DIRECTED RISK RESEARCH PROPOSAL

Risk Theme	Market Risk

Client Info:

Problem Title	Modelling pegged currencies		
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University		Classification	
Problem Nr.	PS16020	Type	Technology-Pull
Proposal Nr.	RP16015	Date	04 November 2016

PROJECT TITLE: Modelling pegged currencies

PROJECT GOAL:

The goal of the project is to propose a new methodology (and compare to existing methodologies) in modelling pegged currencies.

PROJECT SCOPE

We would like to come up with the stochastic process for modelling managed/pegged currencies. Pegged currencies are characterised by low volatility and almost zero drift before peg break. When the peg is broken, there is a jump in the underlying exchange rate. Immediately after the peg break, volatility also increases and there could be some drift in the short term. In the long term, the volatility and drift will tend decrease to some reasonable level. Unlike floating currencies where we can use Geometric Brownian motion, for the managed currencies GBM is not an appropriate model. So, one would need to look at jump models.

HIGH LEVEL DESCRIPTION OF PROBLEM

One of the most important problems in finance is developing of currency exchange rate models. There are two main types of exchange rate regimes: floating and pegged to some currency or currency basket (Ajevskis 2015). In a floating regime, exchange rates are free to move in line with supply and demand

in the market. Unlike in the floating exchange regime, a pegged exchange rate is not free to move in line with supply and demand due to factors such as currency controls and central bank policy (Clark 2016), where it either tries to maintain the local currency at a peg or to defend a particular level beyond which the local currency is not allowed to appreciate.

The floating currency is usually modeled using the Geometric Brownian Motion (GBM) framework (Ruiz 2015). However, the GBM framework does not work particularly well for pegged exchange currency. A pegged currency is characterised by at least two regimes; one in which the pegged currency has low volatility and almost zero drift and one in which the peg or defense level breaks, and there is a jump in the underlying currency – and possibly other regimes where the peg or defense level is subsequently introduced at a different level and/or with wider bands or a crawling peg. Such scenarios are of interest and deserve particular attention.

Lately, there are few instances of pegged currency regimes breaking in a particular fashion. On Jan 15, 2015, the longstanding Swiss National Bank (SNB) defense level 0f 1.20 for the Swiss franc (CHF) against the euro was breached (see Figure 1). The Chinese yuan (CNY) was devalued unexpectedly on Aug 11, 2015 (see Figure 2). On Dec 17, 2015, Argentina abandoned currency controls and allowed the Argentine peso (ARS) to trade freely (see Figure 3).

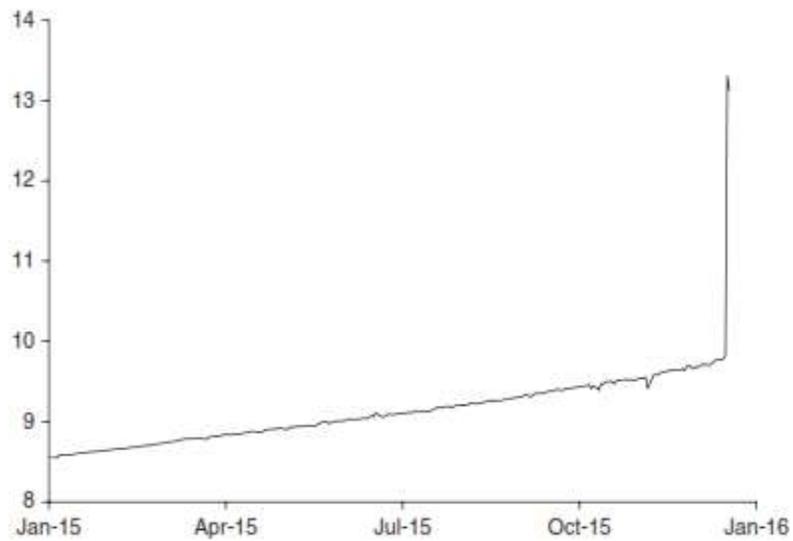**Figure 1: EURCHF spot (with 1.20 defense level from 6 Sep 2011 to 14 Jan 2015)**

