A COINTEGRATION ANALYSIS OF COFFEE PRICE AND U. S. DOLLAR INDEX

Kointegrační analýza ceny kávy a indexu amerického dolaru

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Abstract: Paper is focus on an analysis of relationship among the coffee price and the U. S. dollar index. For the estimation of long-term relationship a cointegration analysis is used. The article identifies a gap in the current research in the field of commodity markets. The reason of use of cointegration analysis is to determine whether the weighted dollar index over the long steady relationship with the price of coffee. The results confirm the absence of a contribution from long-run equilibrium relationship between the price of coffee and the exchange rate of the dollar index. The explanation can be found in inverse relation to the local conditions commodity currencies. Commodity market significantly reacts to changes in supply and demand. Research results show the possibility of breakage of bonds coffee prices on major global currencies

Abstrakt: Příspěvek je zaměřen na analýzu vztahu mezi cenou kávy na finančním trhu a kurzem amerického dolarového indexu. Pro odhad dlouhodobého vztahu je použita kointegrační analýza. Článek identifikuje mezeru v současném výzkumu na poli komoditních trhů. Důvodem použití kointegrační analýzy je zjištění, zda je vážený dolarový index v dlouhodobém rovnovážném vztahu s cenou kávy. Výsledky příspěvku potvrzují neexistenci dlouhodobého rovnovážného vztahu mezi cenou kávy a kurzem dolarového indexu. Vysvětlení je možné nalézt v nepřímé vazbě na lokální podmínky komoditních měn. Komoditní trh významně reaguje na změny nabídky a poptávky. Výsledky výzkumu ukazují na možnost přetrhání vazby ceny kávy na hlavní celosvětové měny.

Introduction

In the recent years there is a sharp increase in many commodity prices. The commodity price fluctuation has changed with the rapid growth in prices between years 2006 – 2009 with subsequent downtrend in the commodity market (Huchet-Bourdon, 2011).

Countries that are dependent on exports of commodities like coffee or cocoa, are threatened by global and political developments, which currently affects their vulnerability to the volatility of commodity markets field (Maurice Davis, 2011).

Currently financial markets are characterized by increasing volatility. Commodity market or the coffee market is prone to abrupt movements (Huchet, 2011). Increased variability in prices occurs in these markets, particularly in the "post-crisis" period (Crete, Joetsu, Mignon, 2013). Commodity markets play an important role in the global financial system (Irwin, Sanders, Merrin, 2009).

The research problem is identified in the possible development of relations between the monetary market and commodity prices. For purposes of analysis in this paper is chosen US dollar index and the price of coffee. The selected relationship can be found in the investment and business opportunities, such as hedging against risk. The reason of using the cointegration analysis is in explanation of long-term stable relationship among selected variables. The aim of this paper is to analyze the relationship between the price of coffee and the exchange rate of the dollar index, critically compare the results of analysis with research by other authors, any generalization and suggest other possible research issues.

Coffee is one of the most valuable commodities in international trade. According Ponte (2002), the coffee market has changed dramatically as a result of deregulation, consumer preferences and corporate strategies. Coffee consumption plays an important role in many nations and cultures (Ponte, 2002). Coffee is also one of the most popular beverages in general. According to the International Coffee Organization was in 2014 the largest export of Brazilian coffee, and 45,342,000 pieces of 60-pound pack (ICO, 2015).

The US dollar plays an important role on the foreign exchange market. The US dollar Currency is compared against other currencies in the currency pair (James March, Sarno, 2012). There is a misunderstanding caused by expression due to the effects of missing all major currencies in the exchange market. For the analysis the weighted index of the US dollar is used - U. S. dollar index ICE Futures, which takes into account the weight of each currency. The index is composed of the weighted values of six world currencies - Euro, Japanese yen, British pound, Canadian dollar, Swedish krona and Swiss franc, see below in Table 1.

Table 1: Weighted values of currencies in dollar index

Currency	Weight
Euro	57. 6 %
Japanese Yen	13. 6 %
British Pound	11. 9 %
Canadian Dollar	9. 1 %
Swedish Krona	4. 2 %
Swiss Franc	3. 6 %

Source: Ice Futures

1 Aim
The aim of this paper is to find out if there is a relationship between the price of coffee and the exchange rate of the dollar index. The partial aim is to suggest some explanation and recommend other possible research issues.

2 Methodology and data basement

The data basement consists of daily closing prices of coffee and the exchange rate of the dollar index quoted on the futures market, with respect to nominal price in USD. The observation period for the analysis is in period from 1. 1. 2010 to 29. 10. 2014. The frequency of data is 5-daily.

The assumption is that all the elements of the time series must be transformed to become individually stationary. For the case of this paper an Augmented Dickey-Fuller test is used. The Augmented Dickey-Fuller test focuses on testing the null hypothesis of non-stationarity time series, which are compared with the relevant critical values. For research purpose, the critical value is $\alpha = 0.05$. In the case non-rejection of null hypothesis can be stated that the given time series are not stationary. Then it is necessary to proceed to the next step. (Engle, Yoo, 1987).

