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# What happens to the passenger's perception of quality of service during the airport's busiest hours?

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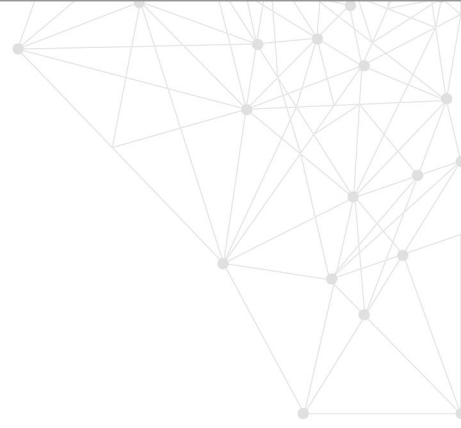
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# End of Studies Project Memoir



*"No book can ever be finished. While working on  
it we learn just enough to find it immature the  
moment we turn away from it"*

Karl Popper

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## **ABSTRACT**

Does the occupancy rate of the terminal influence passenger's perception of airport service quality?

This work tries to answer this question in a case study of Guarulhos International Airport in 2019. I combined two different databases to answer this question, one regarding the passenger perception survey and the other regarding the hourly airport movement for each airport terminal.

The results demonstrate a worsening in the passenger perception of the quality of the airport's operation during the busiest times.

In addition to the results, it is shown that the approach used in this work can be incorporated into ANAC's regulatory toolbox, providing new ways to use information already available to the Agency.

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## **ACKNOWLEDGEMENTS**

During that last year, during the writing of the dissertation, my son was born and the world faced a pandemic, from which my family became ill.

My wife's love and support was essential so that I could complete this work. It is a privilege to share life with someone you love and admire and an immense happiness to welcome a child, even in challenging times like the one we live in.

It is an honor to work at ANAC, an institution with employees committed to the public interest and always looking for improvement.

Working with economic regulation of airports allowed me to meet several people who were essential for my personal and professional growth,, in particular, Tiago Pereira, my supervisor in this project and my first boss at ANAC. I always learn something new in our conversations about economic regulation, even if we sometimes don't completely agree on a subject.

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## **1. Introduction:**

ANAC is the national Brazilian civil aviation agency and is responsible for regulating and supervising safety and security aspects related to civil aviation. The agency also operates in the economic regulation of the sector, especially in structuring and supervising the obligations provided for in the concession contracts. The department responsible for the economic regulation of airports at ANAC is the Superintendence of Economic Regulation of Airports - SRA.

Since 2011 the agency has been improving the regulation provided for in the concession contracts, as well as the ways of monitoring airport obligations.

The economic regulation of the service provided by the airport operator can be understood in two aspects, the first concerning the provision of infrastructure in view of the movement of passengers and the second considers the operation of this infrastructure, assessed by performance indicators. The former is called "Level of Service" monitoring, and the latter is called "Quality of Service" monitoring.

At the beginning of SRA, which was created only in 2015, the monitoring of these two dimensions of service quality was carried out by different managers, with little interaction and learning between the two areas.

This was modified in 2020, with the unification of the structures dedicated to monitoring the quality of service and the level of service.

Despite the unification of the areas, there is still little interaction between the two forms of service monitoring, and this work proposes a methodology that can be used by the Agency, bringing new tools that can add to the work currently done.

## **2. About me**

I have worked with airport concession contracts since I started at ANAC, in 2010. I started as an advisor to the presidency and later assumed managerial positions in the concession area, participating in structuring the management of the concession contracts by ANAC.

Since 2015, I have managed an area that deals with the inspection of financial obligations, issues related to the assets of the concessionaires, analysis of the financial conditions of the companies and maintenance of the database and structuring of reports for the entire SRA.

I participated in the creation of the standard regarding the sending of operational information by airports to ANAC and we are in the process of migrating the database of quality of service information to a format that allows a better measurement of data quality, as well as automated reports.

Recently, in 2020, current for a few months as acting head of SRA, and in this period I worked for the unification of the areas that monitor the quality of service provision of the concessionaires, mentioned in the previous section.

Thus, even though I do not work directly with the issues dealt with in this document, I have always participated in technical discussions on the issues both as a manager, and bringing to the discussions a perspective from a different background (economics). So the idea for that worked came from those conversations about how to integrate the two different approaches to regulating and monitoring the quality of service provision.

## **3. Timeline of the project:**

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The first part of the work was to define which airport would be studied and to obtain the databases. Guarulhos Airport was chosen because it is a relevant airport, with many

passengers and consequently a larger sample of interviews and had not made major investments in the year under analysis, which allowed the strategy adopted. Then the connection of the two databases was carried out. One of the necessary definitions was the time lag indicated to match the flight time and the interview time.

The next phase involved the definition of the equation to be estimated, as well as the dependent and independent variables, including control. Initially, an OLS regression was estimated, however it was noted that the use of ordered logit was more compatible with the characteristic of the dependent variable, which is discrete, and not continuous.

Then, robustness tests were performed, estimating standard errors by bootstrap and estimating a ordered probit model. The estimation of the models applied to the other quality of service indicators occurred later.

The interpretation of the results and how they could be used by ANAC in the monitoring work was the final phase. After the results were analyzed, I changed the dissertation title.

I am not aware of any work similar to the one proposed here, which is understandable, since the economic regulation of other countries is considerably different from that of Brazil, but the approach could be used in other countries.

#### **4. Economic Regulation of Airports in Brazil**

This section intends to summarize the economic regulation of airport concession contracts in Brazil. Each contract has a specific rule, with each round of concessions tending towards greater flexibility and encouraging the participation of airlines in several aspects of the regulation. However, the central pillars of regulation have not been changed.

##### Regulation of Airport Charges

The regulation provided for in the concession contracts provides that airport charges are, to a large extent, unrelated to operators' costs, being defined at the beginning of the contract and readjusted by inflation, "Q" Factor and "X" Factor. There is no Regulated Asset Base mechanism that incorporates the airport's operational and investment costs and generates the price cap.

The "Q" Factor is based on a subset of the quality of service indicators, detailed later in this document, and its overall effect is limited from -7.5% to + 2%.

The regulation of the "X" Factor seeks to pass on gains (or losses) in productivity that occurred in the airport sector. The regulatory model has recently been changed, originally the productivity estimate was based on the operating cost related to airport activities, calculated for the whole sector. Considering the difficulty in segregating costs by activity, as well as the gains in reducing the uncertainty in the calculation, the "X" factor was parameterized, based on the growth in the number of passengers. In simple terms, in case of low growth in the number of passengers during a 5-year interval, the X Factor will lead to an increase in airport charges above inflation in the next 5 years, in case of high growth, the reverse occurs.

Regarding the price structure, originally, and this still applies to Guarulhos Airport, the concession contract defined the maximum charge for all classes, domestic and international boarding charges, domestic and international connection, domestic and international landing, domestic and international aircraft parking, in addition to specific charges for executive and general aviation, and for the processing of imported and exported cargo.

In the most recent concession rounds, the Agency has been making the original model more flexible, where all the specific price caps were previously defined for a model with a global airport charges revenue per passenger price cap, still regulates, but which allows the airport operator to choose a more efficient price structure, considering the characteristics of the airport operation.

Also included was the possibility of agreements between the airport operator and airlines to supplant the tariff rules defined in the contract, but given the recent nature of the change, the mechanism has not yet been implemented in practice and it is expected that in the beginning it will be used to circumvent any specific rules of the concession contract, and not a significant change in the regulatory model.

To understand the interaction between airport charges regulation and service level, the main point is that the tariffs at Brazilian airports are not directly affected by the investments made or operating costs.

