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Do Urban Casinos Affect Nearby Neighborhoods? Evidence from Canada

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Abstract

Access to legal gambling has expanded in Canada. Casinos can generate both positive and negative local impacts. We analyze the effect of new urban Canadian casinos on nearby neighborhoods in terms of population growth and composition, and housing market outcomes based on more than 40 urban casinos opened in Canada between 1986 and 2007. We define neighborhoods based on spatial proximity, and examine changes in census tract profiles around the opening years of those casinos. We find no evidence that casino developments affect population growth or population composition by age, gender and martial status, or home ownership rates, and evidence that casino openings reduced unemployment in surrounding areas, and are correlated with faster growth in household income. We also find evidence of negative effects on changes in housing values and rents despite the faster income growth. The findings suggest a double-edged nature to casino openings: positive for employment and income growth but negative for residential amenities.

Keywords: casino, economic impact, amenities, housing, employment
JEL codes: R23, R31, L83

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1 Introduction

Governments at all levels increasingly take a favorable view of permitting or expanding legal casino gambling in urban areas. Ohio voters in 2009, for example, passed a ballot measure allowing casino development in four large cities: Cleveland, Columbus, Cincinnati and Toledo. In Canada, casinos have long existed in urban centres including Calgary, Edmonton, Winnipeg, Montreal and Windsor. Recently, urban casinos have opened in Vancouver, Toronto, Ottawa, and Quebec.

Proponents of casinos promote them as generators of tax revenue and employment. Opponents blame casinos for increasing traffic, problem and pathological gambling, crime, bankruptcies, and other social problems. The socio-economic impact of urban casinos differs significantly from rural casinos. Urban casinos have many more residents nearby and these households may bear a disproportionate burden of negative externalities generated by casinos. The economic benefits generated by casino gambling, on the other hand, are shared more widely in urban areas compared with rural casinos. Given the potential for localized negative externalities, we propose to empirically investigate the impact of urban casinos on nearby residential areas, using data from Canada in recent decades.

Existing research on the local impact of urban casinos is often constrained by a lack of data for small geographic areas. Much of the research on crime and casinos, for example, uses county or municipal-level data (Evans and Topoleski, 2002; Stitt et al., 2003; Grinols and Mustard, 2006; Humphreys and Soebbing, 2013). The most comprehensive study of the impact of casinos on the quality of life in nearby areas, Wenz (2008), uses US data at the county level, a relatively large geographic area.

A few papers have studied the relationship between casinos development and nearby property values using individual transactions data or data at low levels of spatial aggregation. Wenz (2007) reports that residential housing prices increased

by about 2% near new casinos and by about 6% in areas located farther from new casinos opened in the US before 2000, using census tract level data. Wiley and Walker (2011) find that retail property values increased in a five mile radius of a new casino opened in Detroit using transactions data from 2001 to 2008.

In contrast, we analyze demographic, housing market, and economic outcomes using data available at low levels of spatial aggregation (census tracts) in Canada. Tiebout sorting models of residential choice motivates the use of these particular outcome variables, since residents trade off amenities and living costs when choosing a place of residence. If urban casinos represent a residential disamenity, it will affect the demand for property, and thus rents and home values, which will in turn affect migration patterns. By examining changes in local characteristics in years around casino openings, we can gauge whether or not openings have local impacts that are substantial enough to affect home values and rents, and alter the demographic and economic composition of local residents.

Little research examines the decision to open a casino, and the characteristics of casino locations. Wenz (2008) analyzes casino openings and site characteristics using data from US counties over the period 1990-2000. He finds important differences between the opening and siting of tribal casinos and non-tribal casinos. The most important factor determining the opening and siting of a new casino is local population, along with proximity to the Mississippi River. Clearly, these results do not easily generalize to Canada, which lacks "riverboat" gambling and only recently legalized tribal gambling.

We estimate multiple empirical models in our analysis; all compare neighborhoods near newly opened casinos to neighborhoods that are farther away in the same cities over the same time periods. The impact of a casino opening is reflected in the difference between the two areas in terms of changes in the outcome variables. We

estimate three types of models: 1) a basic difference-in-difference (D-in-D) model, 2) regression models that control for initial local socioeconomic profiles and pre-opening time trends in the outcome variables, and 3) Propensity Score Matching (PSM) models that select control neighborhoods for comparisons with areas near new casinos. We draw our conclusions primarily from the latter two types of models, one of which uses the full sample to utilize all available information; the other has a filtering mechanism to improve comparability; both are designed to alleviate the concern of spurious correlations arising from the non-randomness in casino locations.

We find no evidence that casino openings affect the demographic composition of nearby areas, or nearby home ownership rates. We find evidence of some tangible economic impacts, in the form of lower unemployment rates, consistent with the findings in Humphreys and Marchand (2013), who find that casinos openings in Canada increase earnings and employment in the gambling industry and the related hospitality industry. We also find faster growth in average and median household income in nearby areas relative to more distant areas. In contrast to these positive economic impacts, we also find evidence of negative impacts on rents and house values, despite the decline in unemployment rates and the rise in household income. These results suggest a double-edged nature of casino openings. Opening a new casino may have a positive effect on the local labour market, but it also affects nearby residential amenities negatively. The findings thus suggest a distributional impact: people who benefit from labour market improvements and those who lose out in terms of rental income and housing-wealth accumulation are not necessarily the same group of people.

2 Empirical Strategy

We estimate multiple models that compare neighborhoods near newly opened casinos with neighborhoods that are farther away. This section defines neighborhoods, describes the outcome variables of interest, the empirical models and the motivations behind the modeling choices. The next section, Section 3, describes the data. Section 4 presents the empirical findings.

2.1 Neighborhoods

We use census tracts to define neighborhoods in Canadian cities. According to the Statistics Canada Census Dictionary[1], a census tract is an "[a]rea that is small and relatively stable," usually having "a population between 2,500 and 8,000 persons." Census tracts are only delineated for census metropolitan areas and in census agglomerations that have a core population of 50,000 or more. Given our interest in urban casinos, however, the lack of data outside those areas is not a concern. Using census tracts as the basic unit of observation has several advantages. They are small enough to generate narrowly defined neighborhoods. They are relatively stable, enabling comparisons across censuses. In fact, Statistics Canada discourages changes to census tract boundaries to maintain data comparability between Canadian censuses. A census tract may be split into multiple new census tracts due to a population increase. But Statistics Canada maintains a naming convention so these divisions are identified with decimal points under the same tract name. All our comparisons will be performed at the level of tract names, aggregating splits into single census tracts.

To classify census tracts into treated and non-treated groups, we calculate the distance between the centroid of each census tract and casinos. We identify the

[1]URL: www12.statcan.gc.ca/census-recensement/2011/ref/dict/geo013-eng.cfm.

location of casinos in terms of latitude and longitude of the six-digit postal code for each casino. Canadian 6-digit postal codes identify very small areas in cities. Their longitude and latitude information will be close approximations to casinos' locations. Using this information, we calculate the distance between casinos and the population-weighted centroid of census tracts. We use a two-mile radius from each new casino to allocate census tracts into either a treatment area or a non-treated area; those that have a population centroid within a two-mile radius belong to the treatment area; those outside the radius but in the same urban area belong to the non-treated area.

The 0-or-1 division of neighborhoods into treated and non-treated groups has a restrictive assumption on the form of potential treatment effects, that they are uniform within the treated areas, and zero outside. This assumption simplifies the presentation, but is perhaps unrealistic. Casino effects likely are the strongest in the nearest neighborhoods and weaken gradually as the distance increases. In addition, the 0-or-1 assumption places too much importance on the choice of the radius length, which is subject to two conflicting concerns. A shorter radius reduces the number of census tracts in the treatment group. A longer radius possibly dilutes the treatment effects. Later in our analysis, we will address these concerns by using a larger radius as the maximum sphere of influence, but allow diminishing effects within the sphere, following the approach in Ahlfeldt and Kavetsos (2014) who study the effect of new sports stadia on property prices in London.

2.2 Outcome variables

We examine eleven outcome variables that can be classified into four groups: population growth, demographic composition, economic outcomes, and housing-market outcomes. Specific variables, all constructed using data from the every-5-year Censuses of Canada, are listed below.

- Resident population growth.
- Demographic composition: the share of residents below age 15, the share of residents age 65 and over, the share of male residents, and the share of residents (15 and over) who are legally married.
- Economic profile: the unemployment rate in the population 15 and over, average household income, and median household income.
- Housing-market outcomes: the share of owner-occupied dwellings, the average gross rent, and the average value of dwellings.

2.3 Empirical models

We first estimate a standard difference-in-differences (D-in-D) model, comparing neighborhoods within a 2-mile radius from newly opened casinos to neighborhoods that are farther away in the same cities over the same time periods. The D-in-D comparisons examine whether casino openings have a tendency to coincide with growth differentials between the two areas in terms of the eleven outcome variables, thus describing the basic correlational patterns.

Our extended regression analysis first relaxes the assumption that the effects of new casino openings are uniform within a radius of certain length, and zero outside. Instead, we allow the effects to diminish with distance from new casinos. Specifically, we use an area with a relatively large radius to capture the maximum sphere of influence of new casinos, and use an interactive term to allow the effects to vary within that sphere according to the distance to casinos. An estimated effect that diminishes with distance would make a more convincing case that the effect can be attributed to the new casinos. An opposite finding, that the estimated effect strengthens with distance, would cast doubt on the casino interpretation.

