

Transfers of Kyoto units in the Swiss Emissions Trading Registry



Building Competence. Crossing Borders.

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Motivation

Some literature (e.g. Shishlov et al., 2016) indicates that **Switzerland was a trading hub of international units of the Kyoto Protocol.**

It is important to understand the carbon market under the **Kyoto Protocol** to ensure that **lessons serve** to built a **robust framework for carbon markets under the Paris Agreement.**

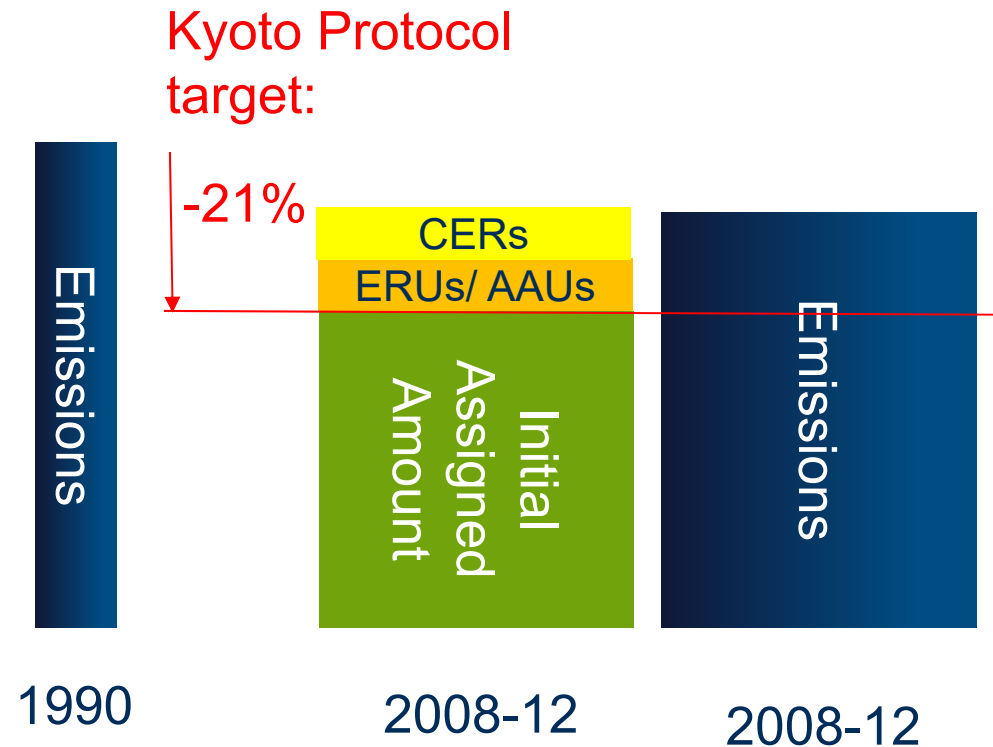
The **Swiss government** stated in their **Paris National Determined Contribution** that it will **use international emission reductions** also in the future.

Only **few studies** assess the **international carbon market** and its flows.

SNIS Project: Designing effective regulation for carbon markets at the international, national, and subnational levels: <https://snis.ch/project/designing-effective-regulation-for-carbon-markets-at-the-international-national-and-subnational-level/>

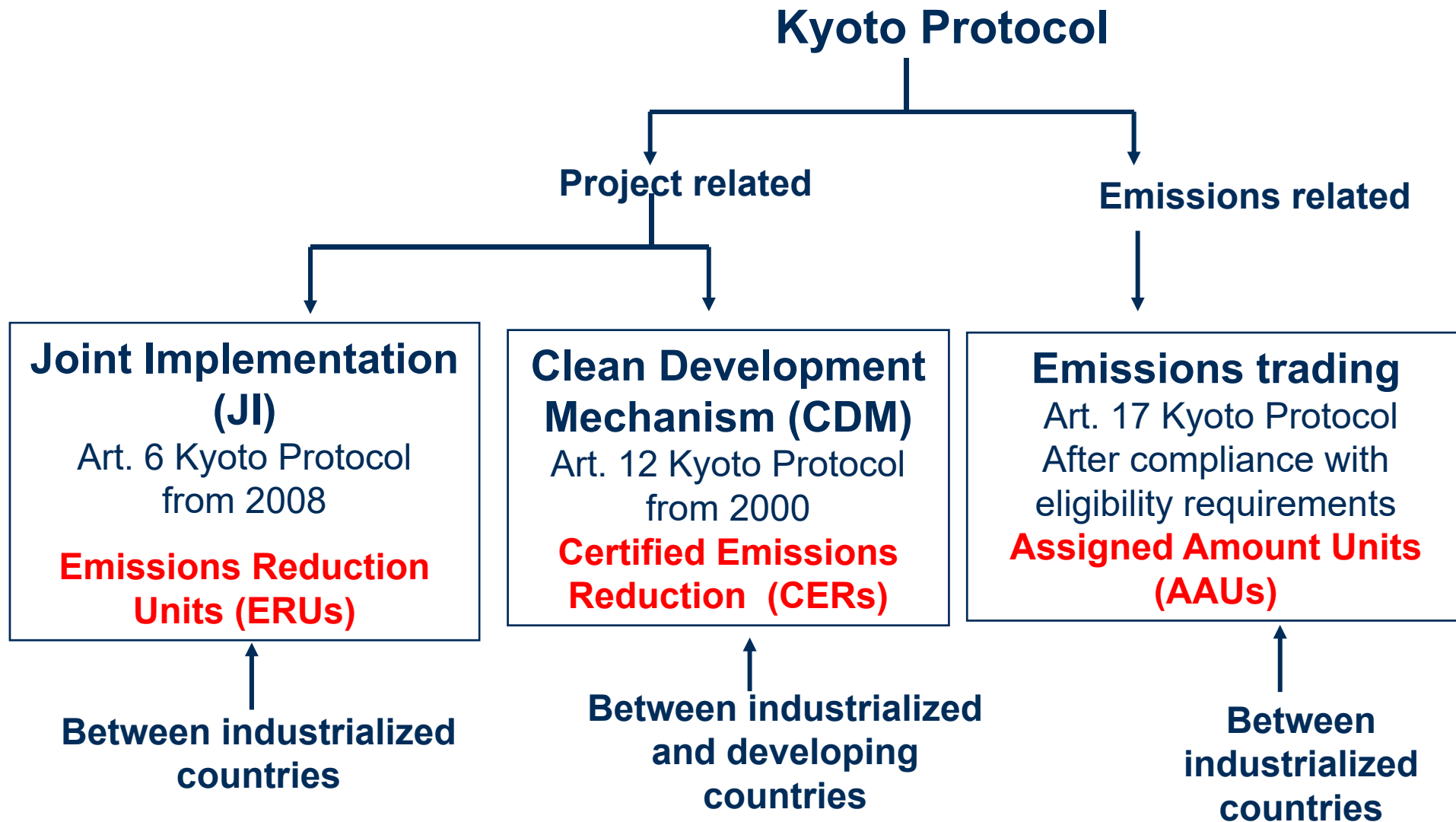
How did the carbon market work of the Kyoto Protocol?