In other countries, the airport charges are defined after an evaluation of the operator's operating costs, as well as the investments made or to be made. In this way, the airport operator has an incentive to invest and spend resources in the operation of the airport, since it will be remunerated for these expenses through tariffs.

In turn, airline operators have different incentives to minimize inefficient investments and expenses, and evaluate investment plans, as well as operating costs, looking for the best infrastructure offer at the lowest possible price. An agreement between the airport operator and airlines, mediated by the regulator, benefits from complementary incentives, which in theory tend to generate investments and efficient operation.

The participation of the regulatory body varies according to each country, but it is usually focused on guaranteeing access to airlines, which is fundamental for competition in the market, as well as issues related to the quality of service provided to passengers that may not be fully captured by both actors involved.

In the case of Brazil, the situation is different, the airport operator wants to invest and spend as little as possible on its infrastructure, since its revenue per passenger is independent of this, and the main incentives it has to make investments are the rules defined in the concession agreement that seeks to create incentives for investments and operations that lead to a good service to passengers. The incentives are basically pecuniary, through fines or the Q Factor, which is applied in tariff adjustments.

Air operators would prefer more investments, since the prices to be paid by them do not depend on the airport costs, but still have little influence on decisions within the Brazilian regulatory model.

### Economic Regulation of the Service

The economic regulation of the service provided by the airport operator can be understood in two aspects, the first concerning the provision of infrastructure in view of the movement of passengers and the second considers the operation of this infrastructure, assessed by performance indicators.

It should be noted that this is not about safety/security regulation, the interactions between economic regulation and safety/security regulation is a very fertile topic that deserves to be explored.

In addition, current contracts do not have a methodology for assessing the availability of airside infrastructure or quality of the operation of the airside. It is currently being discussed at the agency if this theme deserves specific economic regulation to incentivize investments, or whether there are already sufficient incentives to the airport operator.

In this section we will summarize the two approaches used in the concession contracts for the regulation of the quality of service of the airport operator.

### Infrastructure Availability

At the beginning of the Brazilian concession program, there was an explicit requirement for initial investments by the new airport operators, if the airport is saturated at the time of the concession. Such a definition has the advantage of clear rules, but experience in the country has shown that there are risks of requiring over-investments and that the definition of tight deadlines for the realization of these hinders the quality of the projects implemented.

After this initial expansion phase, the regulation on the availability of infrastructure is defined by meeting the minimum sizing parameters defined in the contract, referred to in the concession contract as "service level".

These parameters were inspired by the IATA Airport Development Reference Manual, in the case of Guarulhos in the 9th version of the document, and calibrated to level C. It is noteworthy that the parameters defined for international passengers are more restrictive, partly due to the different characteristics of these passengers, leading to the need for greater investments in the event of an increase in international passengers at peak times.

The regulation seeks to create incentives for the airport to invest and provide adequate capacity for handling incoming passengers. The service level assessment is based on the use of the infrastructure during the 30th busiest hour of the year, considering each component.

This assessment also considers aspects such as circulation areas, which are not treated in the ADRM.

It is important to note that to increase the level of service, there is no requirement for investments in construction, often when making small adaptations and rationalizing passenger flows, the airport operator starts to meet the minimum requirements.

Non-compliance with contractual requirements related to the minimum design parameters lead to fines.

### Infrastructure Operation

With regard to the operation, the contract and legislation provide for general rules that in the event of non-compliance can lead to fines, but the regulation is centered on Service Quality Indicators defined in the contract and formed by the passenger satisfaction survey, availability of equipment and security inspection queue time indicators.

The flights from which the interviewed passengers are chosen are defined by lot. The survey aims to capture the views of those on the quality of security inspection processes, comfort, wayfinding, car parking, cleaning, shopping areas, among others.

While the perception of the passenger is subjective, the other indicators are objective, measured by the operators, audited by independent companies, and supervised by the

Agency. This work will use the 2019 results of the Passenger Satisfaction Survey, the details of which will be reported in a later section.

### Relationship between the two approaches

It can be seen that service quality indicators, both subjective and more objective, aim to create incentives for a better operation of a given infrastructure and the regulation of the service level seeks to create incentives for the availability of infrastructures that lead to a good service provision.

It is evident, however, that the capacity of an efficient airport operation to lead to a good service provision to the passenger is conditioned by the available infrastructure. An operator may have a good terminal, but due to defects in its operation, it does not provide a good service. On the other hand, a qualified operator can assume the operation of an inappropriate terminal and even minimize any impacts on the provision of the service but will not be able to achieve the same quality if it had a good infrastructure.

## **5. GUARULHOS' AIRPORT**

Guarulhos International Airport was built in 1984 by Infraero and transferred to the private sector in 2012. The airport was chosen for this study because of its relevance and because its processing capacity is close to the limit, according to service level assessments.

In 2019, the year used for this analysis, the Airport was divided into 3 terminals and had the largest movement in Brazil and South America, processing 44,345,832 passengers, 29,009,782 (65%) domestic and 15,336,050 (35%) international.

Terminal 1 processed 4,112,816 domestic passengers, Terminal 2 processed 29,429,366 passengers, 24,857,437 domestic (84%) and 4,571,929 international (16%), and Terminal 3 processed 10,781,482 international passengers.

Domestic operations are concentrated in three companies, LATAM (46%), GOL (34%) and Azul (14%). The international is more dispersed, with LATAM maintaining the leadership with 35% and GOL in second, with 7% and American Airlines in third with 6%.

More than 30% of the airport passengers do not have Guarulhos as their origin or final destination, connecting from Brazilian or international destinations.



## Terminal 1

Terminal 1 has one level and domestic operations by a single airline, Azul. It was built before the concession contract and have had occasional interventions over the past few years, which have not changed its main characteristics.

### Terminal 1

#### Landside

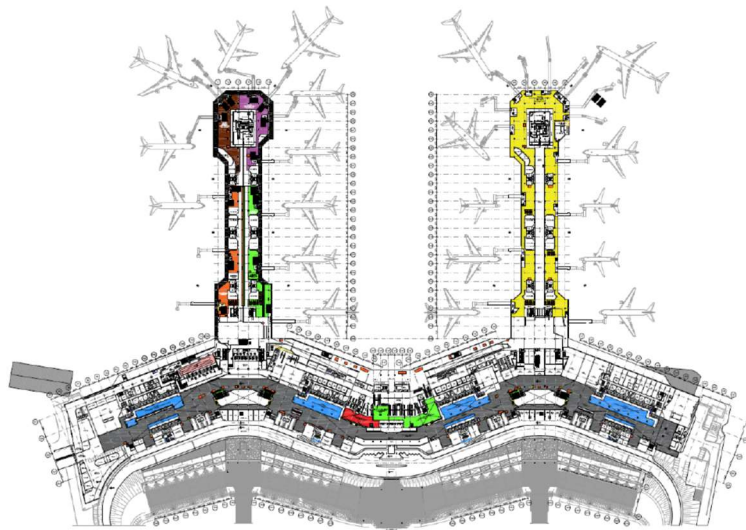


#### Apron

## Terminal 2

Terminal 2 has a pier design, operating domestic and international flights, has three floors, two of which are used for operational purposes. It underwent a major intervention ended in 2016 that unified what were previously two independently operated terminals, centralizing security inspection on passengers and allocating international operations only to the terminal section closest to Terminal 3.

