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INFORMATION SHOCKS AND SOCIAL NETWORKS

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ABSTRACT

The relationships between social networks and economic behavior have been well-documented. However, it is often difficult to distinguish between the role of information sharing and other features of a neighborhood, such as factors that are common to people of the same ethnicities or socio-economic opportunities, or uniquely local methods of program implementation. We seek to gain new insight into the potential role of information flows in networks by investigating what happens when information is disrupted. We exploit rich microdata from Florida vital records and program participation files to explore the effects of neighborhood social networks on the degree to which immigrant WIC participation during pregnancy declined in the "information shock" period surrounding welfare reform. We compare changes in WIC participation amongst Hispanic immigrants living in neighborhoods with a larger concentration of immigrants from their country of origin to those with a smaller concentration of immigrants from their country of origin, holding constant the size of the immigrant population and the share of immigrants in the neighborhood who are Hispanic. We find strong evidence to support the notion that social networks mediated the information shock faced by immigrant women in the wake of welfare reform.

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I. Introduction

The relationships between social networks[1] and economic behavior have been well-documented. Country-of-origin networks have been found to facilitate immigrant assimilation (Borjas, 2000), job seeking (Edin, Fredriksson, and Aslund, 2003; Munshi, 2003), and business relationships (Jackson and Schneider, 2010). Social networks also apparently contribute to the participation in social programs; Bertrand, Luttmer and Mullainathan (2000) find that eligible individuals who live amongst others who speak their same language are more likely to participate in welfare programs.

A major pathway through which these social networks are hypothesized to operate involves information channels. People who have fewer barriers to communicate with others about potential opportunities are likely more able to act on these opportunities. However, it is often difficult to distinguish between the role of information sharing and other features of a neighborhood, such as factors that are common to people of the same ethnicities or socio-economic opportunities, or uniquely local methods of program implementation. Aizer and Currie (2004) challenge the information-sharing hypothesis by showing that participation in a publicly-funded prenatal care program in California does not follow the patterns one would expect if information-sharing is a driving force. They find that measured network effects are not larger for people who are likely independently less informed -- women in their first pregnancies as compared to later pregnancies, and immigrant women as compared to native-born women. Their results indicate that if information-sharing was an important explanation for the

[1] We are referring to the traditional definition of social networks -- relationships between friends and family that involve information-sharing and favors (see, e.g., Jackson, 2010)-- rather than the more recent references to social networking sites such as Facebook.

relationship between social networks and economic behavior, these social networks may not matter as much in steady state.

It may be that the information role of social networks is not particularly important when conditions are stable and information is widespread, but perhaps social networks matter more when there is new information to be disseminated. We seek to gain new insight into the potential role of information flows in networks by investigating what happens when information is disrupted.[2] Specifically, we consider the case of the information shock caused by the enactment of welfare reform in 1995 and 1996, beginning with waivers approved by the U.S. Department of Health and Human Services that allowed states to change the rules of welfare program implementation and culminating in the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), signed into law in August 1996.[3] Welfare reform led to widespread temporary confusion about individuals' eligibility for a variety of social programs such as Medicaid and the Special Supplemental Nutrition Program for Women, Infants and Children (WIC), even though eligibility for these programs was often not directly affected, and this confusion was particularly widespread amongst immigrants. (While Medicaid eligibility for immigrants changed with welfare reform, eligibility for WIC did not change at all during this

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[2] Duflo and Saez (2003) present experimental evidence suggesting that new information regarding retirement plans transmits via social networks. We seek to determine how social networks interact with an information shock regarding social programs.

[3] Florida, where we conduct this analysis, began its experimentation with welfare reform in February 1994, when it introduced the Family Transition Program (FTP) in two counties -- Alachua (Gainesville) and Escambia (Pensacola) -- as a randomized demonstration experiment. The FTP demonstration was expanded to eight counties in September 1995, including larger counties such as Duval (Jacksonville), Orange (Orlando) and Pinellas (St. Petersburg). A search of Google news archives from 1995 indicates that this expansion was receiving considerable attention in newspapers in areas not immediately affected, such as Miami, Fort Lauderdale, and Sarasota. The state was actively gearing up to enact statewide welfare reform during this period, as evidenced by the fact that the FTP program was officially implemented statewide only two months after the passage of PRWORA.

time period.) Mazzolari (2004) and Kandula et al. (2004) document reductions in immigrant program participation associated with the "chilling" effects of the policy climate, and Watson (2010) shows the importance of regional differences in immigration law enforcement in explaining differences in the chilling effects of welfare reform.[4] In an environment of increased uncertainty regarding program eligibility, as well as general unease about financial stability, social networks may prove particularly useful in disseminating information.

This paper uses rich microdata from Florida to explore the effects of neighborhood social networks on the degree to which immigrant WIC participation during pregnancy declined in the "information shock" period surrounding welfare reform. We attempt to identify a role of social networks that is not likely to be due to local implementation of public programs by accessing a database of detailed natality and program participation records for all Florida births in a 6-year period surrounding welfare reform. We concentrate our attention exclusively on the set of Hispanic immigrants who were eligible to receive WIC during pregnancy, as evidenced by the fact that their birth was funded by Medicaid.[5] We compare changes in WIC participation amongst Hispanic immigrants living in neighborhoods with a larger concentration of immigrants from their country of origin to those with a smaller concentration of immigrants from their country of origin, *holding constant the size of the immigrant population and the share of immigrants in the neighborhood who are Hispanic.* Florida is an outstanding place to study these effects, because there are very large populations of young women who were born in Cuba, Mexico and Puerto Rico, and individuals from these countries often live in the same

[4] Welfare reform also had effects on program participation in other dimensions, such as health care utilization. See, e.g., Bitler, Gelbach and Hoynes (2005).

[5] A family income cap of 185% of the federal poverty level applied both for WIC during pregnancy and Medicaid during pregnancy. See Florida Department of Children and Families (2009).

neighborhoods.[6] By controlling directly for the interaction between time and the size of the Hispanic population in the neighborhood, we can avoid confounding the effect of own-origin concentration with the role of language or of treatments of Hispanic immigrants in local policy implementation surrounding welfare reform. While it is still possible that local policy implementation could differ in ways that would affect, say, Mexican women in predominantly Cuban neighborhoods differently than they affect Mexican women in predominantly Mexican neighborhoods, it seems more plausible to believe that country-of-origin information flows are at work. As such, our identification strategy provides us with the opportunity to separate the effects of the *density* of an individual's social network from the effects of the *ethnicity* of that network.

It is clear that something significant happened to the WIC participation of Hispanic immigrants in the period surrounding welfare reform. As can be seen in Figure 1, we observe that participation in the WIC program during pregnancy in Florida fell precipitously -- by over 50 percent from pre-reform highs -- in the time surrounding welfare reform and then rebounded after about a year to levels consistent with pre-welfare-reform trends.[7] (The horizontal axis

[6] There are large numbers of young Hispanic women born in other countries as well, but these other Spanish speaking countries, primarily in South and Central America, are combined in the birth vital records.

[7] The magnitude of this decline may come as a surprise to readers familiar with the annual data on overall WIC caseloads (see, e.g., the figures reported by the Food Research and Action Center, 2005), which continue to rise, albeit modestly, in Florida in the period surrounding welfare reform. These statistics miss the dip in WIC take-up rates for Hispanic immigrants for several reasons. First, the decline in WIC participation does not overlap perfectly with fiscal year definitions; when we construct caseloads at the fiscal year level using the microdata, we observe a decline of only 22 percent, so this reporting distinction alone can account for more than half of the discrepancy. In addition, the statistics in the public domain conflate WIC caseloads during pregnancy with postpartum WIC caseloads, for which we would have little expectation regarding an information problem since women were more likely to have been counseled about their WIC eligibility in the hospital once they were informed about their Medicaid eligibility. We do not have data on postpartum caseloads, so cannot observe the degree to which our explanation accounts for the remaining discrepancy. On the other hand, the dip in observed WIC take-up among Hispanic immigrants is not appreciably different from the overall dip in WIC take-up, so our use of Hispanic

reflects month of birth, so WIC participation could have conceivably begun as early as nine months prior to this time) Medicaid use did not change during this time, but this is likely because uninsured women who arrived at hospitals to give birth were automatically checked to see whether they qualified for Medicaid; the lack of a change in Medicaid participation at birth is a good "gut check" to demonstrate that the change in WIC participation in the period surrounding welfare reform is not artifactual. Because Florida had a gradual process of implementing welfare reform, we do not think of welfare reform as an "event" as we do not know exactly when welfare reform "happened" in the consciousness of Hispanic immigrants in Florida; indeed, in some of our model specifications we will control for neighborhood-by-time fixed effects so that we are explicitly *not* identifying participation effects off of timing alone. Rather, we identify the information shock period as the period empirically observed to have the large dip in WIC participation, and we seek to explain whether neighborhood social networks may have played a role in determining the magnitude of this dip for some groups of people relative to others.

