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Abstract

We examine the housing-market impact of U.S. urban casinos in nearby neighborhoods using data on home-purchase mortgage applications around opening years. Our sample covers 48 new urban casinos opened between 1995 and 2009. We compare changes in the volume of mortgage applications, the average loan amount and the average income of applicants in census tracts near new casinos to those farther away in the same metropolitan areas. We find that casino openings had little impact on the number of applications or applicants' economic profile, but they were associated with declines in the growth of the average loan amount, which we use as a proxy for house prices. The negative effect persists even after we control for possible anticipation effects through which casino openings affect house prices before the openings, and urban casinos' tendency to locate near poor neighborhoods that were disproportionately affected by the subprime mortgage expansion and collapse in the U.S. The estimated loss is 6-7 percentage points from trend over 3 years. We interpret the findings as evidence of casinos' negative impacts on residential amenities.

Keywords: casino, economic impact, amenities
JEL codes: R31, L83

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1 Introduction

Local and state governments in the US increasingly take a favorable view of permitting or expanding legal casino gambling in urban areas. One example is Ohio's 2009 successful referendum that allowed casinos to open in Cleveland, Columbus, Cincinnati and Toledo. Casinos can generate both positive and negative impacts in the local economy, as well as generating distributional consequences if the benefits and costs are not borne by the same group. For urban casinos, the distribution is likely more uneven than those on tribal or rural lands. In cities, taxes and jobs from casinos are shared widely, while noise and light pollution, traffic jams and other disamenities are localized in nearby neighborhoods. Studies in Canada, which in recent decades has had a large number of urban casinos in major cities, highlight the double-edge nature of casino development. Huang, Humphreys, and Zhou (2014) examined data from about 40 Canadian urban casinos opened between 1986 and 2007, and reported evidence of positive economic impacts in the form of greater declines in local unemployment rates and faster increases in household income. But they also found evidence of negative impacts on the growth in rent and home values. Since casinos' housing-market impacts are localized, they are the key factor leading to a potentially asymmetric distribution of costs and benefits from casino openings in cities.

In this paper we use detailed U.S. mortgage application data to further explore the housing-market impacts of casino openings. We match the opening of 48 U.S. urban casinos to the yearly data on home-purchase mortgage applications from the Home Mortgage Disclosure Act (HMDA). The mortgage data are available at the level of census tracts, residential areas that are small and stable to generate narrowly defined neighborhoods for comparison over time. We extract from the raw data the number of applications for home purchase loans, the average loan amount of those applications and the average income of the applicants. We then compare census tracts near new casinos and those farther away to see whether and how the trajectories of these housing-market variables are affected by the opening of casinos.

Wenz (2007) analyzed Public Use Microdata from the 1990 and 2000 U.S. Censuses with a hedonic approach to estimate the impact of casino presence on home values. The estimates suggest a positive casino effect, about 2%, on nearby houses; though the estimated casino impact is stronger, close to 6%, in bordering regions in the same states that do not have casinos. Wiley and Walker (2011) reported that retail property values increased in a five mile radius of a new casino opened in Detroit using transactions data from 2001 to 2008. Several other papers focus on casinos'

social impacts, though they are 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). Wenz (2008), a study on casino openings and life quality, uses county-level data.

Unlike the hedonic model in Wenz (2007), we use a difference-in-difference approach, comparing neighborhoods close to new casino to those farther away around the opening years. The longitudinal information allows us to use before-and-after changes to evaluate the impacts of new casino openings. In addition, our study covers multiple aspects of housing-market outcomes, including not just housing prices (proxied by the average value of home-purchase loans in a difference-in-differences framework), but also housing-market activity (volume of home-purchase loan applications) and the economic profile of home buyers.

We report estimates from multiple empirical models, including 1) a basic difference-in-difference (D-in-D) model, 2) cross sectional and panel regression models that control for local characteristics and pre-opening time trends, and 3) Propensity Score Matching (PSM) models that select control neighborhoods for comparisons with areas near new casinos.

We find no evidence that casino openings affect the number of mortgage applications or the economic profile of applicants. There is, however, evidence that casino openings slow the growth rate of the value of home-purchase mortgage loans. The finding is robust in tests designed to allow alternative explanations including anticipation effects before casino openings, or spurious correlations due to the subprime housing market boom and bust. We interpret the finding as evidence of the casinos' negative effect on house prices.

2 Data and Empirical Strategy

2.1 Casinos in the sample

We collected data, including longitude and latitude information, on more than 500 casinos (including "river boat" casinos) opened in the US in the past three decades. More than half of the casinos are located on tribal land and are excluded from the analysis. Among the rest, about half are located outside metropolitan statistical areas in the 2000 census; they are excluded as well. We also exclude casinos that have less than one census-tract population centroid, as of the 2000 Census, within a 2 mile

radius from their locations. The final sample includes 48 casinos in 28 metropolitan areas that opened between 1995 and 2009 and have matching mortgage data from the Home Mortgage Disclosure Act (HMDA).[1] This constitutes the main analysis sample. Table 1 lists the casinos, the metropolitan areas, and the years of opening. We focus on new casinos. As a result our sample does not include long-established urban casinos like those in Atlantic City, New Jersey.

Local areas and proximity to casinos

We use census tracts to define neighborhoods. Census tracts, according to the US Census Bureau are "small, relatively permanent statistical subdivisions of a county or equivalent ... generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people." To measure distance to casino, we calculate the straight-line distance, calculated from longitude and latitude, between a census tract's population centroid and casinos in each metropolitan area. We use the population centroid from the 2000 Census, assuming that the centroid is largely stable over time.

In some cases we use a two-mile radius from casinos to census tract centroids to allocate census tracts into treated areas or non-treated areas; those that have a population centroid within a two-mile radius belong to the treated area; those outside the radius but in the same metropolitan area belong to the non-treated area.

The 0-or-1 division of neighborhoods into treated and non-treated groups is restrictive, and places much importance on the choice of the radius length. We use this division primarily for descriptive purpose. In our statistical analysis, we follow an approach used in Ahlfeldt and Kavetsos (2014) and Huang et al. (2014) that uses a larger radius to capture the maximum sphere of influence, and allows diminishing effects within the sphere.

Table 2 reports the numbers of census tracts associated with each individual casino, the total number of census tracts in each metropolitan area, 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 the potential treatment areas.

[1] We also eliminated two casinos that have so few census tracts outside a 2-mile radius that a propensity score matching procedure, to be detailed later, cannot be meaningfully applied due to perfect predictions in the first stage, and one casino for which the time series are incomplete and is thus excluded from panel regressions.

2.2 HMDA data and the outcome variables of interest

For outcome variables, we are interested in both house prices and transaction volume, as well as changes in residential population composition that may influenced by casino openings. We obtained relevant variables from the Home Mortgage Disclosure Act (HMDA) – yearly mandatory disclosure reports submitted by mortgage lending institutions. We focus on home-purchase loans, as opposed to refinance loans or home-improvement loans. HMDA reports contain detailed application-level information for individual home-purchase mortgage applications, including the property location, the loan amount and the income and characteristics of the applicant. The HDMA reports have extensive coverage. Avery et al. (2007) suggested that HMDA-covered lenders accounted for about 80 percent of home lending nationwide. Recent studies that make use of HMDA mortgage application data include Munnell et al. (1996), Mian and Sufi (2009), Goodman and Smith (2010), and Hanson et al. (2012).

HMDA reports do not include house prices. We use loan amounts as a proxy for house prices; this understates the house price as buyers use more cash to purchase the house. We perform differences-in-differences comparisons on variables from the HDMA before and after casino openings. For the comparison to be valid, we only require that changes in loan-to-price ratios are not systematically correlated with casino locations. We recognize the possibility for such systemic correlation to arise. Specifically, we find that U.S. urban casinos tend to locate near poor neighborhoods. Over much of our sample period, the well-known U.S. subprime expansion and collapse took place. To the extent that the credit cycle affected the loan-to-price ratios in poor urban neighborhoods – where new casinos are more likely to locate – more heavily than in wealthier neighborhoods, approximating prices with loan amounts can generate biases in our analysis. To address this concern, we will control for census-tract level socio-economic characteristics in our regression models, and use robustness tests to account for potential relative time trends caused by the subprime lending cycle.

We use HMDA data from 1992 to 2011, during which there is one change in census tract delineations, in 2002, from the 1990 Census delineations to the 2000 Census delineations. To ensure comparability over time, it is necessary to reconstruct a consistent census tract delineation before and after 2002. This can be done using the Census Bureau's between-census geographic relationship crosswalk file. Using the crosswalk, and resident population counts as weights, we reconstruct consistent time series using the 1990-Census delineations. We use the 1990 definition because just above half of our mortgage data (11 years out of 20) are based on this definition. We use the Census-2000 resident population as weights in the reconstruction process,

because that year is roughly the midpoint of the sample period.[2]

From the HMDA we extract the yearly observations, at the census tract level, of the follow variables:

- Number of home-purchase mortgage loan applications.[3]
- The average loan amount of those applications.
- The average applicant income of those applications.

These variables are the outcomes in our empirical analysis.

2.3 Descriptive statistics

New urban casinos in the U.S. tend to locate in poor neighborhoods. Table 3 compares the Census 2000 profiles of census tracts near new casinos with those farther away in the same metropolitan areas. Neighborhoods near casinos tend to be poorer, have lower median household income, lower median home values, higher unemployment rates, lower educational attainment, higher poverty rates, greater shares of minority residents, older houses, and greater shares of renter-occupied housing units. The differences are substantial in some cases. The median income, for example, is 30% lower within a 2-mile radius than those census tracts farther away; the median housing value is 25% lower; the poverty rate is 8% higher and the unemployment rate is 3 percentage points higher. The average dwelling is 6 years older. The pattern is similar to those found near urban casinos in Canada (Huang et al., 2014). The table also compares the two groups in terms of the housing-market variables from the HMDA.

[2]The reconstruction proceeds in two steps. First, we use resident population counts in the 2000 Census as weights to allocate the post-2002 application counts, the sum of loan amounts, and the sum of applicant income to the pre-2002 delineations. The next step is just to calculate the average loan amount and average income based on those aggregate numbers. The Appendix in Huang and Humphreys (2014) describes in more detail the allocation process for the case of mortgage counts.

