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## Real-time effects of central bank intervention in the euro market

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#### 1. Introduction

This paper investigates the real-time (intraday) effects of Danish central bank intervention in the Euro (EUR) market over the 1 January 2002 to 31 December 2004 time-period.<sup>2</sup> The interventions under study are carried out under the provisions of the Exchange Rate Mechanism (ERM II).<sup>3</sup> Proprietary data on official, intraday intervention transactions, provided by the Danish central bank (Danmarks Nationalbank, henceforth DN), along with indicative 5-minute spot DKK/EUR exchange rate quotes facilitate our investigation. Our

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#### ABSTRACT

This paper investigates the real-time effects of sterilized foreign exchange intervention using official intraday intervention data provided by the Danish central bank. Our analysis employs a two-step weighted least squares estimation procedure. We control for macro surprises, address the issue of endogeneity, and carry out an array of robustness tests. Only when the direction of intervention is consistent with the monetary policy stance do we find that intervention exerts a significant influence on exchange rate returns.

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investigation employs the time-series econometrics of Andersen and Bollerslev (1998) and Andersen et al. (2003).

It is very rare that a central bank makes official intraday intervention data available for research.<sup>4</sup> In fact, until now only the Bank of Canada and the Swiss National Bank have made such data available. It has, however, been more than a decade since the Bank of Canada and the Swiss National Bank last intervened.<sup>5</sup> By contrast, Denmark is currently pursuing an active intervention policy, i.e. DN carries out sterilized interventions on a discretionary basis when deemed necessary. The DN intraday intervention data, therefore, constitutes a unique opportunity to learn about the real-time effects of foreign exchange intervention carried out by a central bank that is currently intervening.

We investigate whether sterilized intervention is effective in influencing exchange rate returns and whether it works differently when backed by consistent monetary policy (e.g. sterilized intervention sales of domestic currency during a period of domestic monetary policy easing). As discussed in Ghosh (2008), industrialized countries that intervene often use monetary policy (e.g. changing interest rates) towards achieving domestic goals such as controlling inflation or

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<sup>&</sup>lt;sup>2</sup> See Humpage (2003), Neely (2005), and Sarno and Taylor (2001) for recent surveys of the intervention literature.

<sup>&</sup>lt;sup>3</sup> The ERM II is the exchange rate policy framework for Denmark and other European Union member states not currently participating in the EUR.

<sup>&</sup>lt;sup>4</sup> Studies of intraday effects of intervention by G3 and other countries use newswire reports of interventions as a proxy for actual interventions (see, for example, Dominguez, 2003) or impose assumptions regarding the unknown intraday timing of interventions. Fischer (2006) illustrates the lack of accuracy of newswire reports in the context of Swiss interventions.

<sup>&</sup>lt;sup>5</sup> See Beattie and Fillion (1999) and Fischer and Zurlinden (1999), respectively, for early studies of the Bank of Canada and the Swiss National Bank intraday intervention data sets.

stimulating growth, while they use sterilized intervention (e.g. sell domestic currency and use open market operations to off-set any impact on money supply or policy rates) towards achieving exchange rate goals. In such a context, sterilized rather than unsterilized intervention is used since monetary and exchange rate goals are not always compatible and, as a result, it is not uncommon to observe sterilized interventions that are monetary policy inconsistent.<sup>6</sup>

In the case of Denmark, however, the primary objective of both monetary and exchange rate policy is to keep the DKK/EUR exchange rate within its deviation band. Therefore, the Danish monetary policy follows the monetary policy of the ECB, and only deviates when deemed necessary to keep the exchange rate within the band.<sup>7</sup> The active intervention policy is pursued when intervention is deemed sufficient to influence the exchange rate as desired and a monetary policy move is deemed unnecessary. Even though monetary and exchange rate goals in the Danish context are compatible, monetary policy inconsistent interventions can occur. To illustrate, suppose during a period of, say, sustained relative monetary policy tightening the DKK appreciates just enough to prompt the DN to intervene by selling DKK, but not enough to make a relative lowering of interest rates seem necessary, the resulting intervention sales of DKK are monetary policy inconsistent.

The period under study encompasses a structural break and two distinctly different sub-periods in terms of monetary policy. The official Danish monetary policy rate, the discount rate, as well as the key ECB interest rates, including the ECB deposit and lending rates, were all held constant during the first sub-period, whereas during the second sub-period these rates were lowered in tandem by a total of 125 basis points. However, the Danish deposit and lending rates were lowered by a total of 140 basis points during the second sub-period when the ECB deposit and lending rates were lowered by a total of 125 basis points (see DN, 2002, 2003b, and 2004). Accordingly, the first sub-period is associated with an unchanged Danish monetary policy stance while the second sub-period constitutes a period of independent Danish monetary policy easing in relative terms by a total of 15 basis points.<sup>8</sup> It follows that the interventions that occur during the second sub-period are either monetary policy consistent or inconsistent.

