olist

A LOOK AT CUSTOMER LIFETIME VALUE

Rachelle Perez

December 2019

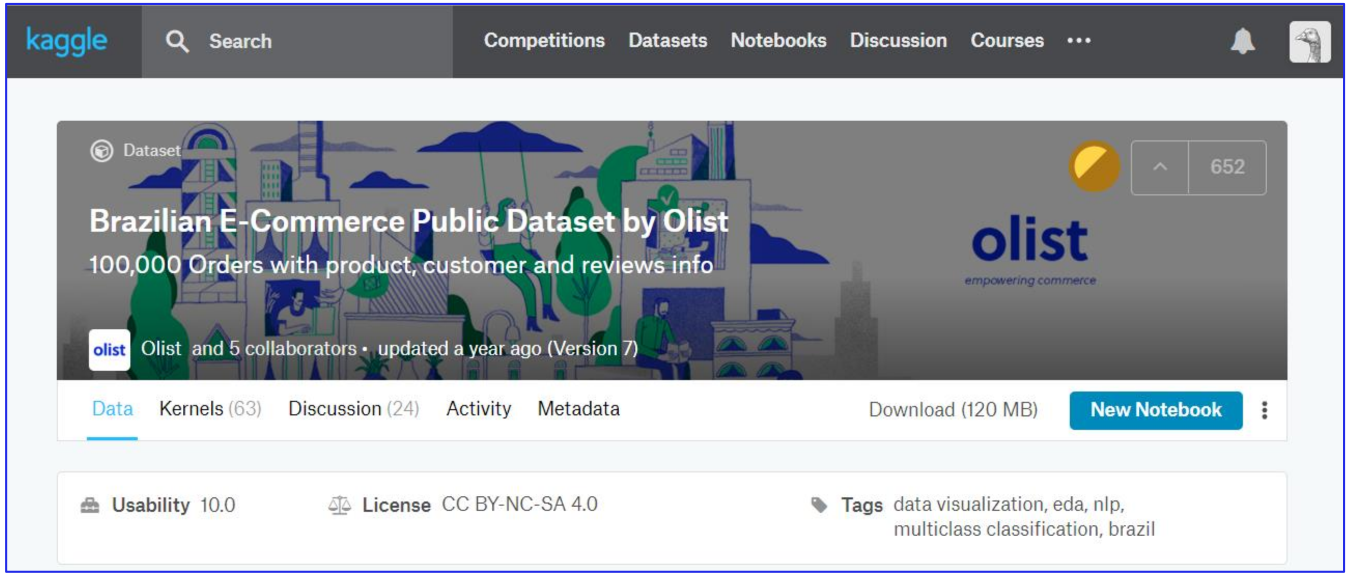
WHO IS OLIST?

- **E-Commerce** business
- Small business merchants ("sellers") **sell their products** to customers through Olist and **ship them directly** to customer **using Olist logistics partners** ("carrier")
- olist.com

PROBLEM: What **factors** affect 6-month Customer Lifetime Value (LTV)?

DATA AVAILABLE

SOURCE



Brazilian E-Commerce Public Dataset by Olist

100,000 Orders with product, customer and reviews info

olist Olist and 5 collaborators • updated a year ago (Version 7)

Usability 10.0 License CC BY-NC-SA 4.0 Tags data visualization, eda, nlp, multiclass classification, brazil

kaggle.com/olistbr/brazilian-ecommerce

towardsdatascience.com/

DATE RANGE

9/4/2016 - 8/29/2018

MAIN TABLES

99,441 Orders

96,096 Customers

SUPPORTING TABLES

Order Items

Products

Sellers

Payments

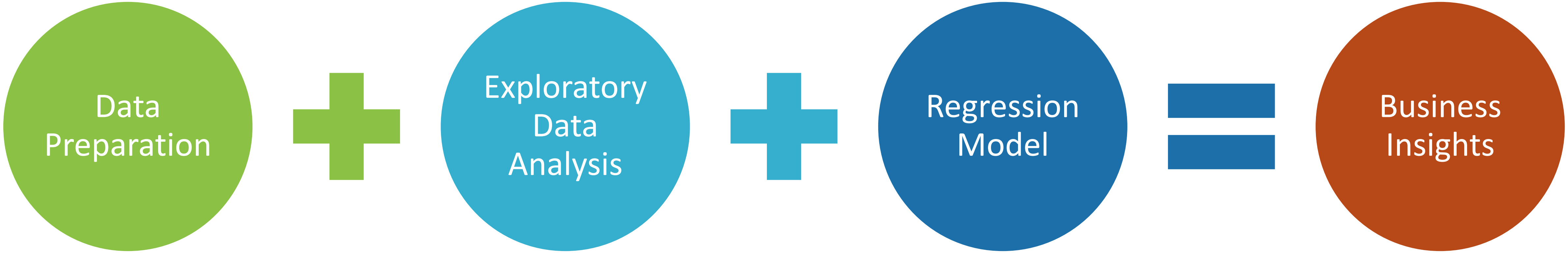
Reviews

REFERENCE TABLES

Geolocation

Product Category Translations

PROJECT STEPS



Data Preparation

Exploratory Data Analysis

Regression Model

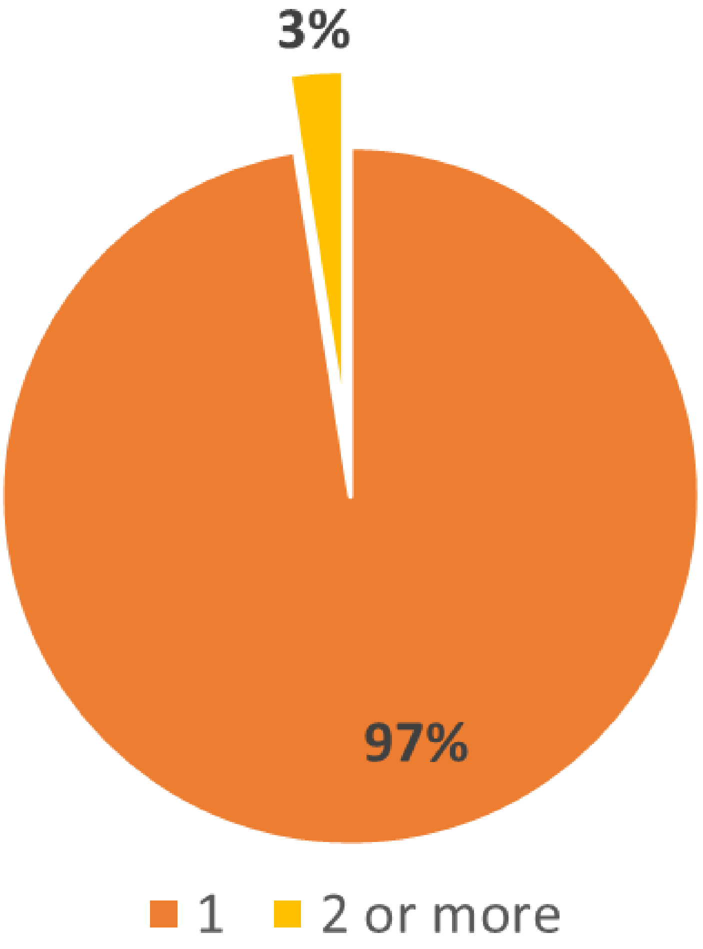
Business Insights

BUSINESS INSIGHTS

What is the overall state of the business?

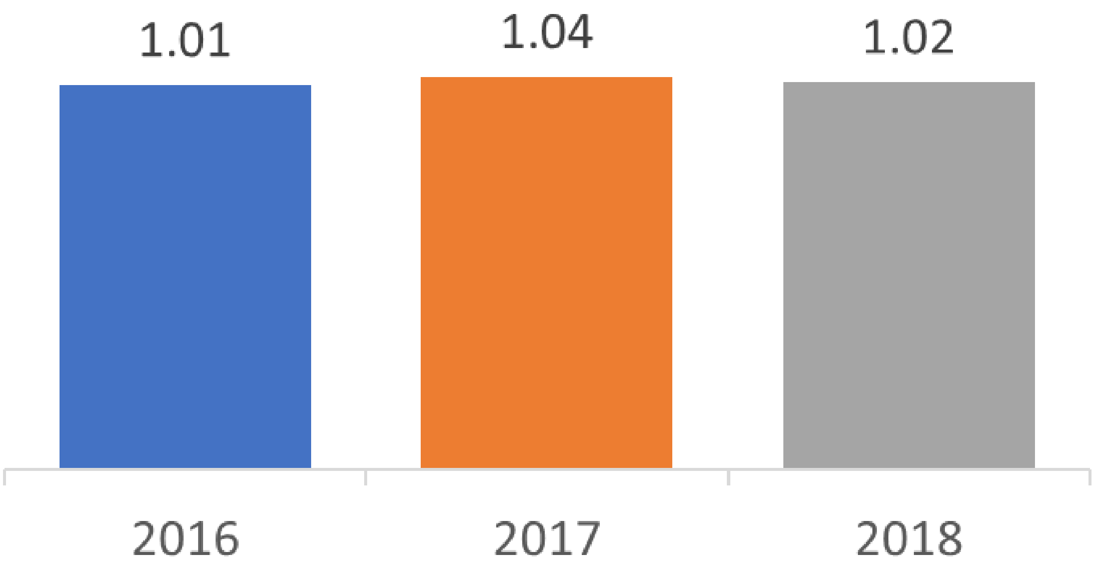
HOW OFTEN CUSTOMERS CHURN?