[3]Beside home-purchase loans applications received by lenders, the HMDA reports also include loan applications for home improvement and refinancing loans, as well as loans purchased by lenders from other financial institutions. We focus solely on home-purchase loan applications, and exclude loans purchased from other lenders to avoid double counting, since those loans would have been reported by other lenders in current year or in years before. Home-purchase loans can be used for newly-constructed or existing residences; the residences include single family homes, multi-family dwellings, and individual condominium or cooperative units in multi-unit structures. We use what the HMDA calls "one-to-four-family dwellings," which includes not just detached housing units, but also individual condominium or cooperative units "even if the unit is located in a structure that houses five or more families" (See for example page 27 of the 2003 *A GUIDE TO HMDA Reporting: Getting It Right!*). We include applications for loans insured by government agencies, such as the Federal Housing Administration (FHA) and Veterans Administration (VA), as well as loans that are not insured by the government.

It shows that, in the years of casino openings, neighborhoods close to new casinos have fewer home-purchase loan applications per 1,000 residents (by 23%), a smaller average loan amount (by 19%) and a lower average applicant income (by 10%). To the extent these differences are related to future economic growth, there may be systemic differences between the treated and non-treated areas in our sample even if those casinos were not opened. Much of our later analysis is designed to avoid wrongly attributing those growth differentials to casino openings.

Next we plot, for each of the three outcome variables, a *typical* trajectory around the year of casino opening. Specifically, we plot the 6-year time series centering on the opening year. If the opening year is 2000, the time series covers the years from 1997 to 2002 with year 1997 as time 1, the opening year as time 4, and year 2002 as time 6. An average trajectory can be plotted for a casino using the population-weighted averages of all relevant census tracts. There are multiple casinos. A typical trajectory is just the population-weighted averages of all those trajectories. This method of presentation is commonly used in business-cycle research, in which the trajectory of a typical business cycle averaged across multiple cycles that occurred over different periods of times.

Figure 1 shows the plots, comparing treated areas (census tracts within a 2-mile radius) to non-treated areas (census tracts outside the 2-mile radius). The number of mortgage applications is expressed in terms of applications per 1,000 residents. The average loan amount and applicant income are expressed as logarithmic transformation times 100. For each of the outcome variables, the left-hand side panel shows the levels and the right-hand side panel shows the gap between treated and non-treated areas. From the plots, treated areas tend to have fewer mortgage applications before casino openings. The gap narrows over the 3 years leading to the opening year, but widens again after the openings. The average loan amount is 20% lower in treated areas in the initial year. The gap narrows to 18% in the opening year, and remains largely flat afterward. The average applicant income in treated areas is 8% lower at the beginning. The gap narrows to 6% in the opening year but widens again afterward, ending with a gap greater than 7%.

2.4 Basic D-in-D comparison

Next we conduct an unconditional D-in-D analysis for illustrative purposes, comparing census tracts within a 2-mile radius (the treated area) to those outside in the same metropolitan area (the non-treated area). Let H indicate one of the outcome

variables. We calculate the 3-year-before-and-3-year-after growth, or

$$Y_i = \left(\frac{\sum_{j=0}^{j=2} H_{i,t+j}}{\sum_{k=1}^{k=3} H_{i,t-k}} - 1 \right) \times 100, \tag{1}$$

for the treated and non-treated areas, respectively, before calculating the difference between these two growth rates. The result is the growth differential for treated and untreated areas. Assuming homogeneous growth rates in the absence of the casino openings, the growth differential could be interpreted as the treatment effect.

Tables 4 to 6 report the growth rates and differentials for each of the casinos in the sample. Figure 3 shows the distribution of the growth differentials in the form of histograms. Based on these growth differentials, there is little evidence that casino openings affect the volume of mortgage applications. For the average loan amount and applicant income, the casino impacts appear positive, meaning that loan application values in neighborhoods near new casinos grew faster (by about 4.5% in both cases from the three before to the three years after) than in neighborhoods farther away from the new casinos. The estimated differences have statistical significance at convention levels (shown at the bottom of the histograms).

3 Econometric models and results

We now proceed to a conditional statistical analysis of the three outcome variables. First we relax an assumption, used in the unconditional D-in-D comparison above, that the effects of casino openings are uniform within a given radius, and zero outside. Instead, we use a relatively large radius (3 miles) as the maximum sphere of influence of a casino opening, and include an interaction term to allow the casino effects to vary within that sphere according to the distance to each casino. Our hypothesis is that casino effects should be the strongest at the center and weaker at greater distance. Estimates that exhibit such a pattern would make a more convincing case that the effects are due to the new casino openings.

We also relax the assumption that the treated and non-treated areas would have grown on average at the same rate in the absence of casino openings. Table 3 shows that new urban casinos tend to locate in poorer parts of a city. Such neighborhoods may have different growth trajectories even without the casino openings. Our regression model includes a substantial number of control variables that serve as predictors of later growth. We use both cross-sectional regressions and panel regressions; the

latter accommodate the possibility of a systemically different time trend between treated and non-treated areas that predates the casino openings.

In addition to analysis that utilizes all available observations, we will also estimate empirical models using census tract samples based on the method of propensity score matching (Rosenbaum and Rubin, 1983; O'Keefe, 2004), or PSM, that selects control census tracts from the non-treated groups for comparison with the treated neighborhoods.

The next two subsections present findings from cross-sectional and the panel regressions, respectively. Both report findings from the full sample as well as from the PSM sample.

3.1 Cross-sectional regression models

The cross-sectional regression model estimated is

$$Y_{i,j} = \alpha_1 D_{i,j}^{3miles} + \alpha_2 S_{i,j} + \alpha_3 D_{i,j}^{3miles} \cdot S_{i,j} + \beta_1 Z_i + \gamma_j D_j^C + u_{i,j}. \tag{2}$$

The subscripts i and j indicate census tracts and casinos, respectively. The dependent variable $Y_{i,j}$ is the the 3-year-before-and-3-year-after growth defined in Equation (1). The variable $D_{i,j}^{3miles}$ is a 0-or-1 indicator of maximum sphere diameter. It equals 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 vector Z_i contains the census tract level control variables, namely the population density, median household income, percentage of residents living below the poverty line, median home values, share of renter-occupied housing units, average age of housing units, percentage of population black, percentage of population Hispanic, percentage unemployed persons, percentage population with university degrees, percentage age over 65, as well as percentage employment in manufacturing industries. For robustness, these variables are added to the regressions step by step in blocks as in Huang and Humphreys (2014).

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 opening-year effects. The inclusion of the casino dummies means we compare census tracts in the same metropolitan area over the same period of time.

Tables 7 to 9 report estimates of Equation (2). The dependent variable in Table 7 is the percentage growth in the number of mortgage applications from the 3-year period before casino openings to the 3-year period after the openings. The first column does not contain any census tract level control variables. The only explanatory variables are the indicator for locating within a 3-mile radius, the distance to the casinos, and the interaction term between the two variables. The estimated coefficient on the 3-mile indicator indicates the effect at the center of the area. The point estimate is -4.62%, though it is not statistically different from zero. The estimated coefficient on the interaction term is positive. This is consistent with the hypothesis that any casino effects should become weaker as the distance to casino increases. Columns 2-5 add more and more census control variables to the model. The estimated center effect rises, but remains statistically insignificant. In summary, the estimates suggests a negative casino effect, but statistically we cannot reject the null hypothesis of zero effect. Table 8 shows results when the dependent variable is the growth in average loan amount. The estimated casino effect is also negative, about 2% at the center in the models with more control variables. The estimated effects also diminish over distance to casinos. In almost all cases, however, the estimates are statistically insignificant even at the center. Table 9 shows results when the dependent variable is the growth in average applicant income over the period. In this model, the estimated center effect tends to be positive, but small and statistically insignificant.

The estimates reported above are from the full sample; the control groups include all non-treated neighborhoods, some of which are drastically different from the treated neighborhoods. Next we narrow down the set of control census tracts to those selected using propensity score matching (Rosenbaum and Rubin, 1983; O'Keefe, 2004), or PSM. The method selects census tracts from the pool of un-treated areas that are "similar" to those within the treated areas. The selection is based on a predicted propensity score, from a probit model where the dependent variable is equal to one when new casino exists nearby. The probability is modeled as a function of observed census tract characteristics such as income, housing values, and other census characteristics. If census tracts nearby casinos are more likely to have lower income residents and lower-valued homes, the selected control census tracts are likely to have such features as well. The PSM selection thus improves the comparability between the treated and control groups.

We use one-to-one matching in the PSM process, selecting only the closest neighbor to each census tract in the control group. The closest neighbor is the census tract in the non-treated areas that has the closest predicted propensity score. The matching predictors in the probit equation include all the control variables in the regressions reported earlier. We perform the prediction-and-matching procedure for each casino individually to make sure that the matching occurs within the same city in the same time period. After selecting the control census tracts, we repeat the regression analysis described by Equation (2).

To implement the PSM method, we revert back to the baseline 2-mile radius treatment, as opposed to the larger 3-mile treatment radius, because a 3-mile radius in some smaller cities covers most of the city, leaving few census tracts outside the treated area for matching. 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 nearby treated areas in terms of the their census profiles, relative to the broader set of census tracts outside the 2-mile radius.

The PSM-based regression model estimates are reported in the last columns of Tables 7 to 9. For the volume of mortgage applications and the growth in average loan amount dependent variables, the new estimates are largely consistent with those from the full-sample results reported above. The at center estimates are generally negative. The interaction effects are positive, indicating weaker effects at a longer distances from the casinos. For the application volume dependent variable, the estimated center effect has borderline statistical significance. The estimates for the average loan amount remain statistically insignificant. For the third outcome variable, the average applicant income, the estimated effect changes sign from positive at the center to negative at the center. The estimates continue to lack statistical significance, suggesting no effects of new casinos on these outcome variables.

To summarize, the cross-sectional estimates, either from the full sample or from the PSM-based sample, do not provide strong evidence that casino openings affect housing market outcomes or the economic profile of home buyers in areas near these casinos.

