McKinsey&Company

Aalto University

Predicting and preventing credit card defaults

McKinsey Analytics

MS-E2177 Seminar on Case Studies in Operations Research

January 12, 2018

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McKinsey helps organizations to solve their most complex and important issues

In addition to “traditional” work we do, we focus heavily on analytics

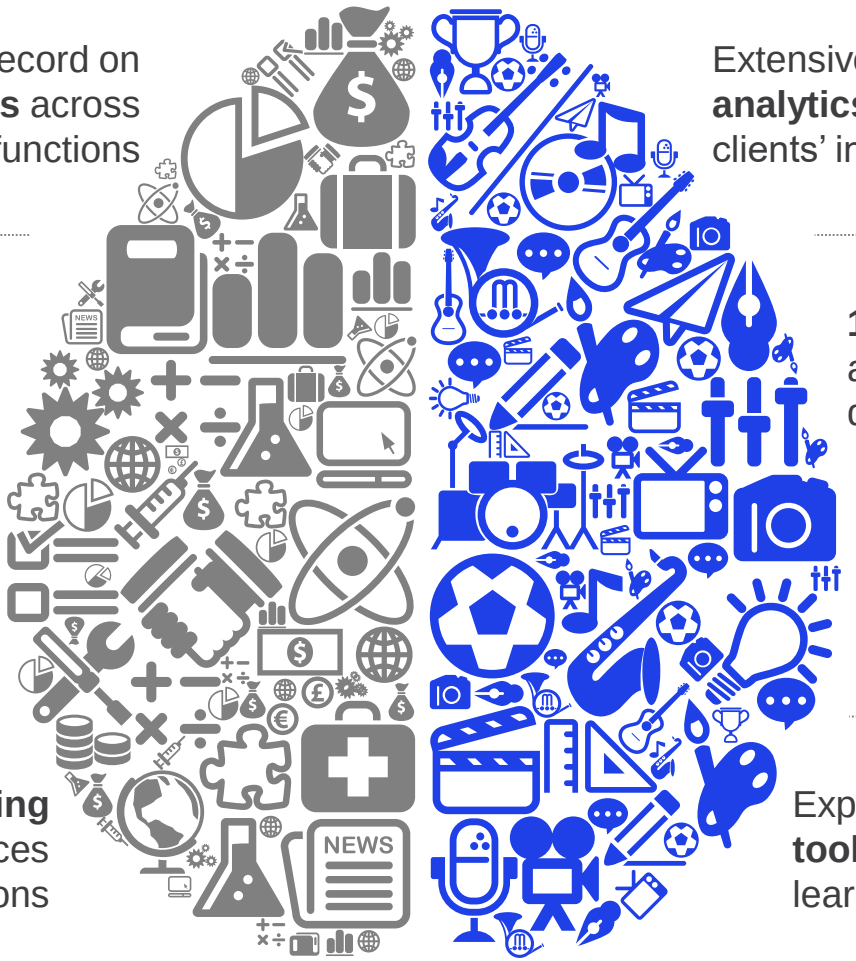
The McKinsey you know …

Highly successful track record on **strategy and change topics** across various industries and functions

+28,000 Firm members in 63 countries providing **global expertise and local insights**

Trusted, independent strategic advisor to **leading companies** worldwide

Cutting-edge expertise and thinking in 180 areas across 22 industry practices and 12 business functions



The McKinsey you don’t know …

Extensive track record in **building analytics business models** to develop clients’ internal processes

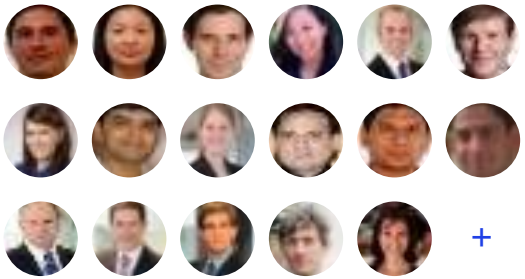
1,000+ Data Scientists, Data Engineers and Translators across globe in +15 different hubs

Practical experience in **developing and implementing analytics** models

Expertise on applying **state-of-the-art tools and techniques**, e.g., deep learning, network optimization

We have a broad range of analytics capabilities, expertise and partnerships across globe…

We have dedicated people …



1,000+ Big Data and Advanced Analytics Scientists, Engineers, and Translators

… across geographies …

90 years of experience | **61** countries | **10,000+** consultants | **116** offices

… with deep functional expertise…

Strategy	What should we do?
Operations	How should we do it?
Marketing & Sales	How should we get to market?
Organization	How should we structure ourselves?
Business Technology	How can we leverage technology?
Corporate Finance	How do we fund the implementation?
Risk	How should we protect ourselves?