Customers split by 1 order vs. 2+ orders



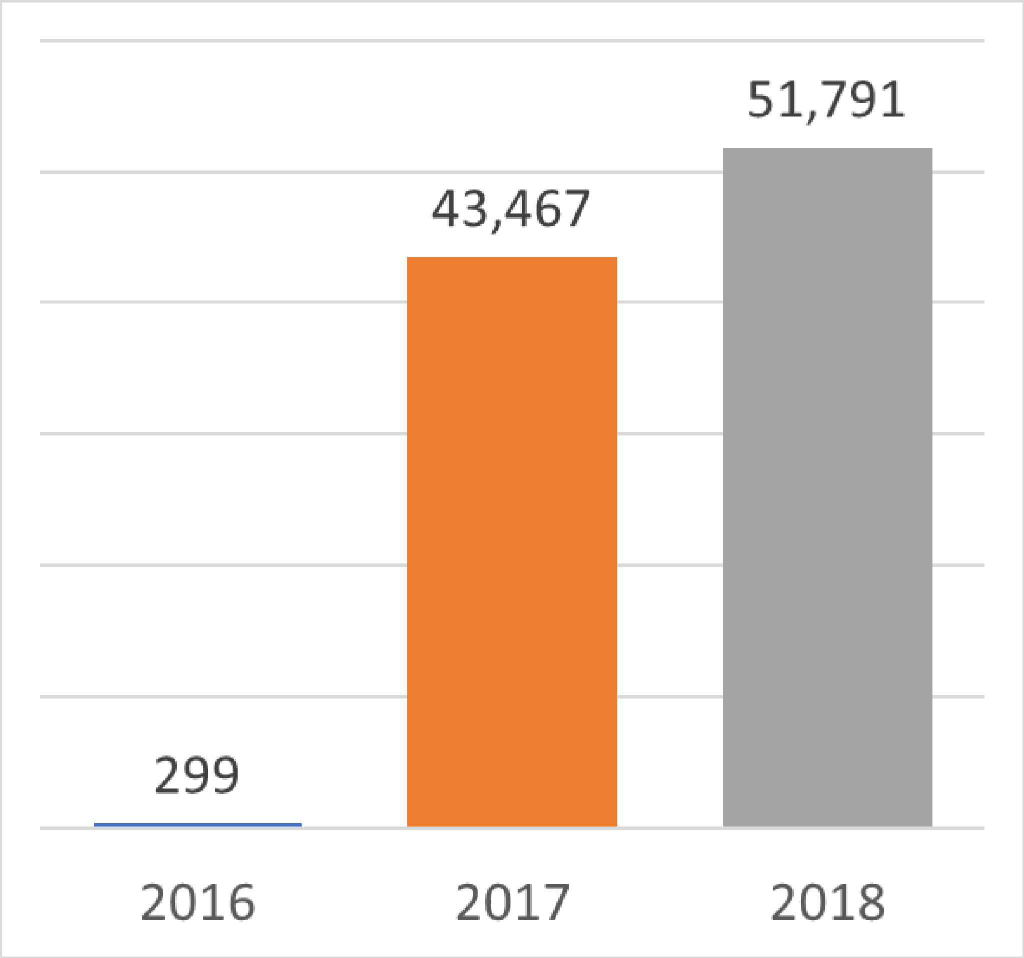
- **97%** new customers churn (they make only 1 order)
- **1 order per customer** has been a consistent pattern across the years.

Average Number of Orders per Customer



HOW IS CUSTOMER ACQUISITION (I)?

Number of NEW Customers Per Year

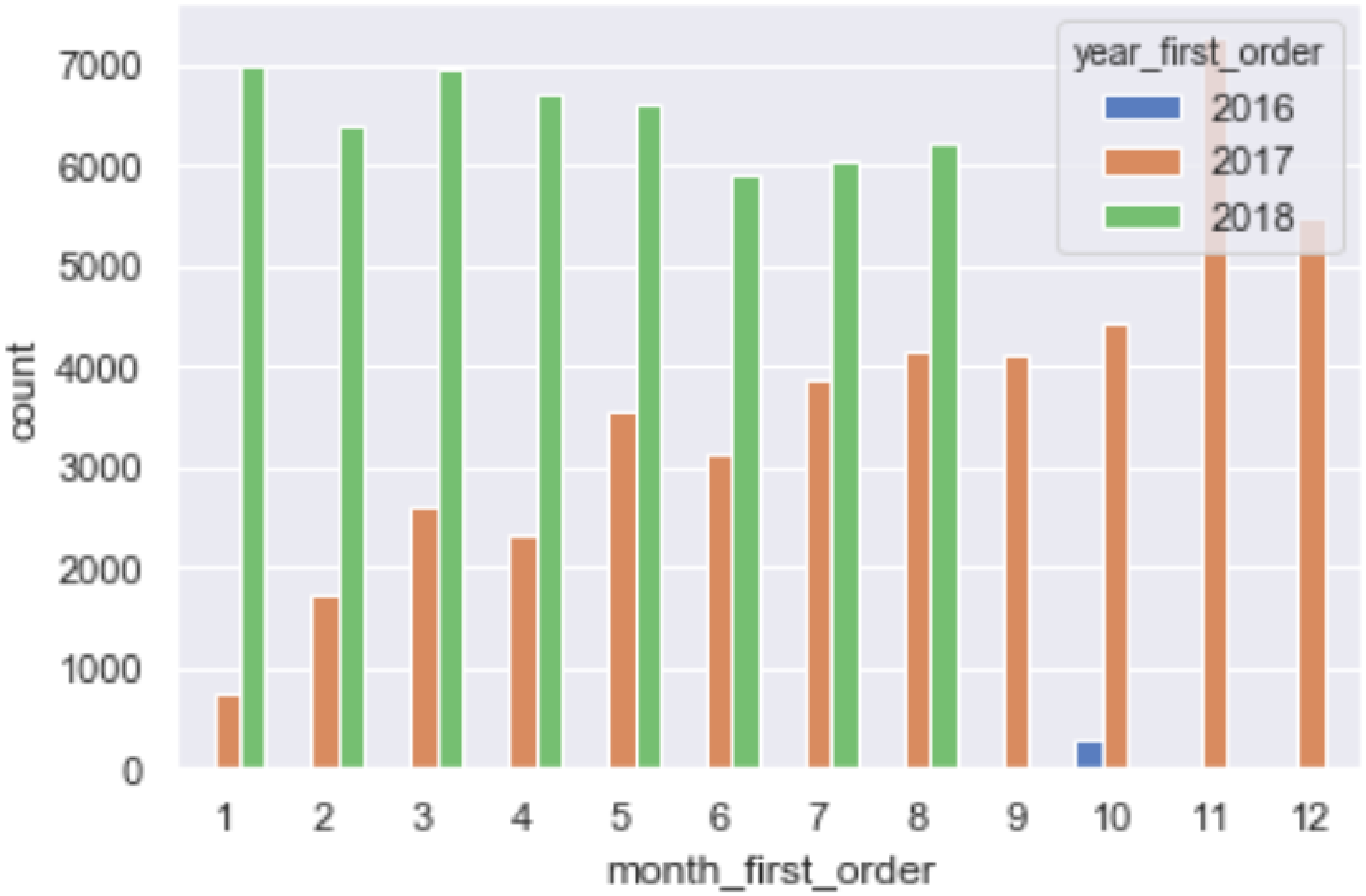


- **Positive trend** in customer acquisition
- 2018 is already **19% up** (despite only 8 months of data)

Does this paint the whole picture?

