

Risk Profiles and the Likelihood of Car Accidents in Bolivia

By: Carolina Alzerreca

A Thesis Submitted to
Saint Mary's University, Halifax, Nova Scotia
In Partial Fulfillment of the Requirements for
The Degree of Bachelor of Arts

June 2017, Halifax, Nova Scotia

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Approved:

Dr. Yigit Aydede
Supervisor

Approved:

Dr. Mark Raymond
Chairperson

Date:

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Abstract

The following honours thesis analyzes a database of reported car accidents with a total of 381,409 observations. The database compiled by the insurance company “La Boliviana Ciacruz S.A” has a timeline of 10 years from 2006 to 2016. The main purpose of the thesis is to find risk profiles that characterize certain clients’ vehicles and expose how much riskier these clients’ vehicles are compared to others. Comparative tables have been developed in order to make the analysis easier to read. Furthermore, the final results of the thesis raise the question of whether the risk profiles created in this thesis act accordingly with their respective premiums.

June 2016

I. Introduction

This Honours Thesis analyzes the insurance company “La Boliviana Ciacruz de Seguros y Reaseguros S.A.” The two main purposes of the Thesis are first, to find risk profiles that characterize certain clients’ vehicles and expose how much riskier these clients’ vehicles are compared to other clients’. To create these risk profiles, different scenarios have been created. These scenarios are combinations of different exposures, increasing or decreasing the probability of a car accident compared to a given baseline. These exposures are characteristics of the vehicle, such as the years of the vehicle, the brand, the type, the city of circulation, the insured value and the colour.

The second purpose is to create statistics and descriptive data to have a better understanding of how the characteristics of the vehicles behave when interacting with each other and with respect to an accident.

The Thesis is distributed as follow: *Section II.* covers the context in which the company operates and gives background to familiarize the reader with the company and Bolivia. *Section III.* describes the database and the independent variables (exposure variables) that will be used in the model. *Section IV.* covers the descriptive section of the Thesis, analyzing and taking percentages of the most relevant variables with respect to the accidents. In *Section V.* the LOGIT model is conducted as well as a description of the expected results. In *Section VI.* observed results are interpreted. *Section VII.* presents a comparison between observed results and prior expectations. In *Section VIII.* the conclusions of the thesis are presented. And finally, in Section IX. the bibliography is presented. As an Appendix in Section X. the results of STATA are shown.

I. Context

“La Boliviana Ciacruz de Seguros y Reaseguros S.A.” is one of the biggest insurance companies in Bolivia. The company was created in 1946 with a central office in La Paz, Bolivia.¹ “La Boliviana Ciacruz de Seguros y Reaseguros S.A.” is a former subsidiary of Zurich Insurance Group AG².

To have a better understanding of the context in which “La Boliviana Ciacruz de Seguros y Reaseguros S.A.” operates, it is useful to have a background of Bolivia.

Bolivia is a developing country in South America, with a population of eleven million. It has one of the most chaotic traffics in the world³, increasing substantially the likelihood of a car accident. A chaotic traffic increases not only the likelihood of an accident but also the probability of the insured being sued by a third party when involved in an accident. Even the most basic traffic rules in Bolivia, such as the pedestrian crossing, red lights, speed limits and many others are violated in a daily basis.

Moreover, Bolivia has a crime index of 56.50 and a safety index of 40.50⁴. A crime index of 56.50 where 100 would represent no crime at all, increases the likelihood of having the whole car or part of the car stolen.

Therefore, it is safe to assume that operating an insurance company in Bolivia can be quite challenging as well as interesting.

¹ “La Boliviana Ciacruz” webpage: <http://www.lbc.bo/default.aspx>

² “La Boliviana Ciacruz” webpage: <http://www.lbc.bo/default.aspx>

³ National Institution of Statistics (INE (Instituto Nacional de Estadística) webpage: <http://www.ine.gob.bo/>

⁴ World Bank Data Base: <http://data.worldbank.org/indicator/IC.FRM.BRIB.ZS?locations=BO&view=chart>

II. Data and Variables

The dataset has a total of 381,409 observations. The variables that will be used in Sections VI. and V are described below. It is important to mention that the vast majority of these variables are dummy variables, given that many of them are categorical variables.

1. Total Premium:

The amount of money the insured must pay to the company for an insurance policy each year. The total premium is considered the income for the company, and also represents a liability in that the company must provide coverage for claims being made against the policy⁵.

2. Total Insured value:

The maximum amount of money that the insurance company will pay if and when the vehicle has suffered a total or partial loss, depending on the terms of the respective policy. The vehicles' insured value can either be its replacement cost or its market value⁶.

3. City:

The city where the car is running the vast majority of the time. The variable "City" has six categories: La Paz, Santa Cruz, Cochabamba, Tarija, Trinidad, and Others.

4. Years of the Vehicle:

This variable has three categories: 0km, between 1 and 20 years and more than 20 years.

5. Type of car:

This variable has three categories: Pick up trucks, Transport trucks, Automobile, SUV's and Others

⁵ Fundamentals Of Corporate Finance, Seventh Canadian Edition, Ross, Westerfield, Jordan, Roberts

⁶ Fundamentals Of Corporate Finance, Seventh Canadian Edition, Ross, Westerfield, Jordan, Roberts

6. Brand of the car:

This variable has six categories: Luxurious, Mitsubishi, Nissan, Suzuki, Toyota, and Others.

7. Colour of the Car:

This variable has twelve different categories: Yellow, Orange, Blue, Calypso, Cranberry, Red, Green, White, Black, Silver, Beige, and Others.

8. Origin:

The variable “Origin” refers to where does the car come from originally. It has two main categories: “Original” and “Transformer”. The context of these categories will be fully explained in Section IV.

9. Probability of Car Accident:

With 1 if the accident has occurred and 0 otherwise.

III. Descriptive Data

Before starting with the description of the database is important to state that from this point forward independent variables will now be referred as “*exposures*”.

Data descriptive figures and charts have been created against the probability of an accident so that there is a more intuitive perspective on how these exposures behave with respect to the occurrence of an accident, as well as to have parameters of comparison. Analyze statistics of the relevant exposures will help create expectations prior to the model conduction.

For the probability of an accident, it is interesting to look at each of the variables that may increase or decrease the probability of an accident and analyze their statistics. From the total number of insured vehicles, eleven percent of them have had an accident. Therefore, the majority of this section will be focused on this eleven percent.

Variables of interest:

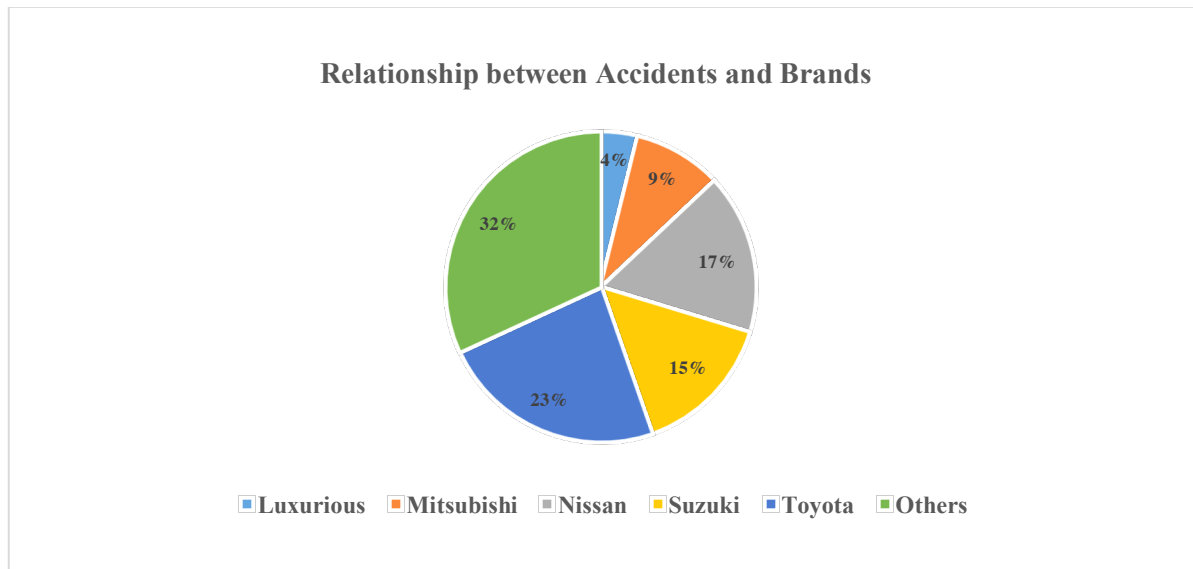
a) **Brand:**

The brand of the car can be a factor that increases or decreases the likelihood of a car accident. For example, expectations will be that a person who buys a Luxurious car such as a Porsche is more likely to have an accident than someone who buys a Suzuki. An intuitive explanation for this lies in the fact that a Porsche can go much faster than a Suzuki because of the engine and other unique characteristics of the car, increasing the likelihood of an accident. For this analysis, the variable brand has been separated into six categories: Luxurious, Toyota, Nissan, Suzuki, Mitsubishi, and Others. These brands together have sixty-eight percent of the total accidents and all the “*Other*” brands have thirty-two percent of the total accidents.

Despite expectations of Luxurious cars having a greater probability of an accident, the data shows that the brands with most of the accidents are: Toyota (23%), Nissan (17%) and Suzuki (15%). Luxurious accounting only with the 4% of the total of accidents.

(See Figure 1.)

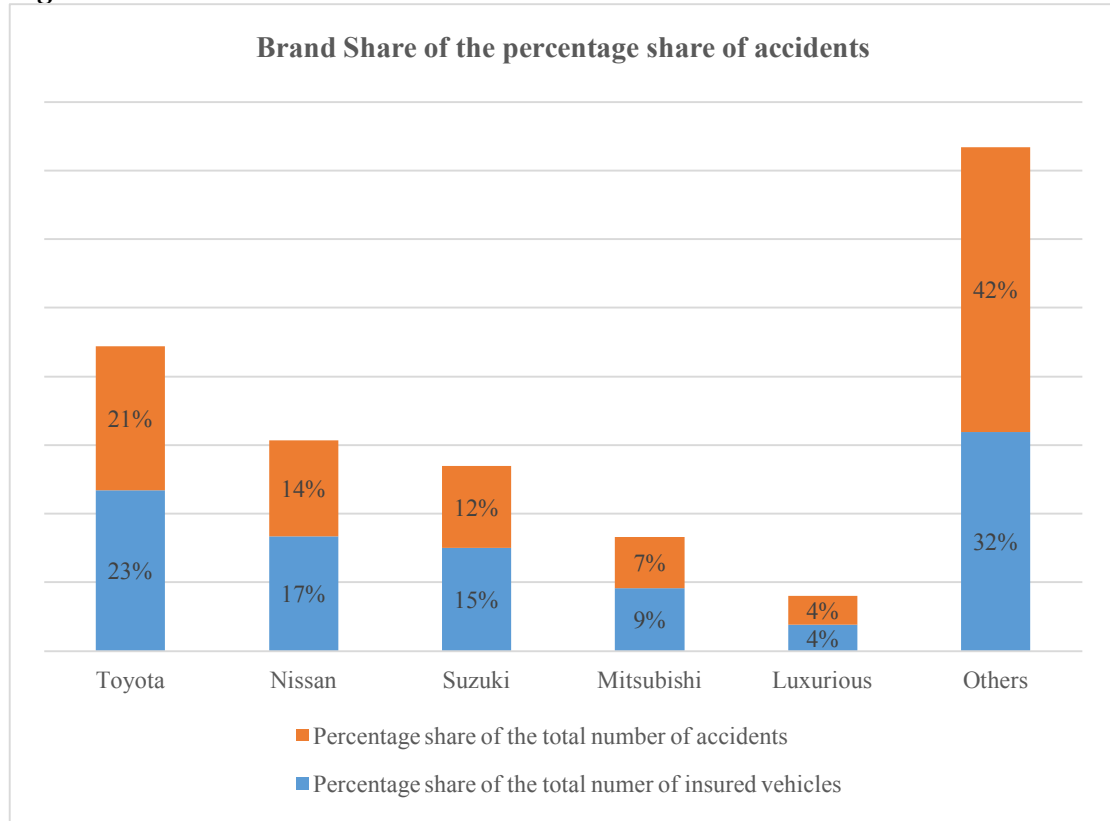
Figure 1. Relationship between Accidents and Brands



Moreover, *Figure 2.* shows the respective percentage of each of the brand categories with their correspondent percentage share of the total number of accidents. It is clear from *Figure 2.* that Toyota has the highest percentage of the total number of insured vehicles with a 21 percent. Out of this 21 percent, 23 percent of them have had an accident. On the other hand, out of the 4 percent of the total Luxurious vehicles, only the 4 percent of them have had an accident. These are nevertheless, relative terms. Even tough, Toyota has the highest percentage share of accidents (23%), out the total of the insured vehicles the

majority (21%) are Toyota vehicles. Therefore, one cannot assume that Toyota is a more vulnerable to accidents based solely on the percentages of its accidents.⁷

Figure 2.



b) Type of the vehicle:

The vehicle type is a variable that is important to take into consideration when looking at the probability of an accident. The database is filtered in five main vehicle types: Automobiles, SUV's, Pick Up Trucks, Transportation Trucks, and Others. The database has been filtered in five categories since these four types represent the majority of the

⁷ To be able to conclude a variable such as the brand of a car is more likely to have an accident, a model has to be ran. We leave that for Section V.

vehicles insured by the company with 75 percent and the category “Others” representing only 15 percent of the insured vehicles.

SUV’s vehicles account for the majority of the vehicles insured by the company with a 35 percent followed by Pick-Up Trucks with 20 percent, Transportation Trucks with 18 percent, Automobiles with 12 percent and Others with 15 percent. (See Figure 3.)

To have a more insightful representation of the relationship between the vehicle type and the accidents, a chart showing the percentage of the vehicle type and its respective accident percentage has been developed. (See Figure 4.)

Figure 3.

