

Is real depreciation expansionary? The case of the Czech Republic

Yu HSING

Southeastern Louisiana University, Hammond, USA
yhsing@selu.edu

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 Kutun, 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:

$$Y^d = h(\pi, G, T, R, S, \varepsilon, Y^f) \quad (1)$$

$$Y^s = g(\pi, W, \pi^e) \quad (2)$$

where

- Y^d = aggregate demand,
 π = the inflation rate,
 G = government spending,
 T = government tax revenue,
 R = the real interest rate,
 S = the real stock price,
 ε = the real effective exchange rate,
 Y^f = foreign income,
 Y^s = short-run aggregate supply,
 W = real wages, and
 π^e = the expected inflation rate.

In equilibrium, $Y^d = Y^s$. Solving for the two endogenous variables, Y and π , 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.

Empirical studies on the impact of the government deficit/debt on real output are inconclusive. The Ricardian equivalence hypothesis (Barro, 1974, 1987, 1989) suggests that the effect of debt- or deficit-financed government spending is neutral in the long run. Feldstein (1982), Hoelscher (1986), Cebula (1997), Cebula and Cuellar (2010), Cebula (2014a, 2014b), Cebula, Angjellari-Dajci, and Foley (2014) and others maintain that more government deficit/debt raises real interest rates and tends to crowd out spending by households and businesses. However, studies by McMillin (1986), Gupta (1989), Darrat (1989, 1990), Findlay (1990), Ostrosky (1990) and others argue that more government deficit/debt would not raise the interest rate.

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 inflation 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 1. *Estimated Regression of Log(Real GDP) in the Czech Republic*

Variable	Coefficient	z-Statistic
Intercept	-1.910142	-13.35956
Log(real effective exchange rate)	0.317331	14.31872
Log(central government deficit/GDP ratio)	-0.002101	-3.264881
Real lending rate	-0.028845	-8.836758
Log(real stock price)	0.085311	13.10267
Log(lagged German real GDP)	0.459725	72.36560
Log(real wages)	0.096593	6.587569
Expected inflation rate	-0.025019	-9.549983
R-squared	0.964390	
Adjusted R-squared	0.958725	
Akaike info criterion	-5.295324	
Schwarz criterion	-4.920085	
MAPE	1.3113%	
Sample period	2003.Q1 – 2015.Q4	
Number of observations	52	
Methodology	EGARCH	

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

- Abraham, K.G. and Haltiwanger, J.C., 1995. Real Wages and the Business Cycle. *Journal of economic literature*, Vol. 33, No. 3, pp. 1215-1264.
- Bahmani-Oskooee, M. and Kutun, A.M., 2008. Are Devaluations Contractionary in Emerging Economies of Eastern Europe?. *Economic Change and Restructuring*, Vol. 41, No. 1, pp. 61-74.
- Bahmani-Oskooee, M. and Miteza, I., 2003. Are Devaluations Expansionary or Contractionary? A Survey Article. *Economic Issues*, Vol. 8, No. 2, pp. 1-28.
- Barro, R.J., 1974. Are Government Bonds Net Wealth? *Journal of Political Economy*, Vol. 82, No. 6, pp. 1095-1117.
- Barro, R.J., 1989. The Ricardian Approach to Budget Deficits. *Journal of Economic Perspectives*, Vol. 3, No. 2, pp. 37-54.
- Buchanan, J.M., 1976. Perceived Wealth in Bonds and Social Security: A Comment. *Journal of Political Economy*, Vol. 84, No. 2, pp. 337-342.
- Castle, J.L. and Hendry, D.F., 2014. The Real Wage-Productivity Nexus. VOX CPER's Policy Portal, January 13. <<http://voxeu.org/article/real-wage-productivity-nexus>>