Next we relax the assumption implicit in the basic D-in-D analysis that, in the absence of new casinos, the treatment and control areas would have, on average, identical growth paths for the outcome variables. This is a strong assumption. Our descriptive statistics show that urban casinos tend to locate in neighborhoods with lower household income and residential property values, higher unemployment rates, and lower shares of owner-occupied housing units. If these initial features are also correlated with later growth in the outcome variables, failing to account for the initial local conditions would bias the estimated casino effects in unknown directions. Our regression model includes a substantial number of control variables that are potential predictors of future growth. To the extent that those variables predict later growth and are systemically different between the treatment and control areas, we remove some of the growth differentials unrelated to casinos. In fact, the results based on this approach can differ substantially from those based on simple D-in-D comparisons. For example, Huang and Humphreys (ming) analyze the impact of new sport stadiums on the volume of mortgage applications and find that new sport facility openings in the United States between 1995 and 2008 tended to occur in poor urban areas that would have grown faster even without the new facilities, likely because of the subprime mortgage credit expansion over the sample period. Failing to control for local economic conditions substantially inflated the stadium effects on mortgage applications.

To further account for local growth heterogeneity unrelated to casino openings, we use past growth trends as additional control variables. There are two reasons for doing so. First, time trends are likely persistent, so past growth can be an important predictor of future growth. Second, past growth may affect the location of new casinos. Urban casinos tend to locate in neighborhoods with lower household income and housing values, perhaps because the land cost is lower and local residents

are more tolerant of having casinos nearby. If so, neighborhoods that are already experiencing urban declines may be attractive targets for casino developers. In this case, a basic D-in-D analysis may over estimate the negative effects of casinos on outcome variables, since part of the decline is due to persistent factors that predate the casino openings. Galster et al. (1999) discuss a similar concern in their study on the impact of section-8 neighbors on property values. Their solution is to use panel data models that allow the treated group to have a different time trend relative to the control group before the treatment begins. The treatment effect then depends in part on how the relative time trends are altered. We cannot run such panel regressions because our data are from censuses conducted every 5 years. Most casinos in our data do not have sufficient observations in time to allow a meaningful panel regression. Instead, we use cross-sectional regressions with past growth as control variables; we detect the casino effect by how casino developments altered the growth trajectories relative to the predictions based on past growth.

Our last way to deal with growth heterogeneity unrelated to casino openings is to use the method of propensity score matching (Rosenbaum and Rubin, 1983; O'Keefe, 2004), or PSM, to select neighborhoods for inclusion in the control areas for an "orange-to-orange" comparison with the treated groups. We recognize that in large cities casinos affect only a small number of neighborhoods. Most areas are not affected; some of them, such as suburban "bedroom" communities, can have very different demographic and economic characteristics from the affected "treatment" areas. Comparing different neighborhoods heightens the concern about the non-randomness of casino locations. Our earlier approach deals with this problem by controlling for initial local characteristics and past growth. PSM is an alternative. It selects neighborhoods from unaffected areas for comparisons with neighborhoods in affected areas, as opposed to using the entire group of unaffected neighborhoods.

Specifically, we use a two-step approach. The first step uses PSM to select unaffected census tracts to match with census tracts in affected areas. The matching is based on a predicted propensity score that a new casino exists nearby. The propensity is modeled as a function of observed census tract characteristics such as income, housing values, and past growth trends. The matched control census tracts are called the closest neighbors. In the second step, we repeat the regression analysis outlined above, comparing the treated tracts to their non-treated closest neighbors. Under PSM, only "similar" census tracts are compared. If tracts nearby casinos are more likely to have lower income residents and lower-valued homes, the selected controls are likely to have such features as well.

3 Data and Data Description

This section describes data sources, presents summary statistics, and plots the average trajectories of the outcome variables using interpolated data from the Canadian censuses.

Casinos in the sample

We collected data on the characteristics of 92 casinos that opened in Canada over the period 1985 to 2007, including the 6-digit postal code for each of these casinos. Based on the postal code, we match the casinos to longitude and latitude information contained in the 2006 Postal Codes Conversion File (PCCF) published by Statistics Canada. To exclude non-urban casinos, we again use the 2006 PCCF. A casino is considered urban if the associated postal code is within a statistical area classified as a "large urban population centre (100,000 or greater)" or a "medium population centre (30,000 to 99,999)" and not classified as "rural" in the PCCF. We also eliminate all casinos that have less than one census tract within a 2 mile

radius. After these exclusions, 47 casinos located in 29 census metropolitan areas or census agglomerations remain in the sample. This constitutes the main sample for our analysis. Table 1 lists these casinos together with the city of location and the year opened.

Neighborhoods and distance to casinos

We define neighborhoods based on census tracts. For each census tract, we calculate its distance to each new casino in the local census metropolitan area (CMAs) or census agglomeration (CAs) based on longitude and latitude information. Essentially the distance is the length of a straight line connecting the casino (more precisely the centroid of the postal code where the casino locates) and the population-weighted centroid of census tracts in the same CMA/CA. The population-weighted centroid is calculated based on the centroid information and population counts at the level of dissemination area (DA) in the 2006 Census. A DA is a small area with a population of 400 to 700 persons. The population-weighted centroid from the 2006 census is used for all years, with an assumption that the centroid is relatively stable. We use the CMA/CA to define the control group, as opposed to city borders, because some integrated metropolitan areas, such as Vancouver, include multiple municipalities.

Table 2 reports the numbers of census tracts associated with each individual casino, showing the total number in local CMA/CA, the number within a radius of 1.5 miles, a radius of 2 miles and a radius of 3 miles, respectively. On average, only a small fraction of census tracts fall into potential treatment areas. Across all casinos in the sample, the average number of census tracts in the CMA/CA of location is 98, with an average of 6.6 falling within a 1.5-mile radius, 10.4 within a 2-mile radius, and 19.5 within a 3-mile radius.

Census data

To measure changes in neighborhood demographics and socioeconomic outcomes, we turn to the every-5 year Canadian censuses from 1981 to 2011, a total of 7 censuses. Several variables are not reported in the 2011 census; for those variables only the 1981-2006 censuses are used. From these every-5 year censuses, we use linear interpolations to obtain annual data. The interpolated yearly data are used for the descriptive illustration in the next subsection, and for calculating the 5-year growth before and after casino openings. Essentially, we use the linear interpolation to fill in missing values in order to obtained the 5-year growth in the outcome variables. For a casino that was opened in 1986 (a census year), the 5-year growth is just the growth from the 1986 census observation to the 1991 census observation. For casinos opened in 1987 (an off-census year), the 5-year growth is the growth from 1987 (interpolated based on the 1986 and 1991 censuses) to 1992 (interpolated based on the 1991 and 1996 censuses). These 5-year growth will become the outcome variables in our regression analysis. We note that those regressions do not use data at the yearly frequency. For each geographic unit associated with a casino, only one observation (the 5-year growth) appears in the regressions.

There are substantial differences between census tracts near new casino and those farther away; nearby census tracts tend to be poorer. Table 3 presents the comparisons, contrasting the economic conditions in nearby neighborhoods in the years of casino openings (based on the interpolated time series) to those farther away in the same years. On average, neighborhoods within a 2-mile radius of new casinos have lower average household income and median household income (by about $1,100 in both measures), lower house prices ($163,000 to $181,000) and lower gross monthly rent ($625 to $681). In addition, the local resident population is less likely to be married (48% to 57%), less likely to be homeowners (54% to 71%), and more likely

to be unemployed (9.6% to 7.8%).

Typical trajectories of outcome variables around casino openings

We now focus on the outcome variables, including population growth, demographic composition, economic and housing-market outcomes. We plot, for each of the outcome variables separately, a *typical* trajectory around casino openings. Here typical means the average values in our sample. Specifically, we plot the interpolated 11-year time series centering around the opening year. If the opening year is 1996, the time series covers the years from 1991 to 2001 with year 1996 as time 0, year 1991 as time -5 on one end, and year 2001 as +5 on the other. An average trajectory can be plotted for the casino using the experience of all relevant census tracts over the period, with resident population as weights. We have multiple casinos in the sample. A typical trajectory for all the casinos is just the population-weighted averages of all the casino-specific trajectories. It shows the average time path of the outcome variables from 5 years before the opening to 5 years after the opening of new casinos. This method of presentation is commonly used in business-cycle research, in which the trajectory of a typical business cycle is the average of multiple cycles that occurred over different periods of times. We note that we do not have data from 2012; so for the 5 casinos that opened in 2007, the missing 2012 data are replaced by 2011 values.[2]

Figures 1 and 2 contain the trajectory plots, comparing treated areas within a 2-mile radius to non-treated or control areas outside the radius. The first figure collects all the variables expressed in shares; the second figure collects variables expressed in levels. For each of the outcome variables, the left-hand side panel

[2]We also note that despite our annual time series being generated by linear interpolation, we do not expect the plots to be linear with a kink at the center. This would be true only for a casino that was opened during a census year. For a casino opened in off-census years, however, the kinks occur off the center. The average of these multiple trajectories with kinks at different points in the time period will not contain kinks.

shows the levels, the right-hand side panel shows the gap between the treated and non-treated areas. Take population size (in Figure 2) as an example, the trajectory plots show that neighborhoods in treated areas are smaller in size, and have slower population growth over time, leading to a widening gap relative to neighborhoods in non-treated areas. The relative time trend, however, predates the opening of casinos, and is little changed after the casino openings.

Overall, we observe two patterns. First, in addition to differences in initial socioeconomic conditions, the treatment and control areas often have different growth trajectories that predate casino openings. Secondly, for most demographic variables including the population size, the shares of young and old residents, the share of married persons and the share of homeowners, the casino openings do not coincide with major changes in relative growth trajectories. But the same cannot be said for for the unemployment rate, household income, rents and housing values. For them casino openings are associated with either stabilization or even reversals of preceding relative trends. For the unemployment rate (in Figure 1), the nearby neighborhoods begin with a higher initial rate. The gap, about 1.8% five years before casino openings, rose to 2.2% around the opening year, before changing its direction afterward, falling to 1.6% in five years' time. For both the average and median household income, the treated areas begin from a lower position; the gaps widen before casino openings but reverse the direction after the opening year. For average housing rent, the treated areas begins from a lower position. The gap widens before the developments but remains largely flat after the development. For average housing values, the treated areas has lower house prices; the gap remains largely flat before casinos development, and widens substantially (by about 6%) after.