Picture adapted from (Clark, 2016)

Figure 2: USDCNY spot
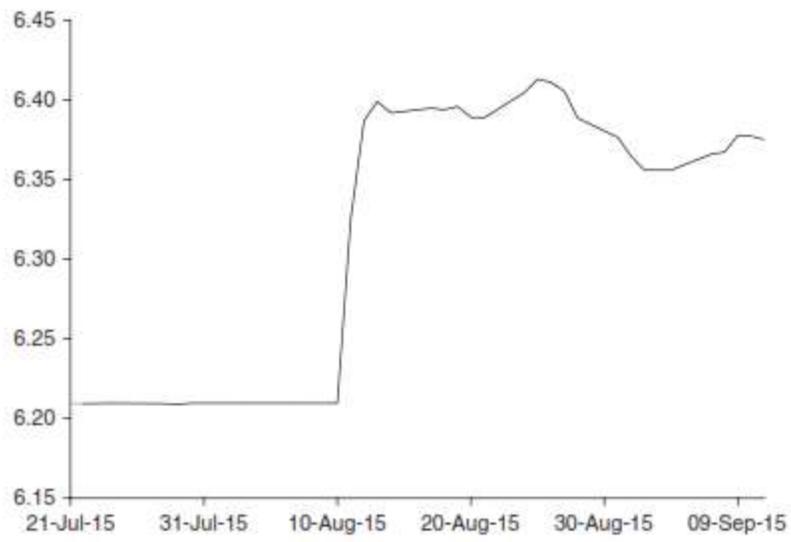
Picture adapted from (Clark, 2016)

Figure 3: USDARS spot

Picture adapted from (Clark, 2016)

It is evident that these breaks have caused extreme jumps the exchange rates (Bruti-Liberati, Nikitopoulos-Sklibosios and Platen 2007), which have had ripple effects on relevant market variables such as interest rates and caused a lot of volatility in the markets.

In this work, we shall focus on the models that can better fit the dynamics for pegged currencies, which include some of the characteristics described above. We further focus on the modeling of depegging risk as well as calibration of the models. In particular, we focus on models for spot FX rates.

PROJECT OBJECTIVES

The objectives of this research study are:

- focusing on the models that can better fit the dynamics for pegged currencies
- focusing on the modeling of depegging risk
- calibration of the model to market dynamics.

APPROACH TO BE FOLLOWED

The approach is as follow:

1. Literature study on current techniques available in Currency Modelling (with application to pegged exchange rates), with their limitations and strengths.
2. Propose the relevant techniques to model pegged exchange rates.
3. Calibrate the proposed models to market dynamics.
4. Backtest the proposed models to different market scenarios.

STRATEGIC VALUE TO DIRECTED RISK RESEARCH

This research will contribute conceptually to market risk analysis techniques applied in the FX trading market.

REFERENCES

Ajevskis, Viktors. "An Exchange Rate Target Zone Model with a Terminal Condition and Mean-Reverting Fundamentals." *ArXiv e-prints*, jun 2015.

Bruti-Liberati, Nicola, Christina Nikitopoulos-Sklibosios, and Eckhard Platen. "Pricing under the Real-World Probability Measure for Jump-Diffusion Term Structure Models." *Quantitative Finance Research Centre, University of Technology, Sydney*, jun 2007.

Clark, Iain J. "Modeling Pegged Currencies – Examples from 2015: EURCHF, USDCNY, and USDARS." *Wilmott* (John Wiley & Sons, Ltd) 2016 (2016): 51-59.

Ruiz, Ignacio. *XVA Desks – A New Era for Risk Management.* Hampshire : PALGRAVE MACMILLAN, 2015.