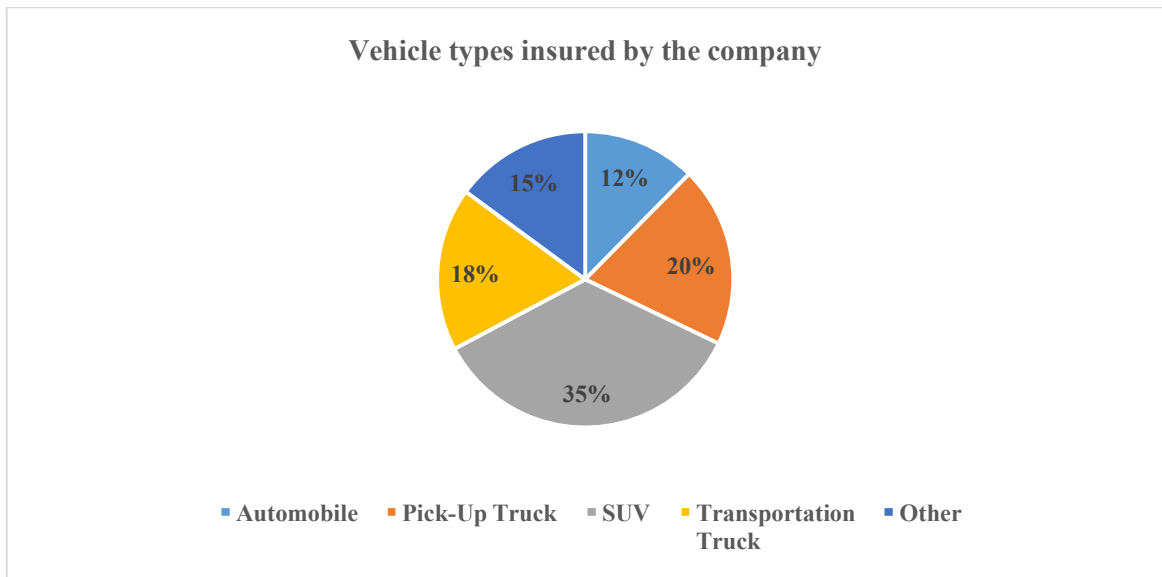
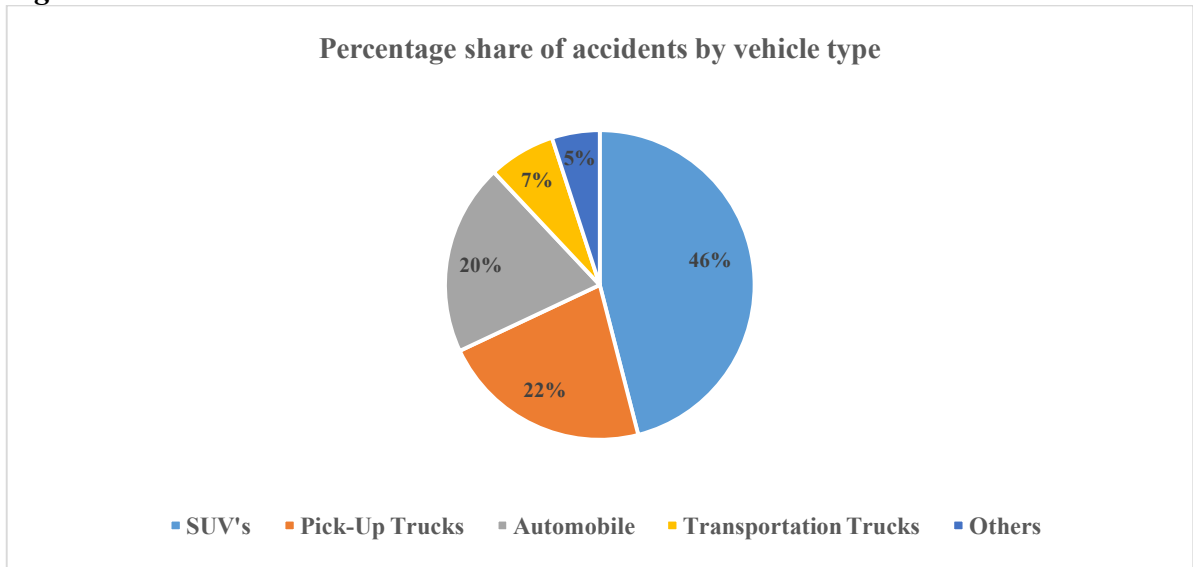


Figure 4.



Out of the 11 percent of accidents, 46 percent of them come from SUV's, followed by Pick-Up Trucks with 22 percent, Automobiles with 20 percent, Transportation Trucks with 7 percent and Others with 5 percent.

To analyze the relationship between accident, vehicle type, and brand, a percentage table has been created. (See Table 1.)

Table 1. shows the relationship between accidents, brands and the type of vehicle. For example, from Figure 1. we know that 23.4 percent of the total accidents come from Toyota vehicles and from Figure 4. we know that 46 percent of the total accidents come from SUV type of vehicles, from this 46 percent, 25 % are Toyota Vehicles.

For illustration purposes, the highest percentage of each brand category (columns) has been highlighted with yellow, in other words, the type of vehicle in which each brand has had most of its accidents. For example, Suzuki vehicles have had most of their accidents (26%) in the category "Others" of types of vehicles. The highest percentage of each Type category (rows) have been highlighted with green, in other words, the brand in which a

certain type of vehicle has had most of its accidents. For example, SUV's type of vehicles has had most of its accidents from Toyota vehicles (25%). Finally, it has been highlighted with blue when the vehicle type and the vehicle brand coincided with its respective highest percentage. For example, most of the accidents of Toyota vehicles have happened to Pick-Up Trucks vehicles (73%), and most accidents of Pick-Up Truck are coming from Toyota vehicles.

Table 1.

Accident	<i>Others</i> (31.9%)	<i>Toyota</i> (23.4%)	<i>Suzuki</i> (15%)	<i>Nissan</i> (16.7%)	<i>Luxurious</i> (3.8%)	<i>Mitsubishi</i> (9.2%)
<i>Transportation Trucks</i> (7%)	73%	5%	0%	13%	4%	5%
<i>Others</i> (5%)	47%	8%	26%	9%	4%	6%
<i>Pick-Up Truck</i> (22%)	25%	38%	1%	24%	0%	12%
<i>SUV's</i> (46%)	23%	25%	19%	17%	5%	11%
<i>Automobile</i> (20%)	40%	14%	23%	12%	7%	4%

Before analyzing the variables of Colour, Cities and the Years of the Car, one interesting observation has to be mention. As mentioned before the variable “brand” has four main categories: “Nissan”, “Mitsubishi”, “Suzuki”, “Toyota” and “Others”. The vehicle brand variable has been filtered this way because 68% of the accidents came from vehicles that are either Nissan, Mitsubishi, Suzuki or Toyota, and 32% are a mix of different brands. Nissan, Mitsubishi, Suzuki, and Toyota are all Japanese brands. Therefore, 68% of the accidents come from Japanese vehicles. This is of special interest because in Bolivia there are vehicles that are called “Transformers”. The

“Transformers” are Japanese vehicles that are imported directly from Japan and once they arrived at the “free zone”⁸ in Bolivia they are “transformed”.

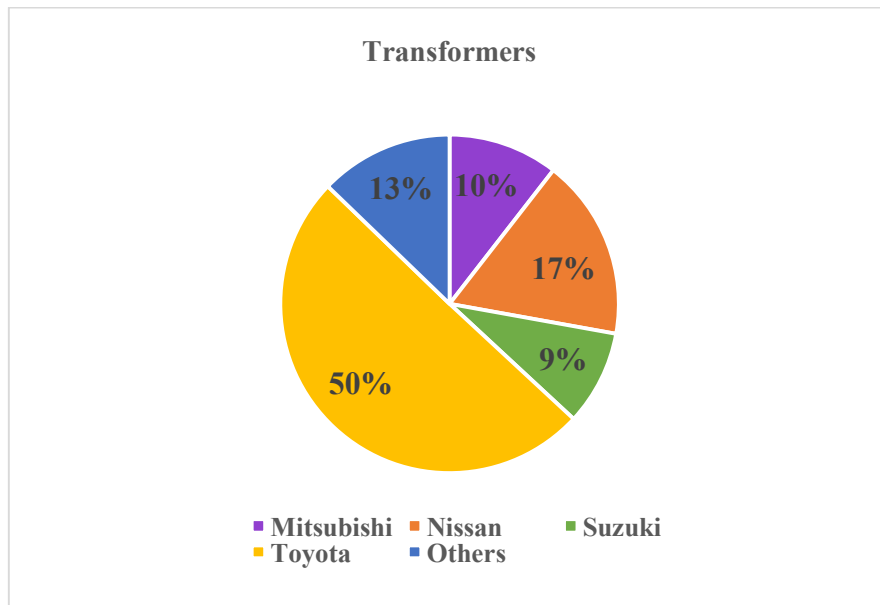
In Japan, cars are built to be driven on the right-side, in Bolivia cars have to be driven on the left-side, therefore when cars that have been built to be driven in Japan arrive in Bolivia, their entire system has to be changed. Once the vehicles’ system is changed they are sold at given away prices in Bolivia. This *transformation* takes place in the free zone between Chile and Bolivia, the problem is that sometimes the transformation is not properly done and can cause problems when driving the vehicle, this is the main reason why these cars are a bargain. There is a total of 7015 transformer vehicles that are insured by the company. Nevertheless, as an investigation by the Chilean Government in 2015⁹ revealed, every month more than 300 transformer vehicles cross the Bolivian frontier from the free zone. The majority of these vehicles cross the frontier around 4 am, these are illegal importations. Therefore, the vast majority of these cars are not insured. With this information, it will be interesting to see the percentage of accidents coming from insured *transformer* vehicles.

- c) **Origin:** This variable has two categories: “Transformer” and “Original”. To analyze the relationship between accidents and the origin of the vehicle, the main focus will be on the transformer vehicles and its statistics. From *Figure 5*: out of the 7015 insured transformer vehicles, 50% are Toyota vehicles, followed by Nissan with the 17%, “Others” with the 13%, Mitsubishi with 10% and Suzuki with 9%. (*See Figure 5.*)

⁸ Bolivian News Journal: “La Razon”: http://www.la-razon.com/economia/Norma-solo-podran-ingresar-autos-antiguedad_0_2391960819.html

⁹ Chilean News Journal: 24 Horas: <http://www.24horas.cl/nacional/estos-son-los-autos-de-zona-franca-que-aduanas-rematara-en-iquique-1773758>

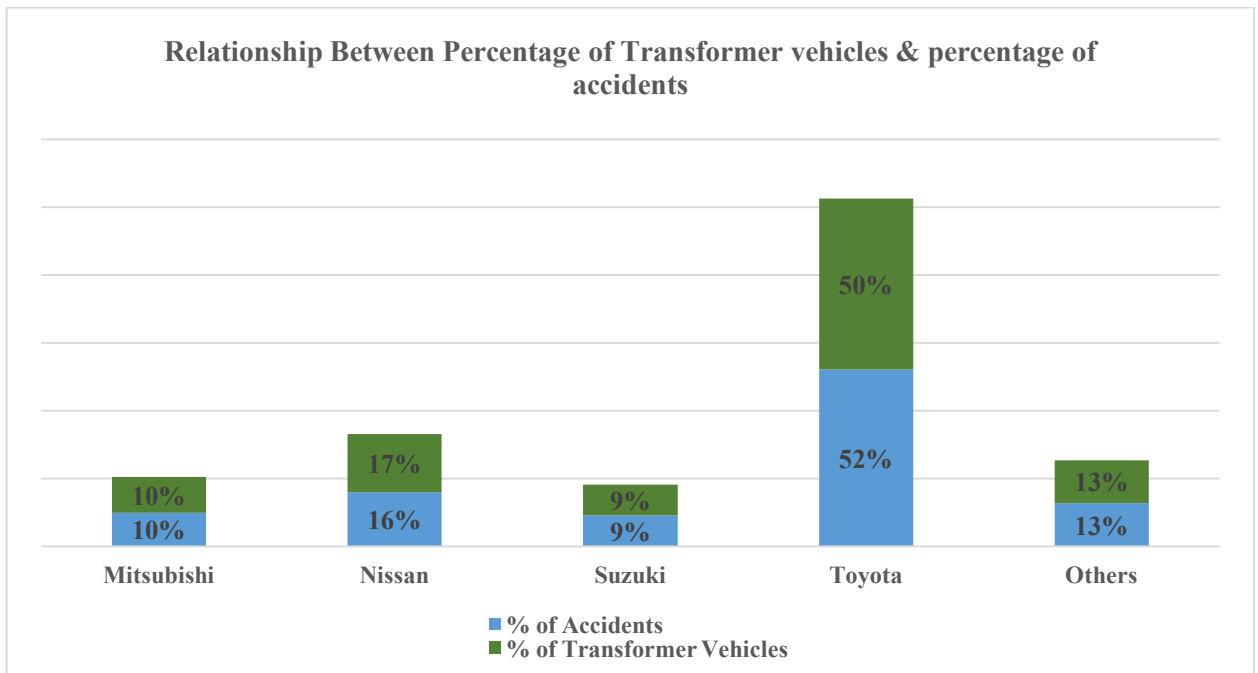
Figure 5



Focusing in the accident occurrence of transformer vehicles only, out of the 7015 transformer insured vehicles, 873 of them have had an accident (12% of the total). From these 873, 52% are Toyota transformer vehicles. It is important to acknowledge that even though Toyota Transformer vehicles are half of the total of the insured cars. For every 10 Toyota Transformer Vehicles, more than 5 have had an accident. (See Figure 6.)

This statistic can open discussion to a very controversial topic in Bolivia, transformer vehicles might not be the safest. But even more important, the majority of the transformer cars in Bolivia are used as means of public transportation, which can raise concerns about public safety.

Figure 6.



d) Colour:

The colour of the car has always been an important variable for insurance companies to help them determine the probability of an accident for an insured. Several studies have shown that red vehicles have a higher insurance rate than other colour vehicles. This is because individuals that have red cars have shown themselves to be risk takers.¹⁰ There is a total of 49,548 red colour vehicles that are insured by the company out of these 49,548, 7.2% have had an accident. To see whether colour plays an important role in the pricing of the company, a table has been created to see the relationship between the colour of the vehicle and its correspondent premium on average. (See Table 2.)

¹⁰ “Factors unrelated to Driving Can Affect Car Insurance Premiums” by Ann Carrns. New York Times Journal

Colours have been divided into 15 categories: Yellow, Orange, Blue, Calypso, Cranberry, Purple, Multicolour, Pink, Red, Green, White, Black, Silver, Beige, and Others.

