

Uncovering the Drivers of Transaction Failures

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Objectives

- Assess the business impact of failed transactions
- Identify key causes and patterns behind transaction failures
- Provide actionable recommendations for the IT department to address and resolve issues effectively

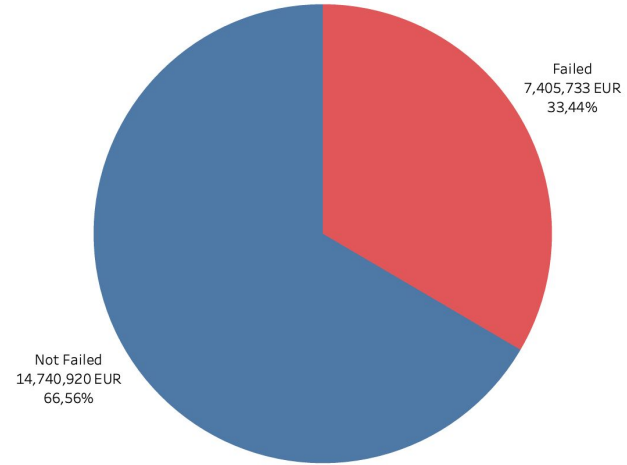
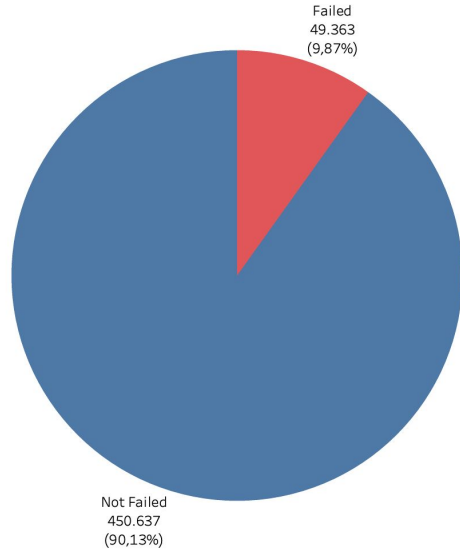
Technical Details

- Transactions were classified as **Failed** if their statuses were: 'failed', 'Failed', 'Rejected', or 'AuthorisationFailed'
- To estimate the monetary impact of failed transactions, amounts in local currencies were converted to EUR
- The monetary impact reflects **potential losses**: it represents the total amount if failed transactions were not retried and subsequently successful
- For simplicity, data in the plots below is aggregated by **month**
- Variables strongly influencing transaction failures were identified using **Logistic Regression**
- On Slide 7, where the failure rate is analyzed for large transactions, bin edges in the bar plot are set to the **95th and 99th percentiles** of transaction amounts in EUR (~89 EUR and ~472 EUR). These were rounded to **90 EUR and 500 EUR** for simplicity
- **Statistical significance** on this slide was assessed using **Chi-Square tests** and **ANOVA**
- Tools used: **Python** for analysis and **Tableau** for visualization
- The absence of understanding the nuances of terminology (the exact meaning of the values in categorical columns) prevents me from delving deeper into inferring causal relationships

Summary of Findings

- From 2004–2010, approximately **10%** of transactions failed, with a potential monetary impact of **~7.4M EUR**
- Transactions with larger amounts exhibit a significantly **higher failure rate**
- The majority of failed transactions are in **CAD**, followed by **USD**
- CAD failed transactions predominantly originate from **Country ID: 9e2b06736b477b7a924f60de14a7e329d82d6f4f**
- USD failed transactions primarily come from **Country ID: f69ad584c025f9b756ce1e8c70de3a33aef50b32**
- The main reasons for failures are **expired**, **not_authorized**, and **provider_rejected**
- In 2008–2009, the prevailing failure stage was **authorizing**. From 2009 onward, **initiated** became the dominant stage
- Most failed transactions are linked to **API v3**
- The top verticals associated with failed transactions are **Vertical 2** and **Vertical 5**
- The prevailing connectivity type for failed transactions is **Type 8**
- A significant portion of failed transactions originates from a **limited number of banks**, most of which are located in **Country ID: 9e2b06736b477b7a924f60de14a7e329d82d6f4f**
- Failed transactions are concentrated among a **small number of customers**. Most of these clients are located in **Country ID: 9e2b06736b477b7a924f60de14a7e329d82d6f4f**, with the second-largest contributor being from **Country ID: 37eec10a53dd5fd2f024a17be5961dfceb0c66e6**