We find strong evidence to support the notion that social networks mediated the information shock faced by immigrant women in the wake of welfare reform. The dip in participation was particularly pronounced for Hispanic immigrants living in neighborhoods populated with larger numbers of other immigrants -- even when those other immigrants are themselves Hispanic. But for those who lived near other Hispanic immigrants *from the same country*, this dip was considerably smaller. These results indicate that the uncertainty surrounding welfare reform's effects on other social program eligibility was much lower when

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immigrants is not an explanation of the difference between our figures and overall fiscal year caseload level statistics. Additional evidence for the accuracy of the dip in our microdata is provided by the observation of a concomitant decrease in WIC spell lengths during the same period.

social networks were likely stronger. These results have important potential implications for the role of social networks in information diffusion in other settings as well.

II. Hispanic immigrant births and program participation in Florida

As we seek to distinguish the effects of social networks during information shocks from factors such as local implementation of policies that vary temporally, program implementation that affects speakers of one language differently from speakers of another language, or language barriers that may not have anything to do with social networks, we make use of the large-scale administrative dataset from Florida to study a very tightly-defined population -- Hispanic immigrants who were born in Cuba, Mexico or Puerto Rico, the three Spanish-speaking places outside of the United States that are identified on the birth certificate.[8] We therefore begin by describing the patterns of births to these Hispanic immigrants in Florida in the years surrounding welfare reform. We make use of data on all live births in Florida between 1994 and 1999 provided to us by the Florida Department of Health, matched with indicators of WIC and Medicaid participation during pregnancy. As seen in Figure 2, during this time period the number of births in Florida was increasing, with about 16,000 births per month in 1994 and about 16,500 births per month in 1999. Figure 3 zeroes in on the share of immigrants as a percentage of total births in Florida: The number of births to immigrant women increased by an even larger degree during this period, from 22 percent of all births in 1994 to 26 percent of all births in 1999, and the percentage of births to Hispanic immigrant women increased from under 13 percent in 1994 to over 15 percent in 1999. The percentage of all births to mothers born in

[8] Some Filipino women self-identify as Hispanic as well, and we can identify Filipino origin on the birth certificate. However, there are very few Filipino women-in the Florida data, only a few hundred. In practice, our results are unchanged depending on whether we include or exclude Filipino women from our analysis.

Cuba, Mexico and Puerto Rico -- the places of birth of the mothers in our study population -- increased from 6 percent in 1994 to 8 percent in 1999. And as can be seen in Figure 3, these percentages have been approximately monotonically increasing over the entire study period; there is no evidence that immigrant births changed at all during the information shock period surrounding welfare reform. Because we further restrict our study to women who were eligible for WIC during pregnancy -- as evidenced by the fact that the birth was paid for by Medicaid -- our study population is the set of 45,528 births to women from Cuba, Mexico or Puerto Rico who were eligible for WIC during pregnancy and resided in a zip code with at least ten births (regardless of immigrant status) in each of the six calendar years of the study.[9]

While the number of births to Cuban, Mexican and Puerto Rican immigrants may not have changed during the information shock period, the composition of these births may have changed. Figure 4 presents month-by-month averages of maternal age, maternal education and whether the mother received adequate prenatal care, according to the Kotelchuck index (prenatal care begun in the first trimester, and at least six prenatal visits.) As can be seen, there is no evidence that the characteristics of the Hispanic women giving birth changed at all during the information shock period surrounding welfare reform. Therefore, the evidence indicates that while participation in WIC amongst those eligible to participate fell considerably and then rebounded during the welfare reform period, this is not due to differences in the attributes of the women who gave birth during this period. More broadly, the dip in WIC participation occurs in

[9] We make this last restriction because we calculate the immigrant percentages based on the observed attributes of mothers living in zip codes, and wish to ensure that we have a reasonably-sized denominator for these calculations. In practice, this sample restriction has tiny effects on our overall sample size; only 3.4 percent of all mothers in Florida (and 2.8 percent of Hispanic immigrant mothers) lived in zip codes that do not meet this restriction, and the median mother lived in a zip code with 307 or more births in each year of the study (393 for Hispanic immigrants.) The tenth percentile mother lived in a zip code with 64 or more births in each year (100 for Hispanic immigrants.)

both immigrant and non-immigrant populations and appears to transcend race and education (figures available upon request), thus resisting simple models of program participation based on individual demographic characteristics. This puzzle leaves us to consider deeper measures of influence related to neighborhood and social structure.

III. Social networks as information channels

Our objective is to identify whether social networks played a role in the degree to which WIC participation during pregnancy fell in the "information shock" period surrounding welfare reform. While it is impossible to measure social networks directly in the administrative datasets available to us, we believe that immigrant women are more likely to be acquainted with and share information with other women of their same nationality than they are with other immigrant women from different nationalities. We therefore hypothesize that immigrant women who live near other immigrant women from the same country will have better information about program rules than might immigrant women who live in communities with fewer immigrants from the same country. But as Aizer and Currie (2004) point out, correlations between concentration of an ethnicity in a neighborhood and members of that ethnicity's propensity to participate in a program could reflect many factors, including local program implementation. Our strategy is to distinguish between immigrant neighbors from one's own country and immigrant neighbors who simply share the same language; thus we can more distinctly identify the potential for information networks amongst immigrant women.

In order to compare immigrant women in communities with few neighbors from the same country to those in communities with many neighbors from their country of origin, we must have immigrant women living in a variety of communities that differ both by (1) the concentration of

Hispanic immigrants in the neighborhood and (2) the concentration of Hispanic immigrants of their same national origin. As can be seen in Figure 5, Hispanic immigrant women live in a wide variety of neighborhoods, as defined by the share of all births to Hispanic immigrants. While some live in neighborhoods with almost no other Hispanic immigrant mothers, others live in neighborhoods where more than four-fifths of all mothers are Hispanic immigrants. More to the point of the paper, Figure 6 presents information about the degree to which Hispanic immigrants live in neighborhoods that vary considerably in the concentration of immigrants from their own countries, conditional on the overall share of Hispanic immigrants in the neighborhood. The figure shows five density plots, where neighborhoods are divided into quintiles based on the percentage of all babies born to Hispanic immigrant mothers. Hispanic immigrant women live in a wide variety of neighborhoods, as characterized by the degree of Hispanic immigrant density, and within each of these groups, one observes considerable variation in the share of all Hispanic immigrants coming from the mother's country of origin. In each of the five quintiles, there are cases where there are virtually no other mothers from the woman's country of origin, other cases where virtually all of the Hispanic immigrant mothers come from the same country of origin, and every combination in between.

IV. Estimates of the effects of social networks on participation during information shocks

Our estimating equation of interest is

$$W_{izt} = \alpha_t + \beta M_{iz} \cdot t_t + \gamma H_{iz} \cdot t_t + \delta O_{iz} \cdot t_t + \sigma X_{izt} + \varepsilon_{izt} \,, \quad (1)$$

where W represents the WIC participation during pregnancy of mother i living in neighborhood z during time t, M represents the percentage of births to immigrant women in the mother's neighborhood, H represents the percentage of births to Hispanic immigrants in the mother's neighborhood, O represents the percentage of births to immigrants from the mother's home country in the mother's neighborhood, and X represents a set of mother-specific covariates (maternal age, education level and country of origin.) The coefficients α, β, γ and δ are all vectors, with different coefficients estimated for each quarter[10] (or month) between January 1994 and December 1999. Our coefficients of interest are the δs, the estimated relationships between the fraction of own-origin women in the neighborhood and a mother's WIC participation during pregnancy, holding constant the immigrant concentration and Hispanic immigrant concentration in the neighborhood, at different points in time. We cluster all the standard errors at the neighborhood level, and we measure the neighborhood as the zip code of residence at the time of the birth. Again, we limit our analysis to pregnancies in which the births were funded by Medicaid, so that we know that all women in the study were eligible to participate in WIC during their pregnancies.