… leveraging our acquisitions and world-class partnerships…

eagleeye ANALYTICS · SPARKBEYOND · QUANTUMBLACK · Risk Dynamics · ClickFox · Security Research Labs · FINALTA Financial Services Benchmarking · IP Soft · atlan-tec · cardlytics · datorama · 4tree

… to create high impact solutions and support ongoing impact capture

McKinsey Solutions · VISUALDoD · people insights · Periscope™ a McKinsey® Solution · Marketing Navigator™ · McKinsey Always On · afiniti · INGENUITY

…and we leverage latest analytics tools and techniques at scale across use cases and functional areas

We use latest analytics tools …

python · Hive · R · SPSS IBM · julia · Spark · SPARKBEYOND · rapidminer · Teradata Aster · SAS THE POWER TO KNOW. · alteryx · Azure Machine Learning · GUROBI OPTIMIZATION · REVOLUTION ANALYTICS

… and apply state-of-the-art techniques…

- Machine Learning
- Data Mining
- Experimental Design
- Econometrics
- Monte Carlo Simulations
- Sequential Pattern Analysis
- Mathematical Optimization
- Mining
- Stream Mining
- Time Series Analysis
- Regression Analysis
- Statistics

… to change the way companies interact with customers commercially …

- Churn
- Cross-Selling
- Pricing & Promotion
- Assortment Optimization
- Risk
- Fraud detection

… and optimize clients' internal processes

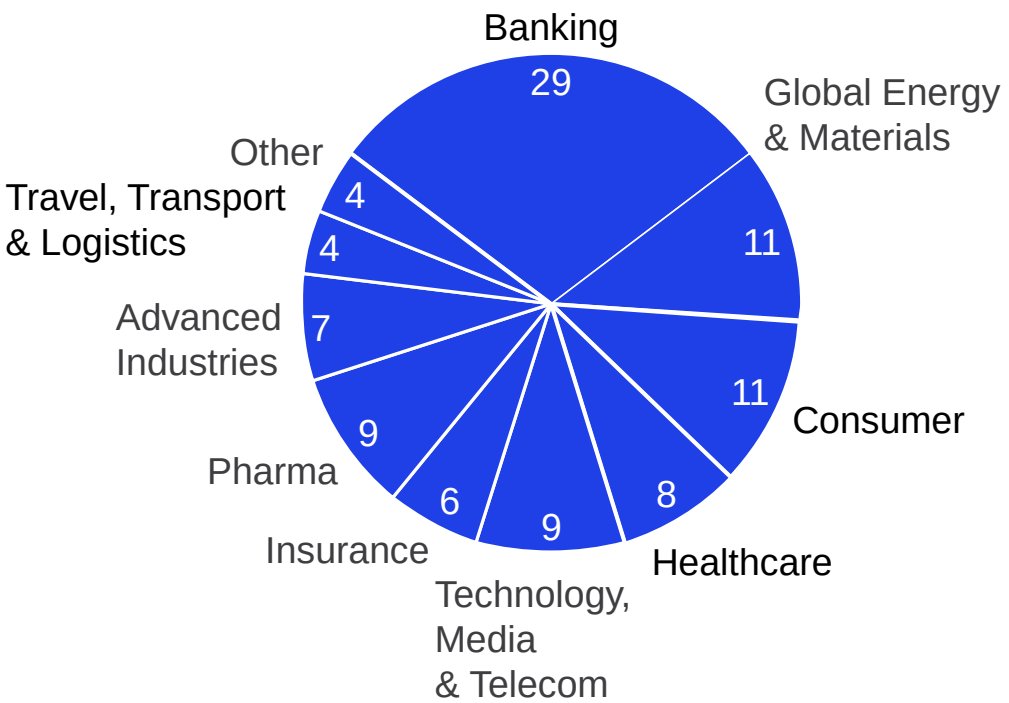
- Predictive Maintenance
- Supply Chain Optimization
- Network Optimization
- Financial Forecasting
- HR Analytics
- Yield Optimization

We complete >1,500 Big Data and Advanced Analytics projects each year across all industries and functions

