supply curve takes over from the white inverse labor supply curve at the discontinuity smoothly. Wages at the long-run $R = 1$ equilibrium can be higher or lower than at the tipping point depending on the shape of the minorities' inverse labor supply curve and its shifts 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 since the passage of the 1965 Immigration Act, the U.S. has experienced a new wave of mass immigration and these so-called "new immigrants" are mostly from less industrialized countries in South America and Asia (Xie and Gough, 2009). Due to different geographic location of firms, there are still likely to be firm-specific shifts in relative labor supply. The model presented above can provide several insights for how firm-level minority composition will react in response to these firm-specific shocks in relative minority labor supply. These insights can be broadly summarized into the following three scenarios:

[13] 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 compositions in neighborhoods with initial minority shares below the tipping points stay relatively stable over time.

(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 to the location of the 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 really small, then the $E[\Delta R_t \mid R_{t-1}]$ could be written as the following functional form:

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

If $\lim_{\epsilon \to 0+} h(R^* + \epsilon) - g(R^* - \epsilon) > 0$, the right-hand side of equation (4) is discontinuous at R^* therefore lead to a "jump". Given the nature of $g(\cdot)$ and $h(\cdot)$, such jump is expected to be significant. 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, due to the derivation of equation (4) and depending on the process of firms change, the time horizon considered, or heterogeneity in the location of tipping points, the function $E[\Delta R_t \mid R_{t-1}]$ might not predict a strict discontinuity at R^* but a very steep slope in the $[R^* - s, R^*]$ range. In this paper, such a pattern, if any, is interpreted as evidence of tipping.

2.3 Empirical Strategy & the Identification of the Tipping Point

The empirical analysis uses establishment-level data and measures changes in their employment composition in a 5-year interval.[14] 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 employment in firm i, industry j, state s and year t, respectively. The main dependent variable, which measures the establishment minority composition changes over a five-year interval, is net percentage change in white employment, $Dw_{ijs,t} = \frac{(W_{ijs,t} - W_{ijs,t-5})}{P_{ijs,t-5}} - \frac{(M_{ijs,t} - M_{ijs,t-5})}{P_{ijs,t-5}}$. In order to reveal the dynamics of the shifting composition of firms and document whether the observed tipping pattern is driven by white flights or minority entering, I also examine the analogous measures for whites and minorities, separately, i.e. $\frac{(W_{ijs,t} - W_{ijs,t-5})}{P_{ijs,t-5}}$ and $\frac{(M_{ijs,t} - M_{ijs,t-5})}{P_{ijs,t-5}}$. The key explanatory variable is the base-year minority employment share in a firm, i.e. $R_{ijs,t-5} = \frac{M_{ijs,t-5}}{P_{ijs,t-5}}$.

Equation (4) from section 2.2 basically 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.[15] Denote R_j^* as the potential tipping point for industry j, define $\delta_{ijs,t-5} = R_{ijs,t-5} - R_j^*$ to be the deviation in minority share of firm i from its industry specific tipping point. The basic empirical specification is:

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

where $\phi(\cdot)$ is a smooth control function, modeled as a third-order polynomial, η_j is the

[14] In previous literature on residential and occupation segregation employing similar empirical strategy, decadal changes calculated from Census data are usually used (Card, Mas and Rothstein, 2008a,b; Easterly, 2009; Pan, 2009). In this paper, five-year changes, instead of decadal changes, are used is because: for one, firm dynamics are more volatile compared to census tracts and occupations; second, data from the LEHD infrastructure files are more frequent than Census data, which frees this paper from some of the data limitations faced by previous research.

[15] The tipping point is assumed to be industry specific because some industries are more prone to minority inflows than others. For instance, in 1995 approximately 17% among the total employed in Construction are either Blacks or Hispanics. This share has increased to 21% in 2000 and close to 30% in 2005. In comparison, the percentage of Blacks and Hispanics among the total employed in Finance, insurance, real estate has remained between 16% to 18% since 1995. Due to data limitation, only blacks and Hispanics are discussed here. Data is 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.

NAICS sector fixed effect, τ_s measures the state fixed effect, $X_{ijs,t-5}$ is a vector of firm-level control variables including: share of workers who are at least 57 years old in the base-period ($\%RET_{ijs,t-5}$). Age 62 is the earliest age that one can claim social security benefits for retirement. Many literature have confirmed the effects of social security benefits on elderly labor supply. Firms might experience decrease in white employment simply because they have larger shares of workers who are close to retirement age. Here the age cutoff is set to be 57 years old because people of this age or older are at risk to retire during the next five-year window. Firm-level covariates also include 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. Since young workers tend to change jobs more frequently, firms may experience large change in minority composition simply because they have larger shares of younger workers. And finally, firm-level log average earnings ($\log \overline{e_{ijs,t-5}}$) is also controlled. Workers may leave a firm simply because she is not paid as well as she would be by working for other firms or because she is merely moving upward on the job ladder.

Unlike research with conventional RD design, most of which the running variable[16] and the cutoff is clearly defined, a critical issue in estimating an empirical model like equation (5) is that the discontinuity point R_j^* is unknown and must be estimated from the data itself. In order to elaborate on the method used to obtain the candidate tipping point, it is assumed for the moment that tipping points do exist. The method used here is the so-called "fixed-point" procedure which is borrowed from Card, Mas and Rothstein (2008a). This approach builds on the shape of smoothed approximation to $E[Dw_{ijs,t} \mid j, R_{ijs,t-5}]$ for industries. Recall, it is observed in Figure 2 that firms which have not hit the industry specific tipping point tend to experience a greater than average growth in net non-Hispanic white employment; on the other hands firms which have reached or exceeded the industry specific tipping point tend

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

to experience relative declines. Formally, this basically implies the following:

$$E[Dw_{ijs,t} \mid j, R_{ijs,t-5} = R_j^* - \xi] > E[Dw_{ijs,t} \mid j] > E[Dw_{ijs,t} \mid j, R_{ijs,t-5} = R_j^* + \xi] \qquad (6)$$

For some $\xi > 0$. Thus, the industry specific tipping point is the minority share at which the white employment of firm grows at the average rate for the industry. To identify this level, I will 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 to this function which is the industry-specific tipping point.[17] If the functional form is correct, this procedure will consistently estimate the locations of the tipping points.

2.4 Hypothesis Testing

Since equation (5) is estimated using the candidate tipping points located using the data, the estimates of d, $\widehat{d}$ will have a non-standard distribution (Hansen, 2000). This is what Card, Mas and Rothstein (2008a) referred to as a specification research bias problem. The conventional test statistics tend to reject the null hypothesis: $d = 0$ too often. Hansen (2000) recommends a solution by 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[18] to locate the tipping point and use the remainder of the total sample to estimate the magnitude of the tipping effect. The authors claim that since the two sub-samples are independent, estimates of $\widehat{d}$ from the second sub-sample will still have a standard distribution thus permit conventional hypothesis testing even under the null hypothesis. In this paper, the split-sample technique is used to facilitate conventional hypothesis testing. I use 50% randomly selected subset of my sample for the estimation of the NAICS sector specific tipping points using the fixed

[17] Detailed description on the fixed point procedure can be found in Appendix C. on Tipping Estimation.

[18] Two-thirds of their sample were used for locating the tipping points because as introduced by Card, Mas and Rothstein (2008a) the fixed point procedure is quite data-intensive.

point procedure. The remainder 50% 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 frame designed to represent the universe of individual-employer pairs covered by the state unemployment insurance system reporting requirement (with federal employees recently added in 2012). The LEHD data cover approximately 98 percent of all private-sector non-farm jobs. Information about the employer characteristics is constructed using the Quarterly Census of Employment and Wages (QCEW). Demographic information of workers comes from two administrative data resources - the Person Characteristics File (PCF) and the Composite Person Record (CPR). The longitudinally linked employer-employee data structure of the LEHD infrastructure 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.[19] Basic information about firm characteristics include total payroll, firm size, firm age, etc. Information on individual demographic characteristics include race, ethnicity, education, date of birth, etc. A more comprehensive overview and description of the LEHD infrastructure files can be found at 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, 2009). Goldin (2002) discusses 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, majority of the studies

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

have focused on racial segregation at the level of occupations or industries. However, Hellerstein, Neumark and McInerney (2008) discover that the 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 observations to study labor market segregation since the essence of social interaction among workers are better captured at the workplace level.

With the LEHD infrastructure files, this study can be achieved at the level of establishments or workplaces by using the single-establishment firms only. 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 that of minorities, this paper does not exploit the full panel structure of LEHD data but focus on changes over two five-year windows: 1995 to 2000 and 2000 to 2005. These two five-year windows are first chosen to be consecutive to cover ten-year time span. The base year of the first five-year interval is chosen such that the sample can cover sufficient number of states. Since many states did not join the LEHD program until the mid- to late 1990s,[20] I choose 1995-2000 to be the first five-year interval. No further analysis is conducted for 2005-2010 is to avoid any possible confound impact due to the Great Recession.

