

Analytical Exercise

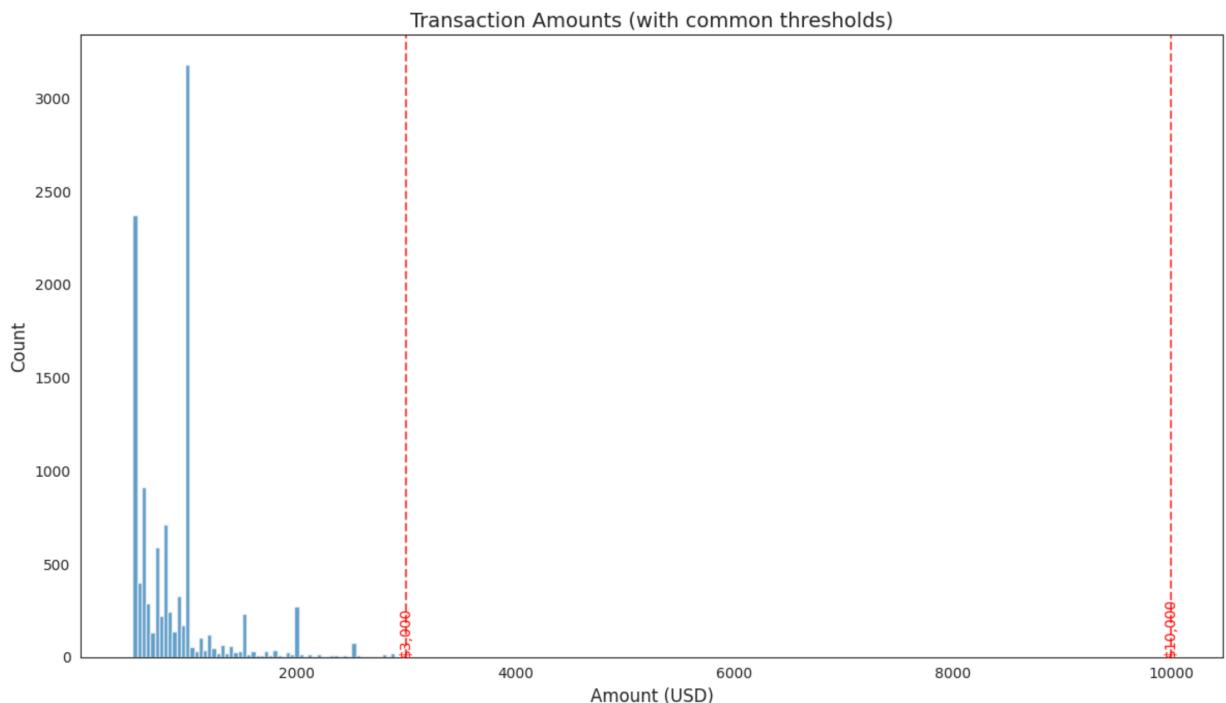
By: Philippe Heitzmann

September 22nd, 2025

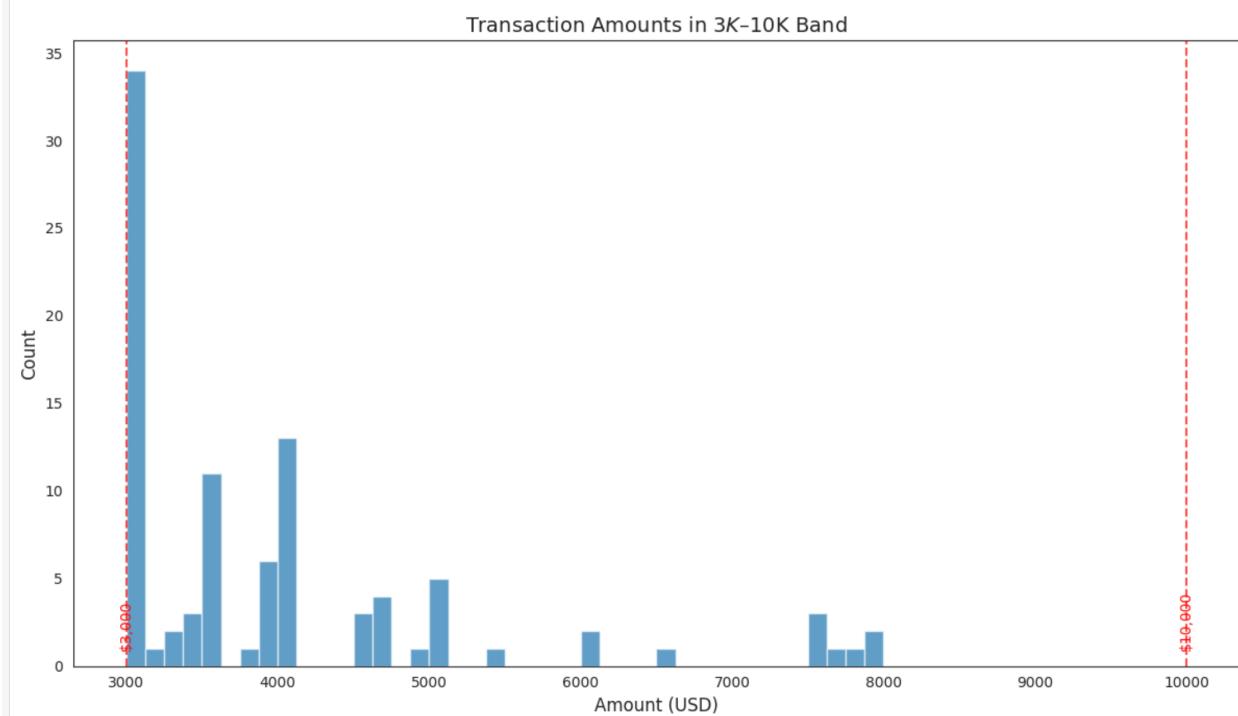
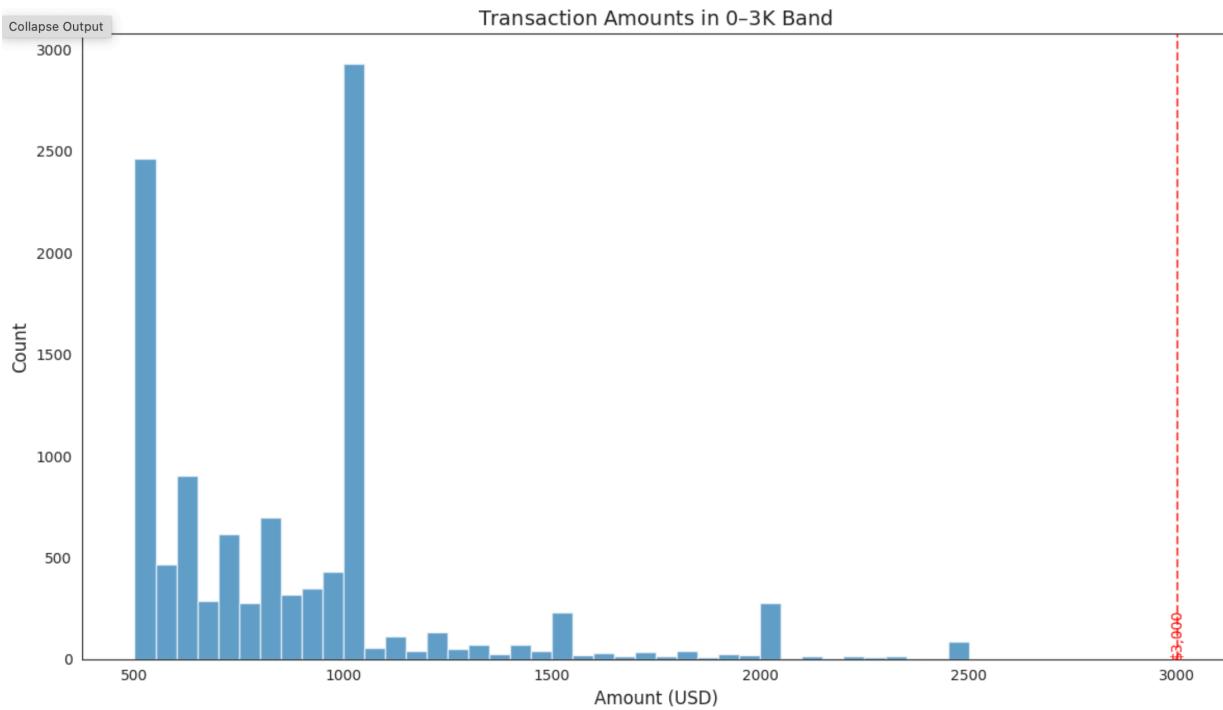
Part 1

1) Data Exploration

A) Transaction Size



Takeaway: We can see that the vast majority of transaction amounts fall below the \$1K range – there seems to be some interesting clustering of transaction amounts right below the \$3K mark, which should warrant further exploration down the line.

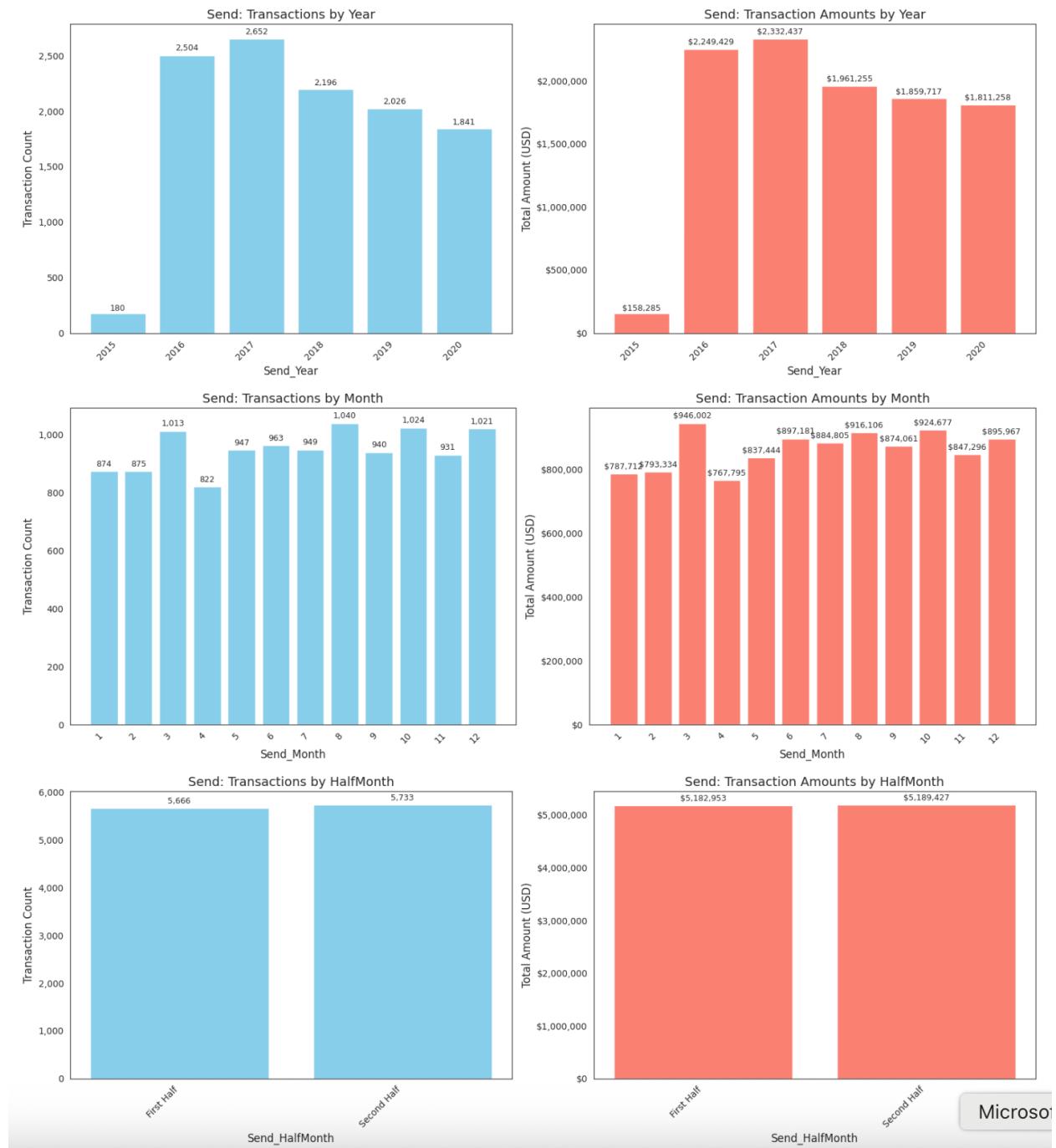


Takeaway: Zooming in on the \$0-\$3K and \$3K-\$10K ranges we can see that there are few transactions above \$5K and that the largest transactions, which will perhaps be the most suspicious ones in a money laundering scenario, cluster around the \$8K mark.

