# A study of the systematic risks of New Jersey's casinos: phase II - impacts of new market entrants

# A STUDY OF THE SYSTEMATIC RISKS OF NEW JERSEY'S CASINOS:

## PHASE II—IMPACTS OF NEW MARKET ENTRANTS

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## EXECUTIVE SUMMARY

This report presents the findings of the second phase of a study commissioned by the Office of Revenue and Economic Analysis, New Jersey Department of the Treasury. The report was requested on behalf of the Governor's Atlantic City Working Group for the purpose of understanding the capacity of the Atlantic City casino marketplace. Phase I of the analysis found that Atlantic City's gaming market as a share of aggregate regional personal income has appeared to be largely saturated since as early as 1993. At the same time, Atlantic City's share of regional gaming revenue dropped significantly over the period (from 100% in 1995 to 26% in 2018), as competition from new facilities eroded what was once the city's virtual monopoly on regional casino gambling.

Phase II of the study uses two modeling approaches to estimate the net change in Atlantic City's gross gaming revenue that would result from the introduction of a 2,000-slot machine casino in Philadelphia and/or New York City, as well as in Atlantic City itself. Phase II of the study results in two key findings:

1. The addition of new casinos in Atlantic City will yield diminishing returns to gross gaming revenues within the city, particularly as new competitors come on line in neighboring states. Gross gaming revenue of new casinos in Atlantic City would come largely at the expense of existing venues.
2. The opening of new casinos in competing jurisdictions is likely to continue eroding Atlantic City's share of regional gaming revenues.

The near-term trajectory of gaming revenues in Atlantic City will be instructive. It will be possible to observe how the maturation of the recently opened Hard Rock and Ocean Resort casinos affects citywide gaming revenues. The second quarter of 2019 marks a full year of operation for the two new casinos. In that time, Atlantic City's gaming revenues have grown by about $280 million – roughly the average revenue of one casino in the city over the four quarters ending in the second quarter of 2019. Thus, the revenue of the new casinos to a large extent has come at the expense of existing casinos within the city. Such cannibalization will likely become more pronounced with the addition of more casinos. This effect will be exacerbated in the event of an economic slowdown. In addition, while our analysis did not detect an effect of Internet gambling on brick-and-mortar casinos, this growing segment may eventually start to draw significant revenue away from traditional establishments. Sports betting may have a similar effect, though it is too new a phenomenon for those effects to be detected by statistical models.

## INTRODUCTION

This report presents the findings of the second phase of a study commissioned by the Governor's Atlantic City Working Group to explore the potential for new casinos in Atlantic City. Phase I of the study examined regional gross gaming revenue (GGR) as a percentage of aggregate regional personal income and Atlantic City's share of regional GGR from 1993 through 2018. That first phase produced two key findings. First, regional GGR as a share of aggregate regional personal income remained relatively stable over the period. This suggests that Atlantic City's market area was saturated with gaming venues as early as 1993, even prior to the opening of new casinos in neighboring states. Second, since the market was saturated, Atlantic City's share of regional GGR dropped significantly over the period (from 100% in 1995 to 26% in 2018), as competition from new facilities eroded what was once the city's virtual monopoly on regional casino gambling.

Phase II of the study examines in detail the sensitivity of Atlantic City gaming revenues to new competitors within the regional market. Using two modeling approaches, Phase II estimates the net change in Atlantic City's GGR that would result from the introduction of a 2,000-slot machine casino in Philadelphia and/or New York City, as well in Atlantic City itself. This is about the average size of the casinos included in the analysis in Atlantic City, Pennsylvania, and Delaware over the last several years.

The Phase II report begins with a description of the data and an overview of the models used in the study. This is followed by a presentation of the model results and a conclusion summarizing the study findings.

## DATA

Phase I of the study examined regional gross gaming revenues (GGR) as a percentage of regional aggregate personal income drawn from 43 counties comprising seven metropolitan statistical areas. This region was selected to represent the gaming market defined by areas roughly within a two-hour drive of Atlantic City (about a 120-mile radius). Regional GGR includes the GGR for 21 casinos outside of New Jersey, plus that for casinos within Atlantic City.

In Phase II, we narrowed the focus of the analysis to include only those casinos that appeared in the course of Phase I to present significant competition to Atlantic City. Thus, four casinos in Maryland included in Phase I of the study were excluded in the course of Phase II.[1] The study team, meanwhile, expanded the market region for all of the remaining casinos to the 78 counties as shown in Figure I. The idea was to include each casino's ability to draw personal income within its individual market area.[2]