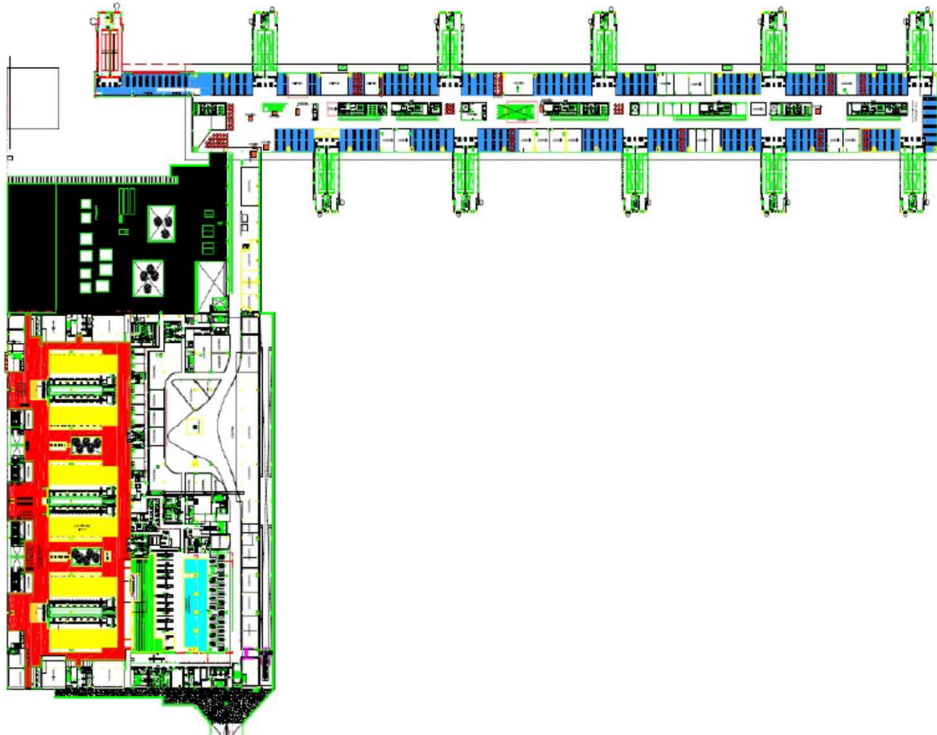
### Terminal 2



### Terminal 3

Terminal 3 was built to comply with the obligations set forth in the concession contract and went into operation in May 2014. The Terminal operates only international flights.

### Terminal 3



It is worth mentioning that in Brazil the operation of domestic and international flights is totally segregated, both in the arrivals and departures flow. The need for segregation on boarding brings inefficiency in the use of infrastructure, accentuated by the high concentration of international flights at specific times (departure between 22:00 and 01:00 and arrival between 5:00 and 8:00), increasing the walking distances for connecting passengers.

A detailed description of the infrastructure of each terminal will not be made here. However, to compare the order of magnitude of the buildings, the table below shows the measurements of some airport areas.

| <b>Passenger Terminal Features</b> |                                     |                                 |  |   |
|------------------------------------|-------------------------------------|---------------------------------|--|---|
|                                    | <b>Boarding room(m<sup>2</sup>)</b> | <b>Check in (m<sup>2</sup>)</b> | <b>Security inspection queue (m<sup>2</sup>)</b> | <b>Baggage claim area (m<sup>2</sup>)</b> |
| <b>Terminal 1</b>                  | 1.223                               | 427                             | 130  | 781                                       |
| <b>Terminal 2D</b>                 | 7.035 – 8.746                       | 2374                            | 509  | 5.628                                     |
| <b>Terminal 2I</b>                 | 1284 - 2995                         |                                 | 330  | 2.455                                     |
| <b>Terminal 3</b>                  | 7.277                               | 2.137                           | 544  | 5.289                                     |

## 6. DATA

The data that will be used in this work are those of the passenger satisfaction survey, carried out throughout 2019, and the airport movement data. The Passenger Satisfaction Survey data was collected by the airport operator and sent to ANAC in compliance with contractual obligations. Airport movement data was sent by the airport operator in compliance with ANAC Resolution No. 464/2019.

### Passenger Satisfaction Survey

In 2019, 11,210 passenger surveys were carried out at the airport. Information about gender, education, age, airline, flight number and destination was gathered.

The questions that make up the quality of service indicators of the concession contract are:

Q.1 "How do you evaluate the waiting time in the security inspection queue?"

Q.2 "How do you assess the rigor in the safety inspection channel?"

Q.3 "How do you evaluate the service and courtesy of the employees in the security inspection queue?"

Q.4 "How do you rate the ease of finding your way at the terminal?"

Q.5 "How do you assess the availability of flight information?"

Q.6 "How do you assess the distance walked at the passenger terminal?"

Q.7 "How do you assess the quality of restaurants?"

Q.8 "How do you evaluate the variety of restaurants?"

Q.9 "How do you evaluate the quality of the stores?"

Q.10 "How do you evaluate the variety of stores?"

Q.11 "How do you assess the availability of banking services?"

Q.12 "How do you evaluate the general cleanliness of the airport bathrooms?"

Q.13 "How do you assess the availability of the airport bathrooms?"

Q.14 "How do you assess the quality of the wireless internet provided by the airport?"

Q.15 "How do you assess the availability of luggage carts?"

Q.16 "How do you evaluate comfort in the departure areas?"

Q.17 "How do you evaluate thermal comfort?"

Q.18 "How do you evaluate acoustic comfort?"

Q.19 "How do you evaluate the general cleanliness of the airport?"

Q.20 "How do you rate the ease of disembarking at the terminal entrance?"

Q.21 "How do you assess the availability of parking spaces?"

Q.22 "How do you assess the quality of the parking facilities?"

Q.23 "How do you evaluate the price-quality ratio of the parking lots?"

Q.24 "How do you evaluate the price-quality ratio of the stores?"

Q.25 "How do you evaluate the price-quality ratio of the stores?"

Q.26 "How do you rate the wait for check-in at the airport?"

Q.27 "How do you evaluate the efficiency of the airport check-in process?"

Q.28 "How do you evaluate the service and courtesy of the check-in staff?"

In case of insufficient results in the evaluations, the airport presents an action plan with the objective of restoring the quality of the service.

The passenger was also asked about their agreement, on a scale of 1 to 10, as to statements regarding the general perception of the service provided by the airport, these assessments are not used directly in the monitoring of the concession contracts, but are the main source of information used in this work. Below are the statements and the average passenger score for the entire airport and for each terminal in 2019.

| Statement  | Airport | Score (1-10) |                     |                          |            |
|--|---------|--------------|---------------------|--------------------------|------------|
|  |         | Terminal 1   | Terminal 2 Domestic | Terminal 2 International | Terminal 3 |
| S.1 In general, I am satisfied with this airport.                              | 8.06    | 7.67         | 8.02                | 8.02                     | 8.31       |
| S.2 The airport met my expectations  | 8.13    | 7.71         | 8.09                | 8.06                     | 8.41       |
| S.3 The services provided at the airport are close to that of an ideal airport | 7.69    | 7.18         | 7.67                | 7.55                     | 7.98       |

Terminal 3 was the one with the best rating. The domestic operation of Terminal 2 was slightly better rated than the international, and Terminal 1 was the one with the worst rating.

