Is there a significant connection between commodity prices and exchange rates?

Preliminary Thesis Report

Study programme: MSc in Business w/ Major in Finance

Supervisor: Håkon Tretvoll

Table of content

Introduction

The focus of our Master Thesis is to research if we can use movements in commodity prices to help explain movements in exchange rates. We also want to research the inverse relationship. Among reasons for choosing this area are the several benefits of predicting both these variables. For one thing, the increased pace of globalization and cross-border trade have lead today's importers and exporters to face a high risk with their end-of-trade currency value. Furthermore, commodity prices have been shown to be volatile, and their price movements are crucial for inflation control and production planning. With this in mind, we want to research both sides of the prediction, with the following research question:

Is there a significant connection between commodity prices and exchange rates?

In our research, we will use the Australian (AUD), the Canadian (CAD), the New Zealand dollar (NZD), as well as the Norwegian krone (NOK). These have all been floating currencies for a considerable time, with the Norwegian krone converting lastly in 1992. Further, the currencies chosen are well known commodity currencies in the foreign exchange market. This comes from the fact that the countries all have primary commodities, which constitutes a significant amount of their total export. All of the currencies will be compared against the US dollar.

There are several studies on the area and Chen, Rogoff & Rossi's (2008) working paper "Can exchange rates forecast commodity prices?" provides useful research on the field of study. They use commodity currencies, which includes the Australian, Canadian, and New Zealand dollars. In addition, the South African rand and the Chilean peso are also included. By extending their research through adding the years from 2008 to 2016 we can compare our results with their findings and research reasons for deviations.

Another relevant working paper, which we will base our further studies on, is "Can oil prices predict future exchange rates?" by Ferraro, Rogoff & Rossi (2015). Their main focus was on the CAD/USD exchange rate and oil price, but they also demonstrate that similar results hold for NOK/USD. We find it interesting to include the Norwegian krone due to the decrease in oil prices since mid 2014, which have lead to a reduction in the overall export. Not to mention, we have at the same time seen a weakening of the Norwegian currency against the

US dollar. Furthermore, as we now have a sufficiently long sample period for the Norwegian krone, we can compliment with additional interesting test areas by including more recent data.

Literature review

Chen, Rogoff and Rossi (2008) find that the individual exchange rates Granger-cause movements in their corresponding country-specific commodity price indices, both in-sample and out-of-sample. They employed Rossi's (2005), referred to in Chen et al. (2008, 3), procedure to account for parameter instability. Furthermore, combining the several exchange rates and using different forecast combinations show that these commodity currencies together predicts price fluctuations in the aggregate global commodity market beyond the random walk. On the other hand, the reversed relationship gave more fragile results. When forecasting exchange rates based on commodity prices, predictability was only found in-sample when allowing for structural breaks. Out-of-sample forecasts showed no predictability above a random walk.

The researchers also investigate the endogeneity issue concerning the "dollar effect". Since global commodity prices are quoted in US dollars, we can intuitively expect a correlation due to the common US dollar denomination with the exchange rate pairs. They therefore conduct additional robustness checks through testing the exchange rates relative to the British Pound.

The working paper "can oil prices predict future exchange rates?" by Ferraro, Rogoff & Rossi (2015) use pseudo out-of-sample forecasting and find rather robust out-of-sample results when using daily data. On the other hand, for in-sample tests, the fit was stronger for monthly and quarterly data than in daily data. This indicates transitory predictability and short-lived effects of oil price changes on exchange rates. We therefore need to consider the frequency of our data with respect to daily, monthly and quarterly data to capture effects.

Moreover, they find that modeling oil prices yields better forecasts than models that includes both oil prices and macroeconomic fundamentals. For further research, they suggest considering predictive ability at various horizons.

The research on commodity currencies by Chen & Rogoff (2003) find evidence that the world price of commodity export, measured in real US dollars, have a strong and stable influence on the real exchange rates of New Zealand and

Australia. For Canada, the relationship is less robust. Moreover, they find that world commodity price fluctuations are better at capturing exogenous shocks to terms-of-trade than standard measures of terms-of-trade.