Client engagements, 2015-2016

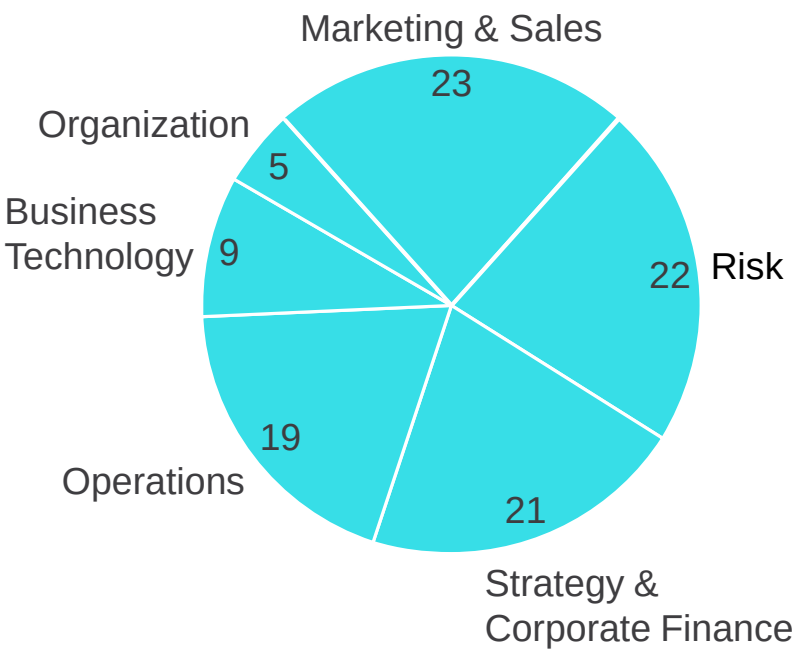
By Industry

Percent, 100% = 3,585

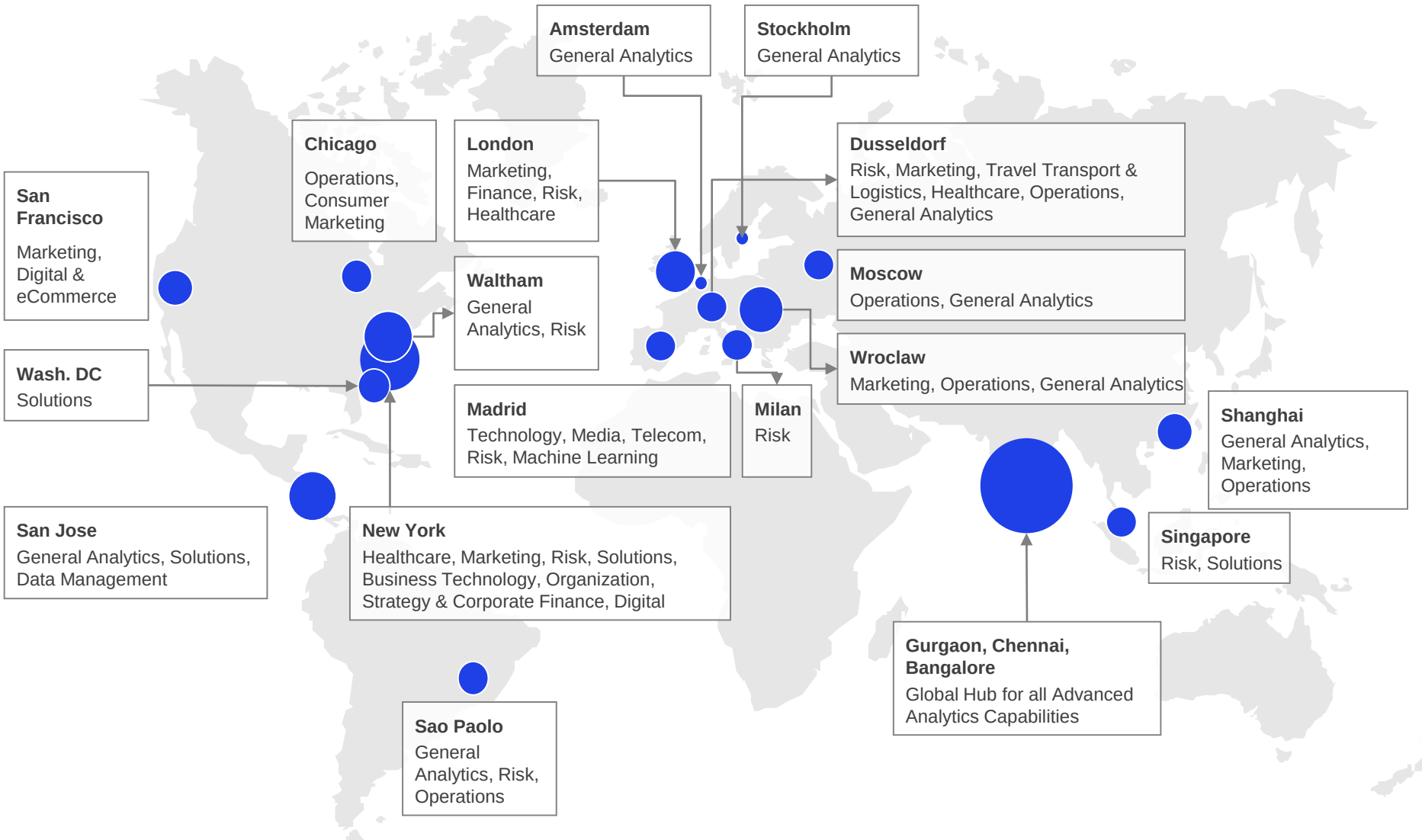


By Function

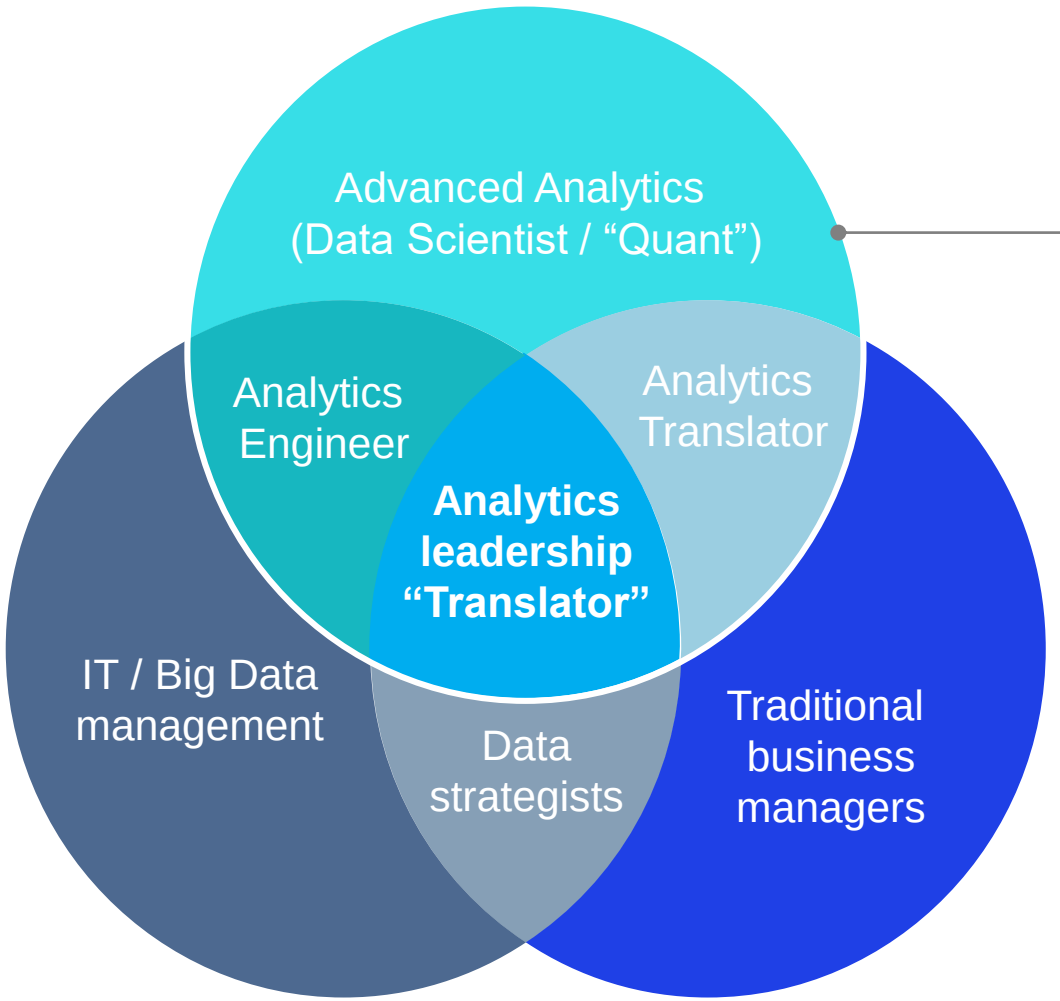
Percent, 100% = 3,585



We are ramping up our analytics efforts in Nordics to provide local insights in addition to global expertise



We have diverse set of analytics-minded profiles working in analytics engagements



Roles and typical profiles needed

Data Scientist – "Quant"

- Background in (Applied) Mathematics, Data Mining, Statistics, Machine Learning, Computer Science, Physics