While our primary specifications rely on the notion that neighborhoods with different attributes may respond differently during the information shock period around welfare reform, it is important to note that neighborhoods are likely settled by different types of individuals who might react differently to the information shock. There is little evidence that high school dropouts and high school graduates live in different types of neighborhoods in terms of immigrant densities -- the typical neighborhood occupied by a high school dropout in our population is 17.8 percent own-origin immigrant, as compared with 17.0 percent own-origin immigrant in the typical neighborhood occupied by a high school graduate ($p=0.647$). However, there is a strong age gradient in the likelihood of living near other immigrants from one's own

[10] Here and throughout the paper, when we refer to a quarter, we are referring to the quarter-year combination, so that all of our models interacting quarter with various variables have 24 interactions to reflect the 6 years. Our monthly interaction models have 72 interactions.

country of origin: While neighborhoods occupied by immigrants 20 and under averaged 15.4 percent own-origin immigrant, this figure rises monotonically with age, from 16.8 percent for those aged 21-25 to 18.3 percent for those aged 26-30 to 19.5 percent for those aged 31 and older ($p=0.000$). Note that this is likely due to differential location patterns at the time of immigration rather than any general patterns leading immigrants to move to relatively homogeneous neighborhoods as they age: When we compare the neighborhood attributes of the 4,679 mothers in our study who moved zip codes between births, we find that 33.6 percent moved to neighborhoods with percent own origin more than 3 percentage points above their previous neighborhood, 33.4 percent moved to neighborhoods with percent own origin more than 3 percentage points below their previous neighborhood, and 33.0 percent moved to neighborhoods with percent own origin within 3 percentage points of their previous neighborhood. Nonetheless, as a further check to ensure that we are not ascribing social network effects to other changes occurring in specific neighborhoods housing particular types of immigrants, in some specifications, we go further still and estimate models with time-specific neighborhood-specific fixed effects:

$$W_{izt} = \alpha_{zt} + \beta M_{iz} \cdot t_t + \gamma H_{iz} \cdot t_t + \delta O_{iz} \cdot t_t + \sigma X_{izt} + \varepsilon_{izt} \, . \qquad (2)$$

In these highly parameterized specifications, we explicitly compare Cubans to Puerto Ricans to Mexicans within the same neighborhood at the same time.

Even in this specification, if certain immigrant groups (e.g., those from Mexico versus those from Cuba, or those who are high school dropouts versus those who are high school graduates) respond differently to the information shock surrounding welfare reform, and they are somehow clustered together in neighborhoods, there remains the possibility that we might interpret, say, a Mexican immigrant-specific response to the information shock as a social network-related response to the information shock. Therefore, as a final step, we estimate a model specification in which we also control for time-specific origin-specific fixed effects, time-specific fixed effects for different education level, and time-specific age interactions:

$$W_{izt} = \alpha_{zt} + \beta M_{iz} \cdot t_t + \gamma H_{iz} \cdot t_t + \delta O_{iz} \cdot t_t + \lambda C_{iz} \cdot t_t + \psi E_{iz} \cdot t_t + \tau A_{iz} \cdot t_t + \sigma X_{izt} + \varepsilon_{izt} , \quad (3)$$

where A represents the mother's age, C is a vector of country of origin, and E is a vector of education levels. In this most heavily-parameterized model, we are comparing the responses of Cubans to Mexicans, say, within the same zip code at the same time, holding constant any temporal changes happening to Cubans and Mexicans statewide, and so on. While this model is more heavily parameterized than we believe to be ideal, it does provide an important check to ensure that our results are not being driven by some omitted variable.

We measure time t at the quarterly level; measuring time at the monthly level does not change the results but makes evaluation of the coefficients of interest more cumbersome. To see this distinction, compare Figures 7 and 8, which present the time dummies α at the quarterly versus monthly level, respectively. It is clear that the quarterly-measured time dummies smooth out some of the small-scale oscillations from month to month in the overall likelihood of WIC participation, but do not change the overall temporal pattern of WIC participation. Therefore, for clarity we will present all results with time measured at the quarterly level.

We begin by estimating two variants of equation (1), our model in which we estimate quarter-specific relationships between percent immigrant (or percent own-origin) in the neighborhood and prenatal WIC participation among Hispanic immigrants to Florida. The coefficients on time dummies and time-specific interactions with neighborhood characteristics are reported in Table 1. Each row in Table 1 represents a different quarter (where 94:1 is the comparison quarter) between 94:2 and 99:4, and the first three columns are all coefficient estimates from a single estimation of equation (1) in which we do not include percent Hispanic immigrant interactions. The second four columns are all coefficient estimates from the estimation of equation (1) in which we also include percent Hispanic interactions with time. Our primary coefficients of interest, those on the interactions between percent own-origin in the neighborhood and time, are bolded in each of the two specifications. As can be seen from the table, during the period of time in which welfare reform was commencing in Florida -- births during 1996 and the first part of 1997 -- Hispanic women eligible for WIC who lived in neighborhoods with relatively more immigrants from their own country of origin were significantly more likely to participate in WIC during pregnancy than were similar women with fewer immigrants from their country of origin. These differences are meaningful in magnitude as well: A coefficient of 0.339, for instance, implies that if a woman lived in a neighborhood that was 100 percent own-origin immigrants, she would be 34 percentage points more likely to participate in WIC than if she lived in a neighborhood with no own-origin immigrants, holding constant the percentage of immigrants in the neighborhood (and in the case of Model 2, the percentage of Hispanic immigrants in the neighborhood as well.) Given that the standard deviation of percentage own-origin immigrant in a neighborhood is 0.172, a coefficient of 0.339 suggests that increasing the percentage own-origin by one standard deviation increased the likelihood of prenatal WIC participation by 5.8 percentage points during that quarter. Since the difference between the pre-dip peak and the bottom of the "information shock" dip is 32 percentage points (note the participation rates provided in the first column of the table, below the quarter labels), this is a meaningful proportion of the dip that could have been mitigated by our proxy for information networks. The results suggest that the generally negative effect of being around other immigrants, and even other Hispanic immigrants, is mitigated and often overwhelmed by being around other own-origin immigrants.

The necessarily large number of coefficient estimates makes the information in Table 1 cumbersome to read. In Table 2 we summarize the point estimates from Table 1 (Model 2, which includes controls for percentage Hispanic immigrant in neighborhood) in a manner that makes cross-specification comparisons more transparent. Because we do not know exactly when the information shock began for the immigrant groups, we present a variety of comparisons. The first row of Table 2 simply summarizes the information from Model 2 of Table 1. Here, we compare the empirically defined "dip period", 96:2 through 97:2, to 94:1, in the first column. In the second through fourth columns, we divide the period from 95:4 though 97:1 into three six month periods. We chose these periods purposefully: The interquartile range in days of WIC participation during pregnancy in Florida is 77 to 186 days, and very few women participate in WIC for more than seven months during pregnancy. Births during the first two quarters, 95:4 to 96:1, roughly correspond to the period of time when the vast majority of women would have entered the WIC program following the September 6, 1995 enactment of the welfare waiver in Florida, and births during the last two quarters, 96:4 to 97:1, roughly correspond to the similar period of time following the enactment of PRWORA on August 22, 1996. The two intermediate quarters, 96:2 to 96:3, represent the period of time after Florida welfare reform was enacted in a set of counties and as statewide (and national) welfare reform was gearing up. We are agnostic about exactly when welfare reform became salient to these women, so present a variety of comparisons. As can be seen from the table, there was no apparent differential WIC take-up rate by women living amongst others from the same country of origin immediately following the welfare waiver, but in the intermediate period and even more following the passage of

PRWORA a substantial gap opened up, suggesting that living near others from the same country of origin provided some useful information channels that helped to overcome the widespread confusion surrounding welfare reform.[11]

We hypothesize that immigrant women might be particularly reliant on information channels when the pregnancy is their first, so we next restrict the analysis to first pregnancies. This is a particularly important check of the information channels story, since Aizer and Currie (2003) suggest the first birth comparison can be an important way to identify the women likely to be most sensitive to information about social programs. As can be seen from the table, the estimated effects of having a larger fraction of women in the neighborhood who were themselves immigrants from the same country are substantially larger when restricting the study population to first births.