3.2 Sample

The sampling universe, which is applied to both five-year intervals, is defined as: (1) firms must be private, non-farm (no NAICS sector 11) and non-public administration (no NAICS sector 92) firms; (2) firms that remain single-establishment in the base year and the end year of a five-year interval; and (3) firms of which the establishment-level employment growths during a five-year interval lie within 2.5 absolute standard deviations of the state and NAICS sector averages for that time window. The purpose of restricting sample in this manner is

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

to avoid results being driven by extreme values. The sample used for 1995-2000 and 2000-2005 analyses is basically a 50% randomly selected sample of the sampling universe and the workers who are employed at these selected single-establishment firms for their dominant job in the base year and the end year of a five-year interval, respectively.

Given the quarterly-base LEHD infrastructure files there are many ways to construct the main dependent variable. In this paper, I will use the beginning-of-second-quarter employment measures[21] to construct the variables used in the empirical specification. The rationale is that the beginning-of-second-quarter employment measures employment on April 1^{st} of a given year which is closest to March 12^{th}, the date the Census Bureau uses as the reference date for employment measures contained in its Business Register and on the Economic Censuses and Surveys (Abowd *et al*, 2009).

In order to obtain the most economically meaningful results, the following sample restrictions are also applied. These restrictions are necessary mostly because the earnings data in the LEHD infrastructure data are extracted from unemployment insurance covered earning records, thereby any payment made to an individual that is no less than one dollar will appear in the data. As a consequence, many one-time payments which do not necessarily agree with the general definition of a job matched between a firm and a worker appear as a "job" that lasts one quarter. Thereby, it is important to define what a dominant job to a worker is and once the definition is formed I will consider the worker to be an employee of the dominant-job matched 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 or who indicate two or more races are excluded.

The final sample for 1995-2000 includes 200,000 unique single-establishment firms matched between 1995 and 2000 from 19 states,[22] 6,600,000 individuals in 1995 and 7,280,000 in 2000. The final sample for 2000-2005 includes 341,000 unique single-establishment firms matched

[21] Once again, the definition of beginning-of-quarter employment follows Abowd *et al* (2009)

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

between 2000 and 2005 from 42 states,[23] 11,800,000 individuals in 2000 and 12,300,000 in 2005.[24]

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 wage records do not link to the PCF (Abowd *et al*, 2009). The LEHD infrastructure files have undergone sophisticated multiple imputations using general Bayesian methods in order to use effectively.[25] For every individual contained in the ICF file, 10 implicates are created for each demographic variable. To ensure the inference validity using the multiple imputation data, all the statistics and estimations are computed following Little and Rubin (2002). Simply put, every statistics or estimate is first computed 10 times using the 10 implicate files, separately. 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.[26]

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 the establishment-level segregation by race, ethnicity and skills using the Decennial Employer-Employee Dataset (DEED). This section is to show that establishment-level segregation still widely prevails at the end of each five-year window in the sample of firms used in this paper. Table 1 is

[23] 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, WV.

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

[25] Refer to Little and Rubin (2002) for the general Bayesian methods for multiple imputation

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

constructed to present evidence on the distribution of white and minority workers across single-establishment firms with various minority composition levels. This is done for all NAICS sectors pooled, as well as goods-producing and service-producing NAICS Supersectors, separately.

An example of how to interpret this table is, for instance, the first row of column (4) shows that in 2000, 3.26 percent of all minority workers work in firms where minorities account for less than 10 percent of employment when looking at all NAICS sectors together. Continuing with the first row, Table 1 also shows that these firms account for close to 29 percent of all non-Hispanic white employment and 20.30 percent of the total employment in all NAICS sectors in 2000. In general, a comparison between column (4) and column (6) reveals that minorities have higher probability to be employed in firms with higher minority shares. Overall, Table 1 presents suggestive evidence that there exists substantial establishment-level segregation in 2000 and 2005. A close comparison among all NAICS sectors pooled, goods-producing and service-producing NAICS supersectors shows that almost identical pattern holds for the two supersectors as well. In Appendix Table 1 using NAICS sectors 23 Construction and 62 Health Care and Social Assistance as examples, I further confirm that these findings also exist in each NAICS sector, separately.

Such pattern appears to have undergone very minimal changes between 2000 and 2005. In particular, in the all NAICS sector pooled sample in 2000, more than 31 percent and 22 percent of all minority workers are employed in firms where minorities account between 50 to 75 percent, and 75 to 100 percent of firm employment, respectively in all NAICS sectors in 2000. Meanwhile, only 10.10 percent and 2.04 percent of all white workers work in firms with such high minority shares. In comparison, in 2005, close to 32 percent and 20 percent of all minority workers, as well as 9.67 percent and 1.71 percent of all white workers are employed in firms with the identical minority compositions in all NAICS sectors. In 2000 and 2005, more than 60 percent of all non-Hispanic white workers work in firms where minority share is lower than 25 percent. Yet, less than 18 percent of all minority employees work in these

firms in both years.

In an attempt to examine whether various racial and ethnic minority groups exhibit different segregation patterns, I replicate Table 1 for Asians, Blacks, and Hispanics, separately. The results are presented in Appendix Table 2. Though all three minority groups experience establishment-level segregation, Blacks seems to face the least. For instance, in 2000 and 2005, less than 50% of all Blacks workers are employed in firms with 50% of higher minority shares in all NAICS sectors pooled. However, in both years, more than a half of all Asian workers and Hispanic workers are employed in these firms. Additionally, Blacks also have the highest proportions of workers work at firms with less than 25% minorities in all NAICS sectors. By contrast, Hispanic workers have the lowest. Such findings can be concluded in goods-producing and service-producing NAICS supersectors as well. Since Asians and Hispanics are the main immigrant groups in recent decades, whom compared to Blacks have a much shorter history in the U.S., the results seem to suggest that these two minority groups may face more prejudice against them.

4.2 Evidence on Systematic Firm-Level Segregation

A conventional way to document segregation is to compute the Duncan and Duncan index. However, Duncan and Duncan index tend to conflate the true magnitude since it quantify segregation via measuring a sample's distance from evenness which is characterized by zero values(Carrington and Troske, 1997, 1998). Built upon the work by Blau (1977), Carrington and Troske (1997, 1998) maintain that the Duncan and Duncan index can be positive even when workers are allocated randomly across units with no systematic segregation. Blau (1977) explains the reasons are two-fold: first, an integer constraint in which each worker must be uniquely allocated to one unit; secondly, the random allocation of workers to units do typically generate some deviation from complete evenness when the firm sizes are small. In an effort to address this concern, Blau (1977) develops a random worker to firm allocation model to adjust and allow complete randomness to be characterized by a non-zero Duncan

and Duncan index.

Though Table 1 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 accomplish this goal, I apply the random worker to firm allocation model developed by Blau (1977) to the same set of firms used in the previous section.[27] This model first enables me to compute the distribution of firms which 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 and 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 NAICS sector. Next, weighted averages of these two indexes across all available states within each NAICS sector are computed. These NAICS sector specific Duncan and Duncan indexes for 2000 and 2005 are in Table 2. Essentially, in plain words, 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 we do not expect an absolute zero value in the Duncan and Duncan index to indicate "evenness", as shown in Table 2, the expected Duncan and Duncan index is considerably less than the actual one.

As we can see from Table 2, a sizable proportion of minorities would have to reallocate among firms such that the actual distribution could be considered as a situation of random worker to firm allocation. This statement holds for every NAICS sector. For instance, in 2000 close to 20% of minority workers in NAICS sector 23 Construction would have to reallocate among firms to approximate a situation of random worker to firm allocations. In 2005, this index still remains to be higher than 18%. In both years, the NAICS sector which shows the most severe systematic segregation is NAICS Sector 62 Health Care and Social Assistance. The Duncan and Duncan indexes for this sector in both years are higher than

[27] The details of the random worker to firm allocation model is provided in E.

30% and have remained fairly constant between 2000 and 2005. Among all sectors listed, NAICS sector 22 Utilities has the smallest difference between the actual and the expected Duncan and Duncan Index for 2000 and 2005. Even then, in order for NAICS sector 22 to be considered as a sector without systematic segregation, about 12% in 2000 and 14% in 2005 of minorities would have to be reallocated among firms, respectively.[28] Thus, Table 2 indicates that systematic segregation does exist at the establishment level in 2000 and 2005, although its extent appears to vary by industry. Yet the magnitude seems to vary minimally between in 2000 and 2005. In the next section, the paper will focus on using the Tipping-RD design to identify the mechanism that leads to the observed establishment segregation.

5 Do Firms Exhibit 'Tipping-like' Pattern?

5.1 Descriptive Statistics

Table 3 presents some descriptive statistics for the establishment-level data in all NAICS sector pooled, goods-producing as well as service-producing NAICS supersectors. In total, the sample for 1995-2000 has $200,000$ single-establishment firms in all NAICS sectors, $48,500$ of which belong to goods-producing NAICS supersector, and the remainders are service-producing NAICS supersector. The sample for 2000-2005 has $341,000$ single-establishment firms in all NAICS sectors, $78,300$ firms are in the goods-producing supersector and $263,000$ firms are in the service-producing supersector. The mean minority shares in these two five-year intervals across NAICS sectors are very similar and are between 33% and 34%. In particular, Hispanics is always the largest minority group.

