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# Nevada Gaming Revenue: A Comparative Analysis of Slots and Tables

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### NEVADA GAMING REVENUE: A COMPARATIVE ANALYSIS OF SLOTS AND TABLES

*Scott Boylan*

**ABSTRACT:** Throughout much of its existence, Nevada's gambling industry has been dominated by table games. Historically, slot machines were of secondary importance because they did not generate much revenue and were costly to maintain and operate. Starting in the late 1970s, a series of technological milestones improved the form and function of slot machines, and fueled replacement cycles on casino floors. Nevada gaming revenue data provides evidence of the economic effects of these improvements. Since 1984, slots generally have produced larger revenue gains than tables, although those gains are distributed neither uniformly over time nor across gaming markets. In addition, slots have achieved most of those revenue gains through superior unit growth, and to a lesser extent, through improvements in efficiency. Overall, the evidence suggests technological advances have broadened the appeal of slots relative to table games. However, there is comparatively little evidence of wholesale increases in the revenue-generating ability or usage of the devices on a per unit basis.

Keywords: Casino, Gaming, Technology, Slot Machine, Revenue, Efficiency, Accounting

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The modern era of gambling in Nevada began in 1931 when it was re-legalized by the state's legislature. This coincided with an influx of workers who were building the Hoover Dam, which was dedicated in 1935. Following legalization, casinos began opening throughout the state. However, it wasn't until the after the end of World War II that legal gambling in Nevada began to emerge as big-business. In late 1946, Benjamin "Bugsy" Siegel opened the Flamingo Hotel and Casino, which, at that time, was the most ambitious development project on the Las Vegas Strip. A few months earlier, the Golden Nugget opened in downtown Las Vegas, based

on a \$1 million initial investment, and was the self-proclaimed "largest casino in the world."<sup>1</sup>

Growth during those early years produced accounting conventions that remain in use in the gaming industry, and which have spread to other industries. Because of relatively thin profit margins, coupled with the amount of cash flowing through casinos, developing good accounting and internal control was paramount.

Slot machines were problematic because they didn't generate much revenue. Table games like craps, 21, roulette, and baccarat were much more popular and profitable. In addition, slots posed unique accounting

and control challenges. However, beginning in the 1980s, new and improved slot machines began appearing *en masse* on casino floors. Slot manufacturers, utilizing advances in technology, achieved a series of milestones in machine design, with each successive generation of devices intended either to increase entertainment value or mitigate accounting challenges. Since the early 1980s, these advances have fueled multiple replacement cycles. Accordingly, as compared to its predecessors, the modern slot machine is a much more sophisticated and immersive device.

Nevada gaming revenue data provides empirical evidence on the economic effects of these changes. In particular, ever since the new breed of slots began replacing older machines in the 1980s, slots have outperformed tables, producing larger revenue gains. However, those gains are not uniform; either over time or across gaming markets. In addition, the most significant source of revenue gains has been from superior unit growth, as opposed to increased revenue-per-unit. This suggests that the main driver of slots' revenue gains has been a broadening of their appeal relative to table games -- rather than from an increase in their efficiency or revenue generating ability on a per unit basis.

### Accounting, Control, and Slots

As casinos grew larger and more elaborate in the 1940s and beyond, they became more costly to build and operate. And, as the size of the properties and their scope of operations grew, so did the need for more sophisticated accounting and control procedures. Accountants in the industry responded by developing practices which at the time were innovative, and which remain in use today. In addition, those practices highlighted the limitations that marginalized slot machines during the industry's early years.

Charles (C.J.) Hirsch was an accountant, and the controller for the Golden Nugget from 1950-1970. He later worked for Howard Hughes, as the Sands Hotel and Casino's controller. Hirsch became a leader and an influential figure in the casino industry. He earned an accounting degree from Pace Institute (later Pace University) in 1937, and spent the next 12 years working as an accountant, including a three year tour as a contract auditor for the Air Force during World War II. Hirsch used his experience to help develop the Golden Nugget's internal accounting and control systems. And because of the youth of the gambling industry itself, Hirsch was uniquely positioned to shape accounting practices



Figure 1: C.J. Hirsch: accountant and controller for the Golden Nugget from 1950-1970. University of Nevada Las Vegas, Lied Library, Special Collections: C.J. Hirsch Collection. MS-00291: Box 1.

industry-wide. In fact, he was a pioneer in the use of statistical analysis to monitor financial performance.