3.2 Panel regression models and results

The greatest benefit of panel regressions is that they can accommodate the possibility that the treated neighborhoods have a systemically different time trend compared to other neighborhoods in each metropolitan area. Such difference in time trends can

arise from, for example, the possibility that casinos tend to locate in areas that are already in urban decline because of lower land costs or outmigration. If so, we might over-estimate casinos' negative effects since the negative trend predates casino openings and is not a result of casino openings. Galster et al. (1999) discuss a similar concern in their study on the impact of section-8 neighbors on property values. Here we follow the approach used in Galster et al. (1999) and later in Huang and Humphreys (2014) and use panel regression models to control for differences in trends. The panel model allows the treated group to have a specific time trend before the casino treatment period begins. The treatment effect is then estimated in part by how the time trends change after the casino openings.

Specifically, the panel regressions use yearly panel data consisting of the three years before and the three years after the opening of new casinos. The choice of time frame is the same as the cross-sectional analysis that uses the 3-year-before-and-3-year-after growth, defined in equation (1), as the dependent variable. Following Huang and Humphreys (2014), we estimate the following model:

$$\widetilde{Y}_{i,j,t} = \alpha_{j,t} + \beta D_{i,j} + \gamma D_{i,j} \cdot T_t + \delta D_{i,j} \cdot Post_t + \zeta D_{i,j} \cdot Post_t \cdot (T_t - 3) + u_{i,j,t}. \quad (3)$$

Again the subscript i indexes census tracts; j indexes casinos; t indicates the order of the time observation in the 6-year sample around each casino opening, with 1 being the initial year in the sample period, 2 the second, and so on. Following Galster et al. (1999), the dependent variables $\widetilde{Y}_{i,j,t}$ are the number of mortgage applications per 1,000 residents, the logarithm of average loan amounts times 100, and the logarithm of average applicant income times 100.

The first term on the right-hand side of Equation (3), $\alpha_{j,t}$, is a casino (j) and time (t) fixed effect. It captures common levels and time trends specific to all census tracts associated with casino j.

The second term, $D_{i,j}$, is a 0-or-1 indicator for whether census tract i is near casino j (defined by a 2-mile radius). It does not have a time subscript and depends solely on location. It captures the possibility that the census tracts near a casino have systematical level differences compared to census tracts farther away.

The third term, $\gamma D_{i,j} \cdot T_t$, captures the potential differences in time trends between the treated and non-treated groups. The first factor, $D_{i,j}$, is the location indicator for census tract i near casino j. The second factor T_t is the time trend. It is 1 if $t = 1$, 2 if $t = 2$, and so on. If $\gamma > 0$, neighborhoods close to casinos tend to grow faster

than other neighborhoods; if $\gamma < 0$, the opposite is true. The time trend is relative because it is in addition to the common time trend captured by $\alpha_{j,t}$, the casino-year fixed effects.

There are two post-treatment effects captured in the model. The first is the impact on levels of dependent variables, captured by $\delta D_{i,j} \cdot Post_t$. The indicator $Post_t$ is equal to 1 from the opening year on, and zero before the opening. The post-treatment effect applies only to census tracts near sports facilities. The coefficient δ captures how the opening of a casino changes the level of dependent variable in nearby census tracts.

The second post-treatment impact is in the relative time trends, captured by $\zeta D_{i,j} \cdot Post_t \cdot (T_t - 3)$. The coefficient ζ reflects the change in the slope of the relative time trend after the opening of a new casino in nearby census tracts.

The right-hand side of the model no long contains a vector of census tract level control variables. Since the census tract control variables are not time varying, adding them to the model will affect the time-invariant intercept, not the treatment variables of interest. Finally we note that new casino dummy indicators, which are present in all our previous regressions, are no longer included here due to perfect collinearity with $\alpha_{j,t}$, the casino-time fixed effects.

Tables 10-12 contain the panel-regression estimates. The dependent variable in Table 10 is the number of mortgage applications per 1,000 residents. The first column is from the full-sample. These estimates suggest that neighborhoods close to new casinos begin with significantly lower mortgage activity; but they have a positive relative time trend that predates the casino openings. These estimates are consistent with the descriptive plots shown in Figure 1. The estimated post-treatment level effect (δ) is negative, though statistically insignificant. The estimated post-treatment trend effect (ζ) is also negative and statistically insignificant. The second column is from the PSM-based sample. It, too, yields statistically insignificant estimated treatment effects (for both level and trend). To summarize, consistent with the cross-sectional regressions, we cannot reject the hypothesis that casino openings have no impact on the volume of home purchase mortgage applications.

The dependent variable in Table 11 is the average loan amount in logs times 100. The coefficient estimates can be interpreted as percentage impacts. The estimates suggest that neighborhoods near new casinos tend to have a lower level of average loan values, but a positive relative time trend predating the casino openings, at the rate of about 2% a year. Both estimates are consistent with the trajectory plots in Figure 1 that show a negative but shrinking gap between the treated and non-treated

areas.

The two estimated post-treatment effects have opposite signs. The level effect is positive, though negligible (0.4%) in the full sample. It is more substantial (4%) and has borderline statistical significance in the PSM sample. The trend effect is negative at -2.7% per year in the full sample and -4% per year in the PSM sample. The negative trend effect indicates that casino openings are associated with a slowdown in the growth of house prices relative to the time trend predating the casino openings. The estimated slowdown is consistent with Figure 1 that shows a widening treated-control gap in the average loan amount. Quantitatively, the negative trend effect dominates the positive level effect in both the full sample and the PSM sample. The full sample estimates suggest a a 8.2% loss of house prices in 3 years relative to the pre-opening time trend. The PSM estimates suggest a 7.8% loss.[4]

While a slowdown in the growth of loan values is consistent with a negative casino effect on house prices, it is also consistent with an alternative explanation that casino openings have positive effects on house prices after the plans to open a casino are announced but before the casinos are opened for business. We cal this the "anticipation effect". One way to test this alternative hypothesis is to analyze casinos that have long enough time span before opening. If the relative time trend predates the opening by a substantial number of years, we can be more confident that it is not due to the anticipation effect. Columns 3 and 4 report estimates from a smaller sample of casinos (30 casinos) that have at least 6 years' data before their opening. Both full-sample and PSM-based estimates are reported. In both cases, the estimated post-treatment effects are consistent with their earlier reported counterparts. Figure 2 depicts the relative time trend in this smaller sample of casinos. It is clear from the plots that the positive pre-opening time trend began several years before the openings, and therefore is unlikely to be the result of casino openings.

We further test for the anticipation effect by shifting the starting date of the treatment effect back by two years, so that any potential anticipation effects in those two years will be counted as part of the treatment period. If the estimated effects are still negative, it means that the negative effect after the opening overwhelms any potential anticipation effect. We re-estimate the models and present the estimates in columns (5) and (6) of Table 11. The estimated post-treatment trend effect remains

[4]The following is the calculation. In the full sample, the estimated level effect is 0.4%. The estimated trend effect is -2.73%. Both come into effect in the opening year, so the net effect in the opening year is -2.73% + 0.4%=-2.69%. The trend effect persist into the future. So by the third year after the opening, the total effect is -2.69%+(-2.73%)*2=-8.15%. For the PSM-sample, the calculation is 4.25% + (-4%) + (-4%)*2=-7.75%.

negative and statistically significant in this version. This provides further evidence that a potential anticipation effect cannot explain the observed slowdown in loan amount after the casino openings.

There is one more concern in this setting: spurious correlation. The U.S. experienced a substantial subprime mortgage credit expansion between the early 2000s and 2007, followed by a deep economic correction, the "great recession." This mortgage cycle disproportionately affected poorer neighborhoods (Mian and Sufi, 2009), where new urban casinos in this sample tend to locate. This may be a reason why the treated areas began with a positive (relative) time trend and ended with a slowdown. The PSM-selection procedure deals with this correlation by selecting similar census tracts as control neighborhoods. Since the PSM-based estimates are similar to those from the full sample, there is reason to believe that the credit-cycle is not the driving force behind the estimated casino effects. Nevertheless, we can try to account for the effects of the credit cycle more explicitly.

Specifically, we re-estimate Equation (3) with 4 additional control variables: the local poverty rate (v_j, acting as a proxy for the mortgage credit constraint, the interaction between v_j and the calendar year (namely $v_j \cdot T^c$ with T^c denoting the calendar year), a post-2007 effect on levels that are dependent on the poverty rate ($Post^{2007} \cdot v_j$) and a post-2007 effect on the relative time trend ($Post^{2007} \cdot v_j \cdot (T^c - 2006)$).[5] In the new model specification, census tracts with a higher poverty rate can have faster (or slower) growth before 2007, and can have changes in levels and trends from 2007 on. The last two columns of Table Table 11 present the estimates from this alternative model. Evidence exists that areas with a higher poverty rate grew faster before 2007, and experienced a deeper correction after 2007. According to the estimates from the full sample, census tracts that have 10% higher poverty rate grows at a faster rate before 2007, by 0.6% per year. But they also experience a faster rate of price declines after 2007, by -1.7& per year. Since the model include casino-time fixed effects, these estimates are differences relative to census tracts within the same metropolitan areas. This is consistent with the hypothesis that the pre-2007 subprime boom and the post-2007 subprime bust have a greater influence on poorer neighborhoods. In the PSM sample, the estimated poverty-specific time trends are insignificant both before and after 2007. This is not surprising because the PSM sample include only similar census tracts; there is thus less variation in the poverty rate.

Returning to the post-casino opening effects, both the estimated level and trend

[5]Note that it is not necessary to include the indicator $Post^{2007}$ itself. It would drop out anyway because the model already has casino-time fixed effects on the right-hand side.

effects are consistent with earlier findings. The estimates are now smaller; but the change is proportionally small. The trend-effect estimate loses statistical significance in the full sample, but retains strong statistical significance in the PSM sample. Quantitatively, the full sample estimates suggest a a 6.2% loss of house prices in 3 years relative to the pre-opening time trend. The PSM estimates suggest a 7.2% loss.[6] They are not much different from the earlier estimates that did not account for the mortgage cycle (7.8% and 8.2%, respectively, for the two samples).

