Chapter 15

Modeling the FX Market Traders’ Behavior: An Agent-Based Approach

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ABSTRACT

In this chapter, the authors use an Agent-Based Modeling (ABM) approach to model trading behavior in the Foreign Exchange (FX) market. They establish statistical properties (stylized facts) of the traders’ trading behavior in the FX market using a high-frequency dataset of anonymised OANDA individual traders’ historical transactions on an account level spanning 2.25 years. Using the identified stylized facts of real FX market traders’ behavior, the authors evaluate the collective behavior of the trading agents in resembling the collective behavior of the FX market traders. The study identifies the conditions under which the stylized facts of trading agents’ collective behaviors resemble those for the real FX market traders’ collective behavior. The authors perform an exploration of the market’s features in order to identify the conditions under which the stylized facts emerge.

1 INTRODUCTION

Classical economics are based on simplifying assumptions such as perfect rationality and homogeneous trading agents, some of which do not hold true in practice. Classical economics fails to explain the dynamics of traders’ behaviour, and the forces that drive such behaviour. LeBaron (2006a) declared “…this world was build on the assumption that asset markets were powerful computational engines, and were able to aggregate and process the beliefs and demands of traders, leaving in place the full set of properly processed information currently available” (p. 1187).
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This leads to the need for the development of alternative approaches to enhance our understanding of financial market behaviour, in order to go beyond traditional theories of economics, which are based upon many unrealistic assumptions. The Agent-Based Modelling (ABM) approach attempts to tackle more efficiently some of the limitations of the analytical models that deal with economics and finance. ABM approach has been developed in the last decade to explore and study the behaviour of financial markets.

In this study, we focus on the Foreign Exchange (FX) market, which is the most liquid financial market in the world. We build agent-based models of FX market traders in which the trading agents’ collective behaviour resembles, to a certain extent, the collective behaviour of the real FX market traders. The aim is to identify conditions under which the statistical behaviour of agent-based models of traders resembles those for the real FX market traders. Due to the complexity of the financial markets, it is difficult to identify which features of the market are responsible for the emergence of the traders’ statistical behaviour in an agent-based market.

Our approach to the modelling of FX market traders’ behaviour is based on simple elements. The trading agents’ trading strategy is based on a zero-intelligent directional-change events trading strategy (DCT0) (ALOud, et al., 2010). Limit orders are incorporated into the agents’ investment strategy. The trading agents are modelled to respond to physical time to account for the different market trading seasonalities such as intra-day and intra-week seasonality.

The initial part of this study is to observe the micro-behaviour of FX market traders to establish stylized facts with regard to their collective trading behaviour in the market. This is performed using high-frequency data at an account level, which represent the physical transactions of over 40,000 anonymous accounts trading on OANDA trading platform under the same terms and conditions. The dataset is provided by Olsen Ltd. To our knowledge, this dataset is the biggest available high-frequency dataset relating to the FX market traders’ behaviour.

One of the main constraints with regard to agent-based models of traders is the ability to validate them due to the lack of knowledge and data about the statistical behaviour of real traders’ behaviour. Using the identified stylized facts of real FX market traders’ behaviour, we evaluate the trading agents’ collective behaviour. By relating the statistical behaviour of real traders’ behaviour to the agent-based models of traders, we may find a pathway to identify the essential elements necessary for modelling the FX market traders’ trading behaviour.

The rest of the chapter is organized as follows:

- **Section 2** presents a brief background of the different approaches used in the literature for studying the FX market traders’ behaviour.
- **Section 3** describes the design routes with regard to agent-based modelling in finance.
- **Section 4** presents an overview of high-frequency data in finance.
- **Section 5** describes the two datasets used in this study, and their potential usefulness.
- **Section 6** conducts a microscopic analysis of FX traders’ behaviour in order to establish some of their stylized facts.
- **Section 7** describes the simulated FX market, reviews its main features, and presents the experimental results.
- In **Section 8**, a description is provided of the key elements that may be responsible for the emergence of real FX market traders’ collective behaviour.
- In **Section 9**, we discuss recommendations in terms of modelling the FX market traders’ behaviour.
- **Section 10** explores possible lines for future research.
- **Section 11** presents the conclusion.