- Builds the mathematical algorithms

Analytics Engineer

- Data Scientist background with more focus on Computer Science and programming
- Takes data scientist's algorithms and makes it more efficient

Analytics Translator

- Data Scientist background + additional background and experience in business
- Understands business problem and translates into technical language and vice versa

SOURCE: McKinsey Analytics

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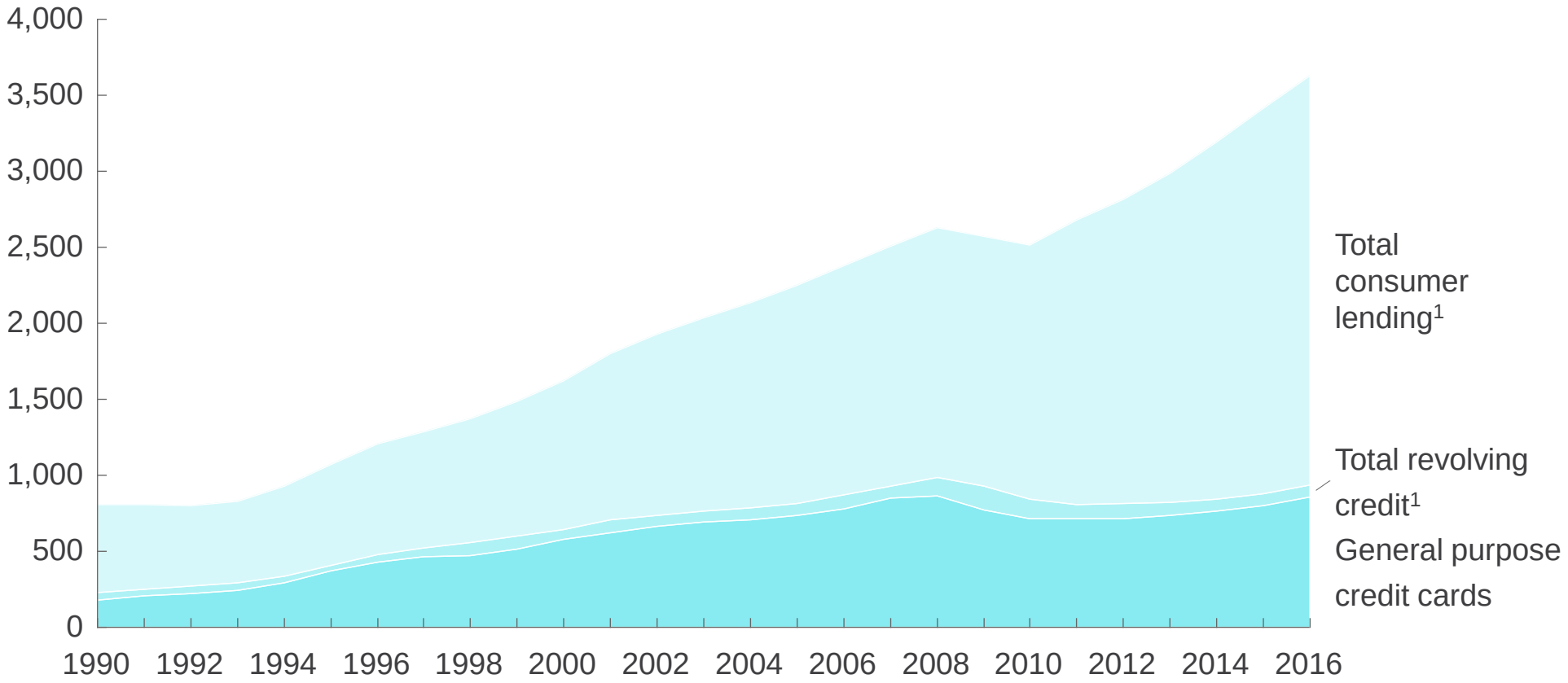
Credit card is one of the major lending products for customers in the U.S.

