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Urban segregation and the US heroin market: A quantitative model of anthropological hypotheses from an inner-city drug market

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We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome. We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

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Abstract

Background—We hypothesize that the location of highly segregated Hispanic and in particular Puerto Rican neighborhoods can explain how Colombian-sourced heroin, which is associated with a large-scale decade long decline in heroin price and increase in purity, was able to enter and proliferate in the US.

Methods—Our multidisciplinary analysis quantitatively operationalizes participant-observation ethnographic hypotheses informed by social science theory addressing complex political economic, historical, cultural and social processes. First, we ethnographically document the intersection of structural forces shaping Philadelphia's hypersegregated Puerto Rican community as a regional epicenter of the US heroin market. Second, we estimate the relationship between segregation and: a) the entry of Colombian heroin into the US, and b) the retail price per pure gram of heroin in 21 Metropolitan Statistical Areas.

Results—Ethnographic evidence documents how poverty, historically-patterned antagonistic race relations, an interstitial socio-cultural political and geographic linkage to both Caribbean drug trafficking routes and the United States and kinship solidarities combine to position poor Puerto Rican neighborhoods as commercial distribution centers for high quality, low cost Colombian heroin. Quantitative analysis shows that heroin markets in cities with highly segregated Puerto Rican communities were more quickly saturated with Colombian-sourced heroin. The level of Hispanic segregation (specifically in cities with a high level of Puerto Rican segregation) had a significant negative association with heroin price from 1990–2000. By contrast, there is no correlation between African-American segregation and Colombian-sourced heroin prevalence or price.

Discussion—Our iterative mixed methods dialogue allows for the development and testing of complex social science hypotheses and reduces the limitations specific to each method used in isolation. We build on prior research that assumes geographic proximity to source countries is the most important factor in determining illicit drug prices and purity, while we find more complex, potentially modifiable determinants of geographic variation in retail drug markets. We show that specific patterns of ethnic segregation, racism, poverty and the political economy of socio-cultural survival strategies combined to facilitate the entry of pure, inexpensive Colombian-sourced heroin.

Keywords

Segregation; Philadelphia; Mixed methods; Ethnography; Quantitative research; Ethno-epidemiology; Drug economics; Heroin price; Heroin purity; Puerto Rican

Introduction

Residential ethnic segregation, characteristic of so many US cities, reinforces economic inequalities and raises concerns about effects on public health (Williams and Collins, 2001; Kramer and Hogue, 2009). Inner city segregation in the US first took shape in the nineteenth century in places like San Francisco’s Chinatown where Chinese immigrants, exploited as a low-cost workforce, lived in over-crowded, degraded conditions (Risse, 2012). African-American urban segregation developed in the northern United States somewhat later. Massey and Denton (1993) describe African-American segregation as a twentieth century

phenomenon that contained the growing black population within ghettos during a time of industrialization and urbanization. From the end of the Civil War until at least 1900, the typical black city dweller lived in a predominantly white neighborhood but through a series of institutional practices, private behaviors and public policies, African-Americans were segregated from whites. From 1900 to 1940, new European immigrants also experienced greater segregation than previous immigrant groups but their segregation was more temporary.

Puerto Ricans migrated to mainland cities in enormous numbers over the twentieth century. The history of their island, a locus of colonial competition because of its strategic position in trans-Atlantic shipping networks, reflected the military and economic interests of their colonizers, first the Spanish and then the United States. Colonial underdevelopment propelled a third of Puerto Rico's population to emigrate to the mainland as low cost factory and farm workers (Bourgois, 1996). Although migration to the continental United States was promoted by US government policies, Puerto Ricans were met with hostility in the host country (Whalen, 2001). In his ethnography of crack-dealing in Spanish Harlem, Bourgois explains, "Literally overnight, the new immigrants, whose rural-based cultural orientation and self-esteem was constructed around interpersonal webs of *respeto* [respect] organized around complex categories of age, gender and kinship, found themselves transformed into 'racially' inferior pariahs. Ever since their arrival in the United States they have been despised and humiliated with a virulence that is specific to North America's history of polarized race relations and ethnically segmented immigrant labor markets" (Bourgois, 1996:52–53).

Like African-Americans, Puerto Ricans were contained in ghettos which concentrated poverty and intensified the effects of discrimination. This complex political economic and cultural dynamic also rendered them especially vulnerable to the negative public health effects of the global heroin trade after World War II when they began migrating to New York City in large numbers. In the early 1960s Puerto Ricans were significantly overrepresented in the New York City Narcotics Register at 24.6%, although comprising only 15% of the population (Chein et al., 1964 cited in Singer, 1999:33–34). Similarly in Chicago, public health researchers in the 1960s noted that drug injection had spread rapidly among Puerto Rican street gang members and that the Puerto Rican community was "Assum[ing] the heavy risks and… social stigma of supplying drugs to higher status white outsiders." (Glick, 1983:290 cited in Singer 1999:34) Singer, an anthropologist working in Hartford in the 1980s and 1990s, noted "We have observed a similar pattern in Hartford… This arrangement creates 'job opportunities' in the drug trade for many Puerto Rican youth…" (Singer, 1999:34).

Ethnic and class segmentation of the heroin market is not a new phenomenon in the United States. Historians have documented, for instance, the fundamental role that segregation of Chicano and Chinese immigrant populations played in structuring the heroin market in several western US states throughout the 1940s and 1950s (Schneider, 2008). In fact, ethnic concentration in segregated and impoverished urban enclaves has regularly been associated with large-scale drug "epidemics" in the United States, often inciting virulent racist backlash (Bourgois, 1996). The connection between economically disadvantaged ethnic enclaves and

illicit drug markets has also been documented outside of the United States (Dixon and Maher, 2002; Paoli 2002; Paoli and Reuter 2008). Our mixed method study examines the specific social processes that shape differential positions in the drug economy across distinct poor, segregated ethnic groups.

The US heroin market is in flux; beginning in the early 1990s, a new type of heroin, sourced from Colombia, entered the US. The competitiveness of this novel heroin source-form led to two oligopolistic changes: the dramatic decline of heroin sourced from Southeast and Southwest Asia; and a decade-long decline in heroin price and rise in purity (Ciccarone et al., 2009a). The public health impact of this structural phenomenon is beginning to be understood, e.g., the nationwide rise in heroin-related overdose and soft tissue infections over the past two decades can be linked to changes in heroin purity, price, and source-form. The US heroin market is now dominated by Colombian powder and Mexican “black tar” heroin, with the former going predominantly to the eastern US and the latter to the western half of the country. Some cities proximal to the Mississippi River (e.g., Chicago) have mixed heroin sources (Ciccarone, 2009b). Cunningham et al. (2010) hypothesize that illicit drug purity is determined by distance from the US-Mexican border, a primary point of entry for illicit drugs. They find that although heroin purity is high near the border, it is also high far away from the border. We use mixed methods to explore segregation as an alternative, complementary or more complex explanation for the observed geographic patterns in the heroin market which heretofore have not been adequately explained.

Understanding social behavior, particularly that which is taboo or hidden, and generalizing that understanding across populations have made multidisciplinary research attractive to researchers in the drugs field (Clatts, 2002). However a number of commentators have remarked on the theoretical and practical difficulties of such projects (Bourgois, 1999; Moore, 2002; Ciccarone, 2003). Noteworthy endeavours have combined qualitative and quantitative methods in a number of different models. Michael Agar, an early ethnographic researcher in the US drugs field, with Heather Reisinger, combined ethnographies conducted at different locations and time periods with epidemiology, history, political economy and complexity theory to produce explanations of the chronology and geography of drug epidemics. (Agar and Reisinger 2001; Agar 2002). Clatts et al. (1999) employed ethnography and laboratory techniques to examine the effect of heating on the HIV virus in drug cookers. Lankenau et al. (2012) conducted large numbers of qualitative interviews with injecting drug users in US cities aiming to harness the benefits of both ethnographic and quantitative research. Early in the HIV epidemic, Booth et al. (1993) used qualitative and quantitative survey methods sequentially in the same neighbourhood to investigate the impact of local regulations on syringe carrying among injectors. Their qualitative methods allowed them to investigate apparently puzzling behavior reported by the quantitative findings, later feeding back ethnographic findings into a larger epidemiological survey. Bourgois has located his ethnographic research within global political economy, recognizing that the parameters of local behavior are set within these constraints (Moore, 2002). Ciccarone and Bourgois have proposed an ethnographically derived hypothesis to explain epidemiological variations in US HIV distribution (Ciccarone and Bourgois, 2003); and they along with colleagues have demonstrated a clinical social science approach combining long-

term ethnographic and survey datasets to understand the socio-cultural underpinnings of ethnic patterns in risk behaviors among heroin users (Bourgois et al. 2006).