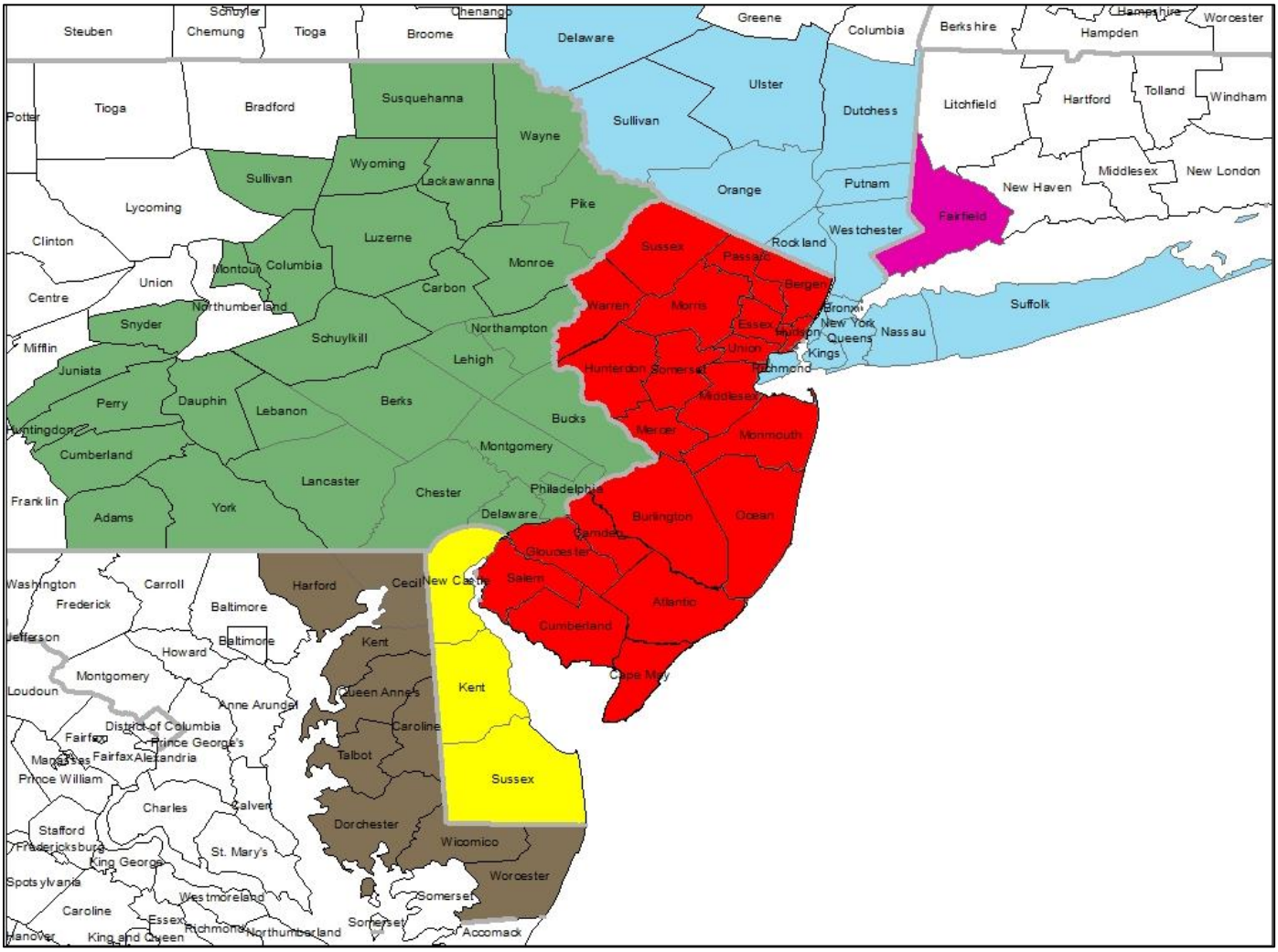
Quarterly GGR, as well as the number of slot machines and gaming tables for each casino were collected from casino authorities of the respective states. The annual county income data series from the U.S. Bureau of Economic Analysis (BEA) were converted to a quarterly basis using the state-level quarterly income patterns reported by BEA.

[1] The Maryland casinos excluded from Phase II were Ocean Downs, Maryland Live!, Horseshoe Baltimore and MGM National Harbor.

[2] The market area for each casino outside Atlantic City was defined as the area within a 60-minute drive. As previously noted, the market area for Atlantic City was defined as the area within a two-hour drive.

**Figure 1**

**78-County Region**



## MODELS

Two models were developed for use in the study – a Huff model and an ARIMA time-series regression model. Both models employ "gravity" type specifications. Gravity in this case is used much the way as it is in cosmology: the gravitational pull of any entity (for our purposes, a casino) is an attraction that is directly proportional to its size (e.g., the number of slot machines) and inversely proportional to its distance from another body. In this case, rather than planets, casinos attract either income from surrounding counties, or revenues from competing casinos.

### *Huff's Model*

Huff's model[3] is based on Reilly's Law of Retail Gravitation, which posits that customers travel further to reach larger retail destinations. It is most commonly used in evaluating the market potential for new retail developments and for identifying peak-period traffic demand between residential areas and workplaces. Huff's model estimates household trip behavior. One of the two "masses" in this gravity model is the wealth of consumers. They are attracted to each destination, which is measured by its "mass" – i.e., its size as a retail or workplace destination. As in the case of Sir Isaac Newton's classical gravity model, the relative attraction between any two masses (households and destinations in Huff's model) is determined by an impedance factor – the distance or travel time between the two masses. In Huff's model, the ratio of each destination's mass to its impedance (i.e., the distance or travel time from the destination to each source of wealth or income – in our case, counties) is calculated. These ratios are summed across the set of all relevant destinations for each source of wealth/income (i.e., county). For a given county, the ratio of the destination mass to its distance from the county is then divided by this total of all ratios to determine each destination's share of the county's income. The relative influence of each mass and impedance in Huff's model can be adjusted via the use of different exponents. For example, literature suggests that when estimating the number of trips between an origin and a destination, distance squared has tended to work best in a retail setting and the square root of travel time in a journey-to-work setting.

In Phase II, we used Huff's model to allocate the 2018 personal income of each of the 78 counties in the region to each of the 17 competing casinos outside Atlantic City as well as to Atlantic City's casino market as a whole.[4] Casino size was measured in terms of the total number of slot machines and gaming tables.[5] Using Google Maps we estimated the car travel times on a Saturday at noon from each county to each given casino.[6] To capture monetary costs of crossing

[3] Huff, David L. (1964). "Defining and Estimating a Trade Area." *Journal of Marketing*, 28, 34-38.

[4] See Appendix A for a list of casinos included in the analysis.

[5] The count of slot machines plus eight times the count of tables worked best, which suggest that an average table secures eight times the GGR of an average slot machine.

[6] More specifically, travel times were measured from the population centroid of each county to each casino. The county population centroid is the point on which a rigid, weightless map of a given county would balance perfectly, if each population member is had equal mass.

the Hudson River in New York City, we added 15 minutes for travel to the two casinos in the New York City area – Empire City in Yonkers and Resorts World in Queens.

The income allocation generated by Huff's model was then used to allocate total regional GGR for 2018, thus producing a GGR estimate for each casino.[7] The sum of these estimates across casinos necessarily equals regional GGR. These estimates of GGR by casino were then compared to the actual casino GGRs to evaluate the accuracy of the model's allocations via the $R^2$ statistic. This exercise was performed iteratively in a search for the "best" exponents on travel time and on the destination mass (slot machines and tables). The best fit used an exponent of 0.7 on travel time for non-New Jersey casinos and 0.5 for travel times to Atlantic City. The lower exponent for travel times to Atlantic City reflect the city's broader market reach, which is founded upon its concentration of gaming, entertainment, hotel rooms, and proximity to beaches. As in the case of travel time, a range of exponents on slot machines was tested, again with separate variants for Atlantic City. The "best fit" took on a value very close to 1.0 and was the same for slot machines in Atlantic City, so no exponent on mass was used.