Among respondents, 51.52% were men. The age distribution of respondents is as follows:

| Passengers by Age    |           |       |
|----------------------|-----------|-------|
|                      | Frequency | %     |
| (1) Up to 21 years   | 533       | 4,8%  |
| (2) 22 to 25 years   | 1124      | 10,0% |
| (3) 26 to 34 years;  | 3141      | 28,0% |
| (4) 35 to 44 years   | 2700      | 24,1% |
| (5) 45 to 54 years   | 1862      | 16,6% |
| (6) 55 to 64 years   | 1273      | 11,4% |
| (7) 65 to 75 years;  | 529       | 4,7%  |
| (8) 76 years or more | 44        | 0,4%  |
| Total                | 11206     |       |

For educational, the sample of respondents was as follows:

| <b>Passengers by Schooling</b>          |           |       |
|---|-----------|-------|
|   | Frequency | %     |
| (1) Illiterate or incomplete elementary | 18        | 0.2%  |
| (2) Elementary School                   | 181       | 1.6%  |
| (3) Incomplete High school              | 285       | 2.5%  |
| (4) High School                         | 1534      | 13.7% |
| (5) Incomplete College                  | 1667      | 14.9% |
| (6) College graduate                    | 7522      | 67.1% |

The distribution of the interviews by terminal was as follows:

| <b>Interviews by Terminal</b> |           |       |
|-------------------------------|-----------|-------|
| Terminal                      | Frequency | %     |
| 1                             | 1,105     | 9.86  |
| 2D                            | 6,242     | 55.69 |
| 2I                            | 1,218     | 10.87 |
| 3                             | 2,644     | 23.59 |
| Total                         | 11,209    |       |

### Airport Demand

The airport movement database is very detailed, presenting information on the number of passengers, cargo, as well as runway used, landing times, aircraft takeoff time and parking position used for each flight.

The peak hour (30th busiest hour) of domestic departure for T1 was 1,005 passengers, of domestic departure for T2 was 4,060, international departure for T2 was 1,274 and for Terminal 3 it was 3,698.

### Database Combination

Considering that the satisfaction survey is carried out only with passengers boarding, information about disembarked passengers was disregarded in this analysis. In addition, the international and domestic areas of Terminal 2 were treated as separate terminals.

For each time / day / month of each terminal, the sum of the boarded passengers was calculated. For each informed interview time, 45 minutes were added, under the assumption that the passenger is interviewed on average 45 minutes before the flight leaves. Considering the time / day / month and terminal of each interview, the interview databases were combined with the number of passengers boarded in each terminal.

## **7. IDENTIFICATION STRATEGY AND ESTIMATION RESULTS**

Is there a relationship between and the perception by the passenger of the quality of service provided by the airport and the number of passengers being processed at the time of the interview?

The answer to this question is not obvious, the perception of quality by the passenger is subjective and depends on numerous factors, some intrinsic to the passenger, and others dependent on the action of the airport operator. Among those under the control of the airport operator, some are independent of how busy the airport is at a given time and others are affected by it. A simple example is that during busy times, there is a higher cost of keeping the airport clean and the airport has to keep more passenger inspection channels open, on the other hand, other categories such as thermal comfort, distance to parking or availability of shops should be less affected.

In theory, it can be argued that if the airport is well dimensioned and efficient in its operation, the passenger will not have a worse perception of the service provision in the busiest periods.

To try to evaluate this question in the case of Guarulhos Airport in 2019, we tried to estimate an ordered logit, where the dependent variable is the score given to the passenger to the 3 questions related to the general perception:

$$\text{Score}_i = \text{TPS}_j + B_j \cdot \text{pax}_{ij} + \text{Controls}_i$$

As control variables, gender, age, education, if he/she was a connecting passenger, and interview time.

A fixed effect per terminal and the variable of greatest interest were placed, the number of passengers being processed at the time of the interview (after correction for +45 minutes as indicated in the previous section). Robust estimators were used to deal with the heterocedasticity of the data.

IN the table below is a summary of the coefficients found for the variable of interest, p-values in parenthesis, the full regression results are at the end of this document.

**Effect on the the passanger score of 1.000 more passengers**

|     | Statement 1       | Statement 2        | Statement 3        |
|-----|-------------------|--------------------|--------------------|
| T1  | -0.44*<br>(0.014) | -0.40*<br>(0.029)  | -0.44*<br>(0.011)  |
| T2D | -0.05*<br>(0.046) | -0.07**<br>(0.005) | -.072**<br>(0.007) |
| T2I | -0.21<br>(0.112)  | -.20<br>(0.136)    | -.13<br>(0.349)    |
| T3I | -.10*<br>(0.026)  | -0.13**<br>(0.005) | -0.11*<br>(0.020)  |

\* Different from zero, 95% confidence interval

\*\* Different from zero, 99% confidence interval

Statement 1: In general, I am satisfied with this airport.

Statement 2: The airport met my expectations.

Statement 3: The services provided at the airport are close to that of an ideal airport

The coefficient for Terminal 2 is not significantly different from one for all estimates, but for all other terminals the coefficients are statistically significant. It should be noted that the sample for Terminal 2 passenger is smaller, and that could be leading to the non-significance result.

The estimated probability for the scores given for statement 1 for each terminal is shown below, calculates at the averages of the correlates, including passenger movement, in each terminal:

| Score probability at the average of the correlates |      |      |      |      |      |      |      |       |       |       |       |         |
|--|------|------|------|------|------|------|------|-------|-------|-------|-------|---------|
| Terminal   | PAX  | 1    | 2    | 3    | 4    | 5    | 6    | 7     | 8     | 9     | 10    | Average |
| T1   | 711  | 0,9% | 0,4% | 0,9% | 1,6% | 7,3% | 6,4% | 17,6% | 32,0% | 12,9% | 19,8% | 7,80    |
| T2D  | 3639 | 0,7% | 0,3% | 0,7% | 1,3% | 5,8% | 5,2% | 15,3% | 31,7% | 14,5% | 24,5% | 8,05    |
| T2I  | 600  | 0,7% | 0,4% | 0,7% | 1,3% | 6,1% | 5,4% | 15,7% | 31,8% | 14,2% | 23,6% | 8,01    |
| T3   | 1483 | 0,5% | 0,3% | 0,5% | 1,0% | 4,6% | 4,2% | 13,0% | 30,4% | 15,7% | 29,8% | 8,28    |

The estimated probability for the scores given for statement 1 at each terminal is shown below, calculated assuming no passenger movement at the terminal and at the averages of the other correlates in each terminal:

| Score probability assuming empty passenger terminal |  |       |       |       |       |       |       |       |        |        |        |         |
|---|--|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|---------|
| Terminal  |  | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8      | 9      | 10     | Average |
| 1D  |  | 0,65% | 0,32% | 0,67% | 1,21% | 5,59% | 5,06% | 14,9% | 31,57% | 14,71% | 25,28% | 8,09    |
| 2D  |  | 0,56% | 0,28% | 0,58% | 1,04% | 4,86% | 4,47% | 13,6% | 30,84% | 15,45% | 28,34% | 8,22    |
| 2I  |  | 0,63% | 0,31% | 0,65% | 1,16% | 5,41% | 4,91% | 14,6% | 31,42% | 14,90% | 25,99% | 8,12    |
| 3I  |  | 0,45% | 0,22% | 0,46% | 0,84% | 3,97% | 3,72% | 11,7% | 29,29% | 16,26% | 33,06% | 8,41    |

The estimated probability for the scores given for statement 1 at each terminal is shown below, calculated assuming the peak hour (the 30<sup>th</sup> busiest hour) at the terminal and at the averages of the other correlates in each terminal:

| Score probability at each terminal's peak hour |      |       |       |       |       |       |       |        |        |        |        |         |
|--|------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|---------|
| Terminal                                       | PAX  | 1     | 2     | 3     | 4     | 5     | 6     | 7      | 8      | 9      | 10     | Average |
| 1D   | 1005 | 1,01% | 0,50% | 1,03% | 1,83% | 8,19% | 7,00% | 18,68% | 31,80% | 12,12% | 17,84% | 7,68    |
| 2D   | 4060 | 1%    | 0,34% | 0,71% | 1,28% | 5,91% | 5,30% | 15,47% | 31,77% | 14,39% | 24,13% | 8,03    |
| 2I   | 1274 | 0,82% | 0,41% | 0,84% | 1,51% | 6,88% | 6,05% | 16,97% | 32,04% | 13,40% | 21,08% | 7,87    |
| 3I   | 3698 | 0,65% | 0,32% | 0,67% | 1,21% | 5,62% | 5,07% | 14,97% | 31,59% | 14,69% | 25,20% | 8,08    |

A striking result is that at peak times there is little difference in the evaluation of terminals 2D and 3.