4 Empirical Findings

This section presents estimates from the three statistical models discussed above: a basic Difference-in-Differences (D-in-D) model, a regression model that utilizes all available observations, and a regression model that uses propensity score matching (PSM) to select control neighborhoods.

4.1 D-in-D analysis

For the D-in-D analysis, we use a 2-mile radius to divide census tracts in each CMA/CA into the treatment and non-treatment areas. For each new casino opening, the treatment area includes all census tracts within the specified radius; the non-treatment, or control area, includes all other census tracts in the same CMA/CA.

The following equation describes the D-in-D regression model, where Y denotes the outcome variable of interest. We have data for $i = 1, 2 \ldots N$ census tracts. Opening a new casino in or near a neighborhood represents the treatment in this case. Let G_i identify Census tracts where $G_i = 1$ identifies those that receive the treatment and $G_i = 0$ those that did not. The outcome variable is observed in two time periods, $T_i \epsilon 0, 1$ where $T_i = 0$ is the pre-treatment period and $T_i = 1$ the post-treatment period. The outcome in the absence of the treatment is $Y_i(0)$ and under the assumption of an additive treatment, the outcome in areas in the treatment group is $Y_i(1) = Y_i(0) + \tau_{did}$, where τ_{did} is the effect of the treatment on the outcome. Imbens and Wooldridge (2009) show that the estimator for this set up is

$$\begin{aligned} \tau_{did} &= (E[Y_i|G_i = 1, T_i = 1] - E[Y_i|G_i = 1, T_i = 0]) \\ &- (E[Y_i|G_i = 0, T_i = 1] - E[Y_i|G_i = 0, T_i = 0]) \end{aligned} \tag{1}$$

In other words, we estimate the treatment effect by comparing the average difference

in the outcome variable over time in the treatment area to the average difference in the outcome variable over time in the control area. This procedure removes any common trends not associated with the opening of a new casino. It also controls for time-invariant metropolitan area specific fixed effects. The difference-in-difference method described above is unconditional, i.e., it does not take into account the possibility that the location of casinos differs from other areas systematically and such systematic differences have an impact on the dynamics of the neighborhoods even without the opening of a new casino.

As an example and an illustration of this method, we consider our first variable of interest, population growth. We compare the treatment area and the control area in terms of their average population growth rate in a window of time around the opening of a new casino. We use a 5-year window, calculating population growth from the opening year to 5 years later. The choice of a 5-year window takes into account that the time series is interpolated from census data collected every five years. Since we use interpolated data, year to year changes are artificial. We need to look at longer term changes. Also, a time window longer than 5 years entails substantial losses of new casinos from the sample. For a subset of our outcome variables, the last data point is 2006. If we use a 10-year time window, we would have to drop data for all casinos that opened after 1997, a cost that is rather significant in our view.

For each of the casinos in the sample, we calculate the average 5-year population growth within the treatment area, and that within the control area, and finally the treatment-control growth differential that is our focus. Take Casino Edmonton as an example. It was opened in 1986 in the Edmonton CMA. The average population growth from 1986 to 1991, weighted by initial population, was -1.59% in census tracts near the casino, and 8.17% in the rest of Edmonton. The difference in growth

is thus -9.75%. In this particular case, the opening of the casino coincided with slower population growth in the treatment area. We repeat this calculation for all the casinos in the sample. It appears that slower population growth associated with casino openings is not an isolated event. We illustrate the distribution of growth differentials graphically, as shown in the first panel of Figure 3. The histogram clearly suggests a growth deficit in the treatment area, as most casinos lie below the zero point. The footnote of the histograms shows the estimated mean and standard error of the growth differential. The average difference is 5.32%, with a standard error of 1.22%, yielding a t-statistic of 4.34. We can thus reject the null hypothesis of equal growth in the treatment and control areas.

Following the same procedure, we conduct a difference-in-differences analysis using the other ten outcome variables of interest. The only difference is that for the unemployment rate and variables that are defined as shares, we calculate 5-year differences instead of 5-year growth. For variables that are defined in terms of levels, such as average income, median income, average housing values and average rent, we use growth calculations as we did for the population variable. We present the findings for these outcome variables as histograms, collected in Figures 3. Each panel has a footnote indicating the average differentials, the standard errors of the differentials and the t-statistics. The results can be summarized as the follows: Casino openings are correlated with relatively lower population growth (-5.32% over 5 years), relative increases in the share of residents below age 15 (0.31 percentage points over 5 years), relative decrease in the share of residents age above 65 (0.68 percentage points over 5 years), relative increases in the share of male residents (0.16 percentage points over 5 years), relative decreases in the share of persons who are married (0.24 percentage points over 5 years), relative decreases in the unemployment rate (0.53 percentage points over 5 years), no statistically significant differences in changes in the share of

owner occupied housing, and no statistically significant differences in changes in the average household income, the median household income, the average rent and the average value of dwellings.

4.2 Regression-based analysis

Here we relax some important assumptions underlying the basic D-in-D analysis reported above. The first is that the effects of new casinos are uniform within a certain radius and zero outside. Instead, we include an interaction term in a regression model to allow the effects of new casinos to depend on the distance between each census tract and a new casino. This also serves a robustness check on the D-in-D analysis to see whether the estimated differentials in the D-in-D analysis are attributable to new casinos or not; we expect any casino effects to diminish with distance to a casino. We use a relatively large radius (3 miles) as the maximum sphere of influence for casinos, and allow diminishing effects within this radius. There are two reasons for choosing a 3 mile radius. First, as seen from the basic D-in-D analysis with a 2 mile radius, most of the estimated growth differentials are quantitatively small. By the edge of a 3 miles radius, the potential casino effects will be even smaller than the average within the 2-mile radius. Second, for some small cities, a 3 mile radius around a urban casino covers almost the entire cities (see Table 2; such case include Cash Casino and Jackpot Casino in Red Deer, Casino Regina in Regina, Point Edward Charity Casino in Sarnia, and others). So a 3 mile radius is quite a large geographic distance. A similar choice of maximum radius is used in Ahlfeldt and Kavetsos (2014), who uses 5 kilometers in their study on the effect of new sports stadiums on property prices in London. Within the maximum sphere of influence, we will use an interactive term to capture casinos effects that are

dependent on the distance to casinos. Specifically, we run the following regression

$$\Delta Y_{i,j} = \alpha_1 D_{i,j}^{3miles} + \alpha_2 S_{i,j} + \alpha_3 D_{i,j}^{3miles} \cdot S_{i,j} + \beta_1 Z_i + \beta_2 \Delta^{Past} Y_{i,j} + \gamma_j D_j^C + u_{i,j}. \quad (2)$$

The subscripts i and j indicate census tracts and casinos, respectively. The dependent variable $\Delta Y_{i,j}$ is the 5-year percent growth (for variables expressed in levels) or 5-year differences (for variables expressed in shares) from the opening year to 5 years after. The variable $D_{i,j}^{3miles}$ is a 0-or-1 indicator of maximum sphere. It equals to 1 if census tract i is within a 3-mile distance from casino j, and zero otherwise. The variable $S_{i,j}$ is a continuous variable indicating the distance between census tract i and casino j. The term $D_{i,j}^{3miles} \cdot S_{i,j}$ is the interaction between the maximum-sphere indicator and the continuous distance variable $S_{i,j}$. The interactive term allows a distance-dependent treatment effect: for census tracts that are x miles away from the casino, the treatment effect is $\alpha_1 + \alpha_3 x$. A diminishing casino effect is captured by α_1 and α_3 having opposite signs.

The second assumption we relax is that the growth trajectories in the treatment and non-treatment areas would have been identical, on average, without the casinos. Instead, we use regression control variables to try to remove growth heterogeneities that are not due to casinos. We include two types of controls. First, initial socioeconomic profile of local residents – here initial means the opening years – because Table 3 suggests that areas nearby casinos tend to be poorer and have a higher residential mobility. These initial profile variables are gathered in vector Z_i that includes the initial share of residents age 15 and below, share of those age 65 and above, share of male residents, share of married residents, share of owner-occupied housing units, share of unemployed persons, average household income and average dwelling values.[3] The median household income and the average rents are

[3]We note that the 5 casinos that were opened in 2007 are missing the 2007 values of the share of owner-occupied housing, the average household income, the unemployment and the average dwelling

not included as they are likely highly correlated with average housing income and dwelling values. But the estimated coefficients on the treatment variables are little changed even if we include those extra control variables. The inclusion of those variables affects mainly coefficients on others control variables, not the estimates of our interests.

The second type of control is just past growth trend in the variable of interest, denoted as $\Delta^{Past}Y_{i,j}$, the growth from 5 years before the opening to the year of opening. Its inclusion is motivated by the concern that casino openings may tend to happen in areas that are already in declines. Two casinos, namely Cash Casino opened in 1995 in Red Deer and Great Canadian Casino opened in 1998 in Nanaimo, do not have enough information to construct the past 5-year trends; they are left out of the analysis.

The vector D_j^C is a set of 0-or-1 indicators for casino j. We note that the inclusion of the casino dummy renders metropolitan area dummies and opening-year dummies unnecessary, because the casino dummy incorporates both the location and year effects. The inclusion of the casino dummies means we are compare census tracts in the same metropolitan area during the same period of time, as in the difference-in-difference analysis reported earlier.

Finally, we note the sample size of casinos in this analysis. A subset of the eleven outcome variables do not have observations in the 2011 census. Their most recent values are from the 2006 Census. This means any casinos that opened after 2001 will not be included in the regressions if the outcome variable is home ownership rate, unemployment rate, average and median household income, average housing price and average rent. For these outcome variables, the sample includes 35 casinos. For demographic outcome variables, the sample has 45 casinos.

values, because the 2011 census does not report such values to allow interpolations. We use the 2006 values in place of the missing 2007 values.