Our multidisciplinary approach links ethnography and historical analysis with quantitative methods to develop a more complex understanding of the relationship between segregation and heroin availability and price. First, we ethnographically document the relationship between structural forces which intensify the ethnically-segmented entrepreneurial enclaving of heroin sales in Philadelphia's Puerto Rican community: Caribbean trafficking routes of Colombian-sourced heroin; the social vulnerability of Puerto Ricans as legal migrants; racial profiling by law enforcement; and varying levels of racialized animosity across neighborhoods. Based on the ethnographic findings, we hypothesize that high levels of segregation, in particular Puerto Rican segregation, combined with geographic proximity to Colombian trafficking routes may explain the facile entry of Colombian-sourced heroin into the eastern US in the 1990s resulting in a competitive retail market. Thus, the second part of our approach is to quantitatively estimate the relationship between patterns of ethnic segregation and: a) the entry of Colombian heroin into the US and b) the retail price per pure gram of heroin in 21 Metropolitan Statistical Areas (MSAs).[1]

Methodology 1: Ethnographic Data

The ethnographic data in Philadelphia consists of over 1,300 pages of field notes and almost 2,000 pages of transcribed and coded (in Atlas.ti) audio-interviews, that were generated from over 430 text and audio files, 500 high-quality photographs, and 18 hours of video. We collected our data from the fall of 2007 to the fall of 2012 in the classic anthropological fashion of participant-observation, requiring long-term immersion in the social world of one's research participants. To accomplish this, GK and FM lived full-time at the ethnographic field site located in the heart of Puerto Rican Philadelphia's sprawling open-air drug market. We conducted our interviews in a conversational format in the natural environment (street corners, shooting galleries, etc.) of our respondents. We purposefully accompanied our research respondents in their daily and nightly activities so as to minimize socially desirable responses and to maximize opportunities for direct observation of the practices and dynamics they were describing to us. Participant-observation and long-term full-time (in the case of GK and FM) immersion in street scenes enables the triangulation (over time, locations, contexts and conversations) of self-reports by direct observation of actually occurring practices. This is especially useful among hard-to-reach or hidden populations involved in drug use and sales who are subject to pursuit by law enforcement, moral censure by the broader public and are often alienated from public health and service institutions.

[1]This research project began purposefully as a cross-methodological multidisciplinary dialogue to document the structural factors shaping the health risk environment of heroin injection drug users. Ethnographers (GK, FM, PB) developed a theoretical explanation linking structural forces and ethnic segregation with observed data on heroin and cocaine markets in Philadelphia's Puerto Rican neighborhood. The senior author (DC), a clinician trained in both anthropological theory/methods as well as epidemiology, developed the national hypothesis and brought the anthropologists (GK, FM, PB) into analytic collaboration with a quantitative sociologist (JU) and economist (DR) to test the ethnography-based hypothesis quantitatively. SM provided a historian's perspective on the development of segregation in US cities.

Methodology 2.1: Quantitative Analysis Data Description

We use two sources of data to test the hypotheses derived from the ethnographic evidence. The first is the DEA's System to Retrieve Information from Drug Evidence (STRIDE). STRIDE includes data on the US heroin market from drug seizures, arrests and undercover law enforcement purchases of heroin. The STRIDE data covers the years 1990 to 2008. After cleaning the data using the method of Arkes et al. (2004) and restricting the sample to the 21 MSAs that also have segregation data, there are 17,538 observations of retail level heroin (0.1 to 1 gram).[2] STRIDE allows us to estimate the average price per expected pure gram of heroin at the MSA level as well as identify the place of origin of heroin observations from the four major producer regions (Mexico, Southwest Asia, Southeast Asia, or South America). Almost all heroin produced in South America is produced in Colombia, so we will refer to Colombian-sourced rather than South American heroin throughout the paper (Paoli et al., 2009).

From the STRIDE sample that identifies the region of origin, we take the average of the yearly proportion of heroin at the MSA-level that is identified as originating in South America and call it the Colombian Heroin Saturation Index (CHSI). The CHSI ranges from 0 to 1, with 1 indicating full market saturation and 0 meaning there has not been any observed Colombian-sourced heroin in the market. This measure is advantageous because it simultaneously takes into account the timing of Colombian-sourced heroin's entry into US cities and the extent to which it has taken over a particular market. The values in our data range from less than 0.01 (Denver, Oakland, Phoenix, and Seattle) to 0.85 (Miami).

We use the estimates of the price per expected pure gram of heroin at the retail level from Rosenblum, Unick, and Ciccarone (In Press), which is similar to the estimation approach of Arkes et al. (2004). The estimation process involves two steps. First, the expected purity is estimated at the MSA-year-level from the actual observed purity in the STRIDE data. This first step is necessary because buyers and possibly sellers do not know the purity of the product being purchased. We assume that buyers expect a certain level of purity when purchasing heroin which we estimate as the average observed purity in an MSA in that year controlling for the amount of heroin.[3] Second, the price per pure gram in each MSA-year at this expected level of purity is estimated for 0.5 grams of heroin.[4]

The second data source is derived from the US census from which we considered five measures of segregation at the MSA-level: the dissimilarity index, the isolation index, the delta index, the absolute centralization Index, and the spatial proximity index (Iceland et al., 2002). Since these measures are correlated and to keep the statistical analysis as concise as

[2]As in Arkes et al. (2004) we restrict the sample to heroin base and heroin hydrochloride observations which make up most of the STRIDE sample. We drop observations of heroin tartrate, heroin citrate and heroin salt undetermined.

[3]If instead we directly measured the price per pure gram, we would have hugely inflated prices for heroin with low purity. For example, under the direct method assume a buyer gets "good" heroin half the time and "bad" heroin half the time. Paying $100 for 50% pure "good" heroin would be calculated as $200 per pure gram, while paying $100 for 1% pure "bad" heroin would be calculated as $10,000 per pure gram. On average the buyer would be paying $10,100/2 = $5,050 per pure gram. Under our method, the buyer would expect purity at about 25% on average, so the price per expected pure gram would be about $400, which we believe is a much more reasonable measure of the market price adjusted for purity. Using our method consistently across MSAs allows for robust trends analysis.

[4]This 0.5 grams amount is simply a convenient middle point in the samples we look at which are less than 1 gram.

possible, we choose to focus on the dissimilarity index.[5] This is the most commonly used measure of segregation but more importantly for our study it captures a neighborhood-level measure of segregation. The index ranges from 0 (full integration) to 1 (full segregation). When combined with the STRIDE data, we have information on both segregation and the heroin market in 21 MSAs: Atlanta, Baltimore, Boston, Chicago, Dallas, Denver, Detroit, Houston, Los Angeles, Miami, New Orleans, New York, Newark, Oakland, Phoenix, Philadelphia, San Diego, San Francisco, Seattle, St. Louis and Washington, D.C.

The US Census Bureau provides segregation measures for American Indians/Alaska Natives, Hispanic/Latinos, Asians/Pacific Islanders, and black/African-Americans but not for subgroups within these categories. Thus we use Vargas-Ramos' (2006) estimates of the dissimilarity index of Puerto Ricans. The data on Puerto Rican segregation is limited in that there is only information for counties with a large population of Puerto Ricans. This limits our data to 8 MSAs where we have information on the heroin market: Boston, Chicago, Los Angeles, Miami, New York, Newark, Philadelphia and San Diego. Instead of using this data for a cross-MSA analysis, we use it to identify cities that our ethnographic evidence suggests should be entry points for Colombian heroin.

Methodology 2.2: Quantitative Analysis Statistical Methods

The statistical analysis has two parts. First we estimate the correlation between the prevalence of Colombian-sourced heroin and the level of Hispanic and Puerto Rican segregation. Second, we investigate the correlation between segregation and the retail-level heroin price per expected pure gram. Because Colombian heroin only became widely available in the US in the mid-1990s, we restrict our segregation measures to those from the 1990 census. Hence we investigate how segregation affected the later wide-scale distribution of Colombian-sourced heroin. This timing clarifies the direction of causality: that segregation in 1990 affected the introduction of a new type of heroin rather than the introduction of Colombian-sourced heroin causing an intensification of segregation.

The linear regression estimation equation we use is as follows:

$$Y_i = \alpha + \beta S_i + \gamma H_i + \delta L_i + \varepsilon_i \quad (1)$$

where Y_i is the outcome of interest (CHSI or price per pure gram) in MSA i, S_i is the Hispanic dissimilarity index, H_i is an indicator variable that equals 1 if it is identified as having a high level of Puerto Rican segregation (and 0 otherwise), and L_i is an indicator variable equal to 1 if the MSA is identified as having a low-level of Puerto Rican segregation (and 0 otherwise). From Vargas-Ramos' (2006) estimates of Puerto Rican segregation we identify five cities as having a high level of segregation, where $H_i = 1$. These cities have a dissimilarity index ≥ 0.5 in 1990: Boston, Chicago, Newark, New York, and Philadelphia.[6] We also identified three cities with a low level of segregation, where $L_i = 1$. These cities have a dissimilarity index < 0.5 in 1990: Los Angeles, Miami, and San Diego.