- Cebula, R.J. and Cuellar, P., 2010. Recent Evidence on the Impact of Government Budget Deficits on the Ex Ante Real Interest Rate Yield on Moody's Baa-Rated Corporate Bonds. *Journal of Economics and Finance*, Vol. 34, No. 3, pp. 301-307.
- Cebula, R.J., 1997. An Empirical Note on the Impact of the Federal Budget Deficit on Ex Ante Real Long Term Interest Rates, 1973-1995. *Southern Economic Journal*, Vol. 63, No. 4, pp. 1094-1099.
- Cebula, R.J., 2014a. Impact of Federal Government Budget Deficits on the Longer-term Real Interest Rate in the US: Evidence Using Annual and Quarterly Data, 1960-2013. *Applied Economics Quarterly*, Vol. 60, No. 1, pp. 23-40.
- Cebula, R.J., 2014b. An Empirical Investigation Into The Impact Of US Federal Government Budget Deficits on the Real Interest Rate Yield on Intermediate-Term Treasury Issues. 1972-2012. *Applied Economics*, Vol. 46, No. 28, pp. 3483-3493.
- Cebula, R.J., Angiellari-Dajci, F. and Foley, M., 2014. An Exploratory Empirical Inquiry into The Impact of Federal Budget Deficits on the Ex Post Real Interest Rate Yield on Ten Year Treasury Notes over the Last Half Century. *Journal of Economics and Finance*, Vol. 38, No. 4, pp. 712-720.
- Darrat, A.F., 1989. Fiscal Deficits and Long-Term Interest Rates: Further Evidence from Annual Data. *Southern Economic Journal*, Vol. 56, No. 2, pp. 363-373.
- Darrat, A.F., 1990. Structural Federal Deficits and Interest Rates: Some Causality and Cointegration Tests. *Southern Economic Journal*, Vol. 56, No. 3, pp. 752-759.
- Feldstein, M., 1976. Perceived Wealth in Bonds and Social Security: A Comment. *Journal of Political Economy*. Vol. 84, No. 2, pp. 331-336.
- Feldstein, M., 1982. Government Deficits and Aggregate Demand. *Journal of Monetary Economics*, Vol. 9, No. 1, pp. 1-20.
- Findlay, D.W., 1990. Budget Deficits, Expected Inflation and Short-Term Real Interest Rates: Evidence for the US. *International Economic Journal*, Vol. 4, No. 3, pp. 41-53.
- Gupta, K.L., 1989. Budget Deficits and Interest Rates in the US. *Public Choice*, Vol. 60, No. 1, pp. 87-92.
- Hoelscher, G., 1986. New Evidence on Deficits and Interest Rates. *Journal of Money, Credit and Banking*, Vol. 18, No. 1, pp. 1-17.
- McMillin, W.D., 1986. Federal Deficits and Short-Term Interest Rates. *Journal of Macroeconomics*. Vol. 8, No. 4, pp. 403-422.
- Mills, T.C. and Pentecost, E.J., 2001. The Real Exchange Rate and the Output Response in Four EU Accession Countries. *Emerging Markets Review*. Vol. 2, No. 4, pp. 418-430.
- Mitchell, A. and Pentecost, E.J., 2001. The Real Exchange Rate and the Output Response in Four Transition Economies: A Panel Data Study. In: *Exchange Rate Policies, Prices and Supply-Side Response* (pp. 68-77). Palgrave Macmillan UK.
- Miteza, I., 2006. Devaluation and Output in Five Transition Economies: A Panel Cointegration Approach of Poland, Hungary, Czech Republic, Slovakia and Romania, 1993-2000. *Applied Econometrics and International Development*, Vol. 6, No. 1, pp. 77-86.
- Morley, S.A., 1992. On the Effect of Devaluation during Stabilization Programs in LDCs. *Review of Economics and Statistics*, Vol. 74, No. 1, 21-27.
- Narayan, P.K. and Smyth, R., 2009. The Effect of Inflation and Real Wages on Productivity: New Evidence from a Panel of G7 Countries. *Applied Economics*, Vol. 41, No. 10, pp. 1285-1291.

-
- Ostrosky, A.L., 1990. Federal Government Budget Deficits and Interest Rates: Comment. *Southern Economic Journal*, Vol. 56, No. 3, pp. 802-803.
- Spencer, D., 2015. Higher Real Wages Would Raise Productivity and Boost Demand. The London School of Economics and Political Science <<http://blogs.lse.ac.uk/politicsandpolicy/higher-real-wages-for-workers-in-britain-would-raise-productivity-and-boost-demand/>>
- International Monetary Fund, 2016. Czech Republic: 2016 Article IV Consultation-Press Release; Staff Report; and Statement by the Executive Director for Czech Republic. Country Report No. 16/213, July 7.