



EUROPEAN CENTRAL BANK

EUROSYSTEM

ECB-PUBLIC

Fabio Franch
Market Infrastructure Expert
European Central Bank

An Addendum to the Eighth Survey on Correspondent Banking in Euro

Bank Clustering via Self-Organizing Maps

11th Payment and Settlement System Simulation Seminar

The views expressed are those of the author and do not necessarily reflect those of the ECB

Overview

- 1 Introduction
- 2 Literature
- 3 The correspondent banking business in euro
- 4 Data
- 5 Model of analysis
- 6 Findings
- 7 Conclusions

Chapter Divider

- 1** Introduction
- 2 Literature
- 3 The correspondent banking business in euro
- 4 Data
- 5 Model of analysis
- 6 Findings
- 7 Conclusions

Introduction

- **It is here assumed that the reader has already become familiar with the main findings of the Eighth Survey on Correspondent Banking in Euro (the Survey)**
- **Not a homogeneous market: two different segments**
 - (domestic) retailers: a high number of transactions and low average size of transaction
 - the more traditional cross-border wholesalers
- **Heuristically chosen threshold for retailers: average size of transaction of €10.000**

Chapter Divider

- 1 Introduction
- 2 Literature**
- 3 The correspondent banking business in euro
- 4 Data
- 5 Model of analysis
- 6 Findings
- 7 Conclusions

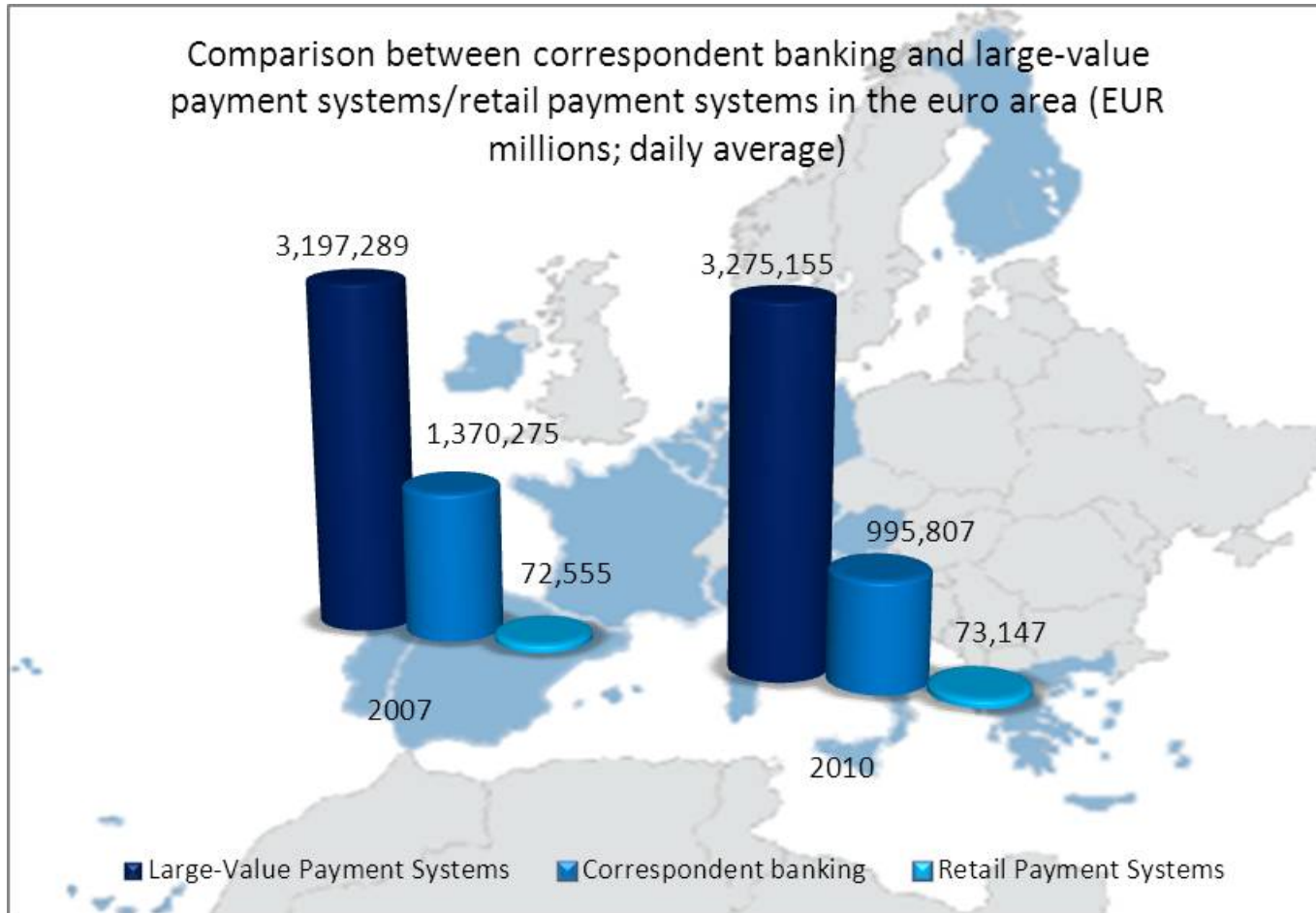
Literature review

- Definition of Correspondent Banking
- Not much can be found in the literature on the European correspondent banking market
 - SWIFT's White Paper on Correspondent Banking (3.0)
 - Osterberg & Thomson, 1999: concentration and competition
 - ECB's Survey (high concentration and first segmentation b/w retail and wholesale)