[5]The dissimilarity index is a measure of the proportion of people who would have to be redistributed within a city to achieve full integration (i.e. when there are equal proportions of different ethnicities in every neighborhood). The US Census' formal definition of the dissimilarity index can be found here: http://www.census.gov/hhes/www/housing/housing_patterns/app_b.html

The other fourteen MSAs do not have large enough Puerto Rican populations to warrant measuring the segregation level of this group and for these cities $H_i = 0$ and $L_i = 0$. Given the ethnographic evidence we expect to find that H_i is a particularly important determinant of the heroin market. Because the geography of the US also matters for the distribution of heroin we also estimate the relationship between geographic regions and our outcomes of interest. All analyses are conducted using STATA 11.2.

Ethnographic Evidence 1.1: The Role of Poverty and Segregation in the Philadelphia Heroin Market

> [Fieldnote PB] Before I have walked halfway down the subway platform stairs I am hailed with, "Works [syringes]! Works! Sub [Suboxone pills], sub, sub!" As I step onto the sidewalk an emaciated white injector offers to take me to a corner "that's poppin' today." He assures me that he was given a sample less than an hour ago "… it's a 10 [highest quality rating]." I have learned to shake my head, mumbling, "I'm good," and continue rapidly down the sidewalk. I find myself in the midst of a stream of mostly white injectors in various states of emaciation and ill-health. They are fanning out from the subway entrance hurrying through the labyrinth of surrounding narrow one-way side streets.
>
> A twenty-something-year-old young white man in a Penn State sweatshirt with his baseball cap tilted backwards is walking just a little too fast and too eagerly next to me. He could look like he just walked off a college campus but is 20 or 30 pounds underweight. He raises his two right hand fingers in what I mistake to be a victory sign and peels off across the street towards a Puerto Rican teenager who is crouching by the tire of an SUV and pulls out two packets of heroin for him from underneath the chassis. They make a quick one-handed exchange. Spinning around, he thrusts his hand down the back of his pants, stashing the heroin in his rear before heading straight back to the subway.
>
> Ahead of me there are two couples, both consisting of a young, skinny, scantily-dressed woman walking more confidently than their older boyfriends. But most of the injectors around me who are on their way to buy heroin are single men walking alone or are in duos, sometimes trios, in temporary nervous alliances for protection and information on "what's best today." Others are scanning about looking for an acquaintance to guide them to "the best dope" in return for a tip or a taste.
>
> A burly, white middle-aged man in paint-splattered pants presumably taking a user's break from a contractor's job, or else still buff from weightlifting during a recent bout of incarceration, asks me, "Is Godfather open today? Have you tried it?" I shrug my shoulders and look away, but another younger more emaciated white 30 something-year-old man with a big friendly smile, overhears the question

[6]Vargas-Ramos (2006) calculates the dissimilarity index at the county-level. We assume that the index for Suffolk County Massachusetts is that for the Boston MSA, Cook County Illinois represents Chicago, Essex County New Jersey represents Newark, and the average of the index for Bronx, Kings, New York, and Queens counties in New York represent the index for the New York MSA. We also assume Miami-Dade County Florida represents the Miami MSA, Los Angeles County California represents the Los Angeles MSA, and San Diego County California represents the San Diego MSA.

> and shuffles over, his foot wrapped in a filthy bandage, "I had some. Godfather's poppin' today." In the same breath, the painter anxiously snaps back, "How long ago?"
>
> The flow of addicts, many of whom look like the walking wounded, has now reached the next corner and we are greeted by two physically-fit, clear-eyed Puerto Rican teenagers dressed in the latest hip-hop style, shouting "DOA [brand name] DOA!" and "powder [cocaine], powder, powder, powder… What you need?" followed by a fainter chorus of "works, works, works" coming from a set of older, broken-down-looking whites who are standing almost deferentially further away against an abandoned rowhome. They are clearly subordinated to the younger Puerto Rican heroin and cocaine street sellers. These choruses repeat themselves half a dozen more times on just about every block, sometimes again halfway through the block through which I walk until I reach our apartment. On our block, the brand name has been "Dead End" for the past three months.

This fieldnote describes what the members of the ethnographic team (PB, GK, FM) would experience virtually every time they walked to their apartment from the nearest subway stop during the five years they conducted participant-observation fieldwork in one of the poorest micro-neighborhoods of Puerto Rican Philadelphia. Up through the 1950s, this area was Philadelphia's largest and most concentrated industrial neighborhood. Today it has morphed into an approximately 800+ square block territory of decaying rowhomes clustered tightly around huge abandoned red-brick factories. Philadelphia has one of the highest rates of housing abandonment of all large cities in the United States and this neighborhood’s exceptionally large abandoned factories, derelict railroad tracks, vacant lots and decaying rowhomes offer a devastated but still heavily-inhabited infrastructure that has fomented a high-risk environment facilitating public narcotics sales and use. A spatially concentrated and highly flexible but efficient structure of hierarchically-controlled open-air drug markets has emerged out of these de-industrialized ruins. Some sales spots are more stable than others but they are all frequently forced to close down for shorter or longer periods of time depending upon the vagaries of law enforcement, sources of supply and fierce competition between rivals. Sales spots regularly shift around on the same block or spill over onto adjacent blocks. They sometimes change ownership despite remaining at the same site and new corners frequently pop up on neighboring blocks – sometimes crashing and burning rapidly and sometimes emerging as stable competitive sites.

Despite their individual fragility and mobility, these open-air markets always remain in the same Puerto Rican neighborhood catchment area. This vibrant, spatially-enclaved specialized market niche is staffed at the entry-level and in the lower tiers of management primarily by second-generation Puerto Rican youth and new Puerto Rican immigrants. It serves primarily white customers from nearby poor working-class neighborhoods as well as some older local Latino residents, some older African-Americans, and a significant number of white suburbanites from the surrounding tri-state region (Delaware, New Jersey, and Pennsylvania). Most of the younger sellers eschew heroin and cocaine use, instead preferring marijuana and diverted prescription pills (primarily opioids and benzodiazepines). Their customers, who arrive predominantly on foot or by public transportation, have a

dependable, constantly updated, informal information network that allows them quickly to discern the variations in heroin quality between sales spots. Fierce competition between corners and a direct link to wholesale suppliers of Colombian-sourced heroin have given rise to a market where it is always easy to find highly pure and cheap heroin (Karandinos et al., In Press).

Our ethnographic and observational data from Philadelphia revealed to us a particular form of ethnic and class segmentation of the heroin market originating in the early 1990s. This restructuring of the heroin market coincided with the influx of Colombian-sourced heroin into the US market. US-orchestrated interdiction efforts paradoxically led to the diversification of Colombian-sourced illicit drugs to include heroin in addition to marijuana and cocaine (Ciccarone, 2009b). Trade routes also diversified but most of the eastern US's cocaine and, after 1990, heroin supply continued to pass through the Caribbean.

Our ethnographic data suggest that much of the wholesale trade at the inner city level is controlled by Dominican nationals (often undocumented) as well as some second generation street-level dealers who are recruited from segregated and economically disadvantaged Puerto Rican neighborhoods. A 19-year-old half Puerto Rican, half Dominican dealer who grew up with his Puerto Rican mother on the block where FM and GK were living, and who was trying to scale the ladder of the heroin market hierarchy by "renting" a drug corner, pointed out:

> The connects [wholesale suppliers] are always Dominican. The people I've worked with have always been Dominican. You see them driving around the neighborhood all the time; they drive around in their fucked up Toyotas with tinted windows, always scared as shit. They always schizzing [anxious and hypervigilant]. If you look at them they look at you like this [throwing his head back and squinting suspiciously].

The dramatically ethnically-segmented labor force and enclaved market requires a large supply of structurally vulnerable local residents to staff it as well as a large surrounding pool of working-class populations because the turnover rates of both workers and customers are extremely rapid as most participants in this illegal drug economy cycle through chronic incarceration. Urban decline and chronic underemployment have spurred the growth of this informal economy. The entire block on which GK and FM resided was literally in the shadow of an enormous abandoned curtain and upholstery fabric factory. From the roof of their rowhome they could see another full square block vacant lot where a yarn mill formerly stood, along with another eleven abandoned factories in the distance.

Philadelphia was particularly hard-hit by the rust-belt decline and our field site was among the most affected. Between 1955 and 1975, precisely when Puerto Ricans began migrating in large numbers to Philadelphia, the city lost over 75% of its manufacturing jobs (Adams, 1991). North Philadelphia's formerly white population, predominantly of Irish, German, Polish, and Italian descent, had progressively little reason to remain living near the abandoned factory cores and began exiting the city in massive numbers turning into a veritable white-flight panic by the 1980s. Between 1950 and 2005, Philadelphia lost 610,000 residents, roughly 30% of its population, even as Puerto Ricans in-migrated. The city's

deindustrialization has resulted in population loss every single year from 1951 to 2009. Philadelphia's overall poverty rate of 25.6% in 2010 makes it the poorest of all US cities with populations exceeding one million people. That poverty is unequally distributed across ethnicities: the rate for Latinos is 39.4%, African-Americans 30.4%, and whites 17.7%[7]. According to the Census Bureau's American Community Survey 2005–2009, three of the census tracts surrounding our field site had poverty rates over 54%; five of the eight poorest census tracts in the city were in the Puerto Rican section of North Philadelphia (Karandinos et al., In Press). The recent prolonged economic recession in Puerto Rico (2006–2012) continues to send new immigrants to the neighborhood who are desperate for Philadelphia's combination of low rents, informal low-wage jobs and minimal public assistance that is inaccessible in Puerto Rico--and has been disappearing in the US (Duany, 2011; Schram & Silverman, 2012).