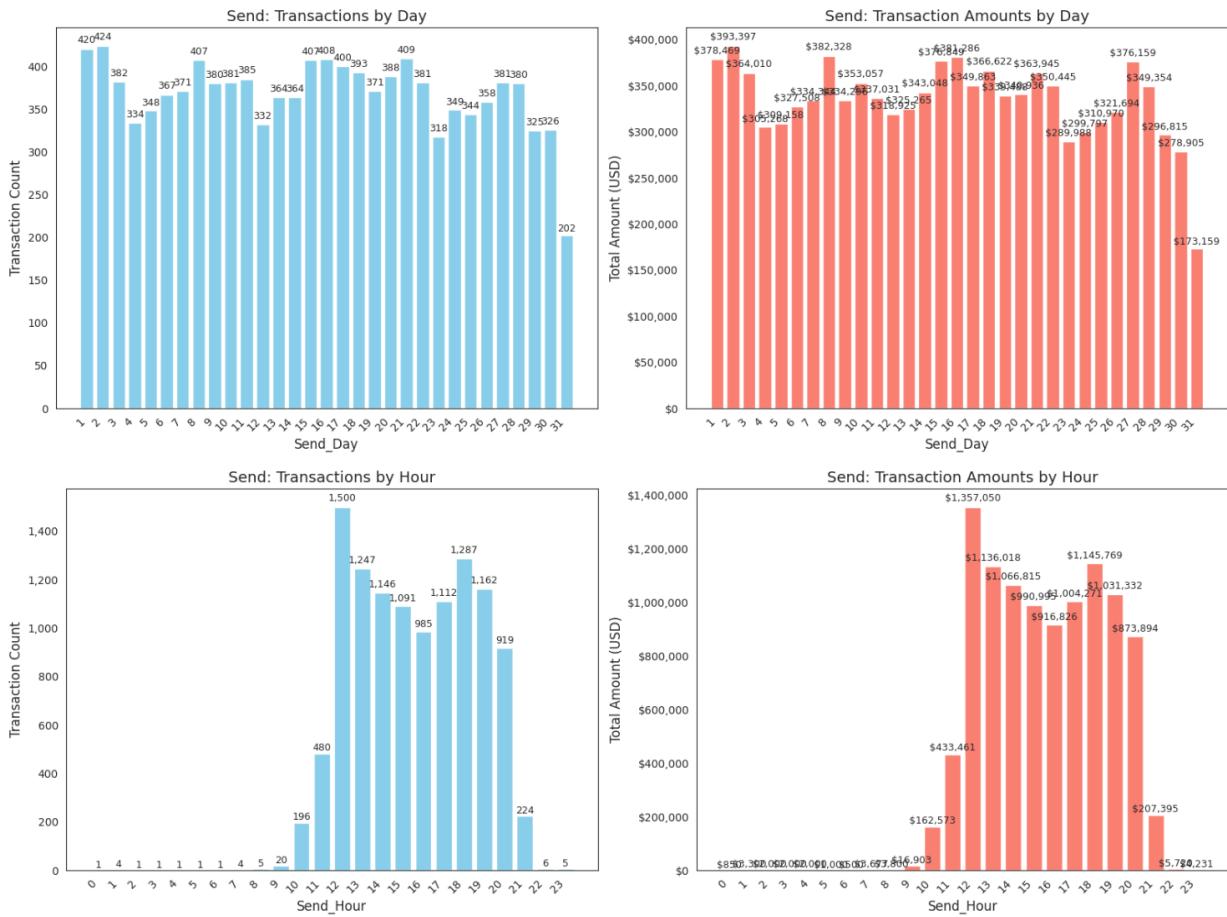
Given that we know that any business or financial institution must file a Currency Transaction Report (CTR) with FinCEN for cash transactions exceeding \$10,000 in a single day, and that in many cases financial institutions will look more closely at transactions that are right below the threshold in the \$9-10K range, we could hypothesize that many of these \$7-8K transactions could be suspicious as a way for money launderers to minimize any potential FinCEN scrutiny.

Likewise given that financial institutions and Money Services Businesses (MSBs) are required to keep detailed records for any funds transfer, payment, or purchase of monetary instruments (like bank checks, cashier's checks, money orders, or traveler's checks) made in cash between \$3K and \$10K, we might expect a cluster of transactions in the \$2.5-\$3K mark in the dataset, which seems to bear out in the above dataset as we can observe ~60 observations right around the \$2.5K mark.

B) Transaction Frequency

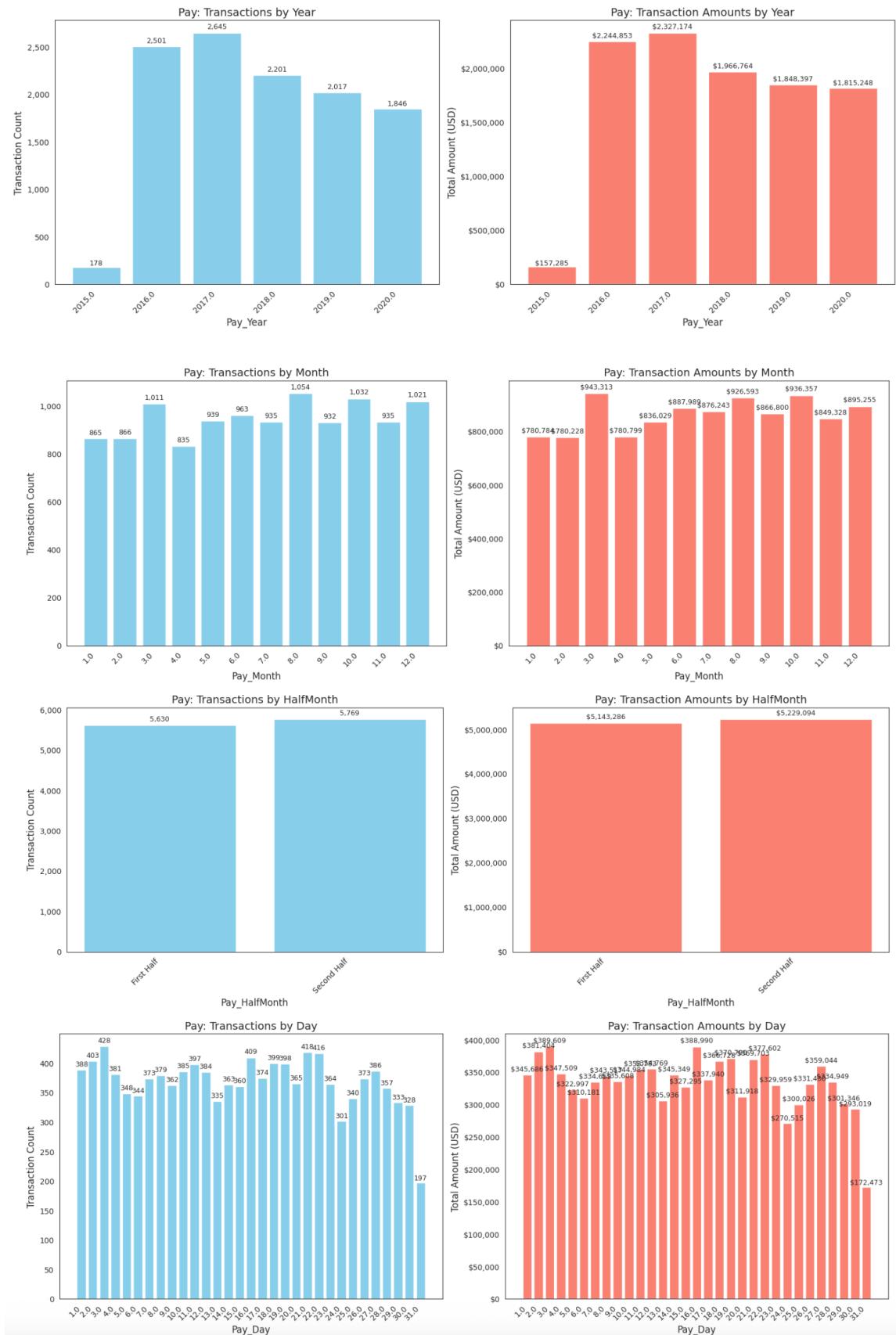


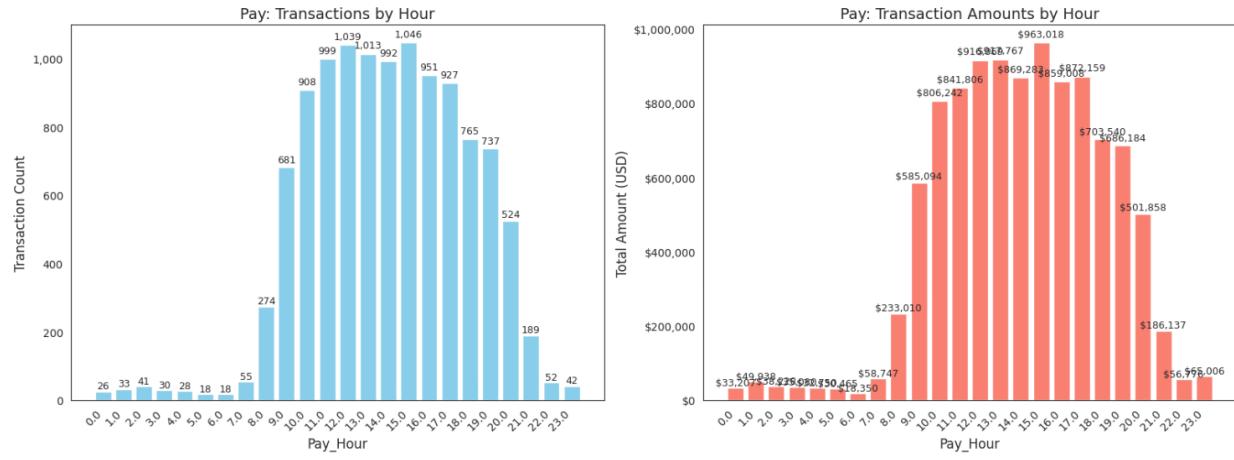
Microsoft



Takeaway: Examining all Send transactions, we can observe some interesting patterns:

- Transaction counts and amounts are observed to be highest in 2016 and 2017, from which point they then decline gradually until reaching their lowest point in 2020.
- There is about 20% variance in transaction counts and amounts across months, with spikes occurring in March, August, October and December and lows occurring in January, February and April.
- Transaction counts and amounts also interestingly show as equal between the first half and the second half of the month – no difference in amounts.
- Transaction counts and amounts further appear to be about equal by day of the month, plus or minus 25%.
- Examining transaction counts and amounts by time of day, we can observe a first gradual increase starting at 9am which culminates to a maximal peak at noon (likely coinciding with lunch breaks). Following this first peak we then observe a gradual decline before a second increase between 5-7pm (likely coinciding with people leaving work). Then, counts and amounts decline gradually again before reaching zero by 11pm.