Finally, the dependent variable in Table 12 is the average income of applicants, also in logs times 100. Throughout the various model specifications, there is little evidence of significant impacts from new casinos on this outcome variable. It does not appear that casino openings have any detectable impacts on the income profile of home buyers in nearby areas.

4 Conclusion

This paper examines the housing-market impacts of new U.S. urban casino openings in nearby neighborhoods. We match the openings of more than 40 U.S. urban casinos to detailed mortgage data from the Home Mortgage Disclosure Act around the opening years, comparing census tracts close to casinos to those farther away to see how casino openings affect the number of home-purchase mortgage applications, the average loan amount, and the average income of applicants. We do not find evidence that casino openings affect the volume of applications or the economic profile of home buyers. There is however evidence that the casinos openings are associated with slowdowns in the growth of the average loan amount, which we use as a proxy for house prices.

According the estimates, the average loan amount in neighborhoods near the new casinos falls, compared their pre-casino opening time trends, by 7-8% in the three years after the openings. The finding is robust to a possible anticipation effect through which casino openings lead to house price appreciations before the casinos are opened for business. Even if we attribute the 2-year pre-opening price movements to the casino development plans, the estimated casino effects are still negative and largely unchanged. The finding is also robust to explicitly accounting for the impacts of the U.S. subprime mortgage credit cycle. The credit cycle disproportionately affected poor neighborhoods, in which the new urban casinos are more likely to locate,

[6]The calculation for the full sample, based on estimates reported in the next-to-the-last column of Table Table 11, is 0.13% + (-2.1%) + (-2.1%)*2=-6.17%. The calculation for the PSM sample, based on the last column, is 3.73% + (-3.64%) + (-3.64%)*2=-7.19%.

resulting in possible spurious correlations. But even in regression models that give poor neighborhoods the degrees of freedom to have different time trends before and after 2007 (the turning point of the credit cycle), the estimated casino effect is reduced only slightly, from 7-8% to 6-7%. We conclude that casino openings are a negative factor for the housing values of nearby communities, a distributional concern because the benefits from new casinos, such as taxes and employments, are likely distributed more widely than the negative impacts on residential amenities.

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Table 1: Casinos in Sample

Casino	Metropolitan	Opening year
Belle of Orleans, Bally's Casino Lakeshore Resort	New Orleans	1995
Isle of Capri - Crown Riverboat	Lake Charles	1995
Casino Aztar	Evansville-Henderson	1995
Delaware Park	Philadelphia-Wilmington-Atlantic City	1995
Isle of Capri Casino & Hotel - Grand Palais Riverboat	Lake Charles	1996
Boomtown Casino & Hotel (Casino Magic)	Shreveport-Bossier City	1996
Harrington Raceway & Casino	Dover	1996
Grand Victoria Casino & Resort	Cincinnati-Hamilton	1996
Hollywood Casino Lawrenceburg (Argosy Casino & Hotel)	Cincinnati-Hamilton	1996
Isle of Capri Casino (Flamingo Casino) Kansas City	Kansas City	1996
Horseshoe Casino Hammond (Empress Casino Hammond)	Chicago-Gary-Kenosha	1996
Majestic Star Casino	Chicago-Gary-Kenosha	1996
Majestic Star II (Trump Casino Hotel)	Chicago-Gary-Kenosha	1996
Naples-Fort Myers Greyhound Racing & Poker	Fort Myers-Cape Coral	1997
Palm Beach Kennel Club	West Palm Beach-Boca Raton	1997
Palace Casino Resort	Biloxi-Gulfport-Pascagoula	1997
IP Casino Resort Spa	Biloxi-Gulfport-Pascagoula	1997
Hollywood Casino St. Louise (Harrah's Casino)	St. Louis	1997
Harrah's New Orleans	New Orleans	1999
Beau Rivage Resort & Casino	Biloxi-Gulfport-Pascagoula	1999
MGM Grand Detroit Casino	Detroit-Ann Arbor-Flint	1999
Motor City Casino	Detroit-Ann Arbor-Flint	1999
Greektown Casino	Detroit-Ann Arbor-Flint	2000
Sam's Town Hotel & Casino (Harrah's Hotel and Casino)	Shreveport-Bossier City	2004
Club 52 at Melbourne Greyhound Park	Melbourne-Titusville-Palm Bay	2005
L'Auberge Casino Resort Lake Charles	Lake Charles	2005
Gulfstream Park	Miami-Fort Lauderdale	2006
Mardi Gras Casino	Miami-Fort Lauderdale	2006
Sarasota Kennel Club Poker Room	Sarasota-Bradenton	2006
Southland Park	Memphis	2006
IMAC Casino/Bingo	Green Bay	2006
Isle Casino Pompano Park	Miami-Fort Lauderdale	2007
Derby Lane Poker Room	Tampa-St. Petersburg-Clearwater	2007
Hard Rock Hotel & Casino - Biloxi	Biloxi-Gulfport-Pascagoula	2007
Lumire Place Casino and Hotels	St. Louis	2007
Harrahs Philadelphia Casino & Racetrack	Philadelphia-Wilmington-Atlantic City	2007
Wheeling Island Racetrack & Gaming Center	Wheeling	2007
Presque Isle Downs and Casino	Erie	2007
Mardi Gras West Virginia Casino Resort	Charleston	2008
Hoosier Park Casino	Indianapolis	2008
Jumer's Casino Rock Island	Davenport-Moline-Rock Island	2008
Magic City Casino	Miami-Fort Lauderdale	2009
Best Bet - Orange Park	Jacksonville	2009
Hollywood Casino at Charles Town Races	Washington-Baltimore	2009
Parx Casino	Philadelphia-Wilmington-Atlantic City	2009
Meadows, The	Pittsburgh	2009
Rivers Casino	Pittsburgh	2009
Sands Casino Resort Bethlehem	Allentown-Bethlehem-Easton	2009

Table 2: Number of Census Tracts in Metropolitan Areas: Total, within 2 miles, and within 3 miles

Casino	Metropolitan	Total	<2	<3
Belle of Orleans, Bally's Casino Lakeshore Resort	New Orleans	387	7	15
Isle of Capri - Crown Riverboat	Lake Charles	41	1	7
Casino Aztar	Evansville-Henderson	81	18	29
Delaware Park	Philadelphia-Wilmington-Atlantic City	1522	7	16
Isle of Capri Casino & Hotel - Grand Palais Riverboat	Lake Charles	41	1	7
Boomtown Casino & Hotel (Casino Magic)	Shreveport-Bossier City	93	13	25
Harrington Raceway & Casino	Dover	31	1	2
Grand Victoria Casino & Resort	Cincinnati-Hamilton	446	1	1
Hollywood Casino Lawrenceburg (Argosy Casino & Hotel)	Cincinnati-Hamilton	446	2	2
Isle of Capri Casino (Flamingo Casino) Kansas City	Kansas City	447	19	34
Horseshoe Casino Hammond (Empress Casino Hammond)	Chicago-Gary-Kenosha	1947	14	26
Majestic Star Casino	Chicago-Gary-Kenosha	1947	8	11
Majestic Star II (Trump Casino Hotel)	Chicago-Gary-Kenosha	1947	8	11
Naples-Fort Myers Greyhound Racing & Poker	Fort Myers-Cape Coral	92	3	3
Palm Beach Kennel Club	West Palm Beach-Boca Raton	210	6	20
Palace Casino Resort	Biloxi-Gulfport-Pascagoula	74	5	8
IP Casino Resort Spa	Biloxi-Gulfport-Pascagoula	74	11	13
Hollywood Casino St. Louise (Harrah's Casino)	St. Louis	464	2	7
Harrah's New Orleans	New Orleans	387	53	104
Beau Rivage Resort & Casino	Biloxi-Gulfport-Pascagoula	74	8	10
MGM Grand Detroit Casino	Detroit-Ann Arbor-Flint	1393	29	55
Motor City Casino	Detroit-Ann Arbor-Flint	1393	33	66
Greektown Casino	Detroit-Ann Arbor-Flint	1393	26	49
Sam's Town Hotel & Casino (Harrah's Hotel and Casino)	Shreveport-Bossier City	93	12	24
Club 52 at Melbourne Greyhound Park	Melbourne-Titusville-Palm Bay	87	5	8
L'Auberge Casino Resort Lake Charles	Lake Charles	41	3	7
Gulfstream Park	Miami-Fort Lauderdale	427	11	19
Mardi Gras Casino	Miami-Fort Lauderdale	427	13	21
Sarasota Kennel Club Poker Room	Sarasota-Bradenton	87	5	6
Southland Park	Memphis	225	3	5
IMAC Casino/Bingo	Green Bay	49	4	6
Isle Casino Pompano Park	Miami-Fort Lauderdale	427	7	12
Derby Lane Poker Room	Tampa-St. Petersburg-Clearwater	409	4	7
Hard Rock Hotel & Casino - Biloxi	Biloxi-Gulfport-Pascagoula	74	8	10
Lumire Place Casino and Hotels	St. Louis	464	13	33
Harrahs Philadelphia Casino & Racetrack	Philadelphia-Wilmington-Atlantic City	1522	19	34
Wheeling Island Racetrack & Gaming Center	Wheeling	50	10	19
Presque Isle Downs and Casino	Erie	70	2	6
Mardi Gras West Virginia Casino Resort	Charleston	61	2	7
Hoosier Park Casino	Indianapolis	330	1	10
Jumer's Casino Rock Island	Davenport-Moline-Rock Island	96	1	5
Magic City Casino	Miami-Fort Lauderdale	427	20	41
Best Bet - Orange Park	Jacksonville	168	3	8
Hollywood Casino at Charles Town Races	Washington-Baltimore	1655	2	2
Parx Casino	Philadelphia-Wilmington-Atlantic City	1522	6	13
Meadows, The	Pittsburgh	779	1	5
Rivers Casino	Pittsburgh	779	46	99
Sands Casino Resort Bethlehem	Allentown-Bethlehem-Easton	144	12	21