Ethnographic Evidence 1.2: Racialized Antagonisms, Profiling, and the Comparative Advantage of Puerto Rican Ethnic Segregation in the Philadelphia Heroin Market

Another important factor that channels unemployed Puerto Ricans into the drug economy is the Puerto Rican disruption of classic US black/white antagonisms. Philadelphia is one of six large US cities that suffer from what demographers call "hypersegregation" between whites and blacks (Wilkes and Iceland, 2004). Maps showing the distribution of the Hispanic, African-American, and white population in Philadelphia (Figures 1, 2, and 3) illustrate this high level of segregation. As of 2012, Philadelphia's population as a whole was 42% black, 37% white, and 13% Latino (9% Puerto Rican) (Pew, 2013). The census tract in which the fieldwork apartment was located was 82% Latino, most of whom are Puerto Rican. The area with the highest concentration of Puerto Rican residents in Philadelphia is wedged between large, impoverished African-American and dwindling working- and lower-middle-class white neighborhoods.

Philadelphia's virulent history of antagonistic black/white relations limits the ability of white addicts to frequent African-American neighborhoods where their skin color marks them for police raids and generates hostility from many local residents. Whites are less immediately anomalous in the rainbow of Puerto Rican phenotypical diversity. Substance-dependent whites are able to circulate in the Latino neighborhood with relative ease. Many local Puerto Rican residents tolerate these visible outsiders because of the social and economic integration of drug dealing into their extremely poor community. Often local residents profit from the cash these outsiders bring into the neighborhood and/or empathize with their physical pain (Karandinos et al., In Press). In contrast, the drug markets in African-American neighborhoods are more self-contained, serving primarily local African-American residents. In fact, some African-American sellers commuted to our primary field site to take advantage of the higher earning potential provided by serving the plentiful white customers who feared entering black neighborhoods.

[7]American Community Survey 2010, 3-year estimate figures.

The greater levels of expressive hostility to whites in poor segregated African-American Philadelphia neighborhoods are not ambiguous, as the following transcription of a conversation with a white longtime heroin injector, Jake, illustrates:

> **Fernando**: Do you ever buy heroin in the African-American neighborhoods farther west?
>
> **Jake**: I don't. I have spent a little bit of time like in South Philadelphia African-American neighborhoods, and it's difficult because I'm what they would call a 'Kensingtonian' [name of previously white working-class neighborhood, now predominantly Puerto Rican] or an 'oldhead' and I know my shit and I put my time in, and a lot of times going to South Philly that's not recognized and I get these fucking assholes coming at my neck with stupid shit [trying to hustle me], and I'm like not the fucking one [to be fooled].
>
> **George**: What do they come at you with?
>
> **Jake**: Oh, “Wait right here, I'll be right back." You know, shit like that, which I know in translation means, "you're fucked," "you're beat," whatever. Or "come on in here." And they hit you in the head [swinging his fist and wincing]. It's embarrassing because it's very transparent to me. I can see this is because of my race, or what I appear to be.

Significantly, it was the African-American dealers commuting to our neighborhood to sell drugs who alerted us to the unique organization of the Puerto Rican drug economy and the way this increased the safety of white customers. They considered Puerto Rican drug corners to be more hierarchically organized than the primarily crack-based drug economy in their home neighborhoods, which they described as being more of a "free-for-all". The generally respected and scripted structure of the Puerto Rican drug market regulates labor and competitive corporate conflicts at all the multiple intermediary and street levels of the underground economy. It also disciplines the lowest-level workers, preventing them from mugging customers or even from treating customers excessively rudely—unless, of course, money is missing and then the punishment is bloody. An African-American dealer put it this way:

> It don't work this way in South Philly… Everybody be out for theyself. *Papis* [epithet for Puerto Ricans] are smart, they get that white money… all of it! And the white junkies keep coming back with more! If these people walked onto my block with cash in their hands, someone would take their money.

In addition, our distinct fieldwork experiences of arrest and police brutality allowed us to explore law enforcement strategies of racial profiling. Most notably, in the four years that the Latino member of our ethnographic team (FM) walked and bicycled through our neighborhood's streets he was stopped, searched and harangued by officers only when he was in the company of one of the white members of our ethnographic team. The white members (PB, GK) of the ethnographic team were stopped both when interacting with Latinos or African-Americans as well as when walking alone. Furthermore, DC (white) made four week-long ethnographic visits to the neighborhood over a 2-year period and was stopped twice. He was able to reconfirm as an outsider the pattern of racialized law

enforcement profiling as well as the structure and organization of the heroin market. Despite this (inconsistent) policing the drug market remained vibrant with outsider heroin-dependent whites passing through in larger numbers day after day. One phrase, a cultural script which mitigated some visibility risk to both dealer and user in this highly charged environment, was repeatedly barked by seller, lookout and runner alike, “Yo, keep it moving!”

Quantitative Evidence 2.1: The relationship between Colombian heroin market saturation, geography and segregation

Our ethnographic evidence suggests that highly segregated Puerto Rican communities were acutely susceptible to the uptake of Colombian-sourced heroin. Table 1 shows the ordinary least squares (OLS) estimates of the relationship between segregation and the degree of Colombian heroin saturation (CHSI). Column (1) shows that there is a positive but not statistically significant, correlation between Hispanic segregation in 1990 and the CHSI. In columns (2) through (4) we see that it is the cities with a large and segregated Puerto Rican population that have a statistically higher CHSI. There is not an especially high level of Colombian heroin in cities with Puerto Rican populations but low levels of segregation (column 3). Furthermore, Hispanic segregation itself becomes negatively related to Colombian heroin saturation once the high Puerto Rican segregation cities are controlled for. Column (5) replaces high and low levels of Puerto Rican segregation with dummy variables for the three large census regions: East, Center, and West, with West as the omitted region. The estimates suggest that the diffusion of Colombian heroin also followed a strong geographic pattern, diminishing from east to west.

The relationship between segregation, geography, and the spread of Colombian heroin can be seen in Figure 4. The eastern US shows a positive correlation between Hispanic segregation and Colombian heroin saturation. The cluster in the upper right corner of the figure (high segregation, high Colombian saturation) consists of Boston, Philadelphia, New York, Newark (all with a high level of Puerto Rican segregation) and are all on the East Coast. By contrast, nearby Baltimore and Washington D.C. have high levels of African-American segregation and poverty but very small Puerto Rican populations and have heroin with significantly lower purity (data not reported). These cities coincide with our hypothesis: Colombian heroin entered the US through highly segregated Puerto Rican communities on the East Coast.

Miami is also in the cluster of cities with a high CHSI but has a lower level of Hispanic and Puerto Rican segregation. One might expect Miami to be an outlier because it is the closest major city on the US mainland to heroin trafficking routes through the Caribbean. It is also the airline and maritime hub for the entire Caribbean as well as most of the Atlantic Coast nations of South America. It has larger and more diverse Latino communities, including Cubans, Colombians and Puerto Ricans, than most other US cities (Stepick, 1994). Geographic location may also explain New Orleans' high CHSI but low level of Hispanic segregation as this port city is a historic center for Caribbean and South American maritime/shipping routes. Chicago's middle level of CHSI but high Hispanic and Puerto Rican segregation is likely due to the mix of heroin it receives from Mexican and Colombian

sources which is probably the result of its historic strategic geographic location as a cross-continental transport gateway.

Quantitative Evidence 2.2: The relationship between heroin price and segregation

After establishing that there is a connection between segregation, geographic location, and the spread of Colombian heroin, we investigate how segregation relates to the price of heroin. Table 2 shows the OLS estimates of the correlation between Hispanic or black segregation in 1990 and the average price-per-expected-pure gram of heroin over three different time periods: 1990 to 1992 when Colombian heroin began to enter the US; 1993 to 2000 the years when Colombian heroin saturated most of the eastern US heroin market; and 2001 to 2008 after Colombian heroin became entrenched in the eastern US. There is a negative and statistically significant relationship between the price of heroin and the level of Hispanic segregation for the 1990 to 1992 and 1993 to 2000 time periods. This relationship is negative but not statistical significant in the 2001 to 2008 time period. There is no statistically significant correlation between black segregation and the price of heroin.

Table 3 examines how levels of Puerto Rican segregation correlate with the price per pure gram of heroin. Columns (1), (3), and (5) show that through the 1990s, cities with a high level of Puerto Rican segregation had a significantly lower price per pure gram. This relationship loses its statistical significance in the 2000s. When the Hispanic Dissimilarity Index is included in the estimates in columns (2), (4), and (6), all the variables lose their statistical significance. Nonetheless, the estimates show that on average cities with higher levels of Puerto Rican segregation tended to have lower prices.