*Time Series Regression Model*

The second model – an ARIMA time-series regression – estimates how changes in Atlantic City's GGR are influenced by changes in other indicators over time. This model uses quarterly data on GGR, county aggregate personal income, and slot machines[8] from 2008 to 2018. The model measures quarterly GGR in Atlantic City as a function of the number of slot machines in the city (with a three-quarter lag, i.e., delay), as well as two gravity-type variables: the number of slot machines at competing casinos, adjusted for their travel time from Atlantic City (with a three-period lag); and Atlantic City's travel-time-adjusted access to each county's aggregate personal income (lagged by one year). Both of the gravity-type variables use the 0.5 exponent on travel time used in Huff's model.[9] Further, we used a log-log functional form, which enables all parameters derived via the regression to be interpreted as elasticities that measure the percentage effect on Atlantic City's GGR from a percentage change in the count of new slot machines at any particular competing casino location within the market area.

[7] In more technical terms, the income allocation was scaled down to GGR estimates using a "gravitational constant."

[8] We tried to include the quarterly count of tables separately but this variable was excluded for statistical reasons – it was highly collinear with the count of slot machines.

[9] The regression also includes variables controlling for Atlantic City's GGR in the preceding quarter, the New Jersey unemployment rate, and a term correcting for autoregressive errors. An analysis of the factors influencing GGR's share of regional income show that the state's unemployment rate is positively correlated with that share, suggesting *ceteris paribus* a propensity to gamble among unemployed workers. New Jersey's unemployment rate also was identified as a determinant of regional GGR share of regional income—market saturation. Thus, it is included in an analysis of Atlantic City GGR as a proxy for variations in market saturation. Internet gaming revenues were also included in several model specifications, but their influence on Atlantic City casino GGR was very weak and statistically significant only in certain cases. Since the introduction of Internet wagering in 2014, Internet gaming revenues have grown to just under $300 million in 2018 – about the size of an average casino. Data from the first two quarters of 2019 indicate that this segment continues to grow substantially and could well cut into the GGR of Atlantic City's casinos. Sports wagering data were also considered, but are too recent a phenomenon to be included in the analysis.

## RESULTS

This section discusses results from the models described above. Each model yields estimates of the impact on Atlantic City GGR of six different scenarios in which "new casinos" are introduced to the regional gaming market. In all scenarios, the new casinos are sized at 2,000 slot machines. This is about the average size of the casinos included in the analysis in Atlantic City, Pennsylvania, and Delaware over the last several years. It is also the estimated size of the Stadium Casino slated for completion in Philadelphia in 2020.[10]

Note that the models react to the addition of 2,000 slot machines to the market in a specific location. *But they do not distinguish explicitly between the introduction of new casinos or the addition of slot machines at existing venues.* This distinction is critical. It is easier and less costly to add or subtract slot machines at existing casinos than to build and license a new one. Adding more slot machines in Atlantic City presently implies some degree of cannibalization across casinos. This is clearly the case for the addition of new casinos. In recent experience, adding two new 2,000-slot casinos to the market returned net GGR gains equivalent to one casino. For the four quarters ending in June 2018 (prior to the opening of the Hard Rock and Ocean Casino Resort in Atlantic City at the end of that month), average total gaming revenue per casino in Atlantic City was about $336 million, with average casino size of about 2,000 slots. In the subsequent four quarters, following the addition of the two new casinos, total gaming revenues in the city grew by approximately $283.6 million (excluding the approximately $7 million in revenue earned by the two new casinos in the final days of Q2 2018). Thus, while the two new casinos generated gaming revenues of $480 million in the four quarters ending in June 2019 ($300 million at Hard Rock and $180 million at Ocean Casino Resort), the existing casinos experienced aggregate revenue declines of nearly $200 million relative to the preceding four quarters. Consequently, *total* gaming revenues per slot machine city-wide dropped from about $169,000 to about $146,000.[11] While a full financial analysis of each casino is beyond the present scope, there is evidence [see Appendix B] that when a casino's *total* GGR per slot machine drops below a certain threshold, there is increased potential for financial issues to arise.[12]

[10] The average size of casinos in New York State included in the analysis is slightly over 3,000. This is skewed upward by the two casinos in New York City, each of which has over 5,000 slot machines.

[11] Note that for the regression analysis, we include only slot machines as an indicator of casino size. As such, in describing the results in terms of revenues per slot machine, we divide total gaming revenues, including revenues from table gaming, by the total number of slot machines. That is, we do not include a count of tables for table games—the other main source of gaming revenues. Slot machine revenues typically account for between two thirds and three quarters of total gaming revenues. [See Appendix B for a discussion of GGR per slot machine over time.]

[12] There are clearly other factors that weigh into the financial viability of a casino. Casinos in Atlantic City are particularly diversified. New Jersey's relatively low tax rate on GGR enables this diversity in the form entertainment, restaurants, rooms, table games, shopping, etc.

The six scenarios estimated are:

1) Adding a casino in Atlantic City.
2) Adding a casino in Philadelphia.
3) Adding a casino in New York City.
4) Adding a casino in Atlantic City and Philadelphia.
5) Adding a casino in Atlantic City and New York City.
6) Adding a casino in Atlantic City, Philadelphia and New York City.

By estimating only the impacts on gross gaming revenues in Atlantic City's casinos, we disregard for now broader economic impacts, like those from construction jobs generated by building or renovating the structure in which the casino will reside, or on employment or income within the State of New Jersey.

As noted previously, Huff's model allocates market potential based on the distribution of existing facilities (casinos). When simulating the introduction of a new facility, the model redistributes the market across all facilities including the new one. As such, in its basic form and in contrast to the regression model, Huff's model assumes a static market size, and therefore tends to produce more moderate predictions than does the regression model. To expand the capability of Huff's model, we applied the model twice for each scenario – once assuming a static market and once assuming typical growth in aggregate regional GGR driven by growth in regional income. Over the past four years aggregate regional GGR annually averaged growth of 4.3%, or about $350 million. Table 1 displays results of the three scenarios in which one casino is added to the market for each modeling approach.

