Is real depreciation expansionary? 
The case of the Czech Republic

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Abstract. Applying the aggregate demand and aggregate supply model and based on a quarterly sample during 2003.Q1 – 2015.Q4, this paper finds that Czech’s aggregate output is positively associated with real appreciation of the koruna, the real stock price, lagged German real GDP and real wages and negatively influenced by the government deficit as a percent of GDP, the real lending rate and the expected inflation rate. Recent real depreciation of the koruna would not help Czech’s aggregate output, and recent relatively low government deficit as a percent of GDP would raise aggregate output.

Keywords: Exchange rates, Government deficits, Stock prices, Real wages.

JEL Classification: F31, E62.
1. Introduction

The Czech economy performed relatively well. The rapid economic growth rate of 4.54% in 2015 increased business and job opportunities. Employment grew 2.00% from 3.778 million in 2014 to 3.854 million in 2015. The unemployment rate continued to decline from a recent high of 7.3% in 2010 to a low of 5.1% in 2015, which was well below the average unemployment rate of 9.4% in the European Union. Improved international trade was evidenced by a trade surplus of 10,473 million koruna in 2015 from a recent trade deficit of 1,772 million koruna in 2013, suggesting that Czech’s export sector became more competitive globally. The low inflation rate of 0.1% in 2015 preserved the value of the koruna and consumer buying power. Recent depreciation of the koruna from 25.16 in 2010 to 27.03 in 2015 is expected to stimulate exports but raise import costs. The relatively low interest rate of 3.3% for new business loans of nonfinancial corporations made borrowings less costly. The 0.41% government budget deficit as a percent of GDP and the 40.31% government debt as percent of GDP in 2015 indicate that both the government deficit and debt as a percent of GDP are well below the 3% and 60% Maastricht criteria and that the government pursued fiscal discipline and would not crowd out too much private spending (Czech National Bank, International Financial Statistics, Eurostat). The International Monetary Fund (2016) provides an assessment of Czech’s economic performance and macroeconomic policy.

There have been several studies on the impact of real depreciation on the Czech output (Mitchell and Pentecost, 2001; Mills and Pentecost, 2001; Bahmani-Oskooee and Miteza, 2003; Miteza, 2006; Bahmani-Oskooee and Kutan, 2008). To the author’s best knowledge, few of the previous studies have applied the aggregate demand and aggregate supply model to examine the impact of real depreciation of the koruna on aggregate output in the Czech Republic. This paper attempts to analyze whether real depreciation of the koruna is expansionary or contractionary for the Czech Republic. Other relevant variables such as the government deficit, the real interest rate, the real stock price, foreign income, real wages, etc. will be considered in the model as well.

2. The model

We specify that aggregate demand in the Czech Republic is determined by the inflation rate, government spending, government tax revenue, the real interest rate, the real stock price, the real effective exchange rate and foreign income and that in the short-run aggregate supply function, real GDP supplied is a function of the inflation rate, real wages and the expected inflation rate. We can express the aggregate demand and aggregate supply functions as:

\[ Y^d = h(\pi, G, T, R, S, \varepsilon, Y^f) \]  \hspace{1cm} (1)

\[ Y^s = g(\pi, W, \pi^e) \]  \hspace{1cm} (2)
where
\( Y^d \) = aggregate demand,
\( \pi \) = the inflation rate,
\( G \) = government spending,
\( T \) = government tax revenue,
\( R \) = the real interest rate,
\( S \) = the real stock price,
\( \varepsilon \) = the real effective exchange rate,
\( Y^f \) = foreign income,
\( Y^s \) = short-run aggregate supply,
\( W \) = real wages, and
\( \pi^e \) = the expected inflation rate.

In equilibrium, \( Y^d = Y^f \). Solving for the two endogenous variables, \( Y \) and \( \pi \), we have the equilibrium real GDP:

\[
\bar{Y} = w(E, G - T, R, S, Y^f, W, \pi^e) \quad (3)
\]

We expect that the equilibrium real GDP has a positive relationship with the real stock price and foreign income and a negative relationship with the real interest rate and the expected inflation rate.

Whether real exchange rate depreciation would increase or reduce aggregate output has been investigated extensively. Real depreciation tends to make domestic-made goods and services cheaper and more competitive globally, increase exports, and shift aggregate demand upward. On the other hand, real depreciation tends to make imports more costly, raise domestic inflation, and shift the short-run aggregate supply curve leftward. The net effect on aggregate output is uncertain.

Mitchell and Pentecost (2001) show that devaluations reduce aggregate output in four accession countries including the Czech Republic in the short and long run and that decrease in output is alleviated by an increase in output one year later. Mills and Pentecost (2001) find that devaluation has a neutral impact on output in the Czech Republic and Hungary in the long run and that real appreciation results in continual output decrease in Poland and persistent output increase in Slovakia.

Bahmani-Oskooee and Miteza (2003) review previous studies. They indicate that early studies based on the aggregate demand model overlook the aggregate supply side and that applying the aggregate demand-aggregate supply model is the right approach. They conclude that real currency depreciation may be expansionary or contractionary depending upon countries under study, model specifications, methodologies employed in empirical work, sample periods, and other factors.
Based on a sample of five transition economies including the Czech Republic during 1993-2000, Miteza (2006) finds that time series variables have a long-term relationship and that devaluations reduce aggregate output in the long run.

Using a sample of nine emerging economies in the Eastern Europe including the Czech Republic, Bahmani-Oskooee and Kutan (2008) reveal that real depreciation is contractionary in the Czech Republic in the short run and has no effect in the long run.