To give a better sense of how Hispanic segregation is related to the price of heroin, Figure 5 presents a scatter plot of Hispanic segregation and the heroin price for the 1990 to 1992 time period. The MSAs in the lower right corner have low prices and high levels of Hispanic and Puerto Rican segregation. The graph shows that segregation provided an environment in which Colombian-sourced heroin could more easily enter the US market rather than Colombian-sourced heroin being attracted to places with traditional economic incentives like higher prices and profits.

Figure 6 shows the line of best fit for the relationship between segregation and the price per pure gram of heroin for Hispanic and black segregation over the three time periods. There are several salient aspects of the graph. First, heroin prices have fallen dramatically since the early 1990s. Second, the US has much higher levels of black segregation than Hispanic segregation. Third, prices have fallen everywhere. The diffusion of Colombian heroin coincided with, or more likely caused, a large decline in heroin prices throughout the US. All of this evidence shows that cities with higher Hispanic, and specifically Puerto Rican, segregation had lower heroin prices than other cities through the 1990s. However, there has been a leveling off of the heroin price, so that if there was some market advantage of highly segregated neighborhoods in maintaining a low heroin price, this advantage was not stronger than larger international structural effects on the US heroin market after 2000. In addition,

Figure 6 highlights the finding that black segregation, by contrast, has little relationship to the heroin market.

Limitations

Even with data cleaning and our statistical methodology STRIDE has its limitations. STRIDE does not contain a randomly collected sample of observations and thus there is debate about the usefulness of the data (Horowitz 2001, Arkes et al 2008). In particular, undercover agents may be paying systematically more for drugs or acquiring drugs of low quality relative to typical drug consumers. And informants may be not be truthful about market prices. If prices are consistently inflated in the STRIDE data across geography and time, one can still use it to reliably measure time trends in the heroin market, if not point estimates of prices paid by typical drug buyers. As a way to verify the data, we compared STRIDE observations for Philadelphia with the ethnographically observed street prices of heroin and changes in heroin purity over time. The STRIDE data was accurate in its recent street prices and trends in heroin purity for this city, giving us some confidence in the reliability of STRIDE (data not reported). Hence although STRIDE is not perfect it is the only large-scale dataset on the price, purity, and source of US heroin and we believe STRIDE provides reasonable trend estimates of the US heroin market.

In addition our empirical analysis is limited by our small sample of MSAs making it difficult to control for potential confounders. Limited DEA data prior to 1990 has reduced our ability to quantitatively analyze the composition of the heroin market prior to the entry of Colombian-sourced heroin. However, our quantitative analysis shows a clear, if complex, pattern between ethnically distinct patters of segregation and the US heroin market.

Participant-observation data by definition relies on the subjectivity and positionality of the researchers who collect it. We collected our qualitative data over a five-year period with 24-hour immersion in our research site as a multi-ethnic/generational/class/gender/sexuality research team in order to triangulate our findings across our multiple positionalities, increase time-series robustness and identify potential researcher bias effects. The primary motive for bringing our quantitative and qualitative data into systematic, iterative methodological dialogue was to address the inevitable limitations of each methodological approach when employed in isolation without the benefit of a multidisciplinary perspective.

Discussion

We have demonstrated that while geographic location matters in understanding illicit drug markets (Cunningham et al., 2010), a multifaceted analysis utilizing social, cultural and political economy perspectives delivers an explanation that is more useful for public health. Complex social processes are difficult to document with aggregate analyses of large statistical samples because they often result in non-linear public health and demographic outcomes changing over time and space (Messac et al., 2013). A key innovation of our approach is to use mixed methods to test empirically the ethnographically observed relationship between segregation and the heroin market in a broad national sample. By combining techniques from anthropology, economics and epidemiology we are able to

develop a more expansive explanation of the underpinnings of the illicit heroin market. The mixed methods help to overcome the limitations inherent in each discipline.

Biological plausibility is a core element for understanding causality in multivariate analysis; without it implausible associations arise. Ethnography in dialogue with epidemiology can identify meaningful risk variables and aid in determining the “social plausibility” of those variables. This leads to better causal explanations and highlights the hidden social and structural logics for unforeseen outcomes, all of which can expand modern epidemiology and promote more meaningful and durable interventions (Ciccarone, 2003; Bourgois et al., 2006; Messac et al., 2013). Similarly, economists working with ethnographers can shed light on the inner workings of illicit markets that would otherwise be too difficult for economists to observe on their own. Collaborations that combine ethnography with statistical analysis and economic modeling can produce a more comprehensive understanding of such markets (Levitt and Venkatesh, 2000).

Segregation is the product of the contemporary and historical political economy of US phenotypically racialized ethnic relations. Our ethnographic findings on the political economy of deindustrialization, Puerto Rican migration and police enforcement of a *de facto* inner-city apartheid in Philadelphia's Puerto Rican neighborhood are consistent with Bourgois’ previous work on the dramatic rise of open-air crack markets in Puerto Rican East Harlem in New York City during the mid-1980s through early 1990s (Bourgois, 1989). The sellers, runners, and lookouts in our sample are best conceptualized as a just-in-time expendable labor force. They take on the highest risk of arrest and violence in exchange for flexible and irregular remuneration that is low relative to drug industry profit. The intertwined detrimental effects of poverty, oppression and racism extend to the whole neighborhood including those who are and are not dealing or using drugs (Singer, 1999).

In quantitative analyses we found evidence that cities with highly segregated Puerto Rican communities in the northeast US are places where Colombian-sourced heroin has had a high level of market penetration. Geographic proximity to Caribbean trafficking routes also likely played a large role in the spread of Colombian-sourced heroin and can explain the dominance of Colombian-sourced heroin in cities like Miami, where Puerto Rican segregation is low, and New Orleans where the Puerto Rican population is small. Our findings have shown that it is not simply segregation but segregated groups with particular social networks and advantageous locations for illegal markets that allowed for the entry of Colombian-sourced heroin: black and non-Puerto Rican Hispanic segregation by contrast have little statistical relationship to the heroin market.

The effect of segregation on heroin price is strongly influenced by eastern and western US regional differences in heroin source-form (Mexican-sourced “black tar” to the west of the Mississippi River and Colombian-sourced beige powder to the east). These geographic differences are consistent with anthropological observations on the interstitial location of Latinos within the phenotypically racialized black-white divide among homeless heroin injectors and crack smokers in San Francisco (1994 through 2007) (Bourgois & Schonberg, 2007).

Our study contributes to knowledge of the political economy of heroin production, distribution, use and consequences. Our prior work has documented the structural forces behind trends in US heroin price and purity (Ciccarone et al., 2009a), the effect of competition between heroin source-forms and prices (Rosenblum et al., In Press) and the structurally mediated public health consequences of the use of different heroin source-forms (Ciccarone et al., 2009b). Our analysis strongly suggests that the domestic political economy of ethnic and class segregation integrated into the international political economy of heroin production and distribution shaped the heroin market structure of the northeast US, influencing heroin price and purity. This knowledge can be used by policy makers to anticipate the locations of populations vulnerable to exploitation by illicit drug markets and the associated complications of crime, violence, and adverse health consequences.

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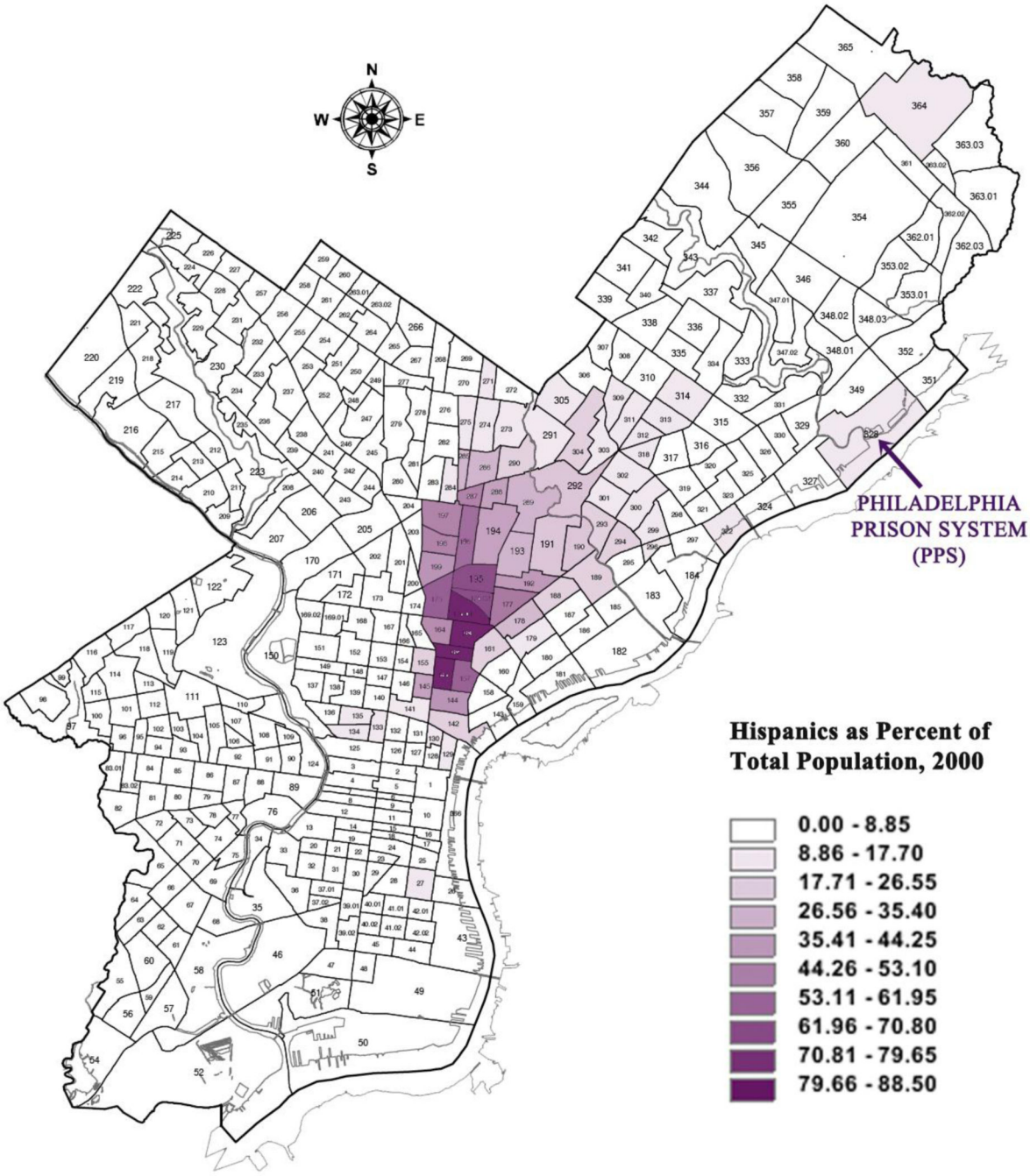