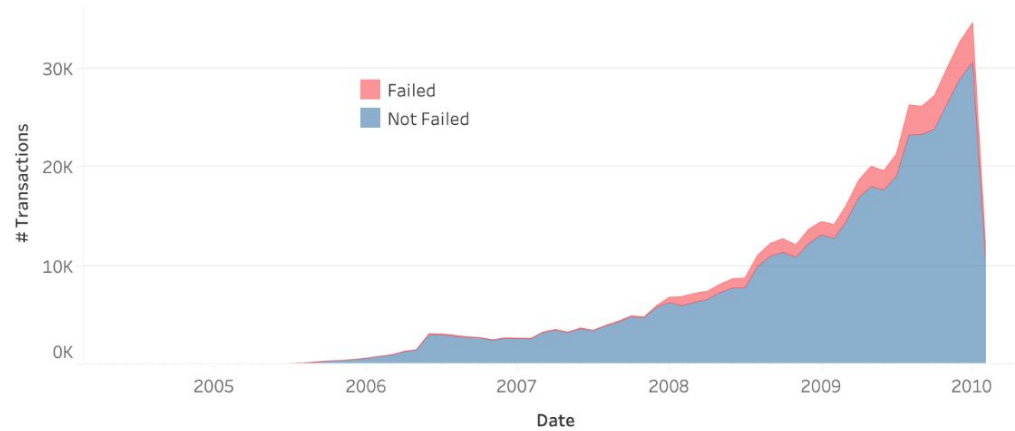
Problem Overview



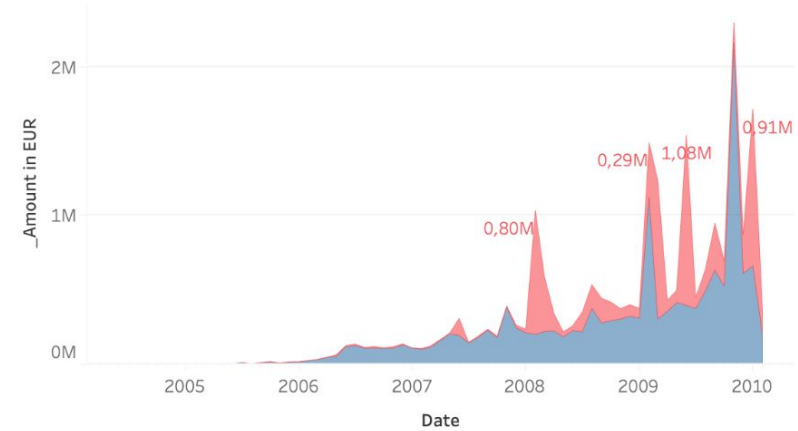
- From 2004–2010, approximately **10%** of transactions failed
- potential monetary impact of **~7.4M EUR**

Trend of Failed Transactions Over Time

Number of Failed Transaction VS Total



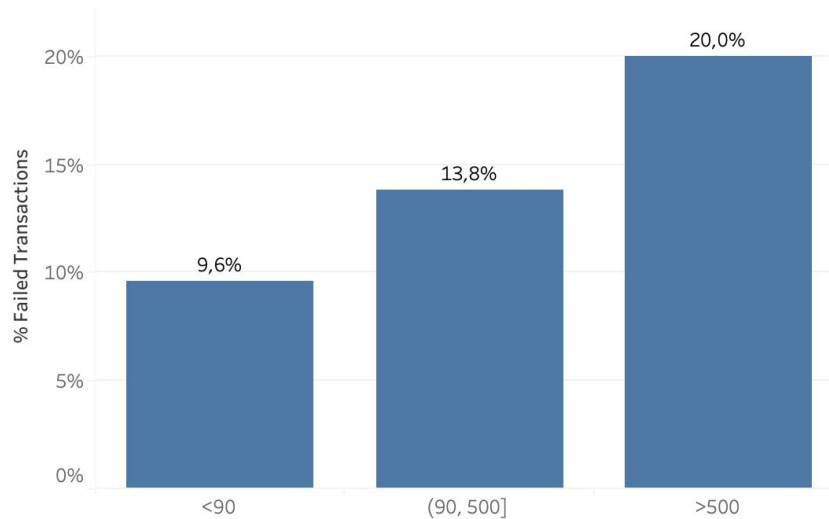
Amount (EUR) Failed Transactions



- A **steadily increasing trend** in the number of failed transactions has been observed
- The **monetary impact of failed transactions** shows spikes, indicating a **higher failure rate for transactions with larger amounts**