- Countries targets (e.g. -21% 2008-2012 on the basis of 1990)
- Assigned Amount reflected the allowable emissions according to target: Base year GHG emissions * (1- emission reduction target (%)) * 5 years
- In case emissions in 2008-12 > AAUs different flexible mechanisms allowed a country to comply: Buying of e.g.
 - AAUs from other countries
 - RMUs
 - CERs
 - ERUs

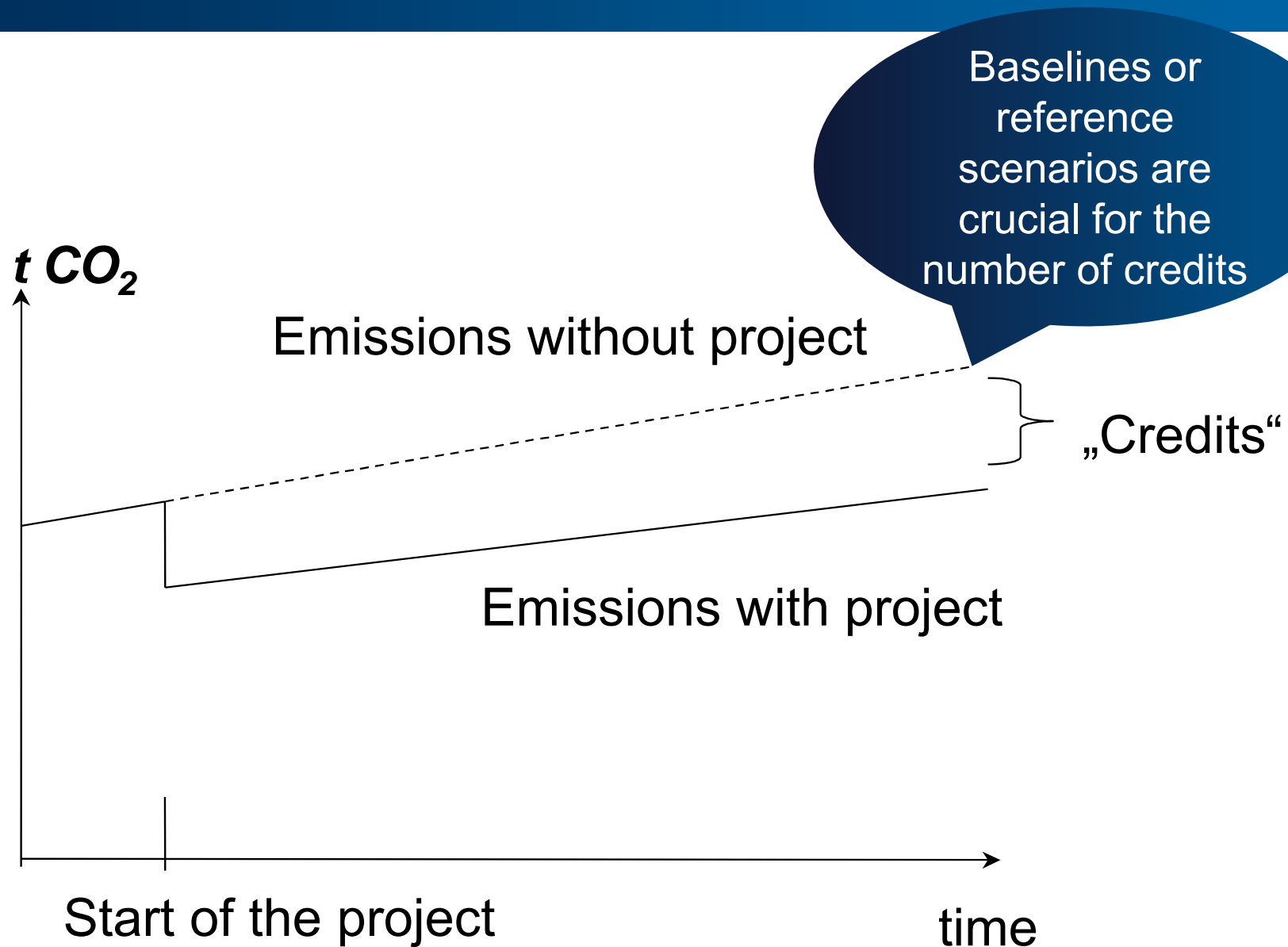


Emissions = anthropogenic greenhouse gases (CO₂, CH₄, N₂O, Industrial gases) from all sectors on the territory of a country (excluding aviation and international ship)

Kyoto Protocol and international unit types



Project based emission reductions (CERs, ERUs)