Figure 1.
Map of Hispanic segregation in Philadelphia.

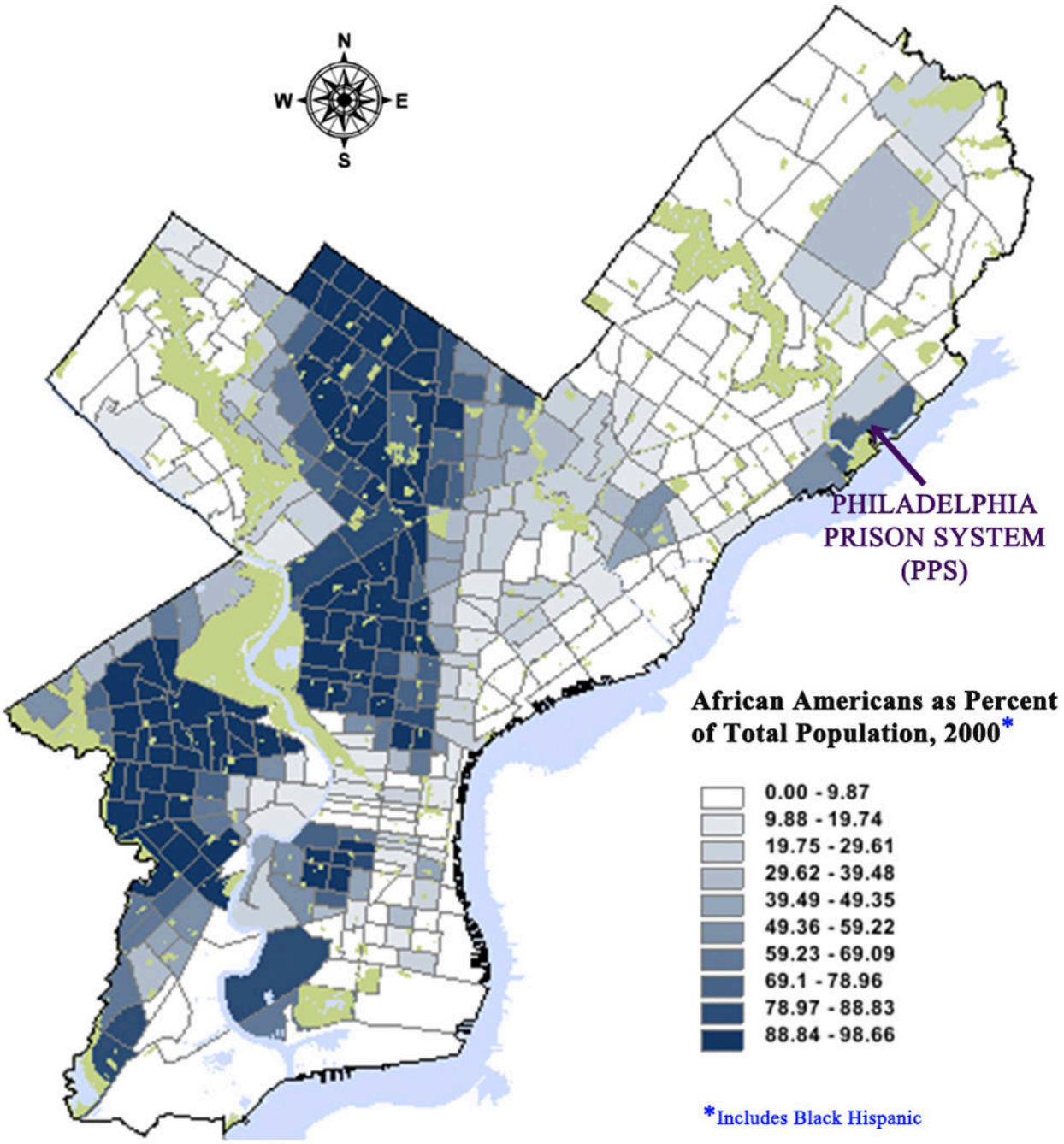

Figure 2.
Map of African-American segregation in Philadelphia.

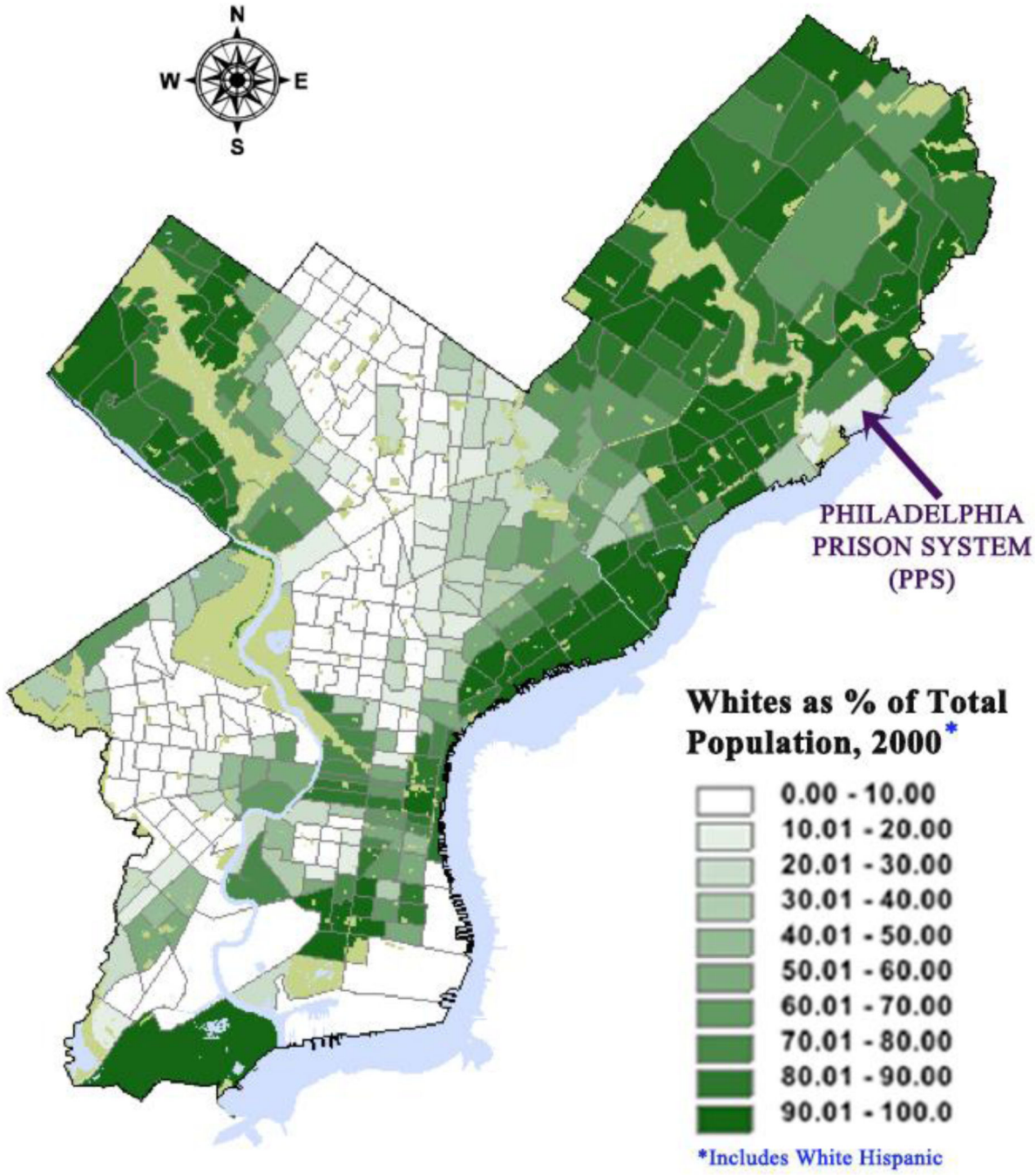

Figure 3.
Map of white segregation in Philadelphia.

