

VENICE PROJECT CENTER

Impacts of Tourism

Analyzing the Impacts of Tourism on the City of Venice

An Interdisciplinary Qualifying Project Submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science.



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Abstract

Venice is one of the most popular tourist attractions in Europe. Over the course of Venice's history, it has evolved from a massive trade empire to a major tourist hotspot. Our objective is to quantify and analyze the impacts of tourism on Venice. Most of these impacts are economical. Therefore, we researched the revenue that tourists provide and the costs they exert on the city. In addition, we extracted the taxes from the revenue to compare how much tourism benefits the city versus the costs. After thorough analysis and calculations, we were able to determine that tourists have a net benefit on the city, but not all tourists are equal in that regard.

Executive Summary

- The total revenue from hotels, food, stores, ACTV, gondolas, taxis and Alilaguna was calculated to be € 2.3 billion

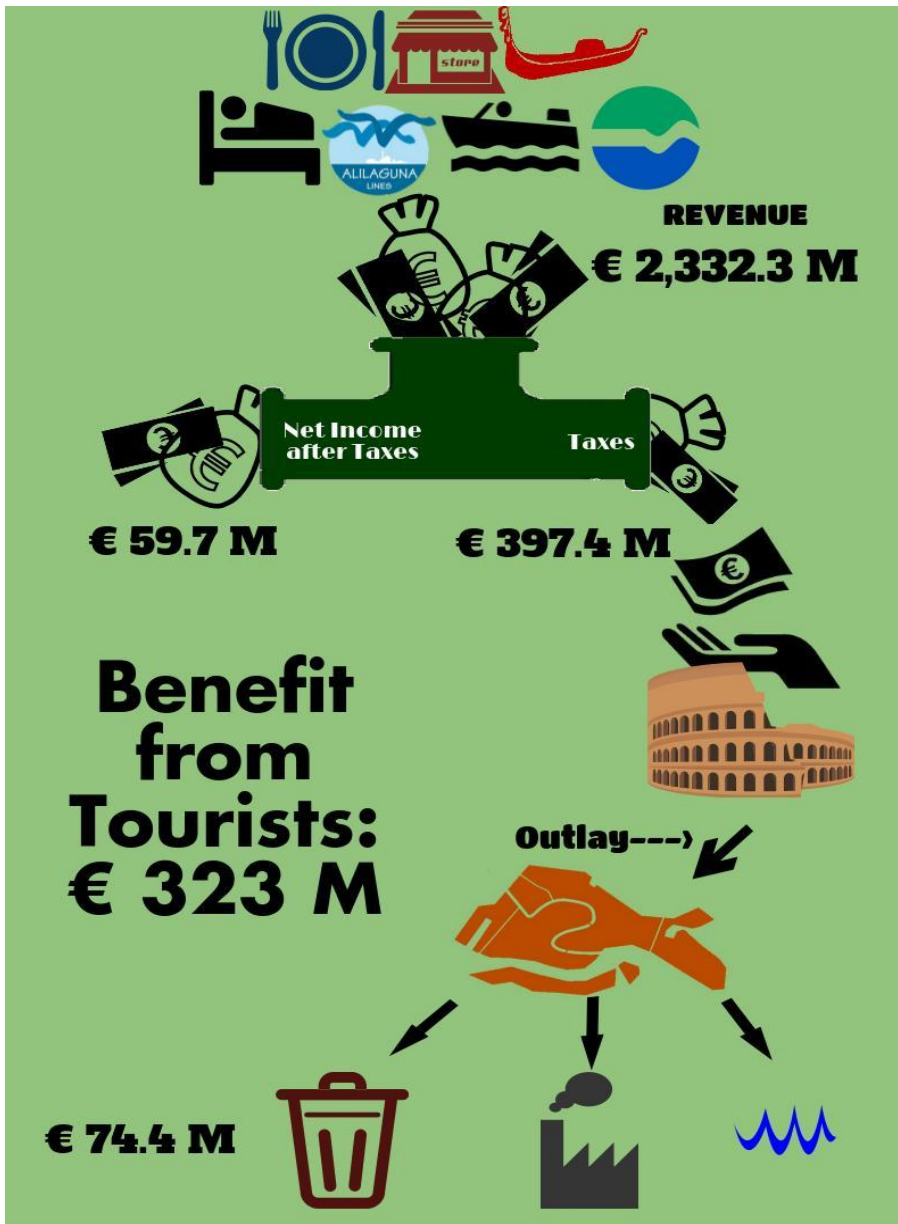
- We assumed all sources earn 20% profit after tax, a net income of € 59.7 million

- The central government receives € 397.4 million in tax revenue

- The central government then sends back a percentage to Venice

- The city of Venice pays for garbage removal, pollution and moto ondosso damage caused by tourists

- The difference between the taxes and the money spent by Venice on garbage, pollution, and



repairs, is the benefit from tourists, totaling at €323 million per year

Yearly Revenue from Tourism (@57,430 Tourists/day)

REVENUE +

Hotels	€1,131.3 M
Food	€788.2 M
Stores	€260.5 M
ACTV	€91.3 M
Gondolas	€29.7 M
Taxis	€18.7 M
Alilaguna	€12.7 M

€2.3 B
per year

Total €2,332.4 M

Yearly Impacts of Tourism (@57,430 Tourists/day)

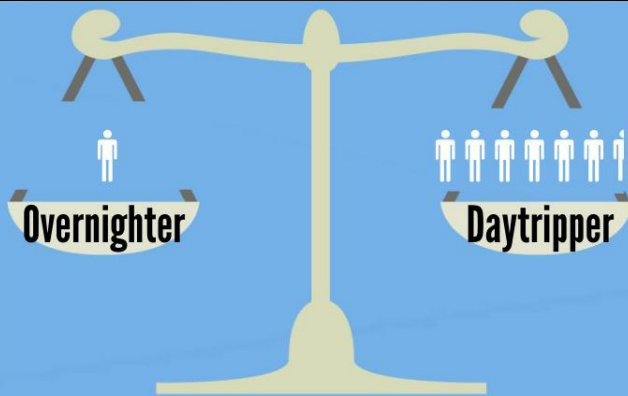
TAXES +

Hotels	€ 189.4 M
Food	€ 117.2 M
Stores	€ 68.3 M
ACTV	€ 13.4 M
Gondolas	€ 4.4 M
Taxis	€ 2.8 M
Alilaguna	€ 1.9 M

COSTS -

€44.8 M	Garbage Removal
€20.6 M	Pollution
€9.0 M	Moto Ondoso
	Wear and Tear
	Congestion
	Cost of Living
	Loss of Culture

Total € 397.4 M € 74.3 M Total



- Each source of revenue was calculated individually and the sum of the revenue is € 2.3 billion per year.

- Taxes were applied to each source of revenue to find the yearly tax revenue. The costs were also calculated and the sum is €74.4 million per year.

- By breaking down impacts from overnighters and daytrippers, we were able to conclude that an overnighter is as beneficial as 6.5 daytrippers.

1. INTRODUCTION

Historic Venice is a tourist's paradise that appears to be floating on water. Visitors can partake in a multitude of activities such as taking a ride on a gondola or experiencing the historic art, architecture, and canals of the wonderful city. They can enjoy the food and wine or take a tour of one of the many museums. Also, with just a short boat ride north of the city, they can visit Murano and sample its famous glass. All of these tourist attractions produce income for the city and help boost the economy. Venice hosts 21 million tourists per year. Each tourist contributes nearly 94 euros to Venice per year.¹ This purchasing power drives the local economy and provides significant tax revenue to the city. While these tourists contribute income to the city they also produce many negative impacts.

These negative impacts come primarily in the form of garbage removal costs, pollution, and damage caused to the city. Specifically, tourists produce more garbage and this increases the demand and cost of removal. Tourists also cause pollution to the city through sewage and CO₂ they produce. Increased population leads to more boat traffic and produces wakes that erode the foundations of buildings and canal walls. None of this comes without a cost.

The goal of our project is to investigate the impacts of tourism on the city of Venice. To accomplish this, we determined the positive (revenue) and negative (costs) impacts and calculated the net effect on the city. We also incorporated the taxes that Venice pays to the government. We collected data, both from research and past projects, on economic aspects of the city. Then, using this data, we compared the cost incurred due to tourism to the amount collected by the tourism tax. These are by no means the only factors that affect the income of the city, but they are the factors we chose to investigate. We will display all of this information in a widget on the Venice dashboard. The Venice dashboard is a quick and easy way of viewing important data from the Venice Project Center website, which contains large amounts of data on Venice. This will make the cost and revenue data accessible and concise, as well as process the data into useful information.

Most of our data was collected from either primary or secondary sources. For anything we were unable to find, we make educated assumptions to fill in these gaps in our data. While all of our numbers seem to be very precise, they are all approximations and should be taken as such.

¹ Veneto, S. O. o. R. (2013). Regione Veneto - Regional Statistics System Management. from <http://statistica.regione.veneto.it/ENG/Pubblicazioni/RapportoStatistico2013/index.html>

2. EQUIVALENT POPULATION

To quantify and evaluate the impacts of tourism, it is essential to study the equivalent population of the city. There are many different types of people who inhabit Venice on a daily basis. These include residents, tourists, commuters, students, and people who own second homes in the city². For our purposes, a resident is defined as any person who claims Venice as their permanent address. In addition, when we use the term “population”, we are referring only to residents living in historic Venice. Tourists are further broken down into overnighters and daytrippers. Overnighters are tourists that stay in Venice for multiple days while daytrippers are tourists who stay just for one day. Commuters are people who work in Venice, but don’t actually live in the city. All of these types of people can be grouped as “equivalent inhabitants”. It is important to know the breakdown of the daily equivalent inhabitants in order to calculate the overall costs and benefits. In the graph below, you can see the breakdown of the equivalent population according to the data from the COSES report from 2007³.

Graf. 8.6 - Popolazione equivalente e stagionalità, per tipologie di utenti, 2007

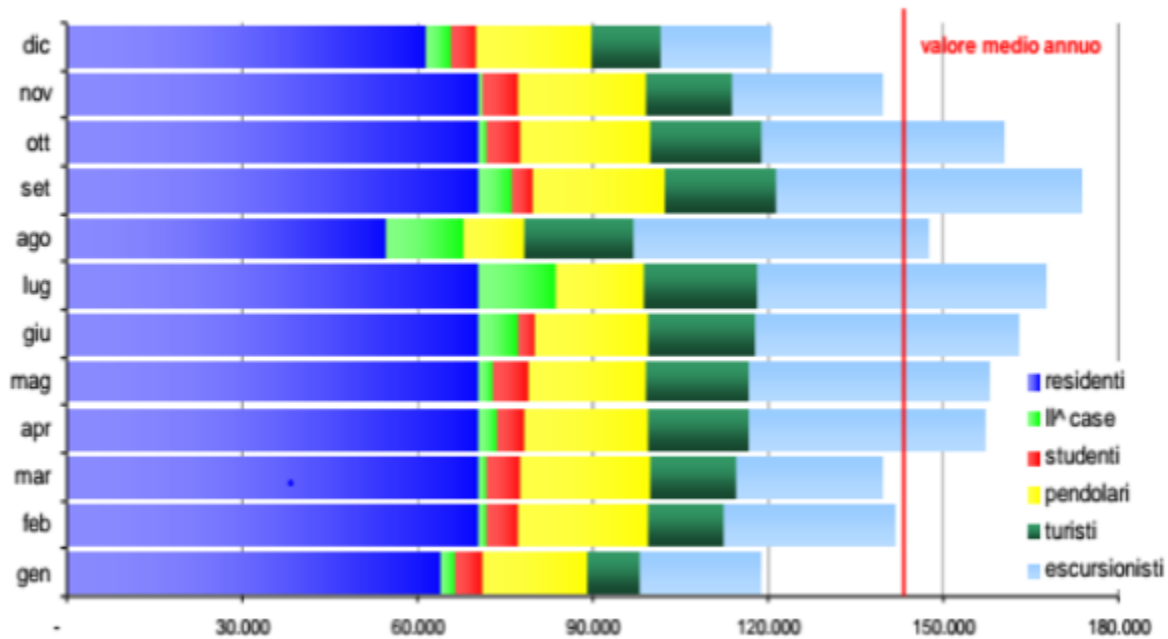


Figure 1 COSES Equivalent Population Graph

² Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). TURISMO SOSTENIBILE A VENEZIA

³ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). TURISMO SOSTENIBILE A VENEZIA.