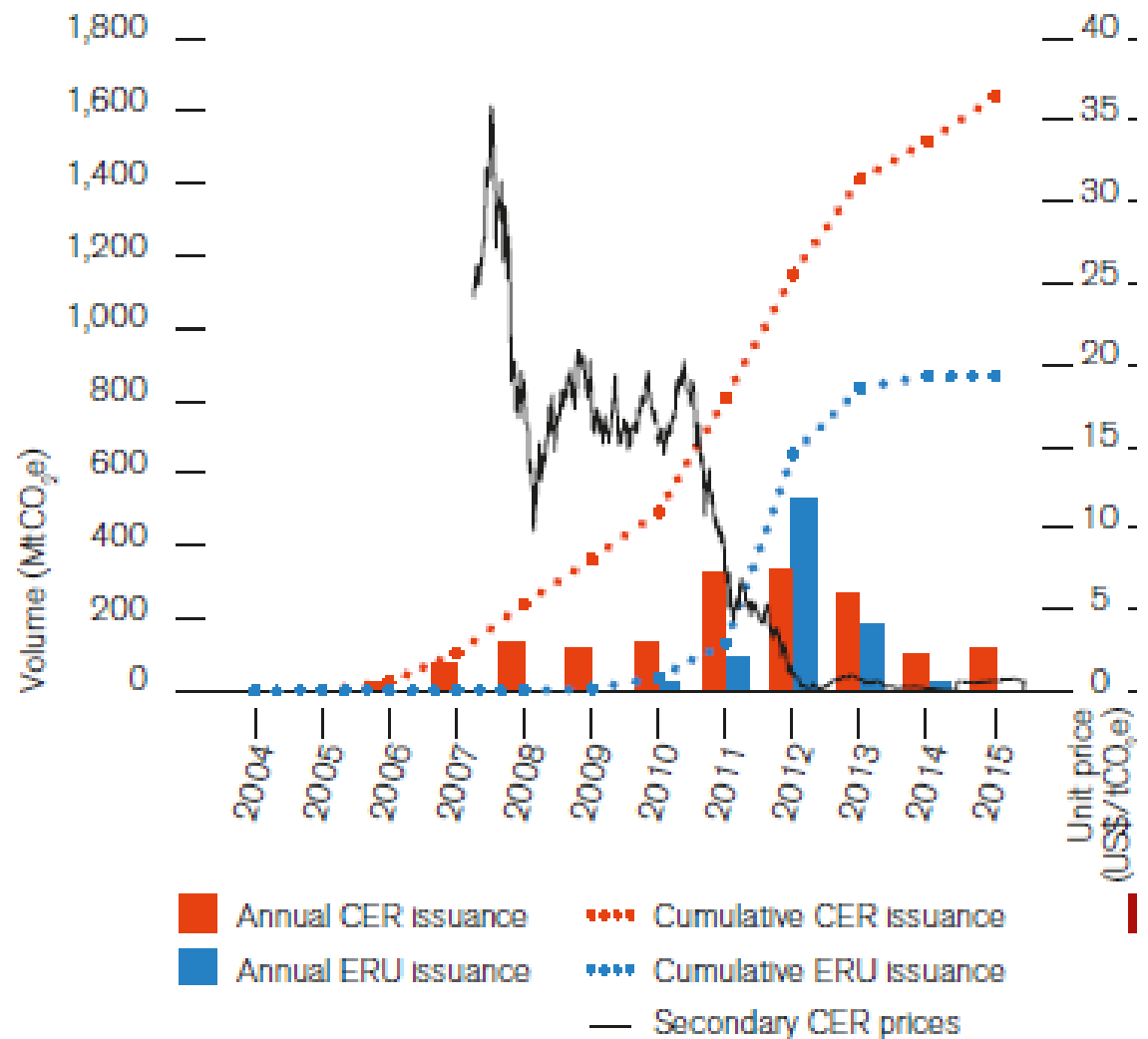
Kyoto Units: Price developments

Since 2007 prices dropped since the oversupply in the EU ETS was obvious

Mid of 2010 prices fall again, as the surplus in Phase 2 of EU ETS becomes obvious and it is decided that **no Kyoto Units can be used for compliance under the EU ETS after 2020.**

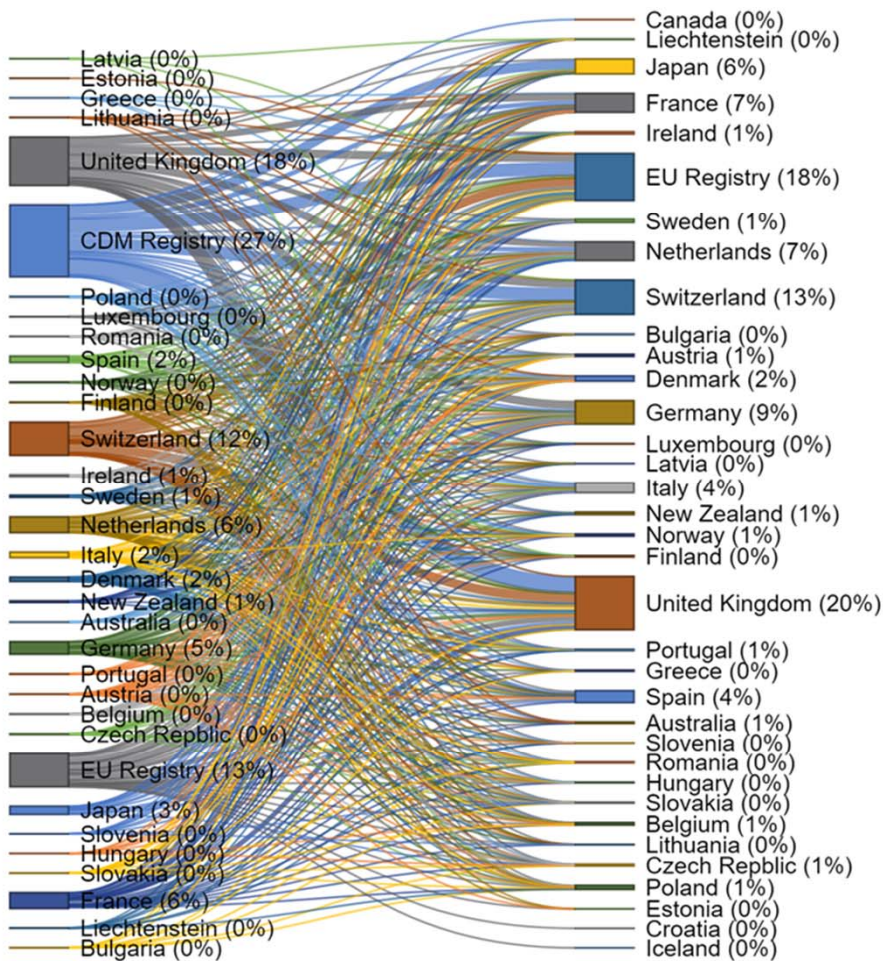
- The maximum use for compliance of 1.6 GtCO₂e of Kyoto units in the EU ETS is almost reached.
- Voluntary cancellation is pushed
- International Civil Aviation Organization (ICAO) is discussing if CERs can be used in the Offsetting and Reduction Scheme for International Aviation (CORSIA)

