ReDI School of Digital Integration

Instant Payments Readiness & Impact Simulator

Developed by Vladyslav Buldenko

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Why this project?

- Instant Payments are rapidly becoming the dominant payment method in Germany.
- Banks must balance speed, security, and operational workload under growing system load.
- Bundesbank data provides a reliable, real-world foundation to validate market trends.
- A simulation model allows testing “what-if” VoP & Fraud settings that real datasets don’t include.

Project Goals

- Process Bundesbank payment data to understand market trends.
- Validate the shift toward Instant Payments and rising system load.
- Build a synthetic simulator to test VoP & Fraud thresholds.
- Identify the optimal balance between speed, security, and operational workload.

Data Cleaning & Preprocessing

1. Extract Data

- Load Bundesbank Excel dataset.
- Extract Table 3a/3b (transactions / values).
- Save cleaned CSVs to data/interim/.

```
file_path = "../data/raw/I.Payments_statistics_810262.xlsx"

xlsx = pd.ExcelFile(file_path)

# Load the Table 3, Table 4 and convert them in the .csv format
table_3 = pd.read_excel(xlsx, sheet_name="Table 3")
table4 = pd.read_excel(xlsx, sheet_name="Table 4")

# Save cleaned CSVs to data/interim/
table_3.to_csv("../data/interim/table_3_transactions.csv",
               index=False, encoding="utf-8")
table4.to_csv("../data/interim/table_4_values.csv",
```