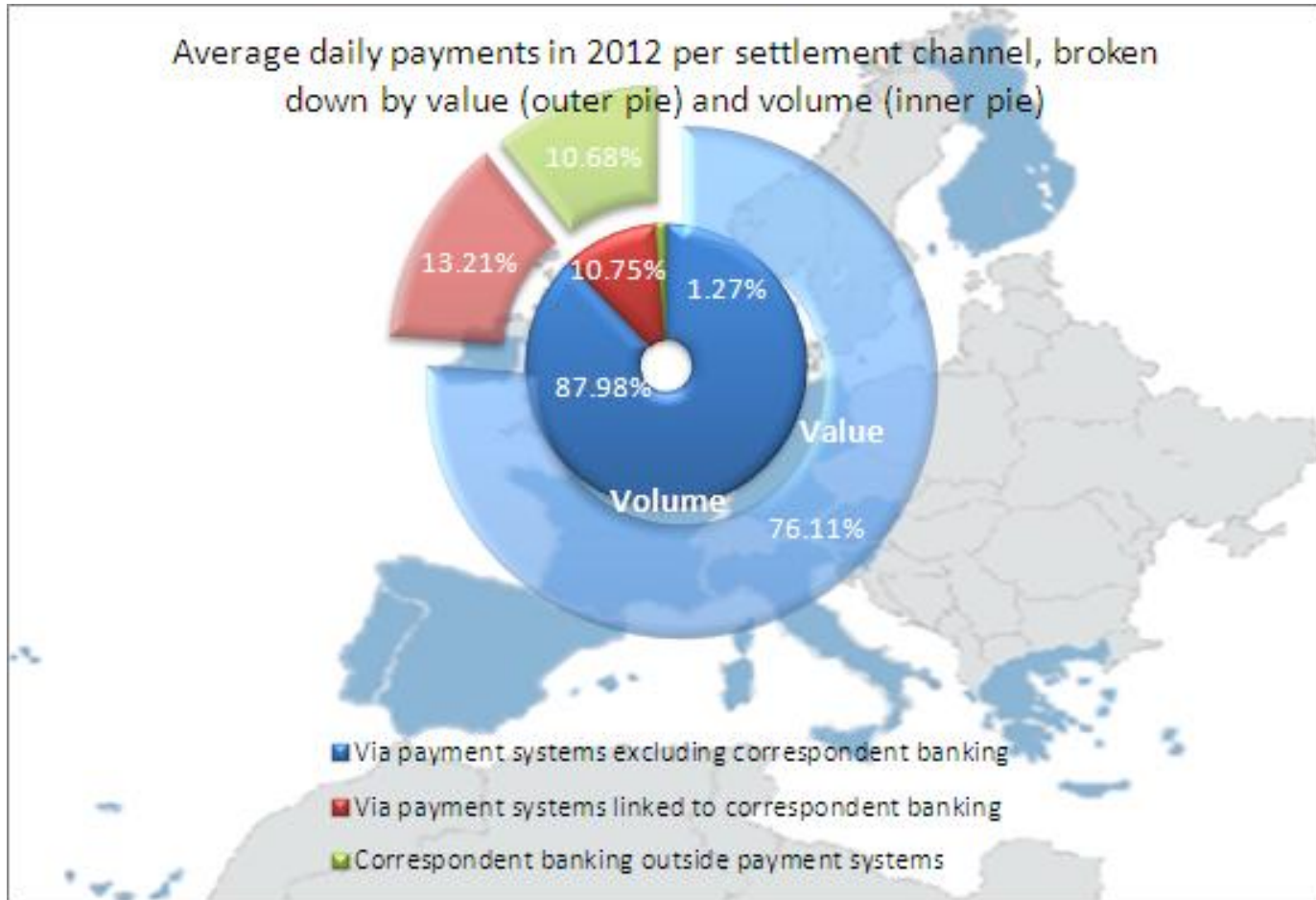
Chapter Divider

- 1 Introduction
- 2 Literature
- 3 The correspondent banking business in euro**
- 4 Data
- 5 Model of analysis
- 6 Findings
- 7 Conclusions