Consumer credit growth
$ Bn

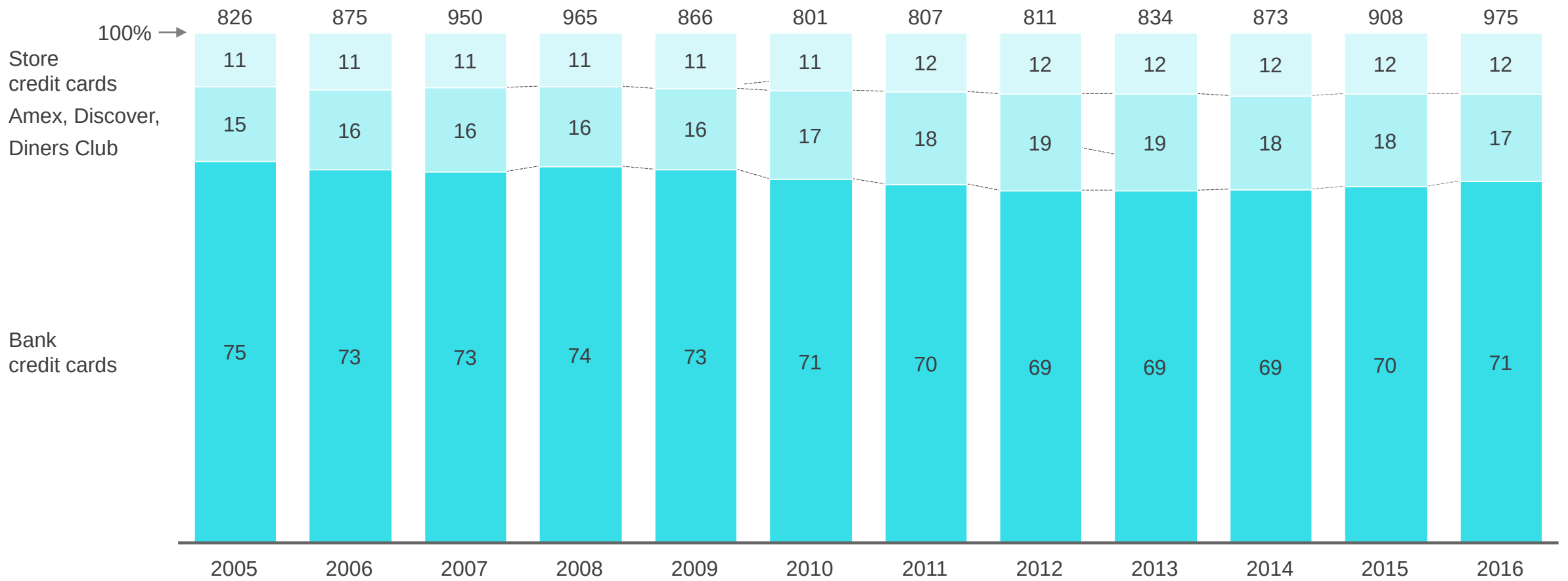


1 Total revolving credit includes non-card consumer revolving credit lines and total consumer lending includes non-revolving consumer credit including auto loans and other non-mortgage credit

SOURCE: Federal Reserve's G. 19, Nilson report

Bank cards dominate the credit card market in the U.S.

Outstanding balances
$ Bn; %



Note: In 2005 and beyond, Diners is included in MasterCard bank credit cards. Amex has recently filed for a Bank charter

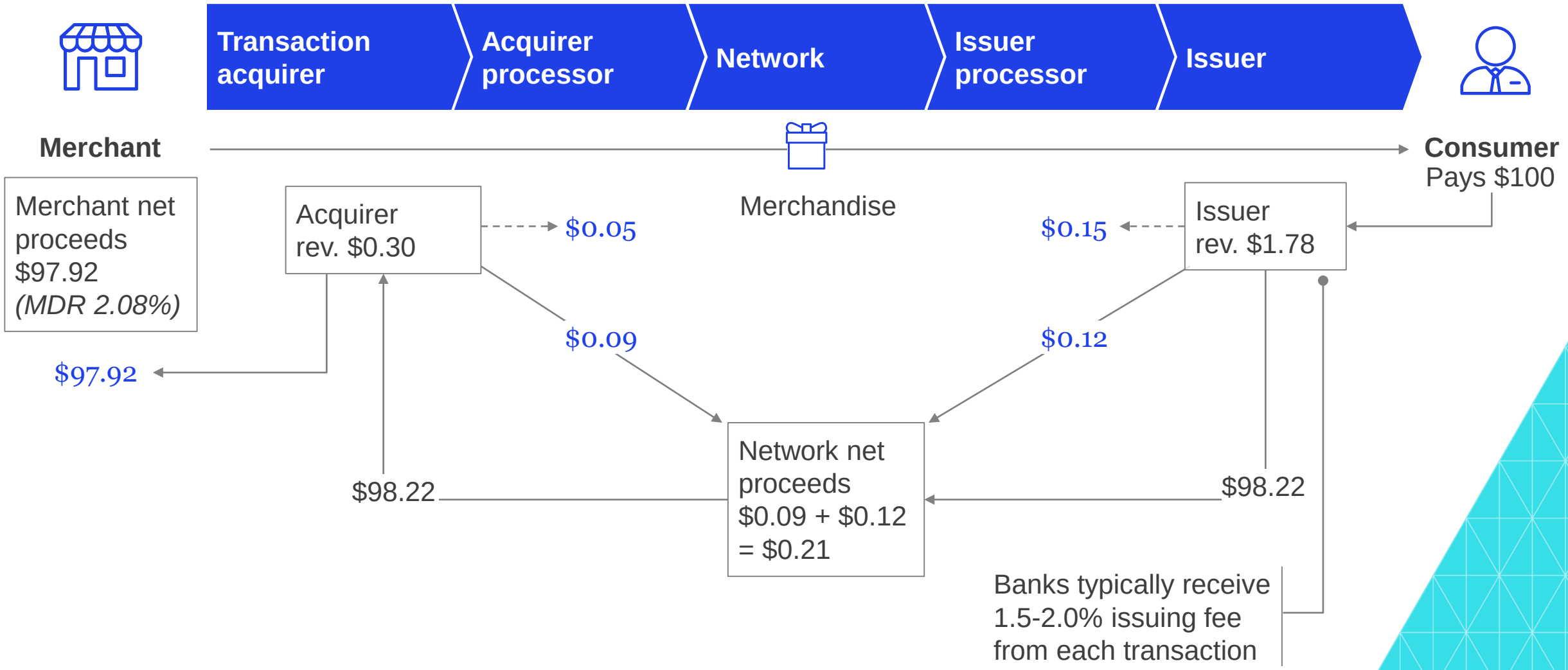
SOURCE: Nilson Report; McKinsey Payments Practice