CDM and JI credit issuances and CDM credit prices

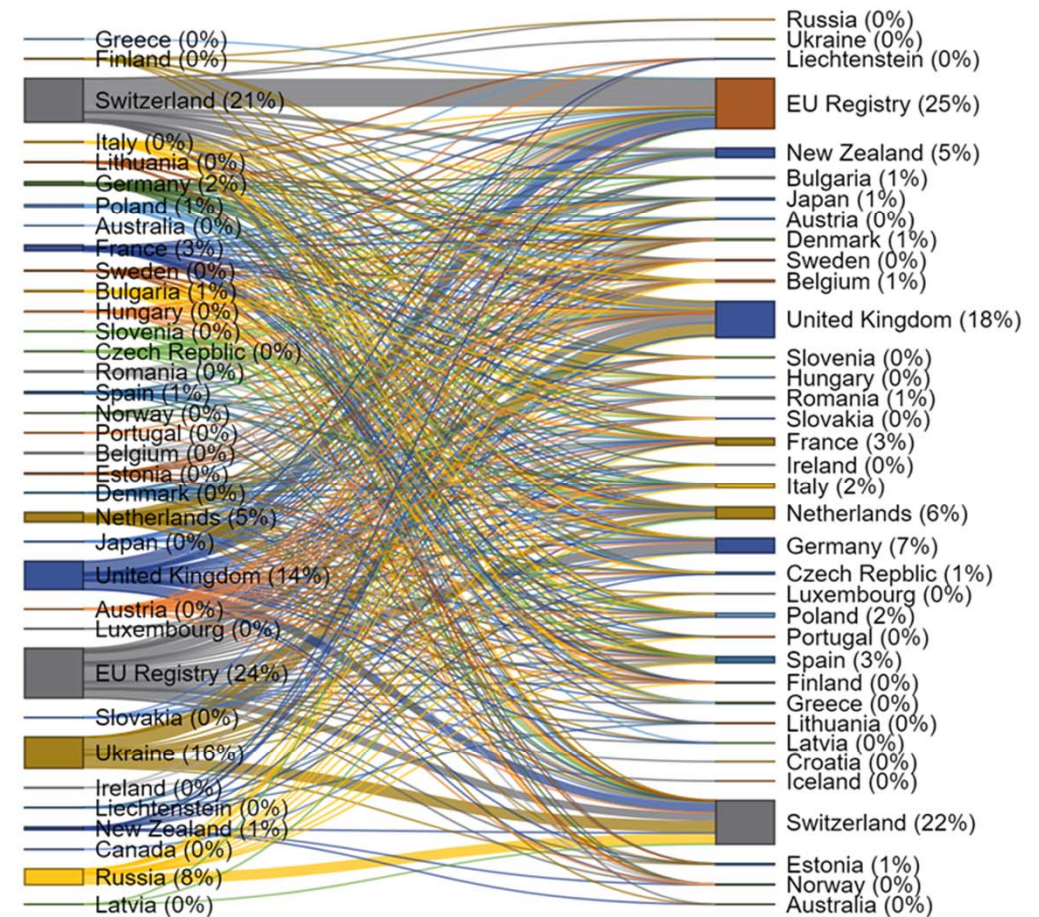


CERs & ERUs flows on registry level (2008-2018)

CERs

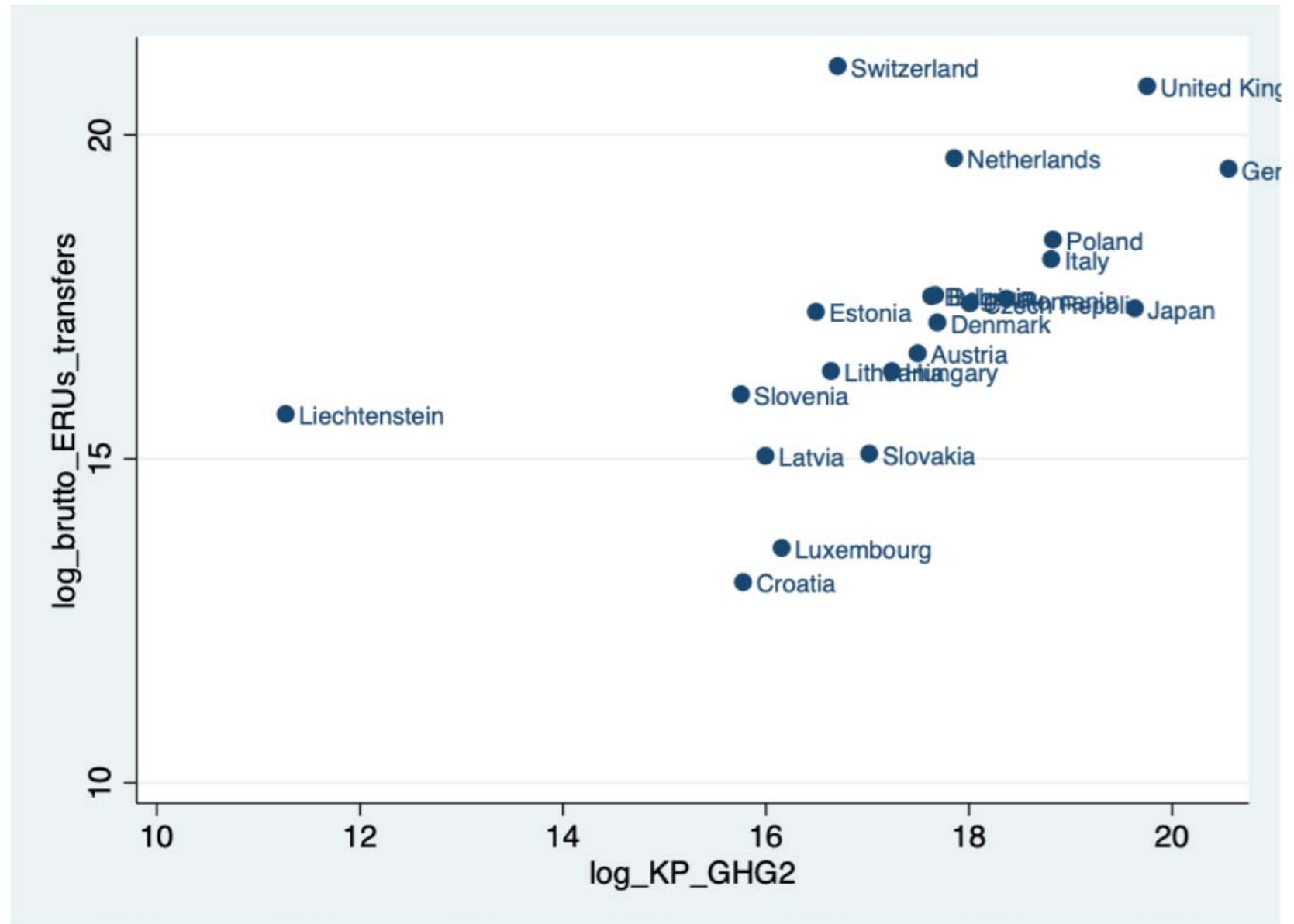


ERUs



Transfer volumes of ERUs compared to Kyoto protocol target

Switzerland and Liechtenstein seem to have higher transfers compared to what they need for compliance with their Kyoto protocol target in the First Commitment Period (2008-2012)



