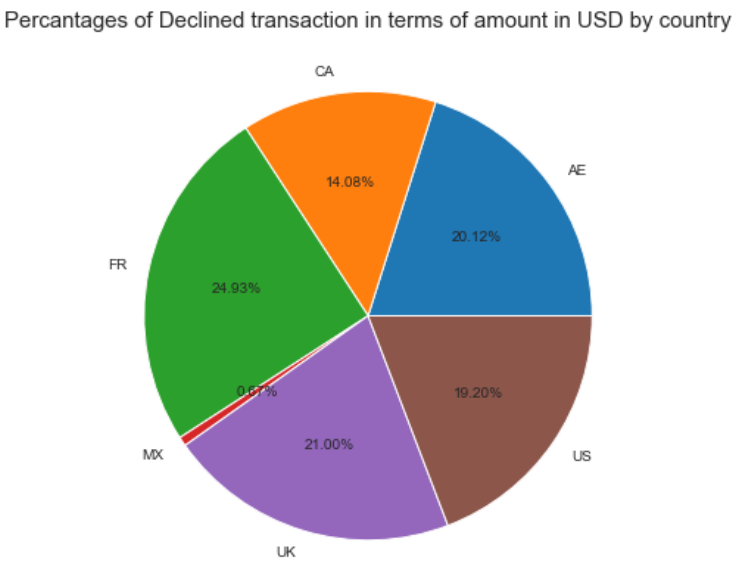
# Answer

## Q1 is as below, Q2 answers please check task.ipynb

### Outlines the volume (in USD) of the declined payments

Below table and pie chart showcase each country's declined amount in USD and their percentages. Additionally, the code in the jupyter notebook contains a part where local currency is transformed into usd_amount column.

| | Declined Amount in USD |
|---|---|
| AE | 26335152.43 |
| CA | 18422315.65 |
| FR | 32628785.93 |
| MX | 876158.35 |
| UK | 27489496.69 |
| US | 25125669.78 |




### The problem root causes

So far, it is a bit challenging to locate the root causes of the card decline problem using the existing data.

#### CVV Provided Cases

One group that yields a rather low acceptance rate belongs to the cases where customers provide their card CVV. The acceptance rate is as low as 62.5% as shown in the table below. Without knowing the common way of how people perform transactions with Deel, I can only guess that these cases might come from manmade mistakes such as customers providing the wrong card number or CVV number, as in the scenario where CVV is needed, the card number is often needed (unlike contactless shopping situation where CVV and the card number is not needed). Additionally, these cases only constitute a small portion of the dataset, with only 40 in total out of the entire 5430 cases.

| | Case Count | A**cceptance Rate** |
|---|---|---|
| CVV Provided | | |
| False | 5390 | 0.696 |
| True | 40 | 0.625 |

## Acceptance Rate Related to Currency or Country

The Currency used or the country where the transaction happens can often impact the transaction acceptance rate. for example, a certain currency or country might be commonly related to fraudulent activity. The entities that are in charge of processing the transaction might enforce stricter rules for the transaction using this currency or occurred in this country to prevent criminal activity. Based on such a notion, the below two tables were created to figure out the acceptance rate in different countries and in different currencies from our dataset. As we can see, USD has the lowest acceptance rate and is used by customers in both UAE and US which happen to be the two countries with the lowest acceptance rate as well. It’s hard to determine the reason for the low acceptance rate comes from the two countries or the currency USD that is used. It could be that the USD is a very popular currency and requires stricter rules to be successfully processed. Nevertheless, the acceptance rate between different countries or different currencies differs less than 5 percent, it’s hard to say whether the currencies or the countries of transaction actually play a big roles in determining the success of the transaction.