**Table 1**

**Impacts on Atlantic City Gross Gaming Revenues of Adding a 2,000-Slot Casino**

| | Net Change in AC Gross Gaming Revenues (millions) | | |
|---|---|---|---|
| **Location of New Casino** | **Regression Model** | **Huff Model (Static)** | **Huff Model (with Regional GGR Growth)** |
| No New Casino | - | - | +$88.3 |
| Atlantic City | +$68.9 | +$62.6 | +$150.9 |
| Philadelphia | -$116.2 | -$31.8 | +$52.5 |
| Yonkers (Empire) | -$72.4 | -$23.9 | +$60.7 |
| New York City (Resorts World) | -$68.7 | -$20.6 | +$64.2 |

*Scenario 1: Addition of 2,000 Slots in Atlantic City*

Based on the regression and static Huff model, we estimate that the addition of a 2,000-slot casino in Atlantic City most likely adds between $62.6 and $68.9 million to total GGR revenues within the city, whereas the current average annual GGR per casino is about $293 million. These estimates reflect an increasing saturation of Atlantic City's market area, which converges upon the historical limit as explored in Phase I of the study. Adding a new casino in Atlantic City is likely to cannibalize potential revenue growth from existing casinos.

The static Huff model result of a $62.6 million net gain in Atlantic City is explicitly generated via a reallocation of a fixed amount of regional GGR across all casinos. The reallocation is based on a readjustment from new shares of distance-weighted slot machines and tables across the casinos. In this regard, estimates from Huff's model are necessarily quite conservative. This is because historical evidence suggests that real regional GGR tend to rise with income over time, recessions notwithstanding. From this perspective, the $284 million in Atlantic City GGR growth in the four quarters following the opening of the city's two newest casinos was buoyed by growth in regional income that the static version of Huff's model does not capture. It is this growth that is reflected in the additional regional GGR we add into the version of Huff's model with regional GGR growth. The positive $150.9 million shown for this case adds local market growth to the static version of Huff's model. As indicated in Table 1, in this version of the model, the total increase in Atlantic City GGR is driven by growth in regional income *and* the additional mass of the new casino. With no casino added in any location, this version of the model implies GGR growth in Atlantic City of about $88 million driven by regional growth alone.

As with the static version of Huff's model, the $68.9 million in additional net revenues as estimated via the time-series regression also likely underestimates the true impact of an additional casino in Atlantic City. In this case, it is because the model parameters are based on historical data, and most of Atlantic City's history within the time series of data used reflect a period of monotonic decrease in both slot machines available and in GGR. As such, the important statistical history lessons provided via the introduction of Hard Rock and Ocean Resorts, while emphasized in the model through their recency, are undoubtedly cancelled somewhat in the model parameters by the years of decline and casino closures.

In summary, we deem that, for a scenario in which a new casino is added only in Atlantic City, the more sanguine estimate that emanates from the version of Huff's model that allows regional GGR growth—a net rise in city GGR of $150.9 million—may be more reasonable at the present time. This is verified somewhat by what occurred after two casinos were recently introduced there. Of course, should regional GGR growth falter and decline, due to a national recession that could be in the offing, the regression-based results would undoubtedly be more vital.

*Scenario 2: Addition of 2,000 Slots in Philadelphia*

The results of the regression and the static version of Huff's model indicate that the addition of the new Stadium Casino in Philadelphia will likely cause Atlantic City GGR losses on the order of $32 to $116 million. Here, we have more confidence in the more discouraging findings (for Atlantic City) from the regression model, since the historical data embody a significant number of similar competing casino starts.

The regression model gauges the impact of those competing casinos on Atlantic City gaming revenues by a metric that embodies the aggregate number of slot machines in competing markets, adjusted for their distance (travel time) from Atlantic City. The coefficient on this variable (-0.6) indicates that a 10% increase in the value of the metric (lagged by 3 quarters) is associated with a 6% decrease in AC GGR.[13] The change in this variable when it is recalculated to reflect the addition of 2,000 slots in Philadelphia with a three quarter lag (using the same travel time from Atlantic City as the Sugarhouse Casino) is approximately 7.4%, resulting in an estimated 4.4% decrease in AC GGR relative to the prior four quarters – a change of $116 million for the most recent four quarters. The regression model may overestimate the magnitude of this effect, however, as the addition of slots in competing markets may not capture the full potential of cannibalization within those markets – i.e., the extent to which a new casino in Philadelphia may be more likely to draw customers away from other Philadelphia casinos than from Atlantic City.

Results from Huff's model with regional GGR growth produces a somewhat different result, with a positive $52.5 million of regional GGR growth allocated to Atlantic City. This indicates that Atlantic City casinos would likely share only about one seventh (i.e., $50 million) of total regional GGR growth of $350 million when a new casino in Philadelphia is added to the mix, rather than the one fourth ($ 88 million) it would share if no casinos were added, and about $100 million less than it would if a casino were added in Atlantic City alone.

*Scenario 3: Addition of 2,000 Slots in New York City*

As with Philadelphia, we simulated the addition of a 2,000-slot casino in New York City, using the Empire City Casino in Yonkers and the Resorts World Casino in Queens as the proxies for travel time from Atlantic City.[14] Because of its distance from Atlantic City, an additional casino in New York City yields a more muted effect on Atlantic City gaming revenues than is obtained from a casino added in Philadelphia. This is as expected given the greater amount of time it takes to get to Atlantic City from New York City, let alone the other side of the East River. The simulations using the two casino locations produce similar results, with a range of $21-$24 million in reduced Atlantic City gaming revenues from Huff's model without growth, and a range of $69-$72 million in reduced Atlantic City revenues according to the regression model.

[13] See Appendix C for full regression output.

[14] While Yonkers is outside the boundaries of New York City, it is located just over a mile from the north end of Bronx County and thus serves as a suitable proxy for casino location and travel time to the city.

Once again, Huff's model with regional GGR growth produces a positive range of $61-$64 million in increased Atlantic City gaming revenues. Due primarily to the longer travel time from Atlantic City, the effect on Atlantic City casinos of adding a casino in New York City seems to be slightly weaker than that of adding a casino in Philadelphia. Nevertheless, Atlantic City's GGR gain is still reduced by about $28 million relative to its expected share of regional growth ($88 million), and remains a rather small portion of regional growth relative to the aggregate size of the city's casinos.

*Scenario 4: Addition of 2,000 Slots in Atlantic City and Philadelphia*

In scenarios 4 through 6, we estimate the results of adding a new casino in Atlantic City concurrent with the opening of a new casino in Philadelphia, New York City, or both. The results of this analysis are provided in Table 2.