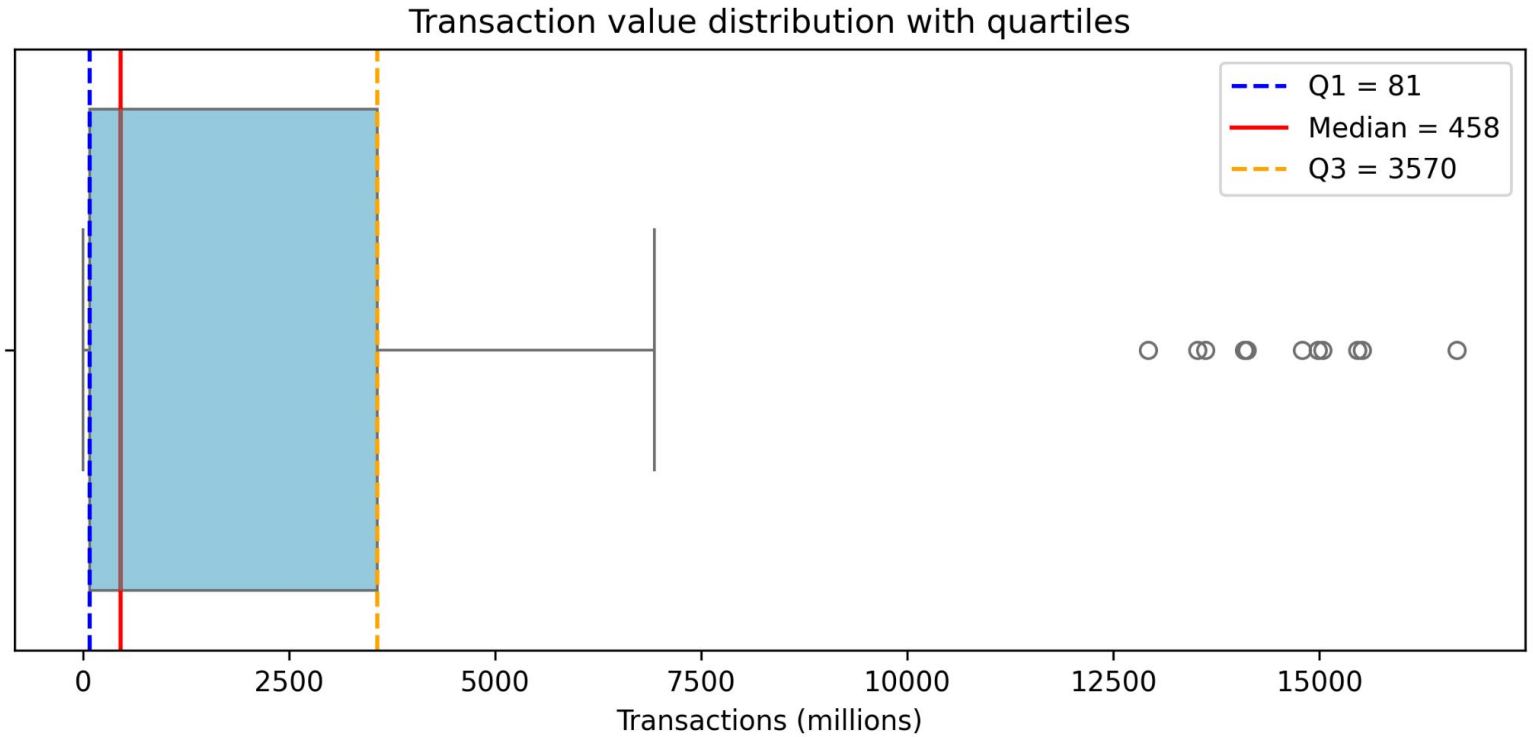
2. Clean Data & Create Tidy Dataset

- Remove helper rows (“of which”).
- Standardize columns (2022 S1→2022H1).
- Convert to long (tidy) format with melt().

```
values = values[~values['Payment type']
                .str.contains('of which', case=False, na=False)]

# Remove spaces and rename periods name
transactions.columns = [c.strip().replace(" ", "")
                        .replace("S", "H") for c in transactions.columns]
values.columns = [c.strip().replace(" ", "")
                        .replace("S", "H") for c in values.columns]

# Convert into Long format and rename
transactions = transactions.rename(columns={"Paymenttype": "Payment_Type"})
values = values.rename(columns={"Paymenttype": "Payment_Type"})
transactions_tidy = transactions.melt(id_vars=['Payment_Type'],
                                      var_name='period', value_name='value')
values_tidy = values.melt(id_vars=['Payment_Type'],
                                      var_name='period', value_name='value')

# Add extra columns
transactions_tidy['metric'] = 'transactions'
```

EDA Goals

- Understand the structure and characteristics of payment data.
- Identify variability, seasonality, and anomalies in transaction volumes.
- Determine key patterns that influence Instant Payments readiness.
- Prepare a reliable foundation for further modeling and simulation.