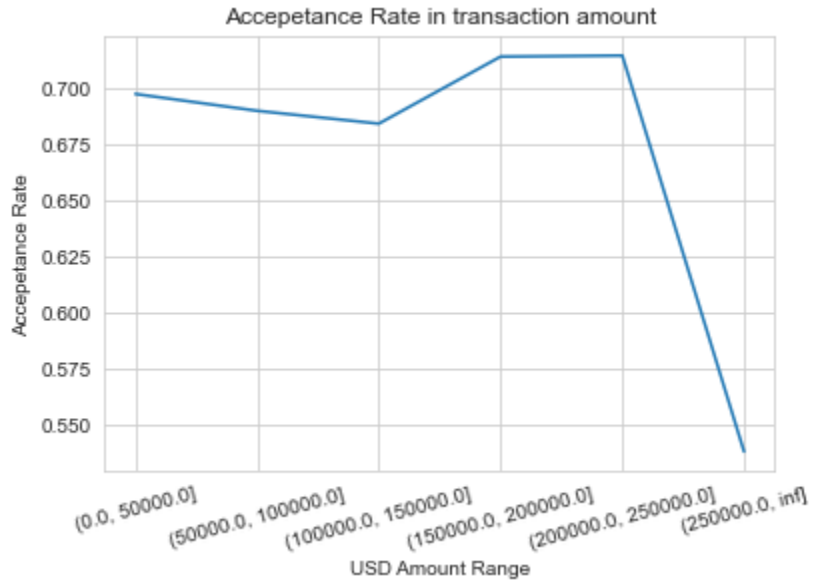
| | Case Count | Acceptance Rate |
|---|---|---|
| **currency** | | |
| CAD | 905 | 0.696 |

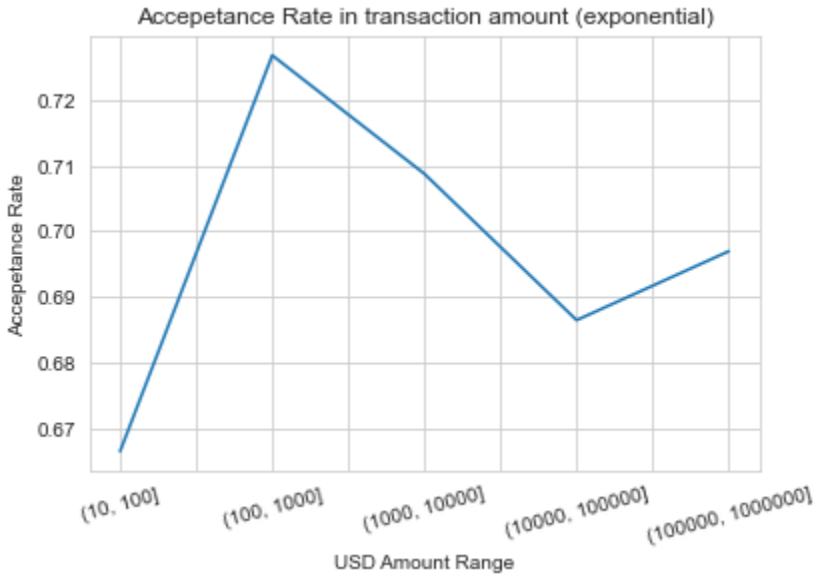
| | Case Count | Acceptance Rate |
|---|---|---|
| EUR | 905 | 0.701 |
| GBP | 905 | 0.715 |
| MXN | 905 | 0.712 |
| USD | 1810 | 0.675 |

| | case_count | acceptance_rate |
|---|---|---|
| Country | | |
| AE | 905 | 0.678 |
| CA | 905 | 0.696 |
| FR | 905 | 0.701 |
| MX | 905 | 0.712 |
| UK | 905 | 0.715 |
| US | 905 | 0.679 |

## Transaction Amount

Another reason that a transaction gets rejected might be related to the amount of money that is being processed. The higher the amount, the higher the level of security is needed in case of fraudulent activity. Below are the two plots related to the acceptance rate in different USD transaction ranges. We can see that the acceptance rate does not fluctuate much in both plots, with at most 3 percent changes in different USD ranges (disregarding the extreme cases). Speaking of the extreme cases, the range above 0.25 million USD only contains 13 data points in the first plot, and the range between 10 to 100 USD in the second plot only contains 9 data points, meaning that their extremely low acceptance rate might be related to their own special context that we can do further analysis on, but they might not be able to represent the cases for declined transaction in the majority of the cases. Additionally, more relation regarding to decline or accept of the transaction related to its transaction amount can be seen in appendix A, unfortunately, they don’t show very insightful relation regarding the USD amount and whether the case is successful or not.