Because people with different likelihoods of participating in the program at different times might have settled in different neighborhoods, as an extra check we repeat the same analysis but include zip code by time fixed effects (equation (2) above.) In this specification, we are now directly comparing different own-origin groups in the same neighborhood at the same time, and identifying solely off of the relative sizes of the different Hispanic national groups in

[11] Because we have no way of knowing exactly how much information had spread throughout the state, and when exactly the information spread, we are cautious about trying to differentiate our results between the eight counties in which welfare waivers had the most direct effect and the 59 counties in which welfare reform did not immediately begin occurring. In addition, the sample size of women in waiver counties is too small to obtain precise estimates, as waiver counties comprise 15.9 percent of our study population (15.6 percent if Alachua and Escambia counties are omitted.) That said, we do observe earlier and larger-magnitude results in the waiver counties than in the non-waiver counties: The estimated own-origin coefficients in waiver counties are 1.474 (se=1.194), 1.369 (se=1.152), and 1.361 (se=1.050), respectively, in 1995:4-1996:1, 1996:2-1996:3, and 1996:4-1997:1. None of these coefficients are statistically distinct from those in the non-waiver counties, which are close in magnitude and statistical significance to the overall results. While the larger estimated results are consistent with an information shock and social network story, we are too uncertain to want to make that claim, and report the disaggregated results purely for the sake of completeness.

the neighborhood. The results, reported in row 3 of Table 2, are less statistically significant than those in the previous specifications, but the pattern of findings -- that the larger the own-origin group in the neighborhood, the more likely a Hispanic immigrant was to participate in WIC during pregnancy during the "information shock" period -- persists. And, of course, since this is now directly comparing, say, Cubans to Mexicans simultaneously in the same neighborhood, it might highlight any systematic differences affecting all Cubans versus all Mexicans that are time-specific. Therefore, in row 4 of Table 2 we estimate equation (3), in which, in addition to zip code by quarter fixed effects, we also control for origin by quarter fixed effects, as well as education by quarter fixed effects and age by quarter interactions. In this very highly parameterized specification, we are comparing Cubans in a neighborhood to Mexicans in the same neighborhood at the same time, holding constant any time-specific differences between Cubans and Mexicans overall. While this model is more highly parameterized than our preference, it is our best attempt to control for all possible omitted variables. In this model, we continue to find that the percentage own-origin in the neighborhood is positively related to WIC participation during pregnancy. The estimated effects are larger in magnitude than in the specifications only controlling for zip code by time fixed effects, and are again statistically significant, suggesting that there may have been differential temporal patterns for Cubans, Mexicans and Puerto Ricans in the time surrounding welfare reform. This is not wholly unexpected, especially since Puerto Ricans are U.S. citizens while Cuban-born or Mexican-born immigrants may not be. Nonetheless, these results continue to provide evidence supporting the notion that social networks were salient in helping to determine immigrants' responses to the information shock surrounding welfare reform.

We further consider whether the estimated responses are stronger for some groups of immigrant women than they are for others. Table 3 presents our estimates of the models reported in rows 1 and 2 of Table 2, stratified along two dimensions: education and age. We compare high school dropouts to high school graduates, and women aged 25 or younger to those aged 26 or older.[12] As can be seen in Table 3, our estimated social network effects are consistently larger for less educated and younger mothers. These patterns are true whether we consider all mothers or restrict the study population to first births. All in all, they suggest that having a higher percentage own-origin in one's neighborhood is particularly important for people who might be less experienced or more sensitive to information shocks.

V. Program office proximity as a substitute for social networks

Our results are consistent with a story that social networks play a role in mitigating information shocks. This finding begs the question of whether government agencies might be able to place offices strategically to help to mitigate information shocks as well. In order to gauge the degree to which program office proximity might serve as a substitute for social networks, we repeat the above analyses, but augment the model with a series of WIC office proximity by time variables. Specifically, we attempt two different specifications of WIC office proximity, one where we observe whether a WIC program office was within two miles of the centroid of the zip code (42.3 percent of the population) and another where we observe whether a WIC program office was within five miles of the centroid of the zip code (75.0 percent of the population.) This measure of WIC office proximity is not perfect; most importantly, the earliest information we have about specific locations of WIC offices in Florida is in 1998, so we may be

[12] The median age of a mother in our population is 25.

measuring WIC office locations during the information shock period with error. That said, we have reason to believe that this measurement error is not very large: For instance, in 1998, zip codes with WIC offices within two miles had a 2.8 percent higher take-up rate than those where the nearest WIC office was over two miles away, and in 1994, the first year of our data, the difference was a statistically indistinguishable 1.7 percent. Measuring access at the five mile radius level yields even more similar comparisons: In 1998, zip codes with WIC offices within five miles had a 2.6 percent higher take-up rate than those where the nearest WIC office was over two miles away, as compared with 2.8 percent in 1994. If there was a major change in WIC office locations during our study period, it is not being reflected in substantial changes in WIC take-up patterns.

Table 4 presents our head-to-head comparisons of the estimated effects of percent own-origin in the neighborhood at different time periods to the estimated effects of having a proximate WIC office during the same time period. As can be seen in the table, we never observe statistically significant estimated effects of WIC office proximity during the critical time period, and to the extent to which the WIC office proximity interactions are substantial in magnitude, they have a negative sign, indicating that if anything, having a WIC office nearby might have reduced, rather than enhanced, WIC take-up amongst our population during the information shock time period. On the other hand, our estimated social network effects remain robust to the inclusion of the WIC office time interactions. While these results are not conclusive, they provide additional evidence that program office proximity is not a substitute for social networks during information shocks.

While WIC office proximity appears to not be a substitute for social networks, this proximity might still affect the degree to which social networks influence program participation in a time of information shocks. We therefore stratify the zip codes by whether there is a WIC office within two miles. The last two rows of Table 4 present the results of this analysis. We observe that the estimated effects of social networks are stronger in communities with a WIC office more immediately accessible. Therefore, these results indicate that while program office proximity may not be a substitute for social networks during times of information shocks, it may help to increase the likelihood that social networks will translate into program participation. We intend to explore this relationship further in future research.

VI. Conclusion

We present new evidence suggesting that social networks provide information that might help to reduce confusion during information shocks. We employ a unique dataset and empirical methodology that allow us to rule out local program implementation factors, ethnic background itself, or shared language as explanations for why program participation is higher in communities where social networks are likely to be stronger. Since we are controlling for ethnic background, we are able to disentangle the effect of the density of the social network from the ethnicity of the network in our analysis. While we do not provide long-run equilibrium explanations of correlations amongst similar individuals in their economic activity or program participation, this research does indicate that social networks may play an important role in the short run.

The fact that we find that program office proximity is associated with the degree to which social networks influence program participation, but that program office proximity per se does not affect participation, has potential policy implications for the role of program office location in spreading information. Our results suggest that strategically-located program offices may be successful in spurring program participation, but perhaps only if key individuals in the surrounding community are made aware of the eligibility rules for services the program office provides. We cannot speak to the mechanisms through which these enhanced information flows might operate, and this is certainly a topic for future experimentation and study. Nonetheless, our evidence on the potential role of social networks suggests that using social networks to spread information about eligibility rules and benefits may be successful in reducing the likelihood of major reductions in program participation in periods of information shocks.

