

Transaction Analysis

A mechanism to detect and prevent VAT-fraud in the European Emissions Trading System (EU ETS)

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Abstract—The European Emissions Trading System (EU ETS) has been shown vulnerable to VAT-fraud. Due to the introduction of the Reverse-Charge-Procedure in the majority of EU Member States (MS), VAT-fraud has reduced significantly. Nevertheless, remaining VAT-fraud patterns need to be detected in the transactions in order to support investigation bodies. On the basis of the Belgium software REMa the National administrators of Germany, France and United Kingdom have developed a method to detect VAT-fraud, called Transaction Analysis. This method is explained. Transaction Analysis has been validated against historical data.

Keywords—*European Emissions Trading System; VAT-fraud; Transaction Analysis; fraud detection;*

I. INTRODUCTION

The European Emissions Trading System (EU ETS) has been introduced in 2005 in all European Member States. It was the first ETS on supranational level. It was designed on basis of the European law [1, 2] and as a decentralized system with strong responsibility of the European Member States (MS).

In 2009 and 2010 the EU ETS was under massive attack by criminals. They abused the simple and elegant mechanism for transferring assets between MS boundaries for VAT fraud. Due to the legal situation at that time it was extremely difficult to prohibit this kind of fraud. EUROPOL and Interpol have estimated losses of up to € 5.5 Billion for the tax systems of the affected MS.

The European Commission (Cion) and the MS took countermeasures by changing the legal basis (introduction of a Reverse-Charge-Procedure) and developing mechanisms to detect fraudulent activities. One mechanism will be explained here, the **Transaction Analysis**. It has been developed in a close cooperation by the National Administrators of Germany¹, France², United Kingdom³ and their respective law, tax and financial authorities. Other National Administrators, in

particular Belgium⁴ by giving access to the software REMa, have contributed to this development.

This article explains the methods for detecting VAT-fraud in patterns of EU ETS transfers and discusses initial results.

II. METHOD

A. *The European Emissions Trading System*

The Emissions Trading Registry (registry) is the heart of any ETS. It is a database software application that is similar to an online banking system. The participants of the ETS (industries, power provider, brick or steel manufacturer, banks, traders, private persons ...) have accounts in the registry. They can hold units of different types on their accounts. In the EU ETS the most important one is the European Allowance (EUA). Other unit types are

- Aviation Allowances (aEUA or EUAA) for the aviation sector
- Certified Emission Reduction Units (CER generated by CDM-projects)
- Emission Reduction Units (ERU generated by JI-projects)
- Removal Units (RMU) for sinks of greenhouse gases like forests

Account holders can perform several actions with units held in their accounts. It is possible to transfer units to another account (e.g. as fulfilment of a purchase contract). It is also possible to cancel units (for compensation of greenhouse gas emissions) and to surrender units (fulfilling the obligation in the EU ETS). As the EU ETS is an economical system for the limitation of greenhouse gas emissions the trading of units is the core part of it.

At the beginning of the EU ETS each MS was obliged to maintain its own registry. These registries were connected by the Community Independent Transaction Log (CITL) at the European level (CITL until 2012 and EU Transaction Log

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³ Environment Agency

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EUTL since then) and by the International Transaction Log (ITL) at the Kyoto level (ITL⁵, maintained by the climate secretariat of the UNFCCC). Further explanations of the network of registries and transaction logs may be found at the websites of the United Nations Climate Secretariat⁶ (UNFCCC) and the German Emissions Trading Authority⁷ (DEHSt). Since 2012 all European registries are consolidated in the Union Registry (UR) maintained by the European Commission.

Operators with installations falling under the EU ETS are required to open an account in the registry in order to fulfil their legal obligations. Other private entities and persons may open trading accounts on a purely voluntary basis. During 2009 and 2010 the National Administrators experienced rapidly growing number of transactions and volumes in their registries. Rather soon it became evident that these transactions were not legitimate but were indicators for VAT-fraud. The National Administrators do not have access to the underlying financial transaction which soon became clear to be a limiting restriction. In 2010 most MS introduced the Reverse-Charge-Procedure and VAT-fraud stopped almost immediately in these countries. With the Reverse-Charge-Procedure the buyer and not the seller is discharging the tax.

B. Patterns of VAT Fraud

VAT fraud is a common method of fraud well known from areas where expensive goods can be transported easily over boundaries (mobile phones, Integrated Circuits ...). The basic principle of VAT fraud is shown in figure 1.