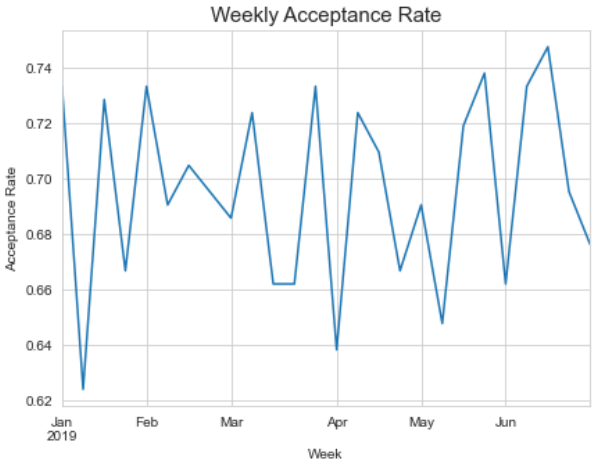


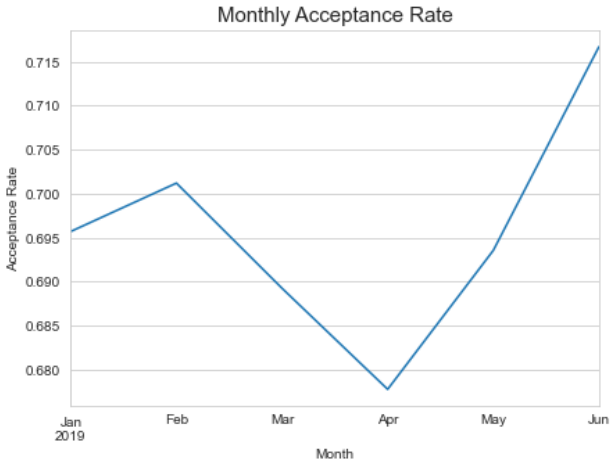



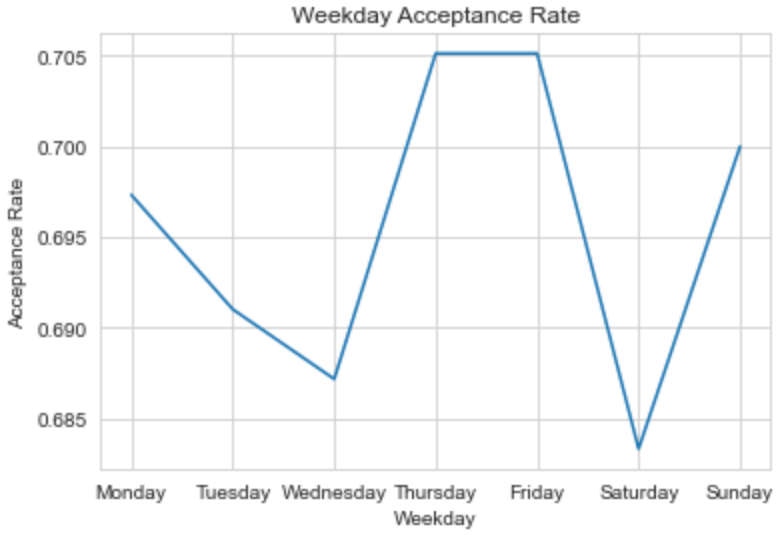

## The Time of Transaction

To see whether there is a trend related to the success rate, I plot the rate through time on weekly, monthly, and weekday bases as below plots. It shows that April 2019 has the lowest acceptance rate, further analysis can look into if there is an external event that might result into the lower transaction rate at that time. Additionally, Saturday has the lowest success rate among the days of the week, but the difference between itself and the highest success rate in a week (Thursday) is only 2 percent, showing that the result

might simply be due to natural fluctuation. More time-related successful rates can be seen in Appendix B.