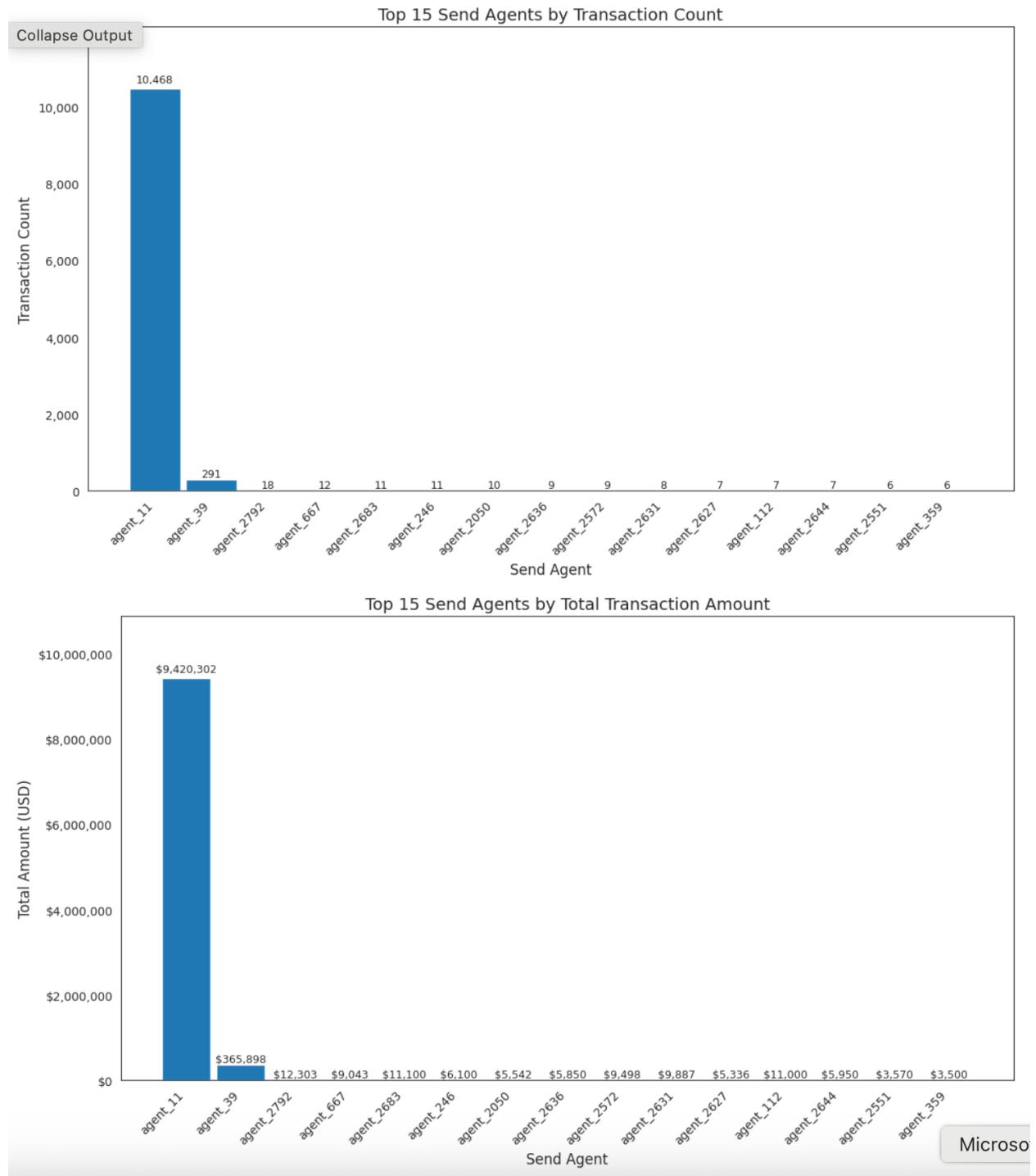




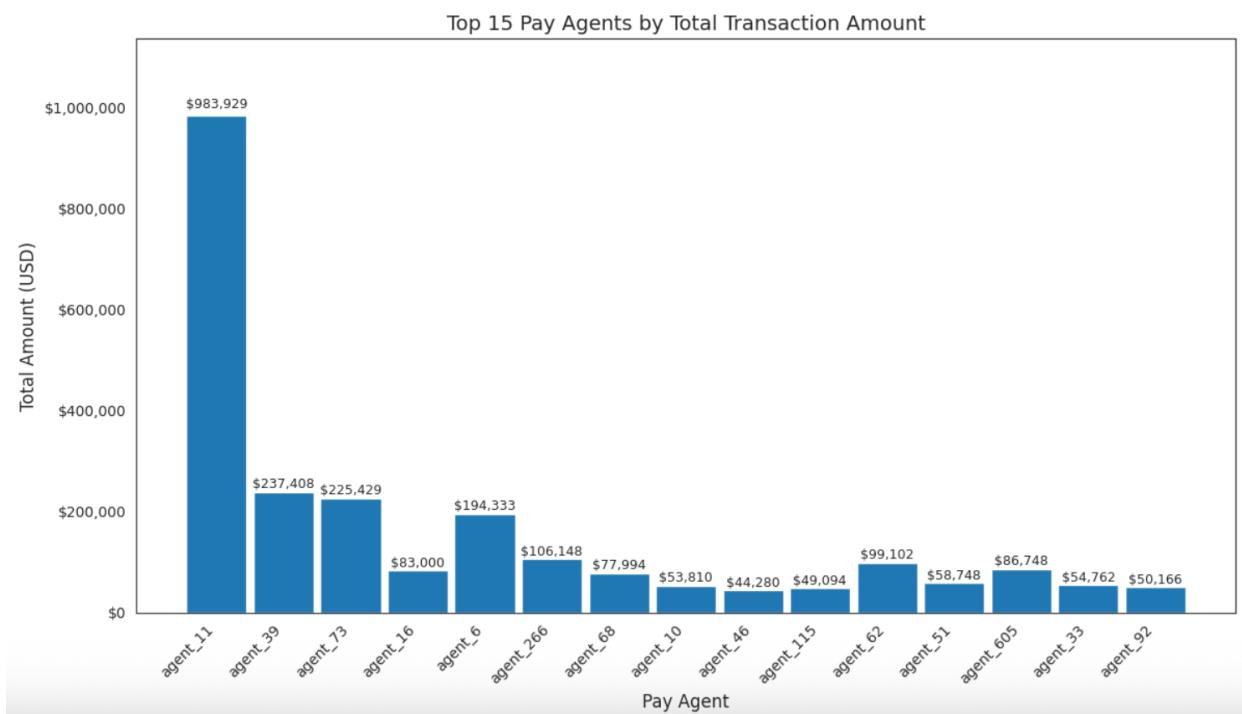
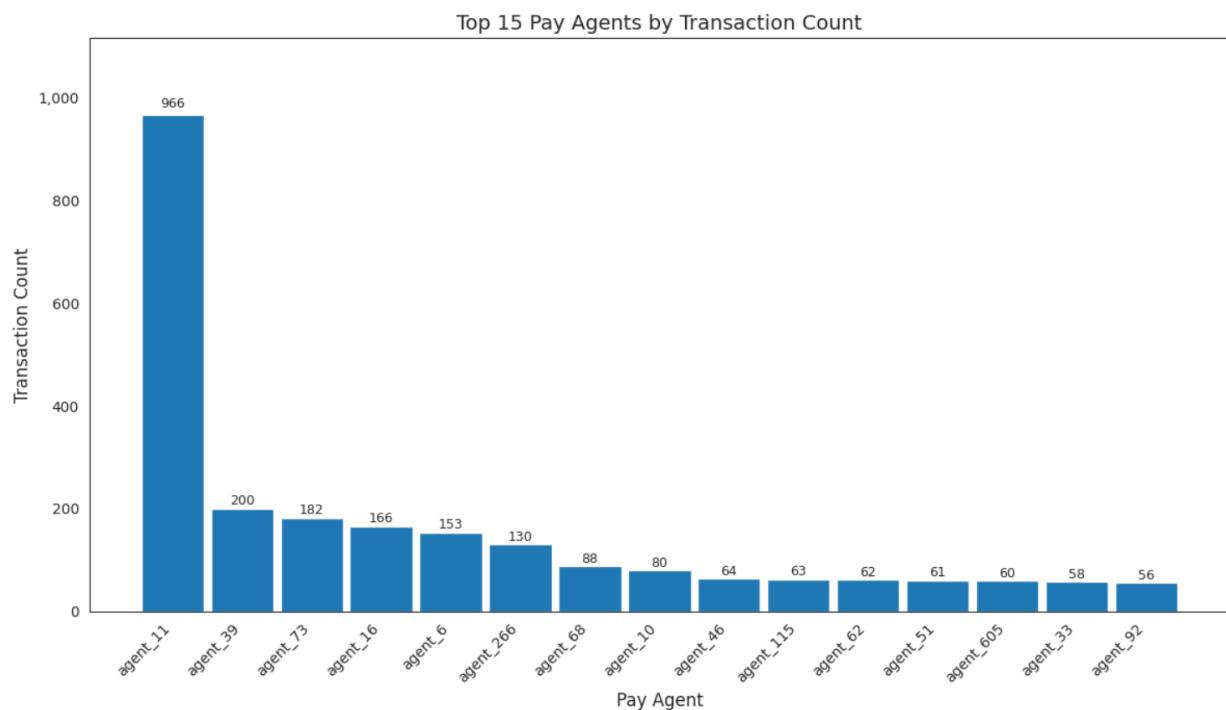
Takeaway: Examining Pay transactions patterns, we can observe the following patterns:

- Similar to Send transactions, Pay counts and amounts are highest in 2016 and 2017 (peaking at 2017) and then decline by equal amounts until 2020.
- There is about 25% variance in transaction counts and amounts across months, with spikes occurring in March, August, October and December and lows occurring in January, February and April.
- Transaction counts and amounts are equal between the first half and the second half of the month.
- Transaction counts and amounts are about equal by day of the month plus or minus 25%, though there seems to be a negatively-sloped trendline across the month with lower daily averages later in the month.
- Transaction counts and amounts follow a normal distribution between 7am and 10pm: they increase gradually until peaking in the mid-day between 2-5pm, then decline gradually until 10pm.

C) Commonly used send and pay agents

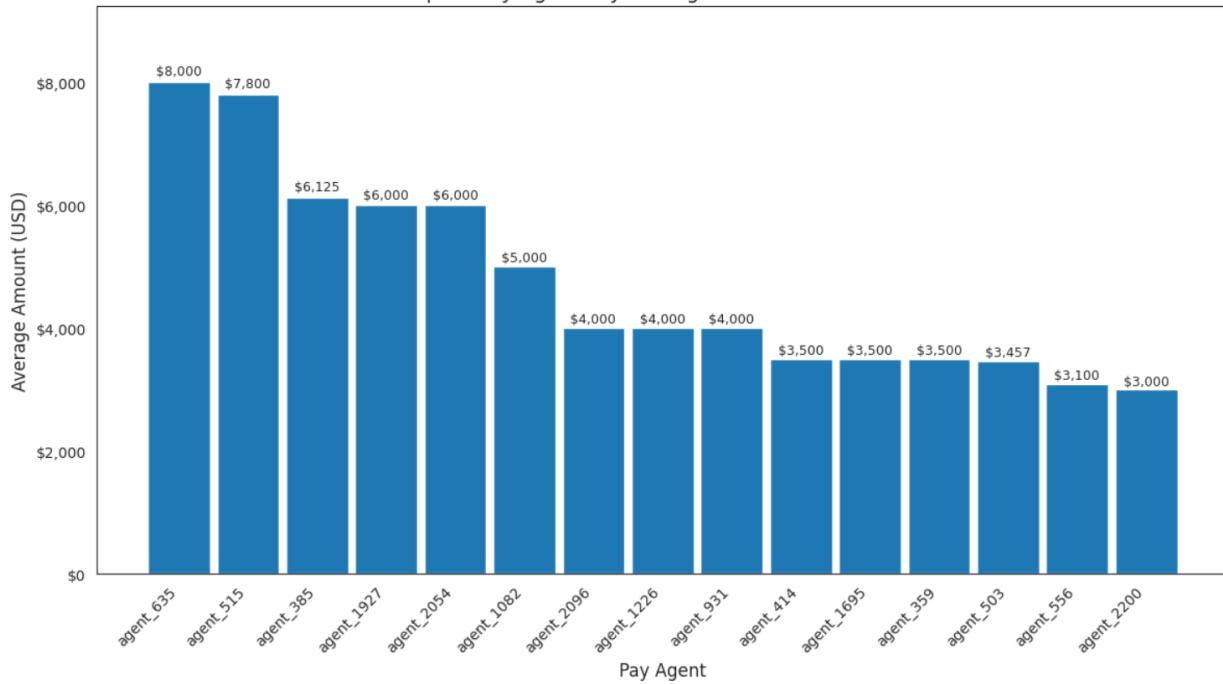


Takeaway: Agents 11 and 39 here appear suspicious here due to their unusually high transactions counts and amounts, warranting further review.