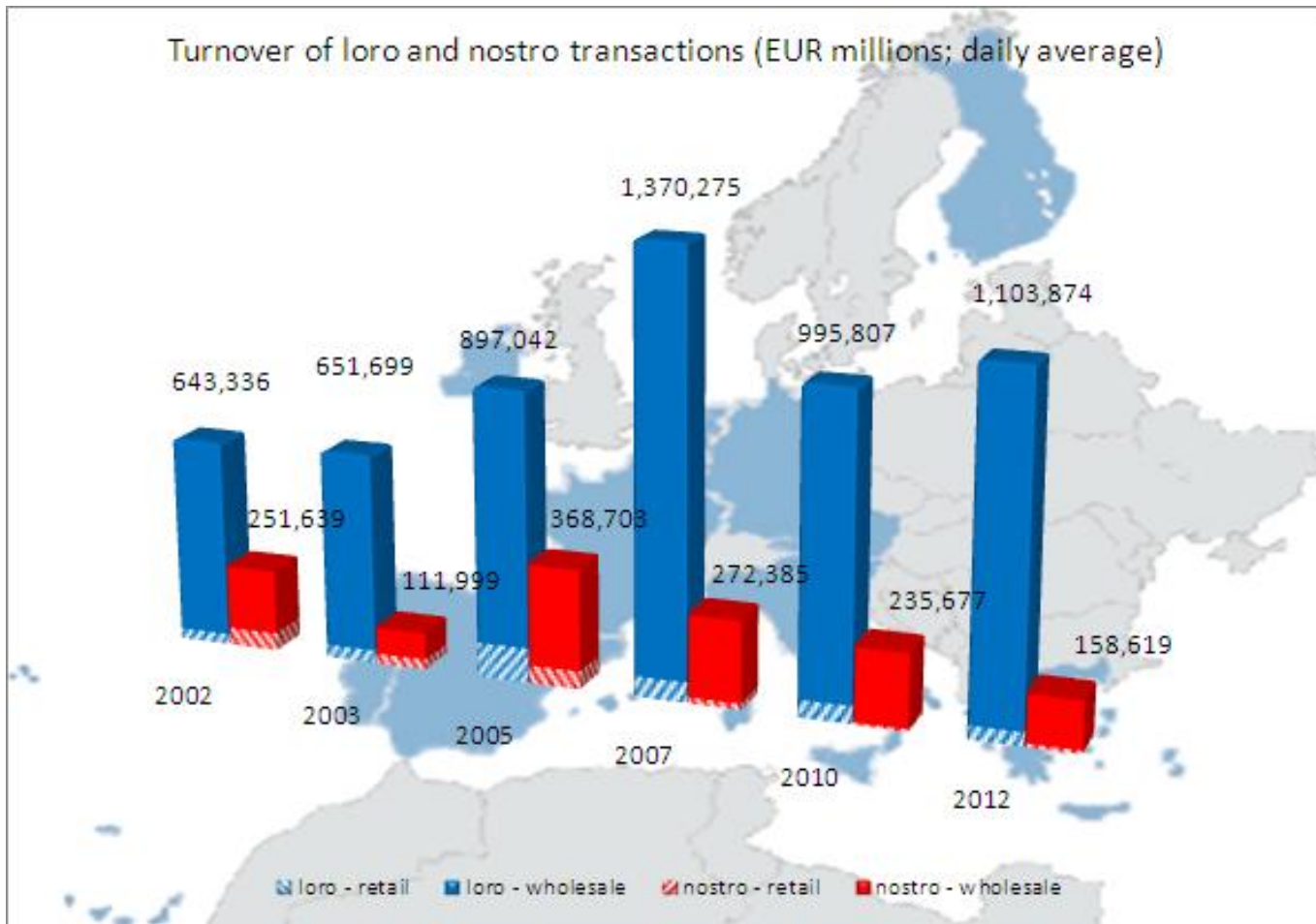
The Survey



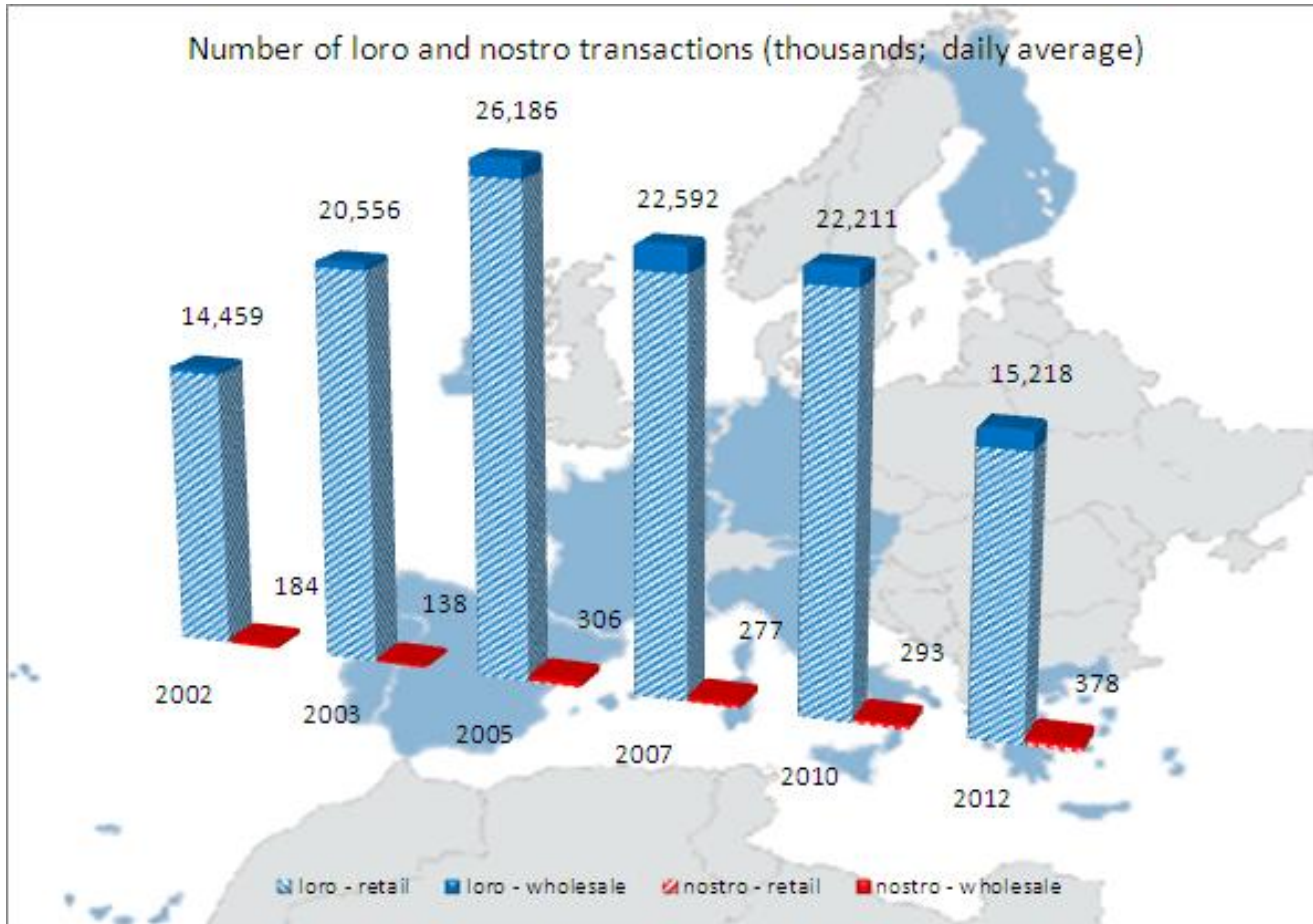
The Survey



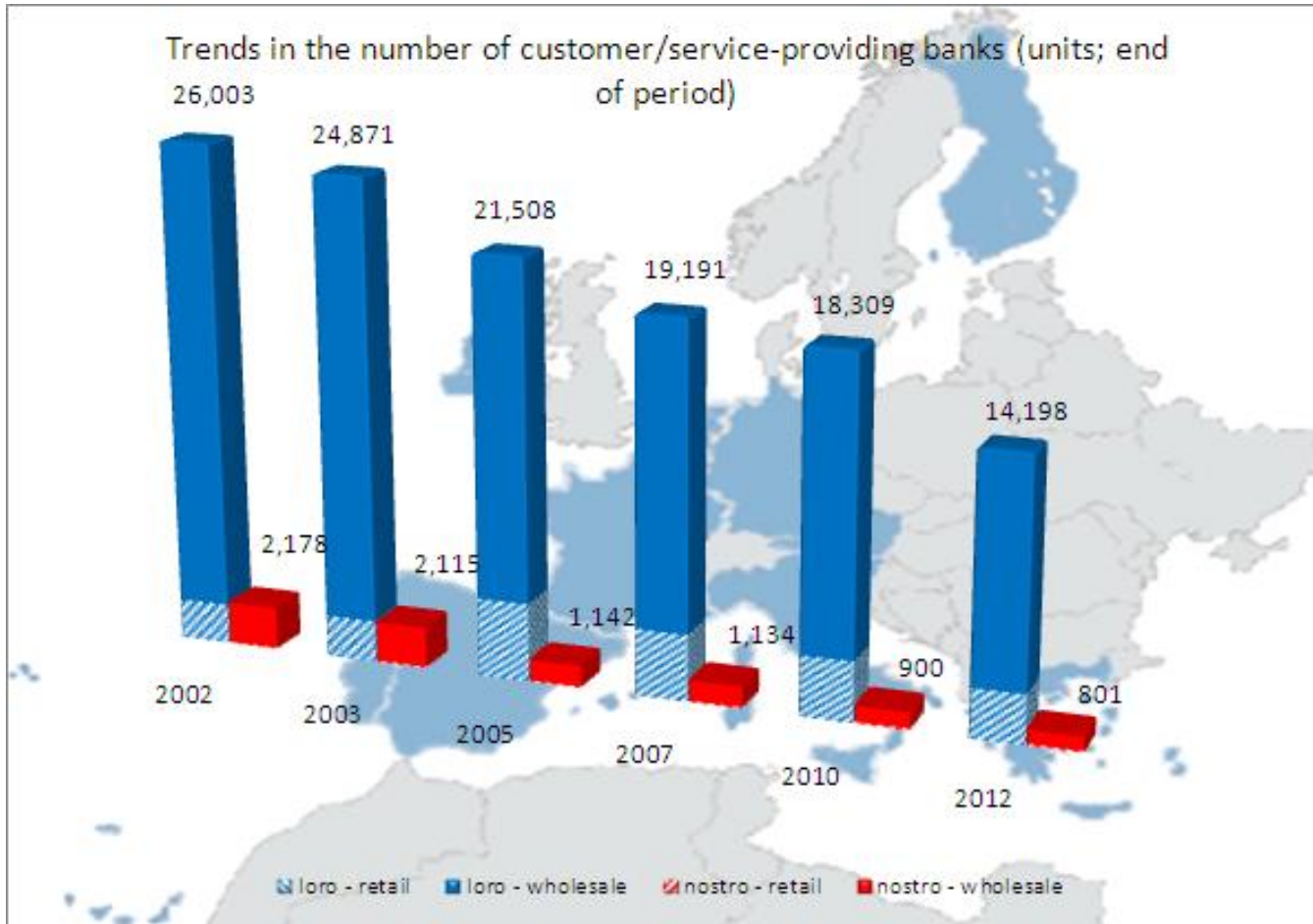
The Survey



The Survey



The Survey



Chapter Divider

1	Introduction
2	Literature
3	The correspondent banking business in euro
4	Data
5	Model of analysis
6	Findings
7	Conclusions

Data

- Use of Survey data for years 2005, 2007, 2010, and 2012
 - Change of data collection requirements;
 - Accuracy
 - Analysis of 2003 and 2002 data shows a high level of inconsistency that would make an analysis meaningless

Data

- Variables found to identify the retailers:
 - Number of Customer Banks/Total Number of Customer Banks (1.1.1)
 - Number of transactions (daily avg)/Total Number of transactions (daily avg) (1.1.2)
 - Value of transactions (EUR, daily avg)/Total Value of transactions (EUR, daily avg) (1.1.3)
 - Daily average payment size (Value of transactions (EUR, daily avg)/Number of transactions (daily avg) (1.1.dap)