## Suggested solutions / Recommendations

So far, all the plots (including the ones in the appendix) show that there is yet to be a determining factor that results in the decline of transactions. Current data only allows for exploration using columns such as the amount, timestamp, currency, countries, and whether the CVV is provided for the analysis. If there is more information or data to be collected, the analysis can be done more thoroughly and better insight can be extracted. For example:

- Card Expiry date: It can be used to see decline comes from about to or already expired card
- Foreign Status: Whether the user is using the card outside of their home country, as sometimes card used in foreign countries are more likely to be declined
- Payment Method: How is the card being used, is it through a website whether card data is put manually, or through certain contactless or swiping device.
- Type of card: Credit card or debit card might have a different success rate
- Transaction Local Time: Current data only has iso-8601 time format on 6 fixed time point, I’m not sure if they are related to the exact time where the user conducts the transaction. It could be interesting to plot the success rate with the local time to see whether the off-work time yields a lower successful rate for example.

## list of further next steps (hypothesis / analysis) you would do as a next steps having more time and business knowledge

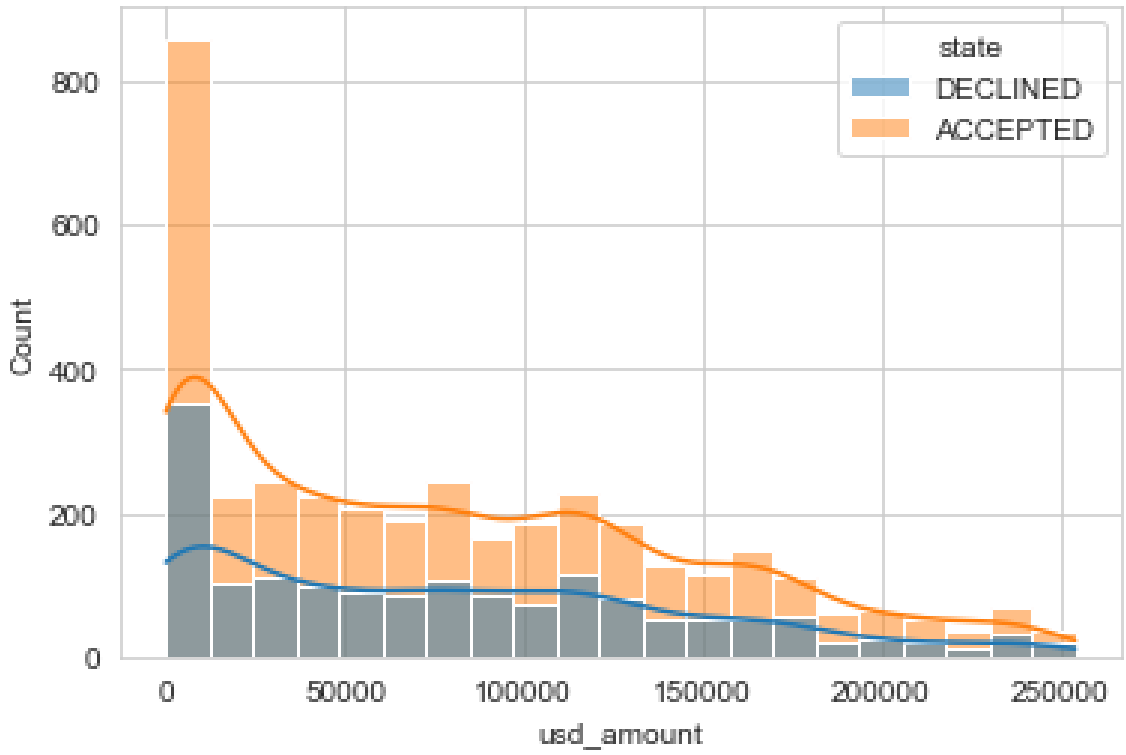
I will have to ask more questions to gain more knowledge around the issues:

- What’s the purpose of customers performing this transaction with Deel? Where will they plan to eventually use the fund for? It might give me more intuition on what kind of transaction behavior are normal and what are not.
- How do people usually perform the transaction, is it an internet web app? for the reason similar to the above question?
- Why are there only 6 repetitive timestamps throughout the dataset? This might let me know more about the mechanism on globepay and determine whether the timestamp is a reliable information to be used for analysis.
- Why does every country have the same amount of data?
- What is the scenario where CVV is not provided?
- Is there an identifier to see if two transactions belong to the same person? Are customers recurrent in this scenario?

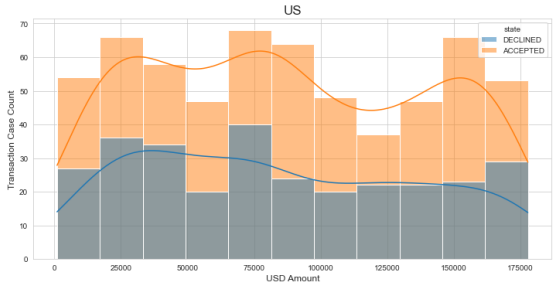
Besides the above questions to get myself a better understanding of the topic, I also would like to request bigger data with more information mentioned in the last question so that I can find better insight into the issue. Additionally, I will explore the local time where the transaction is conducted to see if the success rate is related to that. I would also explore more into the rejected cases in the existing dataset, where the transaction amount is extremely low or high, even though they are kind of the outliers of the dataset so that I can understand the scenario of these extreme cases better.

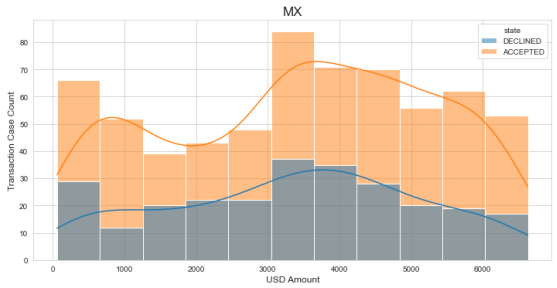
# Appendix A

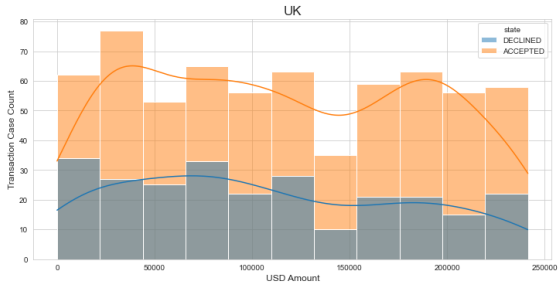
## Distribution of declined and accepted cases in different usd amount

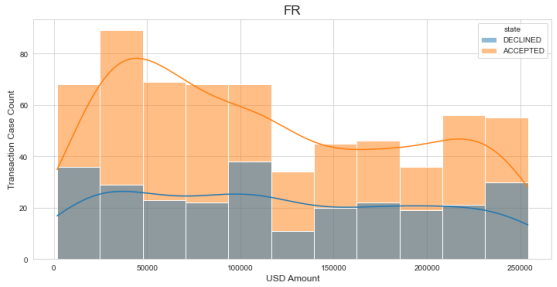


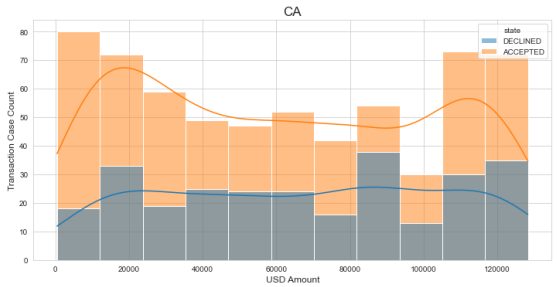
## Distribution of declined and accepted cases in different usd amount by country