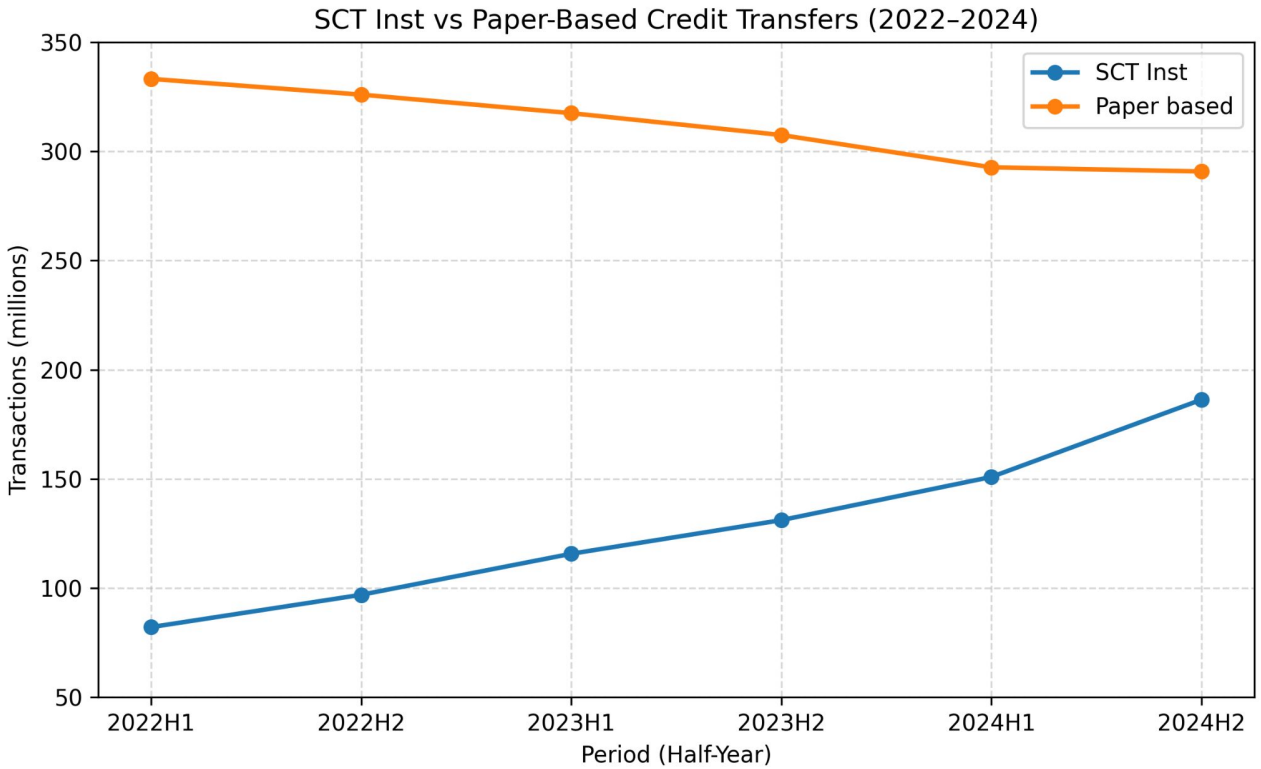


Conclusions:

- Distribution is highly right-skewed → a few very large categories dominate volume.
- Median is much lower than upper values → strong imbalance in transaction sizes
- Several outliers indicate irregular spikes in payment activity.

Hypothesis 1 - Growth of Instant Payments

Are instant payments (SCT Inst) becoming a dominant payment method in Germany?

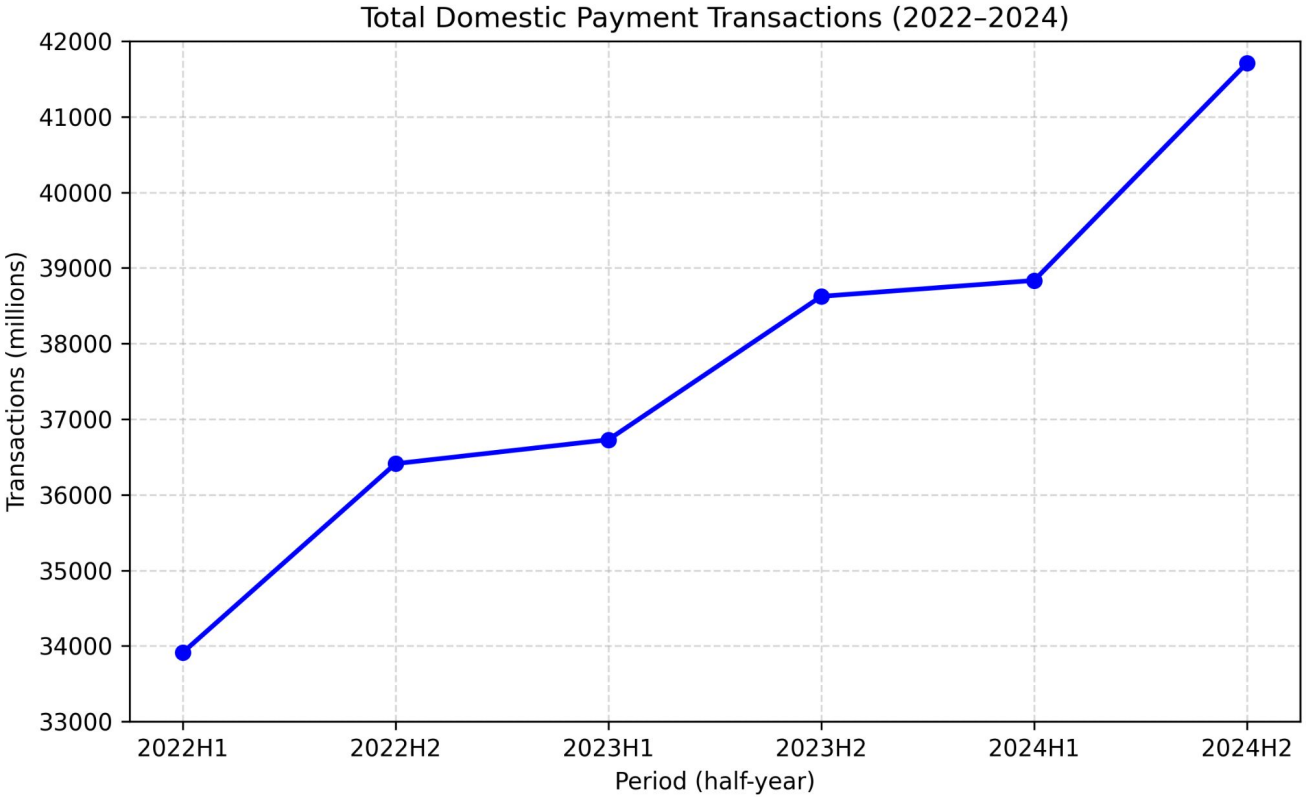


Conclusions:

- The volume of SCT Inst increases steadily and the paper-based transfers decreases.
- This confirms that Instant payments are gradually replacing traditional paper transfers.
- The trend demonstrates a clear digital transformation in the German payment market.