Between 1959 and 1970, Hirsch travelled throughout the United States, giving more than 50 speeches on the Golden Nugget's innovative accounting practices; particularly on the degree to which those practices incorporated statistical analysis as a tool for generating financial information to be used in decision-making, for fraud detection, and for business process control.<sup>2</sup>

Hirsch spoke to practitioners from a variety of industries and professional societies. Several of his speeches -- during the height of the cold war and the space race -- were made to scientists, engineers, and managers at companies like Northrop, Lockheed, McDonnell Douglas, General Electric, and Texas Instruments -- and also at the First Space Congress.<sup>3</sup>

Hirsch also spoke to the accounting profession, addressing state CPA societies, professional conferences, and the Institute of Internal Auditors on the use of statistical analysis as a tool for financial control and fraud prevention and detection. His speeches came at a time when the accounting profession was struggling with the use of statistics and sampling. Hirsch was genuinely interested in convincing skeptical accounting professionals of the benefit -- and necessity -- of implementing the types of accounting processes and procedures that he was using at the Golden Nugget. Also, in 1968, lending credence to the growing significance of his industry, Hirsch even addressed an

Internal Revenue Service training program, focusing on the Golden Nugget's accounting policies and internal controls.<sup>4</sup>

Hirsch's speeches provide insight into the philosophy behind the accounting practices that he helped develop. For example, Hirsch argued that his business, legal gambling, must be above reproach in order to maintain the public trust; and that therein lied its comparative advantage over illegal and quasi-legal gambling.<sup>5</sup> Hirsch felt that this necessitated strict attention to detail and very strong internal control. He argued that customers must be positive that they aren't being cheated, that there are no hidden risks in the games, and they must be assured that the casino has the wherewithal to meet its obligations. He argued that if his industry couldn't provide those assurances, it would lose its advantage, and undermine its business model.

Hirsch also emphasized throughout his speeches that the casino business model itself is built on understanding probability and statistics<sup>6</sup> -- which is why the industry was uniquely positioned to be a leader in using statistical analysis as a management tool. This, in fact, is one of the main reasons why a cost accountant from a small company in an obscure industry from a sparsely populated state had the credibility to go around the country speaking to scientists, engineers, managers, and professional accountants about how to improve their business processes.

Finally, Hirsch emphasized that the economics of his business (low margins driven by probabilities inherent in games, high transaction volume, and inventory highly susceptible to theft) made it imperative for casinos to use statistical analysis as a tool for measuring performance and preventing and detecting fraud.<sup>7</sup> He emphasized that it was essential to measure performance all the way down to the device level. In fact, variations of the concept of "revenue-per-unit" permeate Hirsch's speeches. He stressed the need to use probability theory and statistics to develop objective expectations and tolerances regarding the amount of revenue-per-unit that one should expect a table or machine to generate on a daily basis. He also emphasized the need to measure performance multiple times a day, and immediately investigate unusual variances between actual performance and the statistically derived benchmarks. To Hirsch, this was absolutely necessary for his casino's financial health, and to maintain the public trust.

Hirsch's speeches also reveal that he viewed slots with contempt, and gave clues as to why. His opinion of

the devices can be summed up by the following quote:

"They [slots] are not even gaming devices in the first place. They are amusement devices. People don't gamble on slot machines, they play slot machines. Which is a quite different thing and a lot of fun --- I guess."<sup>8</sup>

One of the main reasons that Hirsch, and other casino managers at the time, had such a dim view of slots is that they did not generate much revenue. For example, records from the Sands Hotel and Casino from 1975, when Hirsch was its controller, show that slots accounted for less than 10% of casino revenue. More specifically, through the first seven months of 1975, slots had produced about \$1.8 million in revenue, as compared to \$18.6 million for table games.<sup>9</sup>

Second, Hirsch noted that slots were a prime target for amateur thieves. He quipped that over 95% of a slot machines' parts were devoted exclusively to preventing theft. Hirsch also was dismayed that the thieves, who according to him, were smart/clever/determined enough to be machinists anywhere in the United States, instead chose to make their careers "stealing nickels" from his casino.<sup>10</sup>

And, third, speaking of nickels, Hirsch lamented that all of the revenue that his slots produced was in the form of coins. He noted that a \$100 bag of nickels weighs 22.5 lbs.<sup>11</sup> So, the \$1.8 million in revenue that the Sands slots generated through July of 1975 weighed about 405,000 lbs. Emptying machines of those nickels, counting them, and sending them to the bank was labor intensive, risky, and very costly. Not a good cocktail for a cost accountant running a business on razor-thin margins.