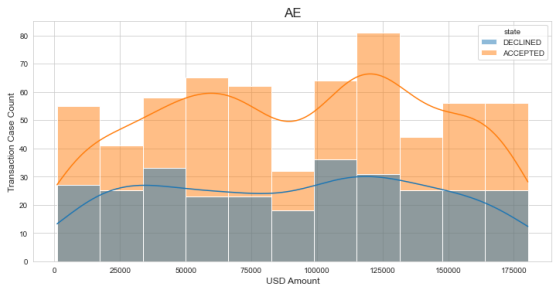

US
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount


MX
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

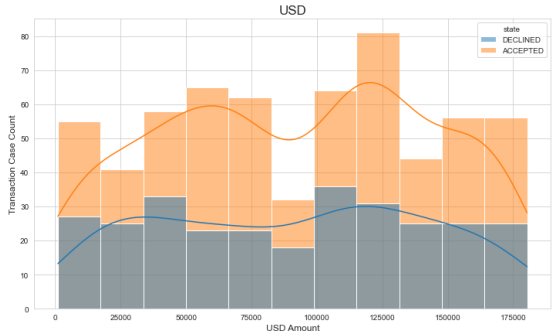

UK
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

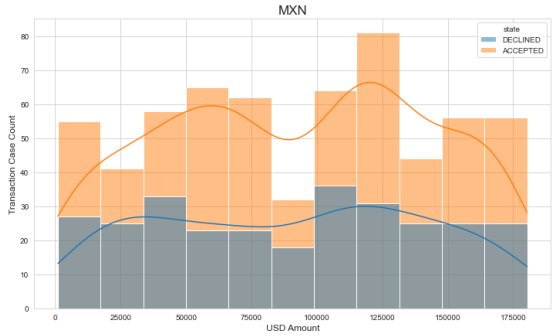

FR
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

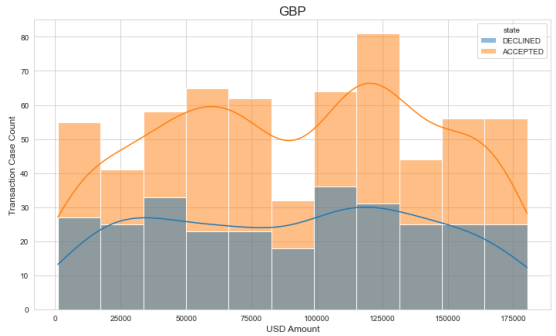

CA
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

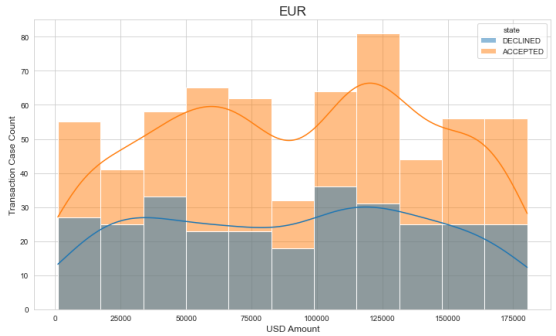

AE
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

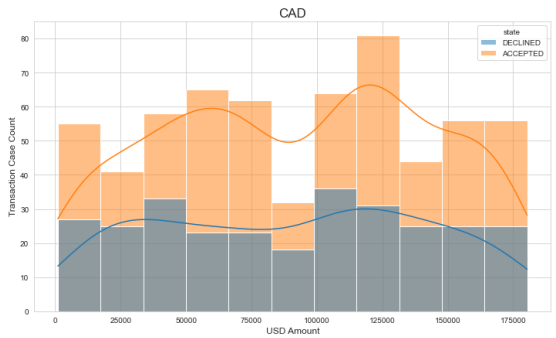
## Distribution of declined and accepted cases in different usd amount by currency