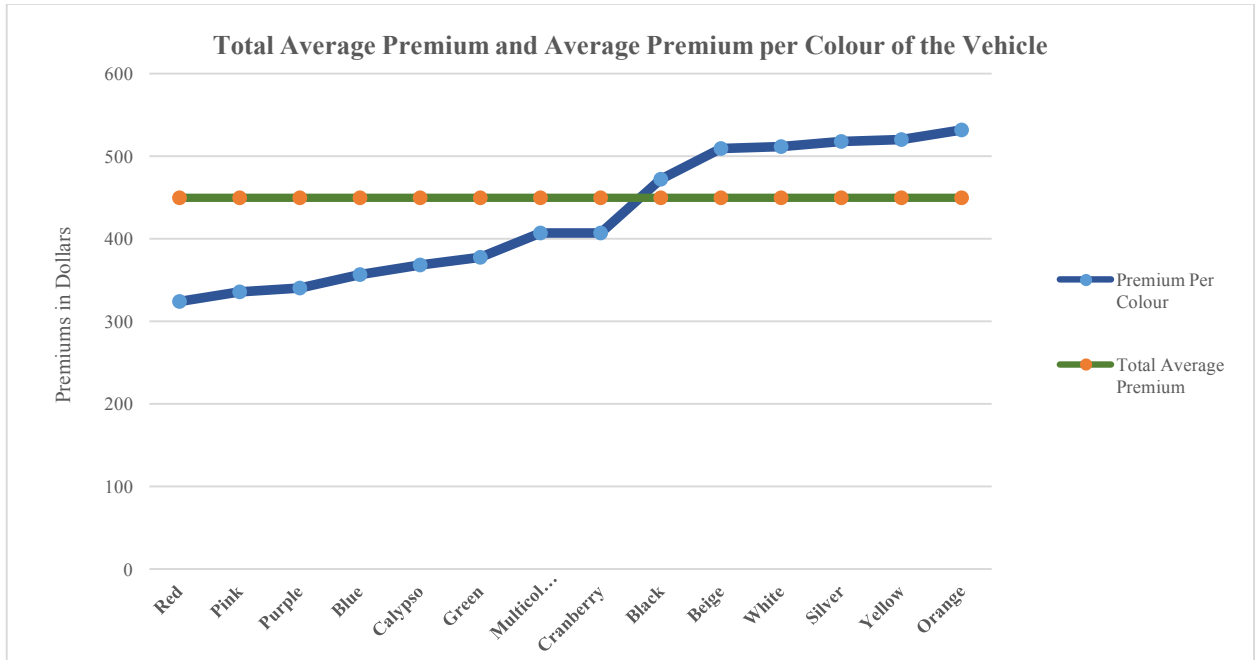
Against all expectations for this company, red vehicles have the lowest premiums on average. The highest premiums on average are for Orange vehicles (*See Table 3.*)

Table 2.

Colour	Average Premium
Red	324
Pink	336
Purple	341
Blue	357
Calypso	368
Green	377
Multicolour	407
Cranberry	407
Black	472
Beige	509
White	511
Silver	517
Yellow	520
Orange	532
Average	449

The Total Average Premium is 449 USD. Leaving Red, Pink, Purple, Blue, Calypso, Multicolour and Cranberry below the average premium and Black, Beige, White, Silver, Yellow and Orange above. (*See Figure 7.*)

Figure 7.



To further analyze the vehicle colour and its relationship with an accident, it is interesting to see the percentage of the vehicles of a particular colour that have had an accident.

The vehicles that have had the highest percentage share of the total number of accidents are white vehicles with 27% of the total number of accidents (*See Table 4.*) This result is to be expected given that white vehicles account for 33% of the total number of vehicles insured by the company.

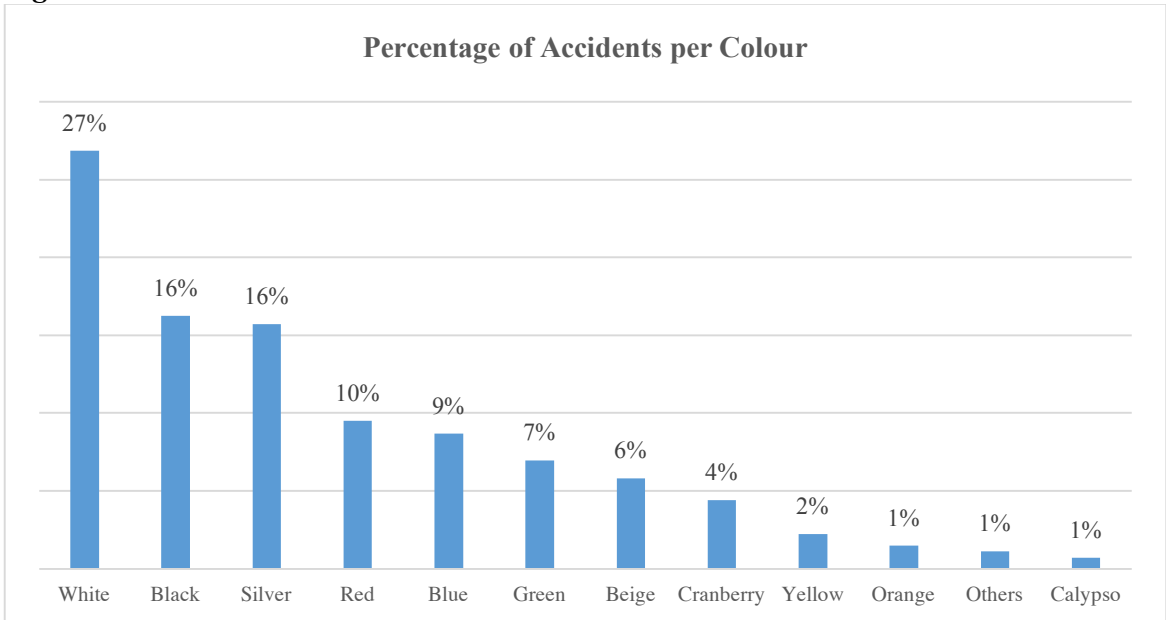
Moreover, one interesting statistic is that red vehicles are in fourth place with 10% of the total number of accidents. Black, silver, and red have approximately the same number of vehicles insured by the company, therefore assuming that white vehicles are supposed to have the highest percentage share of the accidents, red vehicles have the second highest percentage share of the total number of accidents, after black and silver vehicles with the 16% of the total accidents each.

Table 3.

Colour	% of the Total Accidents	% of the Total Insured vehicles
White	27%	34%
Black	16%	6%
Silver	16%	15%
Red	10%	14%
Blue	9%	10%
Green	7%	7%
Beige	6%	4%
Cranberry	4%	4%
Yellow	2%	3%
Orange	1%	1%
Others	1%	1%
Calypso	1%	1%

Note. It is important to notice that even though black cars have one of the highest shares of the total number of accidents, it has one of the lowest percentages of insured cars in the company. Only the six percent of insured vehicles by the company are black, and they account for the sixteen percent of the total number of accidents.

Figure 8.



Finally, comparing *Figure 7.* and *Figure 8.* Orange and Yellow vehicles have the highest premiums on average, nevertheless, they have the lowest percentage share of the total number of accidents with 1%. Red vehicles have the lowest premiums on average, nevertheless, they have had 10% of the total number of accidents. As explained before, the colour variable has not been taking into account when measuring risk and setting risk rates.

As the Risk Manager of “*La Boliviana Ciacruz S.A*” Santiago Bustillos explains: “*Currently in Bolivia, no insurance company has been able to fully develop a pricing model that takes into account: the colour of the car, the level of education of the client, profession, gender, etc. The reason behind this is the strong bargain power of the market*”

e) Cities:

When analyzing probabilities, the vehicle’s city is a risk factor when calculating the probability of an accident.

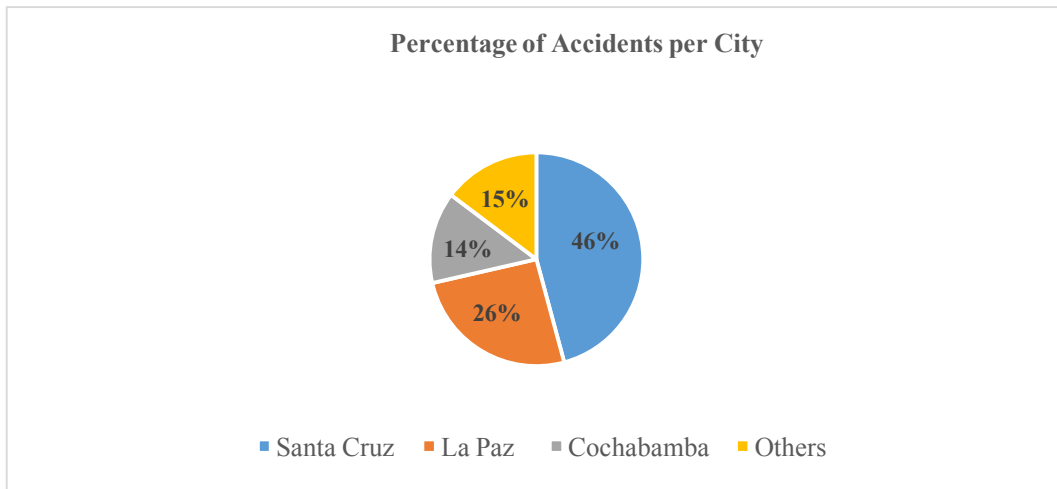
There is a total of nine cities in Bolivia, nevertheless, 85% of the insured vehicles are circulating in three of the main cities: La Paz, Santa Cruz and Cochabamba, the other seven cities have been put together as “*Other*”.

Santa Cruz has the highest percentage of accidents, which is to be expected since Santa Cruz has 40% of the total number of vehicles insured by the company. Out of this 40%, 46% of them have had an accident. La Paz has the second highest percentage share of accidents with 26%, followed by Cochabamba with 14% and the other cities with 15% of the total number of claimed accidents (*See Figure 9.*)

Understanding the context of Santa Cruz is crucial to understand why it has the highest percentage share of accidents. Santa Cruz has had in 2016 35% of the total number of

accidents in Bolivia¹¹, the constant violation of speed limits, lack of transit education, as well as drivers being under the influence of alcohol are the main reasons why Santa Cruz has the highest percentage of accidents in the country.¹²

Figure 9.



f) Years of the Car:

How old the vehicle is can contribute to the likelihood of an accident. On the one hand, 0km vehicles have better technology, making the vehicle faster and hence more likely to have an accident. On the other hand, old vehicles may have malfunctions and are more likely to, for example, have issues with the brakes, increasing the probability of having an accident.

For this statistic, the variable “*Years of the car*” has three categories: 0km, between 0 and 20 years and more than 20 years¹³.

As expected 82% of the insured cars are between 0 and 20 years, 9% are 0km and 8% are more than 20 years.

¹¹ News Journal: “Pagina 7”, <http://eju.tv/2016/01/santa-cruz-encabeza-lista-de-accidentes-de-transito/>

¹² Transit Bolivia Report. 2016

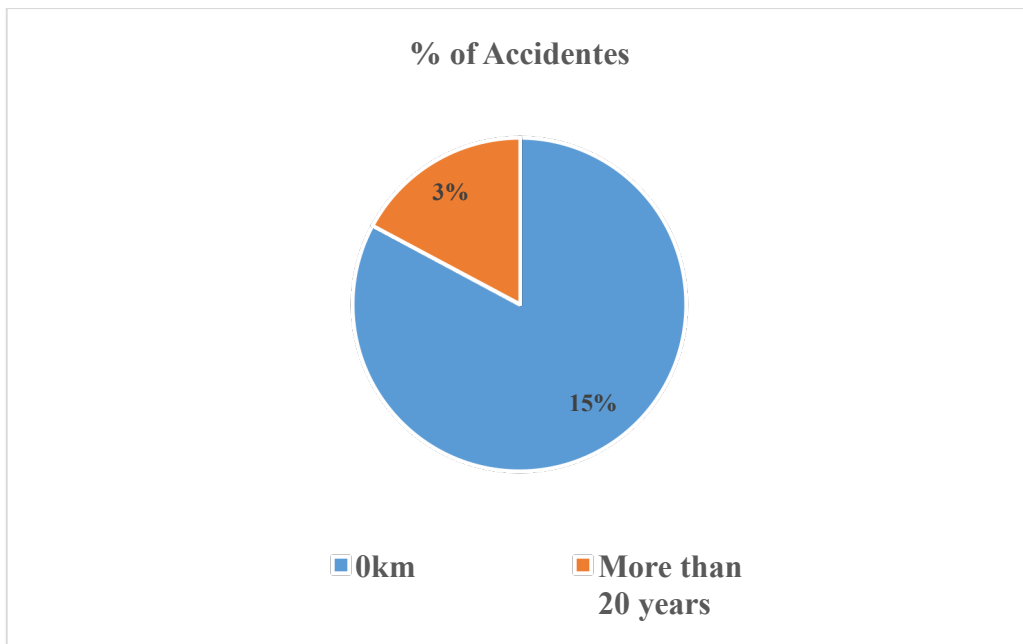
¹³ For this variable is important to acknowledge the key difference between 0km and between 0 and 20 years.

Given that 82% of the insured cars are between 0 and 20 years, naturally, the majority of the accidents will be in this category. It is interesting however to see whether the “0km” vehicles have a higher percentage of accidents than the “more than 20 years” vehicles.

0km vehicles have the highest percentage of accidents with 15% and “more than 20 years” vehicles have a percentage of 3% (See Figure 10.)

“0km” and “More than 20 years” are comparable given that they have approximately the same number of vehicles.

Figure 10.



IV. Model

To evaluate and create different risk profiles, a LOGIT model has been conducted and with it odds ratios with exposures on the probability of an accident have been obtained.

For the model the probability of an accident depends upon the combinations between the type, the brand and the city of the vehicle and the variables below, as well as combinations between each other:

- *Vehicle type*: Automobile, Transportation Truck, Pick-Up Truck, SUV's and Others
- *Colour*: Yellow, Orange, Blue, Calypso, Cranberry, Red, Green, White, Black, Silver and Beige
- *Years of the vehicle*: 0km, between 0 and 20 years and more than 20 years
- *Brand*: Nissan, Mitsubishi, Toyota, Suzuki, Luxurious and Others
- *City of Circulation*: La Paz, Santa Cruz, Cochabamba, Tarija, Trinidad and Other
- *Insured value*: The vehicles' insured value can either be its replacement cost or its market value, depending on the insurance policy

Expectations on the results

Type of the Car:

As seen from Section IV. a vast majority of the accidents come from SUV's, therefore a positive and strong relationship is expected for SUV's vehicles. With regards to Pick-Up Trucks and Automobile, a positive relationship is also expected but with a lower impact

Colour of the Car:

With regards to this variable, the colour White, Black, Silver, and Red are expected to have a positive relationship and a strong impact on the probability of an accident.

Years of the vehicle:

A positive and strong relationship is expected with vehicles that are 0km.

Brand:

Given that the majority of the insured cars are Toyota, and that Toyota has the largest percentage of the accidents. A positive relationship between the probability of an accident and the brand Toyota is expected. A negative relationship between the “other” category of the brands and the probability of an accident is also expected.

City:

A positive and strong relationship is expected between the cities of Santa Cruz and La Paz and the probability of an accident. For the city of Cochabamba and the rest of the cities in Bolivia, a positive but weaker relationship is expected between them and the probability of an accident

V. Results and Interpretation

Odds Ratios

To be able to create risk profiles, the interpretation of the odds ratio is critical. The odds ratio is a measure of association between an exposure and an outcome¹⁴.