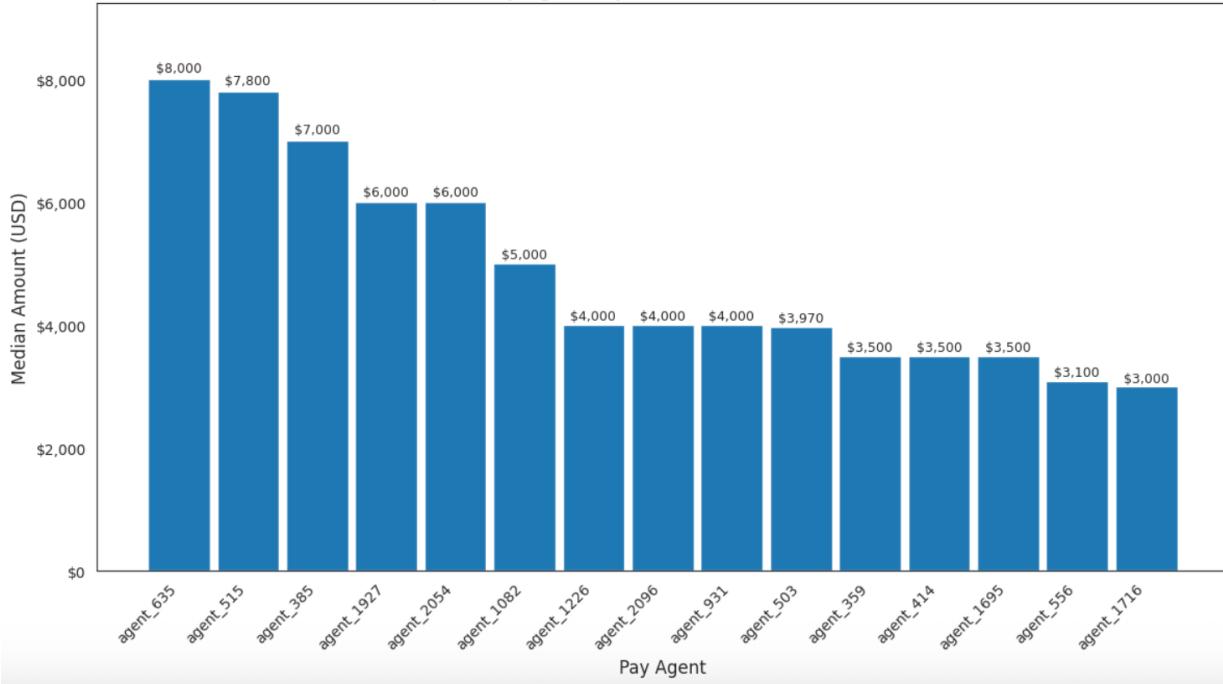


Takeaway: Agents 11, 39 and 73 look suspicious here given their unusually high transactions counts and amounts. Agent 6 also appears to have unusually large total transaction amounts on a relatively large number of transactions (153), which should also be cause for review.

Top 15 Pay Agents by Average Transaction Amount

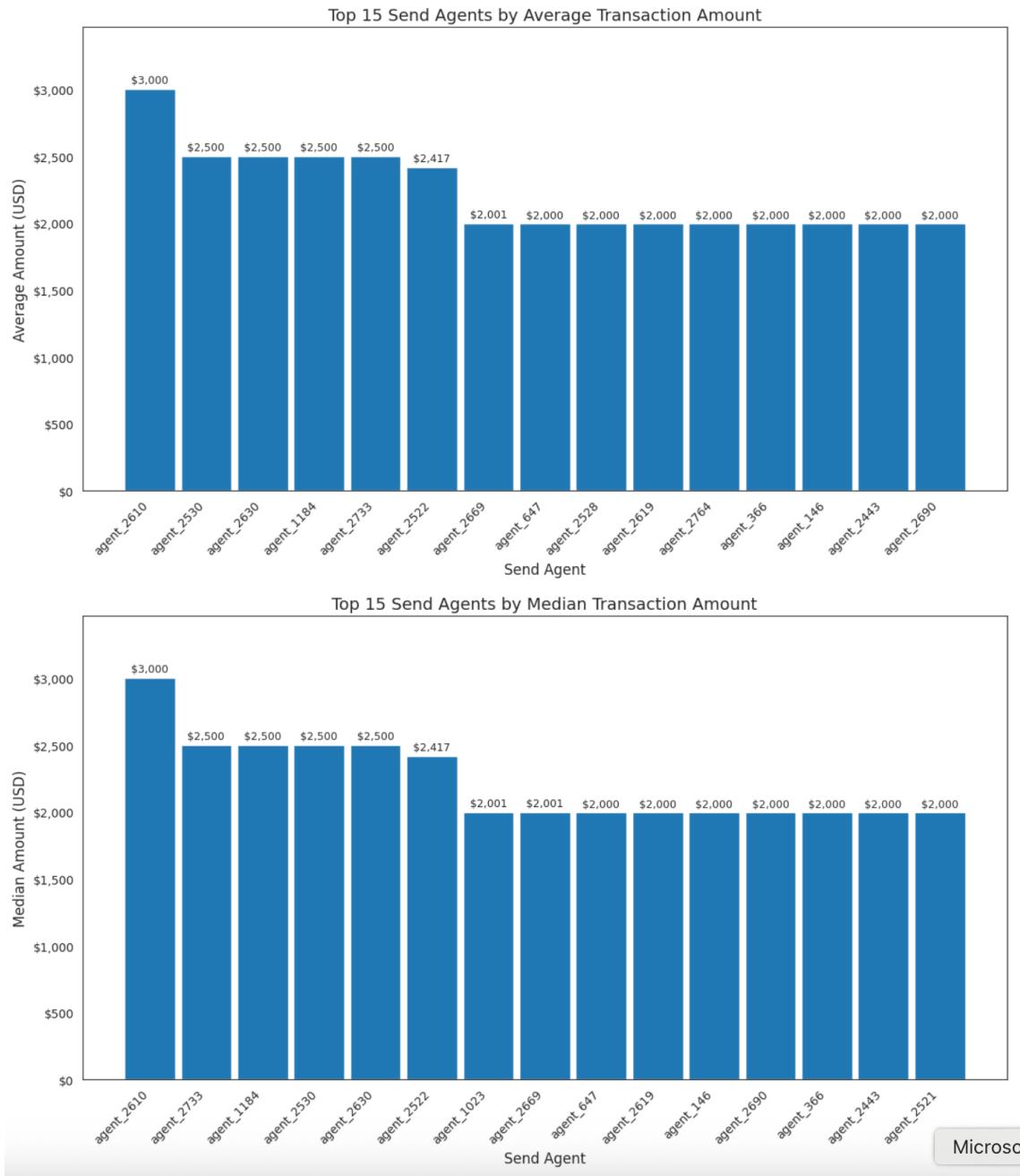


Top 15 Pay Agents by Median Transaction Amount



Takeaway: agent_635 and agent_515 both appear suspicious with average and median transaction amounts clustering around the \$8K mark, which might be a strong signal of

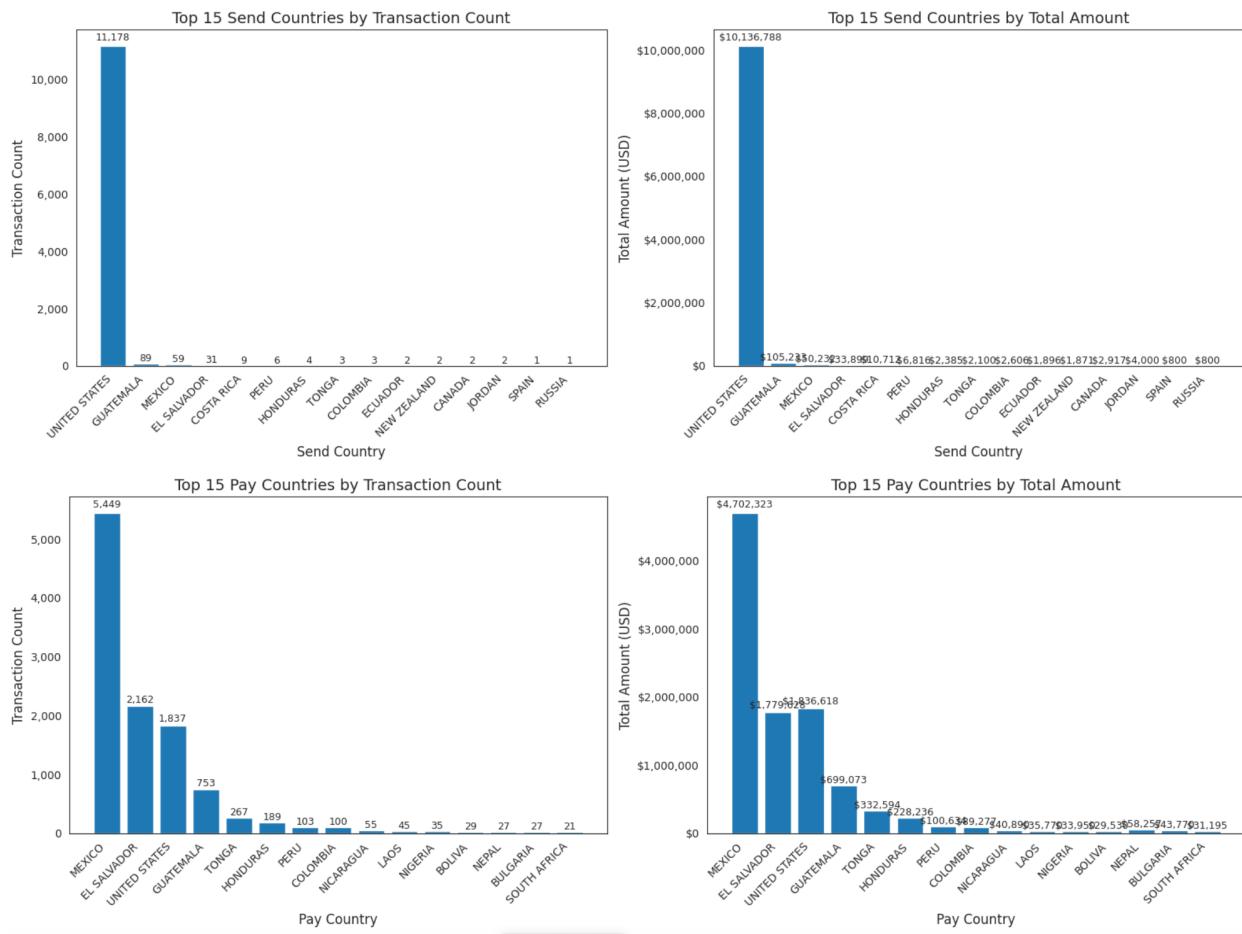
money laundering activity given this is a common transaction amount to fly under the radar of AML authorities. Pending further review, the four agents after these two should also likely be further investigated given their >\$5K pay amounts.



