Identifying Interbank Payments From Large-Value Payment Systems

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Motivation. Banks in the euroarea settle more than 350,000 payments every day using the large-value payment system TARGET2. One important challenge for central banks is to reliably extract which of those payments are loans from one bank to another (i.e. a transfer from A → B with a subsequent transfer from B → A at a later date), and which are retail payments (i.e. a transfer from A → B without subsequent re-transfer). These *interbank loans* are a major source of banks' liquidity and a changing pattern in the availability of interbank loans can provide a valuable early warning signal to detect systemic risk in the financial system. A reliable and dataset of interbank lending can be used to detect possible liquidity shortages while they are building (i.e. before they become acute), measure and assess interbank market stress, and analyze the potential for contagion in the interbank market. To date, the algorithm developed in Furfine (1999) is the only method to identify interbank loans from raw payments data, available to central banks and widely applied within the ESCB, the Federal Reserve System, and at the Bank of England.

Recent developments in the Euroarea interbank market, and in particular the decision to move to a negative deposit facility rate, pose a challenge for the identification of interbank loans from transaction level data. With a negative deposit facility rate it is possible and plausible that banks lend to each other at a *negative interest rate*. In such an environment, however, identifying interbank loans from transaction level data is no longer reliably possible using the standard methodology developed in Furfine (1999).

In collaboration with Deutsche Bundesbank, the central bank of Germany, the aim of this thesis is to develop a novel identification algorithm based on machine learning techniques. Such a novel algorithm can also help to address some of the criticism about the Furfine (1999) algorithm voiced by Armantier and Copeland (2012).

Project Description. The algorithm for the identification of interbank loans, developed by Furfine (1999), relies on a simple matching: a transaction from bank A to bank B with amount X€ on date t is matched to a transaction from bank B to bank A with amount (X+ΔX)€ on date t+Δt. This matching relies on the fact that the returning leg of an interbank loan is returned at a later date t+Δt with a positive implied interest ΔX/X. When ΔX is negative, the algorithm fails to detect the interbank loan.

An alternative approach is to use machine learning techniques and develop an algorithm that computes the probability of a transaction being a leg of an interbank loan based on the implied interest rate (which has to fit within a window around the main refinancing rate, depending on the maturity) *and* previously identified interbank loans between the involved counterparties. This research proposes to use a supervised machine learning approach: specfically artificial neural networks trained as generalized transaction classifiers with existing inter-bank loan data.

This last step is the key deviation from the Furfine (1999) algorithm that simply uses information about implied interest rates (and plausibility checks that preclude negative interest) to assess whether or not a transaction is an interbank loan. In contrast, the algorithm proposed here uses information on payment patterns as well. If, for example, two banks have engaged in interbank lending on every first Monday of a month for four years, it is highly unlikely that this pattern will suddenly stop. If it does, such disruptions of strong payment patterns can carry valuable information for oversight.

Project organization and timeline.

This thesis will be carried out in collaboration with Deutsche Bundesbank. Due to severe data confidentiality constraints, analysis of the data can only be carried out at the premises of Bundesbank in Frankfurt, Germany. The candidate will have the opportunity to get data access during a paid 3-6 months internship at Bundesbank. A sample dataset will be made available to develop the necessary software while being in South Africa. The project is particularly suitable for candidates with an interest to applying methods from computer science to practical problems in finance.

References

Furfine C., **1999**, *"The Microstructure of the Federal Funds Market,"* Financial Markets, Institutions, and Instruments, 8(5), 24-44.

Armantier, O., and Copeland, A., **2012**, *„Assessing the Quality of 'Furfine-based' Algorithms"* Federal Reserve Bank of New York Staff Reports, no. 575, October 2012