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Modelling currency demand in a small open economy within a monetary union

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ABSTRACT

Currency management is a core business function of a central bank. Understanding the factors driving cash demand and its denomination structure are vital for the smooth functioning of the economy. We pursue an analytical framework which allows to model the demand for each denomination individually as well as to capture the interactions between them, both over the short- and long-run. The approach builds on the DSUR estimator for the long-run relationships coupled with a SUR ECM for modelling the short-run dynamics. The focus is on a small open economy within the euro area monetary union. Such a context adds dimensions which go beyond the traditional drivers considered in the previous literature. In particular, the importance of currency migration through tourism flows is highlighted. Furthermore, the interconnections between demand for different denominations are found to be quite significant and the heterogeneous role of the determinants across denominations is documented.

1. Introduction

The deepening of the Economic and Monetary Union led to the adoption of a single currency, the euro. Although the euro was launched on 1 January 1999, the introduction of euro banknotes and coins only took place on 1 January 2002. It was the largest-ever currency changeover with the euro becoming the currency of more than 300 million people in Europe.

Naturally, a key operational task of the Eurosystem is to ensure an adequate supply of euro currency to meet demand conditions. In fact, euro banknotes in circulation are one of the largest autonomous factors in the context of the Eurosystem liquidity management. In practice, euro banknotes are produced jointly by the national central banks of the euro area and each one is in charge of, and bears the costs of, a share of the total production. This issuance activity impacts on seigniorage revenues and its developments affect the need to invest in cash printing, storage, and distribution facilities. Within the Eurosystem, each central bank contributes to the decision making process regarding the production plans through national expertise concerning the currency demand evolution for the corresponding country.[1] Hence, it is crucial to understand the determinants of cash demand in each country to avoid disruptions to the functioning of the economy through shortfalls in the supply of currency and to avoid running unnecessary costs due to overproduction. Furthermore, the evolution of the demand for cash may also impact on the conduct of monetary policy (see, for example, Friedman (1999), Freedman (2000), Goodhart (2000) and Woodford (2000)).

As the determinants of currency demand may differ or have a different impact depending on the cash denomination, it is important to consider the breakdown in terms of value. For instance, large-value banknotes demand is more prone to be influenced by store of value purposes whereas low-value denominations demand is typically driven by the transactions motive. From a central bank point of view, it is also vital to sustain a proper mix of denominations in the currency supply. In this respect, Sargent and Velde (1999, 2002) discuss several historic episodes where the disruption of such a mix had a considerable economic impact.

Recent work focusing on the modelling of cash demand by denomination includes, for example, Doyle (2000) who estimates currency demand equations for the United States, Germany, Switzerland, Canada, Netherlands and Austria and considers a breakdown of currency into large and small-value denominations for some of these countries. Judson and Porter (2004) focus on the United States and consider three groups of U.S. dollar bills. Amromin and Chakravorti (2009)

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[1] In the case of euro coins, although the national governments of the euro area countries are responsible for minting coins, the overall value of the coins to be put into circulation has also to be approved by the Governing Council of the European Central Bank.

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study a panel of thirteen advanced economies and split cash into three denomination categories to investigate its store of value and payment functions. Nachane et al. (2013) and Cusbert and Rohling (2013) consider small, medium, and large denominations for India and Australia, respectively. Concerning the euro area, Fischer et al. (2004) consider small- and large-value denominations for the euro area countries drawing on euro legacy banknotes. More recently, Bartzsch et al. (2015) consider demand for small (€ 5, € 10 and € 20), medium (€ 50 and € 100) and large (€ 200 and € 500) banknotes issued by Deutsche Bundesbank since 2002. The results obtained in the above mentioned studies suggest a heterogeneous behavior across denominations.

The current study goes beyond the previous work by considering a larger disaggregation level of currency demand. In particular, all euro banknote denominations are taken individually, namely € 500, € 200, € 100, € 50, € 20, € 10, € 5, besides coins. Such a high disaggregation level allows to unveil more markedly the heterogeneous behavior across denominations and enables a deeper assessment of the importance of the several determinants of currency demand.

Besides taking on board the heterogeneity across denominations, a key feature that one should also account for when modelling currency demand is the interaction between demands for different denominations. As denominations are substitutable at the margin, the interconnections cannot be disregarded. To address this issue, we consider an analytical framework which allows one to model the demand for each denomination as well as to capture the interactions between them, both over the short- and long-run. As standard in the literature on modelling currency demand, and more generally on the estimation of money demand functions, we consider an Error Correction Model (ECM) framework. However, we depart econometrically from previous work in the following way. By pursuing a two-step approach, we first focus on the estimation of a system of heterogeneous long-run relationships. In particular, we resort to the Dynamic Seemingly Unrelated Regression (DSUR) estimator proposed by Mark et al. (2005) which allows the efficient estimation of multiple-equation cointegration regressions. In the second step, we proceed with the estimation of a SUR ECM for modelling the short-run dynamics. In this way, one is able to model the demand for each denomination while tackling the interconnections among demands over both the long-run relationships and short-run dynamics.