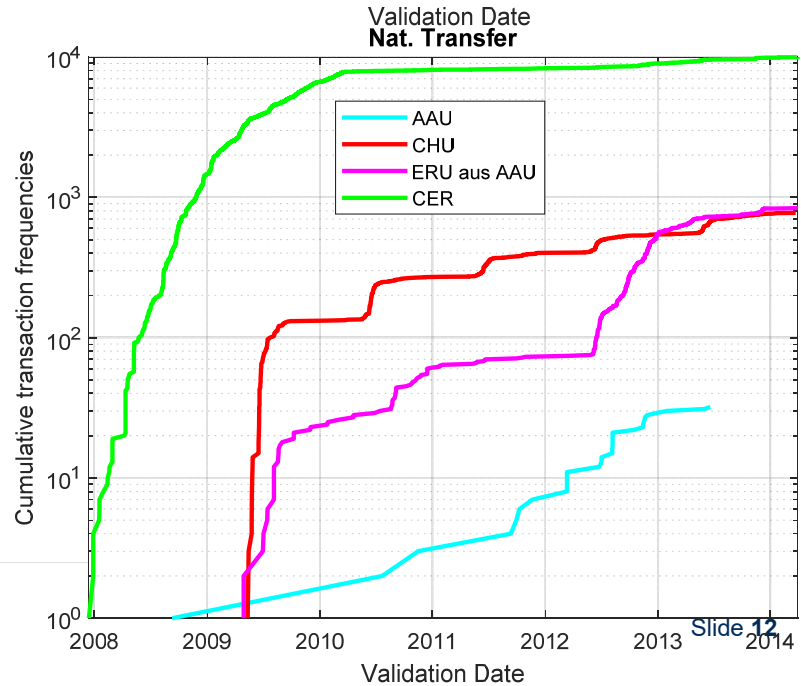
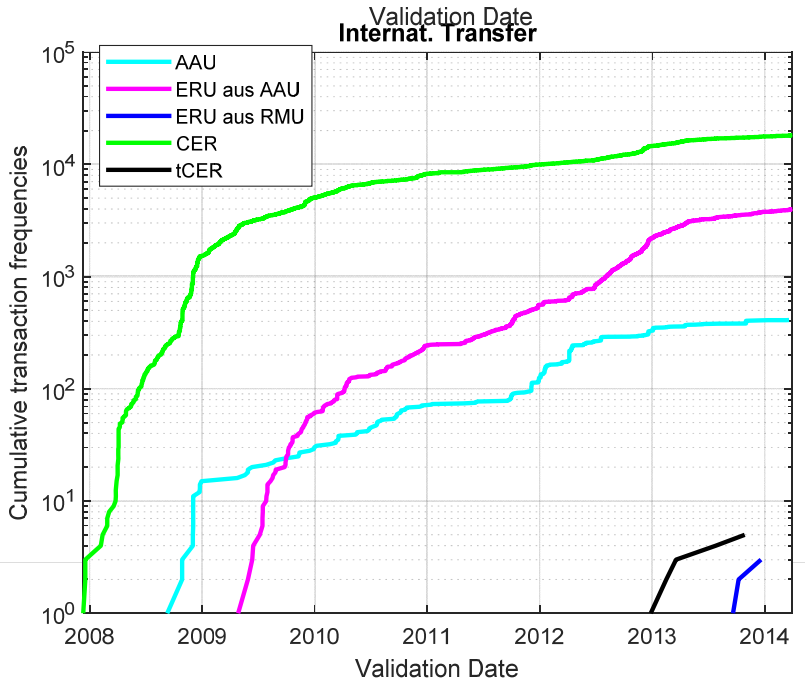
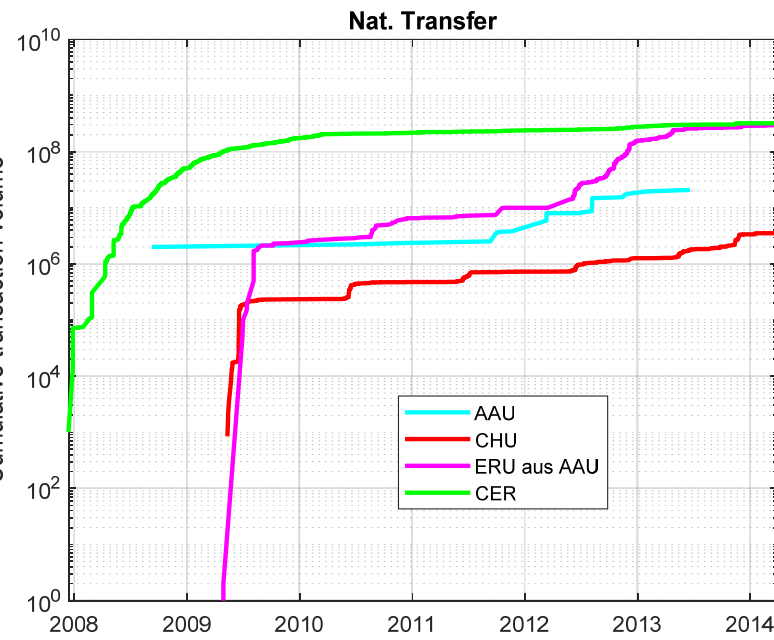
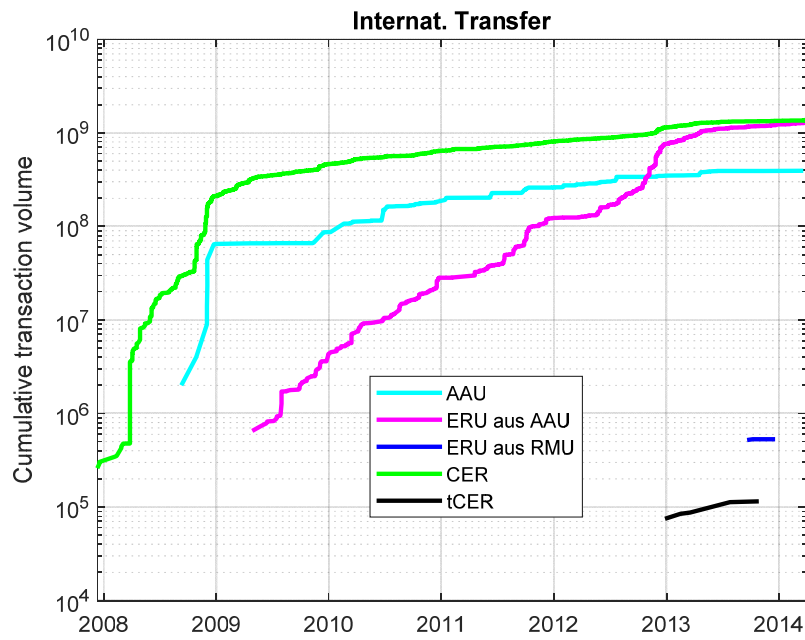
Research Questions

- What role did **Switzerland or the Swiss registry** play in the **international Kyoto Market**?
 - How did **transaction volume and frequency** evolve over time?
 - What players were involved:
 - Which **countries/sectors** were involved?
 - **How many** players from **private sector** were active?
 - **What characteristics** had private sector players?