**Table 2**
**Impacts on Atlantic City Gross Gaming Revenues of Adding**
**2,000-Slot Casinos in Multiple Locations**

| | Net Change in AC Gross Gaming Revenues (millions) | | |
|---|---|---|---|
| **Location of New Casino** | **Regression Model** | **Huff Model (Static)** | **Huff Model (with Regional GGR Growth)** |
| Atlantic City Alone | +$68.9 | +$62.6 | +$150.9 |
| AC + Philadelphia | -$47.3 | +$30.2 | +$117.1 |
| AC + NYC | -$3.5 | +$39.9 | +$127.2 |
| AC + Philadelphia + NYC | -$117.9 | +$8.1 | +$94.1 |

For the regression model, the results in these scenarios are simply the sum of the results of the individual scenarios. Thus, in scenario #4, the addition of new casinos in both Atlantic City and Philadelphia results in a $47.3 million decrease in Atlantic City's gaming revenues. By contrast, the static version of Huff's model estimates that adding the two 2,000-slot casinos at the same time would likely result in a net increase in Atlantic City's GGR. However, this still points to some decay in AC's potential to draw customers due to increased competition (mass) in Philadelphia; the net increase in Atlantic City's GGR is reduced from $62.6 million if a casino is only added in Atlantic City to $30.2 million when a casino is simultaneously added in Philadelphia. In the version of Huff's model with revenue growth, while the net increase in GGR for Atlantic City is larger, it nevertheless reflects the off-setting draw of the new Philadelphia casino. That is, Atlantic City GGR, which would be estimated to increase by about $151 million if a casino were added only in Atlantic City, instead grows by $117 when a casino is also added in Philadelphia.

*Scenario 5: Addition of 2,000 Slots in Atlantic City and New York City*

In this scenario, we estimate the impacts on Atlantic City's GGR of adding new casinos in Atlantic City and New York City.[15] As with Philadelphia, the results suggest that the addition of a new casino in New York City will undermine AC's ability to draw revenue, though with a somewhat weaker effect than that of a new casino in Philadelphia. For example, the regression model indicates a reduction of $3.5 million in Atlantic City GGR when casinos are added in Atlantic City and New York City, versus a reduction of $47.3 million when casinos are added in both Atlantic City and Philadelphia. Similarly, in the version of Huff's model with regional GGR growth, potential revenue gains for Atlantic City are reduced from $151 million when a casino is added only in Atlantic City to $127 million when a casino is also added in New York, while these gains are reduced from $151 million to $117 million when the additional casino is added in Philadelphia.

*Scenario 6: Addition of 2,000 Slots in Atlantic City, Philadelphia and New York City*

Based on the modeling results, we estimate that the impact of adding a 2,000-slot casino in all three locations on Atlantic City GGR will most likely range from a loss of $118 million (regression model) to a gain of $94 million in Huff's model with regional growth. As one would expect, the addition of new casinos in multiple competing jurisdictions significantly offsets any GGR gains that Atlantic City might realize from the addition of a new casino. While this offsetting effect is more muted in Huff's model, either with or without growth, it nonetheless results in negligible GGR gains relative to the average GGR of existing casinos.

## CONCLUSION

This study examined the potential impacts of additional casino capacity on the total gross gaming revenues within the Atlantic City casino marketplace. It used two modeling approaches to obtain a range of impact estimates for each of six scenarios. The range is wide in selected scenarios. Both approaches consistently found that the addition of new casinos in Atlantic City will reap increasingly diminishing returns, and the vitality of a new market entrant depends, in part, on its ability to draw revenues away from the existing set of casinos in Atlantic City. The analysis also shows that a new casino in the competing markets of Philadelphia and New York City would draw gaming revenue away from Atlantic City, much as we have observed since 2005. Gross gaming revenue in Atlantic City declined by over 50% from its 2006 peak of over $5.2 billion to just over $2.5 billion in 2018. This effect further diminishes any growth-inducing capacity of new casinos in Atlantic City.

The near-term trajectory of gaming revenues in Atlantic City will be instructive. For one, we will be able to observe how the maturation of the Hard Rock and Ocean Resort casinos affects citywide gaming revenues. In the year following their opening, Atlantic City's gaming revenues

[15] Here we use the average impact of the addition of a casino in Yonkers (using Empire City Casino as a proxy) and Queens (using the Resorts World Casino as a proxy) to represent the casino in New York City.

have grown by about $280 million –roughly the average revenue of one casino in the city over the four quarters ending in the second quarter of 2019. Thus, the revenue of the new casinos has come to a large extent at the expense of existing casinos within the city. Our analysis suggests that such cannibalization would likely become more pronounced at present with the addition of more casinos.

The study did not find a significant effect of sports betting and internet gaming on brick-and-mortar casino revenues, though these are relatively new segments and may grow in importance over time.

Finally, the current pace of growth in Atlantic City's GGR, while positive is also rather slow. The regional and national economies are growing fairly strongly—as well as they have over the past decade. If general economic growth falters, it is likely to have a deleterious effect on all casinos' GGRs, let alone those for Atlantic City. The degree to which casinos in Atlantic City, which have experienced recent GGR losses, are able to recover will be worth watching.

## APPENDIX A
## CASINOS INCLUDED IN THE ANALYSIS

**NEW JERSEY** (Casinos no longer in operation are shown in red.)
Atlantic Club – closed 2014
Bally's AC
Borgata
Caesars AC
Golden Nugget (formerly Trump Marina, sold in 2011)
Hard Rock
Harrah's AC
Ocean Casino Resort
Resorts
Revel – closed 2014
Showboat – closed 2014
Tropicana
Trump Plaza – closed 2014
Trump Taj Mahal – closed 2016

**DELAWARE**
Delaware Park
Dover Downs
Harrington

**PENNSYLVANIA**
Mohegan Sun Poconos
Parx
Harrah's Philadelphia
Mount Airy
Hollywood/Penn National
Wind Creek Bethlehem (Sands Bethlehem)
Sugarhouse
Valley Forge
Stadium Casino (forthcoming)

**NEW YORK**
Monticello
Empire City Casino
Resorts NYC
Jake's 58
Resorts Catskills

**MARYLAND**
Hollywood Perryville

## APPENDIX B
## TOTAL GROSS GAMING REVENUES PER SLOT MACHINE

It is beyond the scope of the present study to analyze the financial health of any given casino. Still, declines in Atlantic City's share of regional gaming revenues have resulted in the closure of several casinos, so it is worth examining how the metrics at the disposal during this study might distinguish the five casinos that closed in 2014 and 2016.