We investigate whether monetary policy consistency matters for the effectiveness of intervention by estimating the effect of intervention separately across the two sub-periods and separately across consistent and inconsistent interventions.<sup>9</sup> Our main result is that only when the direction of intervention is consistent with monetary policy do we find evidence that intervention influences exchange rate returns. This suggests that even though sterilized intervention is by construction technically detached from monetary policy it is, in reality, not an independent policy instrument but only effective when consistent with monetary policy.

We also assess whether consistency with either official or what we refer to as "de facto" exchange rate policy matters for the effectiveness of intervention. An intervention aimed at bringing the exchange rate closer to the center of the ERM II deviation band is considered to be consistent with official exchange rate policy, whereas an intervention aimed at pushing the exchange rate further away from the center is considered to be inconsistent with official exchange rate policy. As a measure of "de-facto" exchange rate at the time of the intervention relative to the unconditional full-sample mean of the exchange rate. Contrary to our findings regarding monetary policy, we find no evidence that exchange rate policy consistency is a condition for effective intervention.

In addition, we address the issue of endogeneity. Doing so reveals that some endogeneity is present even in our intraday analysis of intervention. However, we also show that the resulting simultaneity bias is too small to affect our results. We also extend our analysis to incorporate Danish, German, and Euro-area macro surprises. This allows us to get a sense of the relative influence of intervention. We show that the magnitudes of the coefficient estimates associated with scaled and thus comparable macro surprises and interventions are similar, thereby illustrating the importance of taking into account interventions when estimating exchange rate models.

Since the Danish ERM II intervention experience pertains to maintaining the exchange rate within a narrow deviation band, our findings are applicable to Denmark and other countries that intervene to keep their respective exchange rates in narrow bands. Additional research is warranted in order to shed light on whether our results also pertain to countries intervening to keep their respective exchange rates in wide deviation bands and to countries with flexible exchange rates.

The rest of the paper is organized as follows. The next section provides an overview of the institutional aspects regarding ERM II and DN intervention. Sections 3 and 4 present the data and the econometric methodology, respectively. Section 5 discusses the results. Section 6 presents several robustness checks. Section 7 concludes.

#### 2. Institutional aspects

With the launch of the EUR on 1 January 1999, the ERM II was introduced and replaced the exchange rate mechanism (ERM I) of the European Monetary System (EMS). According to the EU Accession Treaty, successful participation in ERM II is a requirement for joining the EMU and for adoption of the EUR. Currently Denmark as well as 3 new EU members participate in ERM II.<sup>10</sup>

In ERM II, a bilateral central rate and a deviation band is set for the currency of the participating country vis-à-vis the EUR, but not against the currency of the other member states. The official DKK/EUR central rate is 7.46038 DKK/EUR and the official deviation band is set to  $\pm$  2.25%. The official deviation band for all other ERM II member states is set to  $\pm$  15%. Two of the other existing ERM II member states, Estonia and Lithuania, have EUR currency boards in place, and one existing ERM II member state, Latvia, similar to Denmark keeps its currency in a much narrower band than its official deviation band (the LVL has traded within a narrow range of  $\pm$  1.00% of the Latvian ERM II central rate).

In order to keep its currency inside the deviation band, the ERM II member state adjusts its short term interest rates and/or intervenes in

<sup>&</sup>lt;sup>6</sup> Suppose a country experiences an undesirable appreciation of its currency as well as inflationary pressure. The former would call for lower interest rates (monetary policy easing) while the latter would call for higher interest rates (monetary policy tightening). Monetary policy cannot possibly meet both goals. Instead, a country can pursue sterilized intervention towards the exchange rate goal and at the same time use monetary policy towards the domestic goal.

<sup>&</sup>lt;sup>7</sup> For example, a slight independent easing of Danish monetary policy may occur, as it did in August 2002, to dampen an appreciating pressure of the DKK. This is not an attempt to pursue an independent monetary policy of easing relative to the ECB, but a monetary policy move dictated by the exchange rate objective.

<sup>&</sup>lt;sup>8</sup> While a 15 basis points interest rate change may seem trivial, in the Danish context where the DKK/EUR exchange rate moves in a very narrow band 15 basis points matter. To illustrate, the DKK at its strongest point during our sample period was at 7.4231 DKK/EUR. A 15 basis points relative Danish easing is then according to the standard uncovered interest rate parity (UIP) approximation associated with a depreciation of the DKK to a new DKK/EUR rate of (7.4231 × 1.0015 =) 7.4342. Consider that over the entire sample period, the DKK/EUR rate traded within a very narrow 7.4231 to 7.4524 range. A 15 basis points relative interest rate change is thus associated with an exchange rate change that corresponds to more than a third of the entire fluctuation band within which the exchange rate moved during the three years under study.

<sup>&</sup>lt;sup>9</sup> The two sub-samples may differ in aspects other than the Danish monetary policy stance, thus any evidence based on a comparison of results across the two sub-samples is only circumstantial.

<sup>&</sup>lt;sup>10</sup> Denmark has participated since 1 January 1999, Estonia and Lithuania since 28 June 2004, and Latvia since 2 May 2005. Bulgaria, The Czech Republic, Hungary, Poland and Romania are expected to follow.

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