HOW IS CUSTOMER ACQUISITION (II)?

Number of NEW Customers by Month & Year

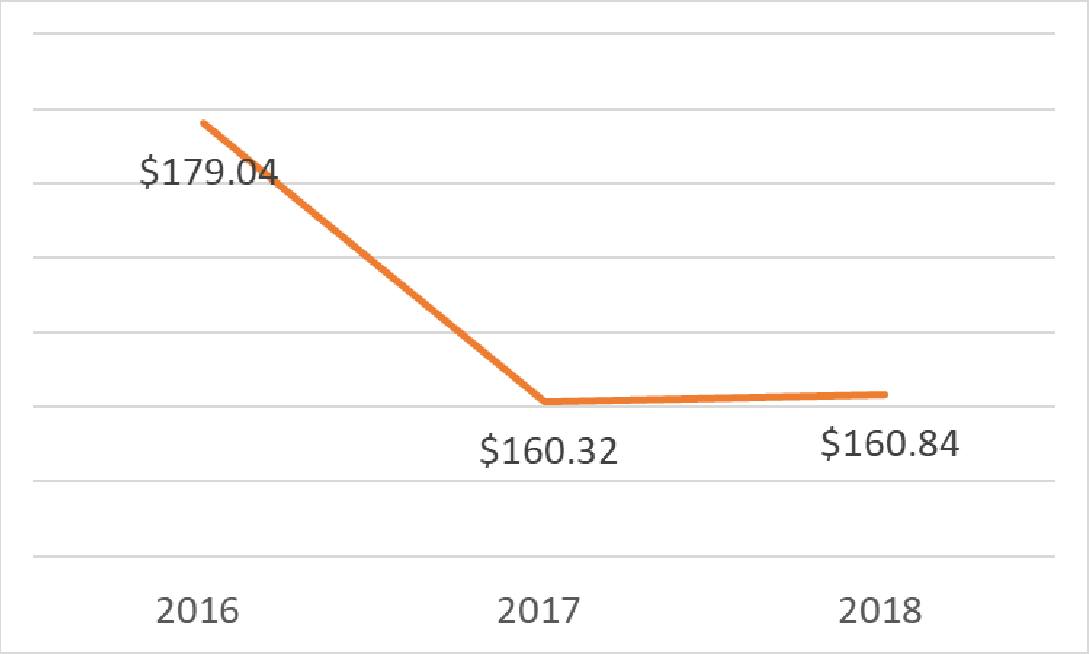


- 2017 (Orange) had a positive monthly trend in customer acquisition
- Despite total new customers up year on year, 2018 (Green) shows a **flat monthly trend** so far

WHAT IS IN AN ORDER?

PAYMENT PER ORDER

Average paid per order, by year



ORDER ITEMS PER ORDER

Average number of items per order

1.14

- Total payments per order is trending mostly **flat.**
- Number of items in one order **stagnant** at around 1 items per order.

WHAT IS GOING ON?

New customers only make 1 order and churn

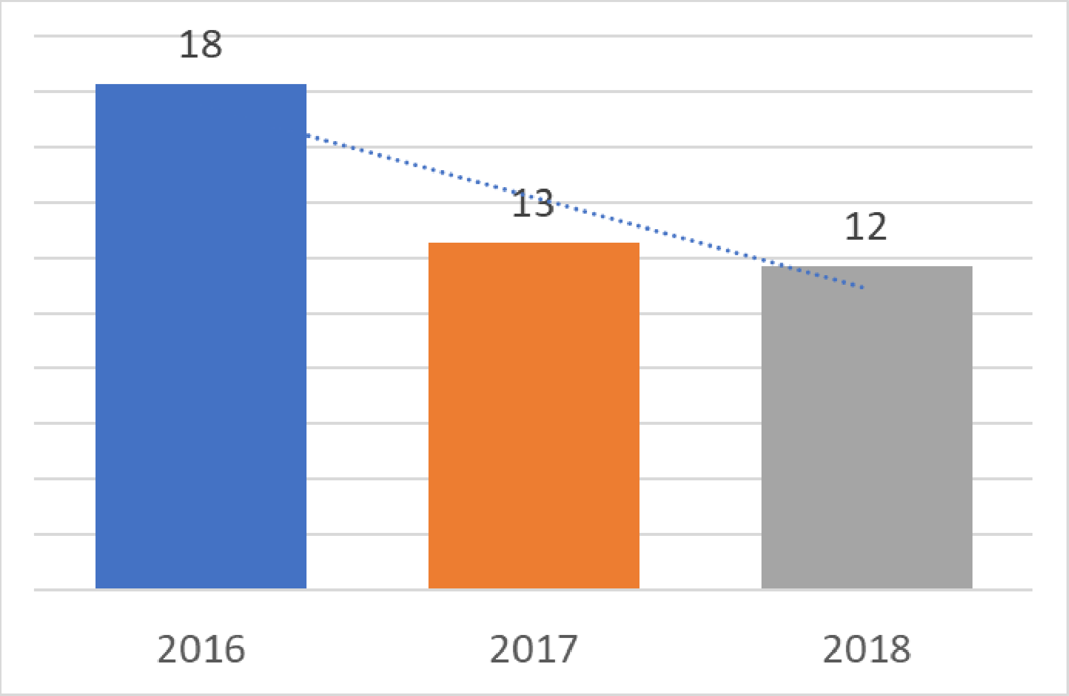
Despite this, company will grow if customer base is growing… but it is stalling

Revenue per order and the number of items in per order are also stagnant.

OPERATIONS REVIEW

LEAD

Average Lead Time per customer, YOY



Average Review Score (Scale 1-5)

4.08

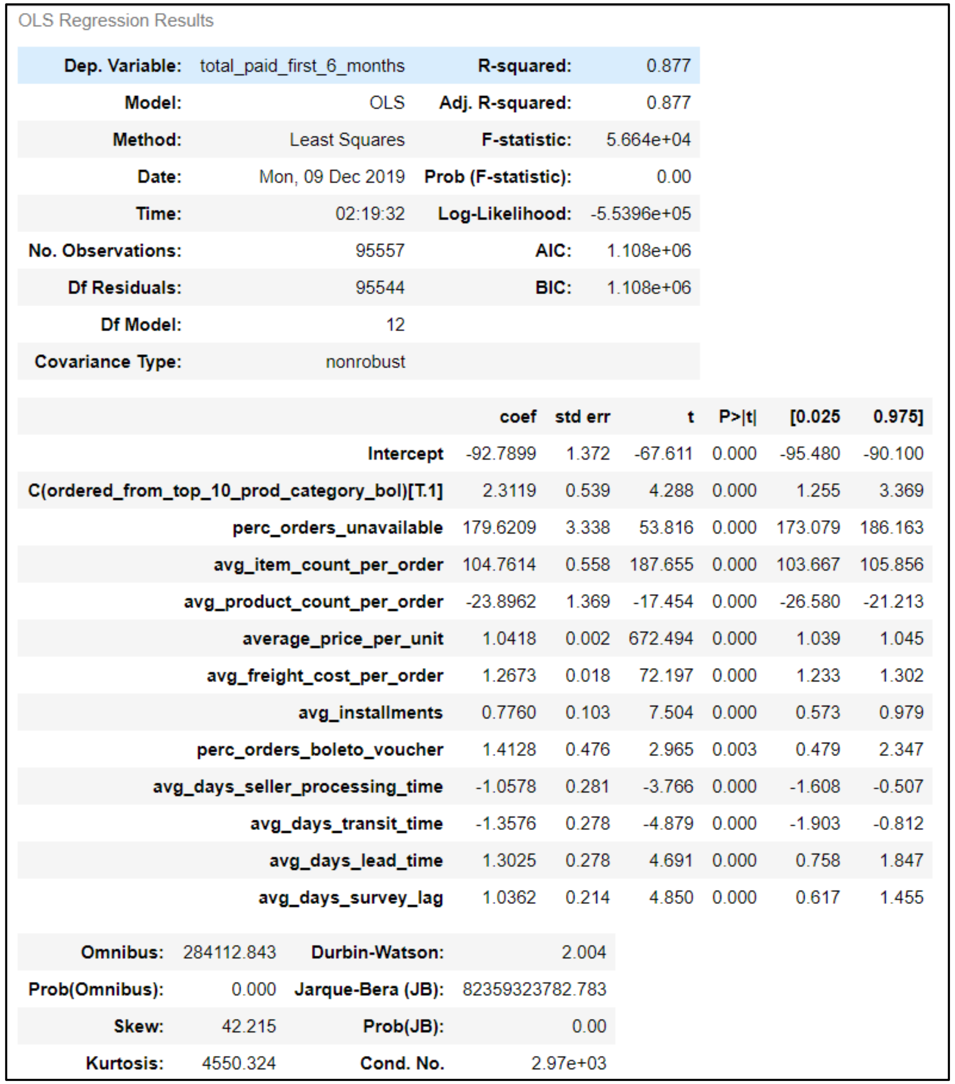
- Lead Time = Time interval between order and delivery
- Lead time is trending **down.** Customer are getting their orders faster than ever.
- Average review score is **high** and continues to trend positively