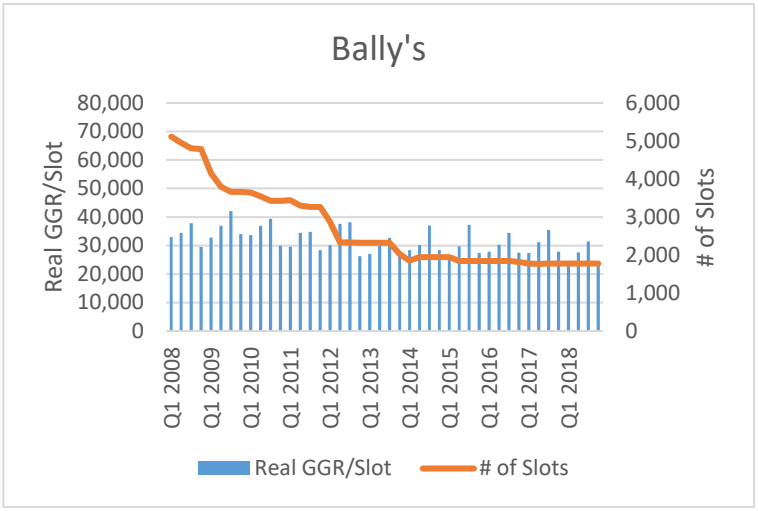
The graphs on the following pages track total GGR per slot machine (that is, combined revenue from slots and tables games, divided by the number of slots). The graphs show the metric for five Atlantic City casinos that closed between 2014 and 2016 as well as for those that remained in operation; The two casinos that opened in 2018 are excluded. Blue bars show the total quarterly GGR per slot machine in inflation-adjusted 2018 dollars (measured on the left axis) and the orange line shows the average number of slots in each quarter (measured on the right axis) from 2008 through the last quarter of operation for those casinos that closed and through 2018 for those that remain.

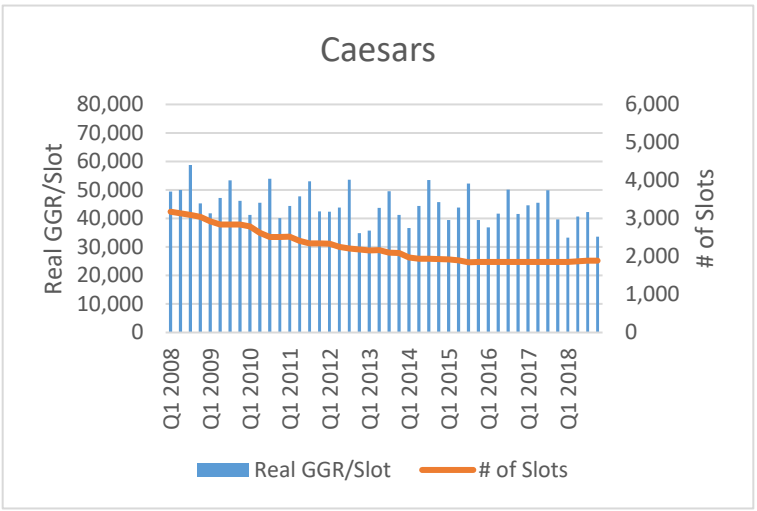
Given the simultaneous pressures of the Great Recession and growing competition from casinos in other states, most Atlantic City casinos appear to have dropped slot machines in 2008-2009 in order to reduce costs and maintain a more robust GGR per slot machine. The GGR per slot machine for the five casinos that closed their doors ultimately fell below $30,000 quarterly for a prolonged period. A few casinos that still exist managed to maintain operations, despite maintaining that key metric at close to $30,000 per slot machine for an extended period. Tropicana, for example, reduced its count of slot machines by over 1,000 since 2008 in an apparent effort to maintain buoyancy; Bally's reduced its slot count by over 3,000 from 2008 to 2014 for what seems to be similar reasons; and the Trump Marina, which fell below that $30,000 threshold for several years wound up being sold and rebranded as the Golden Nugget. It then managed to recover to what appears to be a serviceable GGR per slot beginning in 2014.

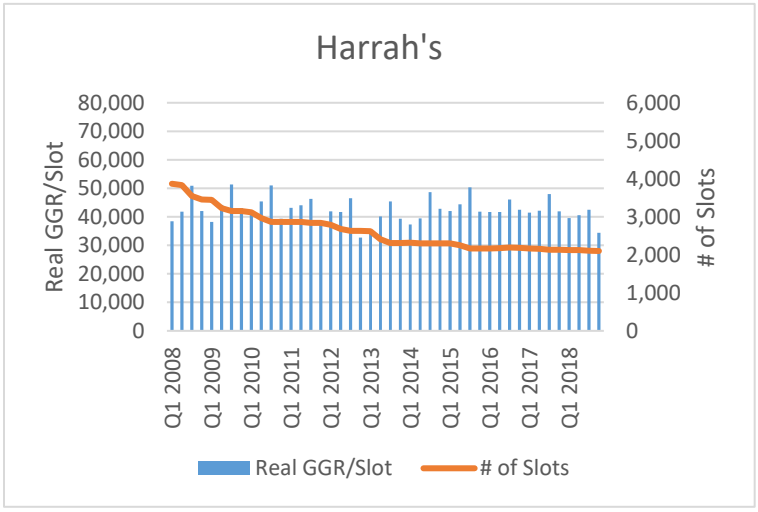
As noted above, there are clearly other factors that weigh into the financial viability of a casino. Casinos in Atlantic City are particularly diversified. New Jersey's relatively low tax rate on GGR enables this diversity in the form entertainment, restaurants, rooms, table games, shopping, etc. This is because higher tax rates consume funds that would otherwise be available for investing in these diversified consumer amenities.[16] In this vein, the degree to which casinos are diversified may help them to weather periods of depressed GGR per slot machine.