 If a given time series trend is therefore considered to be non-stationary, then a logarithmic transformation is used, see formula (1).

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

,where Pt is the closing price time series and Pt-1 is the closing price time series prior period.

Analysis of long time series relationship is managed by using the method of cointegration regression (Engle, Granger, 1987). Both variables emerged from identification - the time series of coffee prices and the exchange rate of the dollar index.

Cointegration test is focused on a long-term relationship between the variables (Engle, Granger, 1987). Cointegration analysis is useful for estimation if the time series are in the long equilibrium. A prerequisite for cointegration analysis is that the originally non-stationary time series can be converted using a linear combination to stationarity. Movement of non-stationary time series leads to a certain equilibrium relationship (Cipra, 2013).

If among variables x_t and y_t is there cointegration, then the linear combination is stationary:

$$y_t - \beta x_{t\,=}u_t \tag{2}$$

if u_t is stationary.

3 Results

The following chart Figure 1 shows the development of coffee prices and the dollar index between 1.1.2010 to 29.10.2014. The price of coffee definitely has important characteristics against the dollar exchange rate index. In the graphic interpretation an inverse relationship can be found, which is accompanied by reverse and asymmetrical movements. Financial time series both variables appear to be based on subjective analysis of non-stationary. Stationary assumption is proved by testing in the Table 2. The development of prices of both variables assumes terms without the possibility of arbitrage.

Figure 1: Price of coffee, price of U.S. dollar index

Price of coffee

USDollarIndex

Source: Own compilation

Table 2: Stationarity test, ADF

Augmented Dickey-Fuller test for price of coffee	Augmented Dickey-Fuller test for USDollarIndex
5 lags(1-L)Price of coffee	5 lags (1-L)USDollarIndex
T = 1259	T = 1259
Null hypothesis: a = 1	Null hypothesis: a = 1
Test with constant	Test with constant
asymptotic p-value 0,474	asymptotic p-value 0,3467

Source: Gretl

After application of the procedure there are no longer non-stationary time series.

Table 3 presents the results of cointegration analysis. P-value is compared with the critical value at the level of 0.05 indicates rejection of the hypothesis of cointegrating relationship.

0.5079 > 0.05 ... .. can not reject the null hypothesis of absence of cointegration.

The results show that among variables, there is a long-term equilibrium relationship variables are constant during the period. Between the price of coffee and the dollar index exists cointegration relationship. Based on the results of the cointegration analysis is not worth further test the relationship between variables.

Table 3: Cointegration analysis

Cointegration regression -			
OLS, T= 2010-01-01:2014-10-28 (T = 1258)			
Dependent variable: Price of coffee			
	koeficient	standard error	t-rate p-value
const	0,000137447	0,000575925	0,2387 0,8114
USDollarIndex	−0,0888771	0,134185	−0,6623 0,5079

Source: Gretl program

Conclusion

The aim of the contribution defined in chapter Aim is to confirm or reject hypotheses about the relationship between the development of coffee prices and the US dollar index based on econometric methods. The variables are analyzed by cointegration regression. Currently, the commodity markets are characterized by instability. For this reason, among others, it was decided to analyze the commodity - coffee prices.

As follows from the results of the results of long-term relationship between the US dollar index and the price of coffee thre is a tendency to return to equilibrium relationship in the long term. However the authors of the above do not reflect the analysis of monetary market.

The observation of the inverse of the stock market in commodities may also be used for investment decisions in the context of portfolio analysis.

The results of this rejection of long-run equilibrium relationship show the different behaviour of currencies and commodity market prices. The explanation can be found in the calculation of weighted dollar index, which plays a significant share of the Euro currency.

Generalization of research results leads to the conclusion that the impact of the US dollar in the currency basket of the analysis is not significant at the coffee commodity market. In other words, variables are not able to maintain among them a long-term constant difference. Stabilization of the position of US dollar occurred using the weighted index of currency basket. This was achieved greater significance and verifiability of currencies represented in the Foreign exchange market. Long-term relationship between variables was shown in the "post-crisis" period. Another possible explanations for the absence of mutual long-term relationships are a few, such as the different policies. Currencies are dependent on making monetary policies of individual central banks. They are driven by fundamentals that affect their development. Conversely, commodity market depends on supply and demand for a particular commodity. Another explanation is in the area of structural shocks and asymmetry. Coffee production is dependent on local conditions - weather, administration, tax, inputs, costs or political influences.

According to results of the paper, the volatility of commodities and currencies should not be the same. Agricultural producers can hedge their production or investments with open trans-actions in these markets. They can use the diversification of investments or productions. The results show there is no relationship between commodity price and the main currency. The future research can deal with prognostic methods and determination of price volatility. The

analysis of volatility can use different methods, for instance autoregressive models or stochastic models.

The future extension of the research could be faced with some problems and limits, for instance with less liquidity in the commodity markets in Europe or information asymmetry. There is also a problem with lack of information among agricultural producers.

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