Table 3: Compare treated and non-treated areas

	Statistics	<2 miles	>2 miles	Difference	PSM control
Population density, thousand/sqkm	mean	1.6	1.4	.2	2.1
	std error	.2	.1	.1	.3
% residents with college degree	mean	15.9	22.6	-6.7	17.6
	std error	1	.6	1.2	1.4
Average age of housing units, years	mean	39.4	33.1	6.3	39.6
	std error	1.6	1	1.4	1.9
Median household income (thousands)	mean	32.1	44.7	-12.6	34.6
	std error	1.4	1	1.6	2
Median home value (thousands)	mean	86.9	116	-29.2	97.9
	std error	4.7	4.2	5.3	14
pctblack	mean	27.8	17	10.7	27.1
	std error	3.9	1.4	3.2	4.5
% residents Hispanic	mean	9.7	7.4	2.3	10.2
	std error	2.3	1.6	1.7	2.5
% share of employment in manufacturing	mean	12.8	13.2	-.4	13.1
	std error	.8	.7	.7	.9
% residents over 65	mean	15.6	13.8	1.8	15.7
	std error	.7	.6	.8	1.2
% below poverty line	mean	19.8	11.9	7.9	19.3
	std error	1.6	.4	1.5	2
% renter occupied units	mean	45.7	29.5	16.1	41.5
	std error	2.3	.5	2.4	2.8
% unemployed	mean	9.3	6	3.2	8.8
	std error	.7	.2	.7	.9
Applications/1000 residents	mean	17.5	22.7	-5.2	18.7
	std error	1.9	1.6	1.4	2.6
Average loan amount (thousands)	mean	98.2	121.6	-23.4	105
	std error	7.9	8.3	4.4	8.8
Average applicant income (thousands)	mean	65.8	73.5	-7.7	73.8
	std error	4.3	3.8	2.6	7.8

Note: The statistics above are from an un-weighted sample of 48 casinos. Each treatment or control area associated with a casino is regarded as a single observation.

Table 4: Percentage growth in the number of home-purchase loan applications: from the 3-year peiod before the opening year to the 3-year period stating from the opening year, showing percentage growth in the treated area, the nontreated area and the treated-nontreated growth differentials

Casino	Treated	Non-Treated	Differential
Belle of Orleans, Bally's Casino Lakeshore Resort	-1.2	46.5	-47.7
Isle of Capri - Crown Riverboat	87.4	109.9	-22.5
Casino Aztar	30.8	71.9	-41.2
Delaware Park	3.8	22.9	-19.1
Isle of Capri Casino & Hotel - Grand Palais Riverboat	54.3	73.6	-19.3
Boomtown Casino & Hotel (Casino Magic)	40.6	52	-11.4
Harrington Raceway & Casino	150	113	37
Grand Victoria Casino & Resort	425	50.2	374.8
Hollywood Casino Lawrenceburg (Argosy Casino & Hotel)	27.4	50.8	-23.4
Isle of Capri Casino (Flamingo Casino) Kansas City	79.4	48.2	31.2
Horseshoe Casino Hammond (Empress Casino Hammond)	11.5	21	-9.5
Majestic Star Casino	8	21	-12.9
Majestic Star II (Trump Casino Hotel)	8	21	-12.9
Naples-Fort Myers Greyhound Racing & Poker	35.2	56.6	-21.4
Palm Beach Kennel Club	43.1	42.4	.8
Palace Casino Resort	31.8	43.9	-12.1
IP Casino Resort Spa	29.9	44.7	-14.7
Hollywood Casino St. Louise (Harrah's Casino)	6.9	30.6	-23.8
Harrah's New Orleans	57.3	8.9	48.4
Beau Rivage Resort & Casino	-25.4	-15.3	-10.1
MGM Grand Detroit Casino	156.4	34.1	122.3
Motor City Casino	170.8	33.9	136.9
Greektown Casino	70.8	17.6	53.2
Sam's Town Hotel & Casino (Harrah's Hotel and Casino)	43.6	15.3	28.3
Club 52 at Melbourne Greyhound Park	-1.9	6.3	-8.2
L'Auberge Casino Resort Lake Charles	12.7	21.9	-9.2
Gulfstream Park	-31.4	-22.9	-8.5
Mardi Gras Casino	-27.5	-23	-4.5
Sarasota Kennel Club Poker Room	-40	-47.8	7.8
Southland Park	-21	-11.5	-9.5
IMAC Casino/Bingo	-18.6	-21.6	3
Isle Casino Pompano Park	-67.1	-67	0
Derby Lane Poker Room	-71.3	-62.7	-8.5
Hard Rock Hotel & Casino - Biloxi	-63.7	-37.4	-26.3
Lumire Place Casino and Hotels	-47.3	-43.2	-4.1
Harrahs Philadelphia Casino & Racetrack	-37.6	-39.7	2.1
Wheeling Island Racetrack & Gaming Center	-26.6	-27.6	1
Presque Isle Downs and Casino	-34.2	-29.7	-4.4
Mardi Gras West Virginia Casino Resort	-34.2	-35.3	1.2
Hoosier Park Casino	-54.3	-54.7	.4
Jumer's Casino Rock Island	-37.2	-29.6	-7.5
Magic City Casino	-83.2	-72.3	-10.8
Best Bet - Orange Park	-63	-57.7	-5.3
Hollywood Casino at Charles Town Races	-39.6	-47	7.4
Parx Casino	-43.3	-47.9	4.6
Meadows, The	-26.6	-37	10.3
Rivers Casino	-45.6	-36.7	-8.9
Sands Casino Resort Bethlehem	-60.4	-49.9	-10.5

Table 5: Percentage growth in the average amount of home-purchase loan applications: from the 3-year peiod before the opening year to the 3-year period stating from the opening year, showing percentage growth in the treated area, the nontreated area and the treated-nontreated growth differentials

Casino	Treated	Non-Treated	Differential
Belle of Orleans, Bally's Casino Lakeshore Resort	14.7	13.5	1.2
Isle of Capri - Crown Riverboat	3.5	7.8	-4.3
Casino Aztar	12.7	12.3	.4
Delaware Park	-1.1	1.8	-2.8
Isle of Capri Casino & Hotel - Grand Palais Riverboat	10.4	8.2	2.2
Boomtown Casino & Hotel (Casino Magic)	13.9	1.1	12.8
Harrington Raceway & Casino	60	23.3	36.6
Grand Victoria Casino & Resort	10.3	10.6	-.3
Hollywood Casino Lawrenceburg (Argosy Casino & Hotel)	16.6	10.6	6.1
Isle of Capri Casino (Flamingo Casino) Kansas City	33.9	13	20.9
Horseshoe Casino Hammond (Empress Casino Hammond)	15	11.4	3.6
Majestic Star Casino	25.3	11.4	13.9
Majestic Star II (Trump Casino Hotel)	25.3	11.4	13.9
Naples-Fort Myers Greyhound Racing & Poker	15	12	3
Palm Beach Kennel Club	45.8	12.7	33.1
Palace Casino Resort	75.1	15.4	59.7
IP Casino Resort Spa	30.2	15.8	14.5
Hollywood Casino St. Louise (Harrah's Casino)	9.7	14.3	-4.6
Harrah's New Orleans	29.1	23.6	5.4
Beau Rivage Resort & Casino	20.5	30	-9.5
MGM Grand Detroit Casino	51.8	25.7	26
Motor City Casino	59.7	25.6	34
Greektown Casino	20.5	22.6	-2.1
Sam's Town Hotel & Casino (Harrah's Hotel and Casino)	42.3	22.6	19.7
Club 52 at Melbourne Greyhound Park	44	42.4	1.6
L'Auberge Casino Resort Lake Charles	19.9	23.1	-3.2
Gulfstream Park	26.9	35.3	-8.4
Mardi Gras Casino	37.2	35.1	2.1
Sarasota Kennel Club Poker Room	37	22.6	14.4
Southland Park	7	11.9	-4.9
IMAC Casino/Bingo	.6	4.7	-4.2
Isle Casino Pompano Park	-3.2	15.4	-18.6
Derby Lane Poker Room	12.4	12.4	.1
Hard Rock Hotel & Casino - Biloxi	30.4	24.6	5.8
Lumire Place Casino and Hotels	4.1	12.1	-8
Harrahs Philadelphia Casino & Racetrack	34.3	20.1	14.2
Wheeling Island Racetrack & Gaming Center	9.3	11.4	-2.2
Presque Isle Downs and Casino	13.4	11.2	2.2
Mardi Gras West Virginia Casino Resort	22.8	17.4	5.4
Hoosier Park Casino	-6.8	6.2	-13
Jumer's Casino Rock Island	-2.4	12.8	-15.2
Magic City Casino	-37.2	-26.3	-10.9
Best Bet - Orange Park	-9.4	-16.7	7.3
Hollywood Casino at Charles Town Races	-15.2	.9	-16
Parx Casino	-.6	3.2	-3.8
Meadows, The	7.1	13.3	-6.2
Rivers Casino	26.1	13	13.1
Sands Casino Resort Bethlehem	-2	-1.6	-.5

Table 6: Percentage growth in the average income of home-purchase loan applicants: from the 3-year peiod before the opening year to the 3-year period stating from the opening year, showing percentage growth in the treated area, the nontreated area and the treated-nontreated growth differentials