Because of the economic limitations highlighted by Hirsch, slots languished for much of their existence. Through the late-1970s they were viewed as a necessary evil; toys to occupy and amuse friends and family of the casino's real customer -- the card or dice player -- the one who generated the \$18.6 million for the Sands; and not in nickels.

### Slot Evolution

Another historic figure in the casino industry is William "Si" Redd, a businessman from Mississippi, who had expertise in the distribution of coin-operated arcade games. He arrived in Nevada in 1967 and got involved in the slot machine business. He immediately noticed the similarities between slots and his arcade games, and also noticed that the slots were old and decrepit. "Everything was 50-75 years old," he observed.<sup>12</sup> Redd needed to convince people like Hirsch to invest in new machines.

But, their underlying economics made that a difficult sell; casinos were reluctant to upgrade their aging machines, despite the fact that they were unreliable and costly to operate, maintain, and repair.<sup>13</sup> That reluctance was the main reason why so many of the machines that Redd saw were first-generation models, dating back to gambling's legalization in 1931.

Redd knew he had to come up with something fresh -- and he did. His idea was to increase slot payoffs; both in size and in frequency. To offset the more generous payoffs, Redd wanted to use electronic componentry to increase the speed of play. He conjectured that increased speed would offset increased jackpots, and also make the games more appealing, which would induce customers to play longer or more frequently. This, in turn, would increase revenue-per-unit in a way that had never been done, and would be the key selling-point to casino operators and accountants like Hirsch. Ultimately, Redd's vision wasn't borne out of a desire to transform the industry, but rather, simply to give him a bona fide selling-point.

Redd eventually founded International Game Technology. By adapting computer programs that ran first generation video games like "pong," IGT introduced video poker machines to the market. In a short period of time, IGT became the world's leading manufacturer of slot machines. Ironically, with respect to video poker, Redd was more proud of the fact that his company figured out how to put those machines into casino bar tops than he was of the machines themselves.<sup>14</sup> He used this as a selling point to casinos, noting that when their customers were in the bar, the casinos weren't generating any revenue.

Redd's innovations began a series of milestones in slot machine technology, utilizing advances in electronics, digital components, and computer processing, each of which advanced the form and function of the devices, and which also systematically addressed Hirsch's concerns about their underlying economics.

Some advances, like Redd's updated pay schedules and later, the implementation of bonus features, progressive jackpots, and improved ergonomics were designed to make the games more entertaining and appealing to customers. Other advances, like bill acceptors, and ticket-in-ticket-out technology eventually eliminated coins from the devices altogether; thus drastically reducing the cost, risk, and effort required to operate them. Yet other milestones, like multi-denomination devices, and more recently, server-based interfaces, have reduced the number of machines required to meet customer demand.

Each of these advances, from a practical standpoint, was designed to favorably change the economics of operating a slot machine; and to serve as a key selling point for manufacturers; thus feeding the cycle of innovation and replacement that has characterized the machine-based gaming industry for the last thirty-five years.

### **Effect on Gaming Revenue**

If technological advances are geared toward improving the economics of machine-based gaming, then a natural question is, "what empirically quantifiable financial effects have these advances generated?"

In contrast to slots, the table gaming experience has been largely unaffected by changes in technology. Games like craps, 21, baccarat, and roulette are governed by underlying rules which limit the types of bets that one can make, and the payoffs associated with those bets. Accordingly, those games today are played largely the same way that they were played fifty or more years ago.

The fact that table games and slots coexist and are played side-by-side in casinos creates an interesting quasi-experimental setting, allowing one to compare table games with slots, which have followed different paths over the past 30-40 years. On one hand, table games represent a stable, unchanging staple of the casino gaming experience. On the other hand, slots represent a more dynamic part of that experience, having evolved significantly and continually in terms of form and function – and which are certain to continue evolving in the future.

Gaming Revenue Reports from the Nevada Gaming Control Board provide the necessary data for examining this question. The University of Nevada Las Vegas' Center for Gaming Research has compiled and published summary data dating back to 1984.<sup>15</sup> That data serves as the basis for this analysis.