USD
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount


MXN
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

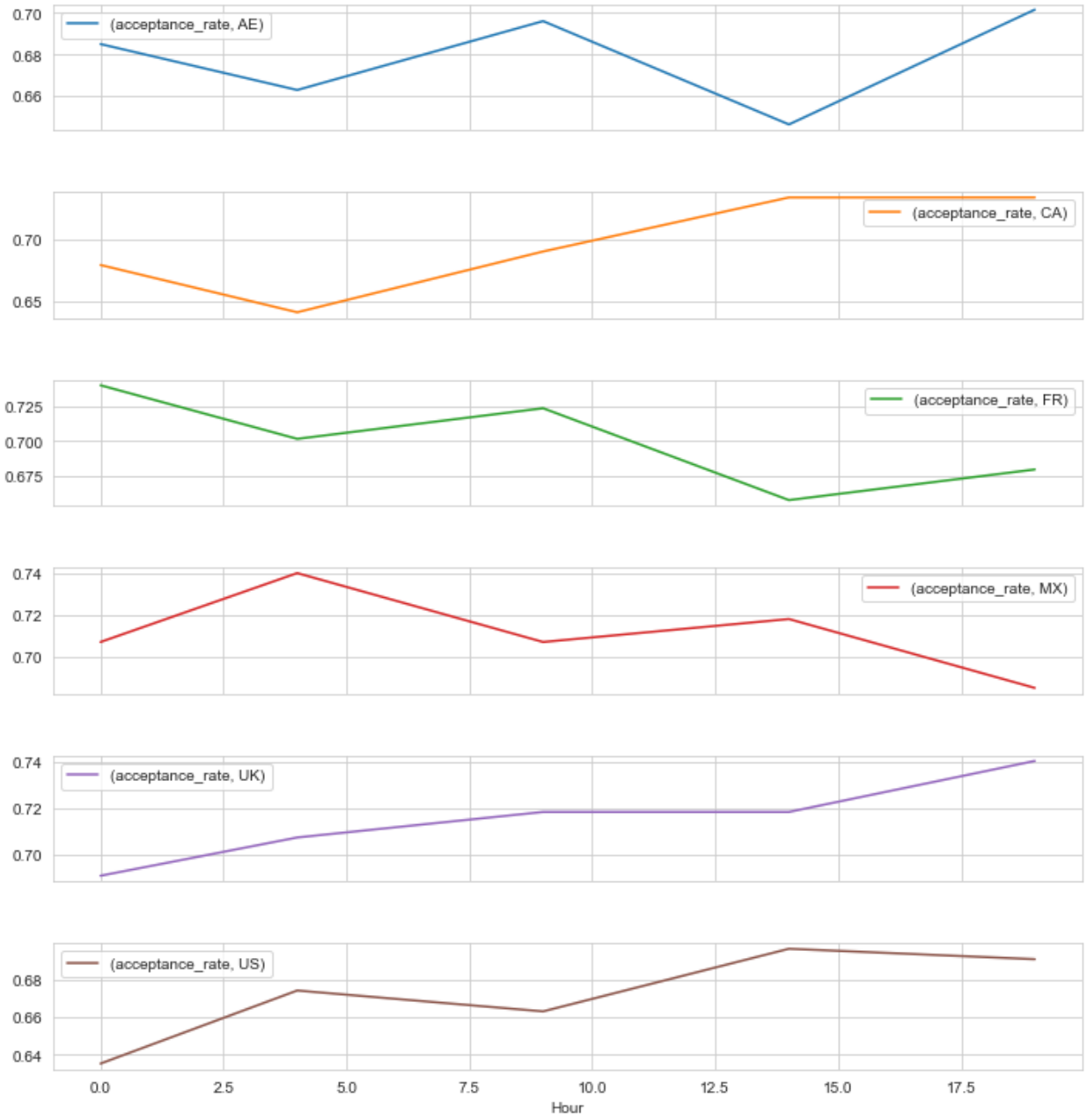

GBP
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount


EUR
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount


CAD
state
DECLINED
ACCEPTED
Transaction Case Count
USD Amount

# Appendix B

## Acceptance rate through every hour by country



## Acceptance rate through month by country