Overall, there is rapid employment growth between 1995-2000 which reflects the economic boom in mid- to late 1990s. Seen from Table 3, goods-producing supersector and service-producing supersector are equally affected by the economic boom. Though between

[28] 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 NAICS sectors rejects the hypothesis of random worker to firm allocation thus confirm systematic segregation.

1995-2000, non-Hispanic white employment grows by more than 4%, over 60% of the total employment growth is driven by growth in minority employment. This is true for all NAICS sectors pooled, goods-producing supersector and service-producing supersector. Hispanics employment experiences the largest growth compared to the other racial and ethnic minority groups. In comparison, the total employment growth between 2000 and 2005 is considerably slower. The goods-producing NAICS supersector even experienced contraction which confirm the economic recession occurred in early 2000 and loss of manufacturing jobs in the U.S. In all NAICS 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. 3.10 percentage points are due to growth in minority employment. Interestingly, only non-Hispanic whites and Blacks experience employment contraction in goods-producing supersector, with the former being close to -3.8%. Similar to 1995-2000, Hispanics undergo the largest employment growth between 2000-2005 compared to the other minority groups.

Table 4 compares five subgroups of establishments, defined by the fraction of minority shares in the base year, i.e., 1995 or 2000. Table 4 serves to show how the growth in non-Hispanic white employment is affected by base year minority share. Taking all NAICS sector pooled in 1995 as an example, it is clear from Table 4 that in establishments that have minority shares between 0 to 5%, more than 70% of the growth in total employment is driven by the growth in white employment. Establishments that were 5 to 20% minority saw a relatively slower growth in white employment, yet still about a half of total employment growth can be accounted for by growth in non-Hispanic white employment. In contrast, establishments that were 20 to 50% minority experienced a 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 increases, growths in non-Hispanic white employment remain low.

The findings here seems to 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 tend to dramatically slow down. Since there is no such indication on total employment growth, the summary statistics presented in Table 4 essentially implies that once base-year minority share reaches a threshold level, minority composition increases dramatically, i.e. the "tipping" phenomenon. It can be seen that the described pattern and trends hold true for all sectors listed in Table 4 except for goods-producing supersector in 2000-2005. The nonconformity may be due to the loss of manufacturing jobs during the early 2000 recession. Additionally, these trends generally stay true for all NAICS sectors, individually. To show that, Appendix Table 3 reproduces Table 4 but for NAICS sector 23 Construction and NAICS sector 62 Health Care and Social Assistance, separately.

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

In order to conduct the RD-tipping design and estimate the empirical specifications developed in section 2.3, the Fixed-point procedure is first applied to obtain the candidate tipping points. The estimated NAICS sector specific tipping points for 1995-2000 and 2000-2005 are presented in Table 5. These candidate tipping points range from 5.26% to close to 40% in 1995, and 2.44% to 38.6% in 2005. The mean tipping point across 18 NAICS sectors is 14.16% in 1995 and 15.51% in 2000. The increase in the average tipping point from 1995 to 2000 suggests increasing "tolerance" level of working with minority in the same firm, though such increase is quite small.

We now turn to pooled specifications that combine the data in all NAICS sectors in the sample for 1995-2000 and 2000-2005, separately. Figure 5 depicts the relationship between the base year minority share in a single-establishment firm, deviated from the NAICS sector specific candidate tipping point, and the net percentage change in the non-Hispanic white employment in the establishment, deviated from the NAIC sector specific mean. The dots in the figure represent mean changes in one-percentage bins of $\delta_{ijs,t-5} = R_{ijs,t-5} - R^*_j$. The

green line is a local linear regression fit separately on each side of the candidate point with an Epanechnikov kernel and a bandwidth of 5. Finally, the 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 5 suggests establishment-level tipping. In particular, the Figure depicts clear evidence that there is a discontinuous change in the minority compositions when we compare tracts just below and just above the tipping point. Though visually telling, Figure 5 does not permit formal hypothesis tests. Neither does Figure 5 control for other establishment-level characteristics that may affect worker mobility, making it hard to distinguish whether the observed tipping behavior is due to differences in other covariates close to the candidate tipping points. The formal econometric evidence will be presented in the next section.

5.3 Formal Econometric Evidence on Establishment-level Tipping

Table 6 presents estimates of $\widehat{d}$ from equation 5 for all NAICS sectors pooled in 1995-2000 and 2000-2005. The regression analysis assess the magnitude of tipping for establishments with initial minority share just above the NAICS sector specific candidate tipping points, compared to establishments just below the tipping points. The main dependent variable is the net change in 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)). In order to reveal the dynamics of the shifting composition of firms and document whether the observed tipping pattern is driven by white flights or minority entering, I also examine the analogous measures for whites and minorities, separately (column (3) and (4) for non-Hispanic whites; column (5) and (6) for minorities; results will be discussed in detail in section 5.4.).

The estimation controls for a flexible control function which is in a form of third order polynomial, establishment-level covariates as described in section 2.3, state fixed effects and a vector of NAICS sector fixed effects. 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 of the variance contribution of the missing data and multiple imputation.[29] The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

The estimated coefficients for the models in column (1) and (2) confirm that the net change in 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 around -6, and -3 percentage points in 1995-2000, and 2000-2005, respectively. This is to say, in 1995-2000 other things equal, the net growth in non-Hispanic white employment in establishments with initial minority share just above the NAICS sector specific candidate tipping points in 1995, is 6 percentage points less, compared to that in establishments just below the tipping points. And in 2000-2005 the magnitude of the discontinuity decreases to -3 percentage points. When establishment controls are included (column (2)), the estimated discontinuities in both five-year intervals remains largely unchanged. One possible reason for the observed "tipping" effect to decrease between 1995-2000 and 2000-2005 might be due to the recession occurred in 2001.[30] Research has shown that worker churning and job-to-job mobility during recent recessions have considerably declined (Kahn and McEntarfer, 2013). In a different paper, Kahn (2010) also finds negative and persistent labor market consequences of graduating from college in a bad economy, in particular, the cohorts who graduate in a bad economy tend to have slightly higher tenure.

5.4 Whites Leaving or Minority Entering?

Evidence presented so far seems to be consistent with the social interaction model and the tipping argument. However, there are alternative mechanisms which could also lead to a tipping phenomenon such as the pollution theory of discrimination by Goldin (2002). A

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

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

usual way to try to distinguish these model from the social interaction model is to consider whether establishment-level tipping is driven by white flight or minority entering. Schelling mechanism suggests that tipping should be driven primarily by a sharp decline in non-Hispanic white employment, though it is entirely possible that minority employment may increase substantially in response to white flight. However, if we observe a sharp decline in non-Hispanic white employment which is not accompanied by a sharp increase in minority employment, this would suggest that tipping driven mostly by the social interaction model.

In order to examine the shifting composition of firms, and in particular, to examine whether establishment-level tipping is driven by white flight or minority entering, column (3)-(6) in Table 6 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 6. Columns (3)-(6) show that in 1995-2000 there is a significant decline in white employment growth and an upward jump in minority inflows at the NAICS sector specific tipping points. In other words, the observed discontinuity in minority composition during this five-year window is almost equally driven by white leaving and minority entering, though the magnitude of the former is slightly larger. 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. Such results indicate that at this point, though tipping is confirmed to be a mechanism that leads to establishment level segregation in the sample of firms used in this paper, I cannot completely rule out alternative models other than the social interaction model to explain the phenomenon.

Thus far, all the analyses have been done using all NAICS sectors pooled sample. Heterogeneity in the "tipping" effect is almost surely to exist across different sectors. To explore this issue, Table 7 presents the results from applying the RD models on goods-producing and services-producing NAICS supersectors, separately. The specifications are otherwise identical to those in column (2), (4), and (6) in Table 6. It is quite obvious that all the ob-

served "tipping" phenomenon seems to exist only in services-producing NAICS supersector. There does not seem to exist "tipping" phenomenon in goods-producing NAICS sector in either five-year window. To further confirm this finding, Figure 6 plots the net change in the non-Hispanic white employment in the establishment, deviated from the NAIC sector specific mean in services-producing NAICS supersectors in 1995-2000 and 2000-2005. These figures are identical in structure to Figure 5. In comparison, the pattern existed in Figure 5 is almost indistinguishable to that in Figure 6 for both five-year intervals, reinforcing the finding that the observed discontinuity exists only in service-producing NAICS supersector.

5.5 Omitted Variables and Effect on Establishment Covariates

One concern with the RD model used in previous sections is that the discontinuous relationship between net white mobility flows and the initial minority share may be due to omitted establishment characteristics that happen to be discontinuous related to the minority share. Though the main specifications (column (2), (4), and (6) in Table 6) include a vector of establishment controls, these linear controls may not be flexible enough to absorb the nonlinear effects. To assess this possibility and to test whether the results presented in Table 6 are sensitive to flexible controls of the pre-period establishment characteristics, Table 8 presents a series of extended specifications that add third order polynomial in these establishment-level covariates. Seeing from Table 8, the estimates of $\widehat{d}$ is 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 the changes in quantities. However, apart from quantities, there are a number of other outcomes worth examining. These include whether earnings, share of retiring workers, or share of young workers are affected by tipping. This part of the analysis therefore looks at how these establishment-level characteristics behave around the NAICS

sector specific candidate tipping points.