2.1 Residents

The local residents of Historic Venice are the focal point of its culture. They are responsible for keeping this sinking city afloat through their tax dollars and devotion to retaining the cultural identity of their beloved city. Since World War II, the population has steadily dropped off⁴. We have calculated the number of current residents using trends, published reports, and the city's census data.

2.1.1 Historical Trends in Population

Throughout the history of Venice, there has been a large decrease in the population of the city. Based on the table below, we observe the maximum recorded population in Venice in recent history to be roughly 174,000 (Figure 2). This provides evidence of a maximum carrying capacity of the city. This will be important later on in our analysis. However, over the years, the population has continued to decrease at a steady rate.

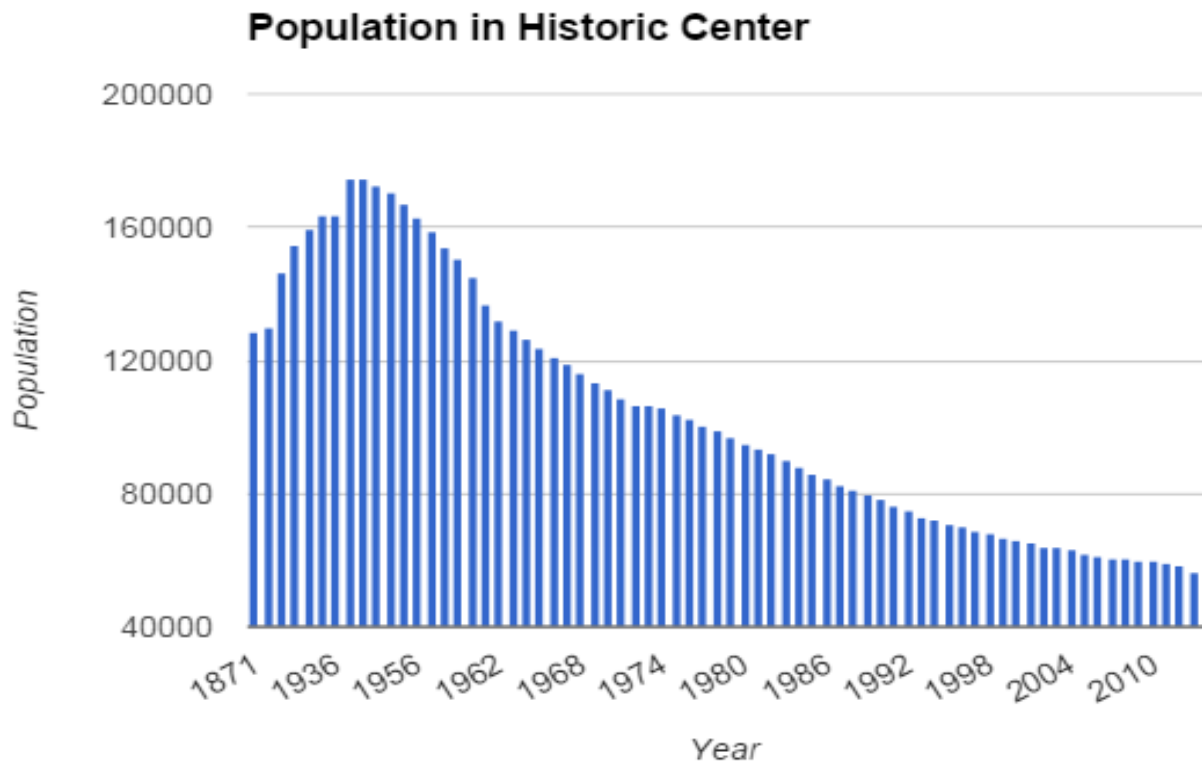


Figure 2 Past Populations in Historic Venice

⁴ Series of the Resident Population. (2014). Retrieved December 12, 2014, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/4055>

2.1.2 Calculating the Number of Residents

In 2007, the reported resident population was approximately 67,000⁵. We know from both historical trends and the Venice Dashboard that the population has declined since then. Using data from the City of Venice, we updated the number of residents to 56,600 (Appendix A). Using the proportions from COSES' original graph(include figure number), we were able to estimate the average number of residents living in Venice each month (Figure 3). Notice that the number of residents drops slightly in certain months. This can be attributed for locals leaving the city for vacations.

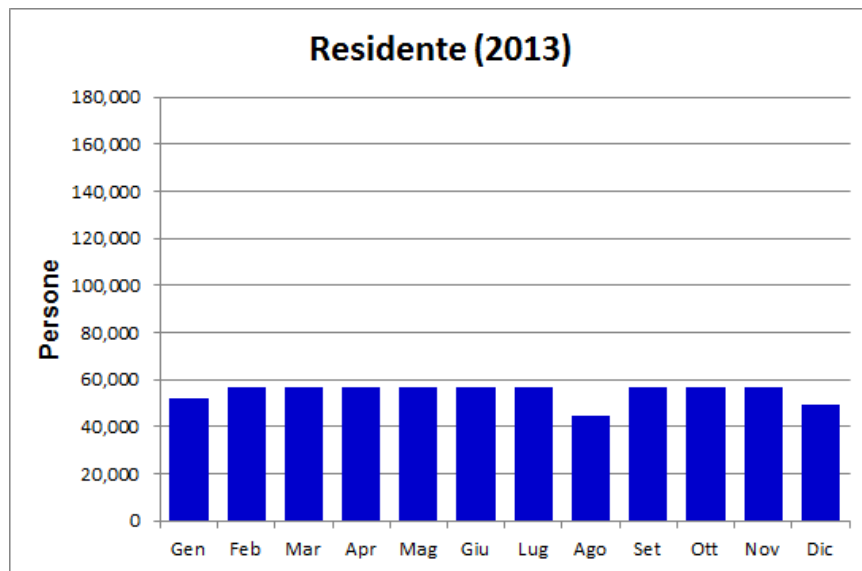


Figure 3 Average Residents per Month

2.2 Tourists

Since World War II, the number of tourists in Historic Venice has increased dramatically. In 2013, there were 21 million tourist presences⁶. The total presences is the sum of all the tourists visiting Venice while counting them each day that they are in the city. For example, if a tourist stays for three days, it counts for three presences; whereas a tourists staying one day will count as one presence. On the other hand, the total number of arrivals would be the total number of tourists who entered the city. Therefore, the tourist staying three days will count as only one arrival.

As a result of the tourist influx, the majority of the equivalent inhabitants in Venice has shifted from residents to tourists. In order to analyze the impacts of tourism, we must ensure that our data on tourists is as accurate and up to date as possible.

⁵ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). TURISMO SOSTENIBILE A VENEZIA.

⁶ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). Annuario Del Turismo 2013 Citta' di Venezia: Comune di Venezia

2.2.1 Estimating the Number of Tourists

Since we are trying to quantify the impacts of tourism, first we need to quantify the number of tourists in the city at various times of the year. Using 2013 the *Annuario Del Turismo*(ADT)⁷, we scaled the numbers from the COSES⁸ report to make them more accurate. In 2013, the average number of daily tourists in Historic Venice was 57,430 per day, with peaks of up to 90,000 in the summer⁹(Appendix A). The daily number of tourists in Venice varies throughout the year depending on the season. For the purpose of our analysis, we need to go deeper and breakdown the tourists to determine the number of daytrippers and overnighters.

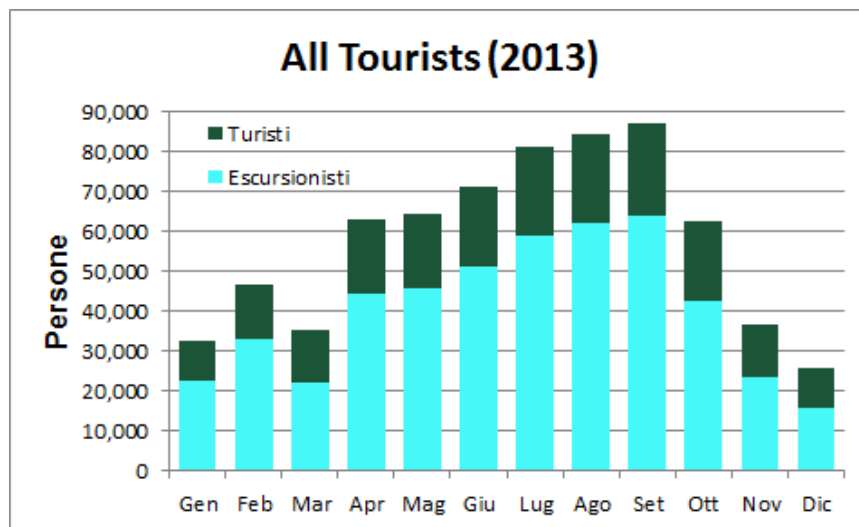


Figure 4 Average Total Tourists per Month

2.2.2 Estimating the Number of Overnighters

“Overnighters” refers to tourists who reside in Venice for more than one day. They often stay in hotels, hostels and bed and breakfasts. We found the average number of tourists staying in hotels to be 17,050 per night¹⁰. This is 31% of all tourists (Appendix A). Then, using the proportions from the COSES report graph (Figure 1), we scaled the number of daily overnighters for each month (Figure 5).

⁷ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). *Annuario Del Turismo 2013 Citta` di Venezia*: Comune di Venezia.

⁸ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). *TURISMO SOSTENIBILE A VENEZIA*.

⁹ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). *Annuario Del Turismo 2013 Citta` di Venezia*: Comune di Venezia.

¹⁰ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). *Annuario Del Turismo 2013 Citta` di Venezia*: Comune di Venezia.

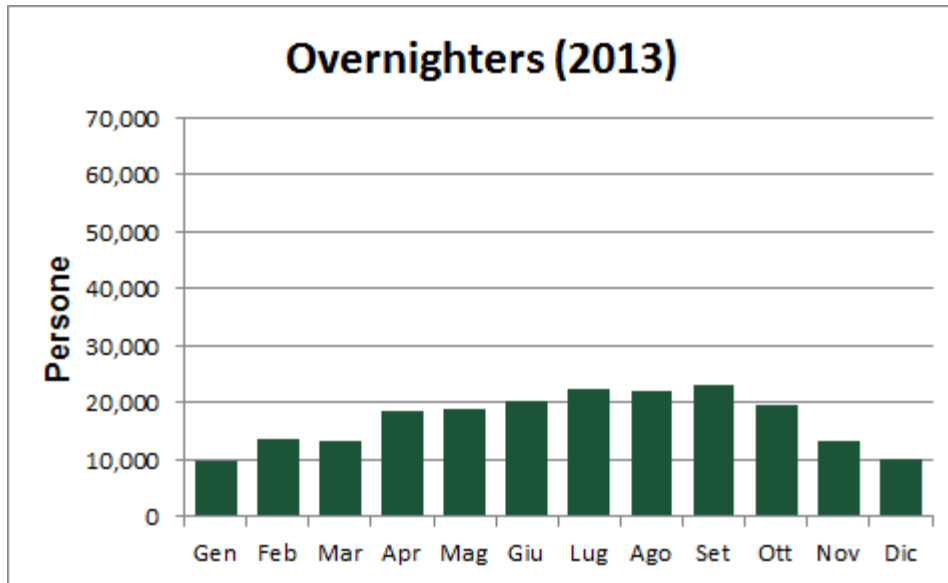


Figure 5 Average Overnighters per Month

2.2.3 Calculating the Number of Daytrippers

“Daytrippers” refers to any tourist who visits Venice for a day, but does not stay overnight. Since we have the total number of tourists and overnighters, we can calculate the number of daytrippers. This distinction is important for making certain calculations later in the analysis. After scaling the number of overnighters and total tourists from the COSES Report, we simply subtracted the number of overnighters from the total tourists. This resulted in an average of 40,000 daily daytrippers in the city, which is 69% of all tourists (Appendix A). In the graph below, you can see how the number of daytrippers changes throughout the year.