We estimated the expected average score for statements 2 and 3, assuming zero passengers and peak hour, and the results follows.

**Estimated average score in empty terminal and peak hour**

| Terminal | Statement 1     |           | Statement 2     |           | Statement 3     |           |
|----------|-----------------|-----------|-----------------|-----------|-----------------|-----------|
|          | Zero Passengers | Peak Hour | Zero Passengers | Peak Hour | Zero Passengers | Peak Hour |
| 1D       | 8,09            | 7,68      | 8,06            | 7,73      | 7,65            | 7,18      |
| 2D       | 8,22            | 8,03      | 8,36            | 8,09      | 7,98            | 7,68      |
| 2I       | 8,12            | 7,87      | 8,16            | 7,93      | 7,65            | 7,48      |
| 3I       | 8,41            | 8,08      | 8,55            | 8,13      | 8,13            | 7,74      |

In this way, we can estimate the difference in passenger perception between an empty airport and the airport at peak hour ( 30<sup>th</sup> busiest hour).

**Difference between empty and peak hour estimated average score**

| Terminal | Statement 1 | Statement 2 | Statement 3 |
|----------|-------------|-------------|-------------|
| 1D       | -0,41       | -0,33       | -0,48       |
| 2D       | -0,19       | -0,27       | -0,29       |
| 2I       | -0,25       | -0,23       | -0,17       |
| 3I       | -0,33       | -0,42       | -0,39       |

The interpretation of these results is speculative, since in addition to passenger satisfaction being subjective, the following statements add more subjectivity since they deal with expectations and assessments of what would be an ideal airport.

The reduction in assessments when comparing the two scenarios may be due either to deficiencies in the operation of the airport, which does not adapt sufficiently to the needs of the busiest hours, or to insufficient infrastructure to deal with the number of passengers in those same periods.

It is not intended to provide answers to this question here, but the results found point to two interesting situations. The terminals with the greatest reduction among the scenarios is the terminal with the worst rating and the best rating in the scenario with zero passengers.

Robustness checks

An “ordered probit” regression was estimated, with the same parameters as before, also presenting parameters that are statistically relevant for the effect of the number of passengers in the evaluation of quality of service. Note that we can’t make a direct comparison between the coefficients, since the estimation premises are considerably different.

**Ordered probit, same control variables**

| 1,000 passengers | Statement 1        | Statement 2          | Statement 3        |
|------------------|--------------------|----------------------|--------------------|
| T1               | -.23 *<br>(0.027)  | -0.40*<br>(0.032)    | -.23 *<br>(0.018)  |
| T2D              | -.033 *<br>(0.035) | . -0.04**<br>(0.004) | -.04 **<br>(0.005) |
| T2I              | -.10<br>(0.207)    | -.09<br>(0.224)      | -.06<br>(0.467)    |
| T3I              | -.05 *<br>(0.048)  | -0.13**<br>(0.005)   | -.06 *<br>(0.022)  |

\* Different from zero, 95% confidence interval  
 \*\* Different from zero, 99% confidence interval

We also estimate standard errors through bootstrap, with 2000 replications. Results are below and similar to the robust standard errors estimated.

**Bootstrapped standard errors**

| 1,000 passengers | Statement 1           | Statement 2             | Statement 3            |
|------------------|-----------------------|-------------------------|------------------------|
| T1               | -.4409877*<br>(0.014) | -0.3977807*<br>(0.032)  | -0.4406521*<br>(0.001) |
| T2D              | -.05368*<br>(0.049)   | -0.0752486**<br>(0.006) | -.0720395**<br>(0.007) |
| T2I              | -.2147759<br>(0.115)  | -.1983722<br>(0.131)    | -.1309488<br>(0.344)   |
| T3I              | -.1034601*<br>(0.023) | .901712**<br>(0.006)    | -0.1112446*<br>(0.026) |

\* Different from zero, 95% confidence interval  
 \*\* Different from zero, 99% confidence interval

Commentary: The first equation I estimated was an OLS model, the results were similar, but I chose not to use it because the dependent variable is not continuous, which is against the OLS assumptions.

**Effects on the other quality of service indicators**

It was also assessed whether the impact was transferred to other quality of service indicators. There was a possibility that the passenger's perception would be affected in general, for all indicators, even those that in theory were not affected by how busy the airport was.

The same regressions, ordered logit, with the same control variables, were estimated for the 28 questions described above. The coefficients that measure the impact of occupancy rate are shown in the table below.

**Effect of 1.000 more passengers on average score**

| Question | TPS1       | TPS2D      | TPS2I     | TPS3       |
|----------|------------|------------|-----------|------------|
| Q.1      | -0.4809**  | -0.09593** | -0.17187  | -0.16229** |
| Q.2      | -0.37888*  | -0.09064** | -0.31002* | -0.14197*  |
| Q.3      | -0.46636*  | -0.08012*  | -0.11509  | -0.07413   |
| Q.4      | -0.20133   | -0.01816   | -0.03387  | -0.10231   |
| Q.5      | -0.31536   | -0.04492   | -0.17698  | -0.13931*  |
| Q.6      | -0.13931   | -0.01876   | -0.31107  | -0.00489   |
| Q.7      | -0.00012   | -0.04242   | -0.2765   | -0.05934   |
| Q.8      | -0.012     | -0.07524   | -0.19851  | -0.05906   |
| Q.9      | -0.02981   | -0.03367   | -0.42576* | -0.089     |
| Q.10     | 0.10291    | -0.01503   | -0.26313* | -0.03812   |
| Q.11     | -0.11601   | -0.05819   | -0.10642  | -0.00257   |
| Q.12     | -0.43038*  | -0.08722** | -0.31896* | -0.14464** |
| Q.13     | -0.48348** | -0.09887** | -0.29374* | -0.16571** |
| Q.14     | -0.46601*  | -0.06163*  | 0.012128  | -0.06289   |
| Q.15     | 0.36086    | -0.00456   | -0.01684  | -0.10142   |
| Q.16     | -0.52656** | -0.07795** | -0.143    | -0.11791*  |
| Q.17     | -0.21748   | -0.06338*  | -0.06747  | -0.0631    |
| Q.18     | -0.50006** | -0.10904** | -0.04619  | -0.19596** |
| Q.19     | -0.29544   | -0.0821*   | -0.22609  | -0.16022   |
| Q.20     | -0.25868   | -0.00599   | -0.2261   | -0.17597*  |
| Q.21     | 0.27405    | -0.0778*   | -0.38382  | -0.03121   |
| Q.22     | 0.063223   | -0.15458*  | -0.32666  | 0.024618   |
| Q.23     | 0.114302   | -0.08917*  | -0.27037  | -0.081     |
| Q.24     | -0.24465   | -0.04976   | -0.38866  | -0.00022   |
| Q.25     | -0.02052   | -0.02662   | -0.37341  | -0.06765   |
| Q.26     | -0.30796   | -0.00124   | 0.040941  | -0.02243   |
| Q.27     | 0.074618   | 0.001158   | -0.07497  | -0.08474   |
| Q.28     | 0.008145   | 0.008145   | 0.020693  | -0.00497   |

\* Different from zero, 95% confidence interval

\*\* Different from zero, 99% confidence interval

The results demonstrate that the effect of movement on the assessment of passengers depends on the question asked. In general, there is no impact, however for questions 1, 2, 12, 13, 16, and 18, the impact was statistically significant for terminals 1, 2D and 3. In the case of terminal 2, the result also was significant for questions 2, 12, and 13.