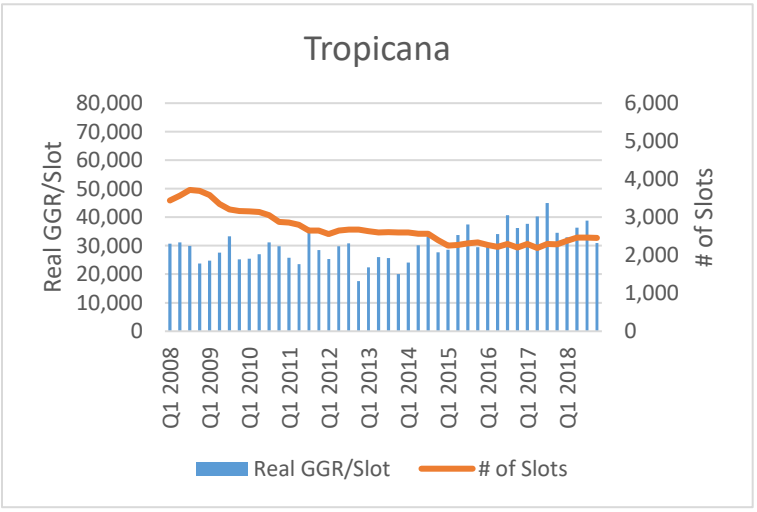
[16] Christiansen, E. 2005. Impacts of gaming taxation in the United States, *AGA 10th Anniversary White Paper Series*. Washington: American Gaming Association.