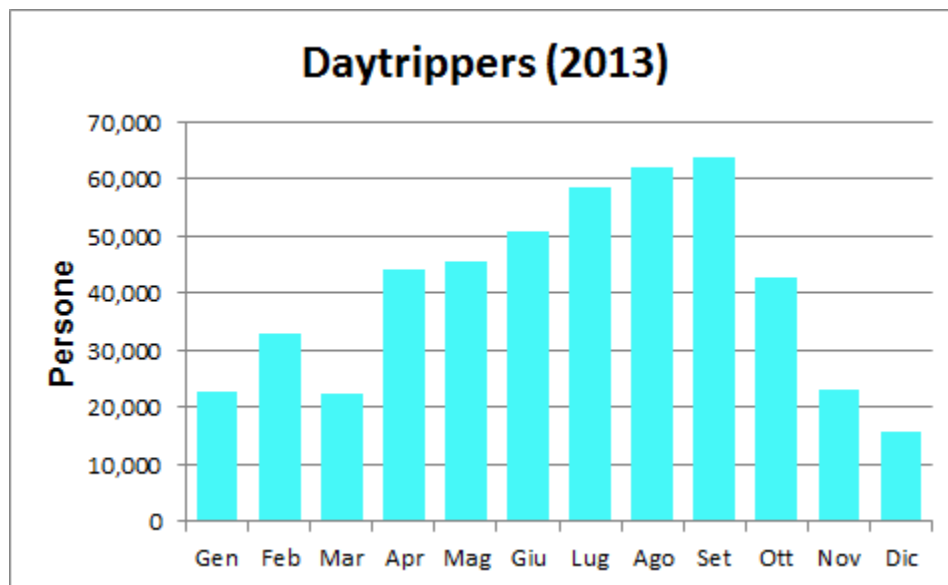


Figure 6 Average Daytrippers per Month

2.3 Other Inhabitants

Commuters, students, and those who own second homes in Venice are also inhabitants, but we do not consider them to be residents or tourists. Regardless, they are part of the equivalent inhabitants calculation. We calculated the average number of commuters to be 18,000 per day using the 2007 population data from COSES and scaling it up with the *Annuario del Turismo* data from 2013 (Appendix A). We did not scale up the students or second home owners in the city since we assume that those numbers did not materially change.

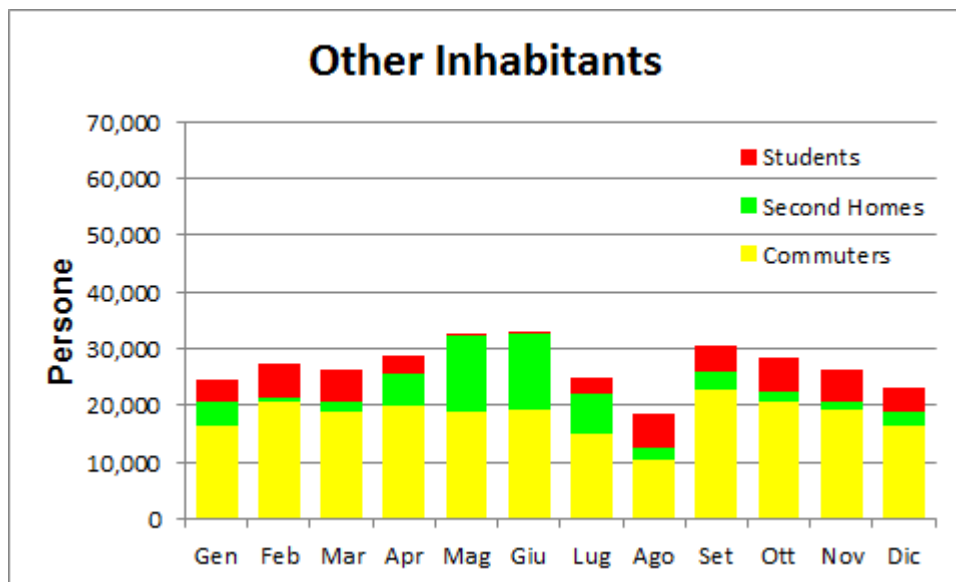


Figure 7 Average Other Inhabitants per Month

2.4 Estimating the Equivalent Inhabitants

Using population data from the COSES Report¹¹, ADT¹², and the B13 Demographics IQP¹³, we have updated the equivalent population graph (Figure 8). It is important to know the number of equivalent inhabitants to determine what percentage are tourists. Based on our updated data, the daily equivalent population is 140,000; tourists make up 42.68% (Appendix A). Notice that the peak average equivalent population occurs in September, at an overwhelming 175,000 (Appendix A). This equals the maximum number of residents that Venice has ever seen. This shows that tourists are causing the equivalent population level to rise to dangerous heights.

¹¹ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). *TURISMO SOSTENIBILE A VENEZIA*.

¹² Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). *Annuario Del Turismo 2013 Citta' di Venezia: Comune di Venezia*.

¹³ Gorowara, A., Matthews, A., Russo, D., & Sezer, A. (2013). *Tourism in the city of canals*. In P. F. Carrera & P. F. Hart (Eds.): Worcester Polytechnic Institute.

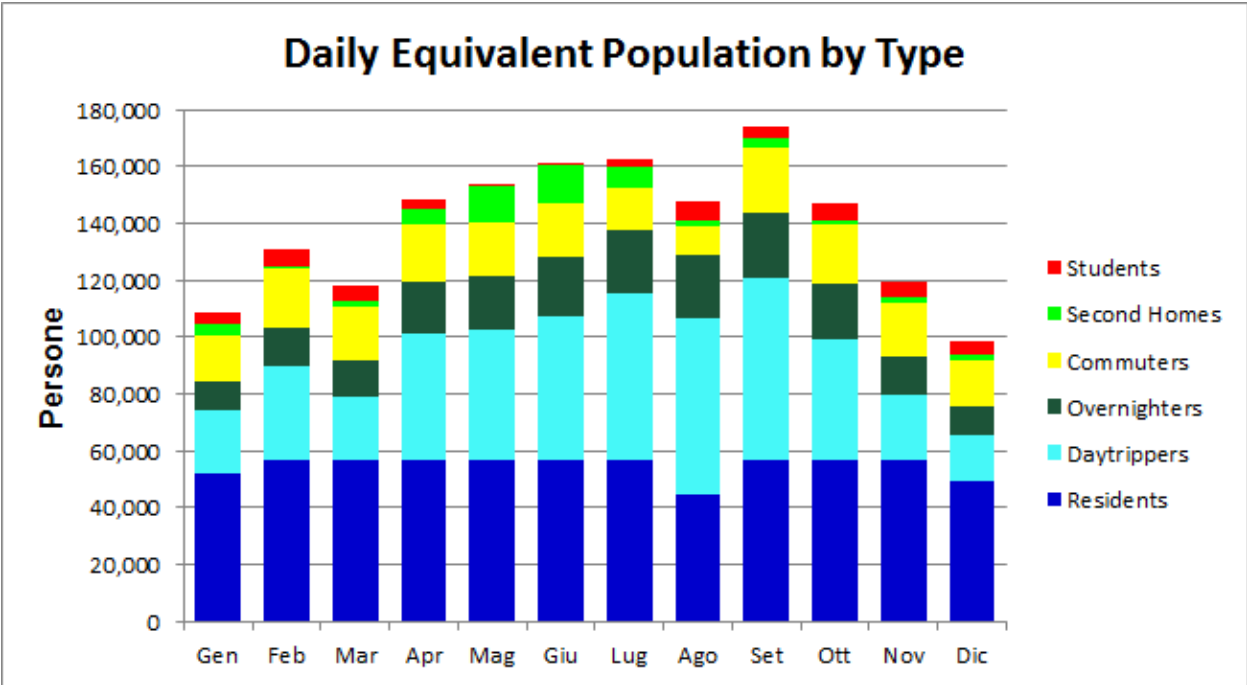


Figure 8 Average Equivalent Population per Month

3. Positive Impacts

The major positive impact of tourism is the money they bring to the city. Tourists bring in billions of euros per year to Venice. This commerce is beneficial to people who work in Venice, but the money that is important to the city of Venice is the taxes on this income. In the following sections we will go into detail on the different ways both the people and the city make money.

3.1 Commerce

Commerce refers to the revenue that tourists bring when visiting Venice. To best demonstrate the impact of commerce, we find the yearly revenue of each source. The sources we consider commerce include hotels, stores, food, gondolas and taxis.

3.1.1 Calculating Hotels Revenue

Hotels are the biggest source of revenue from tourists. Every tourist that stays overnight in Venice must pay for some sort of accommodation. This makes hotels a unique source of revenue in that there is a direct relationship between the number of overnighers and the revenue hotels make. There are 320 hotels in Venice with a total of 24,888 beds¹⁴. These hotels can be broken down into seven classes; each of the five stars, bed & breakfasts, and hostels. As seen in the chart below, we found the number of hotels of each class and the average rates. We collected this data from two sources: the Agency for the Promotion of Tourism (APT) and Hotels.com.

To find the yearly revenue from hotels, we use the average hotel rate and average daily occupancy. Using the APT and Hotels.com, we found the average nightly rate for each class of hotel.

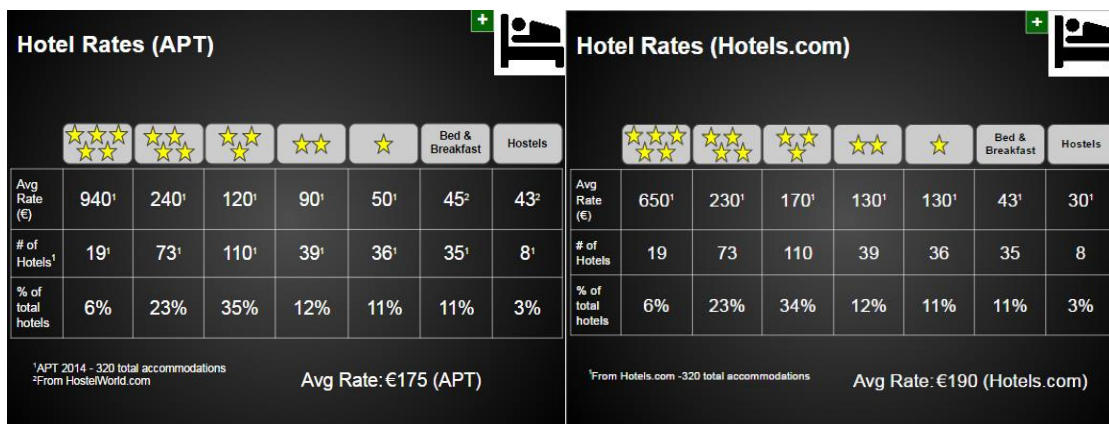


Figure 9 Average Hotel Rate Calculation

¹⁴ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). TURISMO SOSTENIBILE A VENEZIA.

We took an average of the rates, weighted by the number of hotels in each class, to find the overall average hotel rate using the Equation 1 from Appendix B. We calculated the average rate for all hotels to be €180 (Appendix B).

We found the average occupancy to be 17,050 per night¹⁵. This is 68% of the 24,888 total beds in Venice (Appendix B). By multiplying the average daily rate by the average occupancy, we found that the daily revenue is €3.1 million. This means that the yearly hotel revenue is €1.13 billion.



Figure 10 Yearly Hotel Revenue Breakdown

3.1.2 Calculating Food Revenue

Food is the second largest source of revenue from tourists. This includes restaurants, cafes, bakeries, or any of the other 1,170 food establishments in Venice. According to COSES, daytrippers spend an average of €50.50 per day¹⁶. We assume that both daytrippers and overnighters spend the same money outside of accommodations. Of this average daily spending, €37.60 is spent on food and the rest is spent in other stores¹⁷ (Appendix C). We chose this value assuming that seventy five percent of tourist spending is on food.

¹⁵ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). Annuario Del Turismo 2013 Citta` di Venezia: Comune di Venezia.

¹⁶ Scaramuzzi, I., Monte, G. D., Pedenzini, C., & Santoro, G. (March 2009). TURISMO SOSTENIBILE A VENEZIA.

¹⁷ How much does it cost to travel to Venice? (2010-2014). Retrieved December 12, 2014, from <http://www.budgetyourtrip.com/italy/Cities>

Since we know the average daily spending on food and the number of daily tourists we can multiply to determine the total revenue for food establishments (Appendix B). This amounts to a daily revenue of €2.16 million. This means the yearly food revenue due to tourists is €788.4 million (Appendix C).