Tables 4 to 14 present the regression parameter estimates. Each individual table is dedicated to a variable of interest. Within a table, results are shown in the following order: column (1) is from a regression model without the initial conditions variables Z_i or past growth trends $\Delta^{Past}Y_{i,j}$; column (2) is from a regression model with Z_i added; column (3) is from a regression model with both Z_i and $\Delta^{Past}Y_{i,j}$ added. The following summarizes the findings.

- Population growth: In the model without the control variables Z_i or $\Delta^{Past}Y_{i,j}$, the estimated treatment effect in the immediate neighborhoods around the casinos is negative (*i.e.*, a negative main effect before counting the interactive effects). But inconsistent with the hypothesis that the casino effect should diminish as the distance to casino rises, the estimated effect rises instead (*i.e.*, an interactive effect with the same sign as the main effect), albeit just slightly. This raises question whether we can attribute the detected difference to the casino openings or not. The second column adds the local initial profile Z_i to the regression. This has a large impact; the estimated treatment effect changes to positive at the center, though it remains statistically insignificant and dissipates quickly over the distance away from casinos. Column (3) adds the preceding 5-year growth trend $\Delta^{Past}Y_{i,j}$ – population growth in this case – to the model; the estimated main effect becomes effectively zero. We interpret these findings as evidence that casino openings do not affect population growth. The negative correlation detected from the basic D-in-D analysis is due to correlations between casino locations, initial local conditions and persistent trends in population growth.

- For the rest of the basic demographic variables, namely the share of residents below age 15, the share of residents age above 65, the share of male residents, the share of persons who are married as well the share of home ownership, the

estimates suggest that casino openings do not have significant effects. In the case of the elder population's share, there is a significant and negative effect before adding the control variables of local profile and past-growth; after that it changes sign and loses statistical significance.

- For the unemployment rate, the estimated effects are negative – *i.e.*, economically positive – and diminish over the distance to casinos. The signs are consistent throughout the specifications. The findings are also consistent with those from the basic D-in-D analysis and observations from the trajectory plot in Figure 1 which shows a reversal in trend after casino openings. The magnitude and statistical significance of the estimated effects however, vary substantially. Before controlling for local profile and the past trend, the estimated effect is -.75% at the center and -.58% one mile away from the casinos. Adding census controls and the past trend weakens the estimates substantially (to less than -.2% at the center and -.15 one mile farther) and renders the estimate statistically insignificant.

- For the average, and alternatively the median, households income, the estimated effects are positive throughout the specifications, and show tendency to weaken over the distance to casinos. The estimated center effect ranges from 1.5% to 3.8%. But the estimates are statistically insignificant in fuller specifications that have all the control variables included.

- In the average dwelling values and the average gross rent, we have the only estimated effects that have consistent signs throughout the specifications so far and are statistically significant even after including the fullest set of control variables. The estimated effects are negative, suggesting that casino openings are associated with slower growth in housing values and rents. The estimates in

column (3) suggest that the developments reduce the growth of house prices and rents by 4.1% and 4.7%, respectively, in the immediate neighborhoods over the 5-year period. The effects weaken to 2.8% and 3.1% in areas one mile farther away.

To summarize, the estimates suggest that casino openings have little effect on the demographic compositions of residents such as age, gender and marital status. There is no evidence that they affect home ownership either. The developments appear to have economically positive effects of lowering the unemployment rate. They are also associated with faster growth in household income. But the estimates lack statistical significance after controlling for differences in initial local socioeconomic profile and past trends. Neither can we tell wehther the higher household income is due to residential mobility or due to rising income of the same households. The only significant effects we find after controlling those variables are on housing prices and rents. According to the estimates from the specification with the fullest set of control variables, casinos developments reduce the average price and rent by more than 4% at the center and by about 3% in areas one mile away from casinos over a 5-year period starting from the opening year.

4.3 Propensity Score Matching

Next we discuss results based on the method of propensity score matching. The idea is to identify census tracts far away from the casinos (the non-treated areas) for comparison with those nearby (the treated areas). The selection criterion is the predicted propensity score from a probit model of having a casino located nearby. If casinos are more likely to locate in low-income neighborhoods, the selection more likely will identify non-treated census tracts with low income as control neighborhoods. For each treated census tract, the PSM selects its closest neighbor from the

non-treated areas, which is just census tract with the closest predicted propensity score. The predictors in the probit model include the initial local characteristic variables and past trends in the outcome variables, *i.e.*, all the control variables used in the regressions reported earlier. We perform the prediction-and-matching procedure for each casino individually, making sure that the matching occurs within the same city in the same time period.[4] After selecting the neighborhoods in the control groups, we repeat the regressions analysis described in equation (2), essentially comparing the treated neighborhoods to their closest neighbours. We continue to include the interaction term that indicates if casino effects diminish with distance.

To implement the method, we revert back to the baseline 2-mile radius, as opposed to the larger 3-mile radius used as the maximum sphere of influence in the regression models. As discussed earlier, a 3-mile radius in some smaller CMA/CAs covers most of the areas, leaving few census tracts outside the radius for matching. In some cases, it is even possible to achieve a perfect prediction because so few census tracts are in the non-treated area. Using a 2-mile radius avoids this problem. The last column of Table 3 shows the census profile variables of the PSM-selected control census tracts. As expected, the PSM-selected neighborhoods are much more similar to the within-radius neighborhoods in terms of the initial census profiles, relative to the broader set of neighborhoods outside the 2-mile radius.

The last columns of Tables 4 to 14 report the estimates. The following summarizes the findings.

- The PSM approach uncovers no significant effects of casino openings on population growth, other basic demographic variables, as well as the home ownership rate.

[4]Following O'Keefe (2004) and Huang and Humphreys (ming), we allow the possibility that a single non-treated tract is matched to multiple tracts in the treatment group. This avoids bringing in less perfect matches into the control group.

- For the unemployment rate, the estimated casino effects are negative and diminish over the distance to casinos. The findings are consistent with those from the full-sample analysis; but the magnitude and statistical significance are much stronger under PSM than in the full sample. Quantitatively, the PSM-based estimate suggests that casino openings reduce the unemployment rate by 1% at the center and by 0.7% in areas one mile away from casinos. In contrast the full sample estimate under the same specification indicates only a -.2% effect at the center.

- For the average and median households income, the estimated casino effects are positive and weaker in farther away areas. These signs are consistent with the full-sample estimates; the magnitude and statistical significance are stronger under the PSM. Quantitatively, the PSM-based estimates suggest an effect about 4-5% at the center, with a rate of decline that is about .3-.6% per mile.

- For the average dwelling values, the estimate effect is negative, consistent with the full-sample analysis. But unlike the full-sample estimates, the estimated effect is small and statistically insignificant even at the center.

- In the average rent, we find the greatest consistency between the PSM-based analysis and full-sample analysis. Both approaches indicate a significant negative effect around 4% at the center and a rate of decline that is around 1.6% per mile.

To summarize, the PSM-based estimates largely confirm the findings in the full-sample analysis that little if any effects can be found on demographics and home ownership. They also support, to varying degrees of statistical significance, the earlier findings that casino openings have positive economic effects in the form of

lowering the unemployment rate, and are correlated with faster growth in household income; but the casino effects on housing values and rents are negative. We find remarkable consistency in magnitude and statistical significance regarding the negative effect of casino on housing rents, about 3-5% over a 5-year period in areas surrounding the casinos.

5 Conclusions

We examine the impacts of urban casino openings in Canada on nearby neighborhoods. The analysis covers a wide range of outcome variables including population growth and demographic composition by age, gender and marital status, economic outcomes (median and average household income, and unemployment rates) and housing-market outcomes (home ownership rates, housing values and rent). We use observations from more than 40 urban casinos opened in Canada since the mid 1980s. We use multiple econometric approaches in order to assess the robustness of the results; all empirical methods involve comparing nearby neighborhoods, defined at the level of census tracts, to neighborhoods that are farther away. Models estimated include a basic difference-in-differences comparison, a regression model with an extensive list of control variables for dealing with the non-randomness in casino locations, and a model that uses the propensity score matching (PSM) method to select neighborhoods into the control area for "orange-to-orange" comparisons. We also impose an identification constraint that any casino effects should diminish with distance to new casinos.

Overall, the results include three observations. First, casino openings have little if any impact on population growth and residential composition by age, gender and marital status, as well as home ownership rates. Second, casino openings appear to have positive economic effects that lower the unemployment rate in nearby

neighborhoods, and are correlated with rising household income, though it is not possible to tell whether this higher income can be attributed to in-migration of new high income residents or to increased income in existing households. The estimates' magnitudes and statistical significance vary substantially depending on model specification. According to higher estimates from the PSM-based regression analysis, casino openings reduce the unemployment rate by 1 percentage point in immediately surrounding areas 5 years after a new casino opens; household income, on the other hand, rises by about 4 extra percentage points over the period. We caution however, that the estimates from the full-sample analysis are much smaller and are statistically insignificant. Third, casino openings have negative effects on housing values and rents. The estimates are stronger in the full-sample analysis and weaker in the PSM model. The most robust finding, consistent in both models, is the negative effect on housing rent, a loss of about 4 percentage point growth in 5 years in the immediate neighborhoods. For housing values, the full-sample analysis suggests a negative 4 percentage-point impact; the PSM-based estimate is much smaller.

Our results suggest that while casino openings have no detectable impact on population growth and local demographic composition, there is evidence of positive economic impacts in the labour market and negative impacts in terms of slower growth in rent and home values.