REGRESSION MODEL (based on Customers)

PROCESS

- What are we looking to explain? – **6-month Customer Lifetime Value (LTV)**
- Selected 17 possible factors to test for
- Entered into Model
- Interpreted Results

RESULTS



OLS Regression Results

Dep. Variable:	total_paid_first_6_months	**R-squared:**	0.877
Model:	OLS	**Adj. R-squared:**	0.877
Method:	Least Squares	**F-statistic:**	5.664e+04
Date:	Mon, 09 Dec 2019	**Prob (F-statistic):**	0.00
Time:	02:19:32	**Log-Likelihood:**	-5.5396e+05
No. Observations:	95557	**AIC:**	1.108e+06
Df Residuals:	95544	**BIC:**	1.108e+06
Df Model:	12		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Intercept	-92.7899	1.372	-67.611	0.000	-95.480	-90.100
C(ordered_from_top_10_prod_category_bol)[T.1]	2.3119	0.539	4.288	0.000	1.255	3.369
perc_orders_unavailable	179.6209	3.338	53.816	0.000	173.079	186.163
avg_item_count_per_order	104.7614	0.558	187.655	0.000	103.667	105.856
avg_product_count_per_order	-23.8962	1.369	-17.454	0.000	-26.580	-21.213
average_price_per_unit	1.0418	0.002	672.494	0.000	1.039	1.045
avg_freight_cost_per_order	1.2673	0.018	72.197	0.000	1.233	1.302
avg_installments	0.7760	0.103	7.504	0.000	0.573	0.979
perc_orders_boleto_voucher	1.4128	0.476	2.965	0.003	0.479	2.347
avg_days_seller_processing_time	-1.0578	0.281	-3.766	0.000	-1.608	-0.507
avg_days_transit_time	-1.3576	0.278	-4.879	0.000	-1.903	-0.812
avg_days_lead_time	1.3025	0.278	4.691	0.000	0.758	1.847
avg_days_survey_lag	1.0362	0.214	4.850	0.000	0.617	1.455

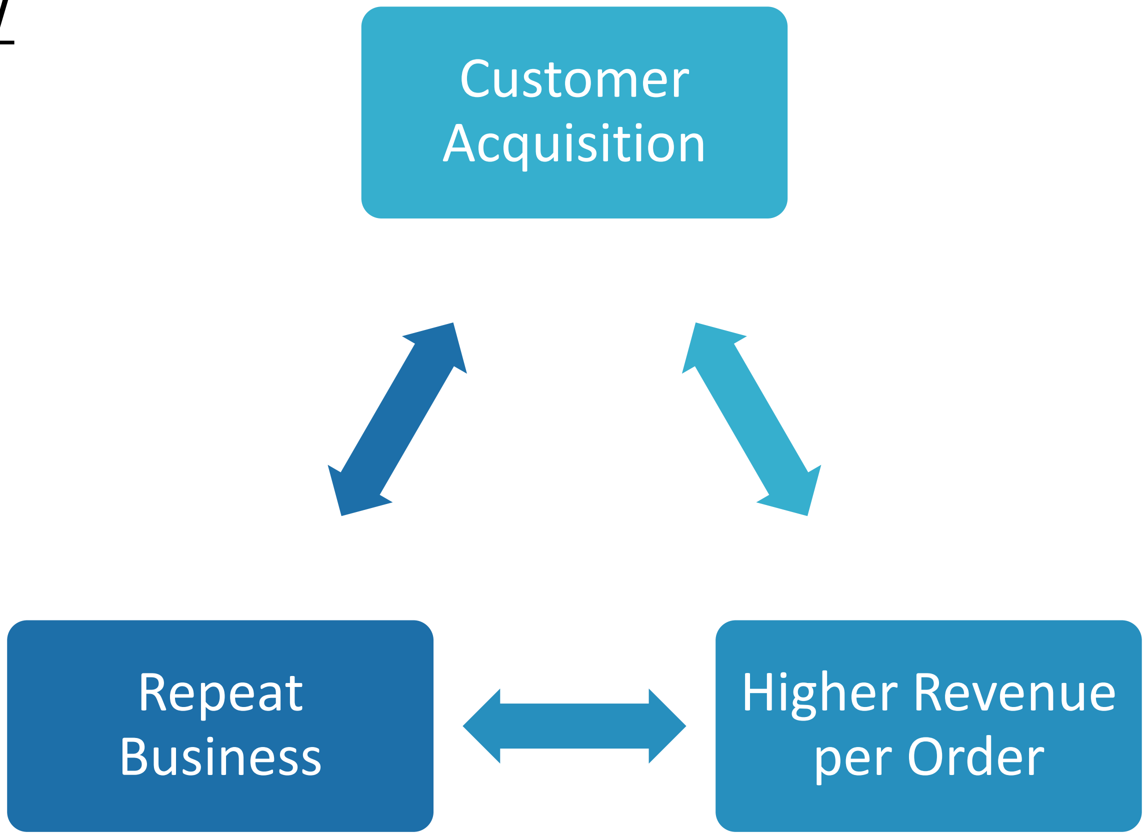
Omnibus:	284112.843	**Durbin-Watson:**	2.004
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	82359323782.783
Skew:	42.215	**Prob(JB):**	0.00
Kurtosis:	4550.324	**Cond. No.**	2.97e+03

REGRESSION MODEL (Results to note)

No Significance	Significant + Positive Correlation	Significant + Negative Correlation
Month customer acquired % orders shipped late % orders from sellers with perfect review	% orders from top 10 categories # payment installments % orders paid with boleto or voucher	Seller Processing Time Transit Time

INITIAL RECOMMENDATIONS

MARKETING STRATEGY REVIEW



Customer Acquisition

Repeat Business

Higher Revenue per Order

INVENTORY REVIEW

- 63% of customers order from your **top 10 categories**, despite having 71 available.
- Is this intentional?
- Should Olist consider focusing on those?

POTENTIAL NEXT STEPS FOR PROJECT

- Churn Rate or Survival Analysis
- Customer Segmentation
- Logistics Audit
- Content Review (NLP)
- Sentiment Analysis
- Seller Patterns
- Inventory Review

TOOLS USED:

- Postgres SQL
- Python:

  Pandas, Numpy, Matplotlib, Statsmodel, Seaborn, Scipy

MORE INFORMATION ON THIS PROJECT:

- Appendix
  - Data Preparation
  - Model Optimization
- github.com/rachelleaperez
- linkedin.com/in/rachelleperez/