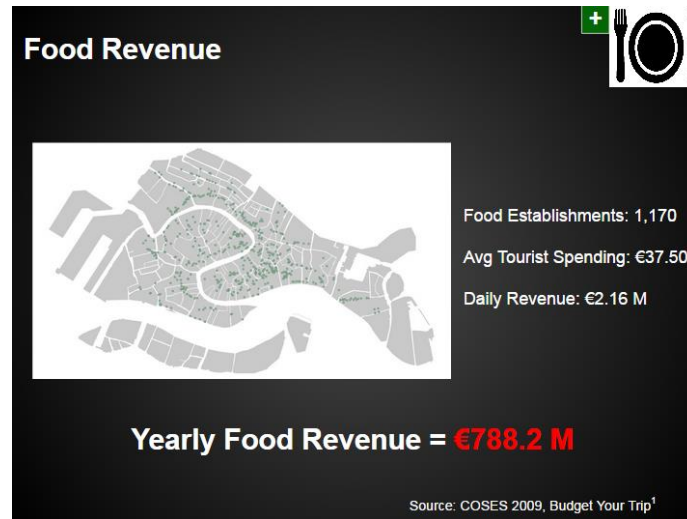


Figure 11 Yearly Food Revenue Breakdown

3.1.3 Calculating Stores Revenue

Stores are another important source of revenue for the city. When tourists come to Venice, they shop for souvenirs, Murano glass, and Burano lace, to name a few. There are 2,500 stores in Venice, 1,600 of which are focused directly to tourists (Appendix D). Obviously, for these stores to stay in business, they must make enough revenue to pay off the costs of the stores.

Using the COSES data previously mentioned, we know that tourists spend an average of €12.90 per day in stores (Appendix D). By multiplying the average daily spending by the number of tourists, we determine the average daily revenue to be €713,600 (Appendix D). This means that the yearly stores revenue from tourists is €260.5 million (Appendix D). We confirmed the calculation by examining the cost to operate a store and applied a 20% margin.



Figure 12 Yearly Stores Revenue Breakdown

3.1.4 Calculating Gondolas Revenue

Perhaps the most popular and sought after tourist attraction in Venice is riding on a famous gondola through the beautiful canals. Since it is so popular and the demand is so high, the price for taking a ride is also quite high. The rate for taking a thirty minute ride in a gondola is €80¹⁸. Additionally, there are 433 gondoliers licensed by the city¹⁹.

The important piece of the equation that is missing is how many trips a gondolier takes each day. To determine this we observed gondolas to find a reasonable number of trips per day for our calculations. Over our observation period, we found the average number of trips to be 4.28 (Appendix F). We also assume that the only people using gondolas are tourists.

Using the cost per trip, number of licensed gondoliers, and the average number of trips, we found their daily revenue to be €81,000 (Appendix F). If we assume 200 work days, then we find the yearly revenue of gondolas to be €29.6 million (Appendix F).

3.1.5 Calculating Taxis Revenue

Taxis are a common form of tourist transportation. According to the City of Venice, there are 250 taxi licenses²⁰. While residents do occasionally use taxis, for our calculations we assumed that only tourists use taxis.

¹⁸ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

¹⁹ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

²⁰ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

Based on price information provided by the City of Venice, we found the average taxi rate to be €75 per trip²¹. If we assume that each taxi takes five trips per day, then the daily revenue per taxi is €375 (Appendix G). Using the number of taxi licenses and the assumed daily revenue, we find that the daily taxi revenue is €51,370 (Appendix G). The City of Venice enacts a *ferma barca*, or boat stops, where taxis are required to be out of the water for a portion of the year. Therefore, we assume 200 work days per taxi per year. This means the yearly taxi revenue due to tourists is €18.7 million (Appendix G).

3.2 Public Transportation

The two types of public boat transportation in Venice are ACTV and Alilaguna; they are funded and run by the city. For this section, we assume that these public services would still be in place even if there were no tourists in the city. Therefore, we will only look at the revenues that these services bring in.

²¹ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

3.2.1 Calculating ACTV Revenue

ACTV is the intra-city public transportation of Venice. ACTV runs the vaporettos (water shuttles) that go from stop to stop inside the city, as well as buses that go from the mainland to the city center.

Based on the ADT, the tourist yearbook of 2013, ACTV sold 18,865 tickets per day, or 6,887,460 tickets per year²². These tickets ranged from €7 for a 60 minute pass to €60 for a 7 day pass²³. By applying these prices to the tickets sold, we found the daily ACTV revenue to be about €250,000. This means the yearly ACTV revenue from tourists is €91.3 million(Appendix E).



Figure 13 Yearly ACTV Revenue Breakdown

²² Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). Annuario Del Turismo 2013 Citta` di Venezia: Comune di Venezia.

²³ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). Annuario Del Turismo 2013 Citta` di Venezia: Comune di Venezia.

3.2.2 Calculating Alilaguna Revenue

Alilaguna is a public transportation service that transports people to and from the airport. Based on the ADT, Alilaguna sold 848,400 tickets to tourists in 2013²⁴. Given that the ticket price for a tourist is €15, we calculated their daily revenue to be €34,866 from tourists²⁵. This means that the yearly Alilaguna revenue from tourists is €12.7 million(Appendix H).



Figure 14 Yearly Alilaguna Revenue Breakdown

3.3 Additional Sources of Revenue

There are a few sources of revenue that we did not research. These include revenue from tourist activities and *indoto*. They are quantifiable, but we did not have time to calculate and analyze them.

3.3.1 Tourist Activities

Tourist activities refers to taking tours of the city or visiting historical and cultural sites. Each of these bring in some revenue to the city. The tour guide industry is incredibly disjointed and would be difficult to quantify. Historical and cultural sites, such as museums, are also a source of revenue for the city. Our team did not look into either of these sources of revenue.

²⁴ Vettese, A., Ellero, R., Csermely, C., Callegaro, N., Berto, M., Miraglia, A., . . . Fabbro, A. d. (May 2014). Annuario Del Turismo 2013 Citta` di Venezia: Comune di Venezia.

²⁵ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

3.3.2 Indoto

Indoto refers to money that recirculates back through the city. Every time a tourist spends money in Venice, it comes from outside the city and raises the overall wealth of Venice. This increases the value of money spent in the city by tourists, compared to that of locals. We did not account for this in our calculations, but it is still worth mentioning.

3.3 Taxes

Not all of the revenue from each of the above sources goes to the city. The city only collects on the taxes on this revenue. All of this tax revenue is sent to the central government in Rome. Then, Rome reallocates all of the wealth around Italy. Since Venice is such a large contributor to Italy's tax revenue, they do not receive as much money back after the wealth is redistributed. We had no way of finding out how much of Venice's tax revenue stays in the city, so we took the best case scenario and assumed all of it stayed in the Venice. The yearly total tax revenue from tourists is €397,379,734 (Appendix M).

There are four main taxes that affect the people of Venice, and one that directly affects tourists. The Value Added Tax (IVA), or sales tax, affects both the resident population as well as tourists. To find how much tax revenue is collected from tourists, we used the total tourists revenue from each source and applied each relevant tax. The average tax burden on the average Venetian is 43%²⁶.

3.3.1 IVA

IVA is a tax that affects every sale in the city. The standard rate is 22%. There are reduced rates of 10% on pharmaceuticals, passenger transport, admission to cultural and entertainment events, hotels, restaurants and 4% on medical, foodstuffs, and books²⁷. We applied the corresponding rate to each of the above sources of revenue. We assumed 10% for food because we assumed more tourists would spend money at restaurants than markets. The yearly total tax revenue from tourists from the IVA is €264,487,725 (Appendix M).

²⁶ International, K. Individual Income Tax Rates Table. Retrieved December, 2014, from <http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/individual-income-tax-rates-table.aspx>

²⁷ International, K. Sales Taxes. Retrieved December, 2014, from <http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages>

3.3.2 IRES

The corporate income tax in Italy, better known as IRES, has a standard rate of 31.4%. The IRES is charged on the net income of any company in Italy²⁸. Therefore, to find the tax revenue from IRES, or any other tax applied to net income, we needed to find a value for net income. We assumed that no business would still be open if it was making below 20% profit, and applied that to each of the above revenues after applying the IVA. We found the yearly total tax revenue from tourists from IRES to be €108,216,731 (Appendix M).

3.3.3 TARES

TARES is the refuse tax in Italy. There is a base tax on all homeowners or businesses establishments of €20 per month²⁹. Then, there is an additional tax on each establishment, depending on their “aptitude to produce waste”. This is an additional €4 per square meter for food establishments and €3 for all other establishments³⁰. Since TARES is a flat tax, we could not use our revenue calculations to find how much is due to tourists. Instead, we attributed 100% of the hotel TARES to tourists, 100% of restaurants to tourists, and 87% of other stores to tourists, based on the breakdown between tourists, resident, and mixed stores. The total yearly TARES revenue from tourists is €6,304,223 (Appendix M).

3.3.4 IRPEF

IRPEF is the individual income tax in Italy. The tax brackets are dependent on an individual’s net income. For the purposes of our calculations, we assumed that individuals would be paid their salary even if there were no tourists in Venice. Therefore, this tax does not directly affect how much money tourists bring into the city.

3.3.5 IMU

IMU is the property tax in Italy. For the purpose of finding how much revenue tourists bring to the city, we assumed that someone would be paying the property tax even if there were no tourists in Venice. Alternatively, we could have assumed that all of the property taxes associated with hotels, retail stores, and

²⁸ International, K. Corporate Tax Rates Table. Retrieved December, 2014, from <http://www.kpmg.com/global/en/services/tax/tax-tools-and-resources/pages/corporate-tax-rates-table.aspx>

²⁹ Venice, C. o. (2013). REGOLAMENTO PER L'APPLICAZIONE DEL TRIBUTO COMUNALE SUI RIFIUTI E SUI SERVIZI INDIVISIBILI.

³⁰ Venice, C. o. (2013). REGOLAMENTO PER L'APPLICAZIONE DEL TRIBUTO COMUNALE SUI RIFIUTI E SUI SERVIZI INDIVISIBILI.

restaurants should be included since they primarily serve tourists. However, we decided this tax does not directly affect how much money tourists bring into the city.

3.3.6 Hotel Tax

In 2011, Rome created a tax for hotels and, consequently, Florence and Venice followed suit.³¹ The tax is in place for tourists who stay overnight in hotels. The extra tax is not too noticeable in a hotel bill, but it helps the city significantly. The value of the tax in a hotel depends on hotel class and the season. The age of the customer is the last factor that contributes to the tax. For example, children ages 10 to 16 will pay half of the tax fare, and those children under the age of 10 will not be taxed at all.³² The hotel tax revenue goes directly to Venice, unlike the other taxes. See Appendix(Appendix M) for more info on hotel tax rates.

To calculate the revenue for the city due to the tourist tax we used the equation

$$Tax = \sum_{h=1}^n c_h o$$

where b is the hotel type, n is the total number of hotels in the city, c is the tax, and o is the average occupancy of the hotel. We found the yearly revenue from the hotel tax to be €18,371,055(Appendix M).

Total Tax Revenue					€
Sector	IVA	IRES / IRPEF	TARES	Tourist Tax	Total Tax
Hotels	€113 M	€53 M	€4.6 M	€18 M	€180.4 M
Food	€79 M	€37 M	€1.1 M		€117.2 M
Stores	€57 M	€10.6 M	€300 K		€68.3 M
ACTV	€9 M	€4.3 M			€13.4 M
Gondoliers	€3 M	€1.4 M			€4.4 M
Taxis	€1.9 M	€900 K			€2.8 M
Alilaguna	€1.2 M	€600 K			€1.9 M
Total	€264.5 M	€108.2 M	€6.3 M	€18 M	€397.4 M

Figure 15 Tax Revenue Breakdown

³¹ Regulation on the contribution of living in the city of Rome Capital http://www.turismoroma.it/wp-content/uploads/2011/07/Testo_Reg_contributo_sogg_emendato_23_12_2010.pdf

³² Tourism - The Tourist Tax in the Territory of the Municipality of Venice

<http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/EN/IDPagina/48016>

4. Negative Impacts

Unlike most cities, where tourists are accepted as a huge source of income, Venice is also affected negatively by their presence. This problem has been increasing with the number of tourists since the end of World War II. The major issue with Venice as a tourist city is that it does not have the capacity to contain such vast numbers. The highest resident population ever in Historic Venice was 174,000 in 1952(Figure 2). Currently, the average daily equivalent population is approximately 174,000 in September(Figure 8). This shows that the capacity of the city is being stressed, fortifying the fact that tourists are negatively affecting the city.

