



# Bidding behavior in the longer term refinancing operations of the European Central Bank: Evidence from a panel sample selection model <sup>☆</sup>

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## Abstract

This paper analyzes individual bidding data of the longer term refinancing operations (LTROs) of the European Central Bank. We investigate how banks' bidding behavior is related to a series of exogenous variables including collateral costs, interest rate expectations, market volatility and to individual bank characteristics like country of origin, size, and experience. A specific feature of these auctions is that the number and composition of bidders varies over time. Therefore, we estimate panel sample selection models to control for a bank's endogenous participation decision. We find that bidding strategies depend on the banks' attributes. Yet, different bidding behavior generally does not translate into differences concerning bidder success. There is evidence for the winner's curse effect in LTROs indicating a common value component in banks' demand for longer term refinancing.

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## 1. Introduction

Repo auctions are the predominant instrument for the implementation of monetary policy of the European Central Bank (ECB).<sup>1</sup> Repo rates govern short-term interest rates and the availability of repo credit determines the liquidity of the European banking sector. The ECB conducts repo auctions as weekly main refinancing operations (MRO) and as longer term refinancing operations (LTRO) maturing after 3 months. Although MROs are the ECB's primary policy instrument, LTROs are far from negligible. Currently, refinancing via LTROs amounts to around 120 billion Euro which is more than 25% of overall liquidity provided by the ECB. This paper provides a first analysis of the empirical performance of LTROs. We investigate how money market conditions and bidder characteristics affect banks' bidding behavior and the auction outcome.

Our analysis is based on a unique data set of 50 LTRO auctions conducted between March 1999 and May 2003. Bidder codes allow us to follow bidding behavior of individual banks over time and to apply panel econometric techniques. In contrast to Treasury bill auctions where bids are placed by a small group of primary dealers (see e.g. Nyborg et al., 2002), the number of bidders in LTROs is large and varies considerably in terms of number and composition of bidders. Apparently, banks' participation in LTROs is determined endogenously. Since a bank's bid amount or its average bid rate can only be observed if the bank actually participated in the LTRO, estimation is subject to a selection bias, see Heckman (1979). Therefore, accounting for banks' participation decision is of crucial importance for the empirical analysis of the LTRO bidding data. This paper introduces the random effects sample selection model into the empirical auction literature which extends the cross-sectional Heckman (1979) approach to the panel case, following e.g. Verbeek and Nijman (1992a) or Nijman and Verbeek (1992).<sup>2</sup>

According to the ECB the LTRO auction format should be simple enough so that longer term refinancing is equally accessible to all banks. In the same vein, LTROs should give a good opportunity to smaller banks which have limited access to the interbank market to receive liquidity for a longer period. We will, therefore, estimate the impact of size, bidding experience and country of origin on banks bidding strategies. In particular, advancing on recent studies on the bidding behavior in central bank repo auctions (see e.g. Bindseil et al., 2004; Bruno et al., 2005; Linzert et al., 2006), we also shed some light on the determinants of bidding success.

In line with the empirical literature on financial auctions, we characterize money market conditions by prevailing interest rate expectations and interest rate uncertainty. Since longer term repos are collateralized central bank credits, we also consider the cost of collateral on the interbank market as opportunity costs for LTRO refinancing. With respect to the role of small banks in LTROs assigned by the ECB, we are particularly interested in

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<sup>1</sup> Note that the operational framework refers to the Eurosystem i.e. the 12 national central banks of the euro area and the ECB. Since the ECB is conducting the repo auctions, the term ECB is used throughout the paper instead of Eurosystem.

<sup>2</sup> The empirical auction literature has typically ignored the selection bias problem inherent to bidding data. Exceptions are Ayuso and Repullo (2001) and Linzert et al. (2006) where the bid volume is analyzed in a rather inflexible Tobit model framework. Jofre-Bonet and Pesendorfer (2003) apply the two step Heckman method but do not take into account the specific selectivity bias correction in the panel case (time and cross-sectional dimension). Our approach is more closely related to Bruno et al. (2005) who use a fixed effects panel sample selection model to investigate the bidding behavior in the ECB's main refinancing operations.

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