Table 9 reports results from regressions where the dependent variable is replaced by changes in log average earnings for all workers, share of retiring workers, and share of young workers over a five-year window. In each regression, a flexible third order polynomial in $\delta_{ijs,t-5}$, state fixed effects, and a vector of NAICS sector fixed effects are controlled for. Similarly, standard errors are clustered on the state-NAICS sector. According to Table 9, there is little evidence of significant changes in the establishment-level covariates around the candidate tipping points. Thus, from Table 9 we can conclude that the observed discontinuity is not driven by abrupt changes in establishment-level characteristics around the tipping points.

5.6 Minority Definition

So far I have defined minorities as nonwhites and white Hispanics. However, it is entirely possible that non-Hispanic whites may react to inflows of different minority workers differently. In particular, evidence presented in Appendix Table 2 suggests that different racial and ethnic minority groups seem to face different degrees of segregation and Table 3 has shown clear heterogeneity in employment trend 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.

Table 10 and 11 presents the estimates by exploring 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 net change in the non-Hispanic white workers, or change in white workers, or change in minority workers, 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, measured both the same way. The composite model includes all three third-order polynomials. The vector of establishment controls are identical as Table 6. State fixed effects and NAICS sector fixed effects are included. Standard errors are clustered on the state-NAICS sector.

The estimates in column (1)-(4) in Table 10 suggests 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. 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 10 (column (5)-(8)) shows that changes in non-Hispanic white employment alone exhibit even strong "tipping" beyond the black share fixed point and Hispanic share fixed point. Interestingly, the results in Table 10 (column (9)-(12)) seems to show that even minority workers escape establishments once its black share or Hispanic share reaches the candidate tipping points, measuring both the same way. However, the latter discontinuity is a lot smaller compared to the former.

In comparison, results presented in Table 11 implies that in 2000-2005, almost all observed tipping behavior seems to be driven by Hispanic share solely. When looking at white employment change and minority employment change individually, Hispanic shares seems to be the only driving force again. In particular, non-Hispanic white employment in establishments with initial Hispanic share just above the NAICS sector specific candidate tipping points, measured in Hispanic share in 2000, experience a 7 (column (7) in Table 11) percentage point decrease, compared to establishments just below the tipping points. The discontinuity observed in minority employment change is a lot smaller, though it is statistically significant and of about -2.5 (column (11) in Table 11) percentage points in magnitude. In all, estimates presented in Table 10 and 11 seems to suggest that as Hispanics become the largest minority group in the U.S., they may face stronger distaste from non-Hispanic whites, and such distaste may even exist among other ethnic minority groups.

6 Conclusion

In summary, using the establishment-level data from the LEHD infrastructure files, this paper first confirms that there is indeed systematic segregation using the random worker to firm allocation model developed by Blau (1977) in 2000 and 2005. Then, this paper makes use of a similar research design and econometric technique developed by Card, Mas and Rothstein (2008a) and demonstrate the importance of tipping. This approach makes use of the cross-sectional variation in base year minority shares across establishments to test whether establishments exhibit tipping-like behavior in respond to firm specific shocks in minority labor supply that occurs over two five-year intervals: 1995-2000 and 2000-2005.

The NAICS sector specific candidate tipping points estimated using this procedure range from 5.26% to close to 40% in 1995, and 2.44% to 38.6% in 2005. The mean tipping point across 18 NAICS sectors is 14.16% in 1995 and 15.51% in 2000. The increase in the average tipping point from 1995 to 2000 suggests increasing "tolerance" level of working with minority in the same firm, though such increase is quite small.

In all, I finds 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 observed "tipping" effect to decrease between 1995-2000 and 2000-2005 might be the recession occurred in 2001. In an attempt to examine the shifting composition of firms, and in particular, to examine whether establishment-level tipping is driven by white flight or minority entering, I find the tipping in 1995-2000 is driven by white leaving and minority 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. I further find that all the observed discontinuities for both five-year intervals exists only in service-producing NAICS supersector, none is found in goods-producing NAICS supersector. 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 that is in large consistent with a Schelling (1971) social interaction model, although currently given the findings I cannot completely rule out other alternative explanations for the observed discontinuity.

As part of robustness checks, I present evidence confirming that the tipping effects for both five-year windows are rather robust to adding flexible controls of establishment-level covariates. I also demonstrate that the observed tipping patterns are not driven by non-linear changes in establishment characteristics. Finally, I have also presented composite model estimates in which I explore the 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 by Hispanic shares solely. Such change seems to suggest that as Hispanics become the largest minority group in the U.S., they may 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 labor market segregation today.

Appendix

A. NAICS Sectors and NAICS Supersectors

NAICS stands for 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). Over the years, several rounds of revisions have been implemented. In this paper, 2007 NAICS is utilized. Altogether there are 20 NAICS sectors (www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007).

For purposes of analysis, the US 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, i.e. Construction) and Manufacturing (NAICS 31-33, i.e. Manufacturing) (www.bls.gov/ces/cessuper.htm). Since the sample of this paper does not include NAICS sector 11 (Agriculture, Forestry, Fishing and Hunting), goods-producing NAICS Supersector only include NAICS sectors 21, 23 and 31-33. 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, i.e. Information), 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, i.e. Other services), and Government (www.bls.gov/ces/cessuper.htm). Since the sample of this paper does not include any public firms, 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" essentially utilize the preference interaction perspective to analyze (residential) segregation by race (Schelling, 1971). Preference interaction is said to occur when an agent's preference ordering on the alternatives within her choice sets depends on the actions chosen by the 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. Such concern is characterized by a upper limit or tolerance over 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 her tolerance level. In this model, heterogeneity in individual preference over neighborhood-level minority share is assumed, ranging from complete integrationist to complete segregationist. Agents are assumed to have perfect information about the minority share within the 'neighborhood' when she decides whether to leave or to enter a 'neighborhood'. However, agents are myopic about other agents' intentions and their future moves. Perfect mobility is also assumed. Finally, there is no capacity constraints and adding-up constraint in the 'neighborhood' to enforce that the population-weighted average of neighborhoods' minority share 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 such 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 essentially represents an unstable equilibrium as 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 have the feature that the only stable equilibria are fully segregated equilibrium. A neighborhood with mixed minority composition is therefore inherently unstable. The triggered dynamic process can lead to either 0% or 100% minority share, i.e. two-sided tipping (Card, Mas and Rothstein, 2008b). More detailed description of Schelling's Tipping model can be found at Schelling (1971).

C. Tipping Estimation

I use the Fixed-point procedure mentioned in section 2.3 to identify NAICS sector specific tipping points in the 50% randomly selected subsample. I identify the roots of $E[Dw_{ijs,t} \mid j, R_{ijs,t-5}] - E[Dw_{ijs,t} \mid j]$ 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 the study by Card, Mas and Rothstein (2008a), I use only firms with minority shares below 60%. Such polynomial is fitted by NAICS sectors. For each NAICS sector, I identify a root of this polynomial taking into consideration of the range of the minority shares in the remainder 50% subsample used for estimations. In particular, I first exclude those roots above 50% minority share. The idea of restricting observations and the identified roots in this range is that this paper intends to focus attention on how establishments with lower shares of minority in the base year respond to minority entry. Secondly, 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 NAICS sector specific tipping point is presented in Table 5.

D. Computation Formulas for Multiple Imputation Statistics

This section is following the work by 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 interested 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, $\overline{Q}$ 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 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 variance covariance matrix T of $Q(Y)$, which accounts for missing data contribution to variance, is defined as

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

The 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 missingness ratio essentially measures the proportion of the total variance that is due to between implicate variance.

$\overline{Q}$, $\sqrt{t_{ii}}$ and the missingness ratio are the final results presented in all tables.

E. Random Worker to Firm Allocation Model

This paper adapts the random worker to firm allocation model developed by Blau (1977) and compute the expected and actual Duncan and Duncan index for each two-digit NAICS sector presented in Table 2.

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 where 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. Thereby, 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 the size of the firms. Each size category contains firms with the same values of n_i. The possible outcomes, i.e. 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:

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

Thereby, 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 straightly 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 which 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.

Thereby, 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, state-NAICS sector specific expected and actual Duncan and Duncan indexes are calculated using the following formula:

Within each state and NAICS sector cell:

Let p_i = the percentage that minority workers comprise of 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 NAICS 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 NAICS sector specific indexes are calculated, the NAICS sector specific actual and expected indexes are simply the weighted averages among all the available states. The weight used is the total number of firms in a given state-NAICS sector cell.