 - Importance ratio (in volume terms), defined as the percentage share of transactions on loro accounts reported in the survey in the reporting bank's total euro payment flow (1.1.6)

Chapter Divider

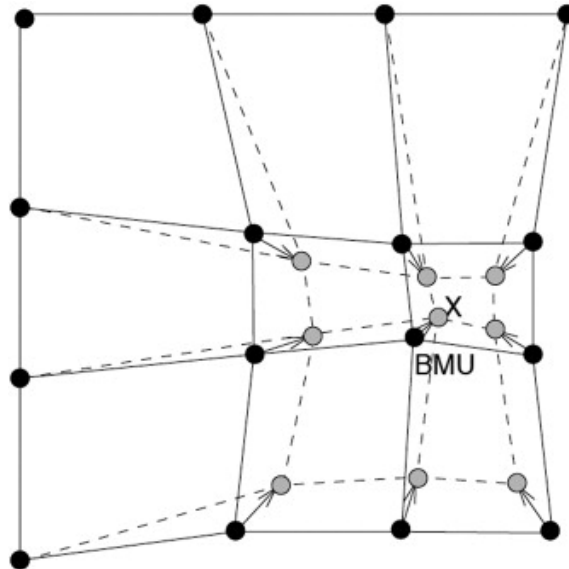
- 1 Introduction
- 2 Literature
- 3 The correspondent banking business in euro
- 4 Data
- 5 Model of analysis**
- 6 Findings
- 7 Conclusions

Model of analysis

- Cluster analysis with Kohonen's Self-Organising Maps (SOM) applied to the banking sector for
 - bankruptcy risk prediction (N. Chen, Ribeiro, & Vieira, 2011; N. Chen, Ribeiro, Vieira, & Chen, 2012; Koyuncugil & Ozgulbas, 2009)
 - forecasting and trading strategy identification (Y. S. Chen & Chang, 2009; S. T. Li & Kuo, 2008)
 - financial performance of banks and monitoring indicators of currency crises (Sarlin, Yao, & Eklund, 2012), credit rating (Shih, 2011)
 - bank integration (Jagric & Markovic-Hribernik, 2009)
 - market segmentation (Chattopadhyay, Dan, Mazumdar, & Chakraborty, 2012; Jiahui & Peng, 2008; W. Li, Wu, Sun, & Zhang, 2010; Namvar, Gholamian, & KhakAbi, 2010; Ren, Sun, & Shi, 2010)