The major quantifiable negative impacts of tourism include garbage removal, pollution, and wake damage. There are other negative impacts, such as congestion, higher cost of living, wear and tear, and loss of culture, that are not easily calculated or are simply unquantifiable.

4.1 Garbage Removal

Unlike most cities, garbage in Venice is collected by boat. This makes the process more time consuming and expensive. The *spazzino*, or rubbish-collector, takes everything in his wheeled cart. Then, at various points throughout the city, the carts are emptied into boats and taken to the mainland for disposal. This service is operated by a company called Veritas, who serves several provinces around Italy in addition to Venice.³³

The growing tourist population is producing more and more garbage in the city and the city is responsible for providing these garbage removal services. Unfortunately, the Venetian tax dollars are paying for services that benefit tourists as well as Venetians. This proves to be an issue for residents who feel they should not be obligated to pay to keep their city clean when tourists are responsible for about half of the total waste.



Figure 16 Veritas Garbage Produced per Person in Historic Venice and Veneto

³³ Adamovic, Mladen. October 2014. *Cost of Living in null, Italy*.

The figure(Figure 16) above shows the daily kilograms of garbage produced per capita in Veneto, the whole province of Venice, and Historic Venice. This data is based on how much garbage Veritas collected and how many “residents” are producing it. Given that the average person creates the same amount of daily garbage and given that there is a one to one ratio between residents and tourists in Venice, it is clear that tourists are responsible for half of the waste created in Venice.

4.1.1 Calculating Garbage Removal Cost

To calculate the garbage removal cost, we needed to find the amount of garbage produced by tourists and the cost of removing garbage in Venice. It was difficult to find accurate values, so we looked at the financial report of Veritas³⁴.

Since Veritas serves other provinces, we found the total population from which they collect garbage. After adding in the average daily tourist population, we were able to find the percentage of Veritas’ clientele that were tourists. We then used this proportion to determine how much of their annual service costs are attributed to tourists.

After doing this calculation, we found the daily cost of tourist garbage removal to be €122,700 (Appendix I). This means the yearly cost of tourist garbage removal is €44.8 million (Appendix I).

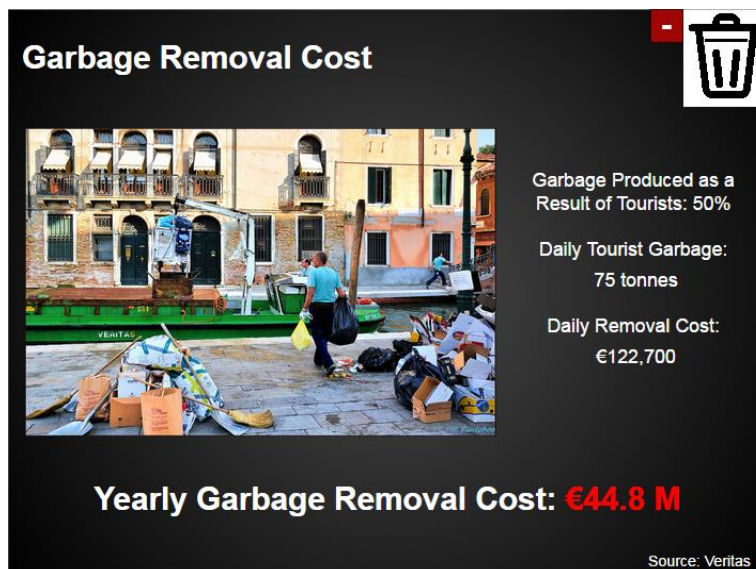


Figure 17 Yearly Garbage Removal Breakdown

³⁴ Veritas, & Venezia, C. d. (2013). Tia e nuovo contratto di servizio di Venezia.

4.2 Pollution

A harmful environmental impact of tourism is the pollution they produce. There are many ways that tourists contribute to pollution in Venice, but we will focus on sewage and CO₂ emissions. Since neither of these costs are actually paid for, we calculated the social costs of pollution. By summing the social costs of sewage and CO₂ removal, we found the average yearly cost of pollution to be €20.6 million (Appendix J).

4.2.1 Hypothetical Cost of Sewage Removal

Venice's waste removal system is quite unusual. In the past, the canals acted as a sewer system by carrying out waste with the tides. All waste was collected in underground tunnels, known as *gatoli*, and was channeled to the canals, out of the city and into the lagoon. Historically, Venice was considered one of the cleanest cities due to this method of removal. This method, however, has now become inefficient and produces a foul odor throughout the city.

Currently, the city is moving toward modern infrastructure and urban utilities to manage the increasing production of waste. The challenges of this movement are the age of the system and the need to preserve Venice's historic areas while performing maintenance. Since these designs are still in the early production stages, we will find the hypothetical cost of removing this sewage.

We want to study how much extra waste tourists are contributing to the system, especially since residents are responsible for paying for these services. We found the average yearly sewage produced per person to be 267 tonnes³⁵. Using the cost of removal and the number of tourists, we found the hypothetical yearly cost of tourist sewage removal to be €7.3 million (Appendix J).

4.2.2 Hypothetical Cost of CO₂ Emission

Tourists indirectly cause CO₂ emissions in Venice through hotels, restaurants, and motor transportation. There is a significant carbon footprint for these based on the fuel they use to operate. This footprint amounts to 13.75 kg per tourist per day³⁶.

Since you can't find the actual cost of pollution removal, we found the social cost of the carbon (SCC) produced by tourists. SCC is a good measure for how CO₂ affects the environment since it accounts

³⁵ Veritas, & Venezia, C. d. (2013). Tia e nuovo contratto di servizio di Venezia

³⁶ A decision-support system in ICZM for protecting the ecosystems: integration with the habitat directive
I. Marotta, I. Ceccaroni, G. Matteucci, P. Rossini, S. Guerzoni, 2011.
Journal of Coastal Conservation 15 (3), 393-405

for the environmental services that naturally remove pollution. Given the SCC is €48 per tonne of CO₂, we found the yearly cost of CO₂ removal is €13.3 million³⁷ (Appendix J).



Figure 18 Yearly Pollution Cost Breakdown

4.3 *Moto Ondoso*

Moto ondosso, or motor waves, is the term given to the wakes created by motor boats. Boat traffic has always existed in Venice, but since the invention of motor boats, *moto ondosso* has become a problem. Research has shown that *moto ondosso* is a major contributor of canal wall degradation.³⁸ The canal walls must undergo constant repair to strengthen the foundation and slow further deterioration. While boat transportation is necessary to the lifestyle of the Venetians, their increased use by tourists causes issues. The sheer volume of tourist traffic contributes to a significant portion of the canal wall damage throughout the city.

³⁷ EPA. (November 26, 2013). The Social Cost of Carbon. Retrieved December 12, 2014, from <http://www.epa.gov/climatechange/EPAactivities/economics/sc.html>

³⁸ The Moto Ondoso Index, IQP

4.3.1 Estimating Damage Done by Moto Ondoso

Boat traffic in Venice can be broken down into 4 main categories: public, tourist, private and cargo. Public transportation consists of ACTV and Alilaguna. Tourist transportation consists of gondolas and taxis, but gondolas create a negligible amount of *moto ondoso*. Private transportation is any privately owned boat in the city, but tourists contribute to zero *moto ondoso* from this source. We assume 50% of the cargo brought into the city is for tourists and, therefore, so is the *moto ondoso* created by them.

We can use the methods used by both the 2002 Moto Ondoso IQP Team and later the 2013 Boat IQP Team to quantify *moto ondoso* damage. They determined as the velocity increases, the wake amplitude also increases at an exponential rate. Using these energy calculations, they created a simple way to relate boat speed to the energy in the wake; the Moto Ondoso Index (Appendix K).³⁹

4.3.2 Calculating Moto Ondoso Repair Cost

The 2013 IQP Boats Team used this along with data from the 2013 IQP Canals Team to estimate the costs of *moto ondoso*. They determined it costs €1 for every 100 units of *moto ondoso* to repair canal walls.⁴⁰ We utilized their method of calculation and data in order to estimate how much damage is attributed to tourists. We assumed that the percentage of tourists using public transportation and cargo was equal to the percentage of tourists in the equivalent population. This is 42.68% (Appendix A). We also assumed that 100% of tourist transportation is used by tourists. This equates to tourists being responsible for 61.79% of the total damage and, therefore, repair costs (Appendix K). Using, the index created by the 2013 team, we found the total yearly damage created by tourists to be 894 million units (Appendix K). This equates to €8.9 million in yearly repair costs (Appendix K).

³⁹ David Chiu, Anand Jagannath, and Emily Nodine, "The Moto Ondoso Index: Assessing the Effects of Boat Traffic in the Canals of Venice" (Worcester Polytechnic Institute, 2002)

⁴⁰ Solomon, A. D. S. a. C. S., Petry, S. O. S. a. B. E., Hastings, S. S. S. a. M. E., Bennett, A. G. S. a. E. C. E., & Carrera, F. F. a. I. D. (2014). *Boats and Wakes*. Worcester, MA

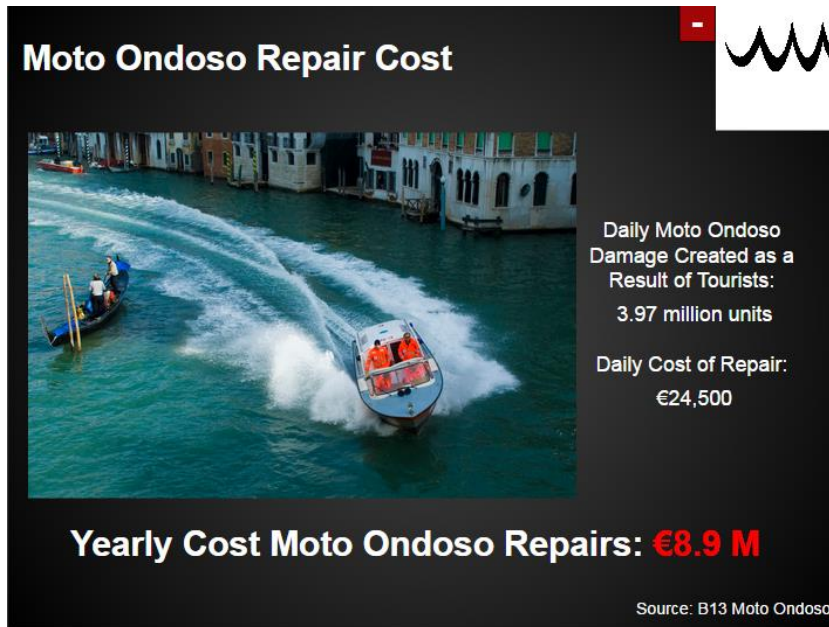


Figure 19 Yearly Moto Ondoso Repair Cost Breakdown

4.4 Additional Impacts

These other impacts are negative impacts of tourism that are either difficult to quantify, or simply unquantifiable. The impacts we chose not to analyze include wear and tear, congestion, cost of living, and loss of culture.

4.4.1 Wear and Tear

In Venice, as the tourist population rises, so does the physical damage they have on the city. Over the years, simply being in the city wears on it. Stairs bowing and handrails wearing are only a couple examples of damage done just from people living in the city. In recent history, the 21 million tourist presences each year have had a lasting effect on the city (Appendix A). Equating this damage to a value or repair cost is difficult if even possible.



Figure 20 Worn Down Staircase

4.4.2 Congestion

Venice is a small city with streets not meant to handle large crowds. Congestion is a huge problem for the city, but is hard to quantify in terms of cost. Since all traffic in the city is by foot or boat, the narrow streets and canals become exceedingly congested as more tourists come to the city. In most cities, more roads and other accommodations could be made to make the city easier to traverse. Venice does not have this luxury. There is little to no room for expansion of these paths given the historic canals and buildings that stand in the way. We mention this as a negative impact since tourists slow down the flow of traffic. According to B14 Time IQP Team, tourists slow down Venetian's walking speed by approximately 16%.