Typical transaction economics for credit cards

Example for $100 open loop transaction in the U.S.

ILLUSTRATIVE

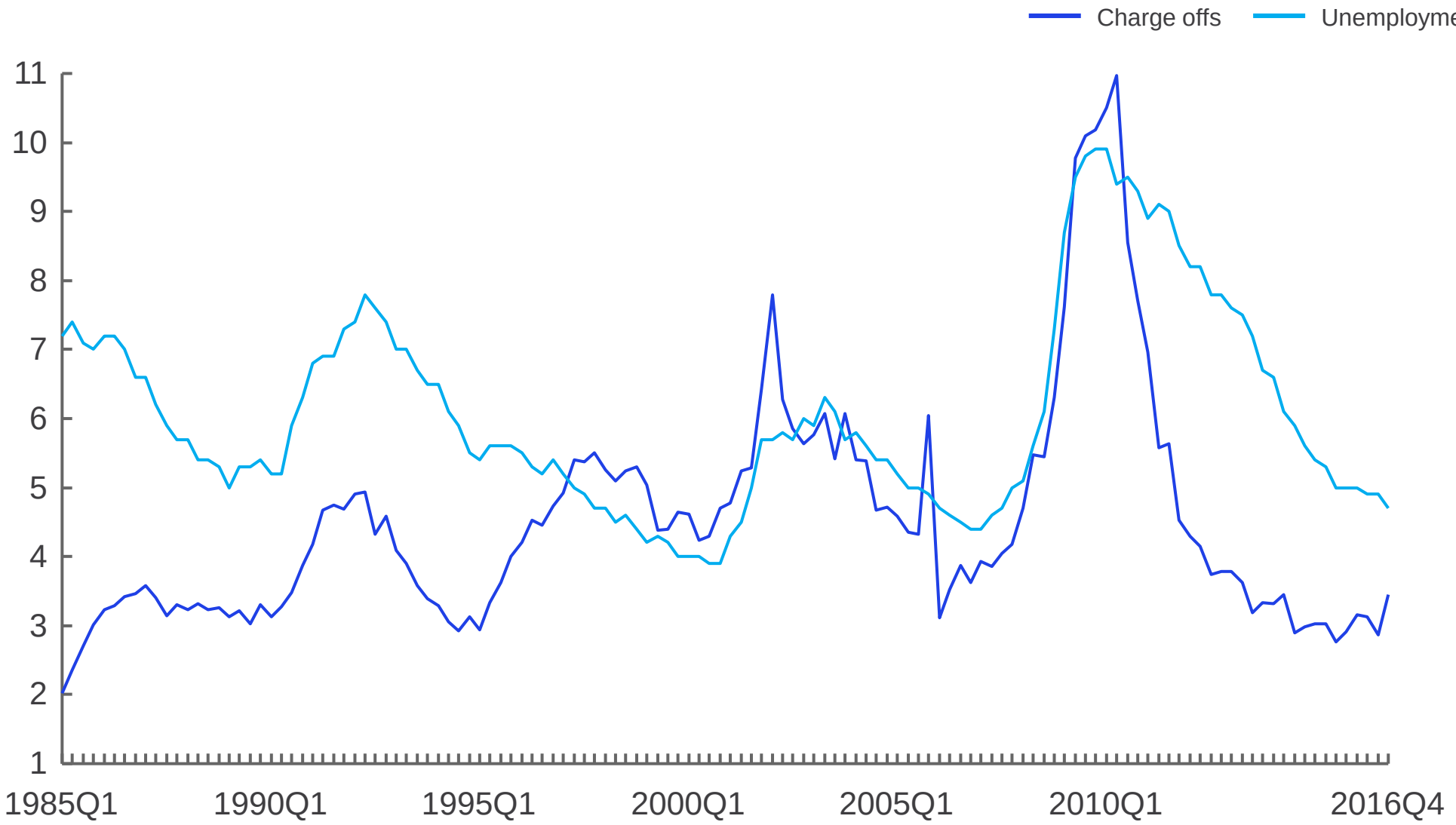
Payment flow Revenue booked ----→ Generally internal transfer/ops cost