THANK YOU

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APPENDIX TO:
A LOOK AT CUSTOMER LIFETIME VALUE

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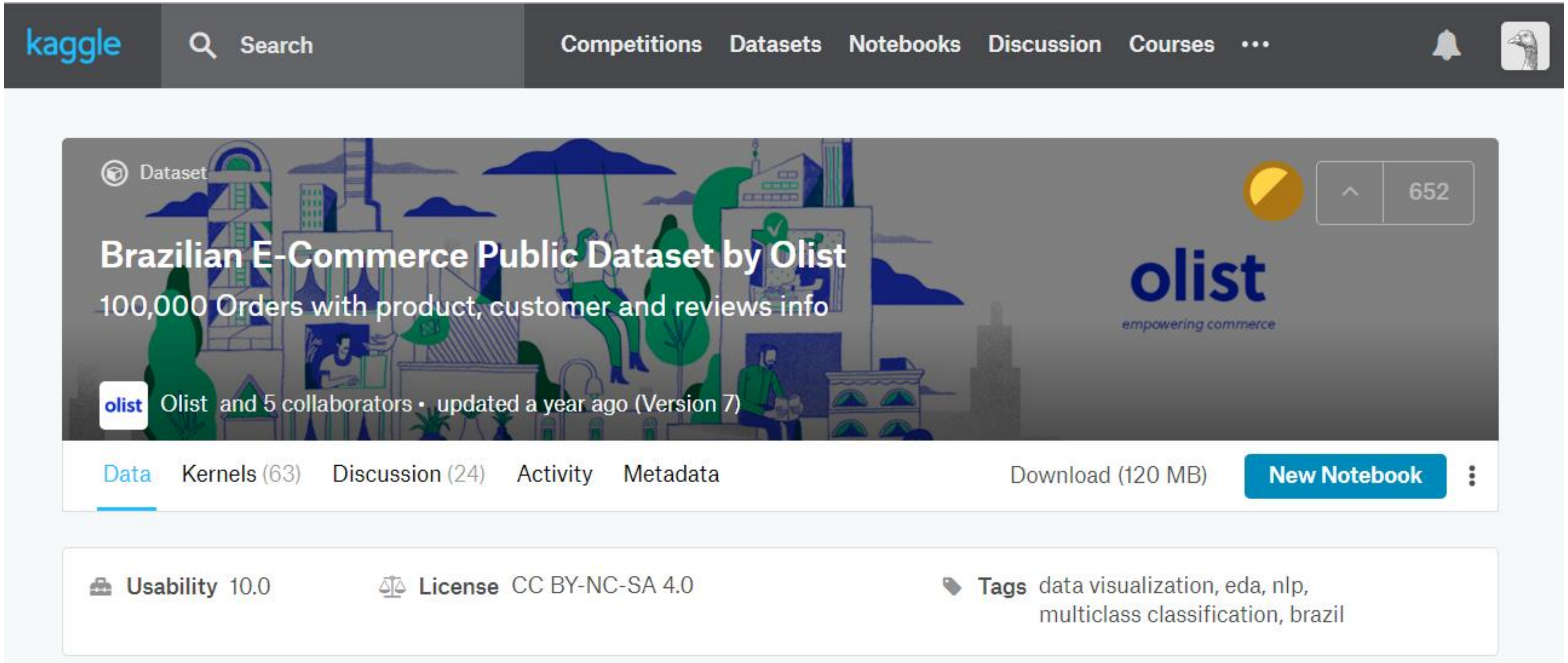
DATA PREPARATION

What data do we have to address the problem?

DATA SOURCE



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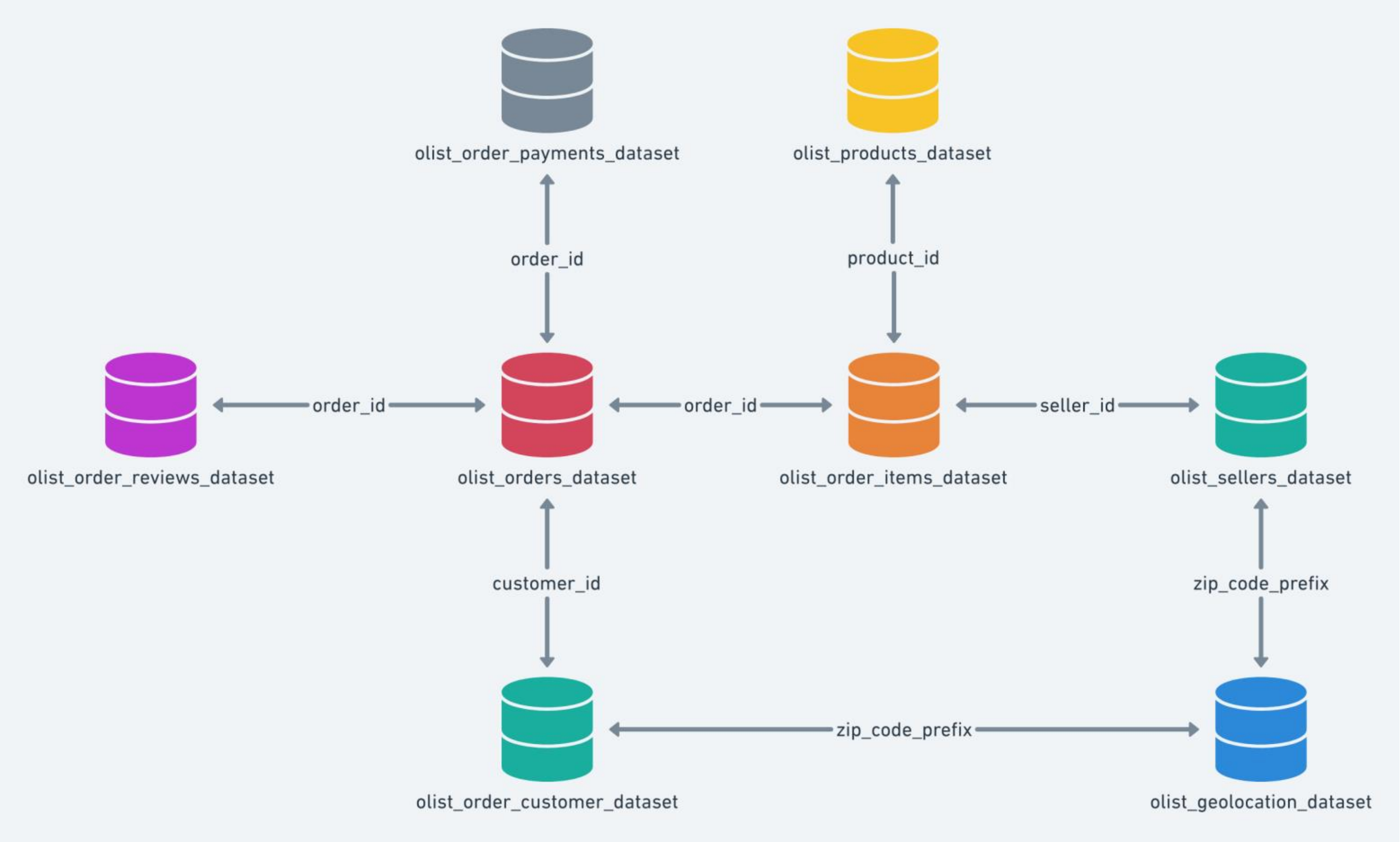
https://www.kaggle.com/olistbr/brazilian-ecommerce

DATA PREVIEW

SCHEMA



INCLUDES

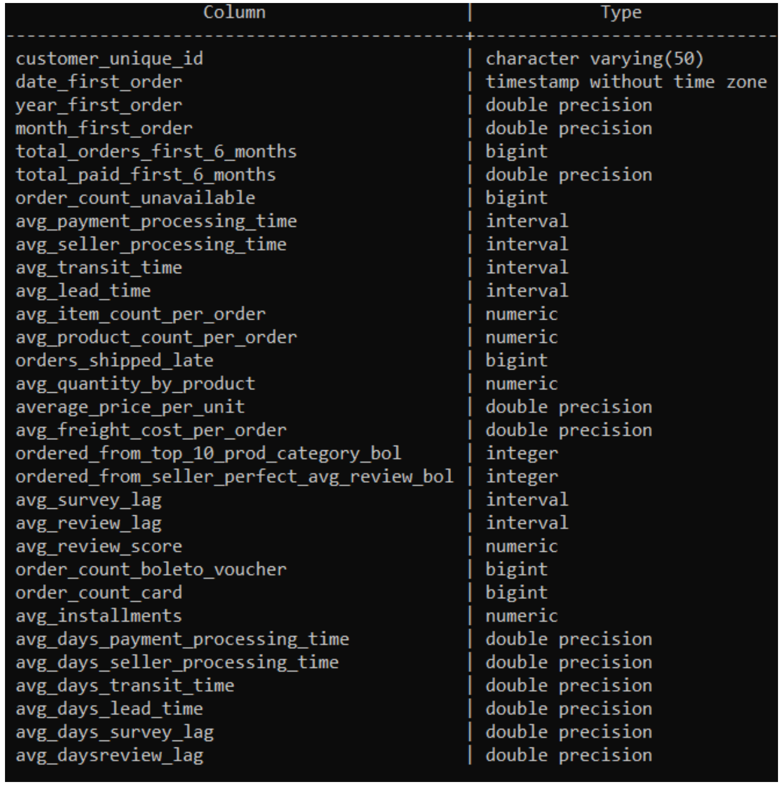
- Date Range: 9/4/2016 – 8/29/2018
- 96,096 Customers
- 99,441 Orders
- 32,951 Unique Products
- 3,095 Sellers

CHALLENGES

- Dependent variable (LTV) by customer and the only customer variables given are city, state, and zip. Aggregates must be created
- Aggregates are difficult as 1) Schema not linear 2) data is split for each **customer**, each **order** per customer, each **product** per order, and each **item** per product