Casino	Treated	Non-Treated	Differential
Belle of Orleans, Bally's Casino Lakeshore Resort	8.5	5.3	3.3
Isle of Capri - Crown Riverboat	-9.3	.6	-9.9
Casino Aztar	4.1	-10.9	15
Delaware Park	5.5	8.2	-2.7
Isle of Capri Casino & Hotel - Grand Palais Riverboat	-12.8	-4.3	-8.4
Boomtown Casino & Hotel (Casino Magic)	12.1	1.8	10.3
Harrington Raceway & Casino	28.4	21.9	6.4
Grand Victoria Casino & Resort	11.1	9.6	1.5
Hollywood Casino Lawrenceburg (Argosy Casino & Hotel)	11.9	9.6	2.3
Isle of Capri Casino (Flamingo Casino) Kansas City	15.8	13.8	2.1
Horseshoe Casino Hammond (Empress Casino Hammond)	8.3	12.4	-4.1
Majestic Star Casino	18.3	12.4	5.9
Majestic Star II (Trump Casino Hotel)	18.3	12.4	5.9
Naples-Fort Myers Greyhound Racing & Poker	-2.7	15	-17.7
Palm Beach Kennel Club	33	24.4	8.6
Palace Casino Resort	34.4	11.8	22.7
IP Casino Resort Spa	34.8	10.6	24.2
Hollywood Casino St. Louise (Harrah's Casino)	7.8	11.8	-4.1
Harrah's New Orleans	32.8	17.9	14.9
Beau Rivage Resort & Casino	13.6	22.4	-8.8
MGM Grand Detroit Casino	19.2	15.3	4
Motor City Casino	20.6	15.3	5.4
Greektown Casino	15.3	15.1	.1
Sam's Town Hotel & Casino (Harrah's Hotel and Casino)	58.7	23.2	35.5
Club 52 at Melbourne Greyhound Park	32.7	42.3	-9.6
L'Auberge Casino Resort Lake Charles	9	13.5	-4.5
Gulfstream Park	33.1	31	2.1
Mardi Gras Casino	49.1	30.7	18.4
Sarasota Kennel Club Poker Room	35.7	22.7	13.1
Southland Park	31.7	18.7	13
IMAC Casino/Bingo	5.7	4.9	.7
Isle Casino Pompano Park	-6.9	3.5	-10.3
Derby Lane Poker Room	2.9	.6	2.3
Hard Rock Hotel & Casino - Biloxi	22.2	14.5	7.7
Lumire Place Casino and Hotels	17.9	5.9	12
Harrahs Philadelphia Casino & Racetrack	-10.7	.6	-11.3
Wheeling Island Racetrack & Gaming Center	39	10	29
Presque Isle Downs and Casino	4.4	11.5	-7.2
Mardi Gras West Virginia Casino Resort	45.2	8.9	36.3
Hoosier Park Casino	-5.1	-6.8	1.7
Jumer's Casino Rock Island	13.2	4.7	8.5
Magic City Casino	-43.1	-29.3	-13.8
Best Bet - Orange Park	-20.1	-20.6	.5
Hollywood Casino at Charles Town Races	-16.1	-11.3	-4.8
Parx Casino	-10.7	-10	-.7
Meadows, The	-2.7	-2.4	-.3
Rivers Casino	3.4	-2.6	6
Sands Casino Resort Bethlehem	-7.6	-8.7	1

Table 7: Cross-sectional regressions - The dependent variable is percent growth of home-purchase mortgage applications from the 3-year period before the opening to the 3 year period since the opening

	C1	C2	C3	C4	C5	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Within-radius indicator	-4.38	-4.55	-12.46	-13.74	-12.96	-10.77
	(8.95)	(8.98)	(9.50)	(8.88)	(8.41)	(6.31)*
Within-radius indicator*Distance to casino	4.10	4.23	6.32	6.66	6.44	-.24
	(4.65)	(4.64)	(4.49)	(4.24)	(4.02)	(3.47)
Distance to casino	-.16	-.20	-.19	-.20	-.14	-.53
	(0.1)	(0.09)**	(0.1)*	(0.09)**	(0.1)	(0.25)**
Population density, thousand/sqkm		-.01	-.04	-.04	-.06	0.07
		(0.01)	(0.01)***	(0.009)***	(0.01)***	(0.05)
Median household income (log)			0.04	0.009	-.11	-.10
			(0.04)	(0.07)	(0.08)	(0.24)
% below poverty line			0.97	0.9	0.4	1.04
			(0.15)***	(0.15)***	(0.1)***	(0.55)*
Median house value (log)				0.05	0.02	0.18
				(0.07)	(0.07)	(0.09)**
% renter occupied units				0.07	0.02	-.27
				(0.05)	(0.05)	(0.17)
Average age of housing units, years				0.09	0.06	0.06
				(0.06)	(0.04)*	(0.41)
% residents black alone					0.12	0.03
					(0.07)*	(0.15)
% residents Hispanic					0.03	-.50
					(0.07)	(0.23)**
% unemployed					0.39	0.77
					(0.13)***	(0.57)
% residents with college degree					0.28	-.49
					(0.05)***	(0.48)
% residents over 65					0.05	0.04
					(0.12)	(0.29)
% share of employment in manufacturing					-.33	0.15
					(0.11)***	(0.71)
Obs.	24459	24459	24459	24459	24459	822
e(N-clust)	96	96	96	96	96	96
R^2	0.48	0.48	0.51	0.51	0.52	0.62

Notes: 1). Columns (1)-(5) use the full sample; the only difference among them is the number of census control variables. Column (6) uses the PSM-based sample in which the control census tracts are selected by a propensity score matching procedure. 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: Cross-sectional regressions - The dependent variable is percent growth of average home-purchase mortgage loan amount from the 3-year period before the opening to the 3 year period since the opening

	C1	C2	C3	C4	C5	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Within-radius indicator	0.19	0.3	-1.46	-1.64	-1.25	-4.40
	(2.65)	(2.58)	(2.45)	(2.48)	(2.37)	(3.24)
Within-radius indicator*Distance to casino	-.19	-.27	0.23	0.29	0.27	3.93
	(1.15)	(1.12)	(1.05)	(1.07)	(1.04)	(2.11)*
Distance to casino	-.07	-.04	-.04	-.04	-.04	-.03
	(0.02)***	(0.02)*	(0.02)	(0.02)	(0.02)*	(0.09)
Population density, thousand/sqkm		0.007	0.001	-.0008	-.002	-.01
		(0.003)**	(0.003)	(0.003)	(0.003)	(0.01)
Median household income (log)			0.02	-.004	-.07	-.02
			(0.02)	(0.02)	(0.01)***	(0.07)
% below poverty line			0.25	0.25	0.13	0.12
			(0.05)***	(0.05)***	(0.04)***	(0.19)
Median house value (log)				0.03	0.04	0.005
				(0.009)***	(0.01)***	(0.04)
% renter occupied units				-.02	-.07	0.12
				(0.02)	(0.02)***	(0.07)*
Average age of housing units, years				0.07	0.07	0.21
				(0.01)***	(0.01)***	(0.09)**
% residents black alone					0.03	-.08
					(0.02)	(0.05)*
% residents Hispanic					0.04	-.11
					(0.03)	(0.08)
% unemployed					-.08	-.06
					(0.03)***	(0.15)
% residents with college degree					0.06	0.05
					(0.04)	(0.12)
% residents over 65					-.17	-.11
					(0.03)***	(0.15)
% share of employment in manufacturing					0.005	-.43
					(0.04)	(0.25)*
Obs.	24299	24299	24299	24299	24299	782
e(N-clust)	96	96	96	96	96	96
R^2	0.43	0.44	0.45	0.45	0.46	0.52

Notes: 1). Columns (1)-(5) use the full sample; the only difference among them is the number of census control variables. Column (6) uses the PSM-based sample in which the control census tracts are selected by a propensity score matching procedure. 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: Cross-sectional regressions - The dependent variable is growth of loan applicants' average income from the 3-year period before the opening to the 3 year period since the opening

	C1	C2	C3	C4	C5	PSM
	(1)	(2)	(3)	(4)	(5)	(6)
Within-radius indicator	2.89	2.82	2.64	1.41	1.33	-3.41
	(2.98)	(3.01)	(2.99)	(2.92)	(2.90)	(4.24)
Within-radius indicator*Distance to casino	-.83	-.77	-.66	-.30	-.28	4.71
	(1.38)	(1.39)	(1.35)	(1.31)	(1.30)	(2.66)*
Distance to casino	-.04	-.05	-.05	-.05	-.05	-.02
	(0.02)**	(0.01)***	(0.01)***	(0.01)***	(0.01)***	(0.12)
Population density, thousand/sqkm		-.004	-.005	-.01	-.01	-.04
		(0.003)	(0.002)**	(0.002)***	(0.002)***	(0.01)***
Median household income (log)			0.07	0.02	-.03	-.09
			(0.009)***	(0.02)	(0.02)	(0.1)
% below poverty line			0.3	0.26	0.12	-.40
			(0.06)***	(0.06)***	(0.06)**	(0.22)*
Median house value (log)				0.06	0.04	0.05
				(0.01)***	(0.01)***	(0.05)
% renter occupied units				0.04	0.006	0.15
				(0.01)***	(0.02)	(0.09)
Average age of housing units, years				0.07	0.07	0.44
				(0.01)***	(0.01)***	(0.15)***
% residents black alone					0.01	0.05
					(0.01)	(0.08)
% residents Hispanic					0.02	-.01
					(0.03)	(0.13)
% unemployed					0.08	0.25
					(0.04)*	(0.23)
% residents with college degree					0.12	0.03
					(0.03)***	(0.18)
% residents over 65					-.04	0.14
					(0.03)	(0.13)
% share of employment in manufacturing					-.09	-.007
					(0.04)**	(0.29)
Obs.	24279	24279	24279	24279	24279	806
e(N-clust)	96	96	96	96	96	96
R^2	0.38	0.38	0.39	0.4	0.4	0.45

Notes: 1). Columns (1)-(5) use the full sample; the only difference among them is the number of census control variables. Column (6) uses the PSM-based sample in which the control census tracts are selected by a propensity score matching procedure. 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: Panel regressions allowing heterogeneous pre-treatment time trends between treated and control areas – The dependent variable is the number of mortgage applications per 1,000 residents.