What do these findings mean? The data suggest that Canadian urban casinos were more likely to be located in poorer neighborhoods with lower income and higher unemployment rates compared to other areas in the same cities. Our analysis suggests that the casinos opening narrowed the gaps. This is a positive development for residents who needed most dearly the additional income and jobs. On the other hand, the casino openings reduced the growth of home values and rents, making casinos a negative factor for nearby homeowners and owners of rental properties who

bear not only the disamenity costs of new casinos, but also lower rental earnings and slower housing wealth accumulation. Casinos thus create winners and losers. While this may not be a unfamiliar point to those who are familiar with specific new casino openings in Canadian cities, our paper is the first to systemically analyze urban casinos' impacts on surrounding areas across all Canadian cities with new casino openings over more than two decades. This analysis covers a large number of casinos and a wide range of outcome variables. We hope the findings provide information for future public discussions about new casino developments and contribute to our understanding of the overall impact of increased access to legal casino gambling opportunities.

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Table 1: Casinos in sample

Name of establishment	City	Province	CMA/CA	Year Opened
Casino Edmonton	Edmonton	AB	Edmonton	1986
Treasure Cove Casino & Hotel	Prince George	BC	Prince George	1986
Stampede Casino	Calgary	AB	Calgary	1988
Elbow River Casino	Calgary	AB	Calgary	1989
Palace Casino	Edmonton	AB	Edmonton	1990
Assiniboia Downs Club West Gaming Lounge	Winnipeg	MB	Winnipeg	1992
Lake City Casino	Kelowna	BC	Kelowna	1992
Lake City Casino	Kamloops	BC	Kamloops	1992
Casino Lethbridge	Lethbridge	AB	Lethbridge	1993
Casino de Montral	Montral	QC	Montral	1993
Club Regent Casino	Winnipeg	MB	Winnipeg	1993
McPhillips Street Station Casino	Winnipeg	MB	Winnipeg	1993
Casino Windsor	Windsor	ON	Windsor	1994
Cash Casino	Red Deer	AB	Red Deer	1995
Casino Nova Scotia	Halifax	NS	Halifax	1995
Baccarat Casino	Edmonton	AB	Edmonton	1996
Casino Regina	Regina	SK	Regina	1996
Casino du Lac-Leamy	Gatineau	QC	Ottawa - Gatineau	1996
Frank Sisson's Silver Dollar Casino	Calgary	AB	Calgary	1996
Northlands Park [Racino]	Edmonton	AB	Edmonton	1996
Casino Calgary	Calgary	AB	Calgary	1997
Jackpot Casino	Red Deer	AB	Red Deer	1997
Rocky Mountain Turf Club	Lethbridge	AB	Lethbridge	1997
Great Canadian Casino Nanaimo	Nanaimo	BC	Nanaimo	1998
Windsor Raceway	Windsor	ON	Windsor	1998
Brantford Charity Casino	Brantford	ON	Brantford	1999
Casino Sault St. Marie	Sault St. Marie	ON	Sault Ste. Marie	1999
Fort Erie Racetrack	Fort Erie	ON	St. Catharines - Niagara	1999
Gateway Casino Burnaby	Burnaby	BC	Vancouver	1999
Sudbury Downs	Chelmsford	ON	Greater Sudbury	1999
Western Fair Raceway	London	ON	London	1999
Casino Yellowhead	Edmonton	AB	Edmonton	2000
Point Edward Charity Casino	Point Edward	ON	Sarnia	2000
Thunder Bay Charity Casino	Thunder Bay	ON	Thunder Bay	2000
Woodbine Racetrack	Toronto	ON	Toronto	2000
Boulevard Casino	Coquitlam	BC	Vancouver	2001
Great Canadian Casino View Royal	Victoria	BC	Victoria	2001
Fraser Downs Racetrack Casino	Surrey	BC	Vancouver	2004
Niagara Fallsview Casino Resort	Niagara Falls	ON	St. Catharines - Niagara	2004
River Rock Casino Resort	Richmond	BC	Vancouver	2004
Edgewater Casino	Vancouver	BC	Vancouver	2005
Century Casino & Hotel	Edmonton	AB	Edmonton	2006
Dakota Dunes Casino	Near Saskatoon	SK	Saskatoon	2007
Hastings Park Racecourse	Vancouver	BC	Vancouver	2007
Ludoplex Trois Rivieres	Trois-Rivires	QC	Trois-Rivires	2007
Salon de Jeux de Quebec	Quebec	QC	Qubec	2007
Starlight Casino	New Westminster	BC	Vancouver	2007

Table 2: Number of census tracts in CMA/CA and in treatment groups

Establishment	CMA/CA	Total in CMA/CA	Within 1.5 miles	Within 2 miles	Within 3 miles
Casino Edmonton	Edmonton	110	6	10	18
Treasure Cove Casino & Hotel	Prince George	27	8	10	14
Stampede Casino	Calgary	85	12	16	29
Elbow River Casino	Calgary	85	11	17	28
Palace Casino	Edmonton	110	6	8	13
Assiniboia Downs Club West Gaming Lounge	Winnipeg	113	3	5	7
Lake City Casino	Kelowna	25	6	6	8
Lake City Casino	Kamloops	26	5	7	10
Casino Lethbridge	Lethbridge	27	5	8	18
Casino de Montral	Montral	582	5	19	83
Club Regent Casino	Winnipeg	113	1	4	12
McPhillips Street Station Casino	Winnipeg	113	11	23	46
Casino Windsor	Windsor	56	11	17	28
Cash Casino	Red Deer	16	6	7	12
Casino Nova Scotia	Halifax	58	14	21	32
Baccarat Casino	Edmonton	110	11	18	40
Casino Regina	Regina	32	11	18	27
Casino du Lac-Leamy	Ottawa - Gatineau	143	6	12	23
Frank Sisson's Silver Dollar Casino	Calgary	85	2	6	22
Northlands Park [Racino]	Edmonton	110	11	19	37
Casino Calgary	Calgary	85	2	4	15
Jackpot Casino	Red Deer	16	9	12	16
Rocky Mountain Turf Club	Lethbridge	27	6	9	13
Great Canadian Casino Nanaimo	Nanaimo	19	3	5	8
Windsor Raceway	Windsor	56	13	16	27
Brantford Charity Casino	Brantford	21	9	10	14
Casino Sault St. Marie	Sault Ste. Marie	21	5	7	12
Fort Erie Racetrack	St. Catharines - Niagara	70	1	2	3
Gateway Casino Burnaby	Vancouver	186	4	8	24
Sudbury Downs	Greater Sudbury	32	1	2	2
Western Fair Raceway	London	72	11	18	29
Casino Yellowhead	Edmonton	110	2	4	11
Point Edward Charity Casino	Sarnia	17	3	8	13
Thunder Bay Charity Casino	Thunder Bay	25	6	10	12
Woodbine Racetrack	Toronto	490	4	7	9
Boulevard Casino	Vancouver	186	3	4	10
Great Canadian Casino View Royal	Victoria	46	2	3	7
Fraser Downs Racetrack Casino	Vancouver	186	1	2	2
Niagara Fallsview Casino Resort	St. Catharines - Niagara	70	5	7	13
River Rock Casino Resort	Vancouver	186	4	6	16
Edgewater Casino	Vancouver	186	15	22	38
Century Casino & Hotel	Edmonton	110	6	9	17
Dakota Dunes Casino	Saskatoon	28	9	13	17
Hastings Park Racecourse	Vancouver	186	8	9	23
Ludoplex Trois Rivieres	Trois-Rivires	29	10	12	19
Salon de Jeux de Quebec	Qubec	104	23	35	49
Starlight Casino	Vancouver	186	2	5	15
Average		98	6.6	10.4	19.5

Table 3: Differences in initial census tract characteristics

		2-Mile Radius			PSM
Variable	Statistic	Within	Outside	Difference	Neighbors
Dwelling Values	mean	163440.8	181228.8	-17788	163215.1
	std error	(16027.7)	(16550.5)	(4494.2)	(16317.8)
Gross Rent	mean	624.8	680.7	-55.9	644.4
	std error	(18.6)	(19.5)	(8.1)	(25.7)
Average Household Income	mean	46401.9	58186.7	-11784.8	48283
	std error	(1676.1)	(1518.5)	(1326.5)	(2109.6)
Median Household Income	mean	38773.9	50198.4	-11424.4	41219.1
	std error	(1535.9)	(1095.3)	(1345.7)	(1829.2)
Share of Residents Age 65 or Above	mean	14.4	11.5	3	13.8
	std error	(.7)	(.5)	(.6)	(.8)
Share of Male	mean	48.8	49.1	-.3	48.9
	std error	(.2)	(.1)	(.2)	(.2)
Share of Married Residents	mean	47.7	56.8	-9.1	50.6
	std error	(1.3)	(.8)	(1.2)	(1.5)
Share of Owner Occupied Units	mean	54	71	-17	58.5
	std error	(2.1)	(.9)	(2.3)	(2.7)
Unemployment Rate	mean	9.6	7.8	1.8	9.2
	std error	(.5)	(.3)	(.3)	(.4)

Notes: The statistics above are from an un-weighted sample of 47 facilities. Each treatment or control area associated with an individual facility is regarded as a single observation.