Theory

Relevant theories attempting to find answers to our research question are needed to build a base for our arguments. Moreover, they will give a better understanding on how to interpret the results we get, and adjust for potential errors. We will in this part present the theories we see relevant as far.

The Terms-of-Trade (TOT)

One of the major variables relevant for our study is the terms-of-trade (TOT), that is, the ratio of prices received for our exports to prices paid for imports. An improvement of the TOT is when the ratio is above 1 and vice versa. That means that when export prices increase relative to import prices a larger volume of imports can be purchased with a given volume of exports, thus increasing the real purchasing power of domestic production. Commodity prices are known to be quite volatile and large movements in these can therefore lead to terms-of-trade shocks. From economic theory, we know that changes in terms-of-trade are likely to have indirect effects on the level of real output, as an increase in the commodity price should improve export revenues for a given country. Moreover, in situations with floating exchange rates, terms-of-trade fluctuations often accompany exchange rate movements. In particular, the exchange rate tends to strengthen when terms-of-trade improves. The currencies in our paper belong to countries where a significant amount of their export consists of their primary commodities. Accompanied with the small size of these countries to the overall economy, movements in the commodity prices are often exogenous and could therefore help to explain their terms-of-trade shocks.

The Purchasing power parity (PPP)

Another relevant theory is the purchasing power parity. It is based on the law of one price and states that identical goods from different countries should

have the same price after adjusting for exchange rates. That is, the exchange rate will according to the theory offset price changes due to inflation. As a result, there should be no arbitrage opportunities. Since it describes the relationship between exchange rates and national price levels, it is often used to find potentially over- or undervalued currencies as well as used to predict the impact of exchange rate fluctuations on a country's economy. The formula is that the domestic price of foreign currency should equal the domestic price index divided by the foreign price index. According to several newer studies the real exchange rates move towards the purchasing power parity in the long run (Rogoff, 1996).

Hypotheses

The research question in our thesis is as following: *Is there a significant connection between commodity prices and exchange rates?* In order to answer this, we have created the two following hypotheses.

Hypothesis 1

Can we use commodity prices to forecast exchange rates?

H_0: There is no significant evidence that commodity prices can forecast exchange rates.
H_A: There is significant evidence that commodity prices can forecast exchange rates.

Hypothesis 2

Can we use exchange rates to forecast commodity prices?

H_0: There is no significant evidence that exchange rates can forecast commodity price.
H_A: There is significant evidence that exchange rates can forecast commodity prices.

Methodology

This part of the paper will focus on how we will apply the data we obtain, with the given theory listed, and how to approach any error terms that we might occur during the analysis. In this approach, we use a structural model that will relate the nominal exchange rate s_t to its own fundamentals f_t and expected future value $E_t s_{t+1}$. Thus, this model will provide us with a present value relation between the nominal exchange rate and the discounted sum of the expected future fundamentals, where ψ and γ are given parameters dictated by the structural model, and E_t is the expectation operator given information I_t.

$$s_t = \gamma \sum_{j=0}^{\infty} \psi^j E_t\left(f_{t+j}\big|I_j\right)$$

Chen, Rogoff and Rossi (2008), argues that the above equation indicates that the exchange rate s, should Granger-cause its own fundamentals f. Although the present-value representation is highly accepted from a theoretical standpoint, it is little empirical support for it in the exchange rate literature. The reasoning for this is in the actual testing, as the exchange rates may be affected by external sources such as those mentioned in the data-section of the paper. Hence, if f is not exogenous, a finding that the exchange rate s Granger-causes fundamental f, could simply be an endogenous response, making the results difficult to interpret.

In comparison to exchange rates, commodity prices are expected to be easier to predict. The original research paper argues this with the fact that commodity prices can have more predictable depended factor such as population growth and cycles. This is though hard to describe in simple times series models. Implying the same assumption as Chen, Rogoff and Rossi (2008), we assume that commodity price is perfectly forecastable by the markets, and $f_t = cp_t$ implies:

$$\Delta s_{t+1} = \gamma \sum_{j=1}^{\infty} \psi^j \Delta cp_{t+j} + z_{t+1}$$

where, z_t represents other shocks that are significant for determining exchange rate in equilibrium, independently of commodity prices.