Moreover, the odds ratio represents the odds that the accident will happen given particular exposures (type, color, brand, etc.) compared to the odds of the accident in the absence of such exposures.

¹⁴ Basic Econometrics, Fourth Edition, Damodar N. Gujarati

For this particular research, the odds ratio is used to determine whether combinations of particular exposures are risk factors that increase the likelihood of an accident compared to a baseline exposure.

The first main exposure will be the Type of vehicle against the insured value of the vehicle, the city where the insured runs the car, the years of the car, the vehicle brand, and the vehicle colour.

The second main exposure will be the Brand of the vehicle against the insured value of the vehicle, the city of circulation, the vehicle type, the years of the vehicle and the vehicle colour.

And finally the third main exposure will be the City of the vehicle against: the insured value of the vehicle, the type, the brand, the years and the vehicle colour.

When an exposure or a combination of exposures is non-significant it will be abbreviated with “(NS)” next to it. This abbreviation will be implemented throughout the Thesis.

1) Main Exposure: Type of the car

Independent effect

- Insured value:

For every one-dollar increase in the insured value of a vehicle, the probability an accident increases a 15%.

- Type:

The types Automobile, Pick-Up Truck, SUV and Transportation Truck will be compared to the type baseline: “Other”. The “Other” category includes types of vehicles not represented by the previous four categories, vehicles such as motorcycles, vans, etc.

Automobile: Compared to the type “other”, the probability of an accident for an automobile is 6.84 times higher. (NS)

Pick-Up Truck: For Pick-Up Trucks the probability of a car accident is 1.99 times higher than for the “other” type

SUV: Compared to the type “other”, the probability of an accident for an SUV is 3.23 times higher.

Transportation Truck: For Transportation Trucks the probability of a car accident is 0.17 times lower than for the “other” type

Combinations for the exposure of Type: Risk Profiles

Five separate categories exist to represent the type of car: *Automobile*, *Pick-Up Truck*, *SUV*, *Transportation Truck*, and *Other*. The “*Other*” category includes types of vehicles not represented by the previous four categories, vehicles such as, “*Motorcycles*”, “*Vans*”, etc.

The exposures: colour, brand, years and city will have one category that will be the baseline for comparison purposes.

Risk Profile: Type and Insured Value

Table 4.

	Type			
	<i>Automobile</i>	<i>Pick-Up Truck</i>	<i>SUV</i>	<i>Transportation Truck</i>
Insured Value	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for an automobile is 0.88 times lower than for “other” vehicle.	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for a Pick-Up Truck is 0.97 times higher than for “other” vehicle. (NS)	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for a SUV is 0.92 times lower than for “other” vehicle.	For every one-dollar increment in the insured value of a vehicle, the probability of an accident for a Transportation Truck is 1.11 times higher than for an “other” vehicle. (NS)

Risk Profile: Type and Colour

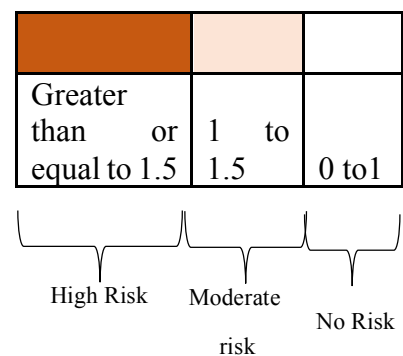
The first risk profile analyzes the impact of two exposures, vehicle colour, and vehicle type, on the probability of an accident. Here, vehicle type is the main exposure and the one to be combined with all the other exposures. The numerous combinations of vehicle colour and vehicle type yield different odds ratios, ratios are critical to the analysis. To understand how to read *Table 5*, one must note that an increase or decrease in the probability of an accident for the different colour and type combinations is relative to a baseline exposure. The baseline exposure designates “*White*” for the colour of the car. For example, the probability of an accident for a *yellow automobile* car is 1.12 times higher than for a *white automobile*. In other words, an *yellow automobile* has a probability 12% higher than a *white automobile*. (See *Table 5*.)

After analyzing the impact of car colour and type on the probability of an accident, the different risk profiles can be divided into four categories. The 3 categories, high risk, moderate risk, and no risk, are shown by different shades of colouring.

Table 5.

<i>Base Colour: White</i>		Type			
		<i>Automobile</i>	<i>Pick-Up Truck</i>	<i>SUV</i>	<i>Transportation Truck</i>
Colour	Yellow	Probability of having an accident is 1.12 times higher. (NS)	Probability of having an accident is 1.25 times higher.	Probability of having an accident is 1.52 times higher.	Probability of having an accident is 0.62 times lower.
	Orange	Probability of having an accident is 1.18 times higher.	Probability of having an accident is 0.68 times lower. (NS)	Probability of having an accident is 1.77 times higher.	Probability of having an accident is 0.54 times lower.
	Blue	Probability of having an accident is 1.15 times higher.	Probability of having an accident is 1.09 times higher. (NS)	Probability of having an accident is 1.30 times higher.	Probability of having an accident is 1.17 times higher.
	Cranberry	Probability of having an accident is 1.14 times higher.	Probability of having an accident is 1.18 times higher.	Probability of having an accident is 1.34 times higher.	Probability of having an accident is 1.23 times higher. (NS)
	Calypso	Probability of having an accident is 1.11 times higher. (NS)	Probability of having an accident is 0.89 times lower. (NS)	Probability of having an accident is 1.24 times higher. (NS)	Probability of having an accident is 1.13 times higher. (NS)
	Green	Probability of having an accident	Probability of having an accident	Probability of having an accident	Probability of having an accident

	is 1.16 times higher.	is 1.09 times higher.	is 1.17 times higher.	is 1.12 times higher. (NS)
Black	Probability of having an accident is 1.32 times higher.	Probability of having an accident is 1.47 times higher.	Probability of having an accident is 1.44 times higher.	Probability of having an accident is 0.99 times lower (NS)
Red	Probability of having an accident is 1.16 times higher.	Probability of having an accident is 1.09 times higher.	Probability of having an accident is 1.25 times higher.	Probability of having an accident is 1.17 times higher.
Beige	Probability of having an accident is 1.13 times higher.	Probability of having an accident is 1.23 times higher.	Probability of having an accident is 1.42 times higher.	Probability of having an accident is 1.09 times higher. (NS)
Silver	Probability of having an accident is 1.19 times lower.	Probability of having an accident is 1.41 times higher.	Probability of having an accident is 1.53 times higher	Probability of having an accident is 0.92 times lower. (NS)



Risk Profile: Type and City

The next risk profile analyzes the impact of vehicle type and city on the probability of an accident. In this case, the baseline city is “*La Paz*”. For example, the likelihood of an accident for an *automobile* in *Santa Cruz* is 1.27 times greater than for an *automobile* in *La Paz*. In other words, it is 27% more likely for an *automobile* to have an accident in *Santa Cruz* than it is to have an accident in *La Paz*. (See Table 6.)

The relative riskiness of the different combinations of vehicle type and city is again highlighted by colour gradients.

For example, the likelihood of an accident for a *Transportation Truck* in *Trinidad* is 1.87 times greater than for *Transportation Truck* in *La Paz*. In other words, it is 87% more likely for a *Transportation Truck* to have an accident in *Trinidad* than in *La Paz*. Therefore, a *Transportation Truck* in *Trinidad* has a *high-risk profile*.

Table 6.

		Type			
		<i>Automobile</i>	<i>Pick-Up Truck</i>	<i>SUV</i>	<i>Transportation Truck</i>
<i>City Base: La Paz</i>					
City	Santa Cruz	Probability of a car accident is 1.23 times higher.	Probability of a car accident is 1.18 times higher.	Probability of a car accident is 1.26 times higher.	Probability of a car accident is 1.67 times higher. (NS)
	Cochabamba	Probability of a car accident is 1.26 times higher.	Probability of a car accident is 1.30 times higher.	Probability of a car accident is 1.35 times higher.	Probability of a car accident is 1.47 times higher.
	Tarija	Probability of a car accident is 1.61 times higher	Probability of a car accident is 1.07 times higher	Probability of a car accident is 1.49 times higher	Probability of a car accident is 1.05 times higher. (NS)
	Trinidad	Probability of a car accident is 1.41 times higher	Probability of a car accident is 1.16 times higher	Probability of a car accident is 1.28 times higher	Probability of a car accident is 1.87 times higher
	Other	Probability of having an accident is 1.23 times higher.	Probability of having an accident is 1.04 times higher.	Probability of having an accident is 1.04 times higher. (NS)	Probability of having an accident is 1.30 times higher.

Risk Profile: Type and Brand

The next risk profile analyzes the impact of vehicle type and brand on the probability of an accident. In the case, the baseline brand is “*Toyota*”. Toyota is chosen as the baseline brand because Toyota is the brand that the company insures the most, and therefore, has the most accidents. Using Toyota as the baseline brand, one can infer that the probability of an accident for a *Suzuki Transportation Truck* is 11.4 times greater than for a *Toyota Transportation Truck*. Therefore, *Suzuki Transportation Trucks* should have a very high risk profile. (See Table 7.)

Again, the relative riskiness of the different combinations of vehicle type and brand are highlighted by colour gradients.

Table 7.

		Type			
		<i>Automobile</i>	<i>Pick-Up Truck</i>	<i>SUV</i>	<i>Transportation Truck</i>
<i>Brand Base: Toyota</i>					
Brand	Nissan	Probability of having an accident is 1.19 times lower.	Probability of having an accident is 0.94 times lower. (NS)	Probability of having an accident is 1.19 times higher.	Probability of having an accident is 0.97 times lower. (NS)
	Suzuki	Probability of having an accident is 1.36 times higher.	Probability of having an accident is 0.60 times lower.	Probability of having an accident is 1.10 times higher.	Probability of having an accident is 10.26 times higher. (NS)
	Mitsubishi	Probability of having an accident is 1.23 times higher.	Probability of having an accident is 1.11 times higher.	Probability of having an accident is 1.13 times higher.	Probability of having an accident is 1.10 times higher. (NS)
	Luxurious	Probability of having an accident is 0.95 times lower.	Probability of having an accident is 0.54 times lower. (NS)	Probability of having an accident is 0.95 times lower. (NS)	Probability of having an accident is 0.5 times lower.
	Other	Probability of having an accident is 1.15 times higher.	Probability of having an accident is 0.95 times lower. (NS)	Probability of having an accident is 1.20 times higher.	Probability of having an accident is 0.79 times lower. (NS)

Risk Profile: Type and Years:

Finally, the next risk profile analyzes the impact of vehicle type and the years of the vehicles on the probability of an accident. In this case, the baseline exposure designates “Between 0 and 20

years” for the years of vehicle. Using “Between 0 and 20 years” as the baseline for years of the vehicle, one can infer that the probability of an accident for a 0km automobile is 1.46 times greater than for an automobile within the “Between 0 and 20 years” category. Therefore, is 46% more likely for a 0km automobile to have an accident than for an automobile within in the “Between 0 and 20 years” category. (See Table 8.)

Again, the relative riskiness of the different combinations of vehicle type and brand are highlighted by colour gradients.

It is important to note that 0km vehicles of any type will always have a greater chance to have an accident than none 0km vehicle.

Table 8.

Base Years: Between 0 and 20		Type			
		Automobile	Pick-Up Truck	SUV	Transportation Truck
Years of the vehicle	0km	Probability of a car accident is 1.46 times higher.	Probability of a car accident is 1.55 times higher.	Probability of a car accident is 1.29 times higher.	Probability of a car accident is 1.66 times higher.
	More than 20 years	Probability of a car accident is 0.51 times lower.	Probability of a car accident is 0.30 times lower.	Probability of a car accident is 0.36 times lower.	Probability of a car accident is 0.62 times lower.

2) Main Exposure: Brand

Independent effect

- **Brand:**

The vehicle brands Toyota, Nissan, Suzuki, Mitsubishi, Luxurious will be compared to the brand baseline: “Other”. The “Other” category includes vehicle brands not represented by the previous four categories such as Ford, Dodge, Renault, etc.

Toyota: Compared to the brand “Other”, the probability of a car accident is 1.24 times higher for a Toyota vehicle. (NS)

Nissan: For Nissan vehicles the probability of a car accident is 2.39 times greater than for the “Other” brand.

Suzuki: Compared to the brand “Other”, the probability of a car accident is 0.48 times lower for a Suzuki vehicle.

Mitsubishi: For Mitsubishi vehicles the probability of car accident is 1.69 times greater than for the “Other” brand. (NS)

Luxurious: Compared to the brand “Other”, the probability of a car accident is 3.78 times higher than for the “Luxurious” brands.

Combinations for the exposure of Brand: Risk Profiles

Six separate categories exist to represent the brand of the car: *Toyota, Nissan, Suzuki, Mitsubishi, Luxurious* and *Other*. The “*Other*” category includes brands of vehicles not represented by the previous five categories, brands such as *Ford, Dodge, Renault, etc.* The exposures: colour, type, years, and city will have one category that will be the baseline for comparison purposes.

Risk Profile: Brand and Insured Value

Table 9.

	Brand				
	<i>Toyota</i>	<i>Nissan</i>	<i>Suzuki</i>	<i>Mitsubishi</i>	<i>Luxurious</i>
Insured Value	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for a Toyota vehicle is 0.94 times lower than for the "other" vehicle	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for a Nissan vehicle is 0.91 times higher than for "other" vehicle.	For every one-dollar increment in the insured value of the vehicle, the probability of an accident for a Suzuki vehicle is 1.07 times greater than for "other" vehicle.	For every one-dollar increment in the insured value of a vehicle, the probability of an accident for a Mitsubishi vehicle is 0.95 times lower than for an "other" vehicle. (NS)	For every one-dollar increment in the insured value of a vehicle, the probability of an accident for a Luxurious vehicle is 0.86 times lower than for an "other" vehicle.

Risk Profile: Brand and Colour

This risk profile analyzes the impact of two exposures, vehicle colour and vehicle brand, on the probability of an accident. Here, the vehicle brand is the main exposure and the one to be combined with all the other exposures. The numerous combinations of vehicle colour and vehicle type yield different odds ratios, ratios are critical to the analysis. To understand how to read *Table 10*, one must note that an increase or decrease in the probability of an accident for the different colour and brand combinations is relative to the baseline exposure. The baseline exposure designates "white" for the colour of the vehicle. For example, the probability for a *yellow Toyota* vehicle is 113% higher than for a *white Toyota* vehicle. In other words, a *yellow Toyota* vehicle is 2.13 times more likely to have an accident than a *white Toyota vehicle*. (See *Table 10*.)

After analyzing the impact of car colour and type on the probability of an accident, the different risk profiles can be divided into three categories. The 3 categories, high risk, moderate risk, and no risk, are shown by different shades of colouring. Therefore, a *yellow Toyota* vehicle has a high risk profile.