Takeaway: The top six agents in these graphs with average and median transaction amounts greater than \$2,000 appear suspicious given these amounts might be chosen

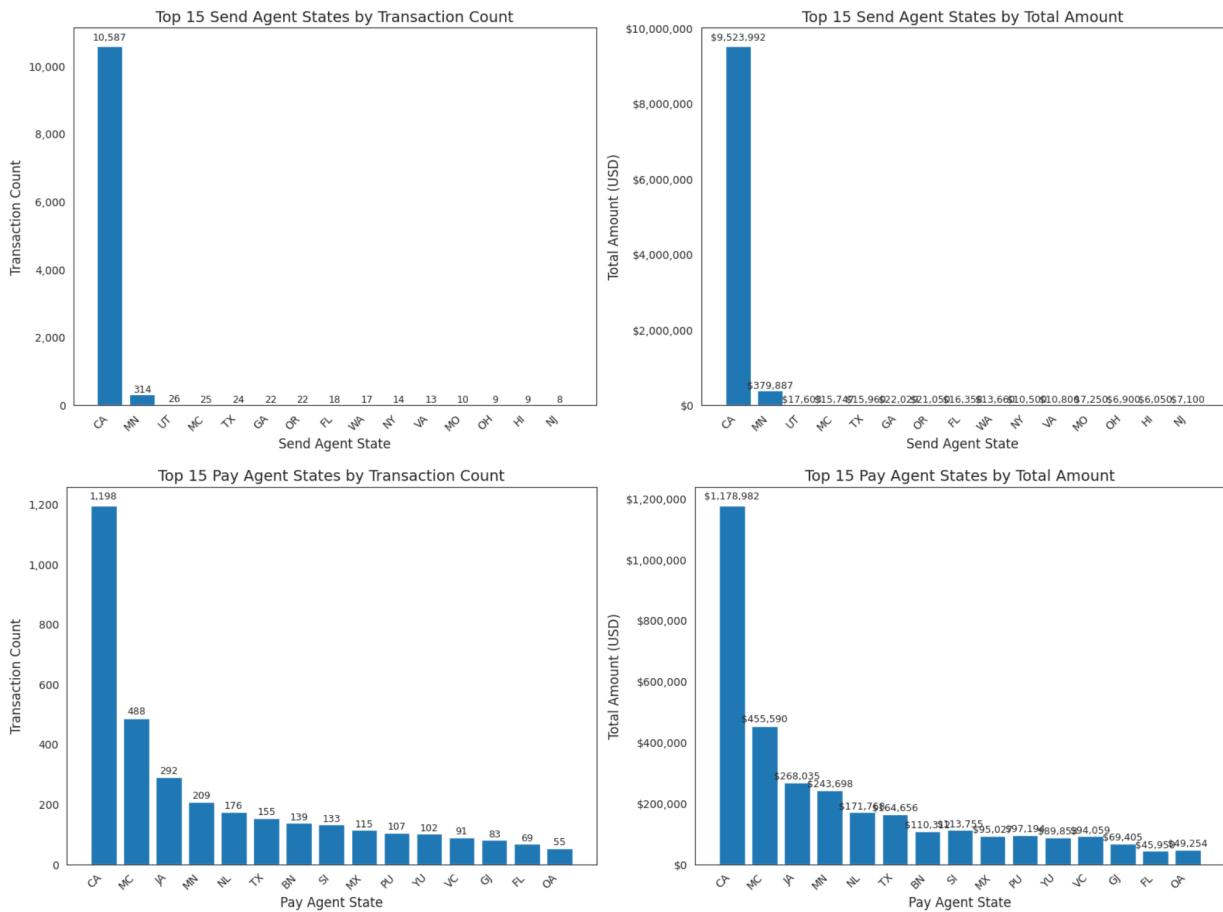
purposefully to be right under FinCEN's first \$3K transaction limit. Given these suspicious amounts, these six appear to be good candidates for further investigation.

D) Send and Pay Locations



Takeaway: From these graphs we can see that the US is by far the country with the highest transaction counts and amounts, with Guatemala coming second after this. Interestingly for Pay Agent countries, Mexico and El Salvador rank as the two largest destinations, followed by the US, Guatemala and Tonga.

As we will see in the next graph that California is the largest Send agent state in the dataset, we hypothesize that these patterns might correlate with California's significant Latino population which may be sending remittances to family and friends in those Latin American countries. However further research and exploration is needed to confirm this.



Takeaway: From these graphs we can see that CA is by far the state with the highest total counts and amounts of transactions, with Minnesota a distant second after this. Interestingly for Pay Agent states, these rank as California, Michoacán and Jalisco in Mexico, and Minnesota for both highest total counts and amounts of transactions.

2) Hypotheses based on outside research:

1. Frequent transactions by the same sender in a short time window (ie. 72h) may be suspicious because this could indicate “layering,” where a sender intentionally breaks up larger transfers into multiple smaller ones to fly under the radar of reporting thresholds.
2. Transactions that occur late at night or outside of typical business hours might be cause for suspicion, as most legitimate remittances tend to be sent during the day. Unusual timing could suggest efforts to avoid scrutiny, though it is also possible that some senders

may be in different time zones, so additional contextual information would be needed to clarify.

- 3.** A sender or receiver with a significantly higher frequency of transactions compared to others may indicate suspicious behavior, since high-volume actors can be associated with money laundering networks.
- 4.** Multiple transactions just below \$3k or \$10k may indicate suspicious behavior, since this can reflect attempts to avoid reporting requirements, and may warrant further review.

Part 2

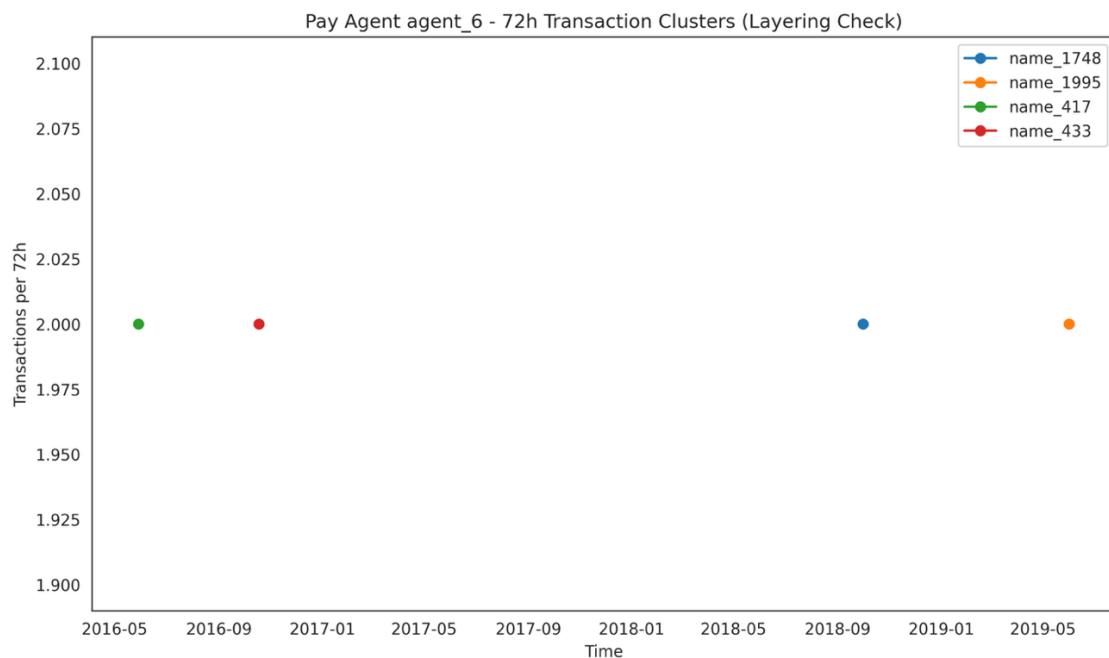
1) Testing hypotheses

Based on our data exploration, the hypotheses we would like to test are:

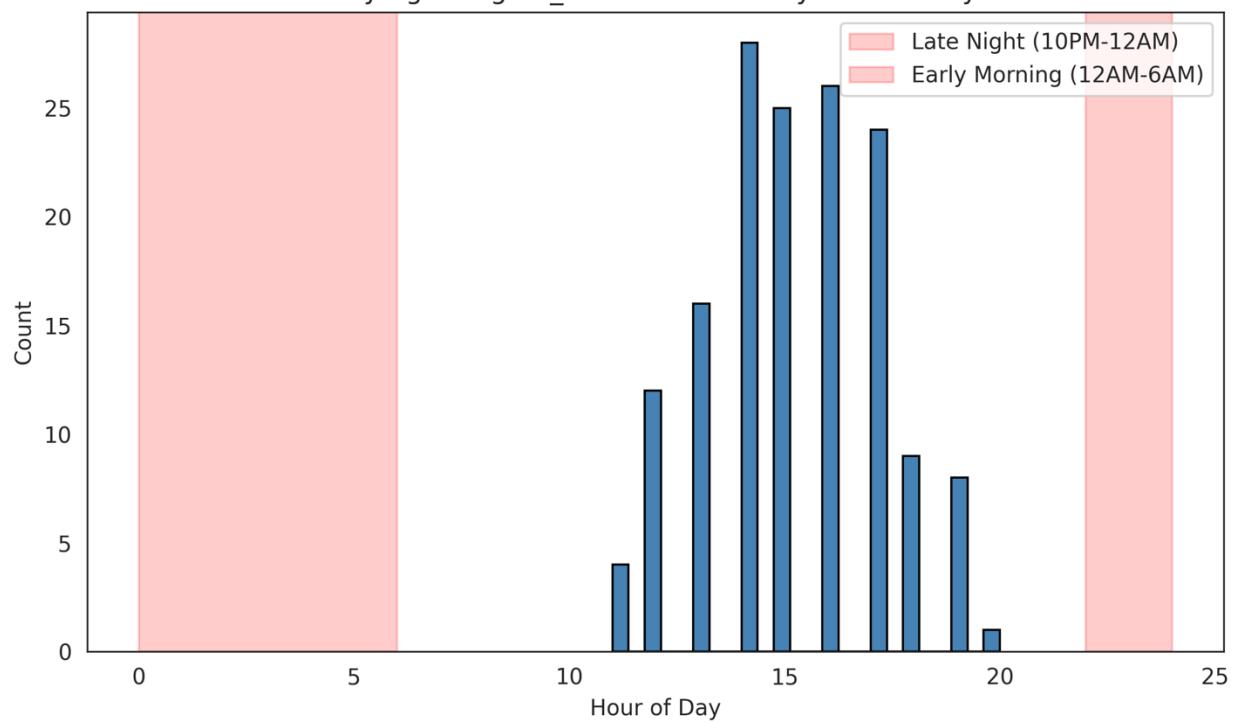
Investigate the agents highlighted in part #3 across Pay Agents #6, 11, 39 to see if they fit the following known money laundering patterns:

- a. Shows patterns of sending multiple transactions just below \$3K or \$10K to potentially avoid reporting requirements.
- b. Initiates multiple transactions within 72h hours to potentially layer illicit funds.
- c. Sends many transactions late at night or outside business hours.
- d. Displays a higher frequency of transactions than normal.

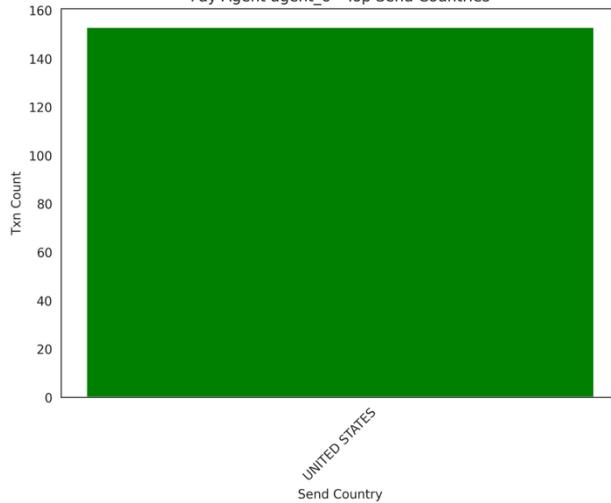
Pay Agent 6



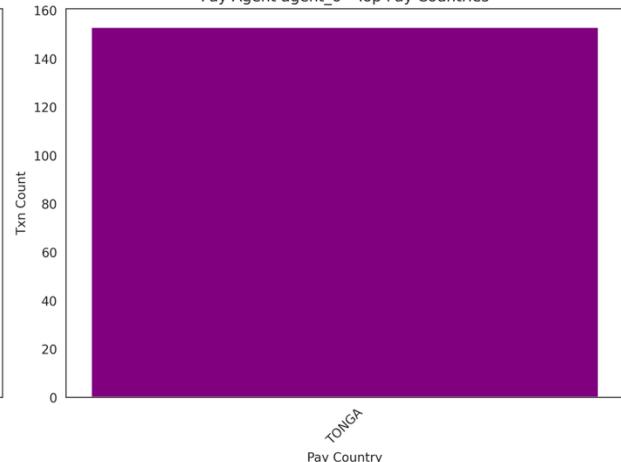
Pay Agent agent_6 - Transactions by Hour of Day