DATA CLEANING

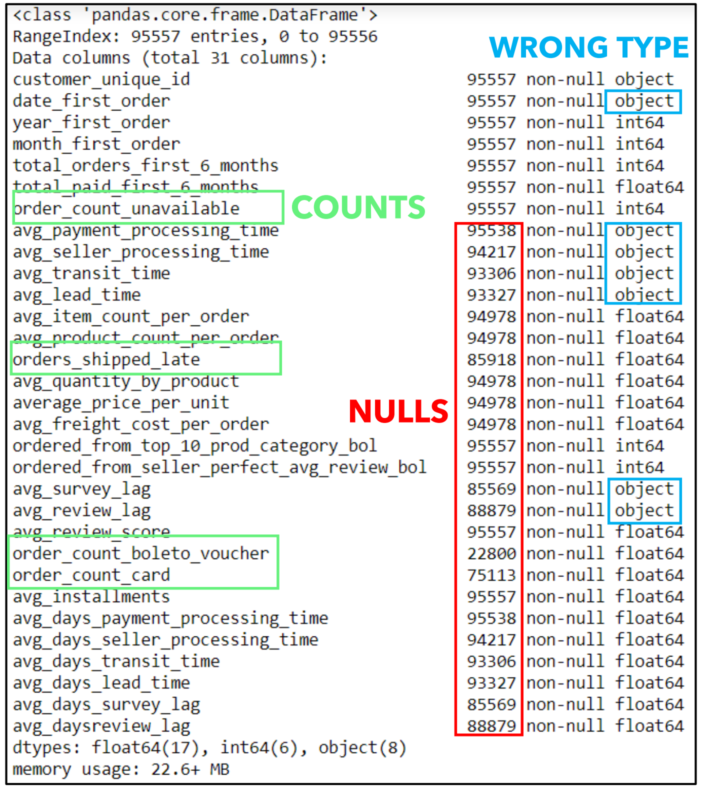
POSTGRESQL



```
                 Column                  |            Type
-----------------------------------------+-----------------------------
 customer_unique_id                      | character varying(50)
 date_first_order                        | timestamp without time zone
 year_first_order                        | double precision
 month_first_order                       | double precision
 total_orders_first_6_months             | bigint
 total_paid_first_6_months               | double precision
 order_count_unavailable                 | bigint
 avg_payment_processing_time             | interval
 avg_seller_processing_time              | interval
 avg_transit_time                        | interval
 avg_lead_time                           | interval
 avg_item_count_per_order                | numeric
 avg_product_count_per_order             | numeric
 orders_shipped_late                     | bigint
 avg_quantity_by_product                 | numeric
 average_price_per_unit                  | double precision
 avg_freight_cost_per_order              | double precision
 ordered_from_top_10_prod_category_bol   | integer
 ordered_from_seller_perfect_avg_review_bol | integer
 avg_survey_lag                          | interval
 avg_review_lag                          | interval
 avg_review_score                        | numeric
 order_count_boleto_voucher              | bigint
 order_count_card                        | bigint
 avg_installments                        | numeric
 avg_days_payment_processing_time        | double precision
 avg_days_seller_processing_time         | double precision
 avg_days_transit_time                   | double precision
 avg_days_lead_time                      | double precision
 avg_days_survey_lag                     | double precision
 avg_daysreview_lag                      | double precision
```

- Create dataframe with aggregates
- Remove cancelled orders & orders not from customer's first 6 months

PYTHON

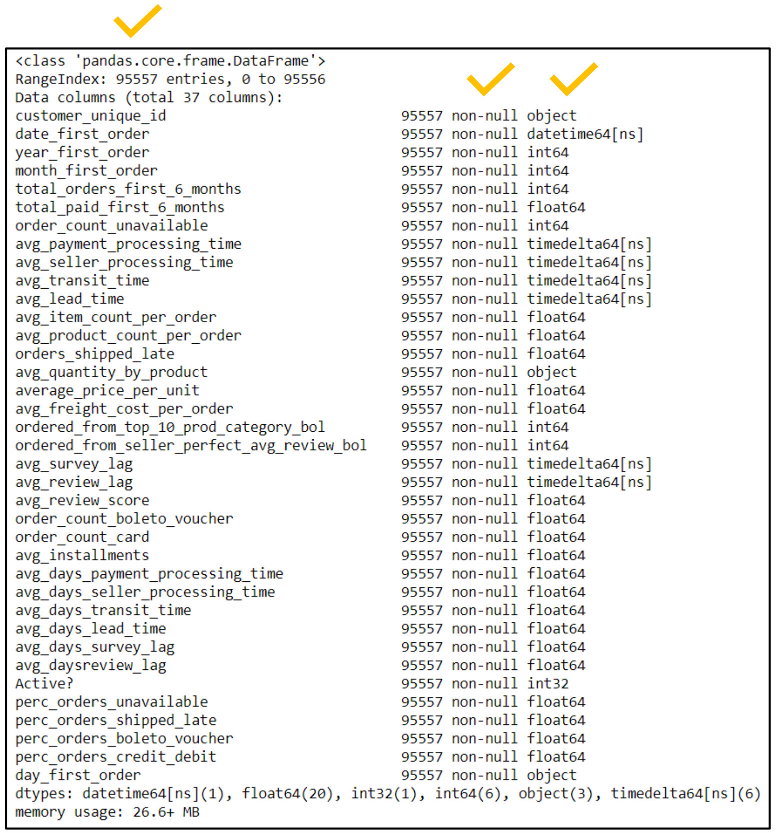


WRONG TYPE

COUNTS

NULLS

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 95557 entries, 0 to 95556
Data columns (total 31 columns):
customer_unique_id                          95557 non-null object
date_first_order                            95557 non-null object
year_first_order                            95557 non-null int64
month_first_order                           95557 non-null int64
total_orders_first_6_months                 95557 non-null int64
total_paid_first_6_months                   95557 non-null float64
order_count_unavailable                     95557 non-null int64
avg_payment_processing_time                 95538 non-null object
avg_seller_processing_time                  94217 non-null object
avg_transit_time                            93306 non-null object
avg_lead_time                               93327 non-null object
avg_item_count_per_order                    94978 non-null float64
avg_product_count_per_order                 94978 non-null float64
orders_shipped_late                         85918 non-null float64
avg_quantity_by_product                     94978 non-null float64
average_price_per_unit                      94978 non-null float64
avg_freight_cost_per_order                  94978 non-null float64
ordered_from_top_10_prod_category_bol       95557 non-null int64
ordered_from_seller_perfect_avg_review_bol  95557 non-null int64
avg_survey_lag                              85569 non-null object
avg_review_lag                              88879 non-null object
avg_review_score                            95557 non-null float64
order_count_boleto_voucher                  22800 non-null float64
order_count_card                            75113 non-null float64
avg_installments                            95557 non-null float64
avg_days_payment_processing_time            95538 non-null float64
avg_days_seller_processing_time             94217 non-null float64
avg_days_transit_time                       93306 non-null float64
avg_days_lead_time                          93327 non-null float64
avg_days_survey_lag                         85569 non-null float64
avg_daysreview_lag                          88879 non-null float64
dtypes: float64(17), int64(6), object(8)
memory usage: 22.6+ MB
```