Data

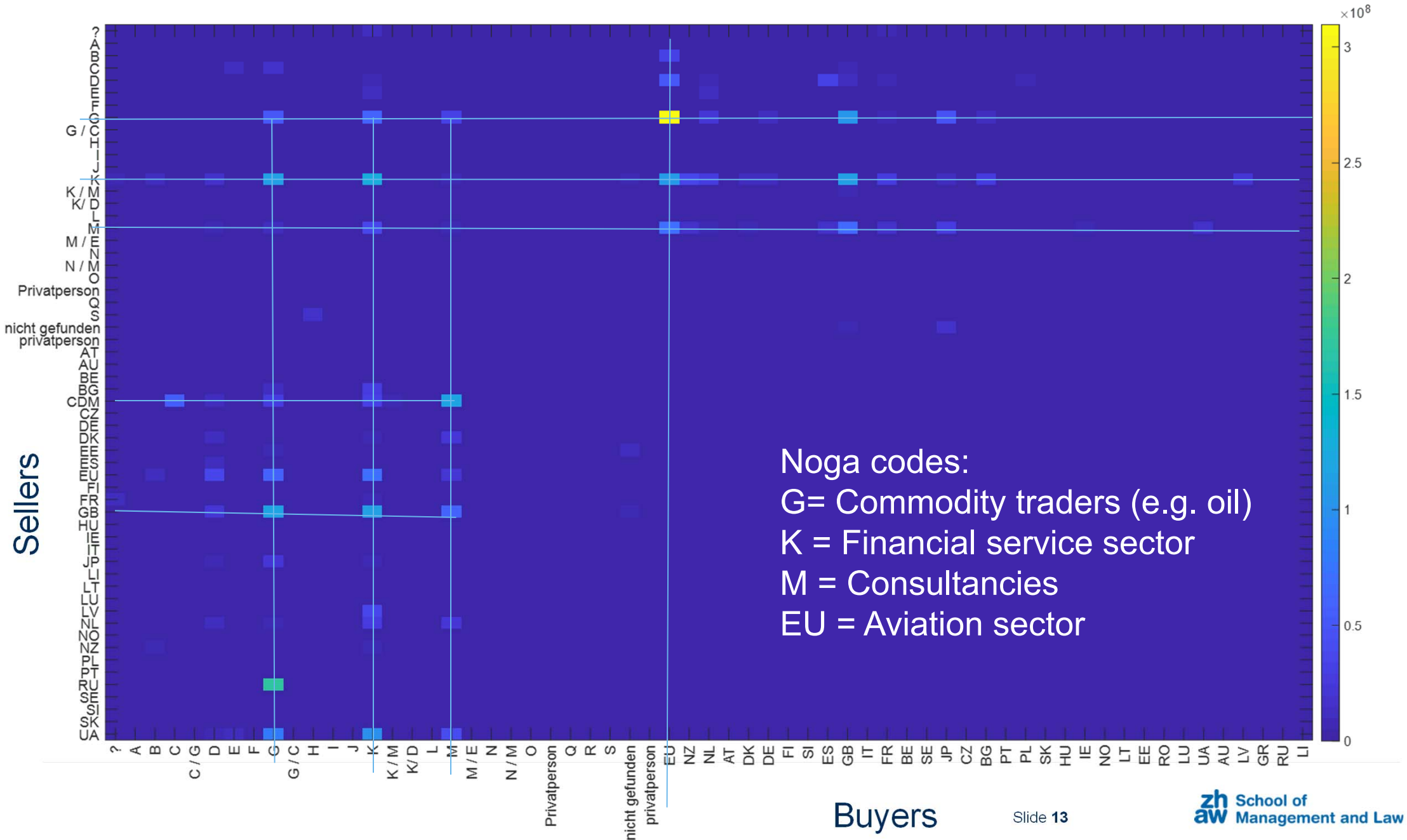
- Swiss environmental agency provided anonymised transaction data
- A registry system works similar to a banking system as it has to ensure that the transfer of units/certificates/allowances between different accounts works well and that the same unit can only be held in one account at the same time.
- The registry tracks different national CHUs and international units such as AAUs, CERs, ERUs holdings and transactions.
- No price information is held in the registry only „physical“ transactions.
- For the analysis no data on „issuance“, „surrendering“ or „voluntary cancellation“ is included
- Dataset contains 33'034 observations
- The unit type (CERs, ERUs, AAUs, etc.) as well as information on the sector of account holders is available over the period 2007-2014.

Transaction volume & transaction frequency over time



- CHUs are almost only transferred nationally
- CERs and ERUs reached similar transaction volumes internationally
- CERs transactions started in 2008
- ERUs in 2009
- CERs transaction frequency was the highest, followed by ERUs.

Data as a matrix of sellers and buyers on country and sector level



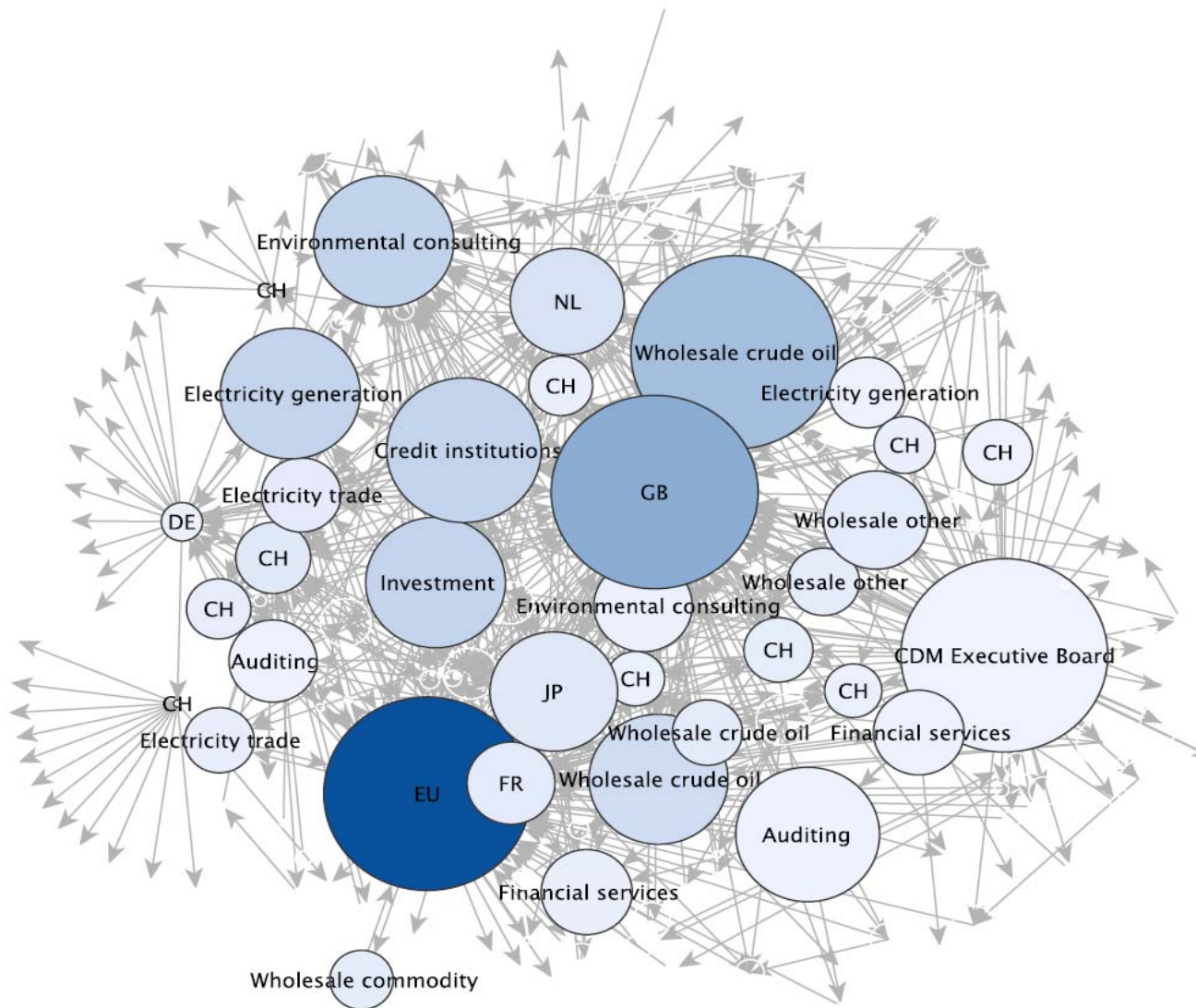
Methodology: Network Analysis

- Network analysis allows to visualise a system as a network $G = (V;E)$
 - V are the nodes representing the agents (e.g. accounts)
 - E represents the set of links between pairs of nodes (e.g. flows of different types of units)
- We show the network for each year to see how the links and positions of an account within the network has changed over time.