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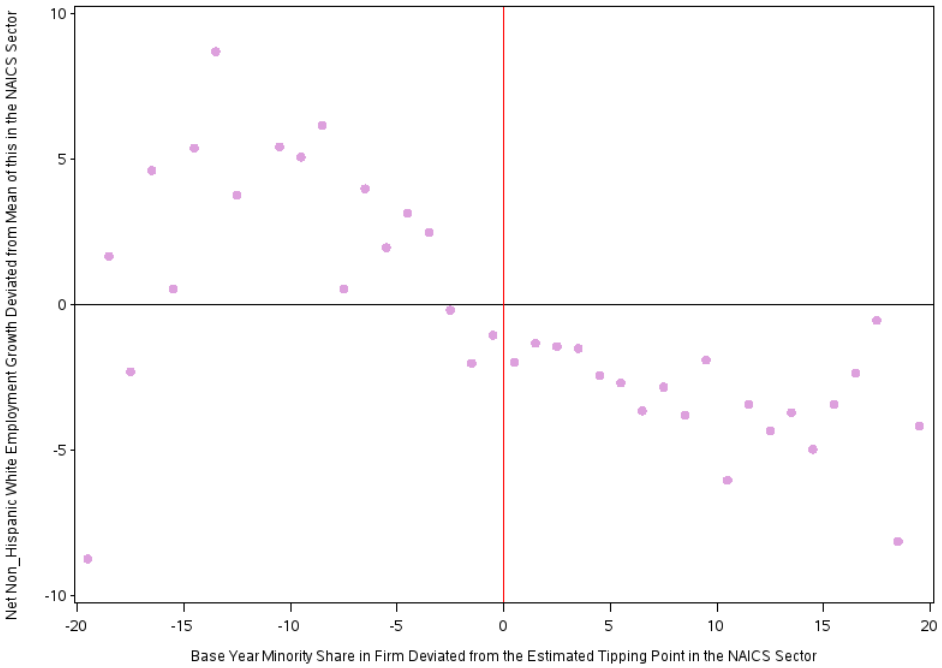
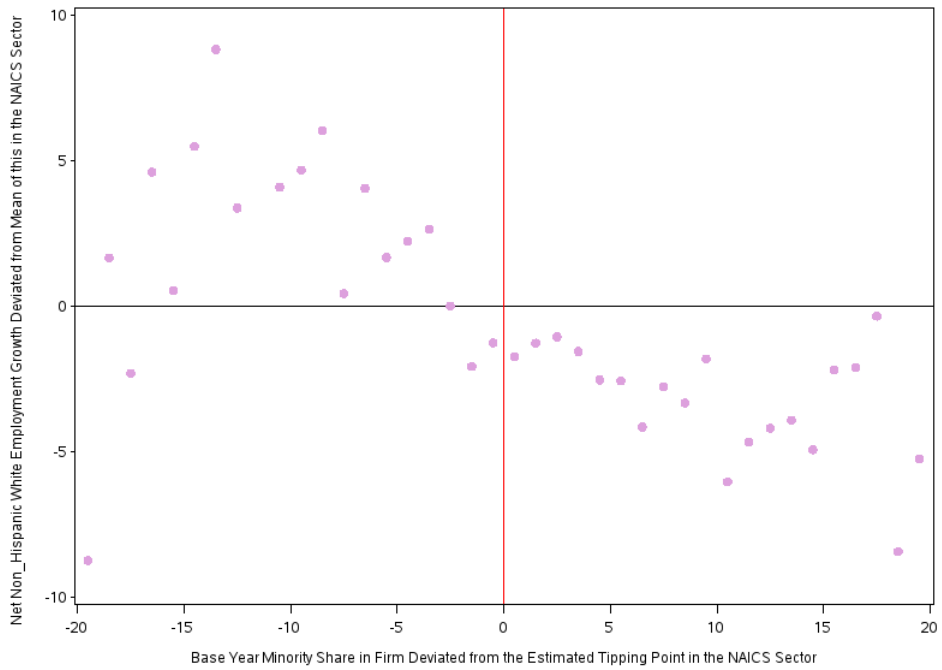
Figure 1. Change in a Pooled Sample of Firm-level Minority Composition, by Relationship to Candidate Tipping Points 1995-2000

All NAICS Sectors Pooled

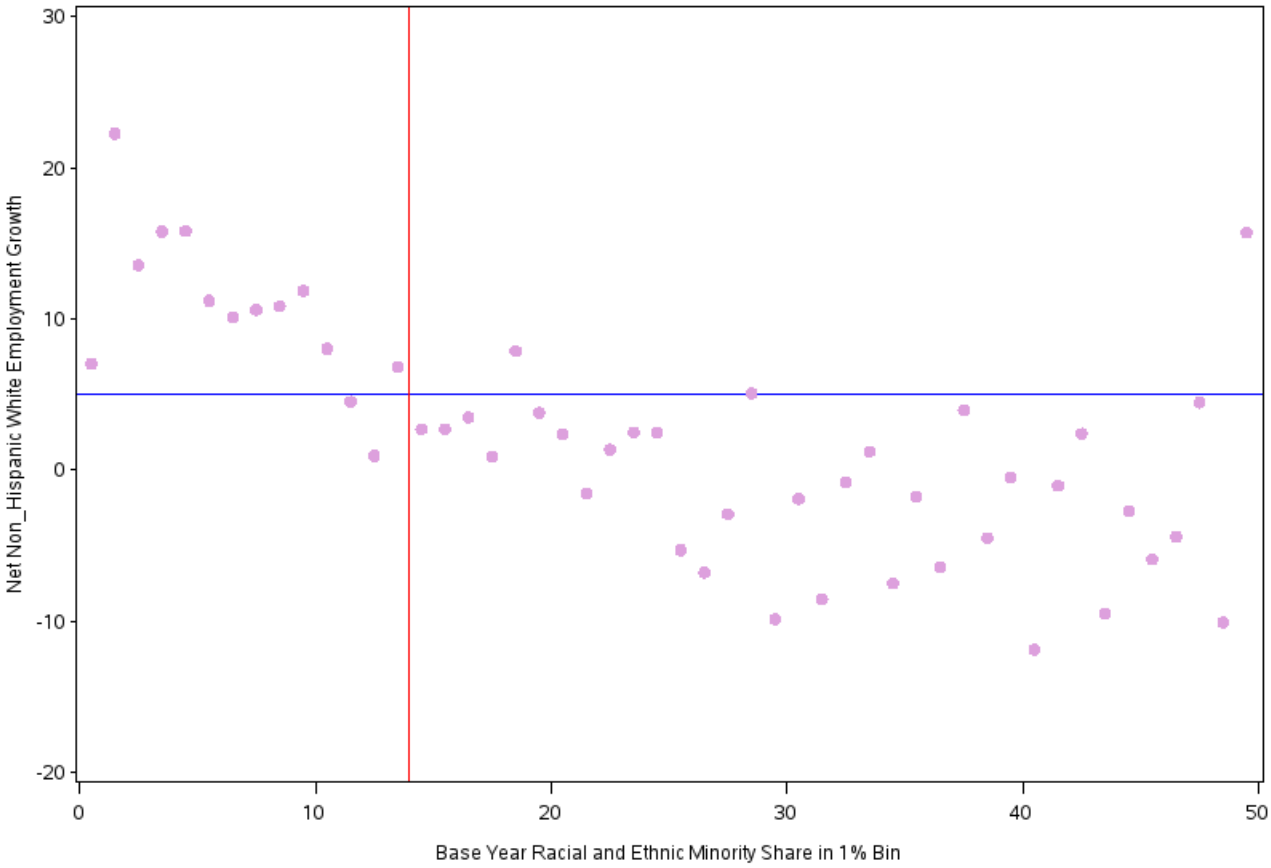


Service-producing NAICS Supersector



Notes: 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. Y axis is the net percentage change in the white employment between 1995 and 2000, expressed as a percentage of the total establishment-level employment in 1995 and deviated from the mean of this in the NAICS sector. Dots depict averages in 1-percentage-point bins by 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 mean of the net change in the 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% sample of single-establishment firms in NAICS sector 23.