Higher real wages are expected to shift short-run aggregate supply to the left due to higher production cost and to the right due to higher productivity. Besides, higher real wages tend to increase consumption, aggregate demand and real GDP. Real wages and output may be pro-cyclical or counter-cyclical. Hence, the sign of real wages is unclear (Abraham and Haltiwanger, 1995; Narayan and Smyth, 2009; Castle and Hendry, 2014; Spencer, 2015).

3. Empirical results

The data were collected from the Czech National Bank, the Eurostat by the European Commission and IMF’s International Financial Statistics. Real GDP is measured in million koruna. An increase in the real effective exchange rate means real appreciation, and vice versa. The deficit variable is measured as central government deficit a percent of GDP. The real lending rate is the difference between the nominal lending rate and the expected inflation rate. The real stock price is equal to the equity price adjusted for the consumer price index. Foreign income is represented by German real GDP lagged one period due to a lag in response and information. Real wages are measured as nominal wages divided by the consumer price index. The expected inflation rate is calculated as the average inflation rate of the past four quarters. Except for the real lending rate, the government deficit as a percent of GDP and the expected inflate rate with actual or possible negative values before or after transformation to the log scale, other variables are measured on a log scale. The sample ranges from 2003.Q1 to 2015.Q4. The data for the government deficit are not available before 2003.Q1.

The DF-GLS test on the regression residuals is applied to determine whether these time series variables are cointegrated. In the test equation with the trend and intercept, the
value of the test statistic is estimated to be -3.4010, which is greater than the critical value of -2.6111 at the 1% level in absolute values. Therefore, these time series variables have a long-term stable relationship.

The estimated regression and relevant statistics are reported in Table 1. The EGARCH method is employed to estimate the variance equation and regression parameters. The seven right-hand side variables can explain approximately 96.44% of the variation in Czech’s real GDP. All the estimated coefficients are significant at the 1% level. Real GDP in the Czech Republic has a positive relationship with real appreciation of the koruna, the real stock price, lagged German real GDP and real wages and a negative relationship with the government deficit as a percent of GDP, the real lending rate and the expected inflation rate. In percent terms and absolute values, lagged German real GDP has the largest impact followed by the real effective exchange rate. The relatively low mean absolute percent error of 1.3113% suggests that the estimated regression performs relatively well in forecasting.

The positive significant coefficient of the real effective exchange rate implies that recent real depreciation of the koruna would reduce Czech’s aggregate output. The negative and significant coefficient of the government deficit as a percent of GDP suggests that lack of fiscal discipline leading to a rising government deficit would be harmful to economic growth. The positive significant coefficient of the real stock price shows that an increase in real stock values would raise household wealth, household consumption spending, and real GDP. A higher real income in Germany or foreign countries causes Germans or foreigners to buy more from the Czech Republic, leading to more net exports.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>z-Statistic</th>
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<tbody>
<tr>
<td>Intercept</td>
<td>-1.910142</td>
<td>-13.35956</td>
</tr>
<tr>
<td>Log(real effective exchange rate)</td>
<td>0.317331</td>
<td>14.31972</td>
</tr>
<tr>
<td>Log(central government deficit/GDP ratio)</td>
<td>-0.002101</td>
<td>-3.264881</td>
</tr>
<tr>
<td>Real lending rate</td>
<td>-0.028845</td>
<td>-8.836758</td>
</tr>
<tr>
<td>Log(real stock price)</td>
<td>0.085311</td>
<td>13.10267</td>
</tr>
<tr>
<td>Log(lagged German real GDP)</td>
<td>0.459725</td>
<td>72.36560</td>
</tr>
<tr>
<td>Log(real wages)</td>
<td>0.098523</td>
<td>6.587569</td>
</tr>
<tr>
<td>Expected inflation rate</td>
<td>-0.025019</td>
<td>-9.549983</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.964390</td>
<td></td>
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<tr>
<td>Adjusted R-squared</td>
<td>0.958725</td>
<td></td>
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<tr>
<td>Akaike info criterion</td>
<td>-5.295324</td>
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<tr>
<td>Schwarz criterion</td>
<td>-4.920085</td>
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<tr>
<td>MAPE</td>
<td>1.3113%</td>
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<tr>
<td>Number of observations</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Methodology</td>
<td>EGARCH</td>
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</tbody>
</table>

**Notes:** All the coefficients are significant at the 1% level. EGARCH stands for the exponential GARCH model. MAPE is the mean absolute percent error.
Several other explanatory variables are considered. When lagged U.S. real GDP replaces lagged German real GDP, its positive coefficient is significant at the 1% level. However, the coefficient of the government deficit as a percent of GDP has an insignificant positive sign, and other results are similar. When labor productivity is added to the regression, its positive coefficient is significant at the 1% level. However, the coefficients of the government deficit as a percent of GDP, the real interest rate, the real stock price and real wages become insignificant, and the coefficient of the expected inflation becomes positive and significant due to a high degree of multicollinearity.

4. Summary and conclusions

This paper has examined the effect of real depreciation of the koruna and other relevant variables on Czech’s aggregate output based on aggregate demand and aggregate supply analysis. A reduced form equation is estimated. Real appreciation of the koruna tends to raise real GDP. Real GDP and the government deficit as a percent of GDP exhibit a negative relationship. In addition, a lower real lending rate, a higher real stock price, a higher lagged German output, a higher real wage, or a lower expected inflation rate would increase real GDP.

There are policy implications. To promote economic growth, the Czech government needs to pursue real appreciation of the koruna, continue to engage in fiscal prudence and reduce the government deficit as a percent of GDP, hold the real interest rate low, maintain a healthy financial and stock market, and reduce inflation expectations.

References