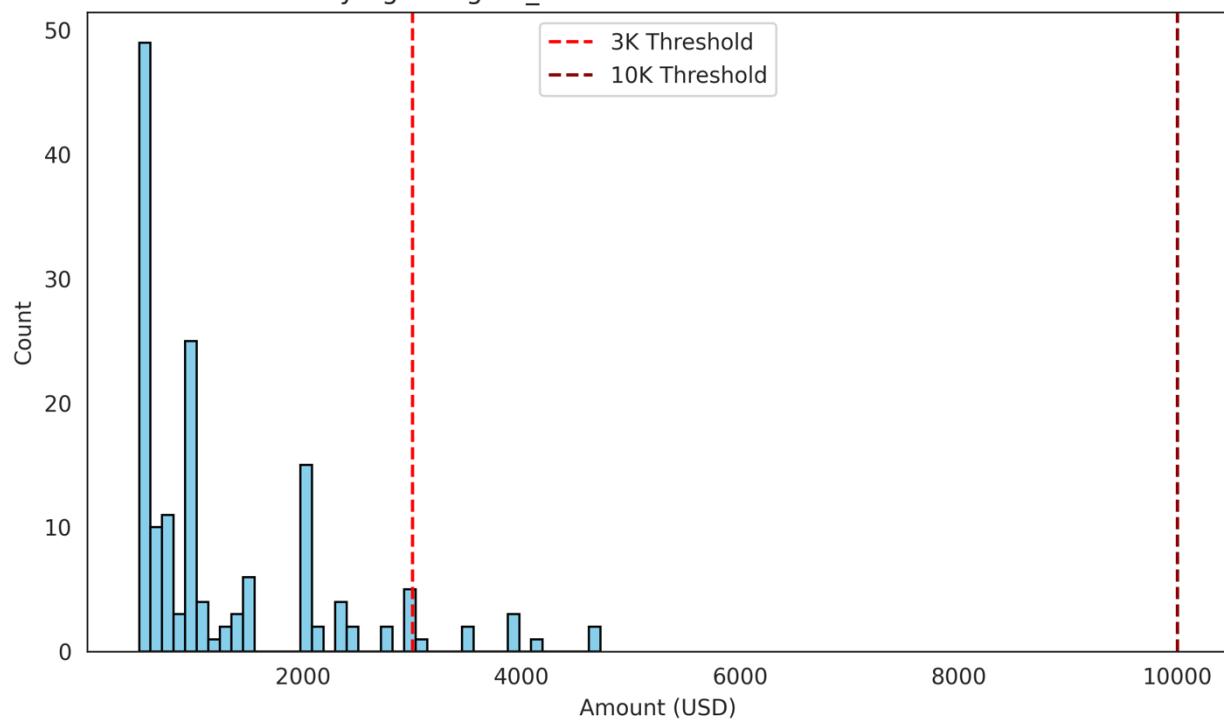
Pay Agent agent_6 - Top Send Countries



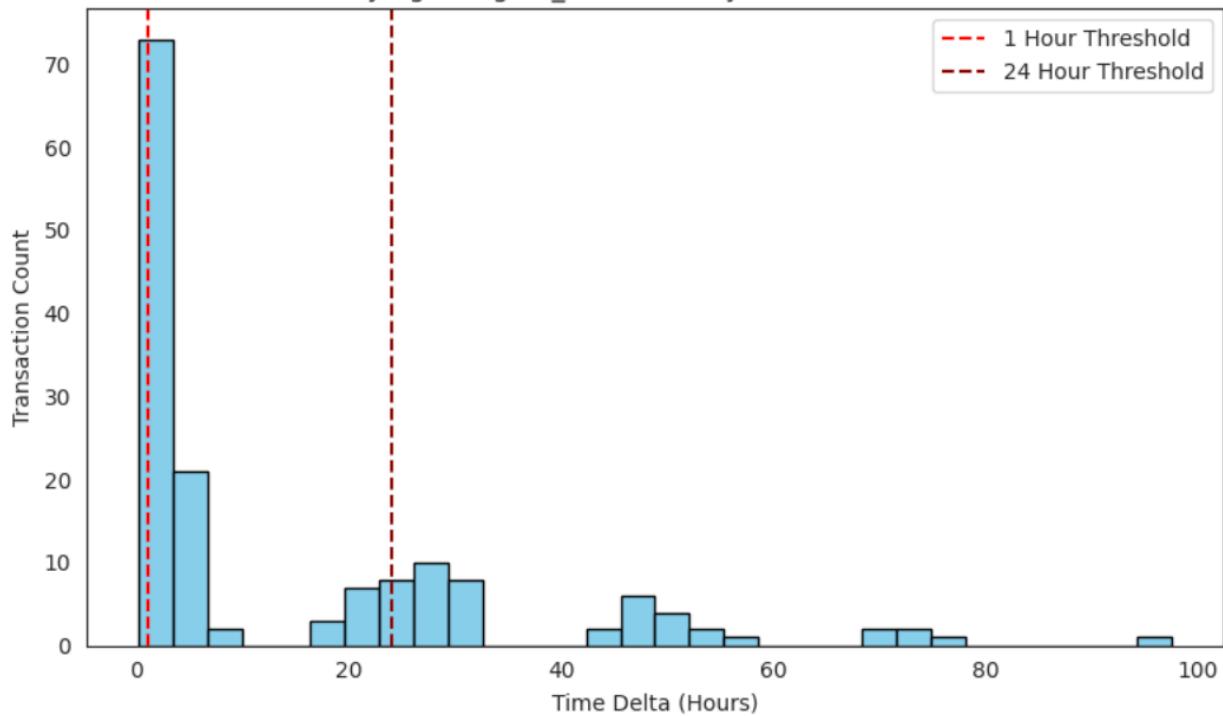
Pay Agent agent_6 - Top Pay Countries



Pay Agent agent_6 - Transaction Amount Distribution

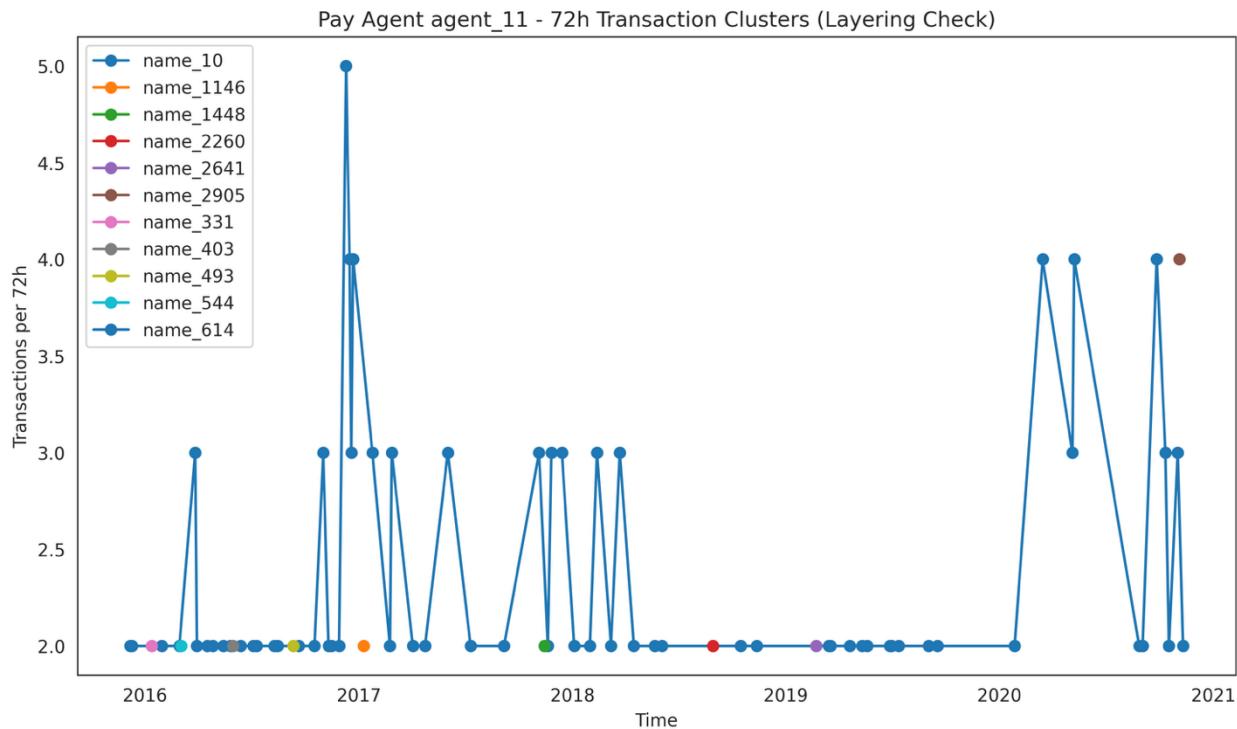


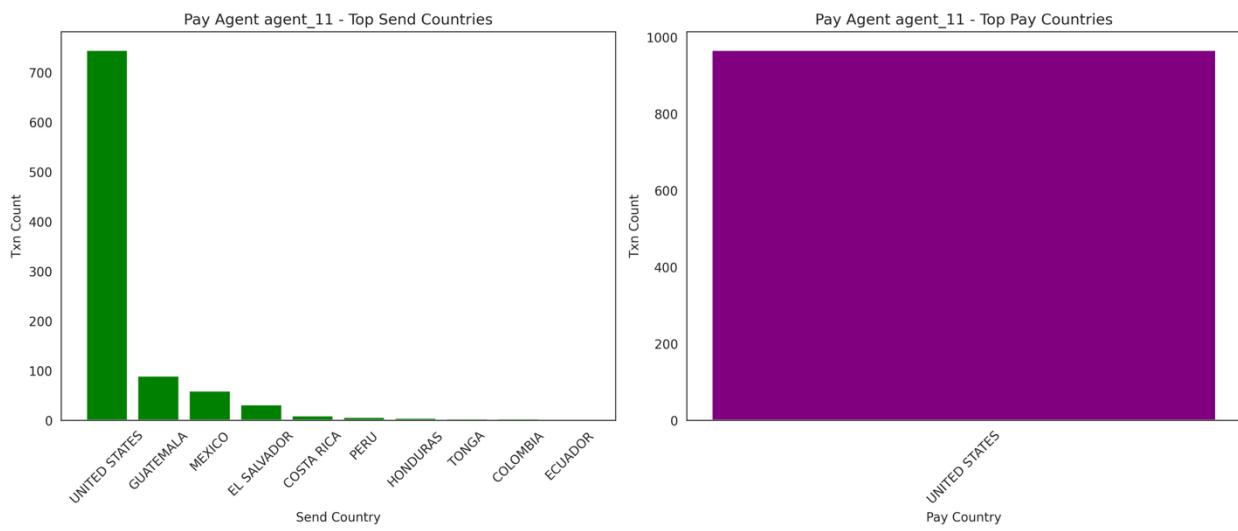
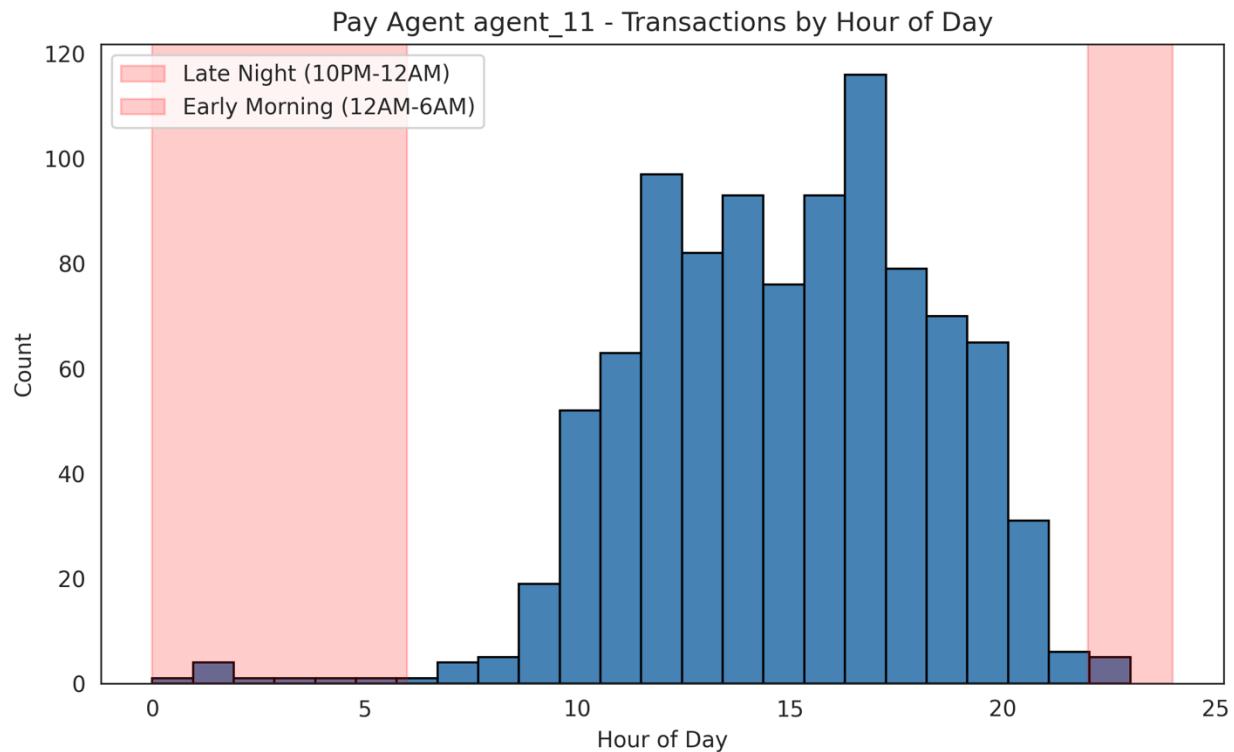
Pay Agent agent_6 - Send→Pay Time Distribution