Figure 3. Three Equilibria, With Social Interaction Effects

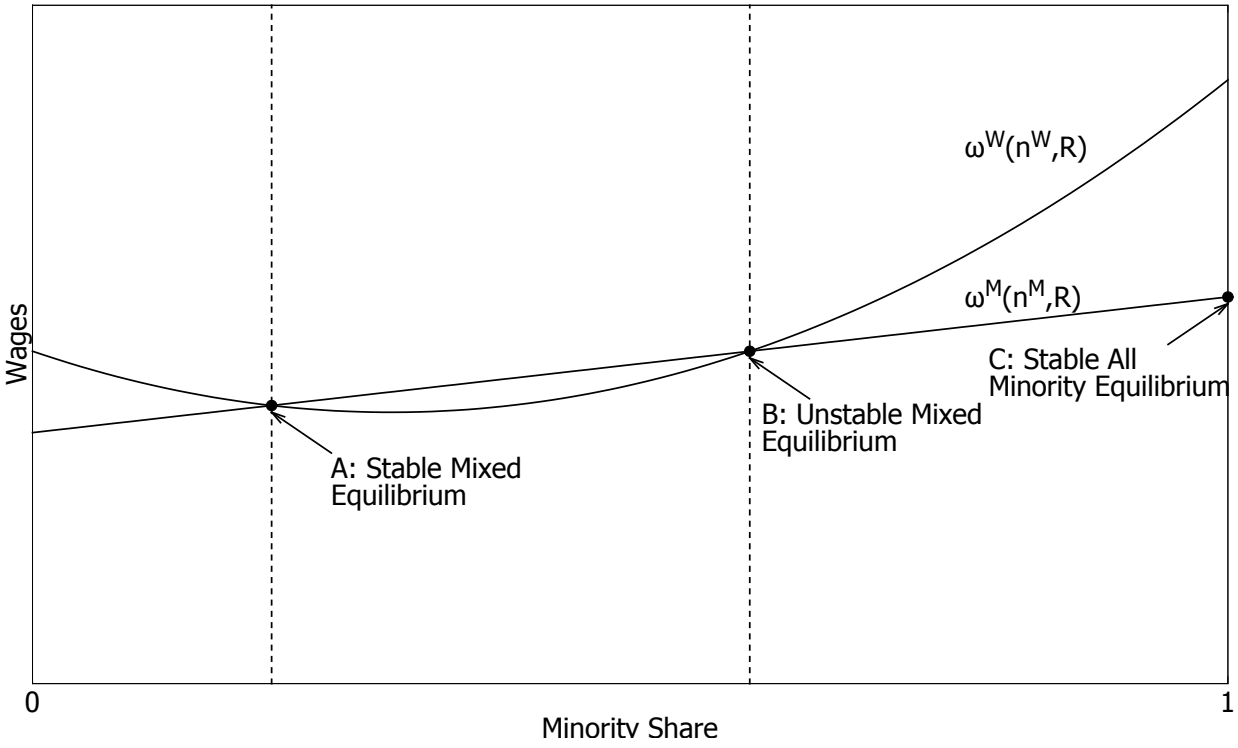


Figure 4. Rising Minority Labor Supply Leads to a Tipping Point

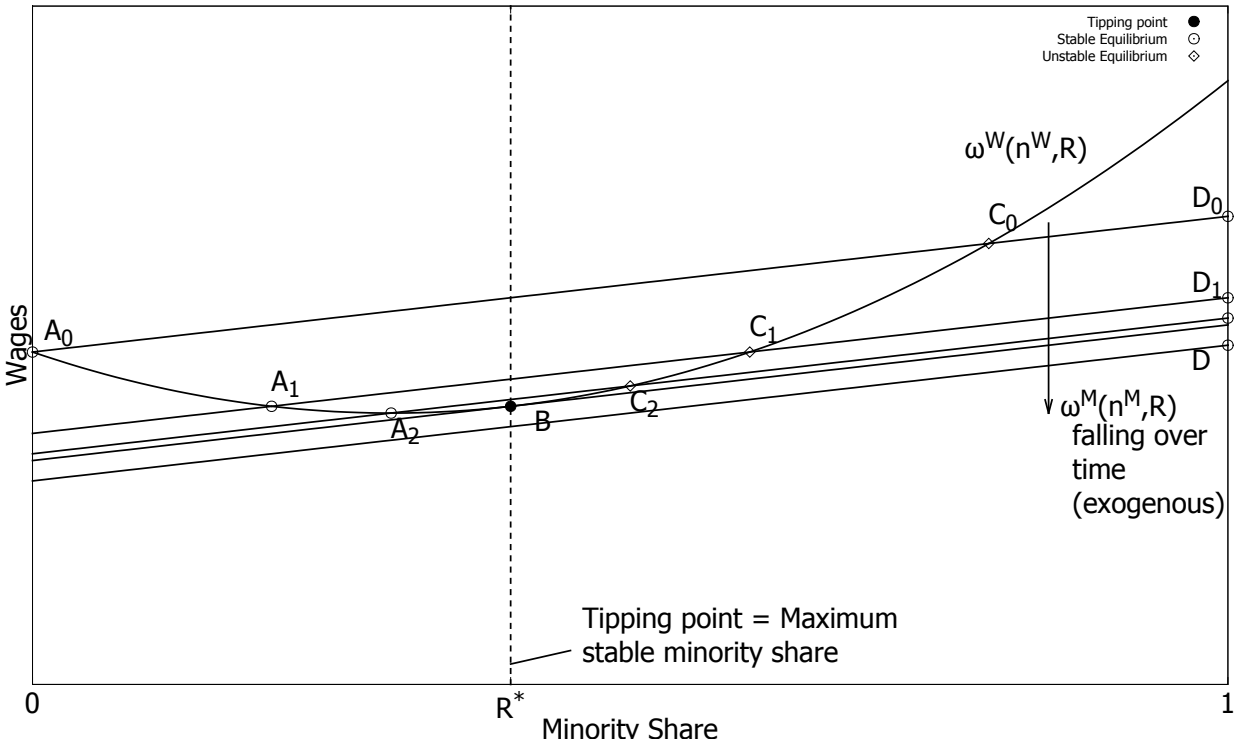
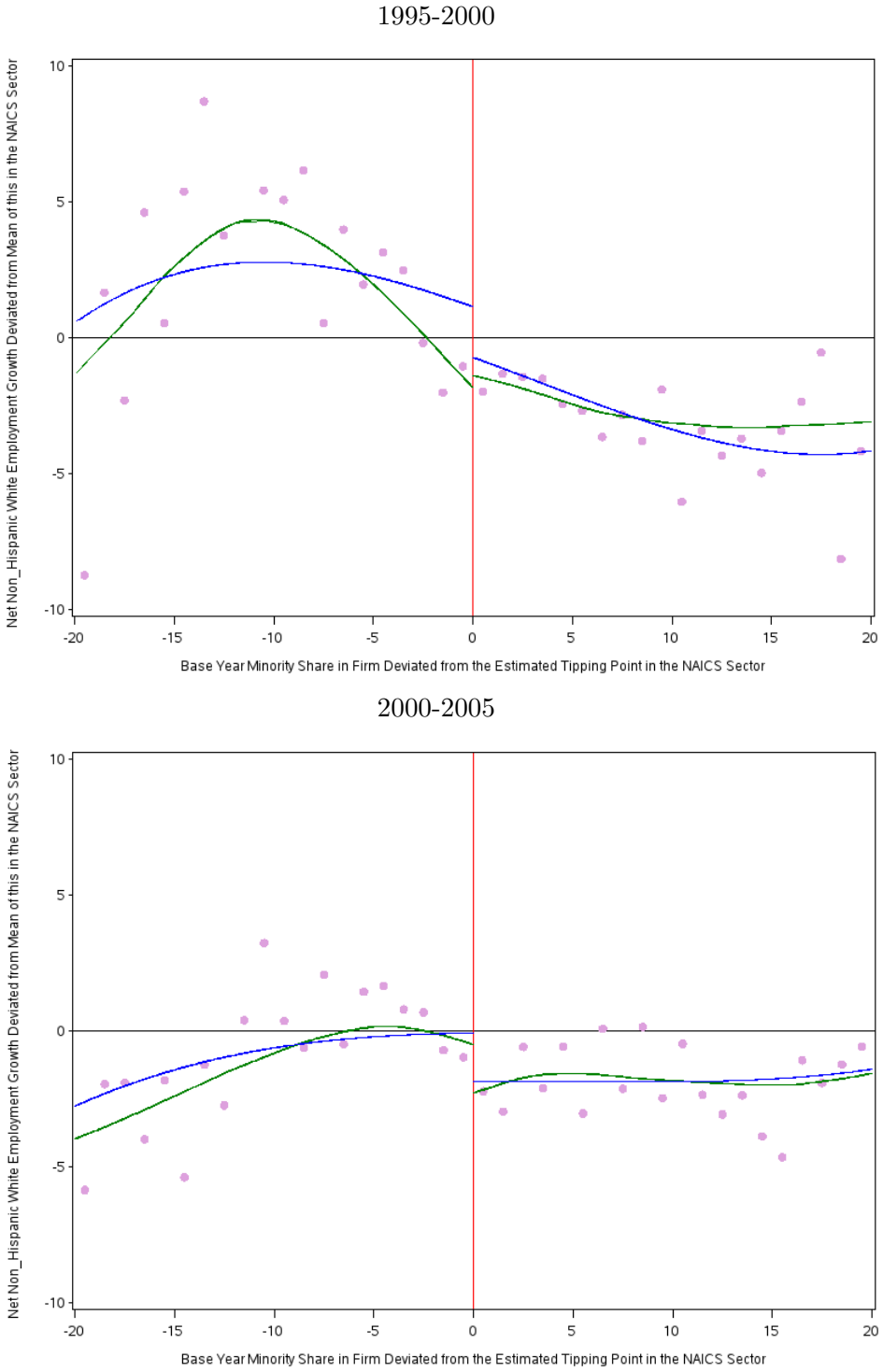