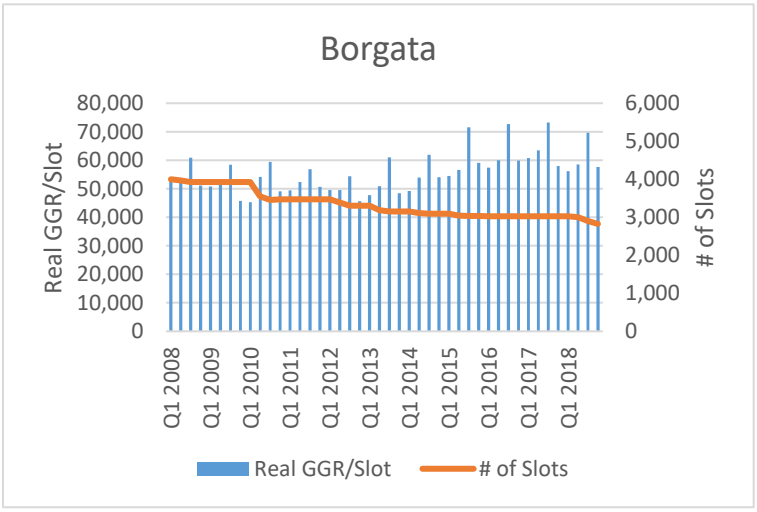
## Currently Operating Casinos

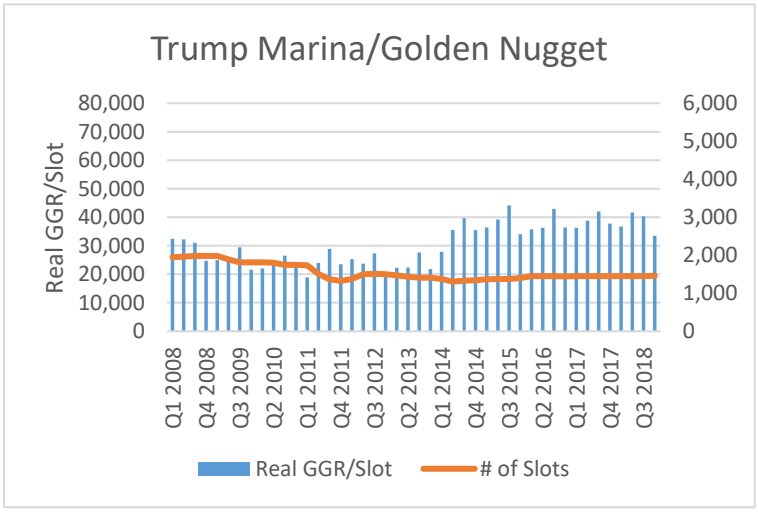


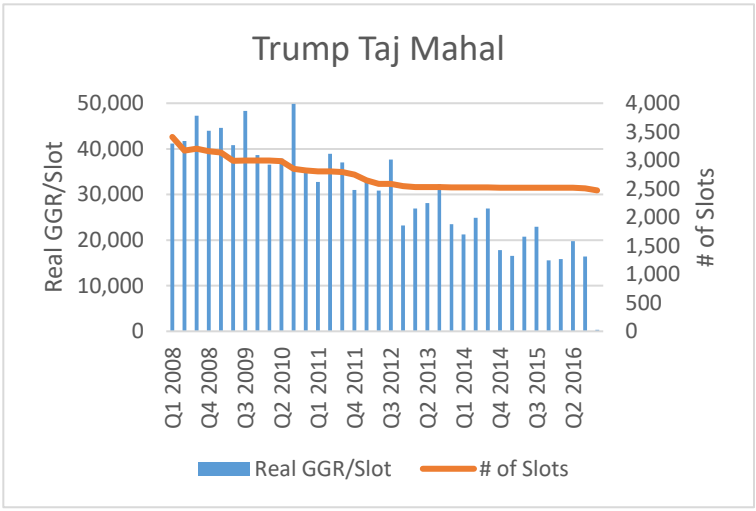



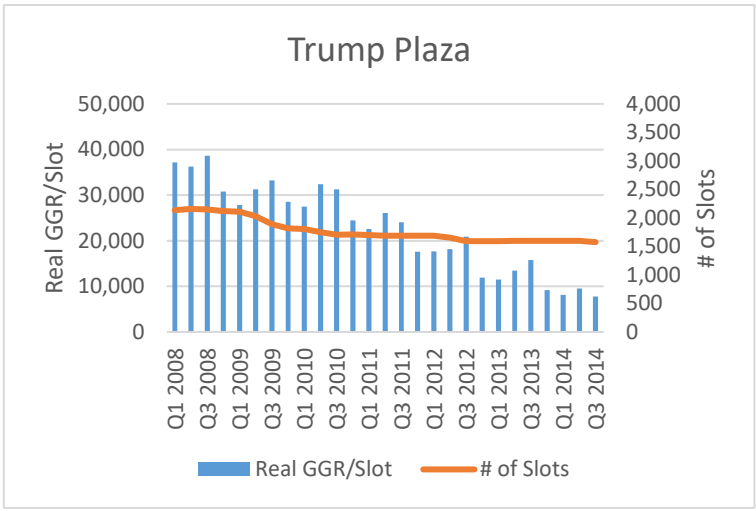



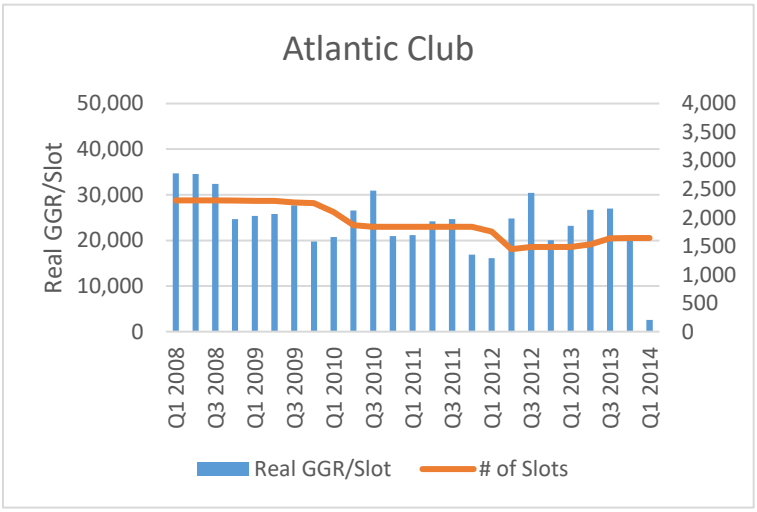



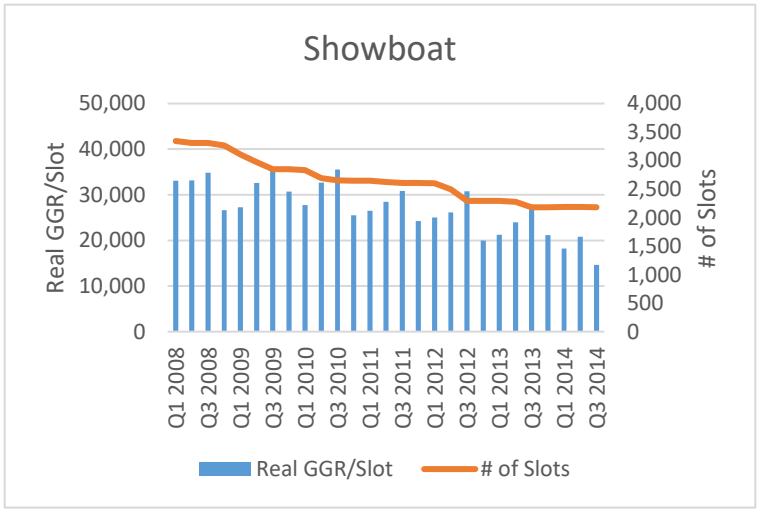



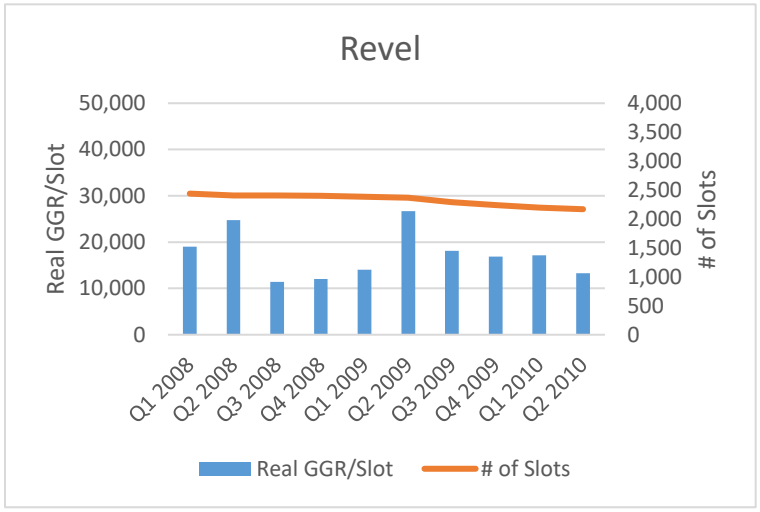
## Closed Casinos



**APPENDIX C**
**REGRESSION MODEL OUTPUT**

Dependent Variable: LOG(ACGGR)
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 11/05/19 Time: 14:56
Sample: 2009Q1 2018Q4
Included observations: 40
Convergence achieved after 10 iterations
Coefficient covariance computed using outer product of gradients

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 2.691056 | 5.825862 | 0.461915 | 0.6473 |
| LOG(ACGGR(-1)) | 0.520802 | 0.165782 | 3.141481 | 0.0036 |
| LOG(ACSLOTSACTUAL( | 0.194489 | 0.111923 | 1.737698 | 0.0919 |
| LOG(DS_SLOTS(-3)) | -0.596524 | 0.193166 | -3.088135 | 0.0041 |
| LOG(REALACINCOME(-4 | 1.464683 | 0.675732 | 2.167549 | 0.0377 |
| LOG(NJURATE(-4)) | 0.117957 | 0.077160 | 1.528738 | 0.1362 |
| AR(4) | 0.926544 | 0.083205 | 11.13565 | 0.0000 |
| SIGMASQ | 0.002355 | 0.000697 | 3.380828 | 0.0019 |

| | | | |
|---|---|---|---|
| R-squared | 0.941100 | Mean dependent var | 20.38479 |
| Adjusted R-squared | 0.928216 | S.D. dependent var | 0.202505 |
| S.E. of regression | 0.054256 | Akaike info criterion | -2.617805 |
| Sum squared resid | 0.094200 | Schwarz criterion | -2.280029 |
| Log likelihood | 60.35610 | Hannan-Quinn criter. | -2.495676 |
| F-statistic | 73.04236 | Durbin-Watson stat | 2.291111 |
| Prob(F-statistic) | 0.000000 | | |

| | | | | |
|---|---|---|---|---|
| Inverted AR Roots | .98 | .00+.98i | -.00-.98i | -.98 |