Data consist of revenue generated from both table games and slots operated by entities with non-restricted licenses during the time period.<sup>16</sup> Revenue amounts have been converted to 2015 dollars in order to account for changes in purchasing power resulting from inflation, and to facilitate comparisons over time. More specifically, historical revenue figures have been adjusted to account for changes in the consumer price index. For instance due to inflation, \$0.44 of revenue in 1984 had the same purchasing power as \$1.00 of revenue in 2015. Equivalently, \$1.00 of revenue in 1984 had the same purchasing power as \$2.81 in 2015.

In addition, data include the number of tables and slots in operation each year. Finally, the dataset consists of two distinct geographic segments; the Las Vegas Strip, and elsewhere in Nevada (hereafter “off-Strip”). Off-Strip represents a combination of markets, including downtown Las Vegas, the Boulder Strip, Washoe County, and the rest of the state, the latter of which includes the balance of Clark County (the Las Vegas metropolitan area; excluding the Las Vegas / Boulder Strips and downtown Las Vegas). Cumulatively, the data represent all of the non-restricted gaming revenue from tables and slots generated statewide. Separately analyzing the Las Vegas Strip is important because it is the most distinct gaming market in Nevada. For instance, the Las Vegas Strip generates most of its revenue from visitation. And, dominant companies like MGM, Las Vegas Sands, Wynn Resorts, have invested heavily in facilities aimed at diversifying business on the Strip; with convention business, entertainment, and retail growing in prominence.

Table revenue comes from games like 21, craps, baccarat, roulette, and a variety of others. The first four games typically account for most of the table activity included in the data. For instance, for the year ended December 31, 2015, these four games accounted for 63 percent of the table seats and 75 percent of the table

revenue generated statewide.<sup>17</sup>

Figure 2 illustrates Nevada gaming revenue from 1984 through 2015. Amounts are in millions of US dollars, and are adjusted for inflation. In addition, figure 2 shows the contributions made by slots and tables, both on the Las Vegas Strip and off. Figure 2 clearly illustrates that, after inflation, gaming revenue more than doubled to nearly \$15 billion between 1984 and 2007. Subsequent to 2007, which marked the beginning of the Great Recession, gaming revenue declined sharply, and has since stabilized. In addition, off-Strip table revenue has fared particularly poorly over the 31 year period. Unlike the other components of gaming revenue; all of which have grown in real terms since 1984, off-Strip table revenue has declined steadily – and by nearly 50 percent. So, while Nevada gaming revenue has shown real economic growth over the past 31 years, this growth has come principally from slots and to a lesser extent, from tables on the Las Vegas Strip. Table performance off-Strip has been a persistent drag on gaming revenue. Incidentally, after adjusting for inflation, Nevada gaming revenue today is approximately what it was 20 years ago, in the mid-1990s.

The data also reveal additional insights about the underlying causes of these revenue swings. Essentially, a casino can change its gaming revenue either by changing