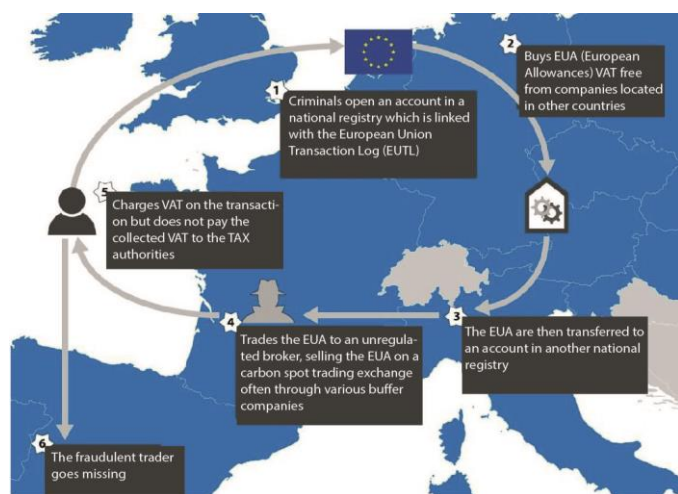


Figure 1 - Carrousel or VAT-fraud

The fraud is performed by several companies that trade (very often there is no real trade and no flow of money) a commodity in circles. There is one trader in the chain that is obliged to pay the VAT but it will disappear after a while without doing so (this fraud is therefore also called missing-

⁵ https://unfccc.int/kyoto_protocol/registry_systems/itl/items/4065.php

⁶ <http://unfccc.int/2860.php>

⁷ http://www.dehst.de/EN/Service/Union-Registry/Union-Registry_node.html

trader fraud). Others in the chain claim money from their tax authorities due to their right of deduction of input tax.

ETS has been abused for VAT-fraud, because it is easy to handle. Companies can open accounts in all European registries and access the systems via the Internet. The emissions allowances, the main commodity to be dealt with in the EU ETS, can be transferred from one account to the other instantaneously.

Very typical patterns of VAT-fraud are:

- The account balance is almost always 0
- Whenever a number of units are received, they are transferred away almost immediately
- Transfers are almost always international (e.g. DE to UK)
- The same units are coming back to the account after having transferred out
- Small and newly founded companies are trading huge amounts of units worth huge amounts of money
- The transfer paths are similar to identical

C. Transaction Analysis

The central method of detecting VAT-fraud activities is the Transaction Analysis (TA). It consists of a bundle of statistical and empirical methods. The combination of these methods may result in a clear indication on VAT-fraud.

The behaviour of market participants is shaped by their specific activities. A small paper manufacturer, for example, would receive a free allocation once per year (until 28 February) from the corresponding National Administrator. The deadline for surrendering (fulfilment of the operator's legal obligations) is 30 April. The paper manufacturer may easily establish if he needs to purchase further units to meet this obligation. He would do that by contacting banks or other operators under the EU ETS. After having received the further units he would surrender them in time, and probably forget about the EU ETS until the end of the year.

Other operators like big power providers use emission allowances like any other asset (energy, heat, coal, gas) and trade them on a daily basis. However, important in this context is the observation, that different groups of participants do show specific patterns of behaviour in their transactions.

As described in the preceding chapter we found typical historic transaction patterns indicating VAT-fraud. The main part of TA consists of a statistical comparison of the transaction behaviour of a specific account with the "average behaviour" of the group the account belongs to. We do not explain in detail in which way this "average behaviour" is being computed, because this could give an indication how to avoid detection by the algorithm.

As a second part we compare the transaction behaviour within a certain time frame (e.g. 12 months) with the behaviour in the preceding time frame. This is based on the assumption that it is unlikely that non-criminal market

participants would change their behaviour in time drastically. And if market conditions do change, the change in behaviour can be seen from all market participants (and all account groups) in almost the same way. Typical examples of accounts with strange and suspicious behaviour can be seen in figure 2 and 3.

Another important aspect of TA is the tracking of units. In the EU ETS units have unique serial numbers. Therefore it is possible to follow their path from one account to the other. The ordinary user cannot see the serial numbers and it is therefore not possible to choose specific units for a transfer. The system chooses the units almost randomly. It is therefore extremely unlikely that a unit will come back several times to one specific account. We have seen units coming back up to 63 times per day in 2009 over identical paths. There is no business case that fits with such high speed trading. The only explanation is that the units are being transferred in closed loops several times and that all units that just arrived at the account are transferred out immediately (before other incoming units could mix up).

Third part of the TA is the evaluation of the transaction behaviour in time. In the EU ETS there are fixed dates for specific actions of the operators or other market participants:

- 28 February: free allocation
- 30 April: surrendering
- 1 December: Delivery of futures contracts

In figure 2 we compare transactions of a typical operator in the EU ETS with the transactions of a convicted fraudster in Germany.

The left diagram shows unsuspecting behaviour. The green bars represent the mean values of the account group. The red bars represent one specific account out of this group. As we can see the extremes are more prominent, but in general the course of transactions show peaks at the same time.

The right diagram shows suspicious behaviour. Again, the green bars represent the mean values of the account group. The red bars show the figures of a known and convicted criminal. Peaks do obviously not occur at the right time and are of magnitudes away from ordinary behaviour.