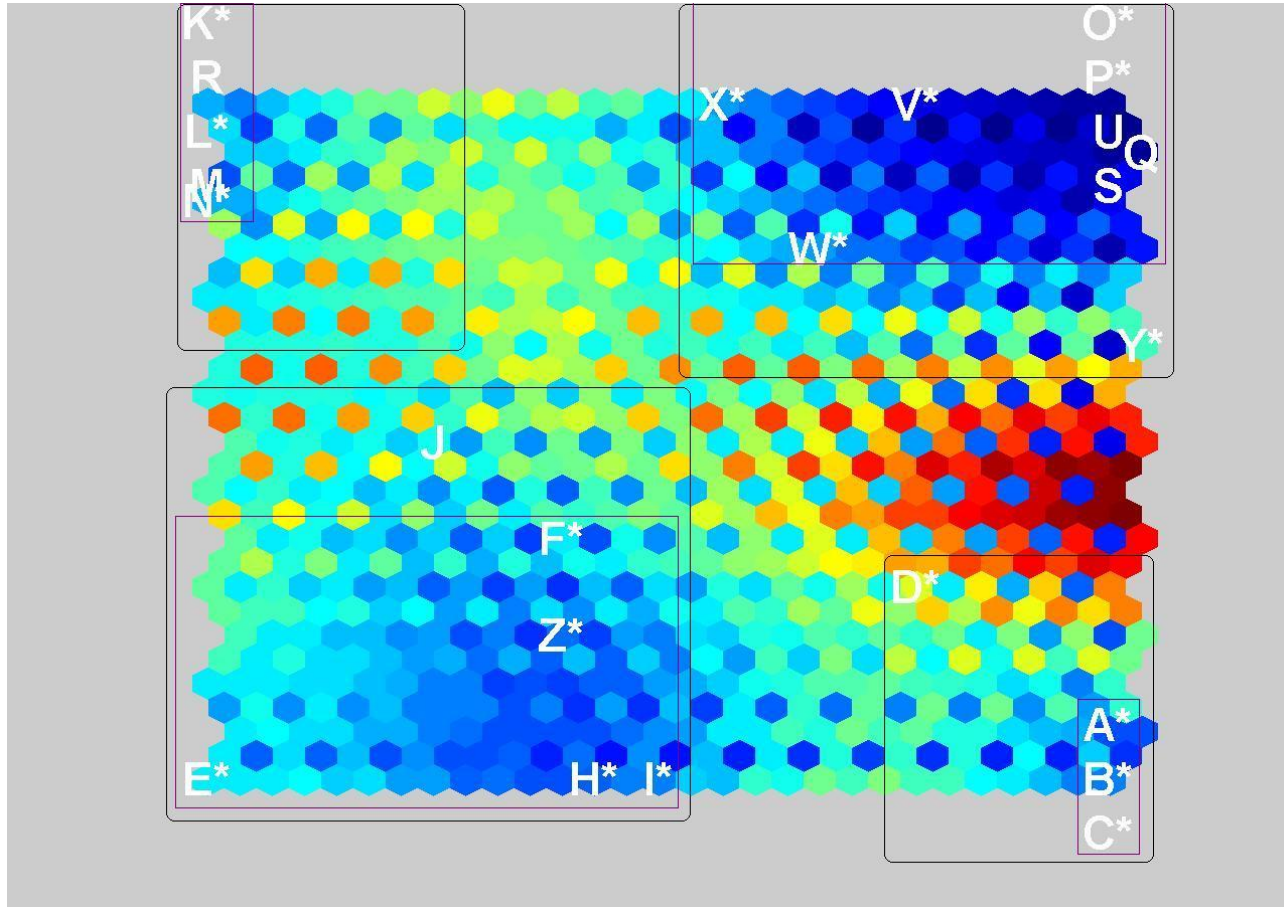
How does a SOM work?

- Unsupervised technique
- a random input vector is matched to the neuron, called Best Matching Unit (BMU), whose weight vector is closer to such input vector
- After the matching, the weight factors of the SOM are updated so that the BMU and its neighbours are moved closer to the input vectors in the input space following a predefined neighbourhood function



An example

2012 U-Matrix



Chapter Divider

- 1 Introduction
- 2 Literature
- 3 The correspondent banking business in euro
- 4 Data
- 5 Model of analysis
- 6 Findings**
- 7 Conclusions

Findings

- Retailers (previously only based on AsT, ≤ 10000 Euro)
 - focus on the domestic market
 - very low average size of payments
 - very high importance ratios

