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Effects of Tobin taxes in minority game markets☆

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ABSTRACT

We show that the introduction of Tobin taxes in agent-based models of currency markets can lead to a reduction of both speculative trading and the magnitude of exchange rate fluctuations at intermediate tax rates. In this regime revenues obtained from speculators are maximal for the institutions acting as market makers. We here focus on minority game models of markets, which are accessible by exact techniques from statistical mechanics. Results are supported by computer simulations. Our findings suggest that at finite systems sizes the effect is most pronounced in a critical region around the phase transition of the infinite system, but much weaker if the market is operating far from criticality and does not exhibit anomalous fluctuations.

1. Introduction

In 1972, James Tobin proposed to "throw some sand in the wheels of our excessively efficient international money markets" (published in Tobin, 1974) by imposing a tax of 0.05–0.5 percent on all foreign currency exchange (FX). The Bretton Woods agreement (a system of fixed foreign exchange rates tied to the price of gold) at that time was gradually being dismantled, with the USA stepping out in 1971. This system had been introduced in the wake of World War II in order to rebuild global capitalism. Tobin feared the effects of countries exposed to freely fluctuating exchange rates and suggested, as a second best solution, the introduction of what is now called a 'Tobin tax' in order to suppress speculative trading, thus allowing domestic macro-economic management.

Since then, under floating exchange rates, the trading volume on international currency markets has grown sharply, especially after the introduction of electronic trading, reaching a level of 1.9 trillion US Dollar per day in 2004 (Galati and Melvin, 2004). Empirical research has shown that FX rates' evolution is 'disconnected' from the dynamics of the macro-economic fundamentals it should depend on and, in particular, that they fluctuate much more than such a dependence would suggest (as a survey see Frankel and Rose, 1995).

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While the Tobin tax has never been implemented in reality, the discussion of this issue is still lively and opinions are widely divided.[1] Proponents, assuming that excess volatility is due to speculators, claim that a Tobin tax would decrease volatility, because it would make speculative trading unprofitable, hence reducing volume. In addition, the tax would improve the situation of countries damaged by international currency speculation. Opponents reject the proposal, claiming that its implementation would hardly be feasible and would be ineffective if not agreed by all countries. It could change unpredictably the market structure, eventually damaging developing countries, and moreover, through a reduction of market liquidity, Tobin taxes might indeed result in more, not less volatility.

This has called for a closer look in the micro-structure of FX markets (Eichengreen et al., 1995; Frankel, 1996; Mende and Menkhoff, 2003; Osler, 2006). This research has shown that, as in other markets, currencies are driven by order flows, and at horizons of 1 day or more, these originate from two main types of traders: commercial traders (i.e. non-financial firms engaged in international trade who need currency as part of their primary business), and financial traders (i.e. institutional asset managers who care for profits generated in the trading activity). Both commercial and financial traders act on time horizons of 1 day or longer, and their activities are negatively correlated to each other, "meaning that at horizons of a day or longer financial demand tend to be met by commercial supply" (Osler). A third group of "liquidity or noise traders", in Osler, or banks, in Mende and Menkhoff, who trade in a manner that is unrelated to information flows, is mainly responsible for FX activity at shorter time-scales. These issues have also been addressed from the more theoretical approach to modeling financial markets. Research has departed from models based on the rational expectations paradigm such as Bacchetta and van Wincoop (2000) and has focused on models that are capable of reproducing excess volatility and the typical features of fluctuations in real markets (the so-called stylized facts discussed by Cont, 2001) and are therefore well-suited to shed light on the effects of introducing a Tobin tax. One strand of research has concentrated on models of interacting agents with heterogeneous (adaptive) expectations (see the survey by Hommes, 2006). These consider agents with an optimizing behavior with respect to an expectation model. Two main types of expectations are considered: those of fundamentalists who expect current price to revert to the fundamental price and trend followers (or chartists), who expect exchange rates to follow a trend.

De Grauwe and Grimaldi (2006) have shown that this approach can be adapted to modeling FX markets, obtaining three main empirical facts: the 'disconnect' puzzle, excess volatility, and non-normality. Westerhoff (2003) analyzed Tobin tax in this framework, showing that its introduction reduces volatility. Westerhoff and Dieci (2006) find moreover that if agents can trade on multiple markets and a Tobin tax is introduced in one of them, that markets stabilize and become attractive for risk-averse investors. If market regulators are competing on investors, the Tobin tax introduction would follow in the other markets as well.[2]

A completely different approach, has been taken by Ehrenstein et al. (2005) in zero intelligence atomistic models based on percolation theory (Cont and Bouchaud, 2000). These models relate the emergence of excess volatility and fat tails in the distribution of returns to herding behavior in the population of traders. Ehrenstein et al. show that generally the introduction of a Tobin tax brings about a reduction in volatility, as long as the tax rate is not too high to cause liquidity problems. This second class of models, though neglecting any notion of optimizing behavior, has the virtue of taking into account the discrete nature of traders, whereas in the heterogeneous agent approach only the effect of the aggregate demand of different types of traders matters.

The present paper addresses similar general questions but from a different approach, that of minority games (MG) (see Challet et al., 2005; Coolen, 2005; Johnson et al., 2003). These are stylized models that depict a financial market as an ecology of different types of agents interacting along an 'information food chain' where speculators 'predate' on market inefficiencies (arbitrage opportunities) created by other investors.[3] This is particularly suited for FX markets as it captures the interplay between commercial traders and financial speculators. In addition, at odds with the heterogeneous agent approach, the demands on the market are not just the aggregated demands of a few trader types, but in principle every agent differs from the others and full heterogeneity is considered.[4]

The MG highlights the tradeoff between volatility and market efficiency in a vivid though admittedly simplified and stylized way. Indeed the analysis of the MG has revealed that within this model framework excess volatility and market efficiencies are identified as two sides of the same coin, both resulting as consequences of speculative trading. The MG exhibits two different regimes, one in which the market is fully efficient and another in which arbitrage opportunities are

[1] A compendium of the different points of view and arguments is in ul Haq et al. (1996). The question about possible implementation is not only academic; contrasting references are Ramonet (1997) and European Banking Federation (2001).

[2] As we discussed above, one argument against the Tobin tax is that it would be difficult to coordinate all markets for its adoption. The result of Westerhoff and Dieci is a good counterargument.

[3] In the MG setup the speculators try to play against the market, so they act as contrarians. This assumption seems incompatible with the usual one of speculators as trend followers. What these agents, however, try to do is to anticipate a reversion of the market trend (e.g. ride a bubble up to the very last minute). This is compatible with most of the technical trading, from moving averages to 'scalping', so that contrarian speculators are actually trend followers who try to anticipate the market (see e.g. the model proposed in Chiarella et al., 2006).

[4] Empirical works such as Frankel, and Osler, find the negative correlation discussed above between the orders of commercial and financial traders. The micro-founded models (Westerhoff, DeGrauwe and Grimaldi, and Westerhoff and Dieci) mimic this negative correlation with the interplay between fundamentalists and chartists: when real prices' drift departs from the fundamental prices, the orders of these two types of traders are anticorrelated. Also the two types of agents considered in the MG submit orders that are on average negatively correlated, but in a more heterogeneous way.