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SIMULATING THE FEDERAL RESERVE AS DEALER OF LAST RESORT

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ABSTRACT

In today's global financial systems, a wide range of regulators focus on ensuring resilient markets. The Federal Reserve is among the most influential financial regulators in the world. The Fed is responsible for formulating *monetary policy*, in contrast to *fiscal policy*. The Great Recession and subsequent global pandemic ushered in a new era with global central banks taking unprecedented actions, extending emergency liquidity to a wide range of financial intermediaries and even directly intervening in markets. This paper focuses on using agent-based modeling (ABM) and simulation to better understand financial crisis dynamics. The overall aim is to highlight the promise of ABM approaches for evaluating regulatory policies, using the US corporate bond market as a case study. In particular, this paper focuses on extending the model with a Fed regulatory agent, guided by the real-world Corporate Bond Market Distress Index (CMDI).

1 INTRODUCTION

The goal of this research is to explore the use of agent-based modeling (ABM) and simulation as tool for evaluating financial regulatory policies (Bookstaber 2017). While the US corporate bond market serves a case study, the approach is likely to be applicable to any complex economic systems (Arthur 2013). The ABM implements a somewhat stylized investor ecology, with participants trading a limited universe of bonds through dealers that provide transaction immediacy on a principal basis using a request-for-quote (RFQ) protocol. The agents mirror actual investor heterogeneity, based on two factors: 1) overall investment mandate (focusing on horizon) and 2) the nature of their liabilities. Key factors with respect to liabilities include term structure and predictability, along with the reliance on short-term funding. Of particular concern is the runnable nature of any liabilities. An open-end vehicle like a mutual fund is exposed to "run risk" since investors can redeem at any time. Figure 1 depicts the five agent classes, trading pathways between the buy-side (mutual funds, hedge funds and insurance companies) and the sell-side broker dealers, along with the Fed regulatory agent, see (Berndt, Boogers, Chakraborty, and McCart 2017) for details.

2 THE FEDERAL RESERVE AS DEALER OF LAST RESORT

Since the establishment of the Federal Reserve Act, the private banking sector has functioned with the Fed acting as "lender-of-last-resort," providing emergency liquidity through a discount window. Similar mechanisms for bond mutual funds are possible, including a minimum cash-to-assets ratio (CAR) as a buffer or the Fed acting as "dealer-of-last-resort" via direct market actions. The Fed recently developed the Corporate Bond Market Distress Index to signal stress (Boyarchenko, Crump, Kovner, and Shachar 2021). The components of interest here include the following: 1) *buy-sell pressure ratio* (BSPR5T) smoothed over 5 ticks, 2) *turnover* (TURN5T) a simple volume-based measure, and 3) *dealer bid-ask spread* (DBAS1Y) aggregated for the 1-year maturity. Equation 1 combines several distress signals to form a basic decision rule to answer some critical questions. Is the market under stress? Should the Fed act?

$$(DBAS1Y > 0.01) \wedge (BSPR5T > 0.4) \wedge (TURN5T > 0.01) \tag{1}$$

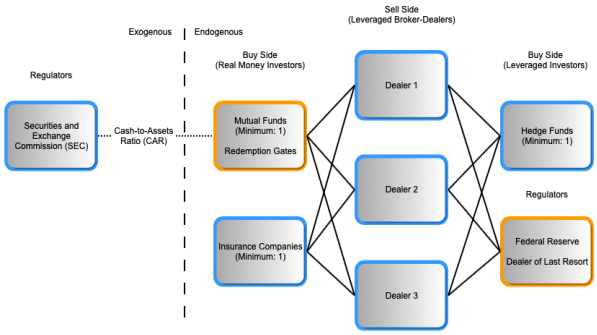

Figure 1: The minimal model includes seven agents, three buy-side agents (mutual fund, insurance company and hedge fund) and three sell-side broker-dealers, along with the Federal Reserve as a regulatory agent.

3 SIMULATION RESULTS AND CONCLUSION

The decision rule shown in Equation 1 triggers Fed interventions. Simulations run for 252 trading days (a year) with five representative bonds across common maturities (1, 2, 5, 10 and 20 years). The mutual funds hold a 30% market share with a 5% CAR as a buffer against investor redemptions. Figure 2 shows the results on a restricted price range to highlight redemption-driven fire sales. The interest rate shock (at tick 50) and resulting straight-line price drop are followed by the beginnings of fire sales across all bonds. Market stress is detected around tick 58 using the decision rule, the Fed then steps in as "buyer of last resort" and within a few ticks bond prices stabilize. A long market recovery follows with upward trending prices (left), in contrast to a market-wide crash absent Fed actions (right). As compared to a simple price-based decision rule used in prior simulations, the Fed acts much earlier, prior to tick 60 and for fewer trading days (ticks 58–59) rather than after tick 70. The associated price drops are much smaller, and the Fed acts across all bonds, thereby supporting all broker-dealers and avoiding further wealth destruction.

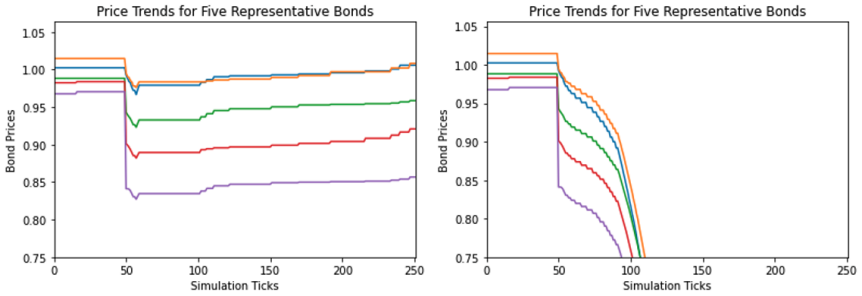

Figure 2: The Federal Reserve acts as "buyer of last resort" using CMDI-based stress detection to foster a market recovery (left), in contrast to a market-wide crash with no Fed interventions (right).

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