The current study focuses on the Portuguese case which is an interesting one by nature. On the one hand, the impact of financial innovation on currency demand has been given an increasingly attention in the literature (see Snellman et al. (2001), Dutta and Weale (2001), Attanasio et al. (2002), Alvarez and Lippi (2009), Lippi and Secchi (2009) among others). As Portugal has been characterized by a strong penetration of financial technology, it constitutes a natural case study to assess the role of financial innovation on the demand for cash. On the other hand, the currency put into circulation may differ substantially from the domestic cash holdings. For instance, in countries like the United States, Japan, Germany and Switzerland, the currency issued by the central bank is strongly affected by foreign demand with a sizeable fraction of their currencies held outside their countries' borders (see, for example, Porter and Judson (1996), Rogoff (1998) and Bartzsch et al. (2011, 2013a, 2013b)). The currency demand by non-residents puts an upward pressure on the net cumulated issuance by the central bank. In contrast, the opposite evolution has been observed for Portugal. Such evidence raises the need to bring forth an additional driver of cash demand evolution. In particular, in a small open economy like Portugal, where tourism plays a noteworthy role, one should consider this channel when modelling cash demand. Since each national central bank is not the sole issuer of currency within the monetary union, tourism flows involving the inflow of euro currency may translate into a significant negative effect on the currency issued by the national central bank. Hence, such a determinant, which has not yet been considered in the literature, should be taken into account when modelling cash demand.

The paper is organised as follows. In Section 2, the challenging nature of the Portuguese case for modelling currency demand is underlined. The econometric framework is outlined in Section 3 and the empirical results are presented in Section 4. Finally, Section 5 concludes.

2. Why is the Portuguese case a special one?

Since the physical introduction of the euro at the beginning of 2002, each central bank within the Eurosystem has been in charge of issuing euro currency. In Fig. 1, the total euro currency in circulation as well as the cumulated net issuance in Portugal are displayed (end of year figures as percentage of the euro area and Portuguese nominal GDP, respectively).[2] Despite a similar starting point (at around 3 per cent of nominal GDP at the beginning of 2002), the cumulated net issuance in Portugal has presented a quite different pattern as against of the Eurosystem as a whole. While there has been a relatively steady increase over time of the euro currency in circulation, the cumulated net issuance in Portugal has been decreasing, becoming negative since 2011 and attaining −6.2 per cent of nominal GDP at the end of 2016. Among the 19 countries that belong to the euro area, this is by far the lowest figure with Portugal being the only country recording a negative cumulated net issuance value at the end of 2016. Hence, the Portuguese case is in sharp contrast with the euro area as whole where the cumulated net issuance stands above 10 per cent of nominal GDP.

At the other end, we find, for instance, Germany with a cumulated net issuance of more than 19 per cent of nominal GDP at the end of 2016 and accounting for more than half of the euro currency issued by the Eurosystem (whereas in 2002 it was only around one third). Contrarily to the Portuguese case, in Germany there has been a strong increase of euro cash demand throughout time. In particular, the development of the cumulated net issuance of euro banknotes by the Bundesbank reflects, to a large extent, foreign demand, that is, German-issued euro banknotes in circulation abroad. According to Bartzsch et al. (2015), at the end of 2013, over 70 per cent of the cumulated net issuance of banknotes by the Deutsche Bundesbank ended up in circulation abroad, namely 50 per cent outside the euro area and 20 per cent in the rest of the euro area.

The breakdown by denomination of cumulated euro currency issued by Banco de Portugal is displayed in Fig. 2. One can see that the above discussed pattern of decrease over time of the cumulated net

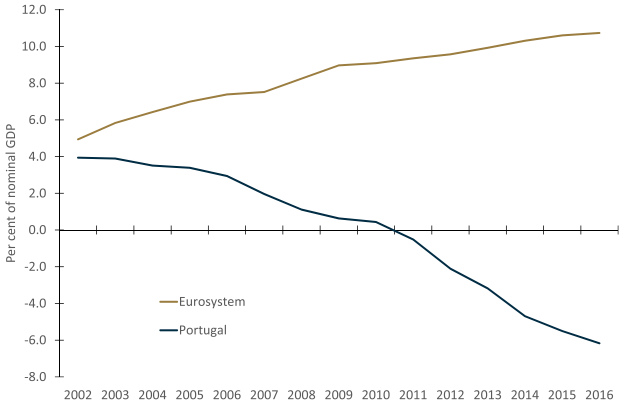

Fig. 1. Cumulated net issuance of euro currency.
Source: Banco de Portugal, INE, ECB, Eurostat.

[2] The net issuance corresponds to the difference between the withdrawals and lodgements at the central bank.