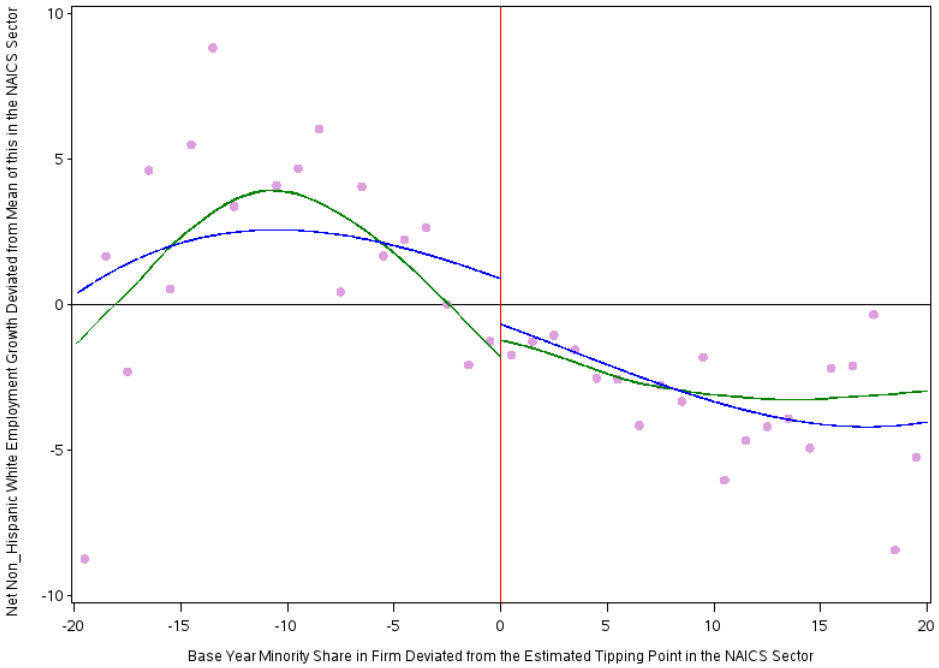
Figure 5. Minority Composition Change in All NAICS Sectors Pooled Sample, by Relationship to Candidate Tipping Point



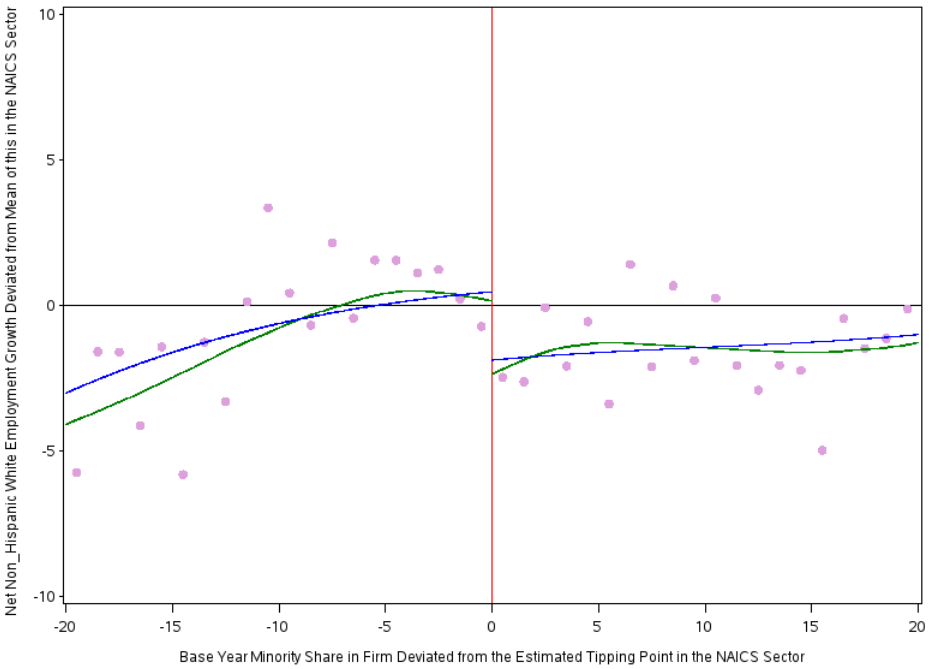
Notes: X axis is minority share in establishment deviated from the estimated NAICS sector specific tipping point. Y axis is the net change in the white employment in a five-year interval as a fraction of the total base year employment and deviated from the mean of this in the NAICS sector. Dots depict means in 1-percentage-point bins. Green line is a local linear regression fit separately on either side of zero using an Epanechnikov kernel and a bandwidth of 5. 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.

Figure 6. Minority Composition Change in Service-producing NAICS Supersector Pooled Sample, by Relationship to Candidate Tipping Point

1995-2000



2000-2005



Notes: X axis is minority share in establishment deviated from the estimated NAICS sector specific tipping point. Y axis is the net change in the 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. Green line is a local linear regression fit separately on either side of zero using an Epanechnikov kernel and a bandwidth of 5. 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. White and Minority Workers in Firms Grouped by Minority Composition Category

NAICS Sector	Minority Composition	All		Minority		White	
		Count	Percent	Count	Percent	Count	Percent
		Year 2000					
ALL	[0, 10%)	1,480,000	20.30	79,000	3.26	1,400,000	28.80
	[10%, 25%)	1,900,000	26.10	321,000	13.30	1,580,000	32.50
	[25%, 50%)	2,010,000	27.60	718,000	29.70	1,290,000	26.60
	[50%, 75%)	1,260,000	17.30	766,000	31.60	492,000	10.10
	[75%, 100%]	636,000	8.73	537,000	22.20	99,200	2.04
	ALL	7,280,000	100.00	2,420,000	100.00	4,860,000	100.00
Goods-producing Super-sector	[0, 10%)	504,000	22.20	25,000	3.18	479,000	32.20
	[10%, 25%)	508,000	22.30	84,300	10.70	423,000	28.40
	[25%, 50%)	586,000	25.80	213,000	27.10	373,000	25.10
	[50%, 75%)	453,000	19.90	277,000	35.20	175,000	11.80
	[75%, 100%]	224,000	9.84	187,000	23.80	36,500	2.45
	ALL	2,270,000	100.00	787,000	100.00	1,490,000	100.00
Services-producing Super-sector	[0, 10%)	972,000	19.40	54,000	3.30	918,000	27.20
	[10%, 25%)	1,390,000	27.80	237,000	14.50	1,160,000	34.30
	[25%, 50%)	1,420,000	28.40	505,000	30.90	918,000	27.20
	[50%, 75%)	806,000	16.10	489,000	29.90	317,000	9.40
	[75%, 100%]	412,000	8.23	349,000	21.40	62,700	1.86
	ALL	5,010,000	100.00	1,630,000	100.00	3,370,000	100.00
		Year 2005					
ALL	[0, 10%)	2,620,000	21.40	142,000	3.63	2,480,000	29.70
	[10%, 25%)	3,350,000	27.20	561,000	14.30	2,790,000	33.30
	[25%, 50%)	3,330,000	27.10	1,190,000	30.30	2,150,000	25.70
	[50%, 75%)	2,050,000	16.70	1,240,000	31.80	810,000	9.67
	[75%, 100%]	926,000	7.54	783,000	20.00	143,000	1.71
	ALL	12,300,000	100.00	3,920,000	100.00	8,370,000	100.00
Goods-producing Super-sector	[0, 10%)	860,000	24.80	43,700	4.00	817,000	34.30
	[10%, 25%)	851,000	24.50	141,000	12.90	710,000	29.90
	[25%, 50%)	884,000	25.50	321,000	29.30	563,000	23.70
	[50%, 75%)	632,000	18.20	385,000	35.20	247,000	10.40
	[75%, 100%]	244,000	7.03	203,000	18.60	40,800	1.72
	ALL	3,470,000	100.00	1,090,000	100.00	2,380,000	100.00
Services-producing Super-sector	[0, 10%)	1,760,000	20.00	98,500	3.49	1,670,000	27.80
	[10%, 25%)	2,500,000	28.30	420,000	14.90	2,080,000	34.70
	[25%, 50%)	2,450,000	27.80	866,000	30.70	1,580,000	26.40
	[50%, 75%)	1,420,000	16.10	858,000	30.40	563,000	9.39
	[75%, 100%]	682,000	7.74	579,000	20.50	102,000	1.71
	ALL	8,810,000	100.00	2,820,000	100.00	5,990,000	100.00

Notes: The numbers of observations do not sum up due to rounding for disclosure avoidance review purposes. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Table 2. Actual and Expected Duncan & Duncan Index By NAICS Sector

NAICS Sector	Duncan & Duncan 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 NAICS sector specific actual and expected Duncan and Duncan indexes are computed by averaging state-specific actual and expected Duncan and Duncan indexes, weighing by the numbers of firms in that NAICS sector and state cell. Each statistics is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Table 3. 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
% Asians	5.88	4.83	6.21	5.95	4.51	6.38
% Blacks	9.02	7.64	9.46	10.20	8.68	10.60
% Hispanics	18.70	21.90	17.70	16.90	19.50	16.10
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 review purposes. Each statistics is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Table 4. 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 top of column is the base year. The numbers of firms do not sum up due to rounding for disclosure avoidance review purposes. Each statistics, except the number of firms as percentage of total number of firms, is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Table 5. NAICS Sector Specific Candidate Tipping Points Using 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

Notes: Observations used to conduct the Fixed-point procedure is the 50% randomly selected subsample of the sample for each five-year interval. The tipping point is measured in base-year minority shares in each NAICS sector. Each estimate is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Table 6. Basic Regression Discontinuity Models for Net Non-Hispanic White Employment Changes Around the Tipping Point