When applying the above equation, we will be able to compare the relationship between exchange rates and commodity prices. This, both in terms of Granger-causality and forecasting ability for out-of-sample, where out-of-sample explains the robustness of the findings. When analysing the in-sample predictability to the world price index, and considering the multivariate Granger-causality regression, the formula needs to exclude some exchange rates to prevent a too large sample size. Hence, we will only use the three longest exchange rate series:

$$E_t \Delta cp_{t+1}^W = \beta_1 + \beta_{11} \Delta s_t^{AUS} + \beta_{12} \Delta s_t^{CAN} + \beta_{13} \Delta s_t^{NZ} + \beta_2 \Delta co_t^W$$

Data

This research paper is purely based on secondary data, which is retrieved from trusted and respected sources. Also, we will not make adjustments for phenomena's that can influence either the exchange rates or commodity prices. This includes factors such as regional instability, climate disasters or changes, political and syndicate decisions, oil storages, rig counts and other macro economical inputs. Further, the different types of data will be arranged accordingly to Chen, Rogoff and Rossi (2008) and sources will be explained.

Exchange rates and terms-of-trade

To obtain comparison to the original research by Chen, Rogoff and Rossi (2008), the original currencies will be applied in our paper, compared to USD. In addition, the following currency will be added, Norwegian Krone. All currencies will be retrieved in nominal rates, and the source will be DataStream. Regarding balance of trade, most of the data concerning import and export will be retrieved from DataStream, or if not available there the data will be collected from either the World dataBank, UN Comtrade, or the given country's own Central Bank. These data's will be important to identify potential exogenous measures of terms-of-trade.

Commodity prices

As a measure to overcome the challenge with some commodities being priced in different currencies, the construction of a country-specifically price index is needed. This index will be weighted to the world market price given in USD, geometrically. Because the same currencies being applied as in the research of Chen, Rogoff and Rossi, the same will apply for the commodities. We have made this decision in order to most easily compare our result against the original research. All commodity prices will preferably be retrieved from DataStream, if some of them cannot be located on this database, we will use the IMF eLibrary, World dataBank, or Bloomberg. Should it occur that one, or more of the commodities only are priced in another currency than USD, we will convert the price to USD.

Progression

Since we handed in the proposal our time has been used to study the different research papers, and some of the theory being applied in these studies. Before we started to write the preliminary, we have also been reviewing previous theses and gotten better known with the different databases available to us through the library. These pre-steps before starting to write the preliminary have provided us with a better starting point, and a greater understanding on what we need to do after we have now handed in the preliminary. The hand-in is a second milestone, but does not imply that we will take a break until we get our feedback. During the next days, we will start retrieving the data we need to start working further on the thesis.

After all the relevant data is retrieved and processed, we will start analyzing it, primarily in EViews and Stata, depending on which regressions that we need to perform. We will arrange consulting with our supervisor, Håkon Tretvoll after setting up our own progress calendar for the entire remaining period.

References

Chen, Y.-c., Rogoff, K. (2003). Commodity currencies. *Journal of International Economics,* 60(1), 133-160. Doi: 10.1016/S0022-1996(02)00072-7

Chen, Y.-C., Rogoff, K., & Rossi, B. (2008). *Can exchange rates forecast commodity prices?* (No. 13901). Cambridge: National Bureau of Economic Research.

Ferraro, D., Rogoff, K. S., & Rossi, B. (2015). Can oil prices forecast exchange rates? An empirical analysis of the relationship bewteen commodity prices and exchange rates. *Journal of International Money and Finance* 54, 116-141. Doi: 10.1016/j.jimonfin.2015.03.001

Ferraro, D., Rogoff, K. S., & Rossi, B. (2012). *Can oil prices forecast exchange rates?* (No. 17998). Cambridge: National Bureau of Economic Research.

Mendoza, E. G. (1995). The terms of trade, the real exchange rate, and economic fluctuations. *International economic review,* 36(1), 101-137. Doi:

Rogoff, K. (1996). The Purchasing Power Parity Puzzle. *Journal of Economic Literature,* 34(2), 647-668.

Rossi, B. (2005), "Optimal Tests for Nested Model Selection with Underlying Parameter Instability", Econometric Theory 21(5), 962-990.