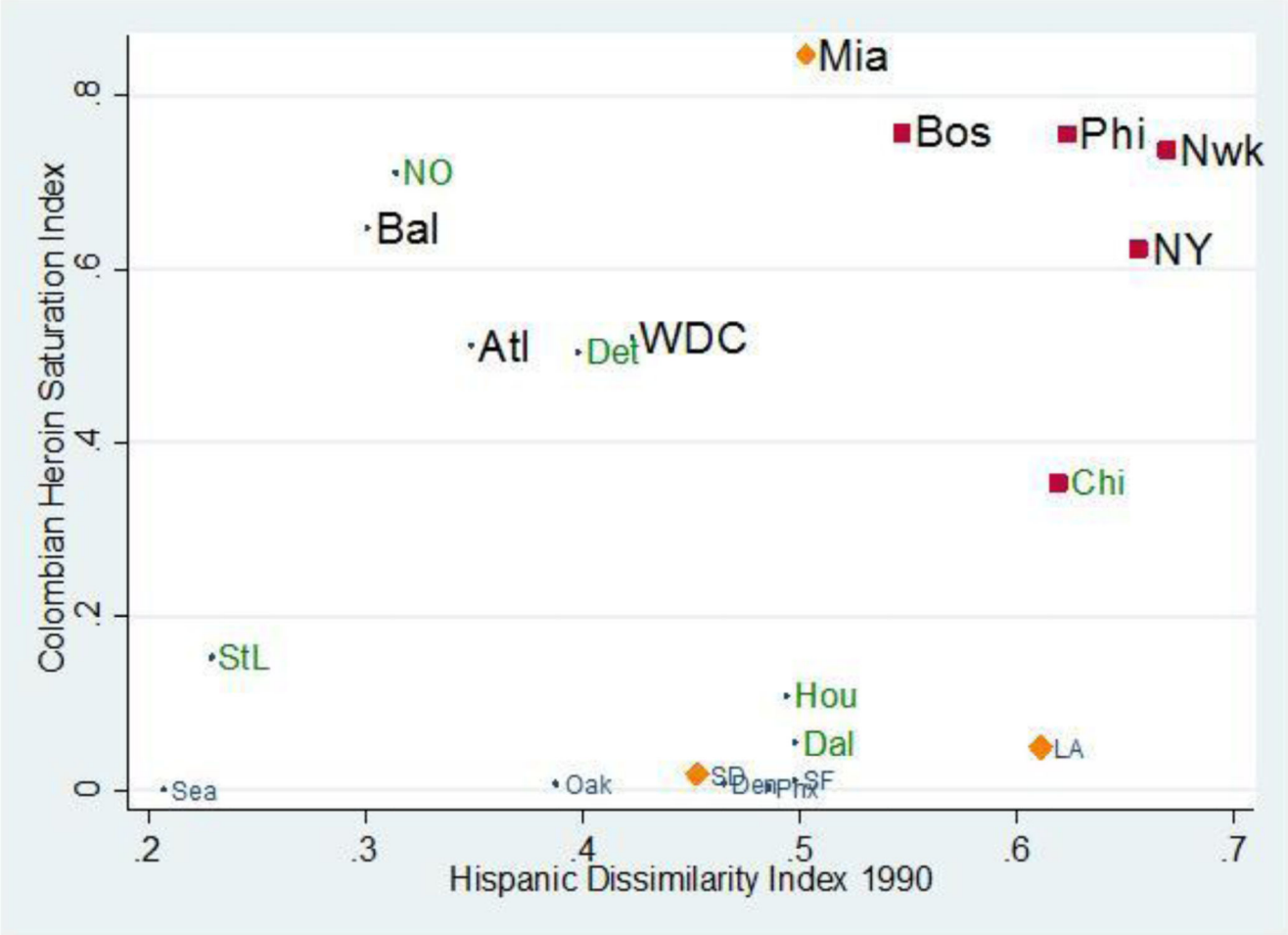

Figure 4.

Red squares indicate MSAs with a high level of Puerto Rican segregation, orange diamonds indicate MSAs with a low level of Puerto Rican segregation, and small blue dots indicate that the Puerto Rican population is too small in these MSAs to warrant segregation measures. Large black city abbreviations indicate the eastern US, medium green city abbreviations indicate the central US, and small blue city abbreviations indicate the western US. (Atlanta = Atl, Baltimore=Bal, Boston=Bos, Chicago=Chi, Dallas=Dal, Denver=Den, Detroit=Det, Houston=Hou, Los Angeles=LA, Miami=Mia, New Orleans=NO, New York=NY, Newark=Nwk, Oakland=Oak, Phoenix=Phx, Philadelphia=Phi, San Diego = SD, San Francisco=SF, Seattle=Sea, St. Louis = StL, Washington, D.C. = WDC)

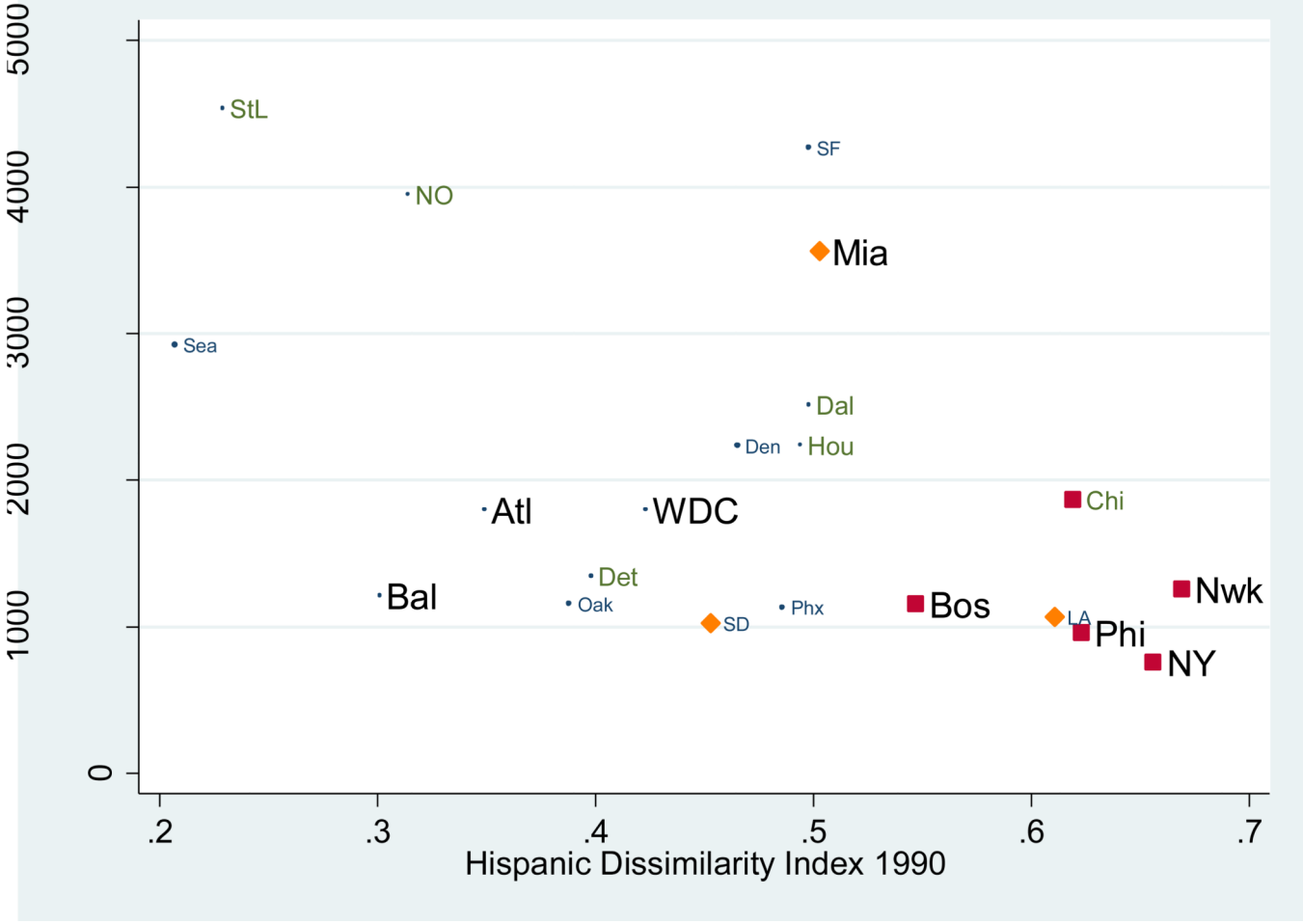

Figure 5.