Table 4: Regressions analysis - DV is percent population growth in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-2.71	1.47	-.01	1.01
	(2.30)	(2.33)	(1.48)	(1.33)
Within-radius indicator*Distance to casino	-.004	-.92	-.04	-.69
	(1.02)	(1.01)	(0.6)	(0.68)
Distance to casino	0.23	0.03	0.01	0.1
	(0.09)**	(0.08)	(0.05)	(0.12)
Initial share of residents age 15 or below		-.16	-.28	0.1
		(0.19)	(0.08)**	(0.12)
Initial share of residents age 65 or above		-.46	-.04	0.05
		(0.12)**	(0.04)	(0.08)
Initial share of male residents		0.68	0.21	0.29
		(0.15)**	(0.11)	(0.12)*
Initial share of married residents		0.29	0.06	-.11
		(0.1)**	(0.07)	(0.1)
Initial unemployment rate		-.41	0.11	-.49
		(0.13)**	(0.1)	(0.18)**
Initial share of owner-occupied units		0.03	0.08	-.01
		(0.07)	(0.04)	(0.04)
Initial average household income		-4.39	-1.66	-1.12
		(2.08)*	(1.00)	(3.97)
Initial average dwelling value		3.56	0.44	2.95
		(2.59)	(1.30)	(2.22)
Preceding 5-yr trend of the DV			0.64	0.52
			(0.07)**	(0.07)**
Obs.	4559	4559	4559	962
e(N-clust)	90	90	90	90
R^2	0.07	0.15	0.54	0.48

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 5: Regressions analysis - DV is changes in percent share of residents age 15 and below in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	0.02	-.32	-.28	-.39
	(0.17)	(0.19)	(0.17)	(0.23)
Within-radius indicator*Distance to casino	0.02	0.11	0.09	0.18
	(0.08)	(0.08)	(0.07)	(0.13)
Distance to casino	-.03	-.008	-.004	0.008
	(0.01)**	(0.01)	(0.008)	(0.02)
Initial share of residents age 15 or below		-.12	-.13	-.08
		(0.02)**	(0.01)**	(0.02)**
Initial share of residents age 65 or above		0.02	-.01	0.04
		(0.01)*	(0.004)**	(0.01)**
Initial share of male residents		-.005	-.03	0.02
		(0.01)	(0.008)**	(0.04)
Initial share of married residents		0.02	0.02	-.002
		(0.008)**	(0.007)**	(0.01)
Initial unemployment rate		0.07	0.07	0.02
		(0.02)**	(0.01)**	(0.03)
Initial share of owner-occupied units		-.004	0.007	-.006
		(0.006)	(0.004)*	(0.007)
Initial average household income		0.66	0.32	1.73
		(0.21)**	(0.17)	(0.5)**
Initial average dwelling value		-.07	-.07	-.64
		(0.17)	(0.15)	(0.33)
Preceding 5-yr trend of the DV			0.38	0.22
			(0.04)**	(0.06)**
Obs.	4556	4556	4556	960
e(N-clust)	90	90	90	90
R^2	0.21	0.43	0.55	0.64

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 6: Regressions analysis - DV is changes in percent share of residents age 65 and above in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-.90	0.05	0.17	0.43
	(0.25)**	(0.16)	(0.13)	(0.27)
Within-radius indicator*Distance to casino	0.17	-.05	-.09	-.17
	(0.12)	(0.08)	(0.07)	(0.15)
Distance to casino	0.01	-.0009	0.01	0.01
	(0.005)**	(0.004)	(0.003)**	(0.02)
Initial share of residents age 15 or below		-.13	-.06	-.14
		(0.02)**	(0.01)**	(0.03)**
Initial share of residents age 65 or above		-.10	-.09	-.13
		(0.01)**	(0.01)**	(0.02)**
Initial share of male residents		-.08	-.06	-.14
		(0.02)**	(0.01)**	(0.05)**
Initial share of married residents		0.09	0.04	0.08
		(0.01)**	(0.006)**	(0.02)**
Initial unemployment rate		0.05	0.02	0.14
		(0.02)**	(0.01)	(0.03)**
Initial share of owner-occupied units		-.009	-.01	-.0009
		(0.006)	(0.003)**	(0.008)
Initial average household income		1.23	0.91	0.004
		(0.58)*	(0.43)*	(0.87)
Initial average dwelling value		-.76	-.22	0.36
		(0.3)*	(0.21)	(0.5)
Preceding 5-yr trend of the DV			0.57	0.54
			(0.03)**	(0.04)**
Obs.	4556	4556	4556	960
e(N-clust)	90	90	90	90
R^2	0.08	0.3	0.54	0.64

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 7: Regressions analysis - DV is changes in percent share of male residents in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	0.08	-.002	0.02	-.14
	(0.13)	(0.1)	(0.07)	(0.13)
Within-radius indicator*Distance to casino	0.02	0.03	0.02	0.06
	(0.06)	(0.04)	(0.03)	(0.07)
Distance to casino	-.006	0.003	0.002	-.005
	(0.003)*	(0.002)	(0.002)	(0.008)
Initial share of residents age 15 or below		0.01	0.008	-.0005
		(0.004)**	(0.003)*	(0.02)
Initial share of residents age 65 or above		0.003	0.002	-.008
		(0.004)	(0.003)	(0.01)
Initial share of male residents		-.08	-.07	-.13
		(0.01)**	(0.01)**	(0.03)**
Initial share of married residents		-.006	-.005	-.02
		(0.004)	(0.003)	(0.01)
Initial unemployment rate		0.007	0.001	0.01
		(0.008)	(0.006)	(0.02)
Initial share of owner-occupied units		-.002	-.0008	-.002
		(0.002)	(0.002)	(0.005)
Initial average household income		-.21	-.23	-.59
		(0.14)	(0.11)*	(0.39)
Initial average dwelling value		0.01	-.006	0.44
		(0.09)	(0.08)	(0.23)
Preceding 5-yr trend of the DV			0.22	0.12
			(0.04)**	(0.05)*
Obs.	4556	4556	4556	960
e(N-clust)	90	90	90	90
R^2	0.06	0.19	0.24	0.44

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 8: Regressions analysis - DV is changes in percent share of married residents in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-.43	-.26	-.17	-.28
	(0.27)	(0.26)	(0.22)	(0.32)
Within-radius indicator*Distance to casino	0.03	0.03	0.01	0.1
	(0.1)	(0.11)	(0.1)	(0.19)
Distance to casino	-.03	-.005	0.0005	0.03
	(0.02)	(0.007)	(0.007)	(0.02)
Initial share of residents age 15 or below		-.20	-.08	0.02
		(0.02)**	(0.01)**	(0.04)
Initial share of residents age 65 or above		-.07	-.05	0.04
		(0.008)**	(0.008)**	(0.03)
Initial share of male residents		-.05	-.09	0.09
		(0.02)*	(0.02)**	(0.05)
Initial share of married residents		0.07	-.02	-.08
		(0.02)**	(0.01)	(0.02)**
Initial unemployment rate		0.14	0.11	0.07
		(0.03)**	(0.02)**	(0.05)
Initial share of owner-occupied units		-.008	0.01	-.005
		(0.008)	(0.007)	(0.01)
Initial average household income		0.61	0.49	3.34
		(0.3)*	(0.28)	(1.15)**
Initial average dwelling value		1.12	0.73	0.05
		(0.45)*	(0.36)*	(0.67)
Preceding 5-yr trend of the DV			0.43	0.36
			(0.02)**	(0.06)**
Obs.	4556	4556	4556	960
e(N-clust)	90	90	90	90
R^2	0.43	0.54	0.64	0.69

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 9: Regressions analysis - DV is changes in percent share of unemployed residents in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-.75	-.17	-.19	-1.06
	(0.25)**	(0.33)	(0.34)	(0.33)**
Within-radius indicator*Distance to casino	0.17	0.04	0.04	0.34
	(0.12)	(0.14)	(0.14)	(0.18)
Distance to casino	0.02	-.01	-.01	-.06
	(0.009)	(0.009)	(0.01)	(0.01)**
Initial share of residents age 15 or below		0.02	0.02	0.06
		(0.02)	(0.02)	(0.03)
Initial share of residents age 65 or above		0.007	0.01	0.01
		(0.01)	(0.01)	(0.02)
Initial share of male residents		-.03	-.01	0.05
		(0.03)	(0.02)	(0.04)
Initial share of married residents		0.03	0.02	-.03
		(0.02)	(0.02)	(0.03)
Initial unemployment rate		-.26	-.29	-.47
		(0.06)**	(0.05)**	(0.05)**
Initial share of owner-occupied units		-.01	-.01	-.02
		(0.004)**	(0.004)**	(0.01)
Initial average household income		-.66	-.85	-1.58
		(0.64)	(0.69)	(1.19)
Initial average dwelling value		0.62	0.63	0.63
		(0.49)	(0.48)	(0.72)
Preceding 5-yr trend of the DV			0.06	0.13
			(0.05)	(0.07)
Obs.	3300	3300	3300	720
e(N-clust)	70	70	70	70
R^2	0.3	0.46	0.47	0.57

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 10: Regressions analysis - DV is changes in percent share of owner-occupied housing units in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-.11	-.11	-.06	0.98
	(0.47)	(0.46)	(0.41)	(0.62)
Within-radius indicator*Distance to casino	-.05	0.003	0.009	-.13
	(0.2)	(0.18)	(0.17)	(0.34)
Distance to casino	-.02	0.004	0.003	0.01
	(0.01)	(0.02)	(0.01)	(0.04)
Initial share of residents age 15 or below		-.0007	0.02	0.08
		(0.04)	(0.04)	(0.07)
Initial share of residents age 65 or above		-.07	-.04	0.03
		(0.02)**	(0.02)*	(0.05)
Initial share of male residents		0.07	0.09	0.02
		(0.06)	(0.05)	(0.08)
Initial share of married residents		0.04	0.04	0.05
		(0.02)*	(0.01)**	(0.03)
Initial unemployment rate		-.19	-.18	-.13
		(0.04)**	(0.04)**	(0.07)
Initial share of owner-occupied units		-.07	-.07	-.07
		(0.01)**	(0.01)**	(0.03)*
Initial average household income		0.78	0.54	0.09
		(0.69)	(0.7)	(1.67)
Initial average dwelling value		-.45	-.53	0.88
		(0.28)	(0.33)	(0.91)
Preceding 5-yr trend of the DV			0.2	0.3
			(0.05)**	(0.08)**
Obs.	3300	3300	3300	720
e(N-clust)	70	70	70	70
R^2	0.12	0.2	0.23	0.42