4.4.3 Cost of Living

Like any other city, there is a certain price to pay to live in Venice. This cost takes into account the price of food, rent, transportation, clothing, taxes, etc. As tourists continue to rush into the city, there has been more demand, causing the cost of living to increase continuously. As a result, many residents are no

longer able to pay such prices, forcing them to leave the city. In fact, over 1,500 residents left the city in the past year⁴¹.

4.4.4 Loss of Culture

Although unquantifiable, this shift in the identity of Venice can be seen as an impact of tourism. The city has evolved from a local trade port to a world renowned tourist hot spot. The culture and values of the residents of Venice has diminished as the newer generations are exposed to a tourist heavy inhabitation. In addition, as the residents leave due to the cost of living, there are less people who value the preservation of the cultural identity of the city.

⁴¹ Bon, E., & Bardella, A. Citta` di Venezia. Retrieved December 18, from <http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1>

5. Analysis and Results

5.1 Overall Impacts of Tourism

After calculating the revenues and costs of the impacts of tourism and incorporating taxes on the revenue, we can analyze the overall impacts of tourism on Venice. After summing the sources of revenue, the overall yearly revenue from tourists is €2.3 billion (Figure 21). After applying the taxes to these revenues, the overall tax revenues is €397.4 million (Figure 21). After summing the quantified negative impacts, the yearly cost of tourists to the city is €74.4 million (Figure 21). By finding the difference between the tax revenue and cost, we find the net benefit from tourists to be €323 million (Figure 21). This shows that tourists have a net position benefit on the city.

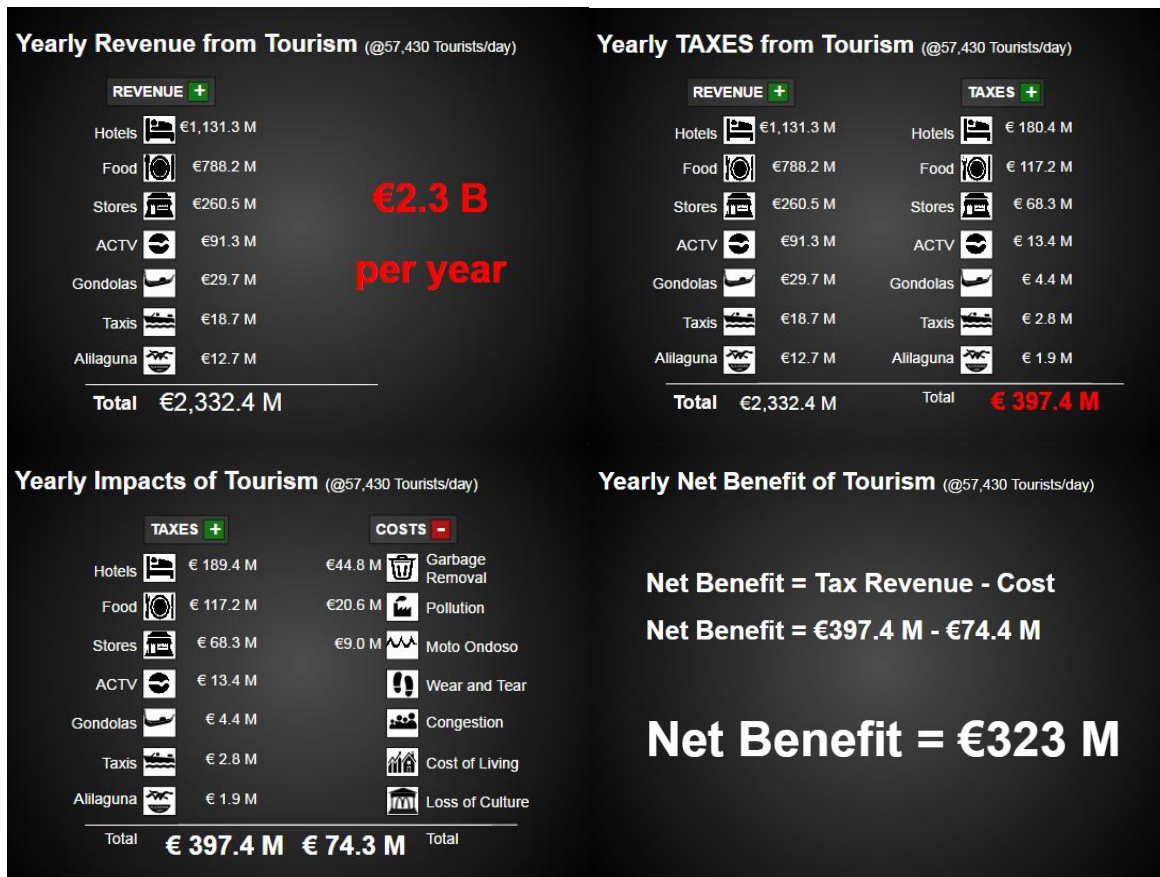


Figure 21 Overall Impacts of Tourism Summary Slides

5.2 Daytripper vs. Overnighter Analysis

Our analysis shows that tourists overall pay for the costs they exert. Therefore, it raises the question “why are they a problem?” To further investigate this question, we broke down the impacts of both daytrippers and overnighters.

In the graphics below, you can see the adjusted numbers for overnighters and daytrippers. For overnighters, it is apparent that the money they bring in far outweighs the costs they exert. Daytrippers, however, do not cover their costs as easily.

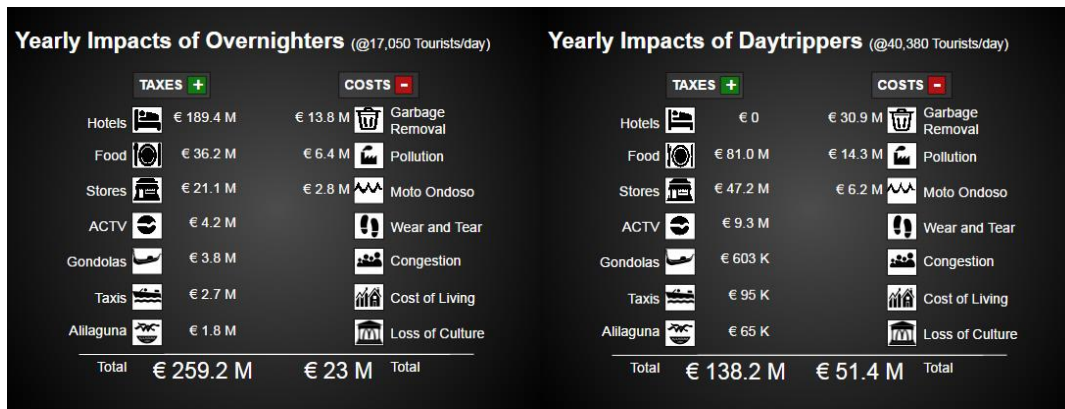


Figure 22 Daytripper vs. Overnighter Analysis

As seen below, the net benefit of overnighters is €236.2 million and the net benefit of daytrippers is €86.8 million (Figure 22). Using the ratio of overnighters to daytrippers, we found that the daily net per tourist for overnighters and daytrippers were €39 and €6 respectively (Figure 23). This means that overnighters are six and a half times more beneficial than daytrippers. In other words, one overnighter provides the same net benefit as six and a half daytrippers.

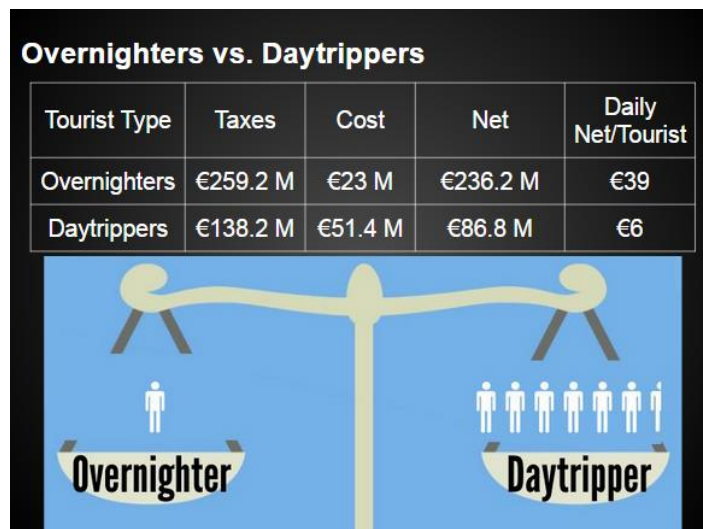


Figure 23 Daytripper vs. Overnighter Daily Revenue per Tourist per Day Breakdown

6. Conclusions

In conclusion, although tourists have negative impacts on Venice, they do pay for themselves. Based on our analysis and calculations, they have an overall net benefit of €323 million each year (Figure 23). This shows that despite their negative impacts, tourists are beneficial to Venice.

We can also conclude that overnight tourists are far more beneficial than daytrippers. Looking back at our equivalent population graph, daytrippers make up the largest percentage of the equivalent population. Therefore, given Venice is at its maximum capacity and daytrippers have been proven to be less valuable and beneficial to the city, measures should be taken to lower the number of daytrippers.

7. Deliverables

Our deliverables include our website (<http://sites.google.com/site/ve14tour>), an update to a current dashboard widget, and two brand new widgets displaying the impacts of tourism.

In our process, we updated the population widget on the Venice Dashboard to get a more accurate number for the number of daily overnights. To find this, we used website scraping to find the percentage of filled beds in the city from booking.com. This method will be very useful for the Venice Project Center for gathering more accurate and up to date information on tourists.

Our first widget displays the revenues from each of the sources of revenue we investigated. It displays the overnights and daytripper breakdown of the revenue, as well as the daily and yearly revenue due to tourists. Our second widget shows the tax revenue and costs to the city from tourists. It displays the values for each impact as well as the net, overnights, and daytripper breakdown. This widget also displays the daily and yearly costs due to tourists.

TOURIST REVENUE (€)				TOURIST TAXES VS TOURIST COSTS(€)			
	Overnighters	Day Trippers	Revenue		Overnighters	Day Trippers	Total
Hotels	1,709,332	0	1,709,332	IRES, IRPEF & TARES	108,803	62,011	170,814
Stores	121,635	308,265	429,900	VAT/IVA	247,220	172,778	419,998
Food	368,075	932,799	1,300,874	Hotel Tax	27,760	0	27,760
Taxis	8,752	22,193	30,945	Garbage Removal Cost	20,916	52,997	73,913
Gondolas	8,752	22,193	30,945	Sewage Removal Cost	3,421	8,660	12,081
Public Transportation	48,563	129,551	178,114	Moto Ondoso Repair Cost	4,173	10,579	14,752
Total	2,265,109	1,415,001	3,680,110	Net	355,273	162,553	517,826

Figure 24 Screen Shot of Our Widgets from the Dashboard

8. Recommendations

We have recommendations regarding both further data collection and daytripper regulations. When we did our calculations, we had occasional holes in our data, so we had to assume some values using educated guesses. We recommend finding better values for these calculations to complete our data. These include the number of daytrippers, average spending on stores and food, and *moto ondoso* repair cost. We also never looked into tour guides and historical attractions throughout the city as a source of revenue. It is incredibly difficult to find some of this data, especially since the tour guide industry is very disjointed. There is also a “black economy” in Venice. This consists of street vendors, fake gondoliers, and unregistered hotel beds. It would be interesting, but difficult, to collect data on the “touring” aspects of tourism as well as this “black economy”. Regardless, this additional information would only strengthen our point that tourists have a large net benefit on Venice.

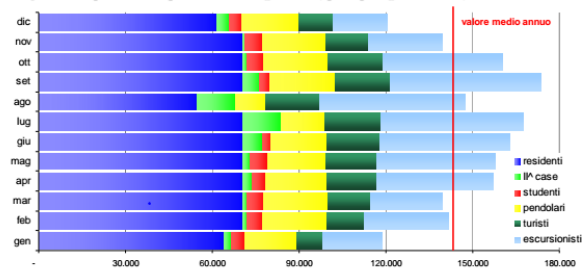
Since we determined that daytrippers are less beneficial than overnighters, we recommend regulating the ways they come into the city. Our recommendation is a tax levied on cruise ships, bus lines, parking garages, and trains. This will increase the revenue from daytrippers and reduce the large numbers of tourists entering on a daily basis. By reducing the number of tourists, the people of Venice will be happier and are more likely to hold on to their cultural identity.