Hypothesis 2 - Electronic payments system load.

Is overall system load increasing as users shift to electronic payments?

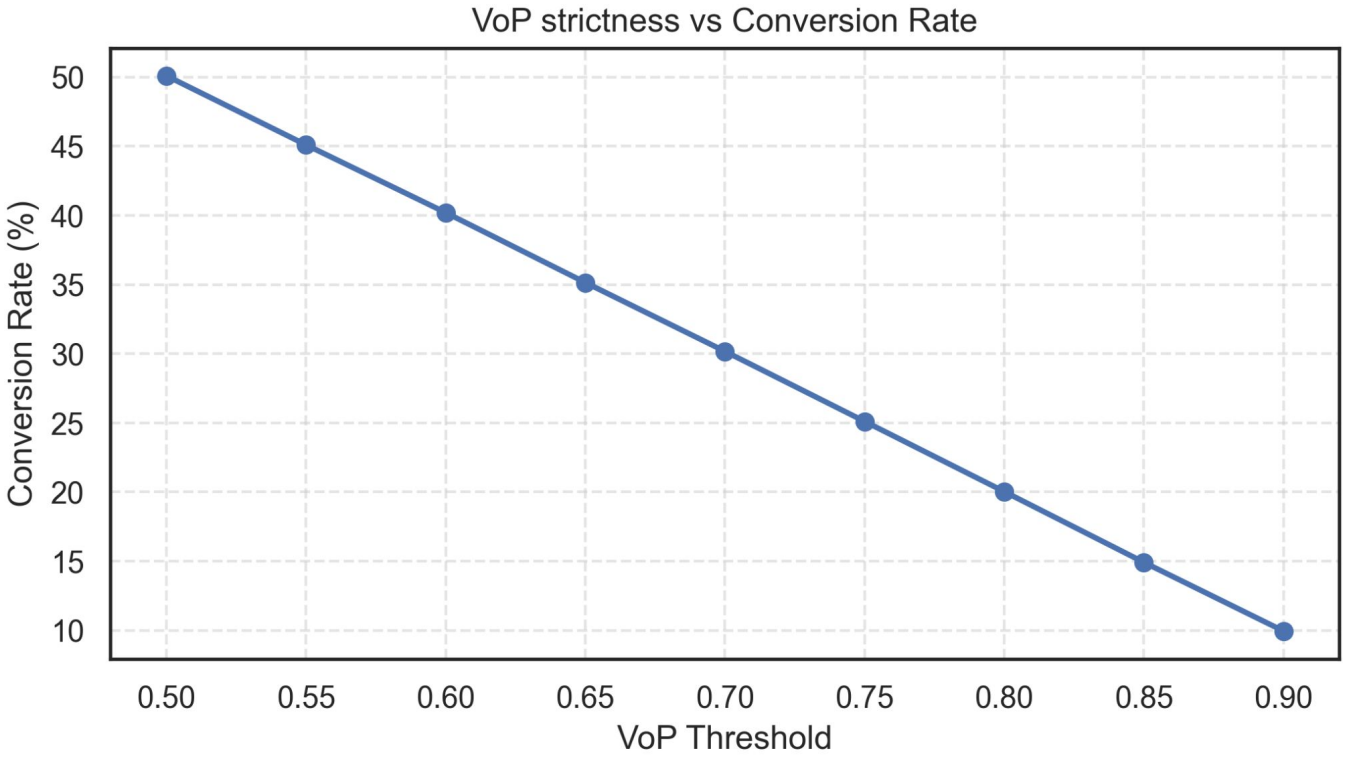


Conclusions:

- The number of Domestic transactions increases steadily.
- Overall payment activity is growing, indicating a heavier operational load on banking infrastructure.
- As electronic and instant payments expand, banks need to ensure that their systems can handle higher transaction volumes and maintain low latency.