We will transcribe them again below:

Q.1 "How do you evaluate the waiting time in the security inspection queue?"

Q.2 "How do you assess the rigor in the safety inspection channel?"

Q.12 "How do you evaluate the general cleanliness of the bathrooms?"

Q.13 "How do you assess the availability of bathrooms?"

Q.16 "How do you evaluate comfort in the departure areas?"

Q.18 "How do you evaluate acoustic comfort?"

The results are consistent with the idea that only subset of the indicators is affected by how busy the airport is at the time of the interview, and seem to point to the airport operator's failure to maintain certain dimensions of service quality at peak times.

## **8. Pathways for the evolution of ANAC's regulation**

What the results mean for regulation?

It was shown that in the case of Guarulhos Airport, in 2019, the general passenger perception of airport quality is affected by the occupancy rate of the terminal is at the time of the interview.

The results also pointed out the same effect for specific service quality indicators, in some cases more significantly than the general perception.

In addition to a specific evaluation of Guarulhos International Airport, the results presented in this work point to new possibilities for using data that were previously analyzed in a segregated way, allowing the regulator to direct its inspection, depending on the results found.

For example, a significant result of a drop in passenger perception for busier times while the same airport meets the minimum design parameters may indicate problems with the airport's ability to maintain quality of operation at these times and alert the regulator of the need to seek more information. On the other hand, if this result is recurrent at several airports, it may indicate the need to adjust the minimum parameters.

Another possibility is to restrict the interviews to the busiest times at the airport, using the estimated parameters to calibrate the new required quality standards, thus preventing operators from being harmed by an increase in the required quality level, but focusing the requirements at the times of greater demand in the operation.

The impact on specific quality indicators may also direct inspection to specific aspects of airport operations. It is worth noting that the use of the methodology used in this work brings benefits in relation to the average quality indicators, since it allows to simulate the situation in the busiest periods, and is less affected by sample variation between airports / terminals, which can lead to certain cases when the average passenger is interviewed during periods of low movement.

The methodology can also assist in the evaluation of eventual Supported Proposals, agreements between airports and airlines that may change contractual requirements, subject to ANAC approval. The proposed methodology makes it possible to assess the impact on the passenger's perception of possible changes in the design parameters, for example.

The methodology used in this work is still in its initial phase and will be inevitably improved when applied at other airports, but the gains from combining airport movement data and passenger satisfaction data seem obvious.

In addition to refining the current methodology, a next, more complex step would be to try to insert information from the airport's physical infrastructure into the model, seeking to understand which aspects of the infrastructure have the greatest impact on passenger satisfaction.

From a personal perspective, working at this essay, apart from making me re-learn statistics and Stata, has helped me improve at thinking in ways to use data to search for a better understanding of regulatory problems. I will present the results to ANAC's team that monitor the airport service quality and my team will provide the support necessary to integrate the databases, facilitating future explorations.

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### Web references •

1. Brazilian airport concession contracts:  
<https://www.anac.gov.br/assuntos/paginas-tematicas/concessoes>
2. Airport movement database, submit request to [geic@anac.gov.br](mailto:geic@anac.gov.br)
3. Passenger satisfaction survey database, <https://www.anac.gov.br/assuntos/paginas-tematicas/concessoes/aeroportos-concedidos/guarulhos/arquivos/04indicadores-de-qualidade-de-servico/dados-dos-indicadores-de-qualidade-de-servico-iqs>

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## Annex Main Regression Results:

Statement: I am generally satisfied with this airport

|                                   |               |   |        |
|-----------------------------------|---------------|---|--------|
| Ordered logistic regression       | Number of obs | = | 11002  |
|                                   | Wald chi2(44) | = | 587.94 |
|                                   | Prob > chi2   | = | 0.0000 |
| Log pseudolikelihood = -18893.072 | Pseudo R2     | = | 0.0172 |

| item_34      | Coef.     | Robust<br>Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|--------------|-----------|---------------------|-------|-------|----------------------|-----------|
| female       | .2768418  | .0347042            | 7.98  | 0.000 | .2088228             | .3448608  |
| conexao      | .1302613  | .043591             | 2.99  | 0.003 | .0448246             | .215698   |
| TPAX         |           |                     |       |       |                      |           |
| 2D           | .1380388  | .1750161            | 0.79  | 0.430 | -.2049864            | .4810641  |
| 2I           | .1682875  | .172471             | 0.98  | 0.329 | -.1697495            | .5063245  |
| 3I           | .4831732  | .1588368            | 3.04  | 0.002 | .1718588             | .7944877  |
| idade        |           |                     |       |       |                      |           |
| 2            | -.1414154 | .0988411            | -1.43 | 0.153 | -.3351403            | .0523095  |
| 3            | -.2593926 | .0935699            | -2.77 | 0.006 | -.4427862            | -.075999  |
| 4            | -.5526291 | .09533              | -5.80 | 0.000 | -.7394725            | -.3657856 |
| 5            | -.5561258 | .0994277            | -5.59 | 0.000 | -.7510005            | -.3612511 |
| 6            | -.5328256 | .1037574            | -5.14 | 0.000 | -.7361864            | -.3294648 |
| 7            | -.5049178 | .1176972            | -4.29 | 0.000 | -.7356001            | -.2742355 |
| 8            | -.5681053 | .2894512            | -1.96 | 0.050 | -1.135419            | -.0007913 |
| escolaridade |           |                     |       |       |                      |           |
| 2            | -.3266833 | .5071161            | -0.64 | 0.519 | -1.320613            | .667246   |
| 3            | -.7260201 | .5003103            | -1.45 | 0.147 | -1.70661             | .2545701  |
| 4            | -1.055934 | .4865372            | -2.17 | 0.030 | -2.009529            | -.1023382 |
| 5            | -1.531967 | .486721             | -3.15 | 0.002 | -2.485923            | -.5780114 |
| 6            | -1.769242 | .484592             | -3.65 | 0.000 | -2.719025            | -.8194588 |
| hora         |           |                     |       |       |                      |           |
| 1            | .2007322  | .2229974            | 0.90  | 0.368 | -.2363346            | .637799   |
| 2            | -.4245391 | .3626632            | -1.17 | 0.242 | -1.135346            | .2862678  |
| 3            | .1656966  | .2157054            | 0.77  | 0.442 | -.2570781            | .5884714  |
| 4            | .1138062  | .2018887            | 0.56  | 0.573 | -.2818884            | .5095009  |
| 5            | .5112611  | .1725432            | 2.96  | 0.003 | .1730827             | .8494394  |
| 6            | .3263654  | .1520532            | 2.15  | 0.032 | .0283465             | .6243843  |
| 7            | .2380085  | .1481712            | 1.61  | 0.108 | -.0524018            | .5284188  |
| 8            | .2822968  | .1523014            | 1.85  | 0.064 | -.0162084            | .5808021  |
| 9            | .3511173  | .1491657            | 2.35  | 0.019 | .0587579             | .6434767  |
| 10           | .1774507  | .1603875            | 1.11  | 0.269 | -.1369029            | .4918044  |
| 11           | .074786   | .1619129            | 0.46  | 0.644 | -.2425574            | .3921295  |
| 12           | .2835827  | .1627671            | 1.74  | 0.081 | -.035435             | .6026003  |
| 13           | .425246   | .1487923            | 2.86  | 0.004 | .1336183             | .7168736  |
| 14           | .1808638  | .1535975            | 1.18  | 0.239 | -.1201817            | .4819093  |
| 15           | .2916503  | .1508183            | 1.93  | 0.053 | -.0039481            | .5872487  |
| 16           | .2770841  | .1508798            | 1.84  | 0.066 | -.0186349            | .572803   |
| 17           | .174034   | .1523734            | 1.14  | 0.253 | -.1246123            | .4726803  |
| 18           | .33826    | .1515972            | 2.23  | 0.026 | .0411351             | .635385   |
| 19           | .1938524  | .1444885            | 1.34  | 0.180 | -.0893399            | .4770447  |
| 20           | .1876198  | .1475831            | 1.27  | 0.204 | -.1016377            | .4768773  |
| 21           | .3179218  | .1468547            | 2.16  | 0.030 | .0300918             | .6057518  |
| 22           | .1338141  | .1458861            | 0.92  | 0.359 | -.1521174            | .4197457  |
| 23           | .3034029  | .1754622            | 1.73  | 0.084 | -.0404967            | .6473026  |
| mpaxt1       | -.4409877 | .1793935            | -2.46 | 0.014 | -.7925926            | -.0893829 |
| mpaxt2d      | -.05368   | .0268479            | -2.00 | 0.046 | -.1063009            | -.0010592 |
| mpaxt2i      | -.2147759 | .1352849            | -1.59 | 0.112 | -.4799295            | .0503777  |
| mpaxt3       | -.1034601 | .0464042            | -2.23 | 0.026 | -.1944107            | -.0125096 |
| /cut1        |           |                     |       |       |                      |           |
| /cut1        | -6.569762 | .5397137            |       |       | -7.627581            | -5.511943 |
| /cut2        | -6.164116 | .5359154            |       |       | -7.214491            | -5.113741 |
| /cut3        | -5.632107 | .5330669            |       |       | -6.676899            | -4.587315 |
| /cut4        | -5.068235 | .5308671            |       |       | -6.108715            | -4.027754 |
| /cut5        | -3.922343 | .529541             |       |       | -4.960224            | -2.884462 |
| /cut6        | -3.396099 | .5290829            |       |       | -4.433083            | -2.359116 |
| /cut7        | -2.461571 | .528688             |       |       | -3.49778             | -1.425361 |
| /cut8        | -1.132887 | .528216             |       |       | -2.168171            | -.0976025 |
| /cut9        | -.4548032 | .5280567            |       |       | -1.489775            | .5801689  |