Findings

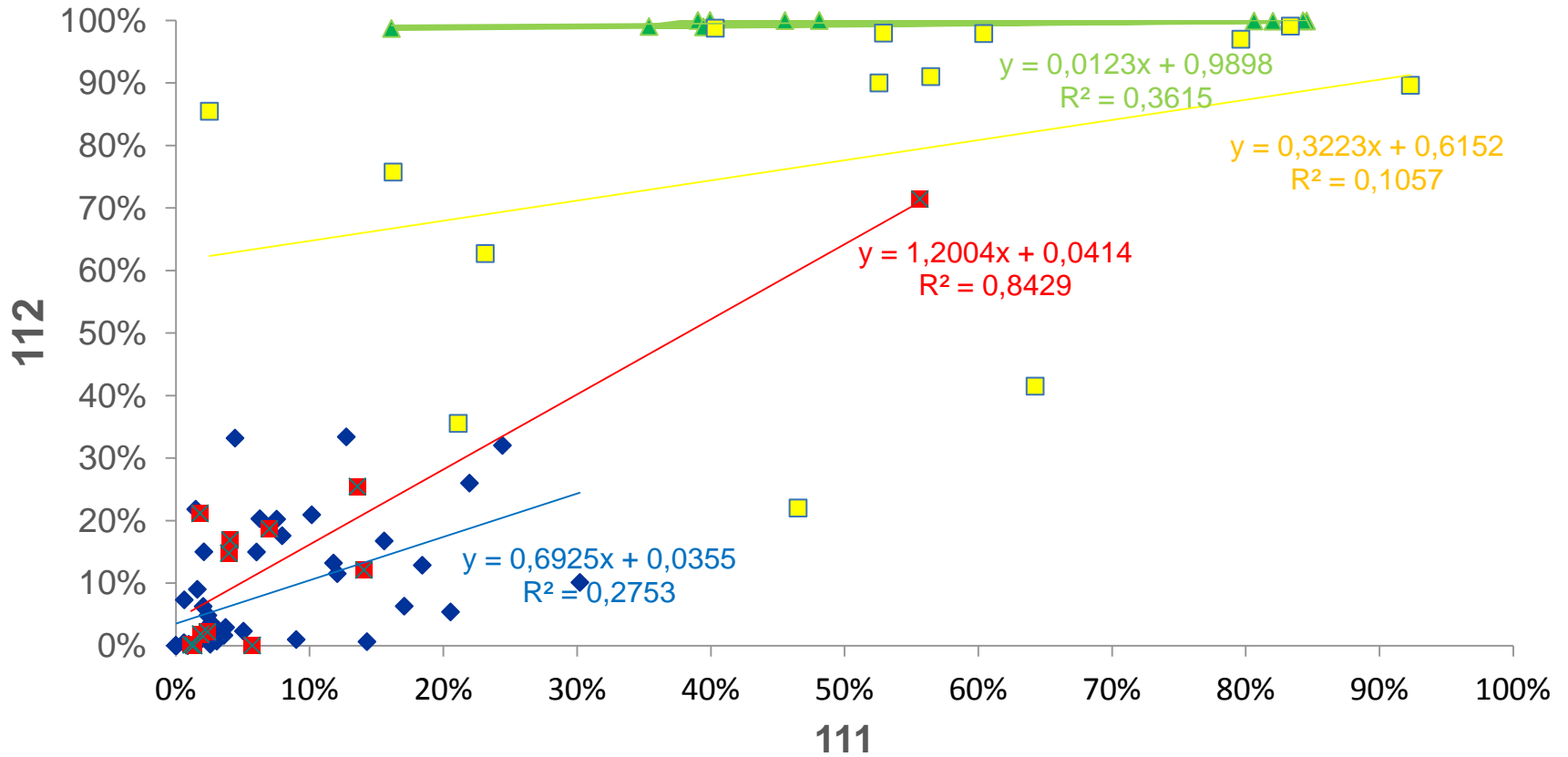
- 3 additional clusters
 - *Domestic wholesale*: a cluster of banks that is highly focused on the domestic market, with high average size of transactions, and a very low importance ratio
 - *International wholesale*: banks whose business is mostly focused on customer banks outside the survey country, with very large average payments and a very low importance ratio
 - *International commercial*: banks whose main focus is outside the survey country, with a medium size of transaction and a relatively low importance ratio

Findings

- Use of medians to define cluster features to reduce effect of outliers

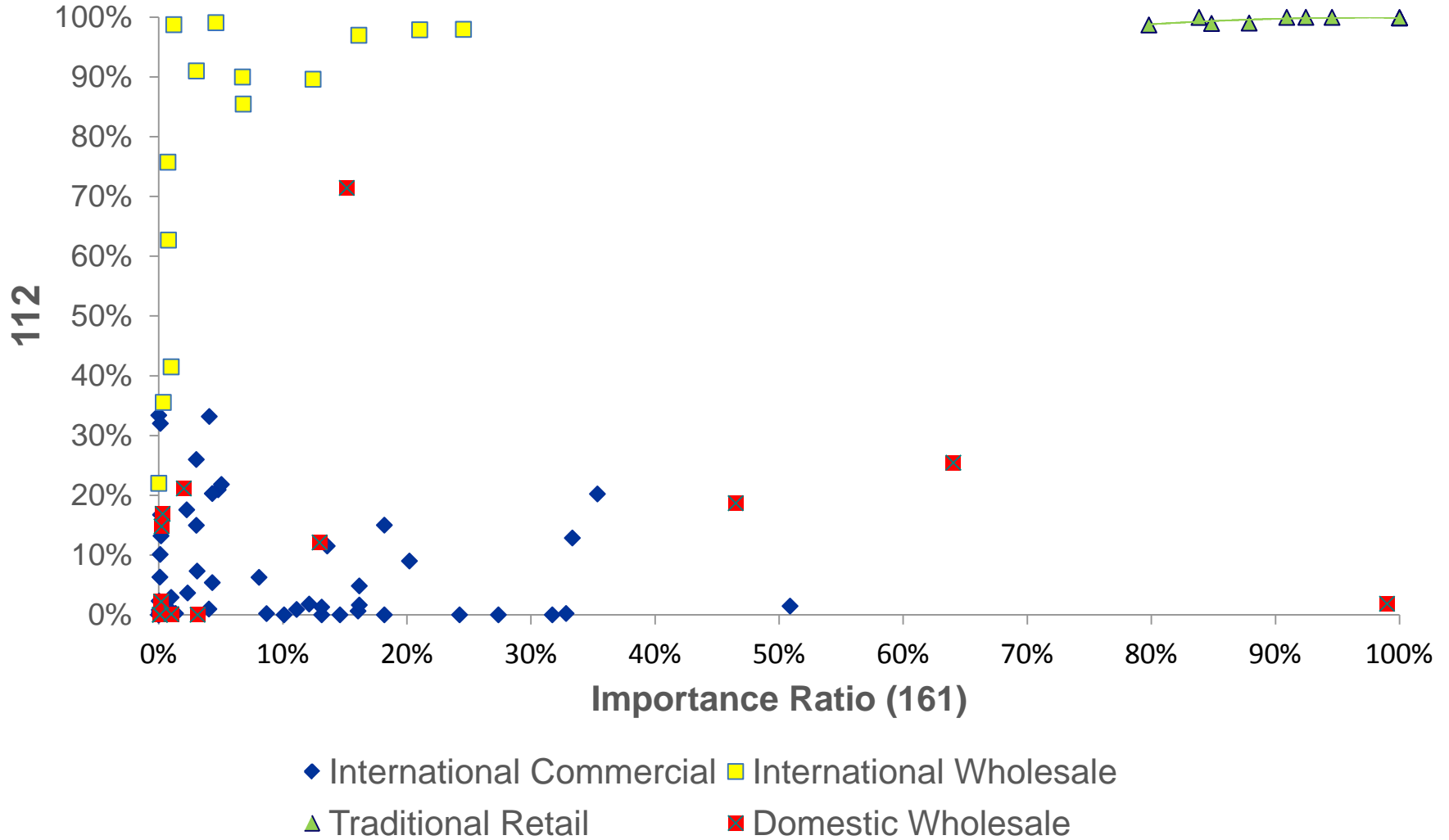
1.5.1	1.5.2	1.5.3	Clusters
16.01% (17.85%)	91.75% (93.58%)	3.67% (3.86%)	Traditional retail
12.48% (14.47%)	1.15% (1.18%)	8.31% (8.53%)	Domestic wholesale
10.54% (10.54%)	0.08% (0.08%)	1.94% (1.94%)	International wholesale
57.14% (61.82%)	5.16% (9.84%)	79.16% (85.87%)	International commercial
8.42%	3.81%	6.92%	Outliers