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Table 1: Estimated relationship between neighborhood characteristics and immigrant WIC participation at different times, first quarter 1994 through fourth quarter 1999

Quarter (% WIC) (94:1= 46%)	Model 1: Controls for %immigrant			Model 2: Controls for %immigrant, %Hispanic immigrant			
	Coefficient on time	**Coefficient on time x %own origin in nbhd**	Coefficient on time x %immigrant in nbhd	**Coefficient on time**	**Coefficient on time x %own origin in nbhd**	Coefficient on time x %immigrant in nbhd	Coefficient on time x % Hispanic immigrant in nbhd
94:2 (45%)	-0.044 (0.046)	**-0.026 (0.152)**	0.087 (0.117)	-0.032 (0.049)	**-0.071 (0.188)**	-0.032 (0.219)	0.135 (0.245)
94:3 (51%)	0.038 (0.040)	**-0.007 (0.151)**	0.019 (0.106)	0.059 (0.049)	**-0.101 (0.171)**	-0.190 (0.302)	0.244 (0.312)
94:4 (50%)	0.048 (0.039)	**-0.138 (0.153)**	0.023 (0.106)	0.062 (0.043)	**-0.194 (0.198)**	-0.111 (0.206)	0.153 (0.246)
95:1 (45%)	-0.008 (0.043)	**-0.115 (0.145)**	0.048 (0.104)	-0.015 (0.047)	**-0.087 (0.172)**	0.114 (0.211)	-0.076 (0.221)
95:2 (47%)	0.025 (0.044)	**-0.168 (0.139)**	0.039 (0.113)	0.027 (0.045)	**-0.180 (0.183)**	0.024 (0.204)	0.021 (0.247)
95:3 (49%)	0.024 (0.042)	**-0.302** (0.138)**	0.146 (0.113)	0.011 (0.042)	**-0.250 (0.181)**	0.272 (0.184)	-0.144 (0.232)
95:4 (60%)	0.100** (0.041)	**-0.097 (0.140)**	0.130 (0.102)	0.098** (0.046)	**-0.089 (0.162)**	0.137 (0.243)	-0.010 (0.249)
96:1 (63%)	0.175*** (0.041)	**0.255* (0.140)**	-0.123 (0.104)	0.181*** (0.043)	**0.228 (0.176)**	-0.192 (0.227)	0.080 (0.258)
96:2 (57%)	0.147*** (0.039)	**0.241** (0.121)**	-0.196** (0.097)	0.127*** (0.043)	**0.324** (0.155)**	0.003 (0.197)	-0.230 (0.217)
96:3 (42%)	0.001 (0.042)	**0.339*** (0.125)**	-0.232** (0.100)	-0.013 (0.046)	**0.394** (0.157)**	-0.091 (0.240)	-0.161 (0.257)
96:4 (40%)	-0.016 (0.041)	**0.339** (0.144)**	-0.241** (0.102)	-0.044 (0.044)	**0.442** (0.176)**	0.036 (0.222)	-0.311 (0.241)
97:1 (31%)	-0.107*** (0.039)	**0.336** (0.139)**	-0.240** (0.102)	-0.127*** (0.042)	**0.424** (0.176)**	-0.027 (0.215)	-0.248 (0.239)
97:2 (44%)	-0.098** (0.043)	**0.073 (0.146)**	0.142 (0.130)	-0.118*** (0.043)	**0.152 (0.201)**	0.339 (0.246)	-0.227 (0.300)
97:3 (67%)	0.140*** (0.041)	**-0.043 (0.166)**	0.186 (0.118)	0.149*** (0.045)	**-0.075 (0.210)**	0.093 (0.227)	0.107 (0.269)
97:4 (70%)	0.143*** (0.045)	**0.139 (0.161)**	0.167 (0.120)	0.171*** (0.049)	**0.027 (0.205)**	-0.130 (0.247)	0.344 (0.290)
98:1 (69%)	0.139*** (0.039)	**0.113 (0.160)**	0.172 (0.107)	0.151*** (0.045)	**0.070 (0.184)**	0.039 (0.275)	0.149 (0.291)
98:2 (68%)	0.092** (0.042)	**0.090 (0.160)**	0.259 (0.107)	0.088* (0.045)	**0.107 (0.197)**	0.298 (0.215)	-0.044 (0.245)
98:3 (70%)	0.116*** (0.040)	**0.060 (0.164)**	0.271 (0.120)	0.110** (0.045)	**0.085 (0.210)**	0.329 (0.254)	-0.066 (0.292)
98:4 (71%)	0.139*** (0.039)	**0.113 (0.126)**	0.219 (0.099)	0.149*** (0.044)	**0.072 (0.159)**	0.096 (0.231)	0.141 (0.249)
99:1 (69%)	0.141*** (0.040)	**0.270 (0.146)**	0.093 (0.102)	0.155*** (0.045)	**0.210 (0.182)**	-0.066 (0.230)	0.185 (0.255)
99:2 (69%)	0.139*** (0.041)	**0.153 (0.146)**	0.153 (0.110)	0.149*** (0.041)	**0.108 (0.188)**	0.040 (0.228)	0.132 (0.256)
99:3 (71%)	0.170*** (0.038)	**0.140 (0.145)**	0.136 (0.098)	0.159*** (0.041)	**0.187 (0.179)**	0.245 (0.203)	-0.127 (0.228)
99:4 (69%)	0.170*** (0.038)	**0.074 (0.150)**	0.129 (0.118)	0.182*** (0.044)	**0.023 (0.189)**	-0.021 (0.219)	0.174 (0.261)

Notes: Standard errors clustered at the zip code level are in parentheses beneath coefficient estimates. The first three columns represent one regression specification, and the final four columns represent a second regression specification. Models also include controls for maternal education, maternal origin, percent immigrant in zip code, percent Hispanic immigrant in zip code, and percent own origin in zip code. Omitted period: 94:1. Number of observations: 45,528 births in 778 zip codes. Coefficients marked ***, ** and * are statistically significant at the 1, 5 or 10 percent level.

Table 2: Estimated relationships between neighborhood percentage own-origin and Hispanic immigrant WIC participation during "information shock" period

Model specification	Time period (compared with 94:1)			
	Downturn period (96:2 to 97:2)	95:4-96:1	96:2-96:3	96:4-97:1
Main specification (Table 1, model 2)	0.347** (0.146)	0.069 (0.151)	0.359*** (0.138)	0.433*** (0.161)
First births only	0.587*** (0.199)	0.266 (0.198)	0.523** (0.215)	0.751*** (0.224)
Adding zip code x quarter fixed effects	0.203 (0.204)	0.193 (0.242)	0.065 (0.216)	0.355 (0.220)
Adding zip code x quarter fixed effects, origin x quarter fixed effects, age x quarter fixed effects, and education x quarter fixed effects	0.492* (0.261)	0.525* (0.290)	0.476* (0.278)	0.548** (0.278)

Notes: Standard errors clustered at the zip code level are in parentheses beneath coefficient estimates. Each row represents a different model specification, except that waiver county and non-waiver county results were estimated in the same model specification. Models also include controls for maternal education, maternal origin, percent immigrant in zip code, percent Hispanic immigrant in zip code, and percent own origin in zip code, as well as interactions between percent immigrant and quarter and between percent Hispanic immigrant and quarter. Omitted period: 94:1. Number of observations: 45,528 births in 778 zip codes. Coefficients marked ***, ** and * are statistically significant at the 1, 5 or 10 percent level.

Table 3: Differences in estimated effects of social networks, by individual attribute

	Time period (compared with 94:1)			
	Downturn period (96:2 to 97:2)	95:4-96:1	96:2-96:3	96:4-97:1
First births only				
High school dropouts	0.835*** (0.280)	0.412 (0.281)	0.735** (0.298)	1.014*** (0.299)
High school graduates	-0.018 (0.294)	-0.111 (0.327)	-0.031 (0.333)	0.136 (0.309)
Age <=25	0.689*** (0.238)	0.325 (0.218)	0.613** (0.253)	0.863*** (0.256)
Age >25	0.293 (0.420)	0.214 (0.497)	0.287 (0.473)	0.407 (0.436)
All births				
High school dropouts	0.349* (0.196)	0.074 (0.221)	0.308 (0.207)	0.496** (0.195)
High school graduates	0.159 (0.256)	0.012 (0.271)	0.280 (0.249)	0.141 (0.289)
Age <=25	0.480** (0.203)	0.072 (0.203)	0.478** (0.215)	0.599*** (0.212)
Age >25	0.159 (0.198)	0.071 (0.200)	0.190 (0.198)	0.206 (0.221)

Notes: Standard errors clustered at the zip code level are in parentheses beneath coefficient estimates. Each row represents a different model specification. Models also include controls for maternal education, maternal origin, percent immigrant in zip code, percent Hispanic immigrant in zip code, and percent own origin in zip code, as well as interactions between percent immigrant and quarter and between percent Hispanic immigrant and quarter. Omitted period: 94:1. Number of observations: 45,528 births in 778 zip codes. Coefficients marked ***, ** and * are statistically significant at the 1, 5 or 10 percent level.