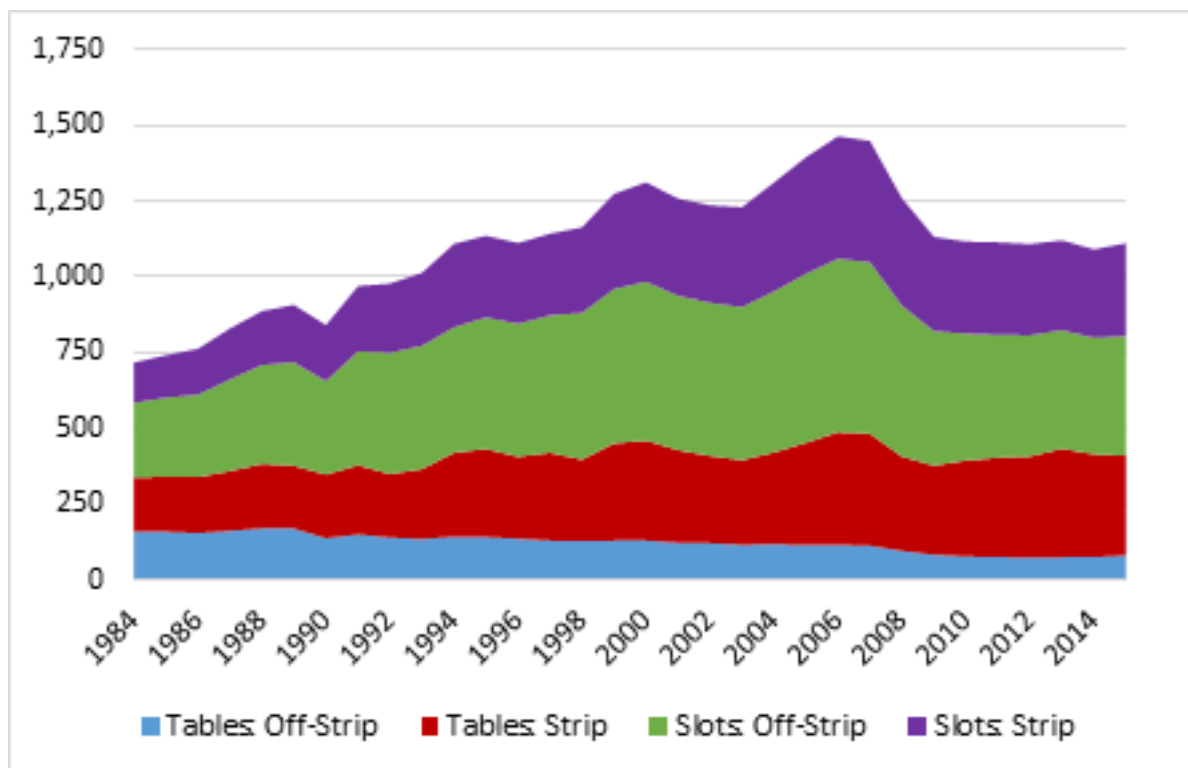


Figure 2: Nevada gaming revenue, by source and gaming market, between 1984 and 2015. Amounts are in US dollars (millions), and are adjusted for inflation.

the number of gaming units (slots or table seats) it has in service, or by changing the average revenue that each unit generates. Casinos can accomplish the latter, for example, by changing the mix of games, or similarly, by replacing underperforming games with more popular ones.

Equation 1, where RPU represents revenue-per-unit, summarizes this intuition. It states that revenue earned in time period t equals the number of units in service during that period – multiplied by their average revenue-per-unit.

$$Rev_t = Units_t * RPU_t \quad [1]$$

With a little bit of algebra, the change in revenue from one period to the next can be expressed as follows, where the symbol, Δ, represents change from the beginning of a time period to the end of that time period.

$$\Delta Rev = \Delta Units * RPU_{(End)} + \Delta RPU * Units_{(Beg)} \quad [2]$$

The first term on the right hand side of equation 2 accounts for the effect on revenue of changing the number of units in service. The expression indicates that each additional unit increases revenue at the current level of RPU. The second term on the right hand side accounts for the effect of increasing or decreasing