Findings

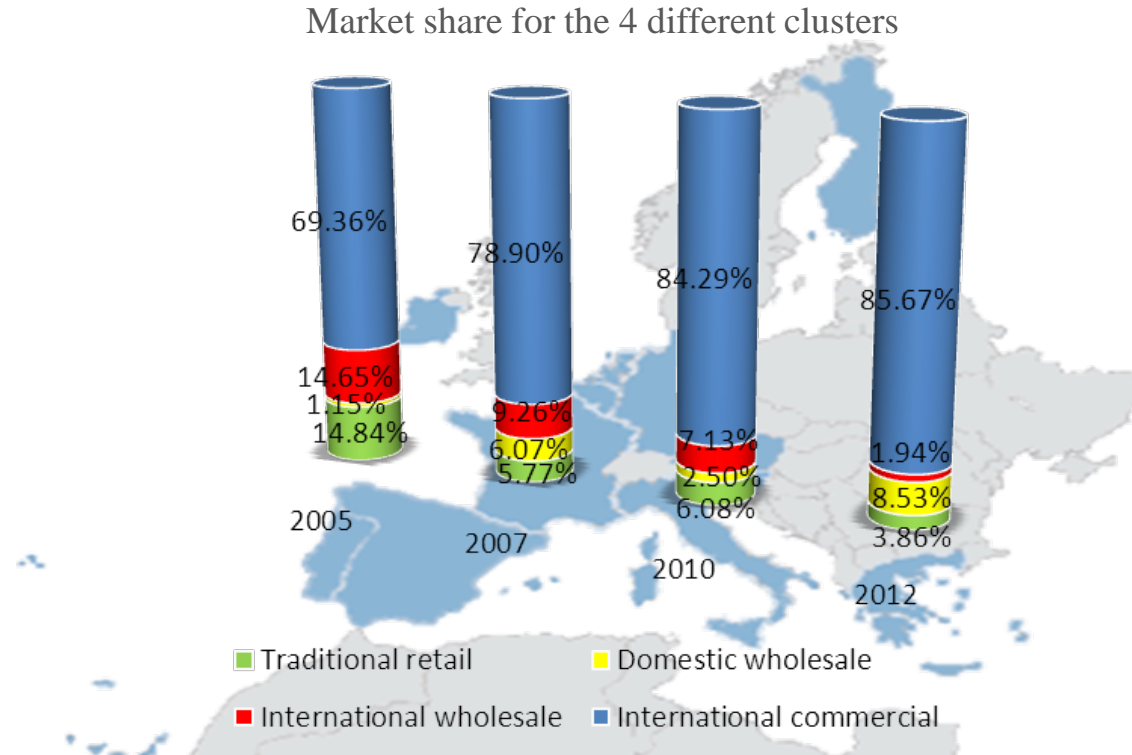


- ◆ International Commercial
- ◆ International Wholesale
- ▲ Traditional Retail
- Domestic Wholesale