	C1	C2	C3	C4	C5	C6	C7	C8
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Within 2-mile radius	-8.36	-3.83	-8.61	-.61	-7.80	0.02	-3.67	-3.21
	(4.06)**	(3.47)	(2.17)***	(0.8)	(1.44)***	(1.52)	(4.21)	(3.62)
Post-treatment level effect	-1.11	0.4	-1.11	0.83	1.67	-.02	-1.32	0.41
	(0.97)	(1.12)	(1.33)	(1.40)	(2.47)	(1.80)	(0.95)	(1.12)
Within 2-mile radius*Time trend	0.73	0.43	0.7	-.26	0.3	-.59	0.59	0.39
	(0.87)	(0.67)	(0.62)	(0.36)	(0.42)	(0.69)	(0.87)	(0.68)
Post-treatment trend effect	-.44	-.08	0.04	0.89	-.05	1.13	-.32	-.11
	(1.13)	(0.82)	(1.04)	(0.68)	(0.89)	(0.91)	(1.12)	(0.81)
% poverty							-.47	-.40
							(0.06)***	(0.13)***
% poverty*Year							0.0004	0.01
							(0.007)	(0.02)
% poverty*Post-2007							0.24	0.005
							(0.04)***	(0.1)
% poverty*Post-2007*(Year-2006)							-.01	0.03
							(0.01)	(0.05)
Obs.	146663	4929	128522	5306	128522	5306	146663	4929
e(N-clust)	96	96	60	60	60	60	96	96
R^2	0.3	0.55	0.28	0.57	0.28	0.57	0.35	0.57

Notes: 1). Columns (1) and (2) show estimates from the basic panel regressions described in equation (3) based on the full sample and the PSM sample, respectively. Columns (3) and (4) are counterparts of (1) and (2) in smaller samples in which all casinos have at least 6 years of data before the opening year. Columns (5) and (6) are counterparts of (3) and (4); the only difference is that the treatment date has been moved backward from the opening year to two years before the opening. Columns (7) and (8) are counterparts of (1) and (2); the only difference is that (7) and (8) allow census tracts with different poverty rates to have different time trends and levels before and after 2007, the turning point of the subprime mortgage credit cycle. Note that the post-2007 dummy indicator drops out due to perfect collinearity with the casino-time indicators. 2). * Significant at the 95% significance level; ** 99% significance level. 3). All regressions contains a set of casino-time dummy indicators to absorb casino-specific flexible time trends applied to all census tract associated with the opening of a casino whether they are nearby or not. 4). The reported standard errors are cluster-adjusted at the level of casino-specific treatment and control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)". 5). The census information is from the 2000 Census, even if the casino involved was opened before 2000. The underlying assumption is that census characteristics are relatively stable over time. The 2000 Census is roughly the midpoint of our sample period. 6) The regressions are weighted by census tract resident population.

Table 11: Panel regressions allowing heterogeneous pre-treatment time trends between treated and control areas – The dependent variable is the logarithm of average loan amount*100

	C1	C2	C3	C4	C5	C6	C7	C8
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Within 2-mile radius	-30.08	-12.31	-25.39	-11.33	-25.46	-12.88	-7.81	-8.11
	(5.81)***	(4.65)***	(5.25)***	(3.45)***	(5.35)***	(3.66)***	(6.88)	(4.65)*
Post-treatment level effect	0.4	4.25	-.85	3.32	4.85	2.20	0.13	3.73
	(1.52)	(2.32)*	(1.96)	(2.88)	(2.76)*	(1.74)	(1.48)	(2.27)
Within 2-mile radius*Time trend	1.79	1.90	2.31	2.55	2.35	3.31	1.24	1.74
	(0.84)**	(0.77)**	(0.89)***	(0.62)***	(1.05)**	(0.97)***	(0.89)	(0.79)**
Post-treatment trend effect	-2.73	-4.00	-4.01	-4.85	-3.47	-3.37	-2.10	-3.64
	(1.47)*	(1.01)***	(1.74)**	(1.45)***	(1.31)***	(1.29)***	(1.55)	(1.03)***
% poverty							-2.63	-1.09
							(0.12)***	(0.29)***
% poverty*Year							0.06	-.06
							(0.02)***	(0.05)
% poverty*Post-2007							0.38	0.85
							(0.23)*	(0.39)**
% poverty*Post-2007*(Year-2006)							-.17	-.02
							(0.04)***	(0.17)
Obs.	144823	4595	126965	4866	126965	4866	144823	4595
e(N-clust)	96	96	60	60	60	60	96	96
R^2	0.44	0.72	0.44	0.62	0.44	0.62	0.61	0.75

Notes: 1). Columns (1) and (2) show estimates from the basic panel regressions described in equation (3) based on the full sample and the PSM sample, respectively. Columns (3) and (4) are counterparts of (1) and (2) in smaller samples in which all casinos have at least 6 years of data before the opening year. Columns (5) and (6) are counterparts of (3) and (4); the only difference is that the treatment date has been moved backward from the opening year to two years before the opening. Columns (7) and (8) are counterparts of (1) and (2); the only difference is that (7) and (8) allow census tracts with different poverty rates to have different time trends and levels before and after 2007, the turning point of the subprime mortgage credit cycle. Note that the post-2007 dummy indicator drops out due to perfect collinearity with the casino-time indicators. 2). * Significant at the 95% significance level; ** 99% significance level. 3). All regressions contains a set of casino-time dummy indicators to absorb casino-specific flexible time trends applied to all census tract associated with the opening of a casino whether they are nearby or not. 4). The reported standard errors are cluster-adjusted at the level of casino-specific treatment and control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)". 5). The census information is from the 2000 Census, even if the casino involved was opened before 2000. The underlying assumption is that census characteristics are relatively stable over time. The 2000 Census is roughly the midpoint of our sample period. 6) The regressions are weighted by census tract resident population.

Table 12: Panel regressions allowing heterogeneous pre-treatment time trends between treated and control areas – The dependent variable is the logarithm of average applicant income*100

	C1	C2	C3	C4	C5	C6	C7	C8
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Within 2-mile radius	-2.35	2.86	-7.82	-2.67	-10.16	-4.12	10.27	2.85
	(5.05)	(5.69)	(3.04)**	(2.62)	(3.36)***	(3.27)	(5.74)*	(5.80)
Post-treatment level effect	1.75	2.68	-2.38	-2.20	-1.25	-.24	1.69	2.24
	(2.45)	(2.77)	(2.46)	(2.87)	(1.92)	(2.70)	(2.41)	(2.78)
Within 2-mile radius*Time trend	-1.47	-1.18	0.93	-.08	1.97	0.42	-1.39	-1.07
	(0.9)	(1.09)	(0.76)	(0.39)	(0.82)**	(0.68)	(0.87)	(1.11)
Post-treatment trend effect	1.80	1.61	0.0008	1.71	-1.77	-.33	2.02	1.37
	(1.23)	(1.35)	(1.41)	(1.51)	(1.04)*	(1.16)	(1.27)	(1.36)
% poverty							-1.57	-.40
							(0.12)***	(0.34)
% poverty*Year							0.005	-.13
							(0.02)	(0.05)**
% poverty*Post-2007							0.4	0.38
							(0.09)***	(0.39)
% poverty*Post-2007*(Year-2006)							-.16	0.15
							(0.03)***	(0.19)
Obs.	144595	4722	127034	5024	127034	5024	144595	4722
e(N-clust)	96	96	60	60	60	60	96	96
R^2	0.34	0.58	0.32	0.43	0.32	0.43	0.45	0.62

Notes: 1). Columns (1) and (2) show estimates from the basic panel regressions described in equation (3) based on the full sample and the PSM sample, respectively. Columns (3) and (4) are counterparts of (1) and (2) in smaller samples in which all casinos have at least 6 years of data before the opening year. Columns (5) and (6) are counterparts of (3) and (4); the only difference is that the treatment date has been moved backward from the opening year to two years before the opening. Columns (7) and (8) are counterparts of (1) and (2); the only difference is that (7) and (8) allow census tracts with different poverty rates to have different time trends and levels before and after 2007, the turning point of the subprime mortgage credit cycle. Note that the post-2007 dummy indicator drops out due to perfect collinearity with the casino-time indicators. 2). * Significant at the 95% significance level; ** 99% significance level. 3). All regressions contains a set of casino-time dummy indicators to absorb casino-specific flexible time trends applied to all census tract associated with the opening of a casino whether they are nearby or not. 4). The reported standard errors are cluster-adjusted at the level of casino-specific treatment and control groups. The row "e(N-clust)" indicates the number of clusters. The number of casinos is just one half of "e(N-clust)". 5). The census information is from the 2000 Census, even if the casino involved was opened before 2000. The underlying assumption is that census characteristics are relatively stable over time. The 2000 Census is roughly the midpoint of our sample period. 6) The regressions are weighted by census tract resident population.

Figure 1: Comparing trajectories of outcome variables in treated and control areas (more specifically areas within and outside a 2-mile radius, respectively); solid lines are for treated areas, or indicate treated-control differences; time=4 is the opening year.