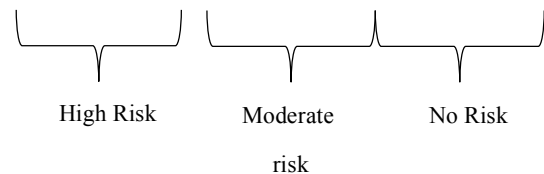
Table 10.

		Brand				
		<i>Toyota</i>	<i>Nissan</i>	<i>Suzuki</i>	<i>Mitsubishi</i>	<i>Luxurious</i>
<i>Base Colour: White</i>						
Colour	Yellow	Probability of having an accident is 1.47 times higher.	Probability of having an accident is 1.31 times higher.	Probability of having an accident is 1.03 times higher. (NS)	Probability of having an accident is 1.07 times higher	Probability of having an accident is 1.16 times higher. (NS)
	Orange	Probability of having an accident is 2.13 times higher.	Probability of having an accident is 0.84 times lower.	Probability of having an accident is 1.42 times higher.	Probability of having an accident is 1.89 times higher	Probability of having an accident is 0.43 times lower
	Blue	Probability of having an accident is 1.30 times higher.	Probability of having an accident is 1.19 times higher.	Probability of having an accident is 0.94 times lower. (NS)	Probability of having an accident is 0.95 times lower	Probability of having an accident is 1.52 times higher. (NS)
	Cranberry	Probability of having an accident is 1.39 times higher.	Probability of having an accident is 1.18 times higher.	Probability of having an accident is 1.15 times	Probability of having an accident is 1.06 times	Probability of having an accident is 1.30 times

			higher. (NS)	higher. (NS)	higher. (NS)
Calypso	Probability of having an accident is 1.67 times higher.	Probability of having an accident is 0.96 times lower.	Probability of having an accident is 0.85 times lower. (NS)	Probability of having an accident is 0.84 times lower. (NS)	Probability of having an accident is 1.10 times higher. (NS)
Green	Probability of having an accident is 1.28 times higher.	Probability of having an accident is 0.98 times lower.	Probability of having an accident is 0.85 times lower.	Probability of having an accident is 1.08 times higher. (NS)	Probability of having an accident is 1.61 times higher.
Black	Probability of having an accident is 1.61 times higher	Probability of having an accident is 1.14 times higher.	Probability of having an accident is 1.52 times higher.	Probability of having an accident is 1.16 times higher. (NS)	Probability of having an accident is 1.36 times higher (NS)
Red	Probability of having an accident is 1.18 times higher.	Probability of having an accident is 1.05 times higher.	Probability of having an accident is 1.12 times higher.	Probability of having an accident is 1.18 times higher.	Probability of having an accident is 1.51 times higher.
Beige	Probability of having an accident is 1.39 times higher.	Probability of having an accident is 1.12 times higher.	Probability of having an accident is 1.41 times higher.	Probability of having an accident is 1.33 times higher.	Probability of having an accident is 1.09 times higher. (NS)

	Silver	Probability of having an accident is 1.49 times lower.	Probability of having an accident is 1.26 times higher.	Probability of having an accident is 1.43 times higher	Probability of having an accident is 1.30 times higher. (NS)	Probability of having an accident is 1.23 times higher. (NS)
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Greater than or equal to 1.5	1 to 1.5	0 to 1



Risk Profile: Brand and City

The next risk profile analyzes the impact of vehicle brand and city on the probability of an accident. In this case, the baseline city is “*La Paz*”. For example, the probability of an accident for a *Toyota* vehicle in *Santa Cruz* is 1.33 times greater than for a *Toyota* vehicle in *La Paz*. In other words, the probability of an accident for a *Toyota* vehicle in *Santa Cruz* is 33% higher than for a *Toyota* vehicle in *La Paz*. (See Table 11.)

The relative riskiness of the different combinations of vehicle brand and city is again highlighted by colour gradients. For example, the likelihood of an accident for a *Luxurious* vehicle in *Tarija* is

1.67 times greater than for a *Luxurious* vehicle in *La Paz*. It is 67% more likely for a *Luxurious* vehicle to have an accident in *Tarija* than in *La Paz*. Thus, a *Luxurious* vehicle in *Tarija* has a *high risk profile*.

Table 11.

City Base: <i>La Paz</i>		Brand				
		<i>Toyota</i>	<i>Nissan</i>	<i>Suzuki</i>	<i>Mitsubishi</i>	<i>Luxurious</i>
City	Santa Cruz	Probability of a car accident is 1.33 times higher.	Probability of a car accident is 1.35 times higher.	Probability of a car accident is 1.22 times higher.	Probability of a car accident is 1.21 times higher.	Probability of a car accident is 1.13 times higher.(NS)
	Cochabamba	Probability of a car accident is 1.42 times higher.	Probability of a car accident is 1.28 times higher.	Probability of a car accident is 1.45 times higher.	Probability of a car accident is 1.19 times higher.	Probability of a car accident is 1.22 times higher.
	Tarija	Probability of a car accident is 1.28 times higher	Probability of a car accident is 1.12 times higher	Probability of a car accident is 1.41 times higher	Probability of a car accident is 1.30 times higher	Probability of a car accident is 1.67 times higher
	Trinidad	Probability of a car accident is 1.41 times higher	Probability of a car accident is 1.29 times higher	Probability of a car accident is 1.10 times higher. (NS)	Probability of a car accident is 1.12 times higher.(NS)	Probability of a car accident is 1.36 times higher.(NS)
	Other	Probability of having an accident is 1.11 times higher.(NS)	Probability of having an accident is 1.06 times higher. (NS)	Probability of having an accident is 1.11 times higher. (NS)	Probability of having an accident is 1.15 times higher.(NS)	Probability of having an accident is 0.27 times lower.(NS)

Risk Profile: Brand and Type

The following risk profile analyzes the impact of vehicle brand and type on the probability of an accident. In the case, the baseline type is “*Automobile*”. Using *Automobile* as the baseline type, one can infer that the probability of an accident for a *Toyota Pick-Up Truck* is 0.78 times lower than for a *Toyota automobile*. (See Table 12.)

Again, the relative riskiness of the different combinations of vehicle type and brand are highlighted by colour gradients.

Table 12.

<i>Type Base: Automobile</i>		Brand				
		<i>Toyota</i>	<i>Nissan</i>	<i>Suzuki</i>	<i>Mitsubishi</i>	<i>Luxurious</i>
Type	<i>Pick-Up Truck</i>	Probability of having an accident is 0.78 times lower.	Probability of having an accident is 0.60 times lower.	Probability of having an accident is 0.34 times lower.	Probability of having an accident is 0.64 times lower.	Probability of having an accident is 0.38 times lower.
	<i>SUV</i>	Probability of having an accident is 0.79 times lower.	Probability of having an accident is 0.82 times lower.	Probability of having an accident is 0.63 times lower.	Probability of having an accident is 0.72 times lower.	Probability of having an accident is 0.95 times lower.
	<i>Transportation Truck</i>	Probability of having an accident is 0.38 times lower.	Probability of having an accident is 0.28 times lower.	Probability of having an accident is 3.49 times higher.(NS)	Probability of having an accident is 0.29 times lower.	Probability of having an accident is 0.18 times lower.

Risk Profile: Brand and Years

Finally, the next risk profile analyzes the impact of vehicle brand and the years of the vehicles on the probability of an accident. In this case, the baseline exposure designates “*Between 0 and 20 years*” for the years of vehicle. Using “*Between 0 and 20 years*” as the baseline for years of the vehicle, one can infer that the probability of an accident for a *0km Toyota* vehicle is 1.22 times greater than for a *Toyota vehicle* within the “*Between 0 and 20 years*” category. Therefore, a *0km Toyota* vehicle is 22% more likely to have an accident than a *Toyota* vehicle within in the “*Between 0 and 20 years*” category. (See Table 13.)

Again, the relative riskiness of the different combinations of vehicle type and brand are highlighted by colour gradients.

Table 13.

<i>Base Years: Between 0 and 20</i>		Brand				
		<i>Toyota</i>	<i>Nissan</i>	<i>Suzuki</i>	<i>Mitsubishi</i>	<i>Luxurious</i>
Years of the car	0km	Probability of a car accident is 1.22 times higher.	Probability of a car accident is 1.33 times higher.	Probability of a car accident is 1.32 times higher.	Probability of a car accident is 1.67 times higher.	Probability of a car accident is 0.95 times lower.(NS)
	More than 20 years	Probability of a car accident is 0.37 times lower.	Probability of a car accident is 0.31 times lower.	Probability of a car accident is 0.5 times lower.	Probability of a car accident is 0.45 times lower.	Probability of a car accident is 0.55 times lower.

3) Main Exposure: City

Independent effect

- **City:**

The cities La Paz, Santa Cruz, Cochabamba, Tarija and Trinidad will be compared to the city baseline “Other”. The “Other” category includes cities not represented by the previous five categories such as Potosi, Oruro, and Sucre.

La Paz: For vehicles in La Paz, the likelihood of a car accident is 1.37 times greater than for a vehicle in the “Other” cities.

Santa Cruz: For vehicles in Santa Cruz, the probability of a car accident is 0.63 times lower than for a vehicle in the “Other” cities.

Cochabamba: For vehicles in Cochabamba, the likelihood of a car accident is 0.62 times lower than for a vehicle in the “Other” cities

Tarija: For vehicles in Tarija, the likelihood of a car accident is 1.66 times greater than for a vehicle in the “Other” cities

Trinidad: For vehicles in Trinidad, the probability of a car accident is 1.36 times greater than for a vehicle in the “Other” cities.

Combinations for the exposure of City: Risk Profiles

Five separate categories exist to represent the city of the vehicle: *La Paz, Santa Cruz, Cochabamba, Tarija, Trinidad* and *Other*. The “Other” category includes brands of vehicles not represented by the previous five categories, brands such as *Ford, Dodge, Renault, etc.* The “Other” category includes cities not represented by the previous five categories such as *Potosi,*

Oruro, and *Sucre*. The exposures: colour, type, years, and brand of the vehicle will have one category that will be the baseline for comparison purposes.

Risk Profile: City and Insured Value

Table 14.

	City				
	<i>La Paz</i>	<i>Santa Cruz</i>	<i>Cochabamba</i>	<i>Tarija</i>	<i>Trinidad</i>
Insured Value	For every one-dollar increment in the insured value of a vehicle in <i>La Paz</i> , the probability of an accident is 0.93 times lower than for a vehicle in the city category "Other".	For every one-dollar increment in the insured value of a vehicle in <i>Santa Cruz</i> , the probability of an accident is 1.05 times greater than for a vehicle in the city category "Other".	For every one-dollar increment in the insured value of a vehicle in <i>Cochabamba</i> , the probability of an accident is 1.05 times greater than for a vehicle in the city category "Other".	For every one-dollar increment in the insured value of a vehicle in <i>Tarija</i> , the probability of an accident is 0.95 times lower than for a vehicle in the city category "Other".	For every one-dollar increment in the insured value of a vehicle in <i>Trinidad</i> , the probability of an accident is 0.97 times lower than for a vehicle in the city category "Other".

Risk Profile: City and Colour

This risk profile analyzes the impact of two exposures, vehicle colour and vehicle city, on the probability of an accident, with the city of the vehicle being the main exposure. To understand how to read *Table 15.*, one must note that an increase or decrease in the probability of an accident for the different colour and city combinations is relative to the baseline exposure. The baseline exposure defines “*white*” for the colour of the vehicle. For example, the probability for a *beige* vehicle in *La Paz* is 51% higher than for a *white* vehicle in *La Paz*. In other words, a *Beige* vehicle

in *La Paz* is 1.51 times more likely to have an accident than it is for a *white* vehicle in *La Paz*. (See *Table 15*.)

After analyzing the impact of car colour and city on the probability of an accident, the different risk profiles can be divided into three categories. The 3 categories, high risk, moderate risk, and no risk, are shown by different shades of colouring. Therefore, an *orange* vehicle in *Tarija* has a high risk profile. Given that is 2.27 more likely to have an accident than a *white* vehicle in *Tarija*.

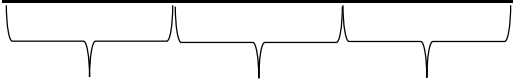
Table 15.

Base Colour: White		City				
		<i>La Paz</i>	<i>Santa Cruz</i>	<i>Cochabamba</i>	<i>Tarija</i>	<i>Trinidad</i>
Colour	Yellow	Probability of having an accident is 1.3 times higher.	Probability of having an accident is 1.12 times higher. (NS)	Probability of having an accident is 1.31 times higher.(NS)	Probability of having an accident is 0.74 times lower.(NS)	Probability of having an accident is 0.68 times lower.(NS)
	Orange	Probability of having an accident is 1.18 times higher. (NS)	Probability of having an accident is 1.15 times higher. (NS)	Probability of having an accident is 1.28 times higher.(NS)	Probability of having an accident is 2.27 times higher.	Probability of having an accident is 1.39 times higher.(NS)
	Blue	Probability of having an accident is 1.26 times higher.	Probability of having an accident is 1.02 times	Probability of having an accident is 1.09 times higher.(NS)	Probability of having an accident is 1.38 times higher.	Probability of having an accident is 1.48 times higher.

		higher. (NS)			
Cranberry	Probability of having an accident is 1.30 times higher.	Probability of having an accident is 1.14 times higher.	Probability of having an accident is 1.28 times higher.	Probability of having an accident is 1.42 times higher.(NS)	Probability of having an accident is 1.31 times higher.(NS)
Calypso	Probability of having an accident is 1.13 times higher.(NS)	Probability of having an accident is 1.14 times higher.(NS)	Probability of having an accident is 1.02 times higher.(NS)	Probability of having an accident is 1.50 times higher.(NS)	Probability of having an accident is 1.12 times higher.(NS)
Green	Probability of having an accident is 1.11 times higher.	Probability of having an accident is 1.06 times higher.(NS)	Probability of having an accident is 1.07 times higher.(NS)	Probability of having an accident is 1.23 times higher.	Probability of having an accident is 1.17 times higher.(NS)
Black	Probability of having an accident is 1.44 times higher.	Probability of having an accident is 1.20 times higher.	Probability of having an accident is 1.31 times higher.	Probability of having an accident is 1.43 times higher	Probability of having an accident is 1.44 times higher
Red	Probability of having an accident is 1.18	Probability of having an accident is 0.92	Probability of having an accident is 0.99	Probability of having an accident is 1.19	Probability of having an accident is 1.38

		times higher.	times lower.	times lower.(NS)	times higher.	times higher.
Beige	Probability of having an accident is 1.40 times higher.	Probability of having an accident is 1.16 times higher.	Probability of having an accident is 1.20 times higher.	Probability of having an accident is 1.51 times higher.	Probability of having an accident is 2 times higher.	
Silver	Probability of having an accident is 1.49 times lower.	Probability of having an accident is 1.24 times higher.	Probability of having an accident is 1.27 times higher	Probability of having an accident is 1.60 times higher.	Probability of having an accident is 1.75 times higher.	