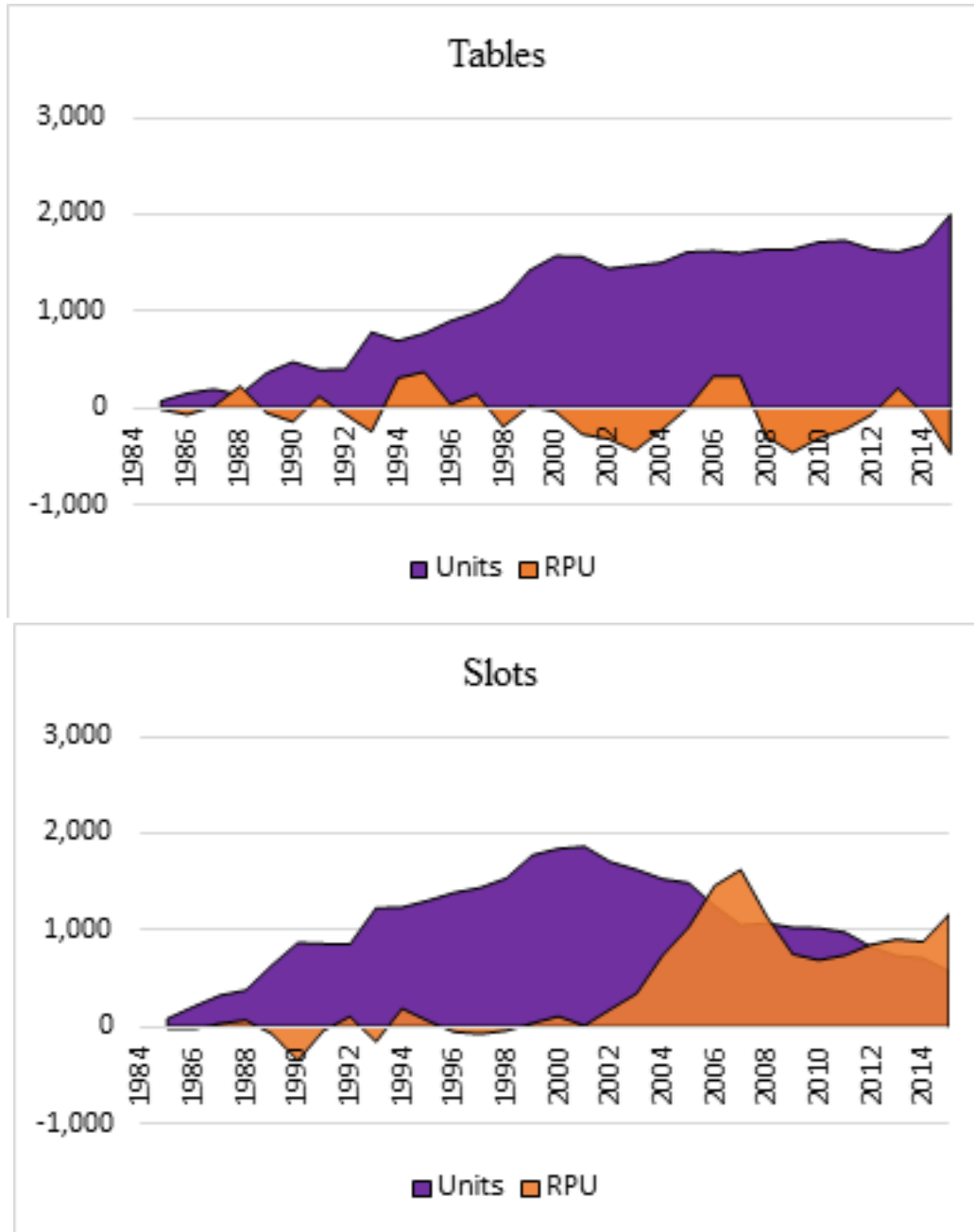


Figure 3: Revenue growth on the Las Vegas Strip between 1984 and 2015. Amounts depict the change in gaming revenue attributable to either the change in units in operation or the change in revenue-per-unit as calculated in equation 2. Amounts are in US dollars (millions), and are adjusted for inflation.

RPU. It indicates that increasing revenue-per-unit increases total revenue in proportion to the number of units in service. The first term is a measure of the effect of changing volume or capacity, while the second term is a measure of efficiency. Separating the change in revenue into these two terms provides insight into the underlying causes of the increases and decreases depicted in figure 2.

Figure 3 focuses on the Las Vegas Strip, and depicts the change in revenue for tables and slots respectively. For example, slot revenue on the Strip – adjusted for inflation – and illustrated in figure 2, grew from

about \$1.3 billion in 1984 to just over \$3.0 billion in 2015. Figure 3 shows how that \$1.7 billion increase accumulated over time.

Figure 3 also illustrates how much of the change in revenue is attributable to the change in the number of units in operation (Units), and how much is attributable to the change in revenue-per-unit (RPU), as calculated in equation 2. First, figure 3 shows that virtually all of the revenue growth for tables on the Las Vegas Strip has come from changes in the number of tables in operation. Overall, there has been little change in table revenue-per-unit since 1984. However, it turns out that these