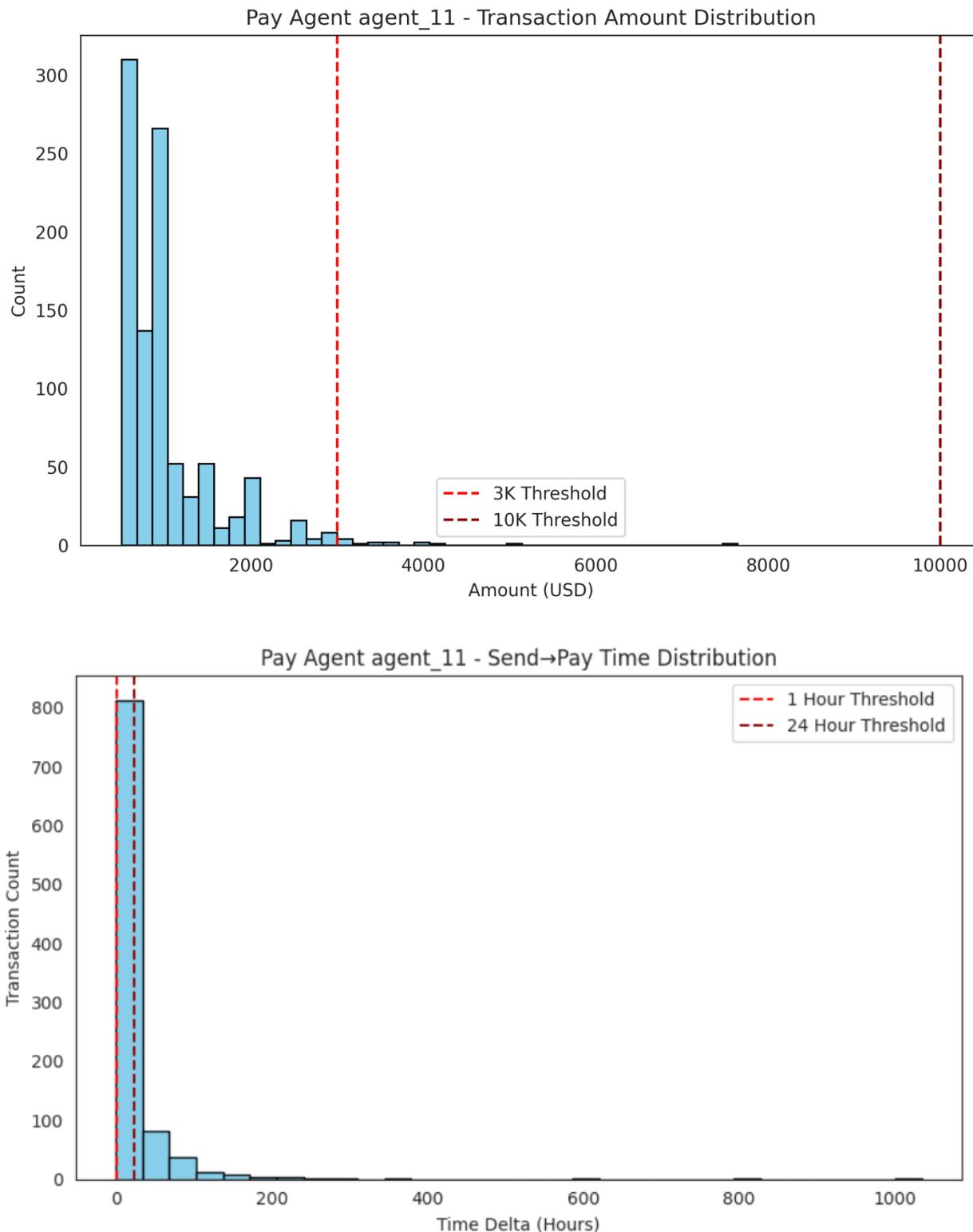


- While we previously observed Pay agent 6 had an above-normal transaction frequency that was deemed suspicious, we can observe that none of their transactions fall outside of normal business hours, and we see only a low number of “layering” transaction clusters overall with there being only four in total between 2016 and 2019.
- We can also observe that all payments originated from the United States with Tonga being the only receiver country, suggesting a limited geographic scope rather than a broader network of transfers.
- Although some of the 15 transactions in the \$2K range and the five transactions near the \$3K mark may look suspicious, we can observe no transactions above \$5K , which makes the overall pattern appear less consistent with laundering activity.
- Given these factors, although it would still be prudent for California law enforcement to review sending activity and conduct further checks, the evidence seems to suggest a lower risk of money laundering.

Pay Agent 11



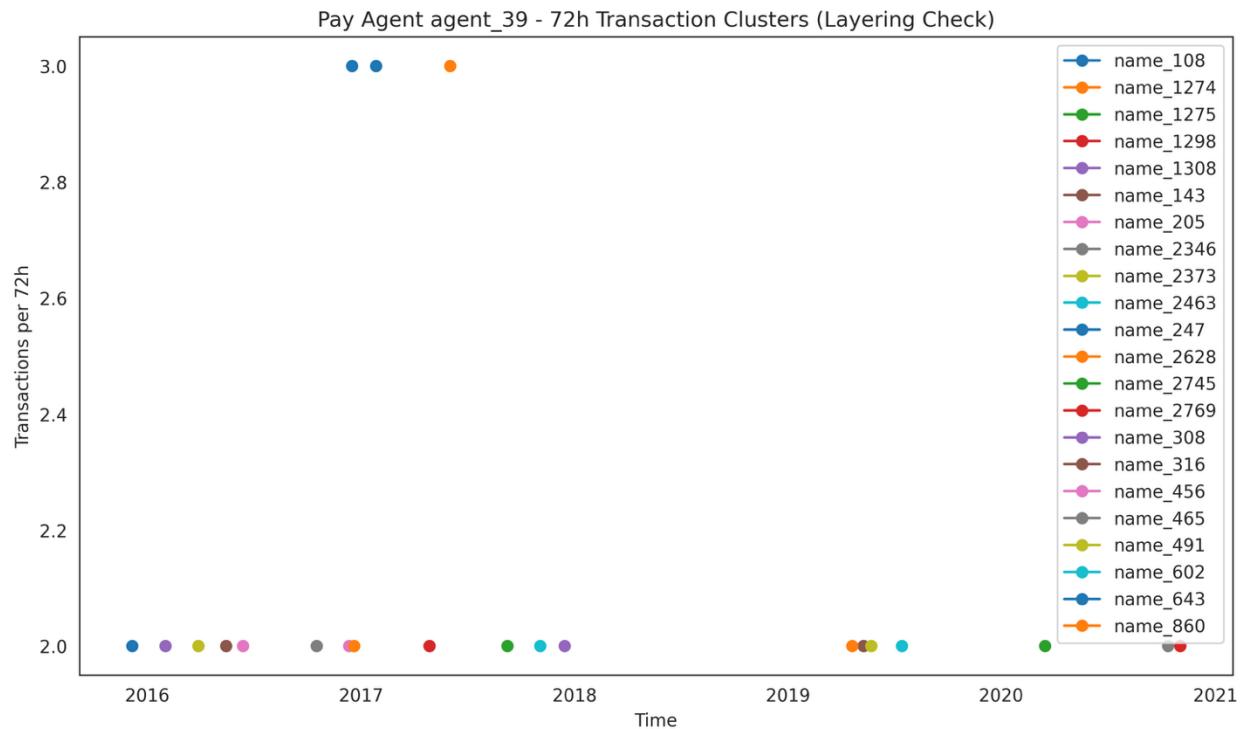


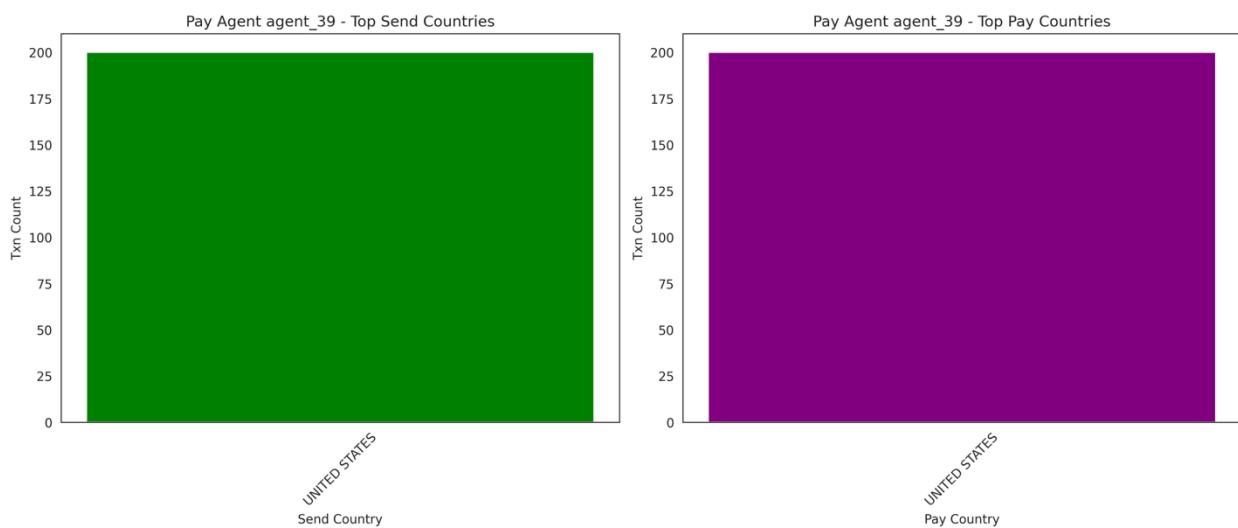
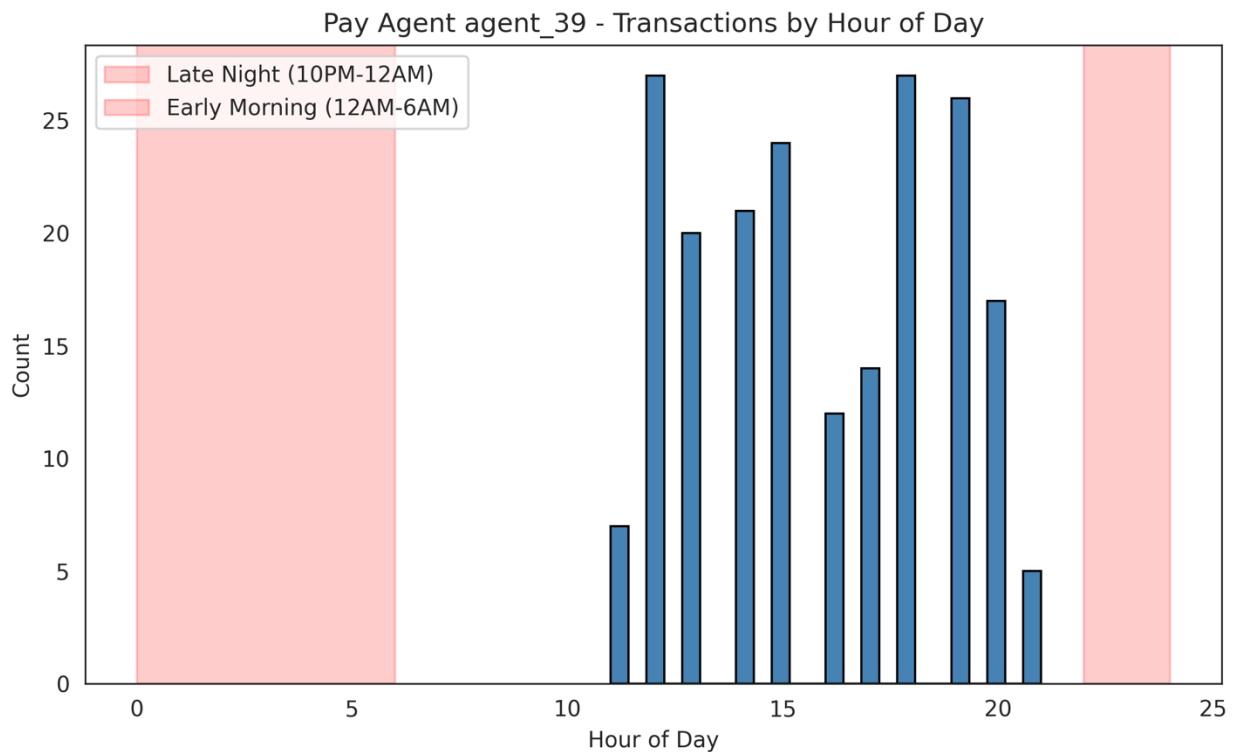