Appendix A: Population

Monthly Equivalent Population - Annuario							
Month	Overnighters	Daytrippers	Commuters	Total Tourists	Total Locals	Total Equiv Inhab	% Tourists
Jan	300,177	700,414	504,029	1,000,591	1,606,558	3,111,178	32.16%
Feb	384,098	921,835	581,504	1,305,933	1,587,124	3,474,561	37.59%
Mar	405,239	688,907	587,760	1,094,146	1,757,173	3,439,079	31.82%
Apr	556,781	1,326,448	599,910	1,883,228	1,700,490	4,183,628	45.01%
May	582,844	1,414,255	588,721	1,997,099	1,757,173	4,342,993	45.98%
Jun	610,038	1,525,095	578,910	2,135,132	1,700,490	4,414,532	48.37%
Jul	690,408	1,816,863	460,505	2,507,271	1,757,173	4,724,949	53.06%
Aug	685,405	1,922,942	322,183	2,608,347	1,380,636	4,311,165	60.50%
Sep	692,345	1,913,057	684,180	2,605,402	1,700,490	4,990,072	52.21%
Oct	605,358	1,322,229	638,817	1,927,586	1,757,173	4,323,576	44.58%
Nov	398,945	696,825	572,430	1,095,770	1,700,490	3,368,690	32.53%
Dec	310,183	491,123	514,662	801,307	1,531,251	2,847,220	28.14%
Avg	518,485	1,228,333	552,801	1,746,818	1,661,352	3,960,970	42.66%
Yearly Total	6,221,821	14,739,991	6,633,611	20,961,812	19,936,221	47,531,644	44.10%

Daily Equivalent Population - Annuario									
Month	Overnighters	Daytrippers	Commuters	Average Tourists/Day	Average Locals/Day	Average Equivalent Population/Day	% Tourists	Tourists % Overnighters	Tourists % Daytrippers
Jan	9683	22594	16259	32277	51824	100361	32.16%	30.00%	70.00%
Feb	13718	32923	20768	46640	56683	124091	37.59%	29.41%	70.59%
Mar	13072	22223	18960	35295	56683	110938	31.82%	37.04%	62.96%
Apr	18559	44215	19997	62774	56683	139454	45.01%	29.57%	70.43%
May	18801	45621	18991	64423	56683	140097	45.98%	29.18%	70.82%
Jun	20335	50836	19297	71171	56683	147151	48.37%	28.57%	71.43%
Jul	22271	58608	14855	80880	56683	152418	53.06%	27.54%	72.46%
Aug	22110	62030	10393	84140	44537	139070	60.50%	26.28%	73.72%
Sep	23078	63769	22806	86847	56683	166336	52.21%	26.57%	73.43%
Oct	19528	42653	20607	62180	56683	139470	44.58%	31.40%	68.60%
Nov	13298	23227	19081	36526	56683	112290	32.53%	36.41%	63.59%
Dec	10006	15843	16602	25849	49395	91846	28.14%	38.71%	61.29%
Avg	17046	40384	18174	57430	54620	130224	42.68%	30.91%	69.09%
Total Yearly "Presences"	6221821	14739991	6633611	20961812	19936221	47531644	44.10%	29.68%	70.32%

Graf. 8.6 - Popolazione equivalente e stagionalità, per tipologie di utenti, 2007



Elabora: COSES, 2008

Tab. 6.1 - Numero medio di persone per mezzo in arrivo a Venezia città antica - Giorno ferialo maggio 1997

Fascia oraria	PERSONE X MEZZO							
	Bus Pub.	Treni	Auto	Moto	Furgoni	Camion	Bus Tur.	Natanti
6.30-7.00	39,6	67,5	1,6	1,0	1,5	1,2	21,8	186,7
7.00-8.00	54,4	201,5	1,7	1,0	1,9	1,1	9,2	140,2
8.00-9.00	48,6	272,9	1,6	1,0	1,6	1,3	23,7	128,3
9.00-10.00	39,8	312,8	1,7	1,1	1,5	1,2	38,1	103,4
10.00-11.00	34,0	263,3	1,8	1,0	1,3	1,1	39,7	91,0
11.00-12.00	22,2	166,0	1,7	1,1	1,3	1,3	34,0	37,1
12.00-13.00	19,0	215,6	1,8	1,1	1,1	1,4	33,0	55,1
13.00-14.00	20,4	112,7	1,6	1,1	1,4	1,2	18,0	49,0
14.00-15.00	20,3	113,0	1,6	1,1	1,2	1,0	19,0	22,2
15.00-16.00	22,3	89,8	1,7	1,0	1,2	1,1	18,9	35,5
16.00-17.00	14,0	94,8	1,6	1,1	1,3	1,0	13,2	47,1
17.00-18.00	15,7	69,3	1,6	1,0	1,4	1,2	10,3	20,6
18.00-19.00	18,4	92,0	1,6	1,1	1,4	1,3	18,5	13,9
19.00-20.00	20,9	78,4	1,7	1,2	1,3	1,3	20,5	21,1
20.00-20.30	17,8	41,3	1,8	1,1	1,7	1,0	30,5	41,0
TOTALE	29,3	158,9	1,7	1,1	1,5	1,2	24,2	51,8

Fonte: ACTV - Comune di Venezia, indagine maggio 1997
Elabora: COSES, 2008

For calculating tourist population, we used the graph shown above from the COSES report and scaled the numbers using the Annuario Del Turismo 2013. For a more detailed look, see our data collection spreadsheet available on our website, under our drive, data collection, equiv pop

Appendix B: Hotels

Base Numbers

Name	Abbreviation	Number	Source
# of Hotels	-	320	COSES
Total Beds	T _b	24,888	COSES
Average Daily Occupancy	O	17,050 (68%)	Appendix A calculated Overnight Percentage

Calculations

Name	Abbreviation	Number	Equation Used
Daily Rate	D _r	€ 180	Equation 1
Daily Revenue	DR	€ 3.1 million	Equation 2
Yearly Revenue	YR	€ 1.13 billion	Equation 3

Equations

Equation 1

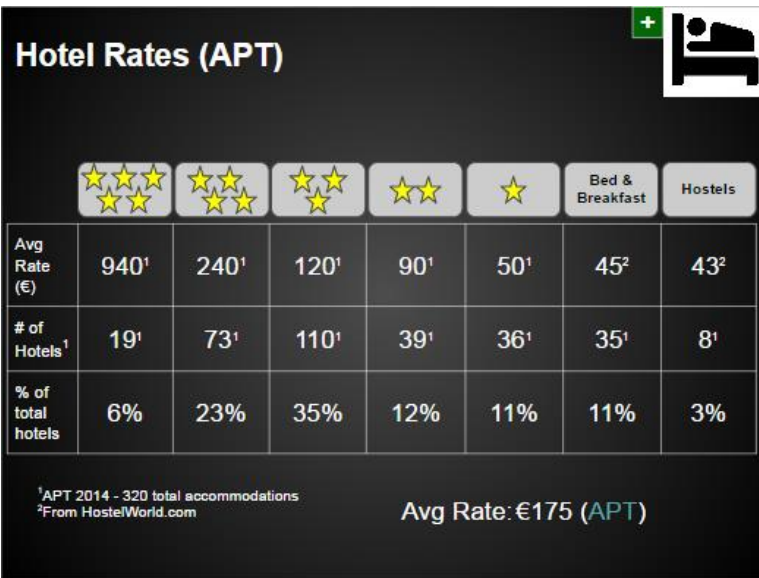
$$D_r = (\sum_{s=1}^2 (\sum_{i=1}^7 r_{is} h_{is}))/2$$
 Applied to the two following tables, in which r is Avg Rate (€), h is % of total hotels, s is the source, and i is the hotel class.



Hotel Rates (Hotels.com)

	★★★★★	★★★★	★★★	★★	★	Bed & Breakfast	Hostels
Avg Rate (€)	650 ¹	230 ¹	170 ¹	130 ¹	130 ¹	43 ¹	30 ¹
# of Hotels	19	73	110	39	36	35	8
% of total hotels	6%	23%	34%	12%	11%	11%	3%

¹From Hotels.com - 320 total accommodations Avg Rate: €190 (Hotels.com)



Equation 2

$$DR = D_r \cdot O$$

Equation 3

$$YR = DR \cdot 365$$

Appendix C: Food

Base Numbers

Name	Abbreviation	Number	Source
Daily Tourist Spending	t_s	€ 50.50	COSES 2009
Daily Tourists	t	57, 430	Appendix A Calculated tourist population
Daily Tourist spending on food	S_f	€37.50	Budget Your Trip

Calculations

Name	Abbreviation	Number	Equation Used
Daily Revenue	DR	€ 2.16 million	Equation 1
Yearly Revenue	YR	€ 788.2 million	Equation 2

Equations

Equation 1

$$DR = t \cdot S_f$$

Equation 2

$$YR = DR \cdot 365$$

Appendix D: Stores

Base Numbers

Name	Abbreviation	Number	Source
Daily Tourists	t	57,430	Appendix A calculated tourist population
Avg Daily Tourist Spending	TS	€ 50.50	COSES 2009

Assumptions

Name	Abbreviation	Number	Description
25% spending is on stores	S _s	€ 13	based off of S _f from Appendix C: base numbers

Calculations

Name	Abbreviation	Number	Equation Used
Daily Revenue	DR	€ 713,600	Equation 1
Yearly Revenue	YR	€ 260.5 million	Equation 2

Equations

Equation 1

$$DR = S_s \cdot t$$

Equation 2

$$YR = DR \cdot 365$$

Appendix E: ACTV

	60 min	1 Day	Multi Day (2-4)	7 Day
Daily Tourist Tickets ¹	13,200	3,340	1,950	375
Cost per Ticket ²	€7	€60	€20	€35
Revenue	€92,500	€22,500	€66,800	€68,200

Avg Daily Tourist Tickets: 18,865

ACTV Daily Revenue: €250,000

Using the Annuario del Turismo 2013 page 53 chart 6.1 to fill the daily tourist tickets for each category, and the link provided for ticket prices. Sum the revenue row to get ACTV revenue for the day.

Ticket Type	Price (Euros)
Adult standard one-way fare	7
children's roundtrip fare	7
disable fare	1,30
One-day Travel Card	20
Two-day Travel Card	30
Three-day Travel Card	40
Seven-Day Travel Card	60
Three-day young person's travel card	20

Appendix F: Gondolas

Base Numbers

Name	Abbreviation	Number	Source
Gondola Cost	c	€ 80	http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/62183
No. Gondolier Licenses	n	433	http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/62183

Assumptions

Name	Abbreviation	Number	Description
Avg Gondola Trips per Day	t	4	Observed value
Tourist Gondola percentage	P	100%	Only tourists use gondolas
Number of work days	WD	200	Accounts for not all gondoliers working on the same day and holidays

Calculations

Name	Abbreviation	Number	Equation Used
Daily Revenue	DR	€ 138,560	Equation 1
Average Daily Revenue	GDR	€ 81,000	Equation 2
Yearly Revenue	YR	€ 29.7 million	Equation 3

Equations

Equation 1

$$DR = c \cdot t \cdot n \cdot P$$

Equation 2

$$GDR = \frac{DR \cdot WD}{365}$$

Equation 3

$$YR = DR \cdot WD = GDR \cdot 365$$

Appendix G: Taxis

Base Numbers

Name	Abbreviation	Number	Source
Number of Taxi Licenses	n	250	City of Venice

Assumptions

Name	Abbreviation	Number	Description
Number of Days per Year Worked	d	200	Taxi drivers don't work every day so we can assume this value to account for their off days
Trips per Day	TD	5	
Rate per Trip	RT	€ 75	
Tourist Taxi percentage	TTT	100%	sometimes residents use taxis, but for the most part only tourists use them, so we assume 100%

Calculations

Name	Abbreviation	Number	Equation Used
Daily Taxi Revenue	DTR	€ 93,750	Equation 1
Average Daily Revenue	ADR	€ 51,370	Equation 2
Yearly Revenue	YR	€ 18.7 million	Equation 3