Selected parameters:

- *In/Out Degree*: directed network if i and j are two nodes (accounts) and there is a link from i to j (buyer: *In Degree* or seller: *Out Degree*)
- *Degree Centrality*: transaction volume → size of the circle
- *PageRank*: weights the links to the centrality of the accounts it is linked to → intensity of the colour of the circle

Network CER 2012 (account level)



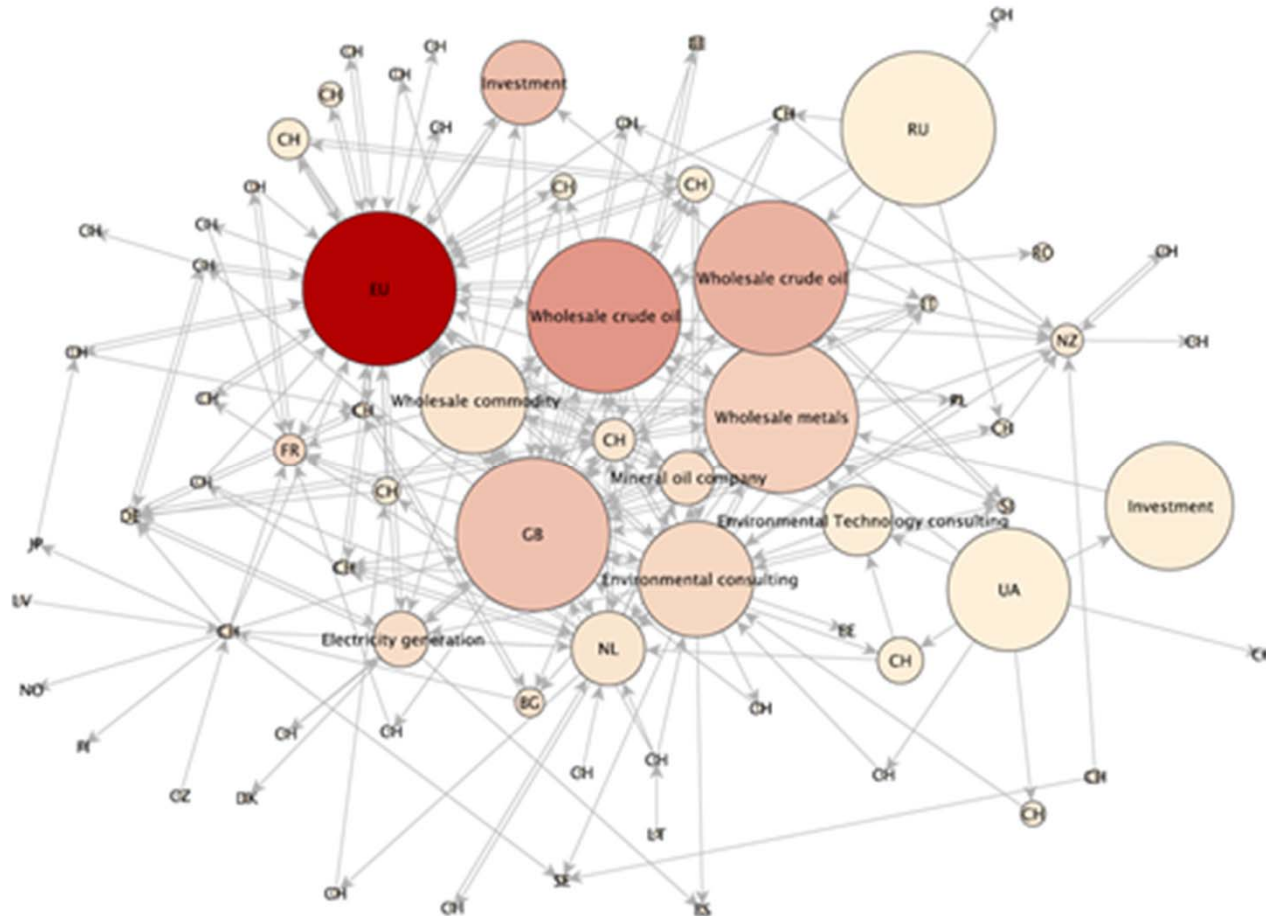
Many accounts in the Swiss registry are active and transfer CERs into the EU (which is the aviation account) or to Great Britain (location of main exchanges)

The CDM Executive Board Account is the major seller

The aviation account has a high PageRank, that means it has links to other central accounts

Wholesale oil traders and electricity generation/traders, consulting as well as financial service companies are all active players in the market.

Network ERU 2012 (account)



The ERU network consists of a lower number of active accounts compared to the CER network

The EU registry (aviation sector) is the major buyer and has the highest page rank similar to CER market.

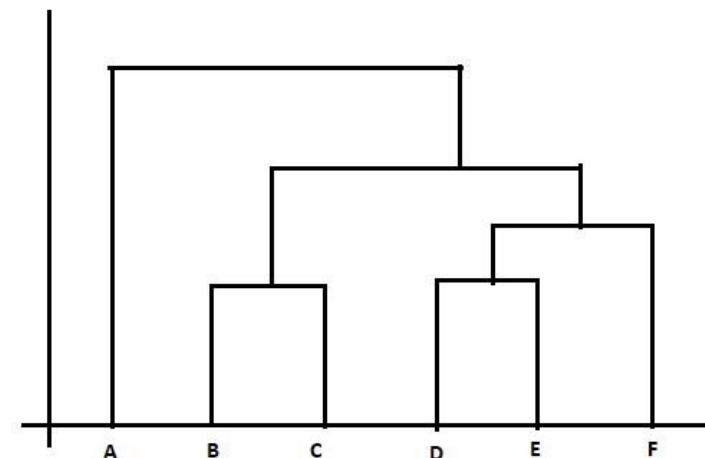
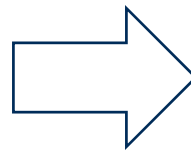
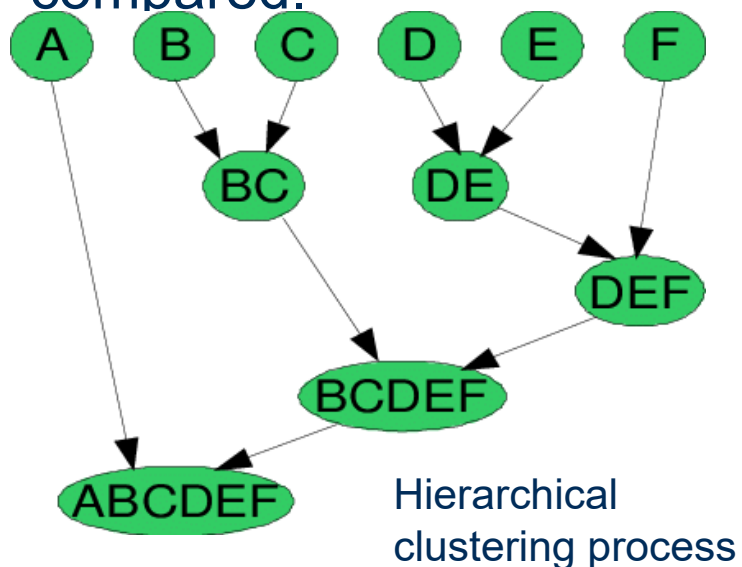
The major selling accounts are in Russia (RU) and the Ukraine (UA)