Findings



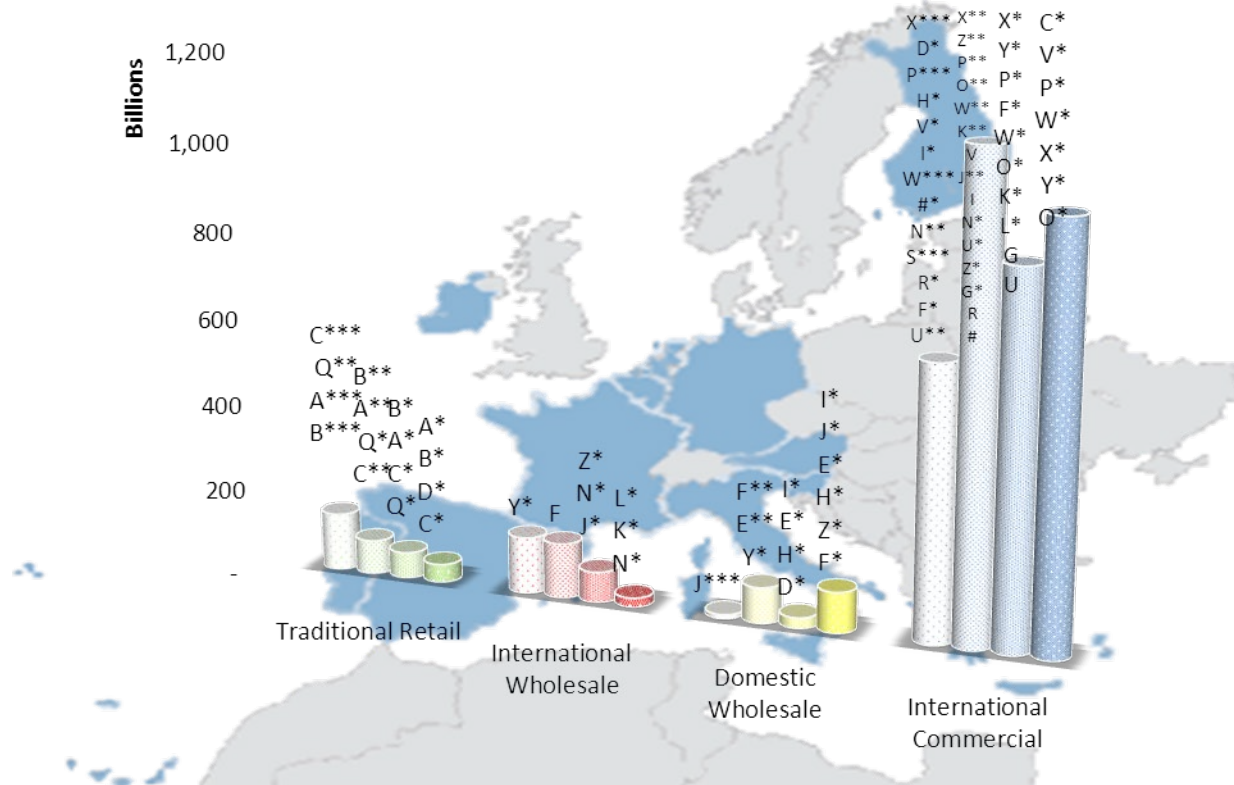
Findings



- Growing concentration: few banks acquire the business not only from the retailers, but also from more highly concentrated banks that focus more on just high-value payments

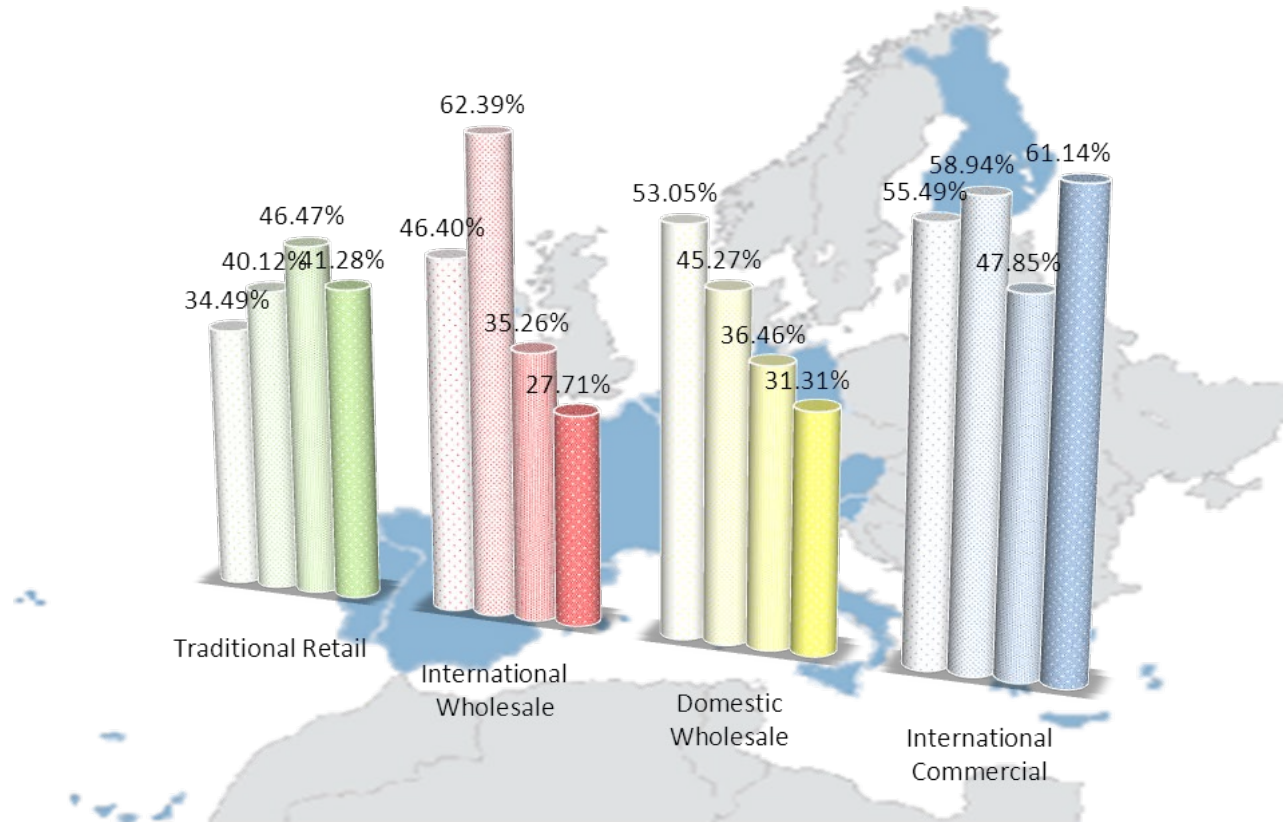
Findings

Cluster composition and total values per cluster over time (2005 to 2012)



Findings

Herfindahl–Hirschman Index by cluster over time (2005 to 2012)



- Growing within-cluster concentration (**Herfindahl–Hirschman Index**)

Chapter Divider

- 1 Introduction
- 2 Literature
- 3 The correspondent banking business in euro
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Conclusions

- **Summing up:**
 - Heterogeneity of correspondent banking data revealed that at least two different business are predominant
 - 10.000€ threshold to split the reporting banks in two simple groups
 - Heuristic threshold, more research needed in this direction
- 2 new business segments found: better insights on evolution of concentration
- Tendency of increased within-cluster concentration for retailers and International Commercial banks
- A reconfirmation of the findings of the Eighth Survey on Correspondent Banking in Euro (trends, combined market share of max 15.85%)
- Limitation: only looking at transactions conducted in Euro