Failure Rate for High-Value Transactions

% of Failed Transaction VS Total

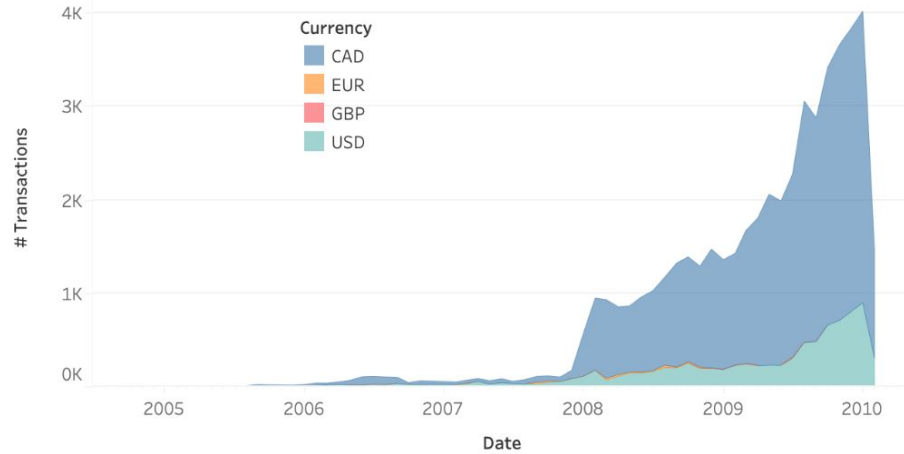


The plot illustrates the **failure rates** for transactions grouped by their amounts in EUR: **less than 90 EUR**, **90–500 EUR**, and **greater than 500 EUR**. The thresholds of 90 EUR and 500 EUR correspond to the **95th and 99th percentiles** of transaction amounts, respectively, meaning that approximately 5% of the largest transactions have values exceeding 90 EUR

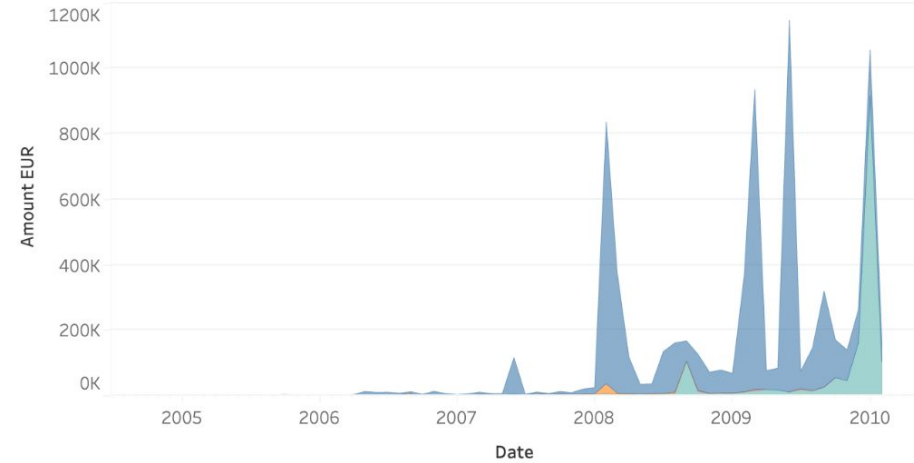
- Transactions with larger amounts exhibit a significantly higher failure rate (significance was proven by statistical tests)

Trend of Failed Transactions by Currency

Number of Failed Transaction by Currency



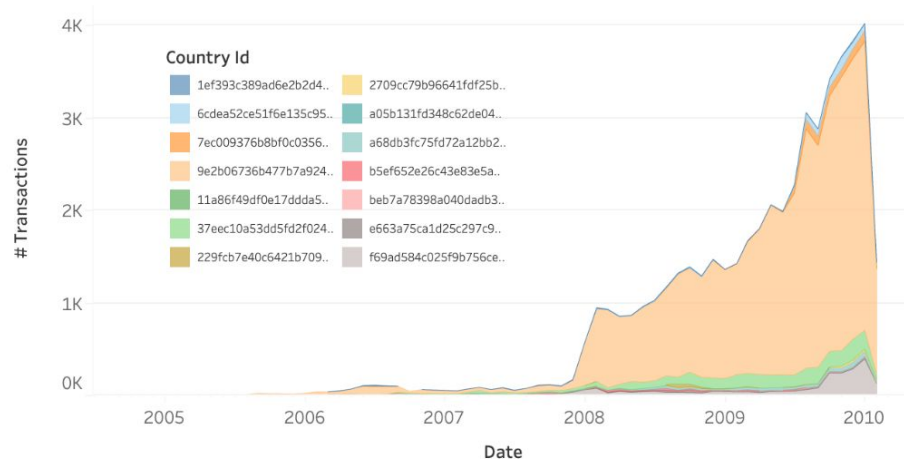
Amount (EUR) Failed Transactions by Currency