Hypothesis 3 - VoP Strictness Impact

How does Verification of Payee (VoP) strictness affect customer experience?

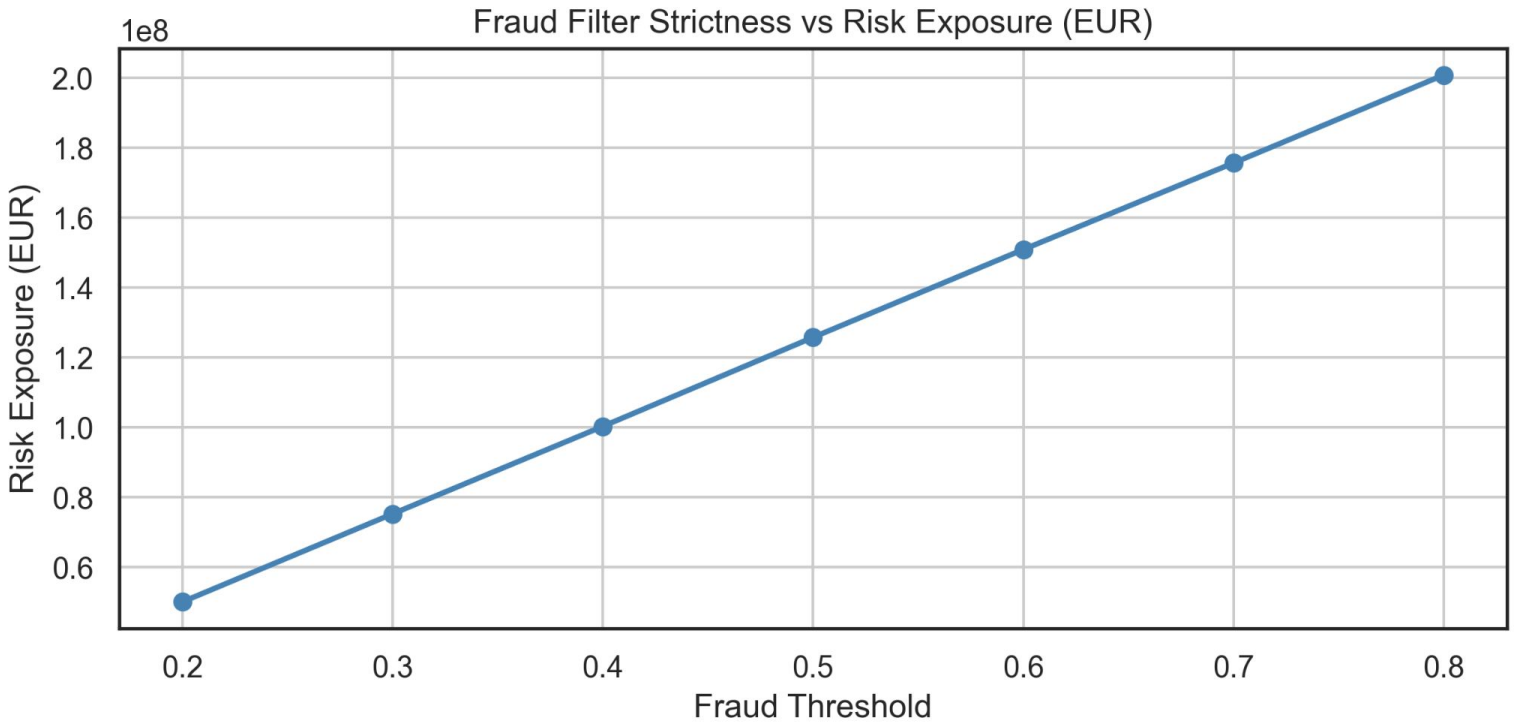


Conclusions:

- Higher VoP threshold → fewer transactions pass verification
- Conversion Rate decreases as VoP becomes stricter
- Too strict VoP harms customer experience and usability

Hypothesis 4 - Risk Exposure & Manual Review Load

How does fraud filter sensitivity influence risk and operations?



Conclusions:

- Lower threshold → less fraud risk, but much higher manual review load.
- Higher threshold → fewer reviews, but significantly more fraud slips through.

Difficulties & How I Overcame Them

1. Converting Bundesbank data from PDF to Excel/CSV

- Required manual cleaning + reconstruction of column names.
- Tables had multi-row headers and merged cells.