Wholesale oil traders are mainly buying from Russia and Ukraine as well as investment and environmental consulting companies.

Methodology: Hierarchical clustering of Swiss industry sectors and countries according to their transaction patterns

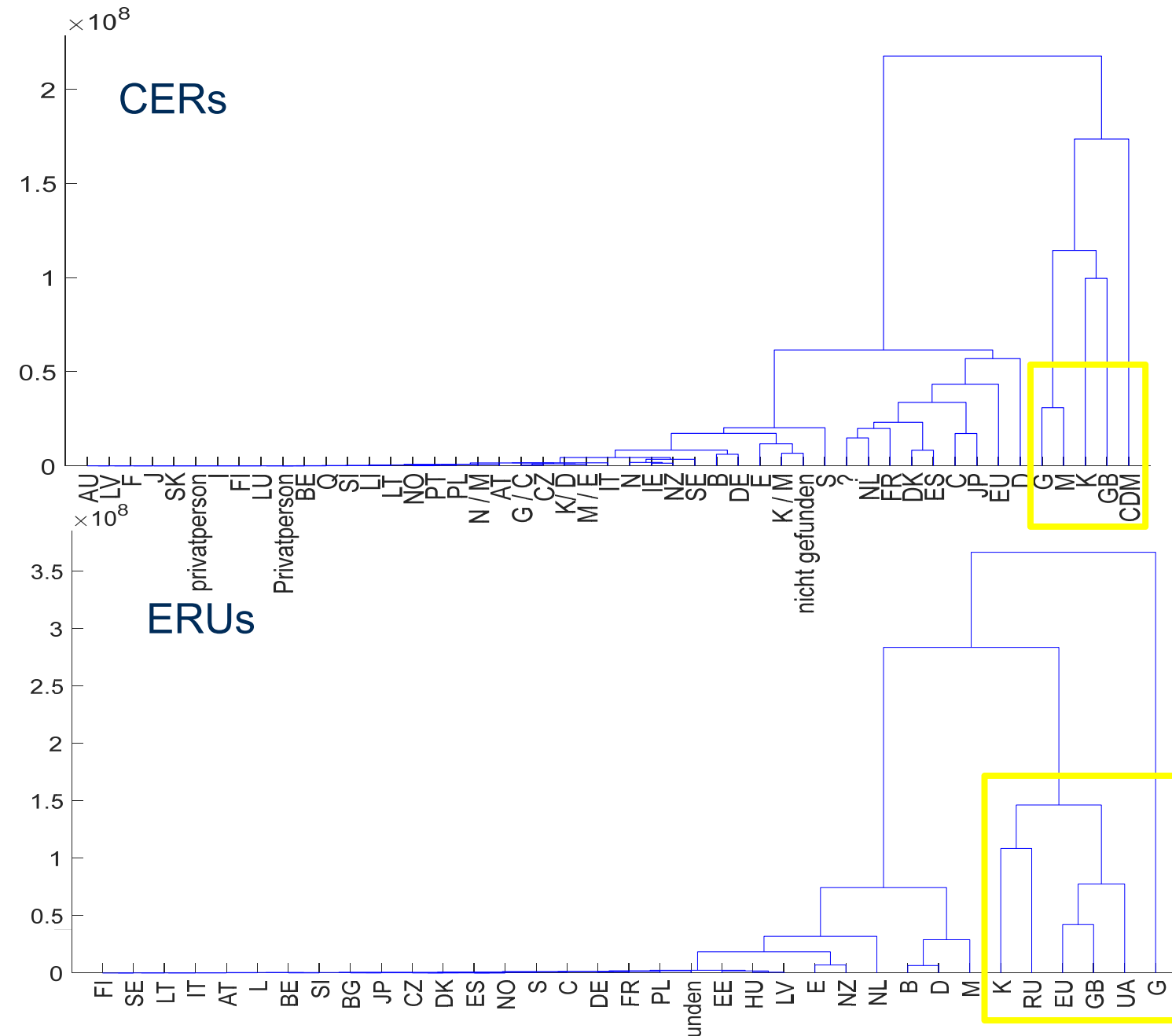
Hierarchical clustering is a **multivariate technique** for grouping objects on the basis of **similarity of each object to each other**. The groups are again compared to each other to form larger groups until a **complete hierarchy** of all objects evolves. This hierarchy can be displayed in a **dendrogram**.

For this study, the transaction patterns of industry sectors/countries are compared.



Dendrogram: A and B are very similar, C and A are less similar.

Hierarchical clusters of debit accounts (sellers) according to cumulative transaction volume patterns towards the buyers



CERs volumina :

- Commodity traders G and Consultances M are alike
- UK and financial service sector K are alike and on a higher level also similar to G&M

ERU volumina:

- EU (Aviation) and UK are alike and also Ukraine (UA)
- Financial sector K and Russia seem to be alike
- Commodity traders G are special, but at a higher level involved with all others

Conclusions

- The Swiss registry shows **high transaction volumes compared to the target** in international Kyoto units **CERs & ERUs** but less AAUs and Swiss allowances (CHUs)
- The international transactions with **CERs started already in 2008** but the volume of transactions of **ERUs** has reached a **similar level** by 2013, although it **started later**.
- The **CDM account** played an important role on the **selling side of the CER** market and **Russia and Ukraine** played an important role on the **selling side of ERUs**
- The **frequency of transactions** of CERs was high at the beginning but slowed down over time, **ERUs** transaction frequency had a **peak in 2009** and **later in 2012**
- There were **many more players involved** in the **CER market** compared to the ERU market
- The players in both markets were wholesale traders mainly in oil, electricity generators/traders, (environmental) consultants and investment companies.
- 7 players were active in both markets and the EU registry (**Aviation sector**) **was the most central one in both markets**.
- Since the **major exchange** for CERs was **located in the UK** it played together with the **financial service sector** a special role.
- Non-EU countries like Liechtenstein and New Zealand seem also active.

THANK YOU VERY MUCH FOR YOUR ATTENTION!