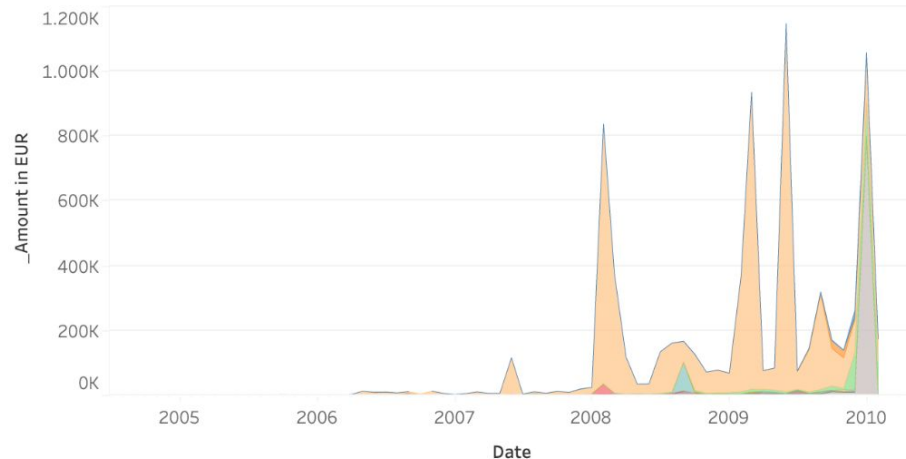
- The majority of failed transactions are in **CAD**, followed by **USD**
- Almost all spikes in the **monetary loss estimates** from failed transactions are associated with **CAD transactions**. The only exception is the final spike, occurring near **2010**, which corresponds to **USD transactions**

Trend of Failed Transactions by Country

Number of Failed Transaction by Country



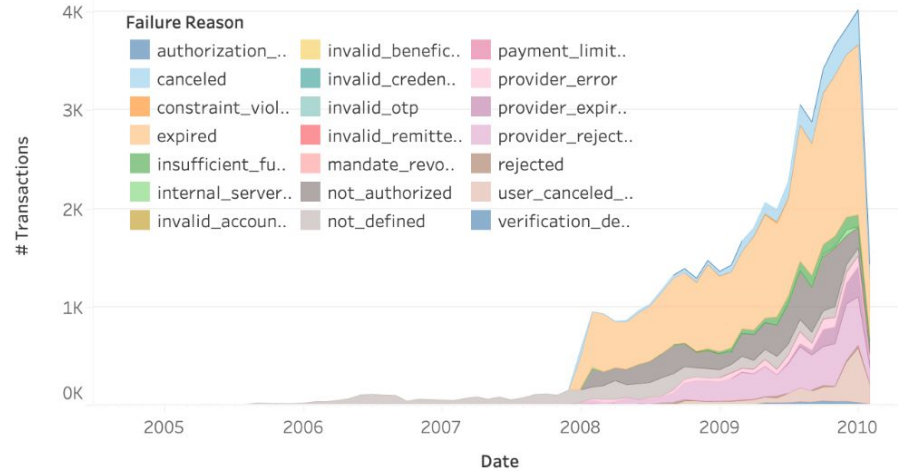
Amount EUR Failed Transaction by Country



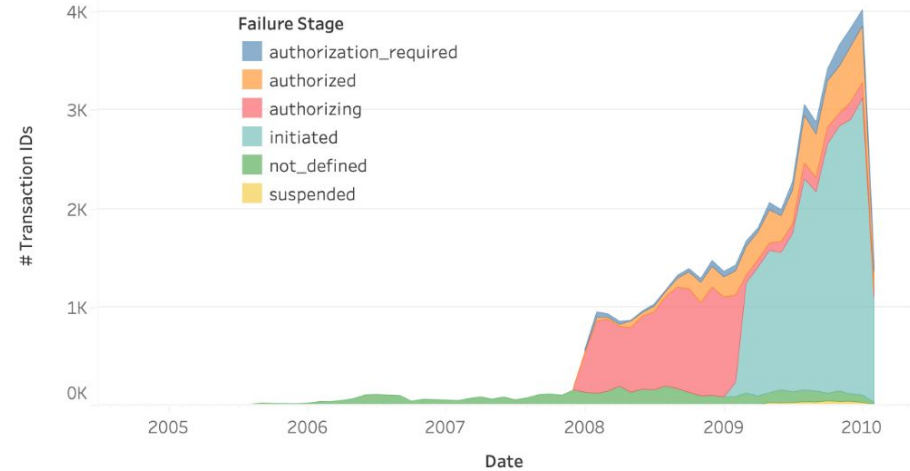
- **CAD** failed transactions predominantly originate from Country ID 9e2b06736b477b7a924f60de14a7e329d82d6f4f
- **USD** failed transactions originate from Country ID f69ad584c025f9b756ce1e8c70de3a33aef50b32