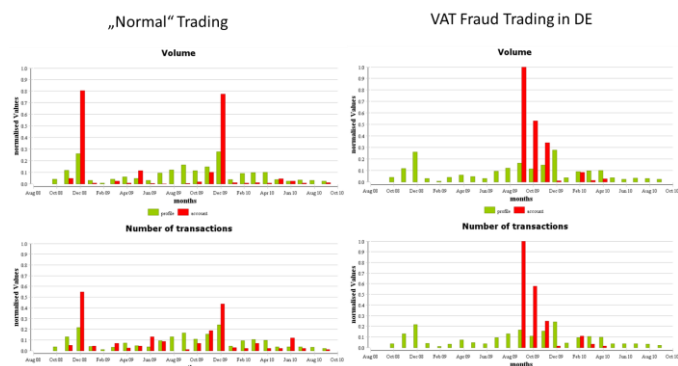


Figure 2 – Transactions in time. Green bars: mean values for the group, red bars: specific account values.

D. Software Implementation

Transaction Analysis is a complex method that shows Indicators for potential fraud in the transactions of a registry. It is based on statistical analysis of transaction data. This data comes from the Union Registry⁸, the central registry of the EU ETS [2]. The data sets are exported on a regular basis for the European Member States.

On the basis of the REMa⁹ software, a module called GYM (German Transaction Analysis Module) has been developed¹⁰. REMa is a database application for the support of administrative procedures of the MS National Administrators. Within REMa data that is needed for the day-to-day management of the accounts in the UR can be administered. GYM is an optional module that is currently used by Germany for systematic transaction analysis and that is currently under test procedures in some other MS.

E. Validation of the Methodology

In order to validate the methodology, we have tested the software with data from the German Emissions Trading Registry. In 2009 and 2010 we have seen VAT-fraud in Germany and since then several court cases have been processed and people have been found guilty for VAT-fraud. We tried to find out whether the TA is able to identify the fraudulent activity on the accounts of these companies.

The result is shown in figure 3. The bubble diagram at the left side shows the volume of transactions, the one on the right side shows the number of transactions. The size of the bubbles corresponds to the respective parameter. At the X-axis the distance to the profile is shown. At the Y-axis the distance to the previous period is plotted. The nearer to the upper right corner a bubble is plotted; the bigger is the deviation from the group and the previous time period. The bubbles indicated by arrows represent the accounts of convicted fraudsters.

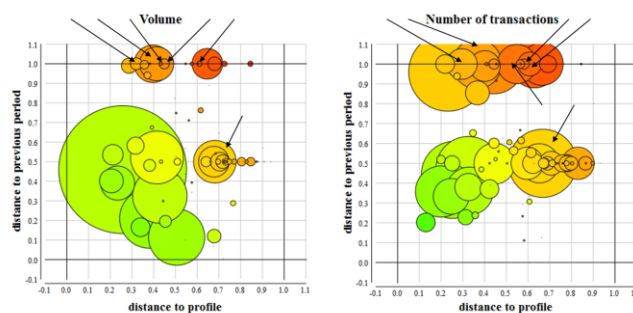


Figure 3 – Bubble diagram on transaction behaviour in relation to the group's mean behaviour. Arrows indicate convicted fraudsters.

⁸ http://ec.europa.eu/clima/policies/ets/registry/index_en.htm

⁹ REMa has been developed and licensed by the Federal Public Service (FPS) Health, Food Chain Safety and Environment DG5 Environment, Climate Change Division of Belgium

¹⁰ Developer is Dr. Lippke und Dr. Wagner GmbH, Berlin

III. RESULTS, CONCLUSIONS AND FURTHER STEPS

The Transaction Analysis is a method for detecting patterns of VAT-fraud in transactions of the EU ETS. We have been able to validate the method against historical data.

VAT-fraud in the EU ETS has become almost impossible in most of the MS due to the introduction of Reverse-Charge-Procedure [3] . Nevertheless, there are still many suspicious cases in the past that are to be analysed and to be brought to court. Additionally, MS where no Reverse-Charge-Procedure has been introduced still have the potential for future VAT-fraud.

TA is not yet implemented in the day-to-day management of all National Administrators. Discussions are ongoing and some MS believe TA should be performed centrally. This position is reinforced by feedback from several MS Financial Intelligence Units as well as the recent EU Court of Auditors report¹¹. Performing TA centrally would improve the oversight and coordination of any investigation of VAT-fraud, especially as they are almost exclusively of an international character.

Article 98 of the Registry Regulation [2] also focuses on money laundering and terrorist financing. Money laundering is a topic that needs further attention. It seems to be more challenging than VAT-fraud, especially because the National Administrators cannot see the money flow behind the transactions of EU ETS units. The German Emissions Trading Authority plans to start a research project on detection of money laundering in the EU ETS in the coming year.

REFERENCES

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- [3] Council Directive [2006/112/EC](#) of 28 November 2006 on the common system of value added tax