Greater than or equal to 1.5	1 to 1.5	0 to 1



High Risk Moderate risk No Risk

Risk Profile: City and Brand

The following risk profile analyzes the impact of vehicle brand and city on the probability of an accident. In the case, the baseline brand is “*Toyota*”. Using *Toyota* as the baseline type, one can infer that the probability of an accident for a *Nissan* vehicle in *La Paz* is 1.15 times greater than for a *Toyota* vehicle in *La Paz*. (See Table 16.)

Again, the relative riskiness of the different combinations of the brand of the vehicle and the city are highlighted by colour gradients.

Table 16.

		City				
		<i>La Paz</i>	<i>Santa Cruz</i>	<i>Cochabamba</i>	<i>Tarija</i>	<i>Trinidad</i>
<i>Brand Base: Toyota</i>						
Brand	Nissan	Probability of having an accident is 1.15 times lower.	Probability of having an accident is 1.14 times higher.	Probability of having an accident is 1.04 times higher.(NS)	Probability of having an accident is 1.06 times higher.(NS)	Probability of having an accident is 0.98 times lower.(NS)
	Suzuki	Probability of having an accident is 1.14 times higher.	Probability of having an accident is 1.05 times lower.(NS)	Probability of having an accident is 1.16 times higher.	Probability of having an accident is 1.19 times higher.(NS)	Probability of having an accident is 0.86 times lower.(NS)
	Mitsubishi	Probability of having an accident is 1.22	Probability of having an accident is 1.14	Probability of having an accident is 1.06 times	Probability of having an accident is 1.24	Probability of having an accident is 0.97

	times higher.	times higher.	higher. (NS)	times higher.(NS)	times lower.(NS)
Luxurious	Probability of having an accident is 0.99 times lower.(NS)	Probability of having an accident is 0.79 times lower.	Probability of having an accident is 0.94 times lower.(NS)	Probability of having an accident is 1.29 times higher.	Probability of having an accident is 0.72 times lower.(NS)
Other	Probability of having an accident is 1.13 times higher.	No Effect	Probability of having an accident is 0.99 times lower.(NS)	Probability of having an accident is 1.32 times higher.	Probability of having an accident is 0.86 times lower.(NS)

Risk Profile: City and Type

The next risk profile analyzes the impact of vehicle city and type on the probability of an accident. In this case, the baseline type is “*Automobile*”. For example, the probability of an accident for a *Pick-Up Truck* in *La Paz* is 0.70 times lower than for an *Automobile* in *La Paz*. (See Table 17.) It is interesting to notice that, for this risk profile having an *automobile* will always increase the probability of an accident more than any other type vehicle.

The relative riskiness of the different combinations of vehicle city and type is again highlighted by colour gradients.

Table 17.

		City				
		<i>La Paz</i>	<i>Santa Cruz</i>	<i>Cochabamba</i>	<i>Tarija</i>	<i>Trinidad</i>
<i>Type Base: Automobile</i>						
Type	<i>Pick-Up Truck</i>	Probability of having an accident is 0.70 times lower.	Probability of having an accident is 0.61 times lower.	Probability of having an accident is 0.65 times lower.	Probability of having an accident is 0.49 times lower.	Probability of having an accident is 0.56 times lower.
	<i>SUV</i>	Probability of having an accident is 0.77 times lower.	Probability of having an accident is 0.74 times lower.	Probability of having an accident is 0.77 times lower.	Probability of having an accident is 0.71 times lower.	Probability of having an accident is 0.66 times lower.
	<i>Transportation Truck</i>	Probability of having an accident is 0.23 times lower.	Probability of having an accident is 0.28 times lower.	Probability of having an accident is 0.23 times lower.	Probability of having an accident is 0.17 times lower.	Probability of having an accident is 0.03 times lower.

Risk Profile: City and Years

Lastly, the next risk profile analyzes the impact of vehicle city and the years of the vehicles on the probability of an accident. In this case, the baseline exposure is “*Between 0 and 20 years*” for the years of vehicle. Using “*Between 0 and 20 years*” as the baseline for years of the vehicle, one can conclude that the probability of an accident for a *0km* vehicle in *La Paz* is 1.62 times greater than for a vehicle in *La Paz* within the “*Between 0 and 20 years*” category. Therefore, a *0km* vehicle in

La Paz is 62% more likely to have an accident than a vehicle in *La Paz* within in the “*Between 0 and 20 years*” category. (See Table 18.)

Again, the relative riskiness of the different combinations of vehicle city and years of the vehicle are highlighted by colour gradients.

Table 18.

<i>Base Years: Between 0 and 20</i>		City				
		<i>La Paz</i>	<i>Santa Cruz</i>	<i>Cochabamba</i>	<i>Tarija</i>	<i>Trinidad</i>
Years of the car	0km	Probability of a car accident is 1.62 times higher.	Probability of a car accident is 1.34 times higher.	Probability of a car accident is 1.58 times higher.	Probability of a car accident is 1.31 times higher.	Probability of a car accident is 1.75 times higher.
	More than 20 years	Probability of a car accident is 0.40 times lower.	Probability of a car accident is 0.39 times lower.	Probability of a car accident is 0.5 times lower.	Probability of a car accident is 0.36 times lower.	Probability of a car accident is 0.85 times lower.(NS)

VI. Observed Results and Expected Results

The following table compares the prior expectations with the observed results.

Table 19.

Exposure	Expected	Observed
Type	SUV's will have the largest impact, followed by Automobiles, then Pick-Up Trucks	Automobiles have the largest impact, followed by SUV's, then Pick-Up Trucks
Type/Colour	Silver, Black, White and Red will have strong, positive relationships with the probability of a car accident	Any Silver, Black, or Red vehicle has a higher probability of a car accident than any white vehicle.
Brand	Strongest impact and relationship: Toyota	Luxurious vehicles have the highest probability of an accident out of all other brand's vehicles, followed by Nissan, Mitsubishi, and Toyota. Compared to other brands, Suzuki has the lowest probability of an accident.
City	Santa Cruz will have the largest impact and relationship with the probability of an accident	Compared to the other cities, Tarija has the greatest likelihood of an accident, followed by La Paz and Trinidad. Compared to the other cities, Santa Cruz and Cochabamba have a lower probability of an accident.
Years of the vehicle	A positive, strong relationship will exist between 0km vehicles and the probability of an accident.	0km vehicles are twice as likely to have an accident than vehicles between 1 and 20 years, and vehicles that have more than 20 years

Risk Profiles Combinations Observed Results:

The next table is designed to analyze the observed results of the exposure combinations against the probability of an accident. The main exposure, the first exposure, is separated by a slash symbol, followed by the exposure to which it is combined with.

Table 20.

Exposure	Observed Results
Type/Colour	Yellow, Orange, and Silver SUVs are over 50% more likely to have an accident than white SUVs. These combinations of exposures have a high risk profile.
Type/City	All the combinations showed a moderate or high risk profile compared to the baseline city of La Paz. In general, regardless of the vehicle type, driving a car in a city other than La Paz is associated with greater risk. The riskiest combination of exposure is a Transportation Truck in Trinidad, which is a combination that increases the probability of an accident by 87% when compared to Transportations Trucks in La Paz. The second riskiest combination is that of Transportation Trucks in Santa Cruz. Such a combination raises the probability of an accident by 67%, when compared to the same combination in La Paz.
Type/Brand	Any Mitsubishi vehicle has a higher probability of a car accident than any Toyota vehicle. Any Luxurious vehicle has a lower probability of a car accident than any Toyota vehicle.
Type/Years of the vehicle	0km vehicles increase the probability of a car accident for any type vehicle, while vehicles that are more than 20 years decrease the probability of a car accident.
Brand/Colour	Orange Toyota and Mitsubishi vehicles increase the probability of a car accident by 113% and 87% when compared to white Toyota and Mitsubishi vehicles, respectively. These exposure combinations are the two riskiest combinations of exposures between the brand and colour of a vehicle.

Brand/City	Overall, regardless of the brand vehicle, driving in any city other than La Paz increases the probability of a car accident. Moreover, a Luxurious vehicle in Tarija is the riskiest profile within these exposures. Such a profile increases the likelihood of a car accident by 67% when compared to Luxuries vehicle in La Paz.
Brand/Type	With the expectation of a Suzuki Transportation Truck vehicle, all types of vehicles, regardless of their brands, have lower probabilities of car accidents when compared with automobiles.
Brand/Years	In general, 0km vehicles, regardless of their brands, increase the probability of an accident when compared to vehicles between 0 and 20 years.
City/Colour	Although in general, all combinations between the vehicle colour and city of the increase the probability of an accident when compared to white vehicles, the riskiest profiles are in Tarija and Trinidad. Orange, Calypso, Beige, and Silver vehicles in Tarija increase the probability of an accident by over 50% when compared to white vehicles in Tarija. Furthermore, beige and silver vehicles in Trinidad increase the likelihood of an accident by over 75% when compared to white vehicles in Trinidad.
City/Colour	In Tarija, all brand vehicles increase the probability of an accident when compared to a Toyota vehicle in Tarija.
City/Type	Regardless of the city, a Pick-Up Truck, SUV, or Transportation Truck will reduce the probability of an accident when compared to an automobile in any city.
City/Years	0km vehicles increase the likelihood of an accident by over 58% in La Paz, Cochabamba, and Trinidad.

VII. Conclusion

There are five important conclusions about this thesis. First of all, automobiles increase the probability of an accident regardless of their city, brand or colour. In other words, having an automobile increases the probability of an accident more than any other vehicle type regardless of the brand and city where the vehicle is driven.

Second of all, even though white vehicles have the largest proportion of the insured vehicles in the company with a 34 percent, accounting for the 27 percent of the total number of accidents. Red vehicles increase the probability of an accident by up to 25 percent for any vehicle type, up to 51 percent for any brand and up to 31 percent in the cities of La Paz, Tarija and Trinidad. Moreover, in general Cranberry, Beige Silver, Black, and Blue vehicles increase the probability of an accident more than white vehicles regardless of the city, the brand, and the type characteristics of the vehicle.

Likewise, with respect to the exposure “city”, La Paz is the safest city to drive any type vehicle regardless of the brand. It is also worth mentioning that, Santa Cruz, Tarija, and Trinidad have the riskiest profiles, increasing the probability of an accident by up to 67 percent for a Transportation Truck in Santa Cruz and up to 87 percent in Trinidad compared to La Paz. As for automobiles, the probability increases by up to 61 percent in Tarija compared to La Paz. In the same way, Luxurious vehicles show a high-risk profile only in Tarija, with a 67 percent increase in the probability of an accident compared to La Paz. Therefore, one can conclude that Tarija is the riskiest city to drive a vehicle regardless of the type, brand or colour of the vehicle.

In addition, another significant result is the fact that any 0km vehicle will increase the probability of an accident regardless of the type, brand or city of the vehicle. The largest percentage

increment in Trinidad, increasing the likelihood of an accident by up to 75 percent for 0km vehicles.

In addition, with these results and tables created in Section VI. one can conclude that the riskiest profile is the one of a Blue Luxurious 0km automobile in Tarija.

Finally, the results of the thesis open to discussion the question of whether the relative increase or decrease in probabilities are reflected in the premiums that the company charges. It would be interesting to analyze whether the risk profiles created in this thesis act accordingly with their respective premiums.

VIII. Bibliography

- Basic Econometrics, Fourth Edition, Damodar N. Gujarati
- “*Factors Unrelated to Driving Can Affect Car Insurance Premiums*” by Ann Carrns, New York Times Journal, August 7th, 2015
- Fundamentals of Corporate Finance, Seventh Canadian Edition, Ross, Westerfield, Jordan, Roberts
- La Boliviana Ciacruz” webpage: <http://www.lbc.bo/default.aspx>
- National Institution of Statistics (INE (Instituto Nacional de Estadística) webpage: <http://www.ine.gob.bo/>
- Bolivian News Journal: “Pagina 7”, <http://eju.tv/2016/01/santa-cruz-encabeza-lista-de-accidentes-de-transito/>
- World Bank Data Base: <http://data.worldbank.org/indicator/IC.FRM.BRIB.ZS?locations=BO&view=chart>
- Chilean News Journal: *24 Horas*: <http://www.24horas.cl/nacional/estos-son-los-autos-de-zona-franca-que-aduanas-rematara-en-iquique-1773758>

IX. Appendix

Stata Results

1) Type as the main exposure:

Logistic regression		Number of obs =		359612		
		Wald chi2(124) =		10280.95		
		Prob > chi2 =		0.0000		
Log pseudolikelihood = -110054.45		Pseudo R2 =		0.0608		
probacc	Odds Ratio	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnvalue	1.151094	.0386176	4.19	0.000	1.07784	1.229327
type						
1	6.841561	3.05346	4.31	0.000	2.852693	16.40799
2	1.99723	.90756	1.52	0.128	.8196608	4.866559
3	3.235475	1.37031	2.77	0.006	1.41069	7.420694
4	.1702757	.0852911	-3.53	0.000	.0637948	.454485
5	1	(omitted)				
type#c.lnvalue						
1	.8872337	.0345611	-3.07	0.002	.8220165	.9576251
2	.9713689	.0380106	-0.74	0.458	.8996547	1.0488
3	.9220391	.0334318	-2.24	0.025	.8587881	.9899486
4	1.115602	.0472772	2.58	0.010	1.026684	1.21222
5	1	(omitted)				

type#years							
1	1	1.465945	.0550828	10.18	0.000	1.361864	1.57798
1	3	.5111048	.0335355	-10.23	0.000	.4494273	.5812467
2	1	1.556868	.0530786	12.98	0.000	1.456235	1.664454
2	3	.3036076	.0279091	-12.97	0.000	.2535513	.3635459
3	1	1.296212	.0366536	9.18	0.000	1.226327	1.37008
3	3	.3601495	.0220186	-16.70	0.000	.3194792	.4059972
4	1	1.505262	.1179039	5.22	0.000	1.291039	1.755031
4	3	.6244942	.0379485	-7.75	0.000	.554375	.7034822
5	1	2.023116	.126703	11.25	0.000	1.789418	2.287333
5	3	.3390962	.0786379	-4.66	0.000	.2152412	.5342203

type#brandf							
1	2	1.195638	.0606386	3.52	0.000	1.082504	1.320595
1	3	1.36423	.0639027	6.63	0.000	1.24456	1.495406
1	4	1.238548	.0896115	2.96	0.003	1.074797	1.427246
1	5	.9594414	.0576762	-0.69	0.491	.8528037	1.079414
1	6	1.151708	.0460031	3.54	0.000	1.064983	1.245496
2	2	.9440484	.0302861	-1.79	0.073	.8865165	1.005314
2	3	.6039976	.0730394	-4.17	0.000	.4765433	.7655404
2	4	1.117515	.0459977	2.70	0.007	1.030901	1.211405
2	5	.547039	.2813003	-1.17	0.241	.1996689	1.49874
2	6	.959857	.0304065	-1.29	0.196	.9020738	1.021342
3	2	1.195572	.0318964	6.70	0.000	1.134662	1.259751
3	3	1.106218	.0286794	3.89	0.000	1.051412	1.163881
3	4	1.132818	.0342571	4.12	0.000	1.067627	1.201991
3	5	.9592525	.0439574	-0.91	0.364	.8768533	1.049395
3	6	1.201542	.0296244	7.45	0.000	1.14486	1.261031
4	2	.9797692	.1081656	-0.19	0.853	.7891362	1.216454
4	3	10.26798	9.471809	2.52	0.012	1.68378	62.61595
4	4	1.10589	.1501762	0.74	0.459	.8474643	1.443119
4	5	.5057836	.0703285	-4.90	0.000	.3851291	.6642371
4	6	.792181	.0759933	-2.43	0.015	.6564011	.9560476
5	2	1.658099	.199086	4.21	0.000	1.310411	2.098037
5	3	.8717991	.0897719	-1.33	0.183	.7124683	1.066761
5	4	.9949391	.1329344	-0.04	0.970	.7657147	1.292784
5	5	.9749433	.1563091	-0.16	0.874	.7120481	1.334902
5	6	.573251	.0577187	-5.53	0.000	.4705873	.6983118

type#city						
1 2	1.239121	.0385402	6.89	0.000	1.16584	1.317008
1 3	1.267759	.0501141	6.00	0.000	1.173245	1.369886
1 4	1.619908	.1020433	7.66	0.000	1.431761	1.83278
1 5	1.413737	.1345711	3.64	0.000	1.173125	1.7037
1 6	1.232819	.0867387	2.97	0.003	1.074015	1.415103
2 2	1.183239	.0383552	5.19	0.000	1.110402	1.260853
2 3	1.303614	.0596477	5.79	0.000	1.191796	1.425924
2 4	1.079669	.0603692	1.37	0.170	.9676006	1.204717
2 5	1.164383	.0820672	2.16	0.031	1.014149	1.336871
2 6	1.046725	.0482417	0.99	0.322	.9563176	1.145679
3 2	1.267138	.025961	11.56	0.000	1.217264	1.319056
3 3	1.351112	.0385843	10.54	0.000	1.277565	1.428892
3 4	1.496119	.0624634	9.65	0.000	1.378568	1.623693
3 5	1.288597	.0813355	4.02	0.000	1.138648	1.458292
3 6	1.042252	.0391564	1.10	0.271	.9682646	1.121894
4 2	1.673536	.0923314	9.33	0.000	1.502011	1.864649
4 3	1.47611	.1125205	5.11	0.000	1.271258	1.713973
4 4	1.056479	.102719	0.57	0.572	.8731737	1.278266
4 5	1.875343	.1877344	6.28	0.000	1.541238	2.281874
4 6	1.302474	.1132816	3.04	0.002	1.098339	1.544549
5 2	1.497152	.0898471	6.72	0.000	1.331017	1.684024
5 3	1.435992	.1048349	4.96	0.000	1.244543	1.656892
5 4	.8448808	.1121395	-1.27	0.204	.6513538	1.095907
5 5	.3460383	.0719114	-5.11	0.000	.2302677	.5200143
5 6	.5493467	.0560641	-5.87	0.000	.4497554	.6709911

type#color

1 1	1.123585	.1195769	1.09	0.274	.9120468	1.384186
1 2	1.188667	.1228246	1.67	0.094	.9707461	1.455508
1 3	1.153615	.0620769	2.66	0.008	1.038143	1.281931
1 4	1.149508	.079949	2.00	0.045	1.003022	1.317388
1 5	1.110544	.1266652	0.92	0.358	.8880763	1.388741
1 6	1.162948	.0715995	2.45	0.014	1.030752	1.312099
1 8	1.325138	.0729327	5.11	0.000	1.189632	1.476078
1 9	1.169397	.0600502	3.05	0.002	1.05743	1.29322
1 10	1.1359	.0769153	1.88	0.060	.9947244	1.297113
1 11	1.198065	.0519922	4.16	0.000	1.100376	1.304427
1 12	1.249985	.2201179	1.27	0.205	.8851386	1.765218
2 1	1.259821	.1016064	2.86	0.004	1.075618	1.475569
2 2	.6896283	.240882	-1.06	0.287	.3477737	1.367519
2 3	1.091851	.0606396	1.58	0.114	.9792398	1.217412
2 4	1.183754	.0874379	2.28	0.022	1.024207	1.368156
2 5	.8961818	.2013871	-0.49	0.626	.5769216	1.392116
2 6	1.09675	.0586291	1.73	0.084	.9876539	1.217896
2 8	1.477813	.0853816	6.76	0.000	1.319596	1.655001
2 9	1.090698	.0441994	2.14	0.032	1.00742	1.180861
2 10	1.231007	.0850594	3.01	0.003	1.07509	1.409537
2 11	1.418315	.0467846	10.59	0.000	1.32952	1.51304
2 12	.2872534	.0814208	-4.40	0.000	.1648146	.5006506
3 1	1.523335	.0879375	7.29	0.000	1.360374	1.705818
3 2	1.771141	.1326626	7.63	0.000	1.529312	2.05121
3 3	1.302793	.0435378	7.92	0.000	1.220195	1.390983
3 4	1.346098	.0528111	7.58	0.000	1.24647	1.45369
3 5	1.247556	.136435	2.02	0.043	1.006865	1.545785
3 6	1.17308	.0398775	4.70	0.000	1.097469	1.253901
3 8	1.44712	.0492767	10.85	0.000	1.353692	1.546997
3 9	1.256156	.0471613	6.07	0.000	1.167041	1.352077
3 10	1.426785	.0488038	10.39	0.000	1.334268	1.525718
3 11	1.530642	.0393125	16.57	0.000	1.455498	1.609665
3 12	.6904435	.1575341	-1.62	0.104	.4414839	1.079795

4 1	.6238594	.0685088	-4.30	0.000	.5030515	.7736793
4 2	.5464973	.1019285	-3.24	0.001	.3791652	.7876759
4 3	1.175762	.0831663	2.29	0.022	1.023553	1.350605
4 4	1.23554	.2268043	1.15	0.249	.8621923	1.770554
4 5	1.132884	.2252569	0.63	0.530	.7672503	1.672762
4 6	1.125457	.119417	1.11	0.265	.914138	1.385625
4 8	.996904	.2138146	-0.01	0.988	.65477	1.517812
4 9	1.173496	.0744322	2.52	0.012	1.036315	1.328836
4 10	1.09324	.2796069	0.35	0.727	.6622353	1.804757
4 11	.9216833	.1708371	-0.44	0.660	.6409272	1.325424
4 12	.596175	.1360239	-2.27	0.023	.3812086	.9323626
5 1	.8907037	.1644752	-0.63	0.531	.6202295	1.279128
5 2	.3954145	.1813645	-2.02	0.043	.1609283	.9715669
5 3	.4855121	.0403783	-8.69	0.000	.4124854	.5714674
5 4	1.067789	.1693925	0.41	0.679	.782442	1.457199
5 5	.8810883	.3098763	-0.36	0.719	.4422362	1.755434
5 6	.7304362	.1063586	-2.16	0.031	.5490845	.9716849
5 8	.7038105	.0698585	-3.54	0.000	.5793854	.8549564
5 9	.377268	.0302186	-12.17	0.000	.3224557	.4413976
5 10	1.319147	.2534568	1.44	0.149	.9052028	1.922385
5 11	1.162006	.0850088	2.05	0.040	1.006785	1.341157
5 12	.8116949	.4149867	-0.41	0.683	.2979943	2.210943
_cons	.0145604	.0057477	-10.71	0.000	.0067168	.0315633

brandf#type							
1 2	.7845604	.0326178	-5.84	0.000	.7231659	.851167	
1 3	.7912119	.0309849	-5.98	0.000	.7327548	.8543326	
1 4	.3863523	.0385876	-9.52	0.000	.3176641	.4698927	
1 5	.5037198	.0473172	-7.30	0.000	.4190163	.605546	
2 2	.6071493	.0285296	-10.62	0.000	.55373	.6657221	
2 3	.8250054	.0357015	-4.45	0.000	.757917	.8980322	
2 4	.2877049	.0210175	-17.05	0.000	.2493247	.3319933	
2 5	.66582	.0599568	-4.52	0.000	.558093	.7943412	
3 2	.3472356	.0430415	-8.53	0.000	.2723415	.4427257	
3 3	.639074	.0235776	-12.14	0.000	.5944941	.6869969	
3 4	3.498145	2.866989	1.53	0.127	.7018027	17.43655	
3 5	.2414512	.0148747	-23.07	0.000	.2139886	.2724382	
4 2	.6431442	.0495738	-5.73	0.000	.5529646	.7480305	
4 3	.7264054	.0505871	-4.59	0.000	.6337255	.8326395	
4 4	.2948433	.0359398	-10.02	0.000	.2321851	.3744107	
4 5	.4290461	.0515984	-7.04	0.000	.3389502	.5430904	
5 2	.3811661	.2021249	-1.82	0.069	.1348152	1.07768	
5 3	.9504204	.0647389	-0.75	0.455	.8316398	1.086166	
5 4	.1855168	.0229459	-13.62	0.000	.1455799	.2364097	
5 5	.4558183	.0664082	-5.39	0.000	.3425944	.6064616	
6 2	.5991629	.0194295	-15.80	0.000	.5622666	.6384804	
6 3	.8083508	.0220715	-7.79	0.000	.7662286	.8527886	
6 4	.2362315	.0083327	-40.91	0.000	.2204515	.253141	
6 5	.1516015	.0065238	-43.84	0.000	.1393394	.1649427	

brandf#city						
1 2	1.339873	.0421398	9.30	0.000	1.259775	1.425064
1 3	1.42772	.059622	8.53	0.000	1.315518	1.549493
1 4	1.284667	.0825888	3.90	0.000	1.132579	1.457178
1 5	1.419115	.1207232	4.11	0.000	1.201175	1.676597
1 6	1.119134	.0518148	2.43	0.015	1.02205	1.225439
2 2	1.357818	.0474556	8.75	0.000	1.267921	1.454089
2 3	1.286344	.0656114	4.94	0.000	1.163967	1.421587
2 4	1.129871	.0671548	2.05	0.040	1.005627	1.269465
2 5	1.2969	.1129688	2.98	0.003	1.093355	1.538338
2 6	1.095358	.0589992	1.69	0.091	.9856161	1.217318
3 2	1.225841	.0475293	5.25	0.000	1.136137	1.322628
3 3	1.45147	.070653	7.65	0.000	1.319393	1.596768
3 4	1.414095	.1073871	4.56	0.000	1.218535	1.641041
3 5	1.104751	.101584	1.08	0.279	.9225606	1.322922
3 6	1.117436	.075342	1.65	0.100	.9791095	1.275305
4 2	1.210214	.0569047	4.06	0.000	1.103668	1.327046
4 3	1.199236	.0803992	2.71	0.007	1.05157	1.367637
4 4	1.307852	.1039137	3.38	0.001	1.119251	1.528234
4 5	1.123942	.1563004	0.84	0.401	.8557991	1.4761
4 6	1.150962	.0926333	1.75	0.081	.9829999	1.347624
5 2	1.133136	.0744859	1.90	0.057	.9961595	1.288947
5 3	1.229141	.1205273	2.10	0.035	1.014225	1.489597
5 4	1.679878	.2595802	3.36	0.001	1.24093	2.274092
5 5	1.368215	.4120281	1.04	0.298	.7582649	2.468809
5 6	.2760527	.0693906	-5.12	0.000	.1686662	.4518103
6 2	1.223009	.0292198	8.43	0.000	1.167059	1.281641
6 3	1.285946	.0413321	7.82	0.000	1.207435	1.369562
6 4	1.311584	.0626795	5.68	0.000	1.194313	1.440371
6 5	1.090529	.0676606	1.40	0.162	.9656627	1.231542
6 6	.8659037	.0430212	-2.90	0.004	.7855591	.9544656

brandf#color							
1	1	1.477221	.1249332	4.61	0.000	1.251575	1.74355
1	2	2.135398	.3350374	4.84	0.000	1.570103	2.904222
1	3	1.301614	.0590924	5.81	0.000	1.190798	1.422742
1	4	1.395533	.0806269	5.77	0.000	1.246126	1.562854
1	5	1.672119	.2451672	3.51	0.000	1.254479	2.228799
1	6	1.283482	.0589346	5.44	0.000	1.173018	1.404349
1	8	1.611658	.0791172	9.72	0.000	1.463817	1.77443
1	9	1.188408	.0603691	3.40	0.001	1.075786	1.31282
1	10	1.391153	.0692326	6.63	0.000	1.261868	1.533685
1	11	1.492425	.0504032	11.86	0.000	1.396835	1.594556
1	12	.4480751	.0983334	-3.66	0.000	.2914395	.6888953
2	1	1.319469	.0902976	4.05	0.000	1.153845	1.508867
2	2	.8471166	.2199385	-0.64	0.523	.5092653	1.409101
2	3	1.191652	.0714502	2.92	0.003	1.059528	1.340253
2	4	1.181727	.0826597	2.39	0.017	1.030332	1.355368
2	5	.9631111	.2195318	-0.16	0.869	.6161029	1.505565
2	6	.9887049	.0604141	-0.19	0.853	.8771112	1.114497
2	8	1.143371	.0697185	2.20	0.028	1.014575	1.288517
2	9	1.058652	.0617493	0.98	0.328	.9442875	1.186868
2	10	1.122341	.0677957	1.91	0.056	.9970287	1.263404
2	11	1.264526	.0499403	5.94	0.000	1.170337	1.366295
2	12	.7479356	.1853261	-1.17	0.241	.4602041	1.215564
3	1	1.033761	.1390413	0.25	0.805	.7942059	1.345572
3	2	1.42458	.1314633	3.83	0.000	1.188875	1.707016
3	3	.9424932	.0545707	-1.02	0.306	.8413823	1.055755
3	4	1.153204	.088731	1.85	0.064	.9917732	1.340912
3	5	.8548761	.1439261	-0.93	0.352	.6146044	1.189079
3	6	.854792	.0611054	-2.19	0.028	.7430392	.9833525
3	8	1.525917	.0930464	6.93	0.000	1.354026	1.71963
3	9	1.128512	.0644074	2.12	0.034	1.00908	1.262079
3	10	1.41403	.0968832	5.06	0.000	1.23634	1.617258
3	11	1.437059	.0660876	7.88	0.000	1.313196	1.572606
3	12	1.060045	.2928225	0.21	0.833	.6168671	1.821615