Trend of Failed Transactions by Failure Reason and Stage

Number of Failed Transaction by Failure Reason



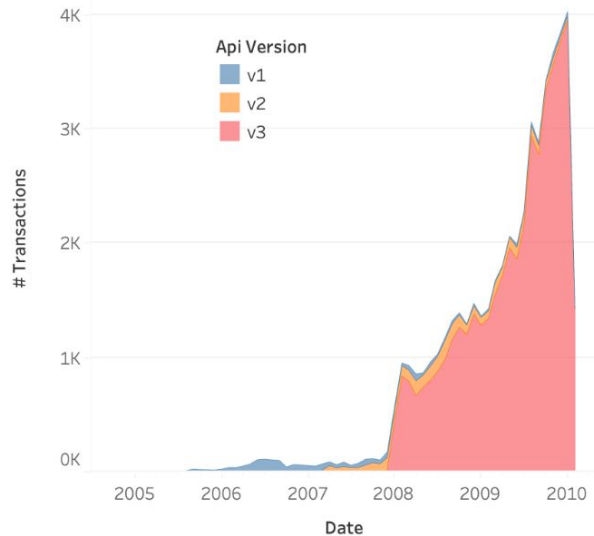
Number of Failed Transaction by Failure Stage



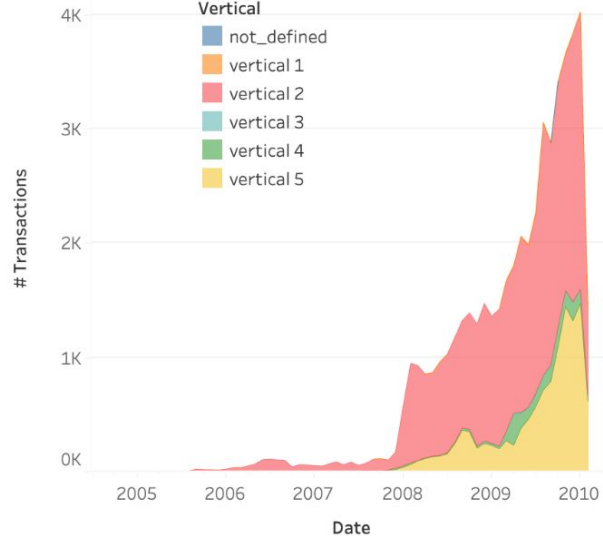
- The main reasons for failures are **expired**, **not_authenticated**, and **provider_rejected**
- In 2008–2009, the prevailing failure stage was **authorizing**. From 2009 onward, **initiated** became the dominant stage

Trend of Failed Transaction by API type and Vertical

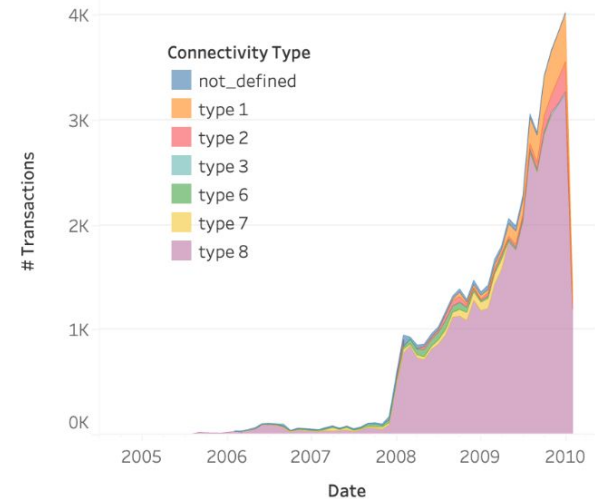
Number of Failed Transaction by API type