Table 4: Estimated effects of social networks and program office proximity over time

	Time period (compared with 94:1)			
	Downturn period (96:2 to 97:2)	95:4-96:1	96:2-96:3	96:4-97:1
First births only				
Estimated effect of % own origin	0.559*** (0.199)	0.268 (0.201)	0.496** (0.212)	0.718*** (0.225)
Estimated effect of WIC office within two miles	-0.062 (0.049)	0.011 (0.053)	-0.059 (0.053)	-0.075 (0.053)
Estimated effect of % own origin	0.511** (0.209)	0.236 (0.207)	0.485** (0.230)	0.671*** (0.232)
Estimated effect of WIC office within five miles	-0.073 (0.068)	-0.034 (0.065)	-0.039 (0.074)	-0.081 (0.072)
All births				
Estimated effect of % own origin	0.344** (0.146)	0.093 (0.154)	0.363*** (0.139)	0.419*** (0.162)
Estimated effect of WIC office within two miles	-0.004 (0.038)	0.044 (0.038)	0.007 (0.039)	-0.019 (0.041)
Estimated effect of % own origin	0.289* (0.156)	0.047 (0.157)	0.308** (0.151)	0.354** (0.171)
Estimated effect of WIC office within five miles	-0.046 (0.045)	-0.019 (0.048)	-0.041 (0.049)	-0.062 (0.046)
Estimated effect of % own origin, WIC office within two miles	0.570*** (0.214)	0.252 (0.255)	0.571*** (0.205)	0.555** (0.244)
Estimated effect of % own origin, no WIC office within two miles	0.159 (0.169)	-0.036 (0.185)	0.219 (0.159)	0.264 (0.199)

Notes: Standard errors clustered at the zip code level are in parentheses beneath coefficient estimates. Each pair of rows represents a different model specification. Models also include controls for maternal education, maternal origin, percent immigrant in zip code, percent Hispanic immigrant in zip code, and percent own origin in zip code, as well as interactions between percent immigrant and quarter and between percent Hispanic immigrant and quarter. Omitted period: 94:1. Number of observations: 45,528 births in 778 zip codes. Coefficients marked ***, ** and * are statistically significant at the 1, 5 or 10 percent level.

Figure 1: Monthly rates of WIC and Medicaid participation, Hispanic immigrants (month, year)