Red squares indicate MSAs with a high level of Puerto Rican segregation, orange diamonds indicate MSAs with a low level of Puerto Rican segregation, and small blue dots indicate that the Puerto Rican population is too small in these MSAs to warrant segregation measures. Large black city abbreviations indicate the eastern US, medium green city abbreviations indicate the central US, and small blue city abbreviations indicate the western US. (Atlanta = Atl, Baltimore=Bal, Boston=Bos, Chicago=Chi, Dallas=Dal, Denver=Den, Detroit=Det, Houston=Hou, Los Angeles=LA, Miami=Mia, New Orleans=NO, New York=NY, Newark=Nwk, Oakland=Oak, Phoenix=Phx, Philadelphia=Phi, San Diego = SD, San Francisco=SF, Seattle=Sea, St. Louis = StL, Washington, D.C. = WDC)

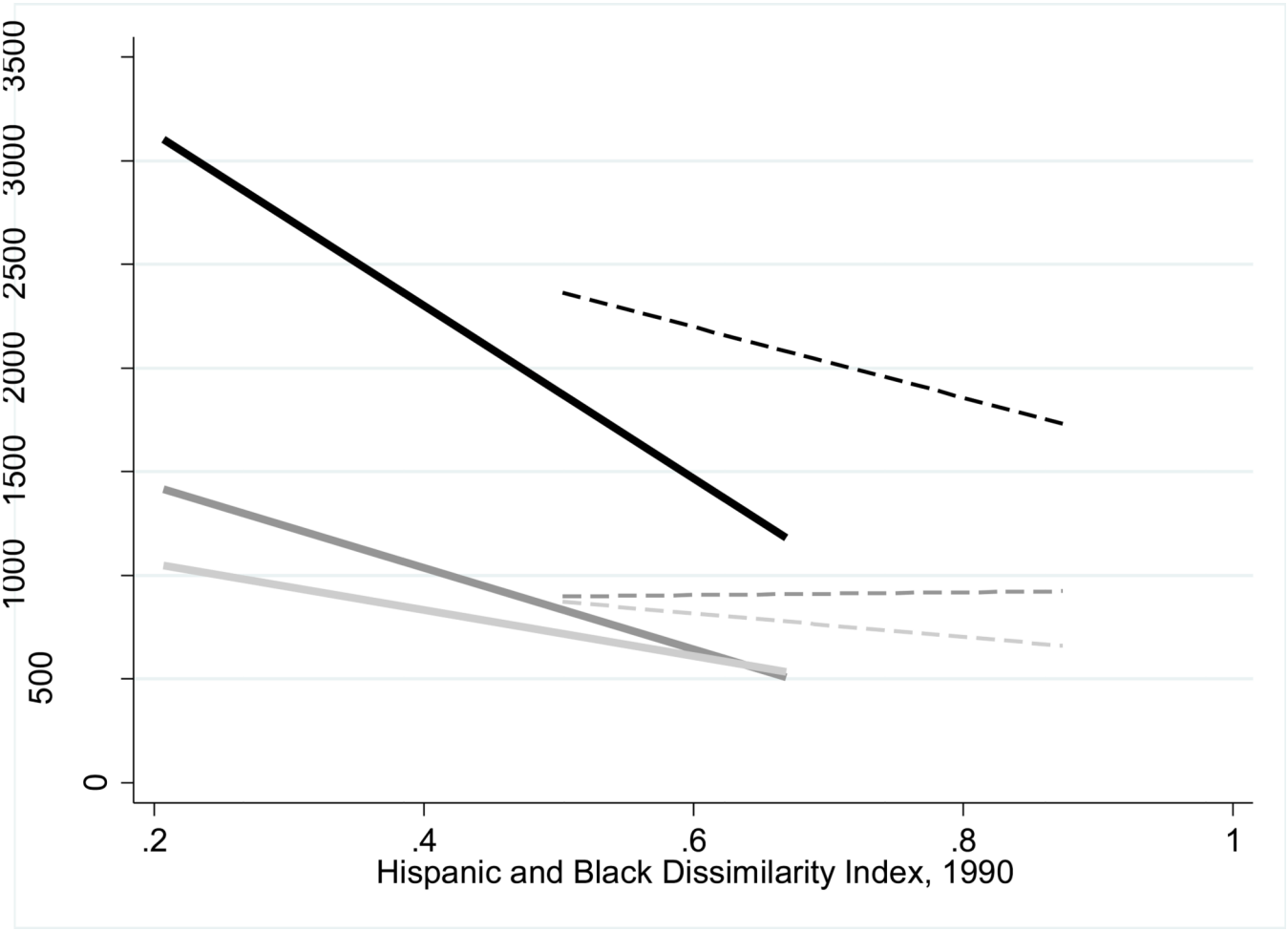

Figure 6.

Lines of best fit for the relationship between heroin price and segregation. Black lines indicate the average price per pure gram, 1990 to 1992. The dark grey lines indicate the average price per pure gram, 1993 to 2000. The light grey lines indicate the average price per pure gram, 2001 to 2008. Solid lines are Hispanic segregation and dashed lines are black segregation.

Table 1

OLS: Relationship between segregation measures, geography, and Colombian heroin saturation

	(1)	(2)	(3)	(4)	(5)
Hispanic Dis. Index 1990	0.5504 (0.5386)			−0.8787 (0.7459)	0.0745 (0.2776)
High P.R. Segregation City		0.3859** (0.1445)		0.6023** (0.2306)	
Low P.R. Segregation City			−0.0543 (0.2059)	0.1734 (0.2086)	
East					0.6565*** (0.0844)
Center					0.3016*** (0.0888)
R-Squared	0.0521	0.2730	0.0037	0.3313	0.7923
Observations	21	21	21	21	21

Notes: Standard errors are reported in parentheses. The dependent variable is the Colombian Heroin Saturation Index. The Hispanic Dissimilarity Index is for Hispanic/Latino with white non-Hispanic as the reference group. High Puerto Rican Segregation Cities are Boston, Chicago, Newark, and Philadelphia. Low Puerto Rican Segregation Cities are Los Angeles, Miami, and San Diego. The omitted region is West. East = Atlanta, Baltimore, Boston, Miami, New York, Newark, Philadelphia, and Washington, D.C. Center = Chicago, Dallas, Detroit, Houston, New Orleans, and St. Louis. West = Denver, Los Angeles, Oakland, Phoenix, San Diego, San Francisco, and Seattle.

* p<0.1,

** p<0.05,

*** p<0.01

Table 2

OLS: Relationship between the Black and Hispanic Dissimilarity Index and the average price per expected pure gram of heroin

	Price Per Pure Gram 1990 to 1992		Price Per Pure Gram 1993 to 2000		Price Per Pure Gram 2001 to 2008	
	(1)	(2)	(3)	(4)	(5)	(6)
Hispanic Dis. Index 1990	−4164**		−1965**		−1113	
	(1765)		(771)		(702)	
Black Dis. Index 1990		−1702		67		−569
		(2803)		(1259)		(1046)
R-Squared	0.2266	0.0190	0.2548	0.0001	0.1168	0.0153
Observations	21	21	21	21	21	21

Notes: Standard errors are reported in parentheses. The dependent variable is the estimated price per expected per gram in each MSA averaged over the corresponding time period. The Hispanic Dissimilarity Index is for Hispanic/Latino with white non-Hispanic as the reference group. The Black Dissimilarity Index is for black/African-American with white non-Hispanic as the reference group.

* p<0.1,

** p<0.05,

*** p<0.01

Table 3

OLS: Relationship between Puerto Rican segregation and the average price per expected pure gram of heroin

	Price Per Pure Gram 1990 to 1992		Price Per Pure Gram 1993 to 2000		Price Per Pure Gram 2001 to 2008	
	(1)	(2)	(3)	(4)	(5)	(6)
High P.R. Segregation City	−1193*	−479	−512*	−158	−375	−326
	(583)	(892)	(257)	(389)	(218)	(357)
Low P.R. Segregation City	−509	−101	−411	−209	−385	−357
	(710)	(806)	(312)	(352)	(265)	(310)
Hispanic Dis. Index 1990		−3044		−1508		−208
		(1161)		(1257)		(1109)
R-Squared	0.1908	0.2406	0.2091	0.0001	0.1876	0.1893
Observations	21	21	21	21	21	21

Notes: Standard errors are reported in parentheses. The dependent variable is the estimated price per expected per gram in each MSA averaged over the corresponding time period. The Hispanic Dissimilarity Index is for Hispanic/Latino with white non-Hispanic as the reference group. High Puerto Rican Segregation Cities are Boston, Chicago, Newark, and Philadelphia. Low Puerto Rican Segregation Cities are Los Angeles, Miami, and San Diego. The omitted region is West. East = Atlanta, Baltimore, Boston, Miami, New York, Newark, Philadelphia, and Washington, D.C. Center = Chicago, Dallas, Detroit, Houston, New Orleans, and St. Louis. West = Denver, Los Angeles, Oakland, Phoenix, San Diego, San Francisco and Seattle.

* p<0.1,

** p<0.05,

*** p<0.01