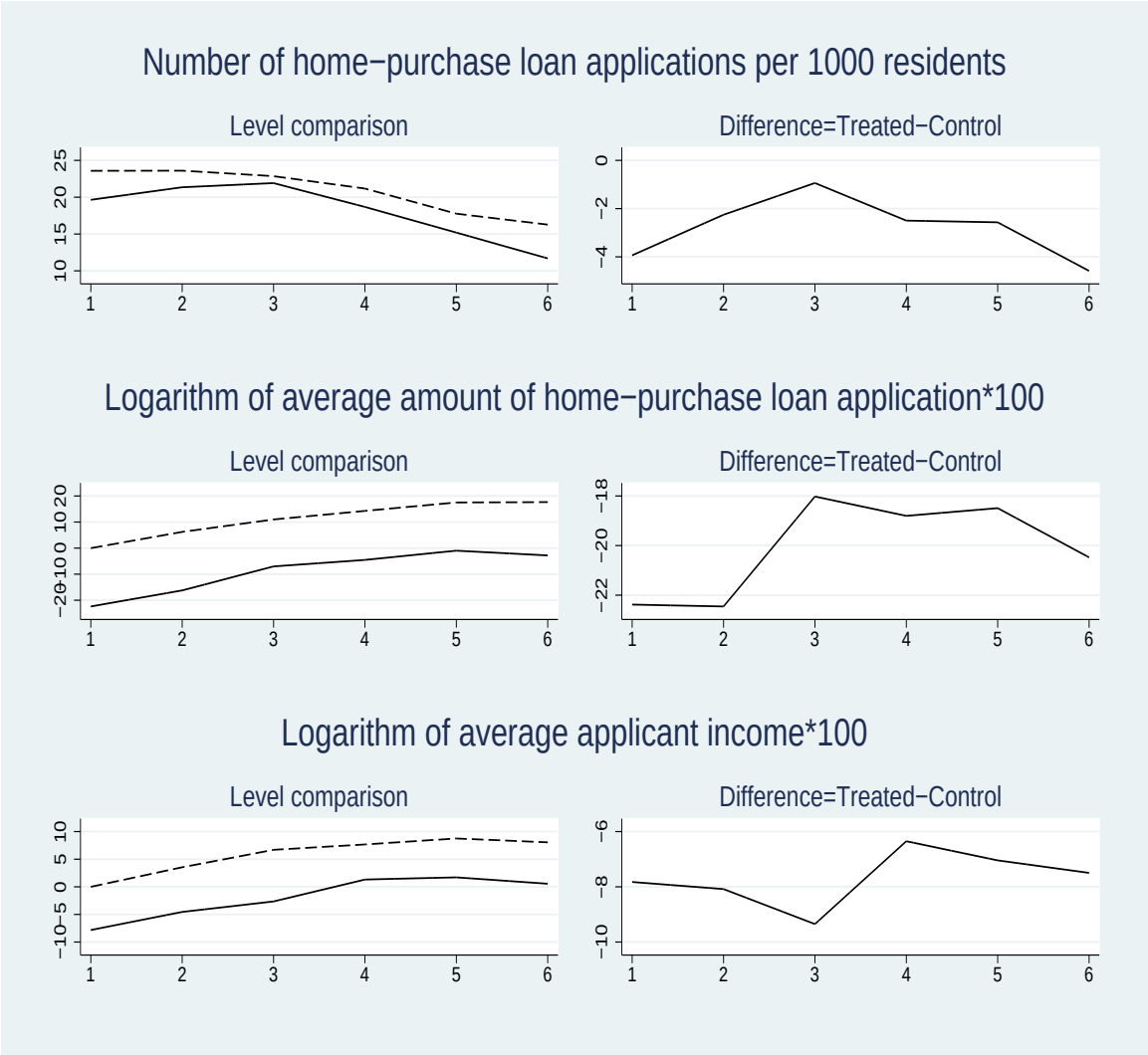

Figure 2: From a smaller sample of casinos with at least 6 years of data before opening – Comparing trajectories of outcome variables in treated and control areas (more specifically areas within and outside a 2-mile radius, respectively); solid lines are for treated areas, or indicate treated-control differences; time=4 is the opening year.

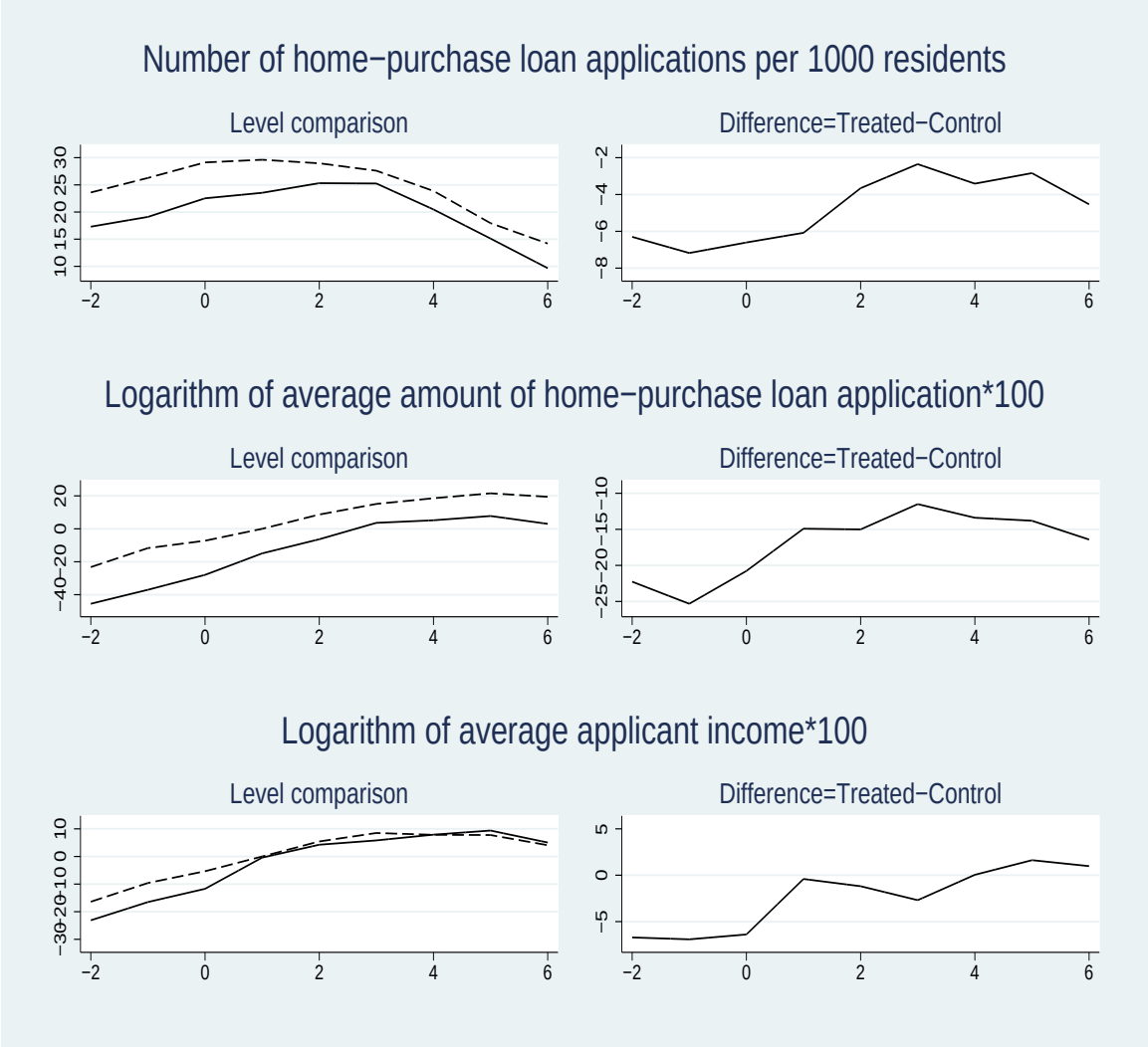

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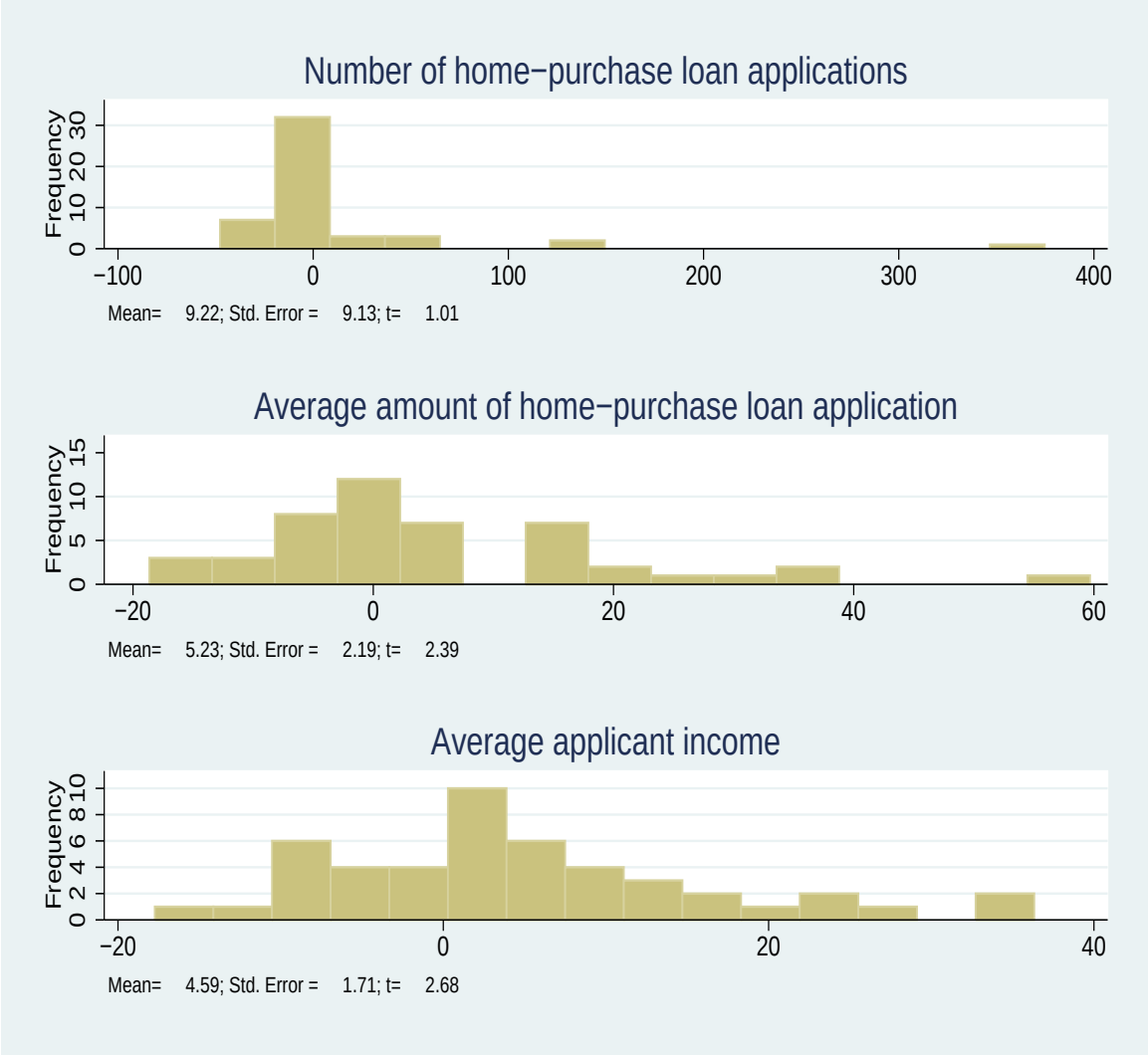
Figure 3: Histograms of percentage-point growth differentials between treated and control areas – more specifically areas within and outside a 2-mile radius – from the 3-year period before the opening to the three year period since the opening



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