Number of Failed Transaction by Vertical



Number of Failed Transaction by Connectivity Type



- Most failed transactions are linked to **API v3**
- The top verticals associated with failed transactions are **Vertical 2** and **Vertical 5**
- The prevailing connectivity type for failed transactions is **Type 8**

Failed Transactions by Bank ID

Country Id	Bank Id	2004	2005	2006	2007	2008	2009	2010
9e2b06736b477b7a924f60de14a7e329d82d6f4f	b5ab8f51d35b64af079485e5bbbc335213f3a0ae	1	23	115	121	1.721	3.618	543
	6cd7d8d37b110668afdca42fc0e1d366b322783e		2	26	14	1.424	3.576	539
	6926610db1dfc17aca46a6f67789d7d6c24a7185		3	15	10	944	2.425	455
	fa485aff3f9e34d55d25f78856d4a2526a5f8e6f		6	74	95	674	2.009	363
	34a0061ba48d1c2810cd930dd69d42482ca92d85		2	69	54	1.046	1.954	285
	e8085010136a26d0ebc200ac0751b1d9d673a764		2	36	40	698	1.906	418
	660054a4565377c6e43ff7709abf56d8494ba604	0	2	62	14	1.083	1.906	329
	0090e57640ed78b0c16ac4606a6773769545bb17	0	6	72	58	871	1.794	375
	b7308502f039e303a048625c725d4aea3380c2ac		0	9	21	323	1.617	303
	4d762ce64874cd49be593313e92a1e61cf74417e		1	20	20	499	972	182
	eb1c4738ae6ac9c907a46a541af2d02d6be2f05b		0	7	4	341	542	90
	f4203d6b7658cb7252d6afdf95a6b692e93c2f7b					14	520	100
	3674b4d292131698ba6c946dda67a8fd8b63f12a		1	6	2	259	429	69
	e67095adf654ddc631bcfd3f7aa3c7e43424ce0f		0	10	12	171	328	34
	ef5fd3772894624523e41ab5fa5205af0a62d902		0	0	0	119	229	42
	6e98f6d55096ecb8a0ff2f7fadbc69dd58d34c00			0	0	0	210	54
	64a5ec02300204a41e41fb8e16a99eb7766af470		0	5	1	120	137	28

- A significant portion of failed transactions originates from a **limited number of banks**, most of which are located in **Country ID: 9e2b06736b477b7a924f60de14a7e329d82d6f4f**

Failed Transactions by Customer ID

Country Id	Customer Id	2004	2005	2006	2007	2008	2009	2010
9e2b06736b477b7a924f60de14a7e329d82d6f4f	63237c0742e42bfd7d59d68d894d010aa4cca170		43	128	131	5.917	5.359	649
	ceca867e41d2c14870fe15b324308c2274486b90				53	786	4.346	495
	72d5501ffb7d3617c28811a329b6c1b466e48d57					591	2.325	198
	d292da2283043c07accb1086a004caaf05472d44				19	958	1.840	227
	e2f7d039a3b57f89fbffcadd6b23f5b825e468cd					59	1.348	388
	03bdc906cb6d5941a654ae715b7ceba07a1f9545		14	53	56	408	1.201	169
	6b18ccd5f538daf6abfc0b6e2689737f16f3a733					0	1.125	117
	9f3b37acca2166d9d8a911c1ad11b609159ce1e3					173	941	342
	64c370a753b1db282770cdbf2aba5434a3185b3d						885	259
	9fc2814d8ba5f9c847a3d59f3561a56703abac41						556	297
	f01dc54a26fe2a3def3dee28f7fb7c56c83ee7e7						482	217
	d0f2e447062bc248e0ecd2b2dc7a9ec7f5321236						363	97
	17f6971ed49b760b31a776a465f8c8d1d1b04976				8	90	293	39
	25dc0237dd6a61d44890c7b6ca61672641ed90e4					2	260	58
	58a4d6a99e5d880ccb6de125a99d05e0b553f717			4	6	436	250	16
37eec10a53dd5fd2f024a17be5961dfceb0c66e6	63237c0742e42bfd7d59d68d894d010aa4cca170			51	195	738	1.759	257
	72d5501ffb7d3617c28811a329b6c1b466e48d57					3	84	2

- Failed transactions are concentrated among a **small number of customers**. Most of these clients are located in **Country ID: 9e2b06736b477b7a924f60de14a7e329d82d6f4f**, with the second-largest contributor being from **Country ID: 37eec10a53dd5fd2f024a17be5961dfceb0c66e6**

Thank You!