SOURCE: McKinsey Payments Practice, Nilson report, Amex company report

While charge offs have returned to pre-crisis levels or better…

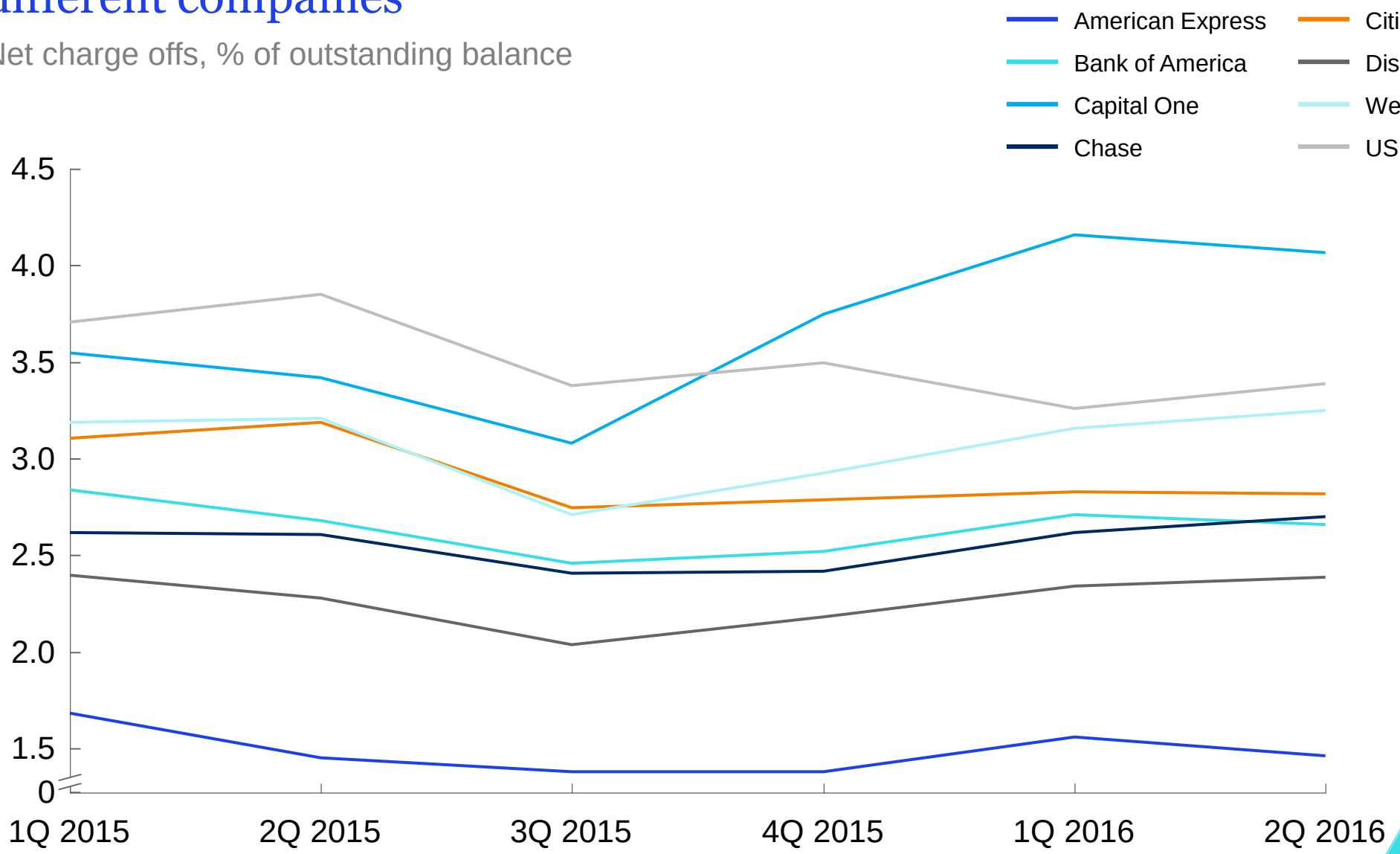
Credit card charge offs, % of outstanding balance, U.S.



SOURCE: Federal Reserve, Bureau of Labor Statistics

…there are still major differences in charge off rates between different companies

Net charge offs, % of outstanding balance



SOURCE: McKinsey, Federal Reserve, Bureau of Labor Statistics

Case study: Predicting and preventing credit card default for a bank

Background

- Our client Kuutti Bank has approached us to help them to predict and prevent credit card defaults to improve their bottom line
- While the client has a proper screening process in place, they don’t have active credit card default mitigation strategies leading to substantially higher default rates compared to their peers
- Client has collected a rich data set on their customer base, but unable to leverage it properly due to lack of analytics capabilities

Our challenge

- Implement a **proactive default prevention program**, identifying customers with high probability of defaulting to improve bottom line

SOURCE: McKinsey Analytics

Learning goals for the case study

Understand *key considerations* in selecting *analytics methods*

Understand how analytics methods can be used *efficiently to create direct business value*

Learn *how to communicate complex topics* to people with different backgrounds

Key questions for the case study

	Key questions	Meetings
1	▪ What is your overall approach for the problem?	Problem solving session with McKinsey
2	▪ Which analytics model should be selected? Why?	Problem solving session with McKinsey
3	▪ What is the model performance, i.e. how accurate it is in predicting defaulting customers? ▪ How the model can be improved?	SparkBeyond session with McKinsey
4	▪ What are the business implications of the model? ▪ What mitigating actions should be taken to improve operations? ▪ What is the most efficient way to communicate the results?	Communication workshop with McKinsey
5	▪ What are recommended next steps for Kuutti Bank?	Final presentation

