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# Overnight interbank markets and the determination of the interbank rate: A selective survey☆

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ABSTRACT

Overnight interbank markets provide critical facilities for the banking system to manage, pool and redistribute its cash reserves. We provide a selective survey of the literature on overnight interbank markets. We outline the typical structure of overnight markets, including the networking relationships involved, as an indispensable prerequisite for a clear understanding of the workings of these markets. We review the theoretical and empirical studies on the determination of the overnight rate, and in that context discuss the implications of the 2007–08 financial crisis. We summarise key issues for further research.



## 1. Introduction

In this paper we provide a selective survey of the theoretical and empirical literature on overnight interbank markets. We identify key results and questions arising from the literature, focussing particularly on the theoretical and empirical determinants of the overnight interest rate, and the impact of the 2007–08 financial crisis. To make the literature more accessible to a wider readership than those working directly in the field, we also include an overview of the broad institutional arrangements in overnight markets. The research literature is large, but concentrated on the US Federal funds and the euro zone EONIA[1] (including its predecessors in the euro zone countries); and we therefore focus particularly on these two markets.

Trading in many frontier and emerging markets is relatively thin, and not sufficient to support fully a monetary policy based on open market operations. There is therefore far less research on overnight markets in these countries.[2] There is, however, a considerable volume of research on interbank markets in general, especially following the 2007–08 financial crisis. For example, in a recent survey paper, Summer (2013) explains how network models of interbank exposures allow the mapping of the complex web of financial linkages among many institutions, in order to address issues of system stability and contagion risk. There are also some interesting recent contributions that focus on emerging economies, including work by Martinez-Jaramillo, Alexandrova-Kabadjova, Bravo-Benitez, and Solorzano-Margain (2014) on Mexico, the development of multi-agent financial network models for India by Markose (2013), work by Vazquez, Tabak, and Souto (2012) on Brazil, and the

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[1] *EONIA: Euro Overnight Index Average.*

[2] One reason for this is that in many countries overnight interbank market data are not readily available for public use.

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research by León, Cely, and Cadena (2015) on Colombia, among others. We depart from these papers by focusing on the overnight interbank market *per se*. Hence, we do not discuss this more general research, except insofar as it is strictly relevant to understanding the overnight markets.

The paper is structured to bring out the main contributions of our survey, given that no such survey exists at this time when overnight interbank markets are attracting increasing interest from researchers, policy makers, and practitioners. In Section 2 we set out key institutional features of the overnight market focussing on its interaction with central bank reserve requirements and intervention policy. Virtually all overnight lending is unsecured and therefore relationships and networking are particularly important in the functioning of the market. In Section 3 we discuss the burgeoning literature on interbank networking insofar as it concerns the overnight market. In Section 4 we expound the basic theoretical model of the overnight rate and summarise recent theoretical developments that study market operations in more detail. In Sections 5 and 6 we turn to empirical work on the overnight rate. Section 5 reviews the early work, based on the efficient markets approach. There is abundant evidence of apparently predictable movements in overnight interbank rates and in Section 6 we examine the explanations which have been advanced for these findings. These focus on the institutional structure of bank reserve management facilities and central bank intervention which tend to produce various level and volatility effects in the overnight rate. Section 7 is concerned with the 2007–08 financial crisis. There is an immense literature on this topic and here too we focus on issues relevant to the overnight market. Specifically, it has been argued that large-scale asset purchases of central banks ("quantitative easing" or QE) and other modifications in operating procedures have fundamentally changed the role of the overnight market, and we focus particularly on this issue. A final section contains some concluding remarks, including the main five messages of the paper.

## 2. The institutional structure of overnight interbank markets

Interbank markets in general enable banks to manage, pool and redistribute their funds, and so provide lending and deposit facilities more efficiently. It was the freeze-up in interbank lending that heralded the onset of the 2007–08 financial crisis (Green, 2011). The overnight market is arguably the most important interbank market. It plays a key role in the monetary and payments system of a country and provides an essential safety valve for banks. Banks that are short of cash to balance their positions at the end of each day can make up the shortfall by borrowing from the central bank, or in the overnight interbank market, or some combination of the two. Banks with excess cash reserves later in the day have an immediate outlet for these reserves by lending them to other banks in the overnight market. Borrowing from the central bank is usually regarded as "last resort" borrowing as it generally involves a penalty in comparison to borrowing from the market: an above-market interest rate or additional non-interest costs, or both. Therefore, borrowing in the overnight interbank market can be seen as "next-to-last resort" borrowing.