## Statement: The airport met my expectations

Ordered logistic regression      Number of obs = 11000  
 Wald chi2(44) = 622.25  
 Prob > chi2 = 0.0000  
 Log pseudolikelihood = -18925.523      Pseudo R2 = 0.0180

| item_35      | Coef.     | Robust Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|--------------|-----------|------------------|-------|-------|----------------------|-----------|
| female       | .2533485  | .0347044         | 7.30  | 0.000 | .1853291             | .3213679  |
| conexao      | .0907841  | .0437014         | 2.08  | 0.038 | .0051309             | .1764374  |
| TPAX         |           |                  |       |       |                      |           |
| 2D           | .2737     | .1769583         | 1.55  | 0.122 | -.0731319            | .6205319  |
| 2I           | .1776761  | .1745892         | 1.02  | 0.309 | -.1645125            | .5198646  |
| 3I           | .6214873  | .1626406         | 3.82  | 0.000 | .3027176             | .940257   |
| idade        |           |                  |       |       |                      |           |
| 2            | -.2438151 | .1028529         | -2.37 | 0.018 | -.4454031            | -.0422272 |
| 3            | -.4032732 | .0974612         | -4.14 | 0.000 | -.5942936            | -.2122527 |
| 4            | -.6902593 | .0990314         | -6.97 | 0.000 | -.8843573            | -.4961613 |
| 5            | -.6805434 | .1023405         | -6.65 | 0.000 | -.8811271            | -.4799597 |
| 6            | -.68361   | .1062033         | -6.44 | 0.000 | -.8917646            | -.4754555 |
| 7            | -.619723  | .1205478         | -5.14 | 0.000 | -.8559923            | -.3834537 |
| 8            | -.5557822 | .320212          | -1.74 | 0.083 | -1.183386            | .0718217  |
| escolaridade |           |                  |       |       |                      |           |
| 2            | -.1246227 | .5993516         | -0.21 | 0.835 | -1.29933             | 1.050085  |
| 3            | -.7525172 | .5889591         | -1.28 | 0.201 | -1.906856            | .4018214  |
| 4            | -.9634326 | .577914          | -1.67 | 0.095 | -2.096123            | .169258   |
| 5            | -1.476648 | .5783805         | -2.55 | 0.011 | -2.610253            | -.3430429 |
| 6            | -1.686098 | .5763438         | -2.93 | 0.003 | -2.815711            | -.5564852 |
| hora         |           |                  |       |       |                      |           |
| 1            | .1391759  | .2224898         | 0.63  | 0.532 | -.2968961            | .5752479  |
| 2            | -.1775668 | .3181621         | -0.56 | 0.577 | -.8011531            | .4460194  |
| 3            | .2250043  | .2277313         | 0.99  | 0.323 | -.2213408            | .6713494  |
| 4            | .1611658  | .215844          | 0.75  | 0.455 | -.2618807            | .5842123  |
| 5            | .4551835  | .1794383         | 2.54  | 0.011 | .1034908             | .8068761  |
| 6            | .2313345  | .16132           | 1.43  | 0.152 | -.0848468            | .5475158  |
| 7            | .2646401  | .1578568         | 1.68  | 0.094 | -.0447536            | .5740338  |
| 8            | .2923948  | .1611364         | 1.81  | 0.070 | -.0234267            | .6082163  |
| 9            | .3535469  | .1593294         | 2.22  | 0.026 | .0412669             | .6658268  |
| 10           | .1565848  | .1683358         | 0.93  | 0.352 | -.1733473            | .4865168  |
| 11           | .1053796  | .1731266         | 0.61  | 0.543 | -.2339424            | .4447015  |
| 12           | .2107288  | .1718864         | 1.23  | 0.220 | -.1261624            | .54762    |
| 13           | .4005389  | .1586346         | 2.52  | 0.012 | .0896208             | .711457   |
| 14           | .1532309  | .1637789         | 0.94  | 0.349 | -.1677698            | .4742317  |
| 15           | .2268474  | .1620743         | 1.40  | 0.162 | -.0908123            | .5445072  |
| 16           | .3082245  | .1608851         | 1.92  | 0.055 | -.0071046            | .6235536  |
| 17           | .1002851  | .1618445         | 0.62  | 0.535 | -.2169243            | .4174946  |
| 18           | .3654279  | .1627711         | 2.25  | 0.025 | .0464025             | .6844534  |
| 19           | .2651388  | .1550421         | 1.71  | 0.087 | -.0387382            | .5690158  |
| 20           | .1841064  | .156786          | 1.17  | 0.240 | -.1231886            | .4914014  |
| 21           | .2560762  | .1560012         | 1.64  | 0.101 | -.0496806            | .5618329  |
| 22           | .1080035  | .156372          | 0.69  | 0.490 | -.1984799            | .4144869  |
| 23           | .2555332  | .1869846         | 1.37  | 0.172 | -.1109499            | .6220162  |
| mpaxt1       | -.3977807 | .1824465         | -2.18 | 0.029 | -.7553693            | -.040192  |
| mpaxt2d      | -.0752486 | .0268535         | -2.80 | 0.005 | -.1278805            | -.0226168 |
| mpaxt2i      | -.1983722 | .1330777         | -1.49 | 0.136 | -.4591997            | .0624554  |
| mpaxt3       | -.1343525 | .0476502         | -2.82 | 0.005 | -.2277453            | -.0409598 |
| /cut1        | -6.674223 | .6268356         |       |       | -7.902799            | -5.445648 |
| /cut2        | -6.171736 | .6229969         |       |       | -7.392787            | -4.950684 |
| /cut3        | -5.54935  | .620237          |       |       | -6.764992            | -4.333707 |
| /cut4        | -4.940896 | .6191515         |       |       | -6.154411            | -3.727382 |
| /cut5        | -3.947852 | .6181445         |       |       | -5.159393            | -2.736311 |
| /cut6        | -3.441226 | .6175643         |       |       | -4.65163             | -2.230822 |
| /cut7        | -2.557382 | .6171735         |       |       | -3.767019            | -1.347744 |
| /cut8        | -1.306458 | .6166368         |       |       | -2.515044            | -.097872  |
| /cut9        | -.6064917 | .6164139         |       |       | -1.814641            | .6016574  |