Solved: Structured parsing + Tidy transformation (melt)

2. Not realistic KPI formula

- Early KPI used only Conversion & Risk.
- Needed to integrate 4 metrics: Conversion, Latency, Manual Review, Risk.

Solved: Feature normalization + weighted KPI

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Final Result - Optimal Vop x Fraud settings

Balanced settings for speed, security, and operational efficiency.

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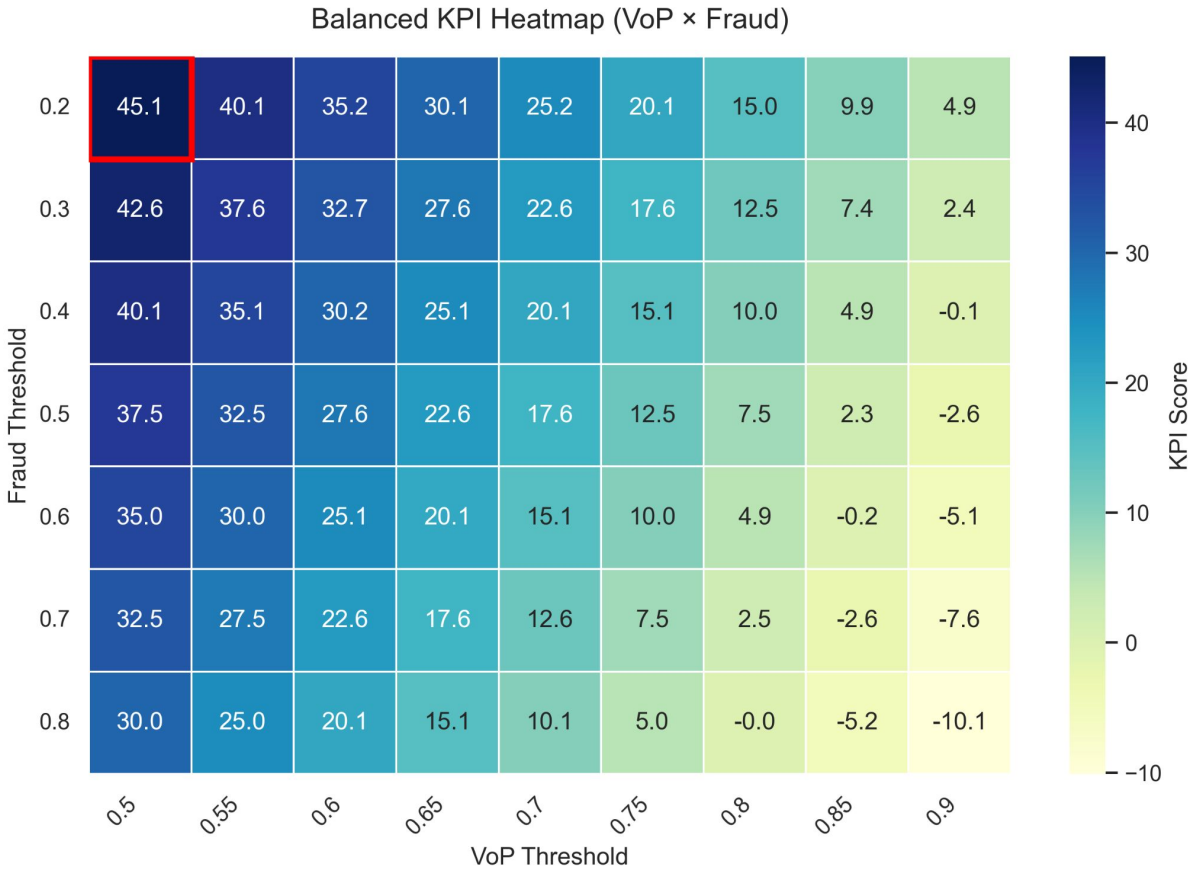

Conclusion: The simulation identifies VoP ≈ 0.80 and Fraud ≈ 0.50 as the optimal balance.

Final Conclusions

- Instant payments adoption in Germany is rising — system load is increasing.
- VoP and Fraud thresholds create trade-offs between speed, safety, and operations.
- Optimal balance found: VoP ≈ 0.80 and Fraud ≈ 0.50.

Future Improvements:

- Realistic latency modeling (Queueing Theory).
- ML-based fraud model.
- Forecasting system load (e.g. 2025–2027).

Thanks a lot!

Contact

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