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Classical and Restricted Impulse Control for the Exchange Rate under a Stochastic Trend Model

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Abstract

Building on [4] and [2] we consider the problem faced by a Central Bank to optimally control the exchange rate, whereby the control is composed of a direct impulse control intervention and an indirect, continuously acting intervention given by the control of the domestic interest rate. Similarly to [4] and [2] we formulate the problem as a mixed classical-impulse control problem and the approach is based on a quasi-variational inequality by considering a specific class of the optimal value functions and controls. As in [2], but differently from [4], we consider a finite horizon that makes the problem time inhomogeneous and we do not have to impose a smooth fit condition so that a fully analytical solution is possible. With respect to [2] we generalize the problem by letting, more realistically, the drift in the dynamics of the exchange rate to be time varying or even unobservable so that it has to be filter-estimated from observable data. Numerical illustrations are presented as well.

Keywords: Exchange rate control, partial information, stochastic filtering, impulse control, quasi-variational inequalities.

JEL Classification: C61, D81, F31, G15, E58

1 Introduction

The control of the foreign exchange rate by a Central Bank has been the object of several studies in the literature, in particular also in the stochastic control literature. The setting is that of a so-called managed float or dirty float regime. The actual exchange rate fluctuates from day to day and may achieve unacceptable levels. One of the purposes of a Central Bank is therefore to intervene in order to keep the exchange rate at an acceptable level. Following [4] and [3], which generalize previous studies on the subject, we assume that the Central Bank can control the exchange rate by two non-excluding tools: direct intervention in the foreign exchange market by buying and selling currencies, and indirect intervention through determination of the domestic interest rate level. Interest rates have in fact an effect on the exchange rate through the attraction or deflection of foreign capital. In choosing the intervention, the Central Bank has to aim at achieving a specified goal. According to the idea of a target zone regime, the Central Bank has to guarantee that the exchange rate, as well as the domestic interest rate, stay within a given band or, more specifically, stay as close as possible to a given target that is usually established at higher levels of authority as result of negotiations or for political reasons and is considered to be sustainable for a given period. Consequently it is reasonable to assume, as we shall do it here, that these target levels are given as known constants or known time varying functions. On the other hand, any type of intervention is costly with the cost that is increasing with the level of the intervention. Since, in order to be effective, actual interventions are not frequent but of relatively large size (see e.g. [5]), as in [3] and [4]

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