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 11: Regressions analysis - DV is percent changes in average household income in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	2.40	1.37	1.52	3.74
	(1.40)	(1.05)	(1.03)	(1.32)**
Within-radius indicator*Distance to casino	-.67	-.33	-.35	-.59
	(0.6)	(0.52)	(0.52)	(0.81)
Distance to casino	0.13	0.1	0.09	0.4
	(0.06)*	(0.04)**	(0.03)**	(0.13)**
Initial share of residents age 15 or below		0.74	0.69	0.31
		(0.17)**	(0.16)**	(0.18)
Initial share of residents age 65 or above		0.38	0.36	0.02
		(0.12)**	(0.12)**	(0.1)
Initial share of male residents		0.9	0.82	0.24
		(0.09)**	(0.12)**	(0.21)
Initial share of married residents		-.44	-.40	-.05
		(0.06)**	(0.05)**	(0.13)
Initial unemployment rate		-.41	-.39	-.43
		(0.09)**	(0.09)**	(0.3)
Initial share of owner-occupied units		0.05	0.06	0.15
		(0.05)	(0.05)	(0.07)*
Initial average household income		-2.53	-4.06	-23.74
		(4.24)	(4.05)	(9.91)*
Initial average dwelling value		13.69	13.78	17.31
		(2.04)**	(2.01)**	(7.21)*
Preceding 5-yr trend of the DV			0.07	0.01
			(0.07)	(0.11)
Obs.	3300	3300	3300	720
e(N-clust)	70	70	70	70
R^2	0.36	0.46	0.47	0.54

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 12: Regressions analysis - DV is percent changes in median household income in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	3.76	2.17	2.24	4.97
	(1.35)**	(1.32)	(1.30)	(1.76)**
Within-radius indicator*Distance to casino	-1.19	-.81	-.82	-.31
	(0.58)*	(0.55)	(0.54)	(1.06)
Distance to casino	0.11	0.06	0.06	0.35
	(0.04)**	(0.05)	(0.05)	(0.15)*
Initial share of residents age 15 or below		0.63	0.62	0.57
		(0.07)**	(0.08)**	(0.29)
Initial share of residents age 65 or above		0.25	0.25	0.22
		(0.06)**	(0.06)**	(0.13)
Initial share of male residents		0.89	0.85	0.51
		(0.14)**	(0.14)**	(0.17)**
Initial share of married residents		-.36	-.34	-.38
		(0.07)**	(0.07)**	(0.25)
Initial unemployment rate		-.55	-.53	0.03
		(0.14)**	(0.15)**	(0.33)
Initial share of owner-occupied units		0.06	0.06	0.22
		(0.03)	(0.03)	(0.08)**
Initial average household income		-7.23	-7.75	-13.85
		(2.11)**	(2.11)**	(14.32)
Initial average dwelling value		9.88	9.84	15.56
		(2.12)**	(2.12)**	(7.17)*
Preceding 5-yr trend of the DV			0.02	0.1
			(0.04)	(0.16)
Obs.	3299	3299	3299	720
e(N-clust)	70	70	70	70
R^2	0.3	0.34	0.35	0.37

Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 13: Regressions analysis - DV is percent changes in average gross rent in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-2.76	-3.75	-4.67	-3.97
	(1.42)	(1.54)*	(1.68)**	(1.96)*
Within-radius indicator*Distance to casino	0.87	1.17	1.55	1.70
	(0.62)	(0.64)	(0.68)*	(1.08)
Distance to casino	0.006	0.03	0.05	-.17
	(0.04)	(0.04)	(0.04)	(0.15)
Initial share of residents age 15 or below		0.27	0.29	-.29
		(0.19)	(0.19)	(0.19)
Initial share of residents age 65 or above		0.23	0.25	-.19
		(0.13)	(0.14)	(0.12)
Initial share of male residents		0.49	0.59	0.07
		(0.14)**	(0.17)**	(0.25)
Initial share of married residents		-.11	-.10	0.19
		(0.05)*	(0.05)*	(0.12)
Initial unemployment rate		-.40	-.43	-.19
		(0.13)**	(0.16)**	(0.16)
Initial share of owner-occupied units		-.08	-.10	-.09
		(0.04)	(0.06)	(0.04)*
Initial average household income		2.38	2.93	0.23
		(2.42)	(2.24)	(4.00)
Initial average dwelling value		0.89	1.28	0.12
		(0.97)	(0.91)	(3.05)
Preceding 5-yr trend of the DV			-.18	-.13
			(0.08)*	(0.08)
Obs.	3296	3296	3296	718
e(N-clust)	70	70	70	70
R^2	0.29	0.3	0.32	0.59

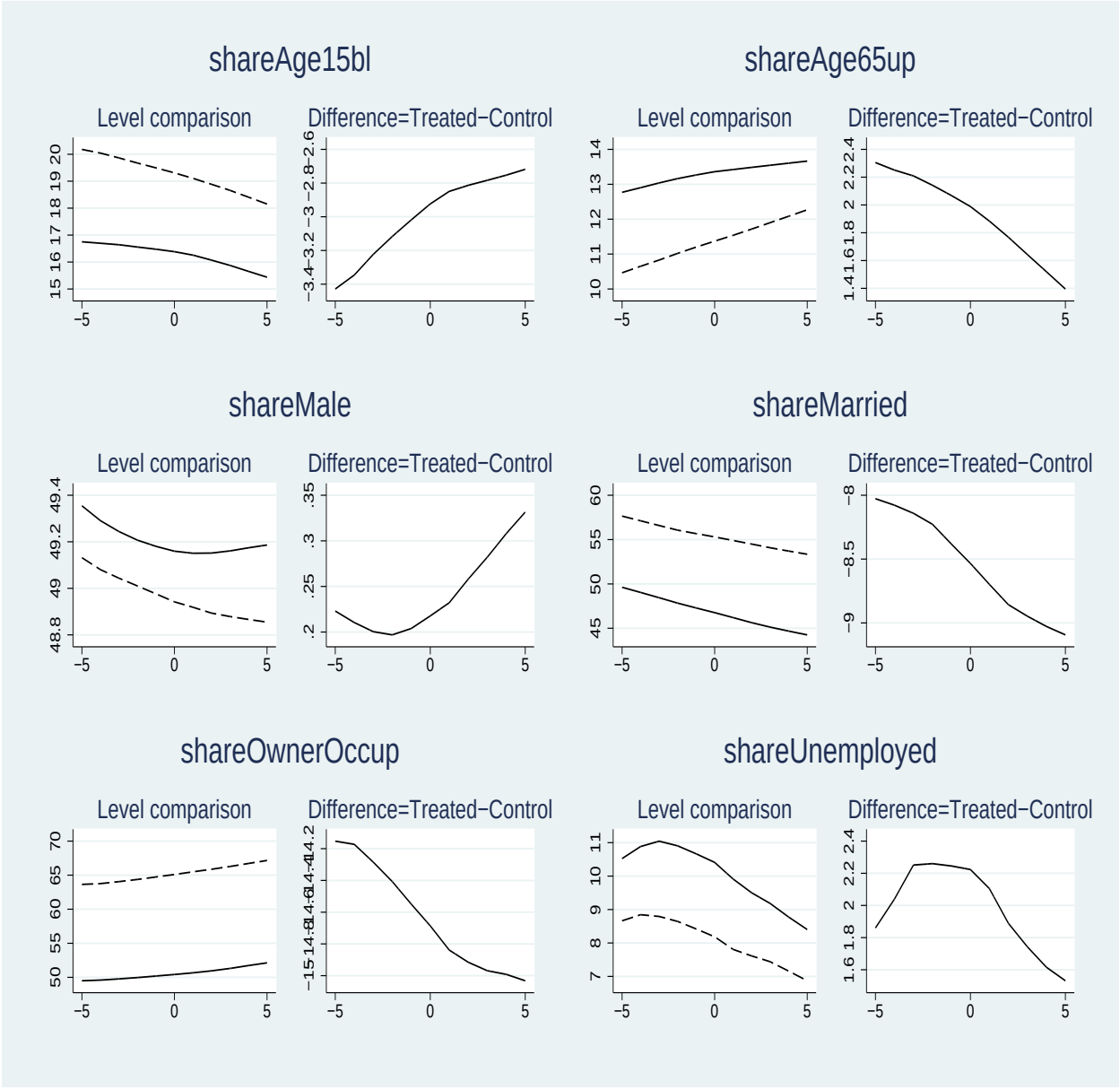
Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Table 14: Regressions analysis - DV is percent changes in the average dwelling value in 5 years since opening

	C1	C2	C3	C4
	(1)	(2)	(3)	(4)
Within-radius indicator	-1.99	-3.80	-4.13	-.80
	(1.46)	(1.55)*	(1.57)**	(1.66)
Within-radius indicator*Distance to casino	0.87	1.18	1.35	0.83
	(0.65)	(0.58)*	(0.61)*	(0.93)
Distance to casino	0.13	0.08	0.05	-.04
	(0.07)	(0.07)	(0.05)	(0.12)
Initial share of residents age 15 or below		0.3	0.15	-.18
		(0.17)	(0.15)	(0.14)
Initial share of residents age 65 or above		0.31	0.23	0.05
		(0.09)**	(0.07)**	(0.07)
Initial share of male residents		1.07	0.96	0.57
		(0.28)**	(0.27)**	(0.16)**
Initial share of married residents		-.20	-.11	-.07
		(0.12)	(0.1)	(0.13)
Initial unemployment rate		-.79	-.65	-.41
		(0.19)**	(0.18)**	(0.26)
Initial share of owner-occupied units		-.05	-.07	0.02
		(0.05)	(0.05)	(0.06)
Initial average household income		1.58	2.67	5.33
		(4.07)	(4.15)	(6.50)
Initial average dwelling value		-1.76	-3.18	-7.52
		(3.71)	(3.57)	(4.20)
Preceding 5-yr trend of the DV			0.2	-.04
			(0.05)**	(0.07)
Obs.	3298	3298	3298	720
e(N-clust)	70	70	70	70
R^2	0.88	0.89	0.89	0.89