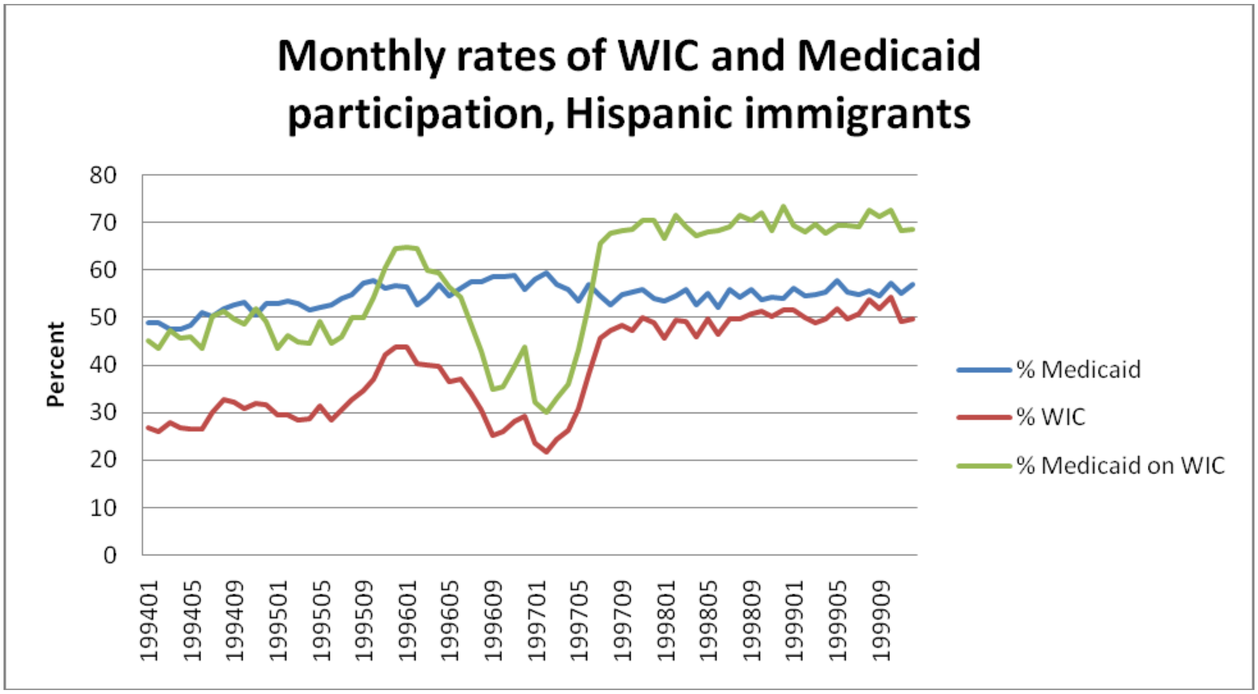

Figure 2: Patterns of birth in Florida, January, 1994 to December, 1999

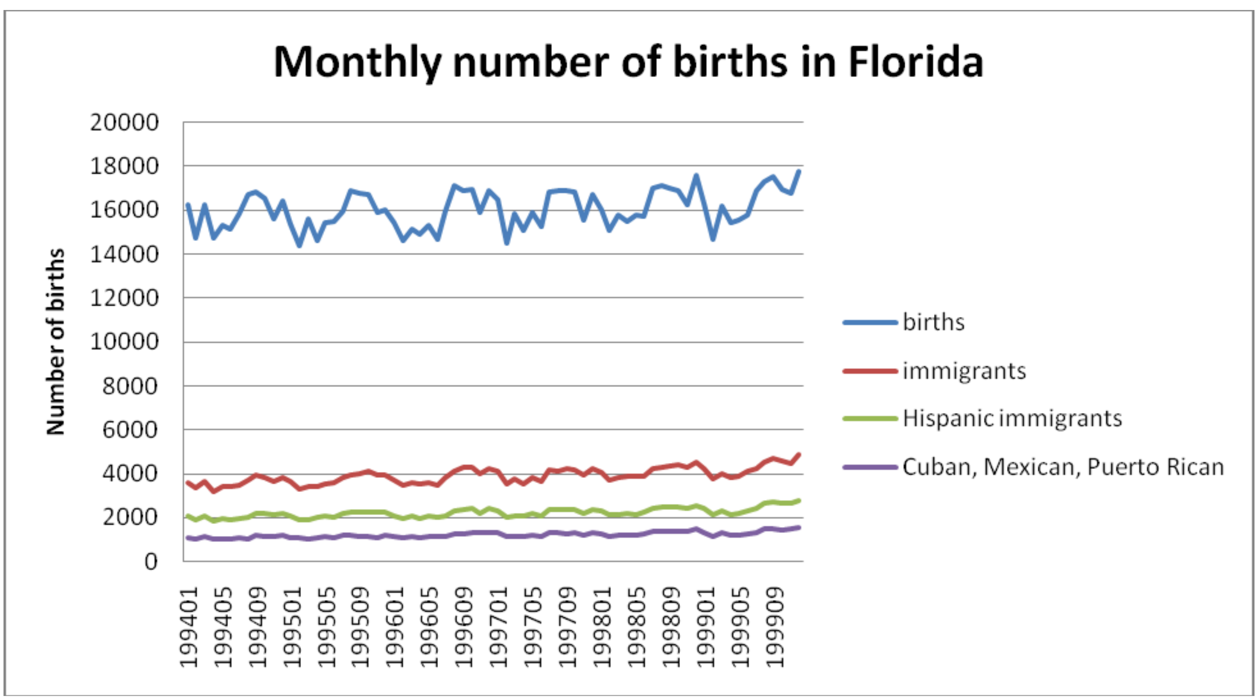

Figure 3: Immigrants as a percentage of total births in Florida, by month

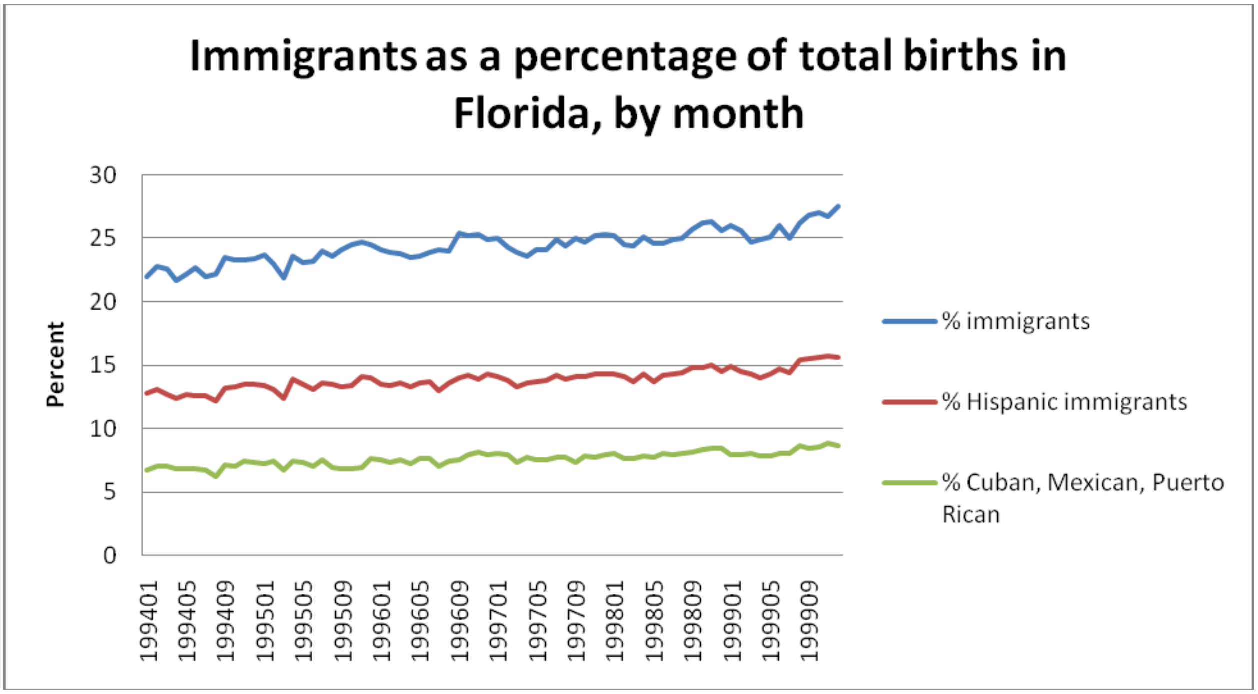

Figure 4: Attributes of Hispanic immigrant births, by month

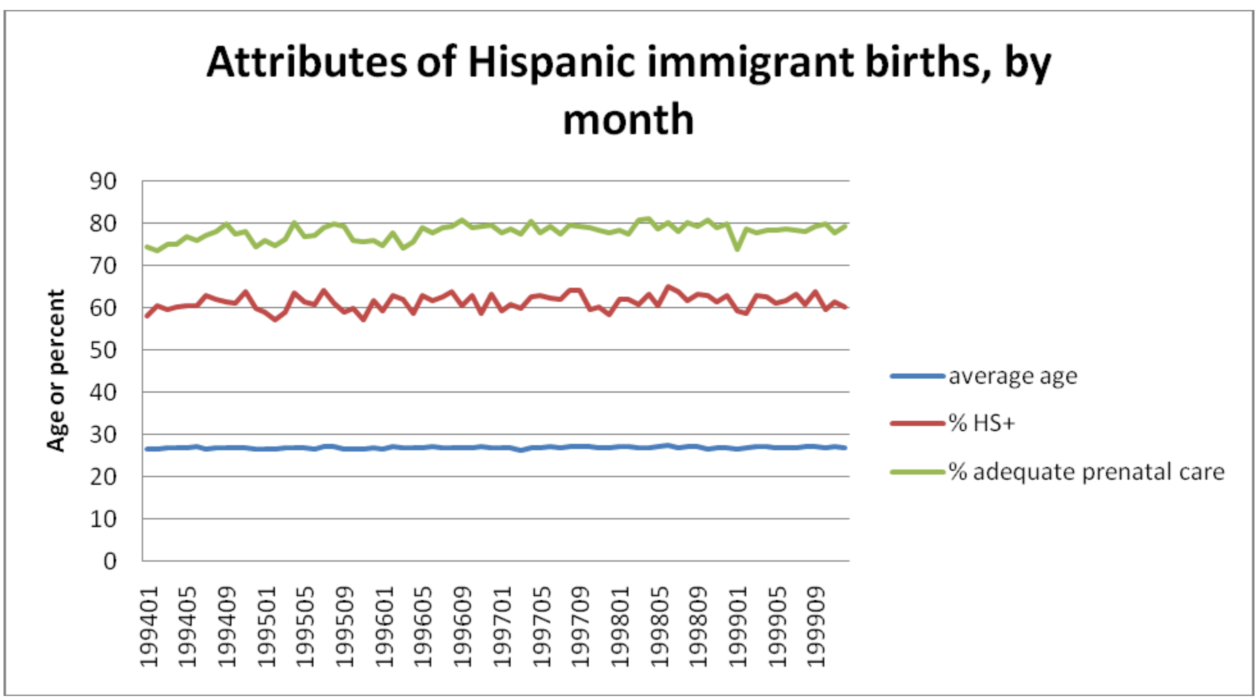

Figure 5: Distribution of percent Hispanic immigrants in zip code of residence, Hispanic immigrants