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Customer credit card behavior data sample (n=30,000)

Attribute	Description
ID	Data id number
Balance_limit	Amount of credit given (USD)
Sex	1 = male, 2 = female
Education	1 = graduate school; 2 = university; 3 = high school; 4 = other
Married	1 = married; 2 = single; 3 = others
Age	Age (year)
MONTH_YEAR_payment_status	-1 = pay duly; 0 = undefined; 1 = payment delay for one month; 2 = payment delay for two months; ...; 8 = payment delay for eight months; 9 = payment delay for nine months and above
MONTH_YEAR_bill_amount	Amount of bill statement (USD)
MONTH_YEAR_payment_amount	Amount of previous payment (USD)
Default	0 = no default; 1 = default
Location	Geocoordinates for customer's home address
Employer	Customer's employer

Kuutti Bank's credit card operations key figures

2017 data

2.2M
household customers

85%
of households customers have a credit card account

60%
of credit card accounts are active

5%
reward rate as % purchase volume

1.30
avg. # of credit cards per account

USD 5,000
avg. annual purchase volume

5%
opex as % of outstanding balance

2.0%
avg. interchange rate

30%
of purchase volume outstanding

1.25%
spread margin

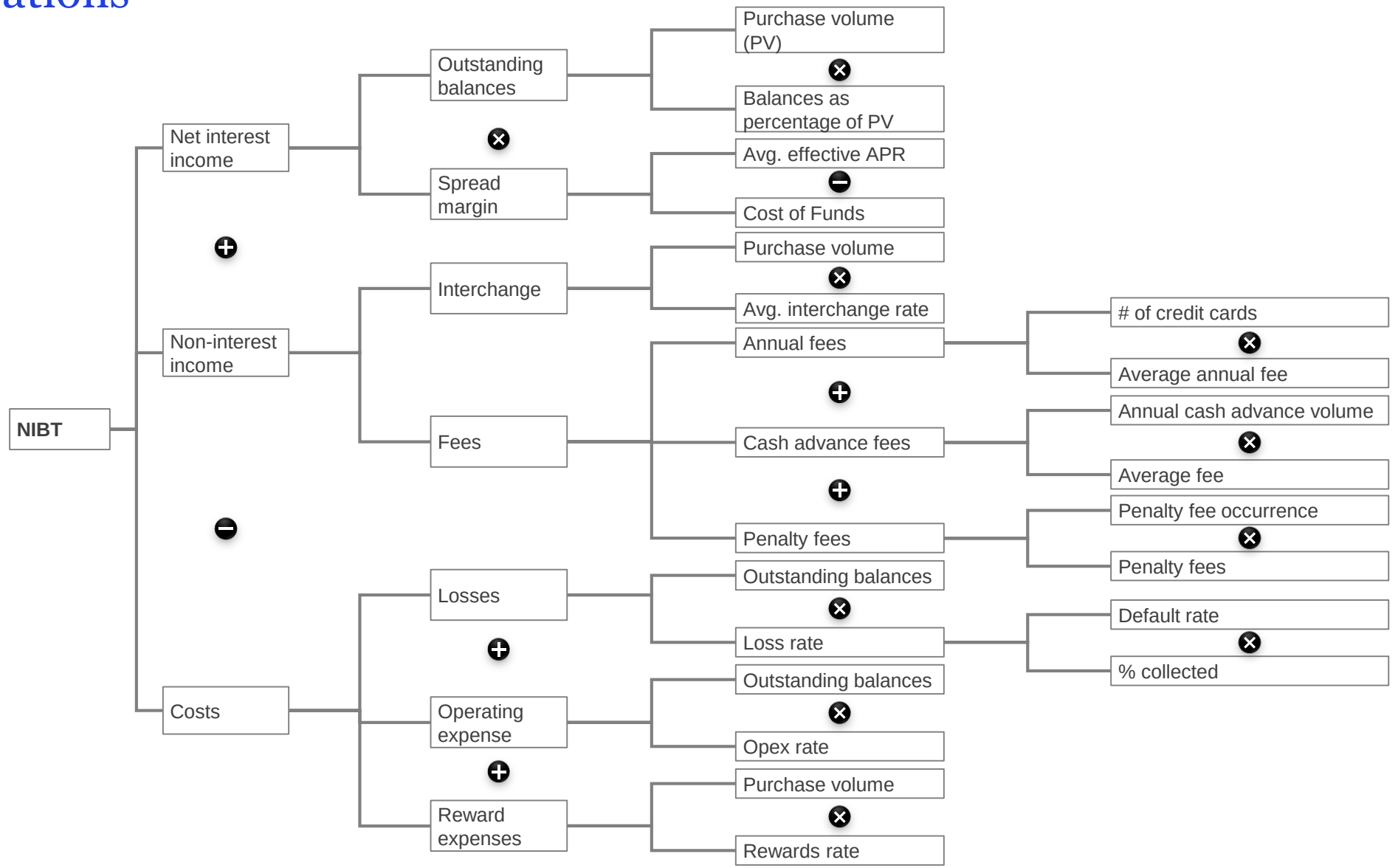
5%
cash advance fee

USD 20
penalty fee from late payments

USD 75
annual credit card fee

USD 300
avg. cash advance volume

Kuutti Bank's driver tree for net interest before taxes (NIBT) from credit card operations



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