Equations

Equation 1

$$DTR = TD \cdot RT \cdot n \cdot TTT$$

Equation 2

$$ADR = \frac{DTR \cdot d}{365}$$

Equation 3

$$YR = DTR \cdot d$$

Appendix H: Alilaguna

Base Numbers

Name	Abbreviation	Number	Source
Tickets Per Year	TPY	484,400	Annuario del Turismo, Page 64, table 6.2

Assumptions

Name	Abbreviation	Number	Description
Cost per Ticket	CPT	€ 15	Purchased a ticket

Calculations

Name	Abbreviation	Number	Equation Used
Yearly Revenue	YR	€ 12.7 million	Equation 1
Tickets per Day	TPD	2,324	Equation 2
Daily Revenue	DR	€ 34,866	Equation 3

Equations

Equation 1

$$YR = CPT \cdot TPY$$

Equation 2

$$TPD = \frac{TPY}{365}$$

Equation 3

$$DR = TPD \cdot CPT$$

Appendix I: Garbage Removal

Base Numbers

Name	Abbreviation	Number	Source
Veritas Avg Cost	VADC	€ 791, 000	Veritas
Population Served by Veritas	P	365,000	Veritas
Daily Tourists	t	57,430	Appendix A calculated tourist population

Calculations

Name	Abbreviation	Number	Equation Used
Average Daily Cost	ADC	€ 122,700	Equation 1
Average Yearly Cost	AYC	€ 44.8 million	Equation 2

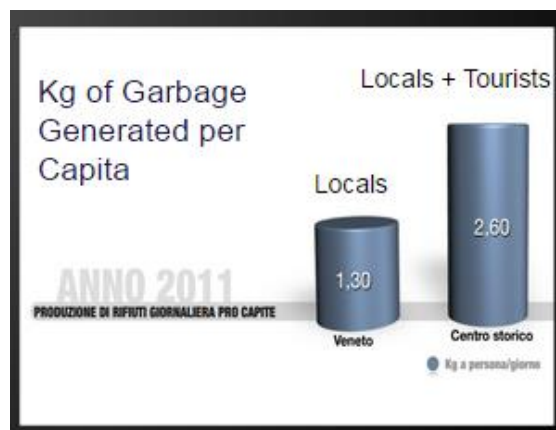
Equations

Equation 1

$$ADC = \frac{VADC}{P} \cdot t$$

Equation 2

$$AYC = ADC \cdot 365$$



Appendix J: Pollution

Sourced Numbers

Name	Abbreviation	Number	Source
Daily Tourists	t	57,430	appendix <i>i</i> variable <i>j</i>
Sewage Produced per Person per Day	S _p	4.65 (kg)	Eurostat
Cost of Sewage Removal	S	75 €/tonne	European Commission
CO ₂ produced per person per day	C	12.5-14 kg	A decision-support system in ICZM for protecting the ecosystems: integration with the habitat directive L Marotta, L Ceccaroni, G Matteucci, P Rossini, S Guerzoni, 2011. Journal of Coastal Conservation 15 (3), 393-405
Social Cost of Carbon	SC	€ 48/tonne	EPA

Calculations

Name	Abbreviation	Number	Equation Used
Total tonnes	T _t	267 (tonne/day)	Equation 1
Daily Cost of Sewage	DCS	€ 20,000	Equation 2
Yearly Cost of Sewage	YCS	€ 7.3 million	Equation 3
Daily Cost of Carbon	DCC	€ 34,500 - €38,500	Equation 4
Yearly Cost of Carbon	YCC	€12.6 M - € 14.1 M	Equation 5

Equations

Equation 1

$$T_t = t \cdot S_p$$

Equation 2

$$DCS = Tt \cdot S$$

Equation 3

$$YCS = DCS \cdot 365$$

Equation 4

$$DCC = C \cdot SC \cdot t$$

Equation 5

$$YCC = DCC \cdot 365$$

Appendix K: Moto Ondoso

Base Numbers

Name	Abbreviation	Number	Source
Moto ondosos repair cost	C	€ 1/100 units	B13 Moto Ondoso
Yearly Moto Ondoso	M_y	145 bil units	B13 Moto Ondoso

Assumptions

Name	Abbreviation	Number	Description
Moto Ondoso due to Tourists	M_t	61.79%	See our data collection spreadsheet

Calculations

Name	Abbreviation	Number	Equation Used
Daily Units of Moto Ondoso	D_uM_o	3.97 M units	Equation 1
Moto Ondoso due to Tourists	M_oT	2.45 M units	Equation 2
Daily Moto Ondoso Cost	DM_oC	€ 24,500	Equation 3
Yearly Moto Ondoso Cost	YM_oC	€ 8.9 M	Equation 4

Equations

Equation 1

$$D_uM_o = \frac{M_y}{365}$$

Equation 2

$$M_oT = D_uM_o \cdot M_t$$

Equation 3

$$DM_oC = M_oT \cdot C$$

Equation 4

$$YM_oC = DM_oC \cdot 365$$

Appendix L: Breakdown

Base Numbers

Name	Abbreviation	Number	Source
Overnighters	O	17,050(31%)	Appendix A
Daytrippers	D	40,380(69%)	Appendix A
Hotel Daily Revenue	HDR	€ 3.1 M	Appendix B
Food Daily Revenue	FDR	€ 2.16 M	Appendix C
Stores Daily Revenue	SDR	€ 713,600	Appendix D
ACTV Daily Revenue	ACDR	€ 250,000	Appendix E
Gondola Daily Revenue	GDR	€ 81,000	Appendix F
Taxi Daily Revenue	TDR	€ 51,370	Appendix G
Alilaguna Revenue	ADR	€ 34,866	Appendix H

Assumptions

Name	Abbreviation	Number	Description
Hotels used by Daytrippers	HD	0%	Daytrippers don't stay overnight
Hotels used by Overnights	HO	100%	All Overnights stay in hotels, it's the definition of an Overnighter
Stores	SD	100%	All daytrippers use stores
Stores	SO	100%	all overnights use stores
Food	FD	100%	All daytrippers purchase food
Food	FO	100%	All overnights purchase food
Taxis used by Daytrippers	TD	5%	Daytrippers don't have luggage to carry around and have no reason to take taxis other than speed
Taxis used by Overnights	TO	95%	Overnights have
Gondolas Used by Daytrippers	GD	20%	Daytrippers only spend one day so they are less likely to take a gondola ride
Gondolas Used by Overnights	GO	80%	Overnights spend more time so they are more likely to use a gondola
ACTV Daytrippers	ACD	100%	All Daytrippers use ACTV
ACTV overnights	ACO	100%	All overnights use ACTV
Alilaguna used by Daytrippers	AD	5%	Daytrippers don't arrive from the airport and Alilaguna is mainly airport to mainland transportation
Alilaguna used by Overnights	AO	95%	Overnights arrive mainly by plane and

			Alilaguna is primarily airport to mainland transportation
--	--	--	---

Calculations

Details	Overnighter	Equation 2	Daytripper	Equation 1
Hotels Revenue	€ 3,099,482	O, HO, HDR	€ 0	D, HD, HDR
Stores Revenue	€ 220,563	O, SO, SDR	€ 493,030	O, SD, SDR
Food Revenue	€ 667,430	O, FO, FDR	€ 1,491,924	D, FD, FDR
Taxi Revenue	€ 49,595	O, TO, TDR	€ 1,775	D, TD, TDR
Gondola Revenue	€ 70,012	O, GO, GDR	€ 11,226	D, GD, GDR
ACTV Revenue	€ 77,279	O, ACO, ACDR	€ 172,745	D, ACD, ACDR
Alilaguna Revenue	€ 33,661	O, AO, ADR	€ 1,204	D, AD, ADR

Equations

Equation 1

$$\text{Daytripper Revenue} = D \cdot \text{Daytrip Multiplier} \cdot RpD$$

Equation 2

$$\text{Overnight Revenue} = O \cdot \text{Overnight Multiplier} \cdot RpD$$

Appendix M: Taxes

Base Numbers

Name	Abbreviation	Number	Source
Value Added Tax	IVA	22% standard rate on all sales	KPMG
Corporate Tax	IRES	31.4% standard rate on income	KPMG
Refuse Tax	TARES	€20 + €0.3 /m ²	Regolamento Per L'Applicazione del Tributo Comunale Sui Rifiuti e sui Servizi Indivisibili
Income Tax	IRPEF	---	KPMG
Property Tax	IMU	---	KPMG
Hotel Tax	---	See Chart Below	Venice Hotel Tax: What it Costs & How to Avoid It

Accommodation Type & Season	Venice Historic Center	Lido & Islands	Mainland
Hotels (high season)	€5 (5 stars) €4 (4 stars) €3 (3 stars) €2 (2 stars) €1 (1 star)	€4.50 (5 stars) €2.80 (4 stars) €2.10 (3 stars) €1.40 (2 stars) €0.70 (1 star)	€3 (5 stars) €2.40 (4 stars) €1.80 (3 stars) €1.20 (2 stars) €0.60 (1 star)
B&Bs (high season)	€3	€2.10	€1.80
Camping (high season)	€0.40 (4 stars) €0.30 (3 stars) €0.20 (2 stars)	€0.28 (4 stars) €0.21 (3 stars) €0.14 (2 stars)	€0.24 (4 stars) €0.18 (3 stars) €0.12 (2 stars)
Rentals (high season)	€2.50 Room rentals (1st category) €2.00 Room rentals (2nd category) €1.50 Room rentals (3rd category) €2.00 Apartment/villa rentals	€2.25 Room rentals (1st category) €1.40 Room rentals (2nd category) €1.05 Room rentals (3rd category) €1.40 Apartment/villa rentals	€1.50 Room rentals (1st category) €1.20 Room rentals (2nd category) €0.90 Room rentals (3rd category) €1.20 Apartment/villa rentals
Monastery/Convent Stays (high season)	€2.00	€1.40	€1.20
Residence (high season)	€2.50 (1st category) €2.00 (2nd category) €1.50 (3rd category)	€2.25 (1st category) €1.40 (2nd category) €1.05 (3rd category)	€1.50 (1st category) €1.20 (2nd category) €0.90 (3rd category)
Hotels (low season)	€2.50 (5 stars) €2.00 (4 stars) €1.50 (3 stars) €1.00 (2 stars) €0.50 (1 star)	€2.25 (5 stars) €1.40 (4 stars) €1.05 (3 stars) €0.70 (2 stars) €0.35 (1 star)	€1.50 (5 stars) €1.20 (4 stars) €0.90 (3 stars) €0.60 (2 stars) €0.30 (1 star)
B&Bs (low season)	€1.50	€1.05	€0.90
Camping (low season)	€0.20 (4 stars) €0.15 (3 stars) €0.10 (2 stars)	€0.14 (4 stars) €0.10 (3 stars) €0.07 (2 stars)	€0.12 (4 stars) €0.09 (3 stars) €0.06 (2 stars)
Rentals (low season)	€1.25 Room rentals (1st category) €1.00 Room rentals (2nd category) €0.75 Room rentals (3rd category) €1.00 Apartment/villa rentals	€1.12 Room rentals (1st category) €0.70 Room rentals (2nd category) €0.52 Room rentals (3rd category) €0.70 Apartment/villa rentals	€0.75 Room rentals (1st category) €0.60 Room rentals (2nd category) €0.45 Room rentals (3rd category) €0.60 Apartment/villa rentals
Monastery/Convent Stays (low season)	€1.00	€0.70	€0.60
Residence (low season)	€1.25 (1st category) €1.00 (2nd category) €0.75 (3rd category)	€1.13 (1st category) €0.70 (2nd category) €0.53 (3rd category)	€0.75 (1st category) €0.60 (2nd category) €0.45 (3rd category)
Hostels ‡	N/A	N/A	N/A

Yearly TAXES from Tourism (@57,430 Tourists/day)

REVENUE +

Hotels  €1,131.3 M

Food  €788.2 M

Stores  €260.5 M

ACTV  €91.3 M

Gondolas  €29.7 M

Taxis  €18.7 M

Alilaguna  €12.7 M

Total €2,332.4 M

TAXES +

Hotels  € 180.4 M

Food  € 117.2 M

Stores  € 68.3 M

ACTV  € 13.4 M

Gondolas  € 4.4 M

Taxis  € 2.8 M

Alilaguna  € 1.9 M

Total € 397.4 M

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