```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 95557 entries, 0 to 95556
Data columns (total 37 columns):
customer_unique_id                          95557 non-null object
date_first_order                            95557 non-null datetime64[ns]
year_first_order                            95557 non-null int64
month_first_order                           95557 non-null int64
total_orders_first_6_months                 95557 non-null int64
total_paid_first_6_months                   95557 non-null float64
order_count_unavailable                     95557 non-null int64
avg_payment_processing_time                 95557 non-null timedelta64[ns]
avg_seller_processing_time                  95557 non-null timedelta64[ns]
avg_transit_time                            95557 non-null timedelta64[ns]
avg_lead_time                               95557 non-null timedelta64[ns]
avg_item_count_per_order                    95557 non-null float64
avg_product_count_per_order                 95557 non-null float64
orders_shipped_late                         95557 non-null float64
avg_quantity_by_product                     95557 non-null object
average_price_per_unit                      95557 non-null float64
avg_freight_cost_per_order                  95557 non-null float64
ordered_from_top_10_prod_category_bol       95557 non-null int64
ordered_from_seller_perfect_avg_review_bol  95557 non-null int64
avg_survey_lag                              95557 non-null timedelta64[ns]
avg_review_lag                              95557 non-null timedelta64[ns]
avg_review_score                            95557 non-null float64
order_count_boleto_voucher                  95557 non-null float64
order_count_card                            95557 non-null float64
avg_installments                            95557 non-null float64
avg_days_payment_processing_time            95557 non-null float64
avg_days_seller_processing_time             95557 non-null float64
avg_days_transit_time                       95557 non-null float64
avg_days_lead_time                          95557 non-null float64
avg_days_survey_lag                         95557 non-null float64
avg_daysreview_lag                          95557 non-null float64
Active?                                     95557 non-null int32
perc_orders_unavailable                     95557 non-null float64
perc_orders_shipped_late                    95557 non-null float64
perc_orders_boleto_voucher                  95557 non-null float64
perc_orders_credit_debit                    95557 non-null float64
day_first_order                             95557 non-null object
dtypes: datetime64[ns](1), float64(20), int32(1), int64(6), object(3), timedelta64[ns](6)
memory usage: 26.6+ MB
```

- Replace or drop nulls & update data types
- Columns with counts turned to proportion of total orders to fairly compare customers

VARIABLES AVAILABLE (36)

CUSTOMER BEHAVIOR

- customer_unique_id
- date_first_order
- year_first_order
- month_first_order
- total_orders_first_6_months
- avg_review_lag
- total_paid_first_6_months
- avg_quantity_by_product
- avg_item_count_per_order
- avg_product_count_per_order
- average_price_per_unit
- ordered_from_top_10_prod_category_bol
- ordered_from_seller_perfect_avg_review_bol
- avg_review_score
- order_count_boleto_voucher
- order_count_card
- avg_installments
- perc_orders_boleto/voucher
- perc_orders_credit/debit
- Active?

LOGISTICS

- order_count_unavailable
- avg_payment_processing_time
- avg_seller_processing_time
- avg_transit_time
- avg_lead_time
- orders_shipped_late
- avg_freight_cost_per_order
- avg_survey_lag
- avg_days_payment_processing_time
- avg_days_seller_processing_time
- avg_days_transit_time
- avg_days_lead_time
- avg_days_survey_lag
- perc_orders_unavailable
- perc_orders_shipped_late

18 Highlighted = Predictors for Model

REGRESSION MODEL

Iterations and Results

REGRESSION MODEL - LTV

MODEL USED

- Statsmodel **Ordinary Least Squares (OLS)** Regression
- Model to **explain** correlation between variables and 6-month customer’s lifetime value

RESPONSE VARIABLE

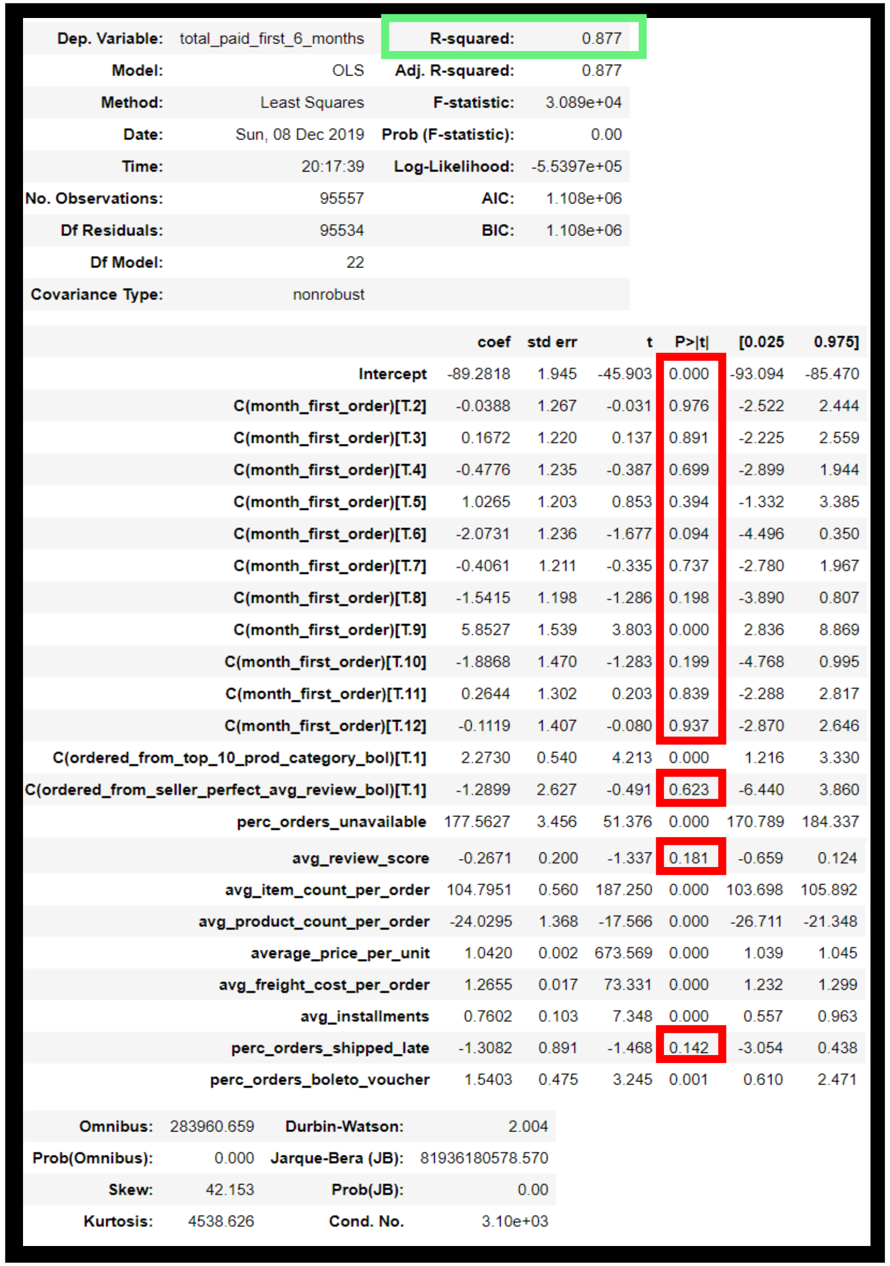
total_paid_first_6_months

PREDICTOR VARIABLES (17)

month_first_order (C)	avg_freight_cost_per_order
ordered_from_top_10_category_bol (C)	avg_installments
ordered_from_seller_perfect_avg_reviews bol (C)	perc_orders_shipped_late
perc_orders_unavailable	perc_orders_boleto_voucher
avg_review_score	avg_days_payment_processing_time
avg_item_count_per_order	avg_days_seller_processing_time
avg_product_count_per_order	avg_days_transit_time
average_price_per_unit	avg_days_survey_lag
	avg_daysreview_lag

MODEL #1

- **22** Variables (including “dummy variables” from categorical data)
- R-squared = **0.877**
- **Missing** timedelta variables
- **4** insignificant variables (P-Score < 0.05)



```
    Dep. Variable:  total_paid_first_6_months        R-squared:        0.877
            Model:                        OLS    Adj. R-squared:       0.877
           Method:              Least Squares       F-statistic:   3.089e+04
             Date:           Sun, 08 Dec 2019  Prob (F-statistic):     0.00
             Time:                   20:17:39    Log-Likelihood:  -5.5397e+05
No. Observations:                       95557               AIC:   1.108e+06
    Df Residuals:                       95534               BIC:   1.108e+06
         Df Model:                          22
 Covariance Type:                   nonrobust