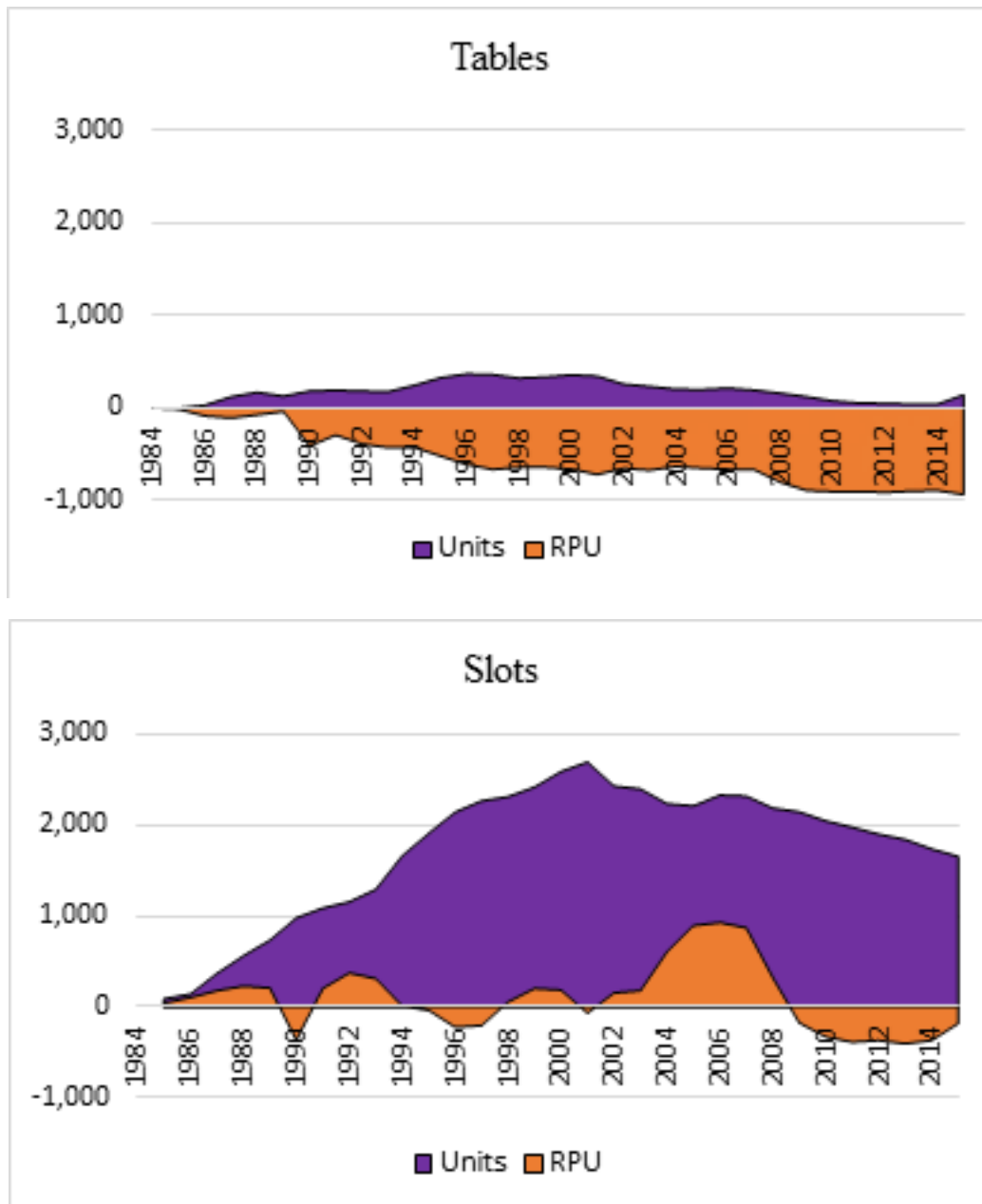


Figure 4: Revenue growth off-Strip between 1984 and 2015. Amounts depict the change in gaming revenue attributable to either the change in units in operation or the change in revenue-per-unit as calculated in equation 2. Amounts are in US dollars (millions), and are adjusted for inflation.



capacity increases are almost exclusively due to growth in the number of baccarat tables. There has been little change in the number of other table games since 1984. So, with the exception of baccarat, table performance on the Las Vegas Strip has been relatively flat -- just managing to keep pace with inflation since 1984, but not exhibiting any real revenue growth.

With respect to slots, figure 3 shows that virtually all of the revenue growth prior to 2002 came from increased capacity. There was very little change in revenue-per-unit during that time-period. One interpretation is that innovations by companies like IGT likely resulted in broadening slots' appeal to a wider variety of players, or perhaps led to players experimenting with a broader range of machines, rather than simply playing a single machine more intensively.

However, starting in 2002, things changed. That year marked the beginning of a substantial multi-year decline in the number of slots in service – and corresponding decreases in revenue depicted in figure 3. This result is likely attributable to multi-denomination devices, which first appeared in 2002, when casinos began replacing older slots with these new devices (which now account for almost 50 percent of the slot units in service statewide). The advantage of these devices is that they allow customers to select whether they want to play in (e.g.) pennies, nickels, quarters, or dollars – and hence reduce the need to have separate machines for each denomination.

However, the data also clearly show a substantial increase in revenue-per-unit that generated revenue growth that more than offset the effect of the decline in number of units in service. This suggests that the decreased capacity stemming from the introduction of multi-denomination devices did not have an adverse effect on overall demand. Customers have played the remaining units more intensively, which has helped casinos on the Las Vegas Strip to maintain, and even increase, slot revenue.