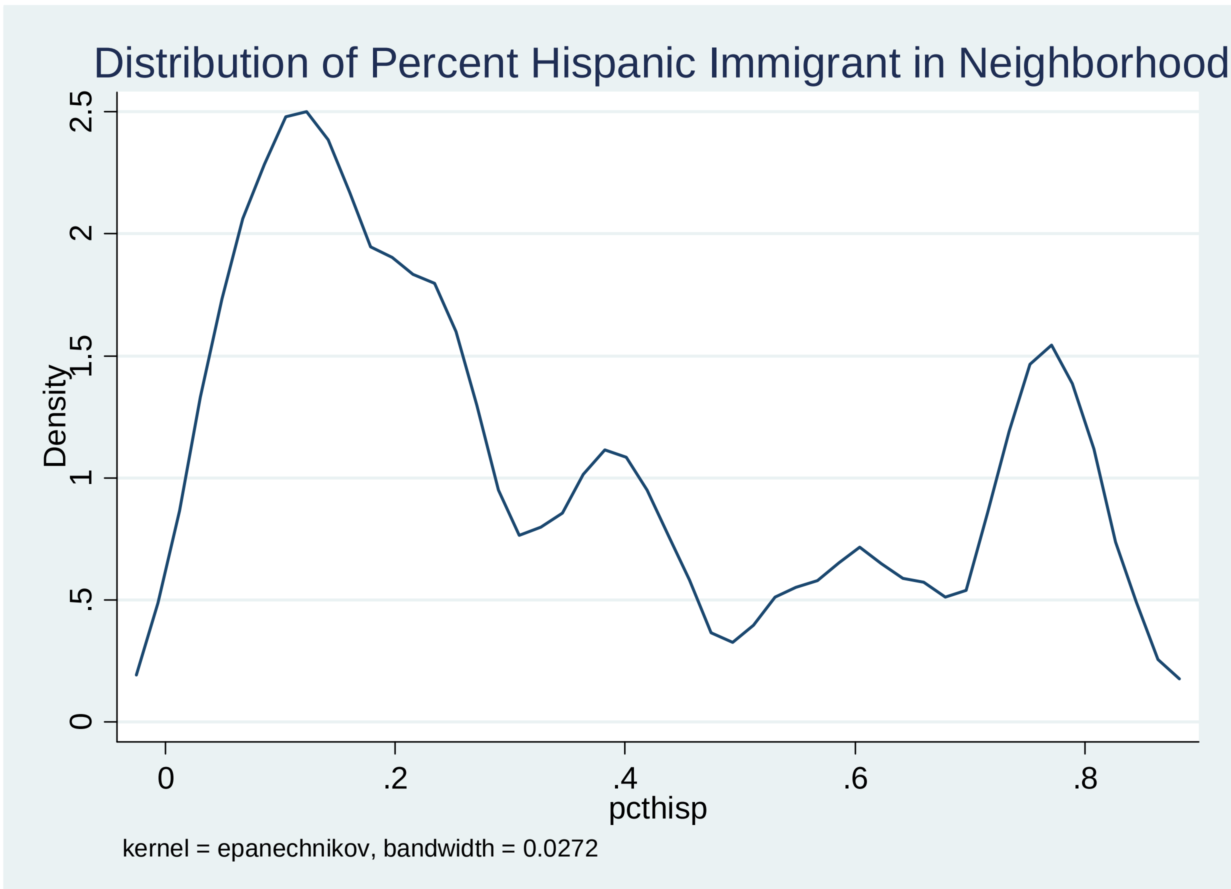

Figure 6: Concentration of own origin in zip code as a percent of all Hispanic immigrants

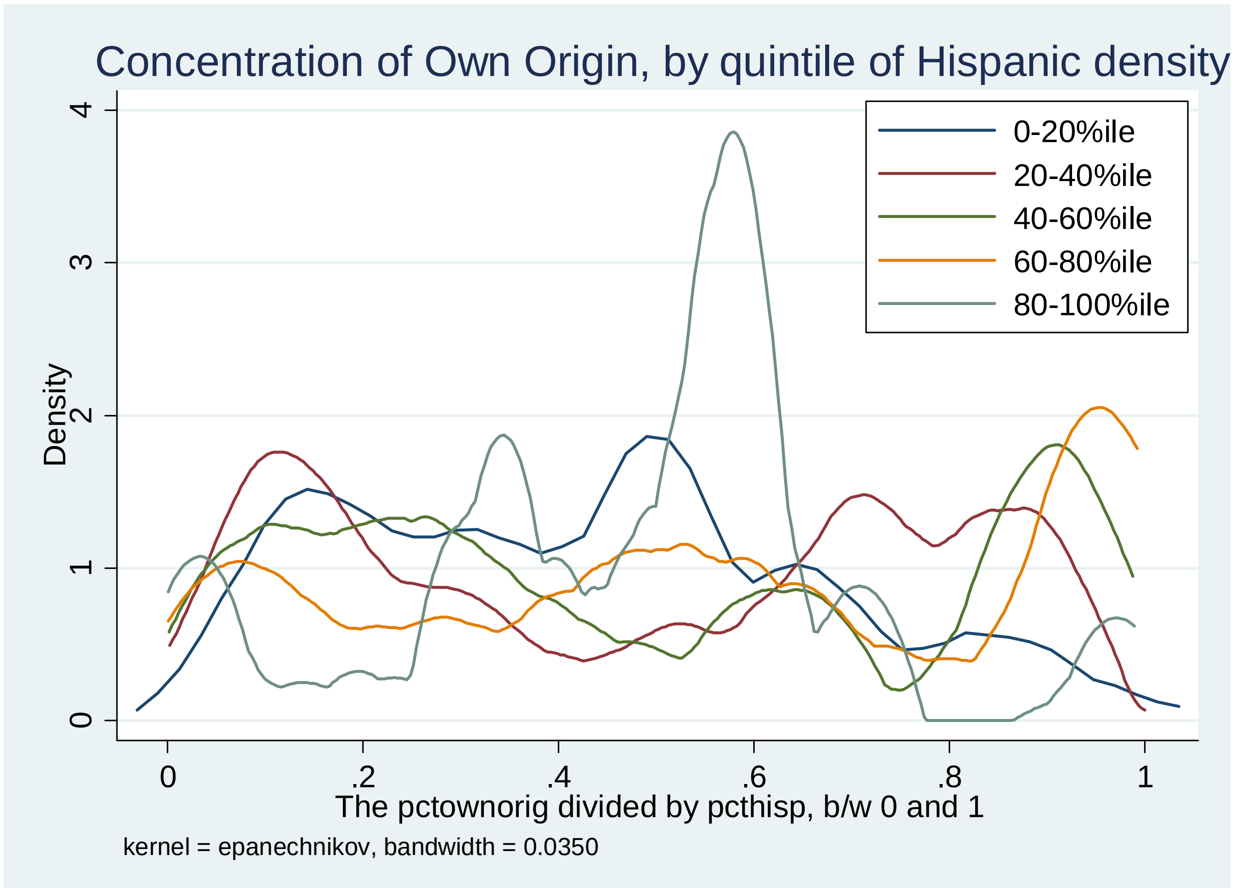

Figure 7: Estimated coefficients on time, by quarter, relative to first quarter of 1994

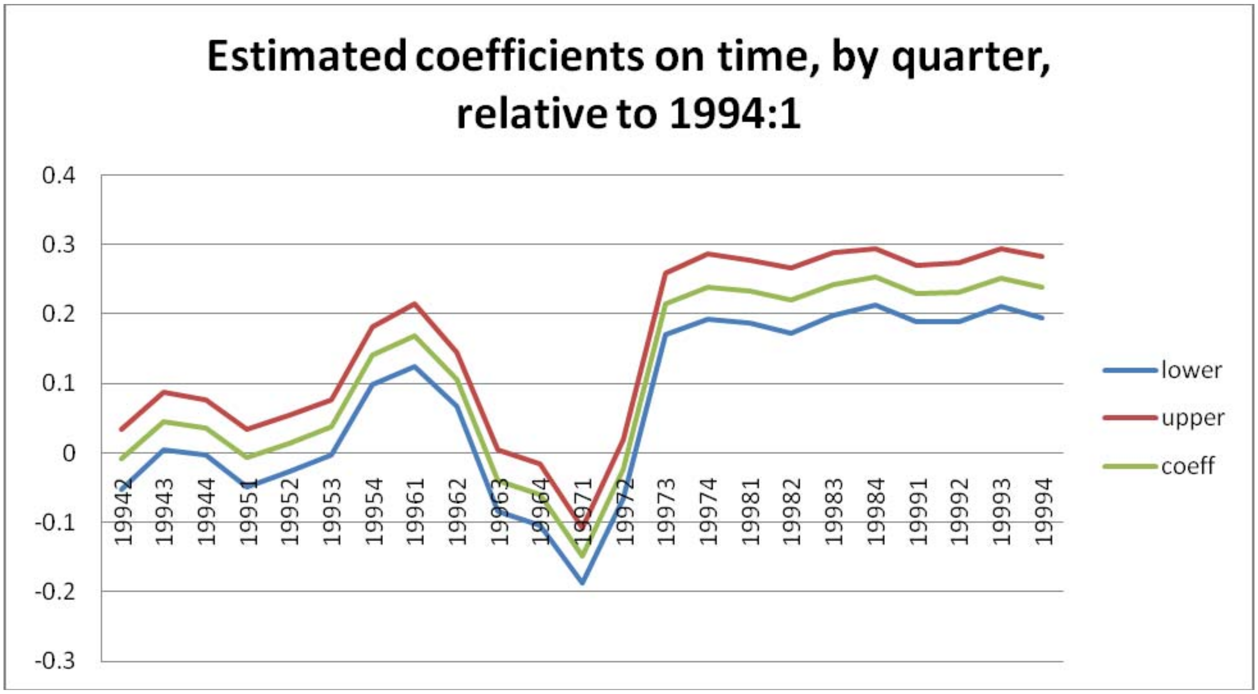

Figure 8: Estimated coefficients on time, by month, relative to January 1994