                                                      coef  std err        t  P>|t|   [0.025   0.975]
                                         Intercept -89.2818   1.945  -45.903  0.000  -93.094  -85.470
                            C(month_first_order)[T.2] -0.0388   1.267   -0.031  0.976   -2.522    2.444
                            C(month_first_order)[T.3]  0.1672   1.220    0.137  0.891   -2.225    2.559
                            C(month_first_order)[T.4] -0.4776   1.235   -0.387  0.699   -2.899    1.944
                            C(month_first_order)[T.5]  1.0265   1.203    0.853  0.394   -1.332    3.385
                            C(month_first_order)[T.6] -2.0731   1.236   -1.677  0.094   -4.496    0.350
                            C(month_first_order)[T.7] -0.4061   1.211   -0.335  0.737   -2.780    1.967
                            C(month_first_order)[T.8] -1.5415   1.198   -1.286  0.198   -3.890    0.807
                            C(month_first_order)[T.9]  5.8527   1.539    3.803  0.000    2.836    8.869
                           C(month_first_order)[T.10] -1.8868   1.470   -1.283  0.199   -4.768    0.995
                           C(month_first_order)[T.11]  0.2644   1.302    0.203  0.839   -2.288    2.817
                           C(month_first_order)[T.12] -0.1119   1.407   -0.080  0.937   -2.870    2.646
      C(ordered_from_top_10_prod_category_bol)[T.1]    2.2730   0.540    4.213  0.000    1.216    3.330
C(ordered_from_seller_perfect_avg_review_bol)[T.1]   -1.2899   2.627   -0.491  0.623   -6.440    3.860
                             perc_orders_unavailable 177.5627   3.456   51.376  0.000  170.789  184.337
                                    avg_review_score -0.2671   0.200   -1.337  0.181   -0.659    0.124
                             avg_item_count_per_order 104.7951  0.560  187.250  0.000  103.698  105.892
                          avg_product_count_per_order -24.0295  1.368  -17.566  0.000  -26.711  -21.348
                               average_price_per_unit  1.0420   0.002  673.569  0.000    1.039    1.045
                              avg_freight_cost_per_order 1.2655  0.017  73.331  0.000    1.232    1.299
                                     avg_installments  0.7602   0.103    7.348  0.000    0.557    0.963
                              perc_orders_shipped_late -1.3082  0.891   -1.468  0.142   -3.054    0.438
                           perc_orders_boleto_voucher  1.5403   0.475    3.245  0.001    0.610    2.471

      Omnibus:  283960.659    Durbin-Watson:           2.004
Prob(Omnibus):       0.000  Jarque-Bera (JB):  81936180578.570
         Skew:      42.153         Prob(JB):            0.00
     Kurtosis:    4538.626         Cond. No.        3.10e+03
```

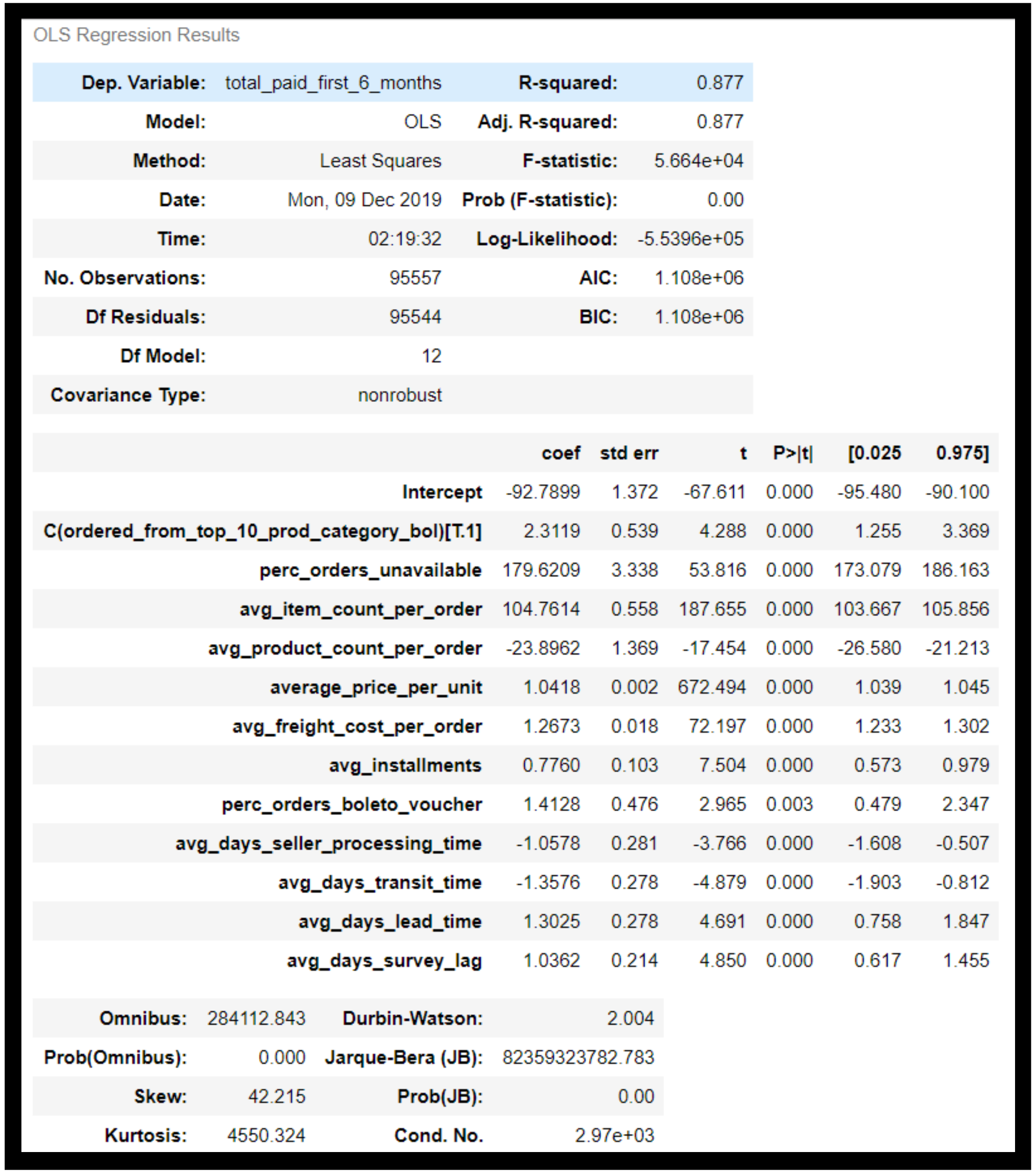
MODEL OPTIMIZATION

Model #	Change Description	N. Of Variables (including dummy)	R-Squared	N. of Variables with p-square > 0.05
1		22	0.877	4
2	Adds timedelta variables as n. of days	28	0.877	6
3	Removes month_first_order (C)	17	0.877	5
4	Removes perc_orders_shipped_late	16	0.877	4
5	Removes ordered_from_seller_perfect_review (C)	15	0.877	3
6	Removes avg_days_payment_processing_time	14	0.877	2
7	Removes avg_daysreview_lag	13	0.877	1
8	Removes avg_review_score	12	0.877	0
9	Normalizes data (z-score)	12	0.877	0

FINAL MODEL

- **Positive** Correlation to LTV
  - **ordered from top 10 categories**
  - % orders unavailable
  - Item count per order
  - price per unit
  - freight cost per order
  - **# payment installments**
  - **% orders paid boleto or voucher**
  - Survey Lag (from Olist to customer)

- **Negative** Correlation to LTV
  - product count per order
  - **seller processing time**
  - **transit time**



OLS Regression Results

Dep. Variable:	total_paid_first_6_months	**R-squared:**	0.877
Model:	OLS	**Adj. R-squared:**	0.877
Method:	Least Squares	**F-statistic:**	5.664e+04
Date:	Mon, 09 Dec 2019	**Prob (F-statistic):**	0.00
Time:	02:19:32	**Log-Likelihood:**	-5.5396e+05
No. Observations:	95557	**AIC:**	1.108e+06
Df Residuals:	95544	**BIC:**	1.108e+06
Df Model:	12		
Covariance Type:	nonrobust		

	coef	**std err**	**t**	**P>|t|**	**[0.025**	**0.975]**
Intercept	-92.7899	1.372	-67.611	0.000	-95.480	-90.100
C(ordered_from_top_10_prod_category_bol)[T.1]	2.3119	0.539	4.288	0.000	1.255	3.369
perc_orders_unavailable	179.6209	3.338	53.816	0.000	173.079	186.163
avg_item_count_per_order	104.7614	0.558	187.655	0.000	103.667	105.856
avg_product_count_per_order	-23.8962	1.369	-17.454	0.000	-26.580	-21.213
average_price_per_unit	1.0418	0.002	672.494	0.000	1.039	1.045
avg_freight_cost_per_order	1.2673	0.018	72.197	0.000	1.233	1.302
avg_installments	0.7760	0.103	7.504	0.000	0.573	0.979
perc_orders_boleto_voucher	1.4128	0.476	2.965	0.003	0.479	2.347
avg_days_seller_processing_time	-1.0578	0.281	-3.766	0.000	-1.608	-0.507
avg_days_transit_time	-1.3576	0.278	-4.879	0.000	-1.903	-0.812
avg_days_lead_time	1.3025	0.278	4.691	0.000	0.758	1.847
avg_days_survey_lag	1.0362	0.214	4.850	0.000	0.617	1.455

Omnibus:	284112.843	**Durbin-Watson:**	2.004
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	82359323782.783
Skew:	42.215	**Prob(JB):**	0.00
Kurtosis:	4550.324	**Cond. No.**	2.97e+03