The data also illustrate a sharp decrease in revenue-per-unit between 2007 and 2010, followed by a partial recovery. This coincides with the overall decline in gaming revenue during the Great Recession depicted in figure 2. It reflects the decline in Las Vegas visitation during that time period -- and the recent recovery -- and highlights the corresponding changes in machine usage.

Figure 4 focuses on the rest of Nevada (aka -- off-Strip). Like figure 3, it depicts the change in revenue attributable to the change in the number of units in

operation (Units) as well as the change attributable to the change in revenue-per-unit (RPU) described in equation 2.

Figure 4 highlights the decline in off-Strip table revenue that has been occurring since 1984. It clearly illustrates that virtually all of the decrease in table revenue is from declining revenue-per-unit. In fact, off-Strip, the average table seat generated about \$128 per day in 2015, as compared to the (inflation adjusted) equivalent of \$267 per seat per day in 1984; a 52% decrease. This accounts for about a \$934 million decline in revenue since 1984, as depicted in figure 4. In contrast, the number of tables off-Strip has remained virtually unchanged since 1984, and accordingly, very little of the revenue swings depicted in figure 4 are attributable to changes in the number of tables in service.

Figure 4 also highlights the fact that slots significantly outperformed tables away from the Las Vegas Strip. It also shows that the vast majority of their revenue gains and losses are accounted for by changes in the number of units in service. There was virtually no change in revenue-per-unit until 2002. Subsequent to 2002, revenue-per-unit temporarily increased, but has since fallen back. Much like slot performance on the Strip, there is a clear effect from the replacement of older machines with multi-denomination devices beginning in 2002. However, from an efficiency standpoint, this effect was much weaker than it was on the Strip. In addition, the decline in revenue-per-unit between 2007 and 2010 associated with the Great Recession was much stronger off-Strip. In fact, figure 4 illustrates that post-2007, off-Strip slots gave back all of the efficiency gains that they had accrued since 2002 – and then some.

Overall, analysis of the data leads to the following conclusions. First, there is solid empirical evidence that slots have outperformed tables -- BUT this is due in large part to poor performance by tables – most especially those located in markets off of the Las Vegas Strip. That said, slot revenue has grown in real terms. However, neither the timing of the growth, nor the underlying causes have been consistent. Virtually all of the growth prior to 2002 was the result of expanding capacity. Between 2002 and 2007, as multi-denomination slot machines replaced older single-denomination units, slot revenue growth was fueled by increased efficiency. Since 2007 and the Great Recession, slot revenue has declined and stabilized. During that time-period, efficiency losses attributable to declining revenue-per-unit were much more significant away from the Las Vegas Strip, and have shown much weaker recovery.

Collectively, these conclusions suggest that changes in the form and function of slots stemming from advances in technology have helped them combat some of the economic challenges reflected in table performance. In addition, the strongest effect of those advances has been to broaden the appeal of slots, as evidenced by significant revenue growth attributable to increases in the number of slots in operation. By comparison, the advances have had more modest effects on revenue generating efficiency on a per unit basis, with most of the increased efficiency associated with the replacement of older single-denomination machines with multi-denomination units. Finally, the Las Vegas Strip has generated both stronger efficiency gains during times of economic growth and less significant efficiency losses during economic contractions than other Nevada gaming markets. This is true for both slots and tables, and at least suggests that efforts to diversify the revenue base on the Strip have had a positive impact on gaming revenue itself; particularly as measured by changes in revenue-per-unit.

## Endnotes

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### About the Author

Scott Boylan is a professor of accounting at Washington and Lee University in Lexington, Virginia. His research focuses on the role of uncertainty, risk, and information complexity in financial decision making. His published work has addressed issues such as unconscious bias in financial forecasting, decision errors in investment decisions, and taxpayer compliance, and has appeared in the *Journal of the American Taxation Association*, *Advances in Accounting*, the *CPA Journal*, and *Issues in Accounting Education*.

Boylan became interested in gaming research as an outgrowth of a course he developed on casino accounting. His current research project examines the evolution of gaming revenue in Nevada, and is influenced by his prior research, which models investment and tax compliance decisions as gambles.

Boylan earned his PhD from The Ohio State University in 1995, and was an assistant professor at the University of Wisconsin – Madison prior to joining Washington and Lee.



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