	All NAICS					
	Net Change in white employment		Change in white employment		Change in minority employment	
	(1)	(2)	(3)	(4)	(5)	(6)
1995-2000						
Beyond candidate tipping point in 1995	−6.06	−5.83	−3.36	−3.15	2.70	2.68
	(1.14)	(1.16)	(1.02)	(1.04)	(0.54)	(0.52)
	[0.60]	[0.61]	[0.51]	[0.54]	[0.48]	[0.46]
Establishment controls	n	y	n	y	n	y
N	99,900	99,900	99,900	99,900	99,900	99,900
2000-2005						
Beyond candidate tipping point in 2000	−3.07	−3.25	−2.50	−2.70	0.57	0.56
	(1.06)	(1.06)	(1.01)	(1.03)	(0.59)	(0.59)
	[0.50]	[0.50]	[0.60]	[0.61]	[0.48]	[0.49]
Establishment controls	n	y	n	y	n	y
N	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 column (1), non-Hispanic white in column (2), and minority in column (3)) as a percentage (0-100) of the establishment's total base-year employment. All specifications are estimated using only the 50% of single-establishment firms not used to identify the candidate tipping points; The specifications include state fixed effects, NAICS sector fixed effects, a cubic polynomial in the deviation in the establishment's minority share from the candidate tipping point, share of workers approaching retirement, share of workers who are 24 years old or younger, log average earnings. All are measured in the base year at the establishment-level. 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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The 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	Chang 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: 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 column (1), non-Hispanic white in column (2), and minority in column (3)) as a percentage (0-100) of the establishment's total base-year employment. All specifications are estimated using only the 50% of single-establishment firms not used to identify the candidate tipping points; The specifications include state fixed effects, NAICS sector fixed effects, a cubic polynomial in the deviation in the establishment's minority share from the candidate tipping point, share of workers approaching retirement, share of workers who are 24 years old or younger, log average earnings. All are measured in the base year at the establishment-level. 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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

Table 8. 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: Specification in column (1) is that from column (2) of Table 6. Dependent variable is the net change in non-Hispanic white employment as a percentage of base-year total establishment employment. 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-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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

Table 9. 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 state fixed effects, NAICS sector fixed 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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

Table 10. 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 6 footnote for a description of establishment-level controls. Specification in columns (1), (5) and (9) are identical to those in Table 6. Other columns explores candidate tipping points in the establishment black share or Hispanic share. All specifications include state fixed effects and NAICS sector fixed 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-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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

Table 11. Tipping in Minority Share, Black Share, and Hispanic Share, 2000-2005

	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	−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 6 footnote for a description of establishment-level controls. Specification in columns (1), (5) and (9) are identical to those in Table 6. Other columns explores candidate tipping points in the establishment black share or Hispanic share. All specifications include state fixed effects and NAICS sector fixed 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-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 of the variance contribution of multiple imputation. The corrected standard errors are presented in parentheses. The missingness ratios are presented in brackets.

Appendix Table 1. White and Minority Workers in Firms Grouped by Minority Composition Category in Selected NAICS Sectors

NAICS Sector	Minority Composition	All		Minority		White	
		Count	Percent	Count	Percent	Count	Percent
				Year 2000			
23 Construction	[0, 10%)	130,000	22.70	7,060	4.10	123,000	30.60
	[10%, 25%)	151,000	26.10	25,300	14.70	125,000	31.00
	[25%, 50%)	173,000	30.00	61,100	35.50	112,000	27.70
	[50%, 75%)	97,200	16.90	58,300	33.80	38,900	9.64
	[75%, 100%]	25,000	4.33	20,600	12.00	4,350	1.08
	ALL	576,000	100.00	172,000	100.00	404,000	100.00
62 Health Care & Social Assistant	[0, 10%)	237,000	23.30	11,800	3.34	225,000	33.80
	[10%, 25%)	236,000	23.20	39,600	11.30	197,000	29.60
	[25%, 50%)	242,000	23.80	88,800	25.20	154,000	23.10
	[50%, 75%)	189,000	18.60	115,000	32.50	74,300	11.20
	[75%, 100%]	113,000	11.10	97,700	27.70	15,700	2.36
	ALL	1,020,000	100.00	352,000	100.00	665,000	100.00
				Year 2005			
23 Construction	[0, 10%)	237,000	23.50	12,800	4.16	224,000	31.90
	[10%, 25%)	252,000	25.00	42,300	13.80	210,000	29.80
	[25%, 50%)	297,000	29.40	107,000	35.00	189,000	26.90
	[50%, 75%)	184,000	18.20	110,000	36.00	73,200	10.40
	[75%, 100%]	40,900	4.05	33,700	11.00	7,210	1.02
	ALL	1,010,000	100.00	307,000	100.00	704,000	100.00
62 Health Care & Social Assistant	[0, 10%)	443,000	23.30	22,400	3.52	421,000	33.10
	[10%, 25%)	476,000	25.00	79,000	12.40	397,000	31.20
	[25%, 50%)	470,000	24.60	169,000	26.70	301,000	23.60
	[50%, 75%)	320,000	16.80	195,000	30.70	125,000	9.86
	[75%, 100%]	197,000	10.30	170,000	26.70	27,800	2.19
	ALL	1,910,000	100.00	635,000	100.00	1,270,000	100.00

Notes: The numbers of observations do not sum up due to rounding for disclosure avoidance review purposes. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Appendix Table 2. Various Groups of Minority Workers in Firms Grouped by Minority Composition Category

NAICS Sector	Minority Composition	Asians		Blacks		Hispanics	
		Count	Percent	Count	Percent	Count	Percent
				Year 2000			
ALL	[0, 10%)	14,500	3.41	30,400	3.73	29,300	2.45
	[10%, 25%)	60,200	14.20	133,000	16.30	124,000	10.30
	[25%, 50%)	129,000	30.40	273,000	33.50	319,000	26.70
	[50%, 75%)	130,000	30.70	232,000	28.50	414,000	34.60
	[75%, 100%]	90,400	21.30	147,000	18.10	311,000	26.00
	ALL	424,000	100.00	815,000	100.00	1,200,000	100.00
Goods-producing Super-sector	[0, 10%)	4,460	3.17	9,440	5.10	9,270	1.99
	[10%, 25%)	14,600	10.40	32,800	17.70	35,300	7.56
	[25%, 50%)	39,000	27.70	67,700	36.50	107,000	22.90
	[50%, 75%)	50,700	36.00	52,600	28.40	178,000	38.10
	[75%, 100%]	31,800	22.70	22,500	12.20	137,000	29.40
	ALL	141,000	100.00	185,000	100.00	466,000	100.00
Services-producing Super-sector	[0, 10%)	10,000	3.53	21,000	3.33	20,100	2.75
	[10%, 25%)	45,600	16.10	99,800	15.80	88,500	12.10
	[25%, 50%)	89,900	31.70	205,000	32.60	212,000	29.00
	[50%, 75%)	79,500	28.00	179,000	28.50	236,000	32.30
	[75%, 100%]	58,500	20.60	125,000	19.80	174,000	23.80
	ALL	283,000	100.00	630,000	100.00	731,000	100.00
				Year 2005			
ALL	[0, 10%)	25,200	3.57	57,800	3.96	51,500	2.92
	[10%, 25%)	98,600	14.00	248,000	17.00	203,000	11.50
	[25%, 50%)	218,000	30.80	482,000	33.00	491,000	27.80
	[50%, 75%)	218,000	30.80	420,000	28.80	620,000	35.20
	[75%, 100%]	147,000	20.80	251,000	17.20	398,000	22.60
	ALL	706,000	100.00	1,460,000	100.00	1,760,000	100.00
Goods-producing Super-sector	[0, 10%)	7,170	3.88	17,400	5.63	16,500	2.74
	[10%, 25%)	22,400	12.10	58,300	18.90	56,700	9.39
	[25%, 50%)	52,100	28.20	113,000	36.70	156,000	25.80
	[50%, 75%)	66,200	35.80	90,100	29.20	234,000	38.80
	[75%, 100%]	36,700	19.90	29,600	9.58	141,000	23.30
	ALL	185,000	100.00	309,000	100.00	604,000	100.00
Services-producing Super-sector	[0, 10%)	18,100	3.46	40,500	3.52	35,000	3.02
	[10%, 25%)	76,200	14.60	190,000	16.50	147,000	12.60
	[25%, 50%)	166, , 000	31.70	369,000	32.10	335,000	28.90
	[50%, 75%)	151,000	29.00	330,000	28.70	386,000	33.30
	[75%, 100%]	110,000	21.20	221,000	19.20	257,000	22.20
	ALL	522,000	100.00	1,150,000	100.00	1,160,000	100.00

Notes: The numbers of observations do not sum up due to rounding for disclosure avoidance review purposes. Each of the statistics is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.

Appendix Table 3. 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
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: "BY" stands for "Base Year". Year at top of column is the base year. The numbers of firms do not sum up due to rounding for disclosure avoidance review purposes. Each statistics, except the number of firms as percentage of total number of firms, is computed and averaged across the results obtained using the 10 implicate files. Standard errors are forthcoming.