## Statement: The services provided at the airport are close to that of an ideal airport

Ordered logistic regression                      Number of obs =            10977  
    Wald chi2(44) =            818.95  
    Prob > chi2 =             0.0000  
 Log pseudolikelihood = -20667.112            Pseudo R2 =             0.0215

| item_36      | Coef.     | Robust Std. Err. | z     | P> z  | [95% Conf. Interval] |           |
|--------------|-----------|------------------|-------|-------|----------------------|-----------|
| female       | .2421494  | .0343568         | 7.05  | 0.000 | .1748113             | .3094874  |
| conexao      | .1326897  | .0432834         | 3.07  | 0.002 | .0478559             | .2175236  |
| TPAX         |           |                  |       |       |                      |           |
| 2D           | .2978514  | .175057          | 1.70  | 0.089 | -.0452539            | .6409568  |
| 2I           | .1357958  | .1745984         | 0.78  | 0.437 | -.2064107            | .4780023  |
| 3I           | .5998507  | .1617072         | 3.71  | 0.000 | .2829104             | .9167911  |
| idade        |           |                  |       |       |                      |           |
| 2            | -.1872046 | .1013335         | -1.85 | 0.065 | -.3858146            | .0114055  |
| 3            | -.3713784 | .0951282         | -3.90 | 0.000 | -.5578263            | -.1849304 |
| 4            | -.7133275 | .0965119         | -7.39 | 0.000 | -.9024874            | -.5241676 |
| 5            | -.6795547 | .0996348         | -6.82 | 0.000 | -.8748355            | -.484274  |
| 6            | -.6558546 | .1035799         | -6.33 | 0.000 | -.8588675            | -.4528418 |
| 7            | -.5613222 | .1176796         | -4.77 | 0.000 | -.79197              | -.3306744 |
| 8            | -.6569697 | .3407586         | -1.93 | 0.054 | -1.324844            | .0109049  |
| escolaridade |           |                  |       |       |                      |           |
| 2            | -.2754342 | .6536566         | -0.42 | 0.673 | -1.556578            | 1.005709  |
| 3            | -.6868859 | .6462915         | -1.06 | 0.288 | -1.953594            | .5798222  |
| 4            | -1.041392 | .6372535         | -1.63 | 0.102 | -2.290386            | .207602   |
| 5            | -1.6049   | .637566          | -2.52 | 0.012 | -2.854507            | -.3552938 |
| 6            | -1.930435 | .6358783         | -3.04 | 0.002 | -3.176733            | -.684136  |
| hora         |           |                  |       |       |                      |           |
| 1            | -.0606967 | .220522          | -0.28 | 0.783 | -.4929119            | .3715185  |
| 2            | -.3027155 | .3942516         | -0.77 | 0.443 | -1.075434            | .4700034  |
| 3            | .3097731  | .2275025         | 1.36  | 0.173 | -.1361237            | .7556699  |
| 4            | .092138   | .2100869         | 0.44  | 0.661 | -.3196247            | .5039008  |
| 5            | .5122008  | .1800629         | 2.84  | 0.004 | .1592841             | .8651176  |
| 6            | .2626386  | .1623334         | 1.62  | 0.106 | -.0555291            | .5808063  |
| 7            | .2566733  | .1585416         | 1.62  | 0.105 | -.0540624            | .567409   |
| 8            | .2549761  | .1630256         | 1.56  | 0.118 | -.0645483            | .5745005  |
| 9            | .3009385  | .1600781         | 1.88  | 0.060 | -.0128087            | .6146858  |
| 10           | .1024521  | .1722552         | 0.59  | 0.552 | -.2351618            | .4400661  |
| 11           | .0370114  | .1709568         | 0.22  | 0.829 | -.2980578            | .3720807  |
| 12           | .3116519  | .1748885         | 1.78  | 0.075 | -.0311164            | .6544202  |
| 13           | .3860461  | .1600423         | 2.41  | 0.016 | .072369              | .6997233  |
| 14           | .1159511  | .1663585         | 0.70  | 0.486 | -.2101056            | .4420077  |
| 15           | .2126474  | .163747          | 1.30  | 0.194 | -.1082909            | .5335857  |
| 16           | .3216084  | .1612681         | 1.99  | 0.046 | .0055287             | .6376881  |
| 17           | .0258668  | .1628144         | 0.16  | 0.874 | -.2932435            | .344977   |
| 18           | .3539751  | .1618948         | 2.19  | 0.029 | .0366671             | .6712831  |
| 19           | .268186   | .1547992         | 1.73  | 0.083 | -.0352149            | .5715868  |
| 20           | .1837124  | .1572947         | 1.17  | 0.243 | -.1245796            | .4920044  |
| 21           | .2191596  | .1561791         | 1.40  | 0.161 | -.0869459            | .5252651  |
| 22           | .0710201  | .1567245         | 0.45  | 0.650 | -.2361542            | .3781944  |
| 23           | .2970925  | .1801753         | 1.65  | 0.099 | -.0560446            | .6502296  |
| mpaxt1       | -.4406521 | .1729019         | -2.55 | 0.011 | -.7795337            | -.1017706 |
| mpaxt2d      | -.0720395 | .0266591         | -2.70 | 0.007 | -.1242903            | -.0197887 |
| mpaxt2i      | -.1309488 | .1398573         | -0.94 | 0.349 | -.405064             | .1431663  |
| mpaxt3       | -.1112446 | .0479029         | -2.32 | 0.020 | -.2051325            | -.0173567 |
| /cut1        | -6.204572 | .6771784         |       |       | -7.531817            | -4.877327 |
| /cut2        | -5.619246 | .6748487         |       |       | -6.941925            | -4.296567 |
| /cut3        | -4.935164 | .6733898         |       |       | -6.254983            | -3.615344 |
| /cut4        | -4.457678 | .6725978         |       |       | -5.775946            | -3.139411 |
| /cut5        | -3.594699 | .6722392         |       |       | -4.912263            | -2.277134 |
| /cut6        | -3.088814 | .6721166         |       |       | -4.406139            | -1.77149  |
| /cut7        | -2.252947 | .6718896         |       |       | -3.569827            | -.9360676 |
| /cut8        | -1.194793 | .6715766         |       |       | -2.511059            | .1214727  |
| /cut9        | -.4026988 | .6712614         |       |       | -1.718347            | .9129493  |