4 1	1.075767	.1887561	0.42	0.677	.7627189	1.5173
4 2	1.891346	.5289348	2.28	0.023	1.09326	3.272039
4 3	.9598312	.0729799	-0.54	0.590	.826941	1.114077
4 4	1.062365	.1054749	0.61	0.542	.8745085	1.290577
4 5	.844489	.2420946	-0.59	0.555	.4814765	1.481197
4 6	1.082501	.0737989	1.16	0.245	.947105	1.237253
4 8	1.160408	.0991433	1.74	0.082	.9814891	1.371943
4 9	1.182028	.0824742	2.40	0.017	1.030948	1.355249
4 10	1.333362	.1126648	3.40	0.001	1.129859	1.573519
4 11	1.304864	.0737826	4.71	0.000	1.167978	1.457793
4 12	1.141579	.4458244	0.34	0.735	.5309871	2.454304
5 1	1.165298	.22019	0.81	0.418	.8046326	1.687628
5 2	.4379358	.1444396	-2.50	0.012	.2294393	.8358976
5 3	1.529648	.1668339	3.90	0.000	1.235247	1.894216
5 4	1.300616	.244632	1.40	0.162	.8995955	1.880404
5 5	1.104924	.3411954	0.32	0.747	.6032331	2.023855
5 6	1.611713	.218926	3.51	0.000	1.234995	2.103343
5 8	1.366883	.1342941	3.18	0.001	1.127463	1.657146
5 9	1.512011	.1934733	3.23	0.001	1.176623	1.942999
5 10	1.091895	.189611	0.51	0.613	.7769032	1.534598
5 11	1.23476	.1163476	2.24	0.025	1.026541	1.485213
5 12	.3739353	.2717963	-1.35	0.176	.0899699	1.554159
6 1	.8712179	.0615605	-1.95	0.051	.7585437	1.000629
6 2	.9213229	.0826695	-0.91	0.361	.7727416	1.098473
6 3	1.046768	.0399161	1.20	0.231	.9713854	1.128
6 4	1.150675	.0597218	2.70	0.007	1.039379	1.273889
6 5	1.078602	.1109526	0.74	0.462	.8816595	1.319538
6 6	1.06518	.0474071	1.42	0.156	.9762011	1.162269
6 8	1.123202	.0486115	2.68	0.007	1.031855	1.222637
6 9	.911659	.0317621	-2.65	0.008	.8514843	.9760862
6 10	1.102914	.057499	1.88	0.060	.9957849	1.221569
6 11	1.208302	.0384054	5.95	0.000	1.135326	1.28597
6 12	.7261169	.1285228	-1.81	0.071	.5132675	1.027234
_cons	.0441328	.0074071	-18.59	0.000	.0317612	.0613232

3) City as the main exposure:

Logistic regression		Number of obs	=	359612
		Wald chi2(143)	=	10552.20
		Prob > chi2	=	0.0000
Log pseudolikelihood = -110458.94		Pseudo R2	=	0.0574

probacc	Odds Ratio	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
lnvalue	1.104434	.0368237	2.98	0.003	1.034568	1.179017
city						
1	1.378286	.5583851	0.79	0.428	.6230058	3.049205
2	.6354147	.2483619	-1.16	0.246	.29536	1.366982
3	.6236661	.2585179	-1.14	0.255	.2767691	1.405357
4	1.662156	1.03181	0.82	0.413	.4923509	5.611368
5	1.364418	.8775239	0.48	0.629	.3868103	4.812788
6	1	(omitted)				
city#c.lnvalue						
1	.9379764	.0353147	-1.70	0.089	.871253	1.00981
2	1.053723	.0382975	1.44	0.150	.9812725	1.131523
3	1.055386	.0408278	1.39	0.163	.9783229	1.138518
4	.9590687	.0556962	-0.72	0.472	.8558896	1.074686
5	.975601	.0566148	-0.43	0.670	.8707157	1.093121
6	1	(omitted)				
city#years						
1 1	1.620122	.0527256	14.83	0.000	1.520009	1.72683
1 3	.4095353	.0255204	-14.33	0.000	.3624502	.4627372
2 1	1.349851	.0365669	11.07	0.000	1.280051	1.423458
2 3	.3965909	.0227119	-16.15	0.000	.3544838	.4436997
3 1	1.583332	.0794081	9.16	0.000	1.435099	1.746875
3 3	.5037246	.0355476	-9.72	0.000	.4386563	.5784449
4 1	1.315833	.094931	3.80	0.000	1.142328	1.515692
4 3	.3684469	.0571389	-6.44	0.000	.2718755	.4993208
5 1	1.757118	.1639918	6.04	0.000	1.463384	2.109811
5 3	.856458	.1344025	-0.99	0.323	.6296924	1.164887
6 1	1.372075	.0922229	4.71	0.000	1.202721	1.565275
6 3	.5090417	.0537043	-6.40	0.000	.4139528	.6259733

city#type						
1 2	.7043207	.0273594	-9.02	0.000	.6526878	.7600381
1 3	.7740257	.0234739	-8.45	0.000	.7293583	.8214285
1 4	.2340224	.0124767	-27.24	0.000	.2108027	.2597997
1 5	.2512435	.0132086	-26.27	0.000	.2266441	.2785128
2 2	.6111539	.0173969	-17.30	0.000	.5779904	.6462203
2 3	.7412017	.0180232	-12.32	0.000	.7067054	.7773817
2 4	.2827365	.0111061	-32.16	0.000	.2617857	.305364
2 5	.2962165	.0128273	-28.10	0.000	.2721128	.3224552
3 2	.6527936	.033686	-8.26	0.000	.5899994	.7222711
3 3	.7707278	.0310238	-6.47	0.000	.7122591	.8339962
3 4	.2374276	.0174945	-19.51	0.000	.2054999	.2743156
3 5	.234506	.0154023	-22.08	0.000	.2061804	.2667231
4 2	.4990753	.0420652	-8.25	0.000	.423079	.5887226
4 3	.7128262	.0535409	-4.51	0.000	.6152466	.8258821
4 4	.1732823	.0208862	-14.54	0.000	.1368221	.2194582
4 5	.0773016	.0116238	-17.03	0.000	.0575697	.1037965
5 2	.5670718	.0708522	-4.54	0.000	.4439004	.7244202
5 3	.6695172	.0798038	-3.37	0.001	.5300317	.8457103
5 4	.3004247	.0437178	-8.26	0.000	.2258753	.3995788
5 5	.0388007	.0090938	-13.86	0.000	.0245099	.0614239
6 2	.5569772	.0449397	-7.25	0.000	.4755085	.652404
6 3	.5900401	.046236	-6.73	0.000	.5060352	.6879904
6 4	.2439088	.026594	-12.94	0.000	.1969785	.3020203
6 5	.0794196	.009459	-21.27	0.000	.0628852	.1003013

city#brandf

1 2	1.15359	.0452955	3.64	0.000	1.068142	1.245873
1 3	1.146882	.0480604	3.27	0.001	1.05645	1.245055
1 4	1.220912	.0570743	4.27	0.000	1.11402	1.33806
1 5	.9950137	.0559319	-0.09	0.929	.8912123	1.110905
1 6	1.135191	.0383417	3.75	0.000	1.062475	1.212882
2 2	1.14457	.0301504	5.13	0.000	1.086976	1.205216
2 3	1.05586	.0303831	1.89	0.059	.9979579	1.117121
2 4	1.148631	.0363731	4.38	0.000	1.079508	1.22218
2 5	.7994036	.0388375	-4.61	0.000	.7267953	.8792656
2 6	1.008036	.0248204	0.33	0.745	.9605442	1.057876
3 2	1.048113	.0559102	0.88	0.378	.9440651	1.163629
3 3	1.160638	.0585861	2.95	0.003	1.051309	1.281337
3 4	1.063594	.0678944	0.97	0.334	.938511	1.205347
3 5	.9450975	.0859694	-0.62	0.535	.7907666	1.129548
3 6	.9917146	.0439083	-0.19	0.851	.9092842	1.081618
4 2	1.066164	.0855639	0.80	0.425	.9109859	1.247775
4 3	1.193557	.115838	1.82	0.068	.9868058	1.443626
4 4	1.246419	.1154046	2.38	0.017	1.039566	1.494431
4 5	1.297312	.2152192	1.57	0.117	.9372024	1.79579
4 6	1.329193	.1105826	3.42	0.001	1.129204	1.564603
5 2	.9820385	.1158415	-0.15	0.878	.7793286	1.237475
5 3	.8642758	.1134831	-1.11	0.267	.6681685	1.117941
5 4	.971458	.1535556	-0.18	0.855	.7126512	1.324253
5 5	.7220077	.2242802	-1.05	0.294	.3927622	1.327254
5 6	.8606321	.0966653	-1.34	0.181	.6905761	1.072565
6 2	1.107445	.0672178	1.68	0.093	.983235	1.247346
6 3	1.381535	.1056618	4.23	0.000	1.189216	1.604956
6 4	1.34934	.1113322	3.63	0.000	1.147862	1.586181
6 5	.2254155	.0567384	-5.92	0.000	.1376359	.3691783
6 6	.900005	.0631652	-1.50	0.133	.7843409	1.032726

city#color

1	1	1.300707	.0876207	3.90	0.000	1.139827	1.484293
1	2	1.182226	.1064458	1.86	0.063	.9909679	1.410397
1	3	1.268888	.0528068	5.72	0.000	1.169497	1.376726
1	4	1.302815	.0764935	4.51	0.000	1.161195	1.461707
1	5	1.130964	.149145	0.93	0.351	.8733679	1.464537
1	6	1.114599	.056286	2.15	0.032	1.009564	1.230562
1	8	1.44446	.0670944	7.92	0.000	1.318766	1.582135
1	9	1.182175	.0492722	4.02	0.000	1.089443	1.282801
1	10	1.400411	.0758249	6.22	0.000	1.259411	1.557197
1	11	1.495072	.0530829	11.33	0.000	1.394569	1.602818
1	12	1.575494	.3865402	1.85	0.064	.9740432	2.548327
2	1	1.120726	.0720811	1.77	0.076	.9879918	1.271293
2	2	1.155253	.1086651	1.53	0.125	.9607529	1.389129
2	3	1.020557	.0354962	0.59	0.559	.9533042	1.092555
2	4	1.148071	.0486198	3.26	0.001	1.056625	1.24743
2	5	1.145784	.1174452	1.33	0.184	.9372444	1.400724
2	6	1.065865	.0369475	1.84	0.066	.9958545	1.140798
2	8	1.209947	.0416498	5.54	0.000	1.131008	1.294396
2	9	.9237921	.0313607	-2.34	0.020	.8643265	.9873489
2	10	1.169688	.0436879	4.20	0.000	1.087121	1.258527
2	11	1.242577	.0297762	9.06	0.000	1.185566	1.302329
2	12	.4570011	.0635727	-5.63	0.000	.3479429	.6002422
3	1	1.311171	.1370779	2.59	0.010	1.068242	1.609345
3	2	1.286663	.1845874	1.76	0.079	.9712918	1.704434
3	3	1.099503	.0631152	1.65	0.098	.9825049	1.230434
3	4	1.283324	.0947432	3.38	0.001	1.11044	1.483124
3	5	1.027474	.1842056	0.15	0.880	.723048	1.460072
3	6	1.075312	.0697363	1.12	0.263	.9469614	1.221059
3	8	1.312956	.0848909	4.21	0.000	1.156684	1.490342
3	9	.9960451	.0574859	-0.07	0.945	.8895137	1.115335
3	10	1.206184	.0860561	2.63	0.009	1.048779	1.387213
3	11	1.273986	.0601229	5.13	0.000	1.161433	1.397447
3	12	1.301478	.3679518	0.93	0.351	.7478022	2.265099

4	1	.7433162	.117522	-1.88	0.061	.5452485	1.013334
4	2	2.279638	.5011855	3.75	0.000	1.481585	3.507561
4	3	1.389193	.140566	3.25	0.001	1.139287	1.693915
4	4	1.422478	.2038853	2.46	0.014	1.074093	1.883863
4	5	1.506544	.3695078	1.67	0.095	.9315557	2.436434
4	6	1.230449	.1287973	1.98	0.048	1.002222	1.510648
4	8	1.432367	.1638857	3.14	0.002	1.144625	1.792444
4	9	1.193854	.1048079	2.02	0.044	1.005136	1.418005
4	10	1.516469	.1901683	3.32	0.001	1.186017	1.938991
4	11	1.60095	.1198046	6.29	0.000	1.382545	1.853856
4	12	1.902833	1.102753	1.11	0.267	.6110855	5.92515
5	1	.68928	.2110495	-1.22	0.224	.3782402	1.256098
5	2	1.397113	.3880969	1.20	0.229	.8105519	2.408144
5	3	1.488731	.2237385	2.65	0.008	1.108896	1.998672
5	4	1.315304	.2953658	1.22	0.222	.8469928	2.04255
5	5	1.128078	.4613202	0.29	0.768	.5061108	2.514389
5	6	1.171247	.2045819	0.90	0.365	.8317047	1.649408
5	8	1.440974	.2536291	2.08	0.038	1.02055	2.034595
5	9	1.480169	.1761622	3.30	0.001	1.172211	1.869033
5	10	2.009848	.3172894	4.42	0.000	1.47498	2.738673
5	11	1.750786	.190055	5.16	0.000	1.415245	2.165881
5	12	1.684507	.8999434	0.98	0.329	.5911814	4.79982
6	1	1.415335	.1712668	2.87	0.004	1.116496	1.794161
6	2	1.105959	.2252997	0.49	0.621	.7418858	1.648697
6	3	1.146863	.0942707	1.67	0.096	.976211	1.347346
6	4	1.275363	.1444478	2.15	0.032	1.021472	1.592359
6	5	1.155511	.3373621	0.50	0.621	.6520158	2.047813
6	6	1.386525	.1169878	3.87	0.000	1.175189	1.635866
6	8	1.600308	.1570044	4.79	0.000	1.320363	1.939608
6	9	1.060394	.0784597	0.79	0.428	.9172462	1.225882
6	10	1.254522	.1368929	2.08	0.038	1.012967	1.553678
6	11	1.456411	.1008625	5.43	0.000	1.271554	1.668143
6	12	.4868417	.3608074	-0.97	0.331	.113906	2.080794
_cons		.0576116	.0205904	-7.99	0.000	.028595	.1160727