For individual banks, overnight cash shortages or excesses arise either from distributional shocks that temporarily transfer liquidity from one bank to another, or from shocks that affect aggregate liquidity. The overnight market provides banks with liquidity insurance, enabling them to pool liquidity and settle large or unexpected transactions flows resulting from distributional shocks without holding large cash balances for settlement purposes. Aggregate shocks can only be insured by the central bank increasing or decreasing the aggregate supply of liquidity (reserves). In managing the aggregate supply of reserves, central banks face a difficult set of conflicts. Bank reserves are required to finance the payments mechanism but are also used to underpin monetary policy. The funds required for payment purposes typically far exceed the quantity consistent with the central bank's desired interest rate. Central banks must allow a high level of reserves for payments purposes during each day, but shrink them back to a level consistent with monetary policy objectives at the end of the day. The element of liquidity insurance implicit in reserve management operations may create moral hazard, and lead to excessive risk-taking by banks.

The interest rate in the overnight market serves several important purposes. First, it is often used as the main operational target for monetary policy: the Federal funds rate in the US and the unsecured call rate in Japan.[3] Alternatively, it may act as a key short-term indicator, as does the EONIA for The European Central Bank (ECB) and the SONIA for the Bank of England (BoE).[4] Pressures on the financial system are reflected rapidly in a shortage or excess of bank reserves and corresponding movements in the overnight rate. Second, as it is the shortest maturity interest rate in the financial system it acts as the anchor for the term structure of interest rates. Movements in the overnight rate are often followed by changes in longer-term rates. Third, the overnight rate is the first link in the transmission mechanism of monetary policy. Policy actions have their first effects in the overnight market, and these spread through the financial system and the whole economy. Understanding the overnight interbank rate is therefore of crucial importance for the implementation of monetary policy.

To balance transactions and policy consideration while ensuring an orderly overnight market, central banks typically adhere to a highly structured pattern of activities during the working day linked to the operation of the real-time gross settlement system. See Akhtar (1997) on the US Federal Reserve (the Fed); Bank of England (2012, 2014); Bank of Japan (2012); Hartmann, Manna, and Manzanares (2001) and European Central Bank (2011). Links between the overnight market and the market for bank reserves are determined mainly by reserve requirement arrangements (Gray, 2011). The amount of reserves a bank is required to hold is calculated as a given percentage (*the reserve requirement ratio*) of selected (eligible) deposit liabilities in a particular time period: *the calculation period*. The calculation period may be a single day (Turkey), or the average of eligible liabilities over a period such as a fortnight (US) or a month (Japan) preceding that in which the reserves must be held. The holding period for required reserves is called *the maintenance period*. This may be daily (Kenya until 2011[5]); more usually it is between 14 days (US) and one month (Japan), and gives a regular fixed period within which banks have to meet their reserve requirements[6] (O'Brien, 2007). Unless the reserve test has to be met on a daily basis, a *reserve averaging* procedure is used. This means that commercial banks must meet the reserve test on the final day of the maintenance period (*the settlement day*) based on the average of reserves over the maintenance period.[7] Thus, banks know for certain their required minimum reserves only on the settlement day. Reserve averaging serves an important practical purpose: in permitting some volatility in the quantity of required reserves over the maintenance period, it helps prevent excessive volatility in overnight interest rates and central bank intervention rates (Gray, 2011).

The main day-to-day determinants of banks' reserve demands are the transactions flows through the banking system. Some of these are highly predictable and largely distributive and temporary in nature, such as the monthly cycle of wage and salary payments. Other flows are random shocks which may be aggregative or distributive, permanent or temporary, or some combination. Under a reserve averaging system banks can have a shortage or excess of reserves during the

[3] From March 2001 the call rate was replaced by a quantitative target for commercial bank reserve balances at the Bank of Japan. See the discussion in Section 7.

[4] SONIA (sterling overnight index average) refers to the rate on unsecured loans and RONIA (repo overnight index average) refers to that on secured loans (Bank of England, 2012).

[5] Central Bank of Kenya (2011).

[6] The maintenance period in the Eurozone was increased from 4 to 6 weeks effective January 2015 to coincide with the contemporaneous increase in the interval between successive meetings of the governing council.

[7] In the US, the weekend accounting convention dictates that Friday's data count three times in the averaging.