Chapter 6
Using FMI Transaction Data in Simulations: Less Is More?

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ABSTRACT

In this chapter the authors provide a method to aggregate large value payment system transaction data for executing simulations with the Bank of Finland payment simulator. When transaction data sets get large, simulation may become too time consuming in terms of computer power. Therefore, insufficient data from a statistical point of view can be processed. The method described in this chapter provides a solution to this statistical problem. In order to work around this problem the authors provide a method to aggregate transaction data set in such a way that it does not compromise the outcome of the simulation significantly. Depending on the type of simulations only a few business days or up to a year of data is required. In case of stress scenario analysis, in which e.g. liquidity position of banks deteriorates, long time series are preferred as business days can differ substantially. As an example this chapter shows that aggregating all low value transactions in the Dutch part of TARGET2 will not lead to a significantly different simulation outcome.

INTRODUCTION

The financial crisis, starting in the summer of 2007, made it clear that the liquidity position of financial institutions (like banks and insurance companies) can deteriorate quickly. When Lehman Brothers collapsed in the fall of 2008 a severe shock went through the whole financial system. The impact was tangible way beyond the direct counterparties of Lehman Brothers. As a result of this collapse distrust in financial markets increased substantially, see e.g. Arciero, Heijmans, Heuver, Massarenti, Picillo and Vacirca (2013) for the European unsecured money market.

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Financial institution settle many of their obligations in so called Financial Market Infrastructures (FMIs). These obligations can either be on behalf of their own business or of their customers (such as, businesses, consumers, governmental organizations or other financial institutions). In other words FMIs facilitate the settlement of many economic processes. Due to their importance for the economy FMIs have to live up to high standards. These standards are called the Principles For Financial Market Infrastructures (PFMIs), CPSS (2012).

An important sort of FMI are payment systems and among them is Real Time Gross Settlement (RTGS) systems.[1] These systems are often offered by central banks. The key features of an RTGS system are that each payment is executed individually and with finality. Finality means that as soon as a payment is processed by the system it cannot be revoked anymore, not even in case of bankruptcy. Each currency area in the industrialized world has its own system. In the euro area this system is called TARGET2, in the US this is Fedwire and in the UK this is CHAPS. The receiving institution can reuse the liquidity immediately again to fulfil its own financial obligations. Over the last years RTGS systems provide additional functionality, like sorting within waiting queues, re-entry of rejected payments, bilateral limits and so on. These features intend to speed up the settlement in case payments end up in the queue. This happens when insufficient liquidity is available. In a (pure) RTGS these payments would remain in the queue until sufficient liquidity is received from other financial institutions. The paying institutions could also bring in more collateral, which it can use for intraday credit.[2]

An often used method to analyze behavior, liquidity risk, credit risk and the efficiency of the payment system is simulation. The Bank of Finland developed a software tool that imitates several large value payment system, of which the RTGS is an example. As input the tool needs to know at least the system's characteristics, the participants that are active in the payment system and the individual transactions. Besides, it allows for setting the beginning of day balance (the available liquidity at the account at the beginning of the day) and the potential credit line (the maximum negative balance that is allowed). For a detailed description of the simulator tool see Leinonen and Soramäki (2005). In the remainder of this chapter the authors mean by "the simulator" and "simulations" the BoF simulator and simulations executed with the BoF simulator unless explicitly stated otherwise.

The main question of this chapter is to what extent it is possible to aggregate LVPS transaction data to be used in simulations without significantly changing the outcome of those simulations. The reason why researchers often limit their data sets is the amount of time required to run all simulations. Too often researchers are forced to settle for a very short time span or a too limited amount of days because running the simulations simply takes too much of their time.

The outline of this chapter is as follows. The authors first start with a background section containing an overview of simulation literature, then move on to the methodology section after which the results section contains the main findings. Finally the conclusion section shows the conclusions.

BACKGROUND

Focus of Simulation Research

Research in which FMI transaction data has been used as input for the simulator, can focus on a variety of aspects. The authors distinguish four main aspects, at the same time realizing that often a combination of multiple aspects occurs within the same research.