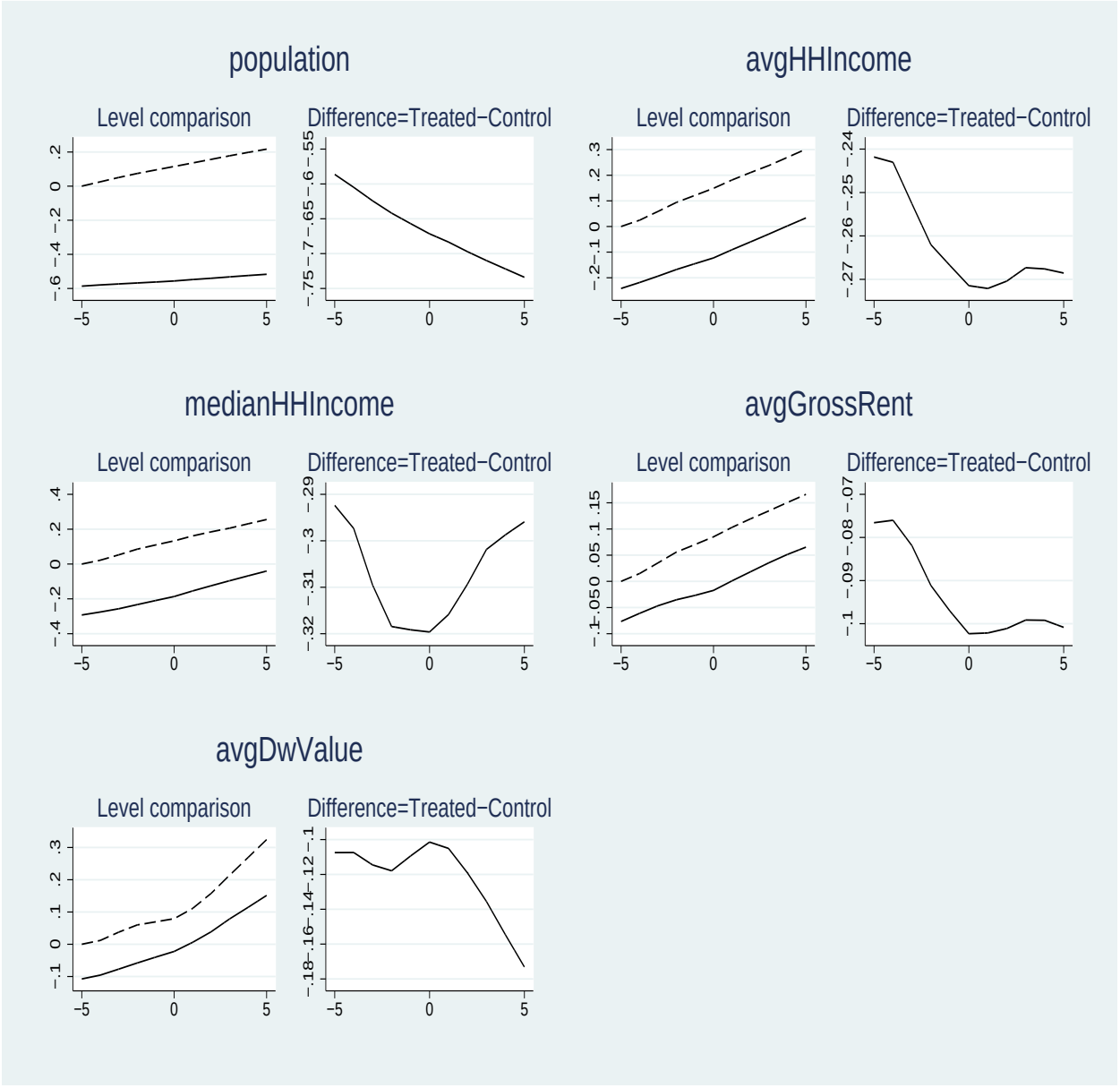
Notes: 1). Columns (1)-(3) use the fullest sample, and a maximum sphere of influence with a 3-mile radius. The sample used in Column (4) includes only the treated neighborhoods and PSM-selected control neighborhoods, and uses a smaller 2-mile radius to define "treatment". 2). Standard errors in parentheses. *, **, and *** indicate statistical significance at 10 percent, 5 percent and 1 percent levels. All standard errors are cluster-adjusted at the level of treatment/control groups by casino. Therefore, for each casino there are two clusters, the treatment and the control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)".

Figure 1: Comparing trajectories of outcome variables in treated and control areas (more specifically areas within and outside a 2-mile radius, respectively) – Part 1 of 2 parts; solid lines are for treated areas, or indicate treated-control differences



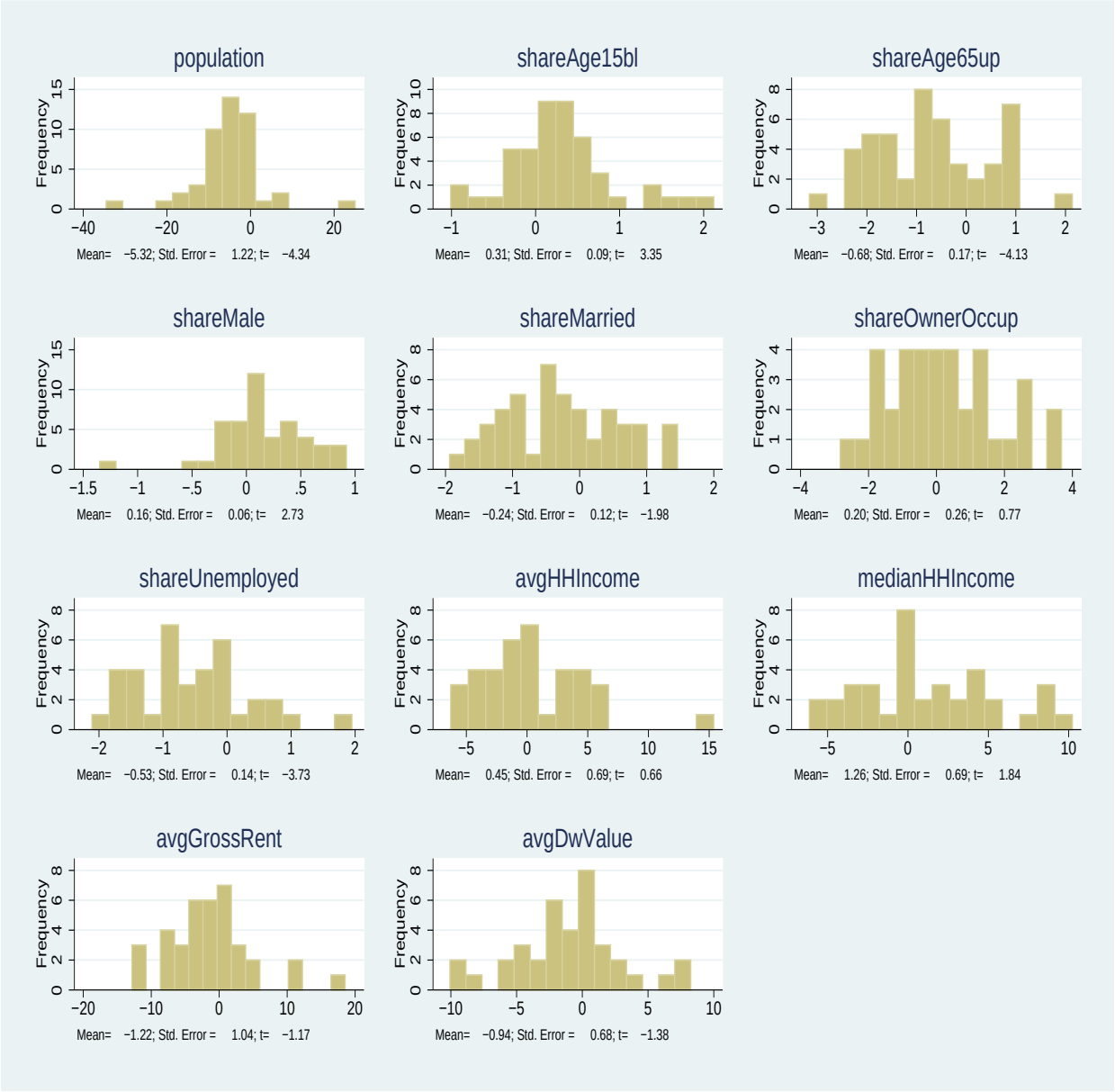
Notes: The variables are, clockwise, share of persons age below 15, share of persons age 65 and above, share of male residents, share of married residents, share of owner-occupied housing, and share of unemployed residents.

Figure 2: Comparing trajectories of outcome variables in treated and control areas (more specifically areas within and outside a 2-mile radius, respectively) – Part 2 of 2 parts; solid lines are for treated areas, or indicate treated-control differences



Notes: The variables are the logarithm transformation of, clockwise, average population size of census tracts, average household income, median household income, average gross rent, average dwelling value. All are normalized such that the control areas have a value of zero in the initial year.

Figure 3: Histograms of 5-year growth differentials between treated and control areas (more specifically areas within and outside a 2-mile radius, respectively)



Notes: The 11 panels, clockwise, are respectively treatment-control differences in population growth, changes in the share of persons age below 15, changes in the share of persons age 65 and above, changes in the share of male residents, changes in share of married persons, changes in the share of owner-occupied housing, changes in share of unemployed persons, percent changes in average household income, percent changes in median household income, percent changes in average gross rent, and percent changes in average dwelling value.

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