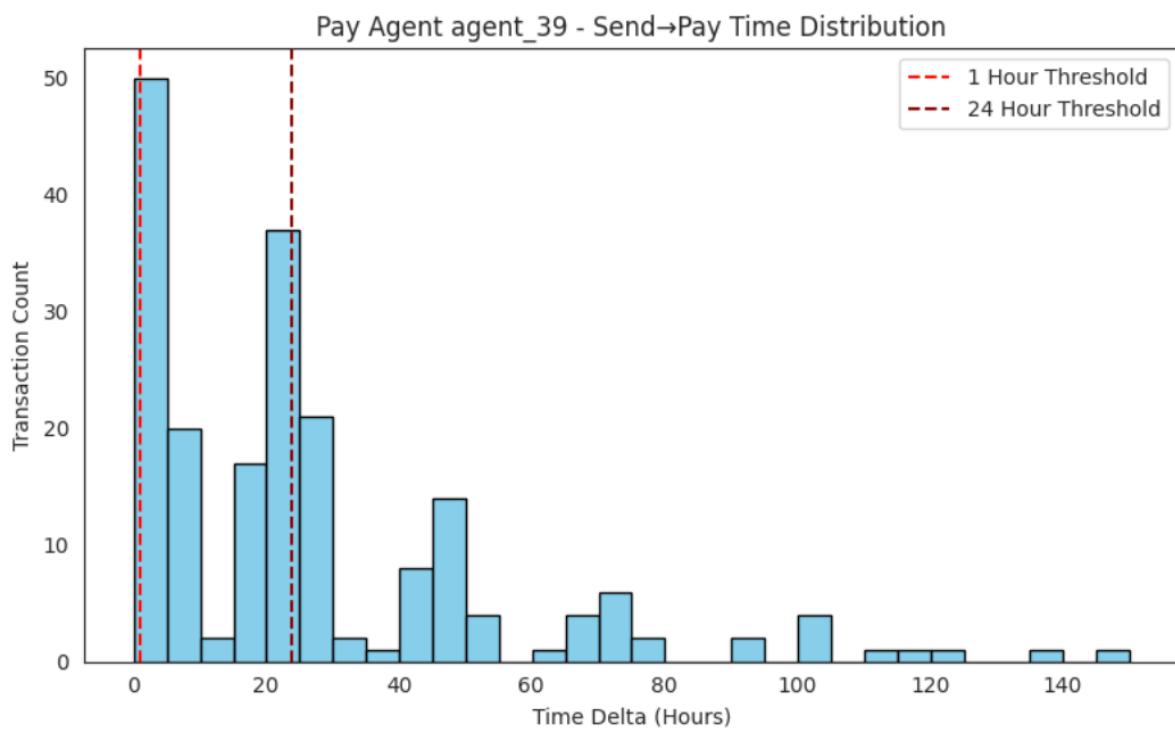
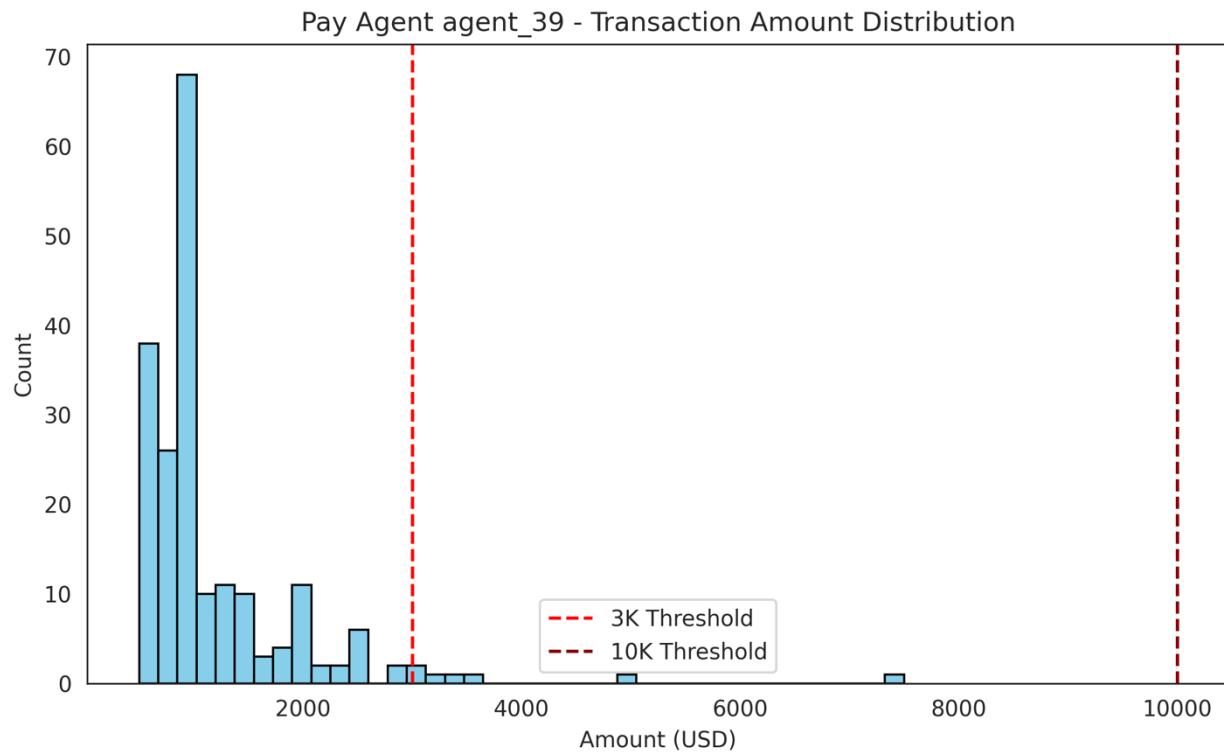
- As we noted previously, a high frequency of transactions for pay agent 11 already seems suspicious at the outset.

- We can further note that a non-negligible share of these transactions fall outside of normal business hours, about 10% of the total, which strengthens the concern of unusual activity.
- We can also observe a large number of layering spikes spread across the full time period, with more than ten instances of 72h windows registering more than three transactions, and notably six instances of four or more in that same time window, which is highly suspicious.
- In addition, we see a significant volume of transactions directed to Guatemala, Mexico, and El Salvador, destinations that are often cited in connection with gang or criminal networks involved in money laundering.
- Taken together, these patterns make Pay Agent 11 the case with the highest level of suspicion, and we strongly recommend that this agent be investigated further by California law enforcement.

Pay Agent 39







- The high transaction count that we had noted previously was a cause for concern for this agent as well.

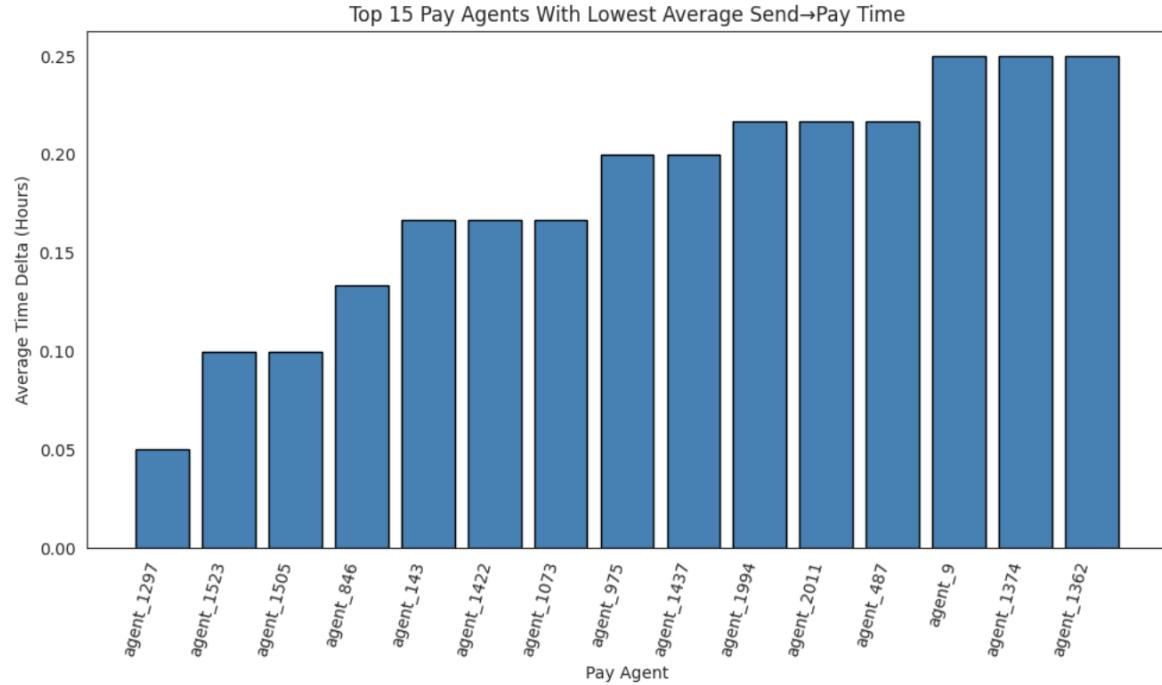
- We can observe a relatively low number of transactions above the \$5,000 mark with only five total, and that most transactions fall under \$3,000.
- However, it seems that there might be some layering behavior present given we can observe ~15 cases of 72-hour periods with more than two transactions, which may be evidence of layering behavior, like that observed with agent 11.
- Additionally, about 15% of the total transactions occur after 8 p.m., which may also be considered suspicious, as most legitimate transactions tend to occur during standard business hours.
- Given the presence of potential layering activity and the notable share of after-hours transactions, we recommend that Pay Agent 39 be investigated further for possible money laundering activity.

2) Final Recommendation

We therefore recommend that Pay Agents 39 and 11 be investigated immediately, given both display more than 15 instances of layering activity in the observed five-year period (defined as two or more transactions in a 72-hour period), as well as suspicious behavior with many transactions falling outside of normal business hours, notably before 9am and after 8pm.

In the case of Pay Agent 11, the concern is further heightened by the large number of transactions directed to foreign countries such as Guatemala, Mexico, and El Salvador, destinations often associated with money laundering networks.

While we also recommend investigating Pay Agent 6 given the high transaction frequency that we observed in the dataset, the very low level of transaction layering in 72-hour periods, with only four being observed over a five-year span, and the absence of any transactions outside of business hours make our office believe this is a lower likelihood case of money laundering. Nevertheless, this agent should still be reviewed by law enforcement to ensure that no suspicious activity has been overlooked.



Beyond the three agents that displayed high frequency counts, we also recommend investigating some of the agents with very low average time deltas between send and pay operations, which are shown here for the top 15.

This pattern can be another marker of potential money laundering activity, as short gaps between sending and receiving wires may indicate that both the send and pay agents were notified ahead of time, allowing for immediate payout once the transfer was initiated.

Given this, these agents should be reviewed closely in addition to the high-frequency cases, as both patterns together may signal coordinated structuring behavior.

Appendix

Link to Github: https://github.com/philippe-heitzmann/data_analysis_mny_lndring

Link to ChatGPT conversation: <https://chatgpt.com/share/68d14684-1a34-800f-8ea0-a714eb7620b5>